

*The* **Electro-set** *Co's.*

**HANDY BOOK**  
*and*  
**CATALOGUE**

EDITION B-2

**"ELECTRICAL THINGS  
FOR EVERYBODY"**

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The Electro-set Co.  
Leader News Bldg.      Cleveland O.  
**Price 25 cents**

## HOW TO ORDER

### Please Read Carefully

**NO ORDERS FOR LESS THAN FIFTY CENTS ACCEPTED, excepting only for Arlington Tested Minerals.** Always give the name of goods, catalog number and page.

Write your name plainly and give exact address, including town, street and number.

If your town has no postoffice give postoffice address.

**TERMS:** Cash with order. Remit by N. Y. draft, money order or registered letter.

U. S. stamps (two cents only) are accepted in payment of amounts up to \$1.00.

C. O. D. orders must be accompanied by 25 per cent advance payment.

Always give shipping directions.

In event that no directions are sent we will use our best judgment.

Always include postage with your remittance except when article plainly states "postage paid" or "prepaid."

We cannot be responsible for goods lost or broken in the mails.

**EACH SHIPMENT IS CAREFULLY PACKED AND INSPECTED BEFORE LEAVING OUR HANDS.**

For your protection order goods insured and include the slight extra insurance charge in your remittance. \$5.00 insurance, 3c; \$25.00, 5c; \$50.00, 10c.

Personal Checks must be accompanied by ten cents (10c) additional to cover cost of exchange.

**POSTAGE:** In computing the extra postage on articles sold by the pound always allow postage for one pound additional for packing weight. Thus: Two pounds of wire with packing weighs three pounds. One pound of tin-foil with packing weighs two pounds, and the postage is so figured.

THE ELECTRO-SET CO., LEADER-NEWS BLDG., CLEVELAND, O.

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## WHY BUY FROM THE ELECTRO-SET CO.

Ask yourself:

Why should you send your money to us?

Why entrust us to fill your wants rather than one of a score of other companies who have solicited your trade?

It is not only your right but it is also your duty to spend your money where you can get the most for it. Satisfy yourself thoroughly then, that the Electro-set Co. will give you the fullest measure of value and service—that they **DESERVE** your patronage.

Here is what the Electro-set Co. offers you:

- 1st (and foremost) a company which practices the much used preachment, "WE GUARANTEE SATISFACTION." Your transaction with us **MUST** be satisfactory to you.
2. A company which willingly returns your money if YOU do not feel that the goods are as represented.
3. A company which fills 90 per cent of its orders within 18 hours of their receipt and back orders but 11-14 per cent of the orders which it receives.
4. A company which appreciates the trust vested in a mail order house and therefore represents its merchandise exactly as it is.
5. A company organized primarily to serve the experimenter with the experimenter's wants constantly in mind.

6. A progressive "live wire" company constantly on the alert for new things.

7. A company, which, little more than a year old, has already made a spectacular, colossal success.

8. A company which has already originated 63 new things, including the Arlington tested and certified wireless mineral, the Tele-set, the Phono set, the Electro-set, the Boy Scout Secret Service Writing Outfit, the 1-6 K. W. Transformer and others.

9. A company that maintains a complete experimental laboratory and wireless test station, **IN CHARGE OF EXPERTS**, for the express purpose of testing and developing our lines—to back up our statement, "Electro-set Goods Are Best."

More than one-half the population of the United States and Canada lives within 500 miles of The Electro-set Co.'s main offices and stockrooms.

All the eastern trunk lines of the United States enter Cleveland, providing direct and fast express and mail service to all parts of the continent.

Taxes, fuel and raw materials are **CHEAPER** in Cleveland than in most cities.

These conditions permit **THE ELECTRO-SET CO.** to give you **FASTER SERVICE, LOWEST PRICES AND BETTER VALUES.**

If our prices are **LOWER**, these conveniences account for it. If our prices, in some instances appear higher, remember that the quality of our merchandise permits no alternative.

We sell **NO SECONDS, NO JOB LOTS, NO BAD MERCHANDISE.**

We've established **CONFIDENCE**—we've grown through **SATISFACTORY SERVICE**—our goods, if not lower in some instances, are **CHEAPER** in the end.

We want no dissatisfied customers. Our whole business and its remarkable growth are founded on **SQUARENESS.**

The Electro-set Co. tolerate no "tricks of business." **EVERY EMPLOYEE IS WARNED AGAINST ANY ATTEMPT TO "PUT ONE OVER" ON OUR CUSTOMERS.**

We realize that our business future depends upon **YOUR SATISFACTION.** You must be pleased with our service or the transaction is not complete in our eyes.

IF WE "SLIP UP" **ONCE IN A WHILE—AND WE DO, OCCASIONALLY—LET US KNOW. MISTAKES ARE HUMAN**—but we can always **SQUARE** ourselves with you if you'll give us a chance.

Just remember these points. Remember that our intent is to build up a big business through friendship—through service—through value. Our whole organization is geared up to this idea—"A **SQUARE DEAL TO THE EXPERIMENTER.**"

We ask you to think these things over carefully, then decide whether **The Electro-set Company** should be entrusted with your money. **THE ELECTRO-SET COMPANY.**

# The Electro-Set Company

## Handy Book and Catalogue

EDITION B-1

Copyright 1916 by The Electro-Set Co.

LEADER-NEWS BLDG.

CLEVELAND, OHIO

Prices Are Subject to Change Without Notice

### IMPORTANT

**READ** Everyone is by now familiar with the serious and unprecedented rise in the price of all materials that go into the manufacture of electrical goods.

Copper, zinc, brass, fibre, rubber, wire, iron, steel, aluminum, insulating materials—all have advanced from 100 to 400 per cent. Chemicals have advanced in some cases as high as 1000 per cent (10 times former cost).

In spite of these advances The Electro-set Co. find themselves fairly well fortified by contracts and large stocks of goods on hand. Of course our goods cost more, but you will notice that many finished articles in our new catalogue are actually lower in price, and very few, if any, have been raised more than a few cents in your costs.

In some instances greatly enlarged production account for our low prices. In other instances we are bearing the major part of the price increase on our own shoulders, knowing that you will understand and appreciate our efforts to keep down prices.

In the case of raw materials, however, we are obliged to revise our prices on many items. We have thought it best to list these articles in our catalogue at the old standard list prices so as not to confuse our customers.

#### **CONSULT OUR NEW PRICE SHEET IN EVERY INSTANCE BEFORE ORDERING.**

We cannot ship goods advanced in price at the old lists.

From all present indications the prices now in force will positively not become lower for from two to three years. In fact the price trend is still upwards.

However do not be afraid of price changes. You may rest assured that if prices go down we will refund differences in every instance.

Do not compare our prices with old, out-of-date catalogues. Remember that all mail order companies are issuing price advance sheets. You will only lose time by sending in orders for raw materials at the old prices no matter from whom you are ordering.

Many concerns have simply doubled their prices and let it go at that. Please note that our price revision sheet is lower than you can get the same goods elsewhere.

**ELECTRO-SET GOODS ARE BEST—SHIPMENTS ARE PROMPT.  
IN THE LONG RUN YOU ALWAYS SAVE MONEY WHEN YOU BUY FROM US. "A SQUARE DEAL  
FOR THE EXPERIMENTER."—THE ELECTRO-SET CO.**

**PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE**

# THESE EFFICIENT QUARTERS ENABLE US TO TAKE CARE OF YOU

Our clean, bright rooms promote accuracy and speed in handling your orders. Our expert employees are constantly endeavoring to meet your requirements.

"A Square Deal For The Experimenter."

Save money in the long run—Send your orders to The Electro-set Co.



HOME OF THE ELECTRO SET CO.

You run no risk in buying from us. Our merchandise is selected by experts and tested by experts in our special laboratory. Electro-set goods are standard.

You cannot buy the same quality of merchandise we offer at lower prices than we sell them.



CATALOG DEPARTMENT



MAIL ORDER OFFICES



A VIEW OF OUR RETAIL STORE



VIEW OF ONE OF OUR STOCKROOMS



MAILING AND EXPRESS ROOM

Our prices are as low as good quality and good service will permit. You'll pay more for the same goods elsewhere.

## RATES FOR PARCEL POST SHIPMENTS

Your postmaster will tell you the parcel post zone in which your postoffice is located, measuring from Cleveland.

All merchandise shipped by mail takes parcel post rates. Packages up to 4 ounces in weight are carried at the rate of 1 cent an ounce, regardless of distance. Packages over 4 ounces are charged for by the pound. The rate per pound varies according to the distance, which is measured by the Government zone system, each zone covering a certain number of miles from point of shipment. Distances and rates are shown in the table below. Packages carried by parcel post are handled just like any other mail matter. They are delivered to your box by your rural mail carrier if you live on a rural route, or delivered to your door if you live in a city where there is carrier service, or delivered to your local postoffice if you live where there is no carrier service.

This table shows the charges when shipping by parcel post, according to the weight of the package and according to distance by zones.

### RATE TABLE FOR PARCEL POST SHIPMENTS

		Local Zone	Zones 1 & 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8
			Not Over	151 to	301 to	601 to	1,001 to	1,401 to	Over
			150	300	600	1,000	1,400	1,800	1,800
			Miles	Miles	Miles	Miles	Miles	Miles	Miles
Over 4 oz. up to 1 lb.	.....	\$0.05	\$0.05	\$0.06	\$0.07	\$0.08	\$0.09	\$0.11	\$0.12
Over 1 lb. up to 2 lbs.	.....	.06	.06	.08	.11	.14	.17	.21	.24
Over 2 lbs. up to 3 lbs.	.....	.06	.07	.10	.15	.20	.25	.31	.36
Over 3 lbs. up to 4 lbs.	.....	.07	.08	.12	.19	.26	.33	.41	.48
Over 4 lbs. up to 5 lbs.	.....	.07	.09	.14	.23	.32	.41	.51	.60
Over 5 lbs. up to 6 lbs.	.....	.08	.10	.16	.27	.38	.49	.61	.72
Over 6 lbs. up to 7 lbs.	.....	.08	.11	.18	.31	.44	.57	.71	.84
Over 7 lbs. up to 8 lbs.	.....	.09	.12	.20	.35	.50	.65	.81	.96
Over 8 lbs. up to 9 lbs.	.....	.09	.13	.22	.39	.56	.73	.91	1.08
Over 9 lbs. up to 10 lbs.	.....	.10	.14	.24	.43	.62	.81	1.01	1.20
Over 10 lbs. up to 11 lbs.	.....	.10	.15	.26	.47	.68	.89	1.11	1.32
Over 11 lbs. up to 12 lbs.	.....	.11	.16	.28	.51	.74	.97	1.21	1.44
Over 12 lbs. up to 13 lbs.	.....	.11	.17	.30	.55	.80	1.05	1.31	1.56
Over 13 lbs. up to 14 lbs.	.....	.12	.18	.32	.59	.86	1.13	1.41	1.68
Over 14 lbs. up to 15 lbs.	.....	.12	.19	.34	.63	.92	1.21	1.51	1.80
Over 15 lbs. up to 16 lbs.	.....	.13	.20	.36	.67	.98	1.29	1.61	1.92
Over 16 lbs. up to 17 lbs.	.....	.13	.21	.38	.71	1.04	1.37	1.71	2.04
Over 17 lbs. up to 18 lbs.	.....	.14	.22	.40	.75	1.10	1.45	1.81	2.16
Over 18 lbs. up to 19 lbs.	.....	.14	.23	.42	.79	1.16	1.53	1.91	2.28
Over 19 lbs. up to 20 lbs.	.....	.15	.24	.44	.83	1.22	1.61	2.01	2.40
Over 20 lbs. up to 21 lbs.	.....	.15	.25						
Over 21 lbs. up to 22 lbs.	.....	.16	.26						
Over 22 lbs. up to 23 lbs.	.....	.16	.27						
Over 23 lbs. up to 24 lbs.	.....	.17	.28						
Over 24 lbs. up to 25 lbs.	.....	.17	.29						
Over 25 lbs. up to 26 lbs.	.....	.18	.30						
Over 26 lbs. up to 27 lbs.	.....	.18	.31						
Over 27 lbs. up to 28 lbs.	.....	.19	.32						
Over 28 lbs. up to 29 lbs.	.....	.19	.33						
Over 29 lbs. up to 30 lbs.	.....	.20	.34						
Over 30 lbs. up to 31 lbs.	.....	.20	.35						
Over 31 lbs. up to 32 lbs.	.....	.21	.36						
Over 32 lbs. up to 33 lbs.	.....	.21	.37						
Over 33 lbs. up to 34 lbs.	.....	.22	.38						
Over 34 lbs. up to 35 lbs.	.....	.22	.39						
Over 35 lbs. up to 36 lbs.	.....	.23	.40						
Over 36 lbs. up to 37 lbs.	.....	.23	.41						
Over 37 lbs. up to 38 lbs.	.....	.24	.42						
Over 38 lbs. up to 39 lbs.	.....	.24	.43						
Over 39 lbs. up to 40 lbs.	.....	.25	.44						
Over 40 lbs. up to 41 lbs.	.....	.25	.45						
Over 41 lbs. up to 42 lbs.	.....	.26	.46						
Over 42 lbs. up to 43 lbs.	.....	.26	.47						
Over 43 lbs. up to 44 lbs.	.....	.27	.48						
Over 44 lbs. up to 45 lbs.	.....	.27	.49						
Over 45 lbs. up to 46 lbs.	.....	.28	.50						
Over 46 lbs. up to 47 lbs.	.....	.28	.51						
Over 47 lbs. up to 48 lbs.	.....	.29	.52						
Over 48 lbs. up to 49 lbs.	.....	.29	.53						
Over 49 lbs. up to 50 lbs.	.....	.30	.54						

Within Local Zone and Zones 1 and 2 packages up to 50 pounds in weight are carried. The limit of weight for all other zones is 20 pounds. Articles measuring more than 6 feet in length and girth combined cannot be shipped by parcel post.

**REMEMBER**—Always allow 1 pound extra in buying material by the pound to cover cost of packing. Thus, 2 pounds of wire, packed for shipping weighs three pounds, 6 pounds of brass weighs 7 pounds. If insufficient postage is included it will surely delay your order. In such cases we usually send goods balance C. O. D. collect, and this will cost you more in the end.

You will readily appreciate, however, that this is the only way we can handle cases where insufficient postage is included. Our profits are small—volume of business is our slogan.

The shipping weights of all articles are plainly printed. This represents the actual weight of package, ready to send. In some cases we prepay charges, but only when plainly stated in the catalogue. In some cases express shipments are cheaper.

**FOREIGN RATES**—Parcels post rates to all United States possessions, 12 cents per pound. Weight limit 20 pounds. Rates to Canada, Cuba and Mexico, 12 cents per pound. Limit 4 pounds, 6 ounces. Rates to other foreign countries, 12 cents per pound; limit 11 pounds.



# WIRELESS TELEGRAPHY

## A VERY SIMPLE TREATISE For Beginners and Students

BY J. S. NEWMAN

This little treatise is written for the purpose of explaining in a simple way the first principles of wireless telegraphy for beginners.

You cannot hope to successfully operate even the simplest wireless equipment without a reasonable understanding of the subject. The limited space will not permit anywhere near a complete explanation. However, if you will carefully read the following pages, you will at least understand the working principles of this fascinating subject.

It is earnestly recommended that you purchase or get from the library, several good books on Wireless Telegraphy. If you are at all interested you will find them mighty interesting. Live, modern people are always interested in the "why" of things.

In the first place, then, wireless telegraphy is not really wireless at all, because, of course, a great deal of wire is used in wireless apparatus, sometimes as much as 80 miles in a single instrument! A better name for it would be Radio-Telegraphy or Electric Wave Telegraphy, both of which terms express the principle better. However the word "Wireless" has gained such wide usage that perhaps, after all, it is as good a name as any. The term means the science of transmitting messages through space without wire, or other material substance, between the sender and the recipient.

**HISTORY**—Wireless Telegraphy is by no means new. Savages have used a form of wireless signaling for centuries. They sent messages by building "smoke fires." The columns of rising smoke could be seen for many miles and by proper manipulation they were able to convey information to their allies or cohorts.

Morse, himself, the inventor of the telegraph, was able to send messages by wireless telegraphy for considerable distances (a mile or more). He used two parallel wires, one running along either side of the banks of a river. By sending a current through one wire, a very weak current would be induced in the parallel conductor at the other side. This weak current made itself known by its action on a sensitive galvanometer.

Many other early experimenters accomplished even more remarkable results. Among these pioneers might be mentioned the names of Preece, Dolbear, Edison, Lodge, Branley, Popoff and others.

It was left to Guglielmo Marconi, a young Italian, to develop, in 1895, the first principles of a practical system of wireless telegraphy. His methods are those still used today, although they have been greatly improved and enlarged upon.

**ILLUSTRATION OF PRINCIPLE**—The principle of wireless telegraphy is quite simple. Let us assume in Fig. 3 that "A" is a small surface of water. Drop a stone at "B." A series of widening circles or waves will spread out in all directions until they give up their energy at the edge of the pond. The bits of cork at "C," "D," "E," "F," will bob up and down until the train of waves pass by them. Every time a stone is dropped into the water at "B" the corks will move. In other words, the energy freed by the dropping of the stone is carried in every direction by waves in the water-medium, and affects any cork within the radius of these waves.

Wireless telegraphy works on just this principle. The stone, dropping, represents the sending station. The corks represent the receiving stations, any number of which can "get" the message without interfering with the others.

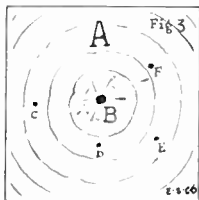
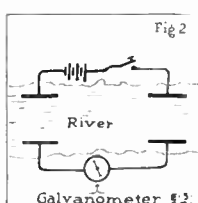
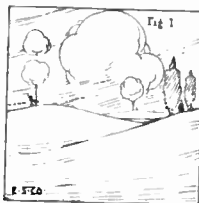
**EXPLANATION**—In the last paragraph we learned, by analogy, the principle of wave transmission of signals. In wireless telegraphy we use "ether" or "space" instead of water, electrical spark disturbances instead of stones, and sensitive "detectors" instead of corks.

"Ether" is the term applied by scientists to space. Scientists have proven that there really is no such thing as "vacuum" or "space." They have shown that what we call space is really a very elastic, invisible substance without weight, color or smell. Thus, we know that although there is no air in an X-ray tube we can nevertheless see through it. What carries the light beams through it? Obviously something must. It is impossible to suppose

otherwise. This something is called "ether."

Light, heat and electric waves are supposed to represent different states of ether activity or vibration. Now, if we find some way of making waves in the ether, just as we do in water, and can find some method of detecting these waves at a distance, we have wireless telegraphy. This has been accomplished.

We can disturb the ether by passing any kind of an electric spark through it. This disturbance will generate electric waves which will spread out in all directions, just as our water waves do. They are invisible



to eyesight, however, but they will travel thousands of miles at tremendous speed (186,000 miles per second).

Any electric spark will cause electric waves in the ether (Fig. 4.) When you see a trolley slip off the wire, or a lightning flash, you may be sure that electric waves are speeding out in every direction and that suitable apparatus can detect these waves. In fact we are now able to tell, long before it reaches us, when a lightning storm is coming our way. The lightning causes ether waves which we can detect miles away, thus warning us of the coming storm.

In wireless telegraphy electric sparks are artificially generated with instruments called spark coils or high-tension transformers. We have only to press a key and a train of sparks leap across a suitable gap, making powerful wireless waves at will. The heavier the spark the further the waves will travel, just as the heavier the stone we drop into water, the more powerful and far-reaching will the water waves be.

**THE TRANSMITTING SET**—The simplest transmitting set consists of a spark coil giving a steady stream of electric sparks (obtainable at from \$1.50 to many hundreds of dollars), a battery, a telegraph key to send the wireless code, and a spark gap. These are connected as shown in Fig. 5. Every time the key "K" is depressed, a spark leaps between the metal points at "G," and waves are generated in the ether.

It was long ago discovered that if one side of the spark gap were connected to a system of overhead wires and the other side was connected into the ground, the waves would be much more powerful and would travel further. Such a system of wires is called the aerial or antenna and may be anywhere from a few feet long and high to several hundred feet (Fig. 6). The effect of using an aerial is very much the same as would be the effect on water waves if you were to drop your stone from a great distance. The waves would be much more powerful. The higher you held your stone the longer would each wave be; that is, the distance from circle to circle would be wider and deeper. The wave length would vary with the height. This is exactly what occurs in electric waves. The higher the aerial, the more powerful are the waves and the greater is their length.

**THE RECEIVING INSTRUMENTS**—The earliest practical form of detector for electric waves was the "coherer," a tiny glass tube with plugs at either end and silver filings between them. This device is described elsewhere in this book. (See index.) When the coherer is connected in an electric circuit with a relay and battery (Fig. 7), the current cannot get through the filings to operate the relay. The resistance is too great. Electric waves have the peculiar property, when they pass through these filings of causing them to theoretically "cohere" or jump together. This makes a ready path for the current from the battery, which then flows through the coherer and into the relay. (See index.) The relay then closes another circuit which operates a tiny electric hammer. This hammer taps the coherer, shaking apart the filings and leaving them ready for the next wave.

Just as in the ending instruments, it is found advisable to use aerial wires at the receiving end. The electric waves, traveling through space, are readily caught by these wires and led through the instruments, there to perform their work.

**WIRELESS SYSTEM**—We are now in a position to understand the simplest of wireless sets. The transmitting or sending set consists of instruments for making electric sparks which generate ether waves, spreading out in all directions from the aerial wires. The receiving set consists of a detector or coherer which is affected by these waves whenever they are led down to it through the receiving system of aerial wires, which catch a small portion of the waves as they pass by. The coherer allows a battery current to operate a relay which in turn operates an electric tapper. The sound of the tapper makes the arrival of the wave known. The little hammer or tapper continues vibrating as long as the transmitting set holds its key down, making sparks.

Thus, by a system of long and short taps we may send messages with the Morse or Wireless code that can be readily understood at the receiving end.

The above explanation describes only the simplest possible outfit. Of course many improvements have been made. Much more sensitive detectors are in use today than the coherer. Messages may be sent thousands of miles with accuracy and speed.

Now the reader may procure a good book on the subject and start in to study it with understanding and interest.

(See "Books" in Index.)

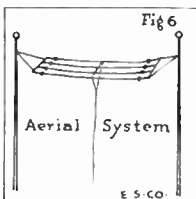
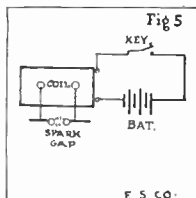
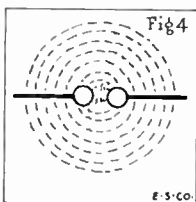
#### GENERAL BEGINNERS' INFORMATION

The following general information will be of interest to beginners and students. In the back end of this book will be found additional information, mostly for more advanced experimenters. You will also find a number of valuable "Hook-ups" or connection diagrams elsewhere in this Handy Book.

#### ESTIMATED TRANSMITTING DISTANCES

These figures can only be approximately guessed at, as much depends upon the skill and ingenuity of the experimenter and the conditions under which he works.

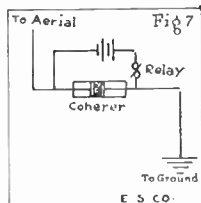
Rating of Spark Coil	Distance Easily Possible	Distance Often Covered	Record Distances	Rating of Transf'r's	Distance Easily Possible	Distance Often Covered	Record Distances
¼ inch	½ mile	1 mile	5 miles	1-6 K. W.	25 miles	50 miles	100 miles
½ inch	1 mile	3 miles	15 miles	¼ K. W.	30 miles	65 miles	150 miles
1 inch	3 miles	8 miles	25 miles	½ K. W.	45 miles	100 miles	200 miles
1½ inch	5 miles	10 miles	30 miles	1 K. W.	75 miles	200 miles	400 miles
2 inch	10 miles	15 miles	40 miles	2 K. W.	150 miles	400 miles	800 miles
3 inch	15 miles	20 miles	50 miles				
4 inch	20 miles	25 miles	60 miles				



The figures here given are not to be relied on for your particular case. They do, however, represent the average possibilities in wireless transmitting. Everyone knows, in this connection, that a 1 inch spark coil has actually been able to transmit wireless messages as far as 300 miles and more; 2 k. w. commercial stations are often heard 1,500 miles away. The table therefore underestimates rather than exaggerates.

#### RECEIVING RANGES

The average receiving range for amateur and experimental wireless apparatus is well over 500 miles; 2,000 mile receiving ranges are common; 5,000 miles have been covered. Receiving range depends up so many factors that any actual figures are difficult to compile. Good detectors, good aerial insulation and good, sensitive telephone receivers are important requisites. The more selective your tuning equipment, the better you will be able to operate and to receive. In general, it may be estimated that with an aerial 35 feet high, 75 feet long, and with reasonable equipment no one ought to experience difficulty in receiving 500 miles and more. With good equipment it is easily possible to receive 1,000 miles, on such an aerial. Many experimenters are actually receiving messages from Germany, France and Hawaii. Of course, this requires specially good equipment.



## TUNING

### What It Means And How It Is Accomplished

For the benefit of beginners we submit the following short, simple explanation of "tuning," wireless telegraph "selectivity" and "interference."

It is obvious, from the foregoing simple treatise on wireless telegraphy that if two or more stations are sending wireless waves at one time, they will both reach every receiving station within range, and "interfere" with one another. How can we prevent this?

**ANALOGY**—Suppose we had a violin string, 20 inches long, of a certain diameter and stretched to a certain tension. When we strike this string it gives out a certain distinct note and send out sound waves of a certain distinct length and frequency. These waves travel quite a distance, so that everyone within range can hear them.

If we now stretch another string the same length, thickness and tension, let us say, 10 feet away from the first, we note that whenever the first string is "played," the second string will vibrate in harmony or "sympathy" with it. This is because both strings, being exactly alike, in all particulars, have the same frequency of vibration, give off the same kind of sound waves in air, have the same tune and the same wave length.

Therefore, when one string is played it sends out sound waves which exactly match the waves of the other. These waves, traveling through the air, strike the other string just at the right frequency to start it vibrating, and it consequently "responds" vigorously. If the second string had a different tune, accomplished by changing its length, diameter or tension) it would have a different vibration frequency, tune and wave length. The little wave impulses from the first string would reach the second string just at the wrong time to make it "respond" properly. In other words it would be out of tune. (See any book on Sound or Physics.) In order to tune the second string to the first we may change either its length or tension. This would change its wave length and tune until it was exactly the same as the first string. Every time we then played the first string the second one will vibrate in unison.

Thus, you know when you are swinging someone in a swing, you have to "push" him exactly at the right time, or you will stop the vibration of motion of the swing. The shorter the ropes the oftener you have to give a push impulse. The longer the ropes or the heavier the person, the less impulses you will give in a given time. In just this way, unless the wave impulses from the first string exactly match the natural frequency of the second, the second string will not "swing" or vibrate properly.

#### EXPLANATION

The foregoing tune principles apply equally as well to radiant electric waves, used in wireless, as they do to sound waves. Theoretically, the receiving aerial and circuits must have the same wave length as the sending set in order to receive messages.

The tune, wave length and frequency of any kind of wave are closely related and, in the case of wireless waves, depend on the length, capacity and inductance of the aerial or antenna and the various circuits comprising them.

Thus, let us assume sending station "A" has an aerial X feet long, with a capacity of X micro farads and inductance of X Henrys. Let us say it wave length is therefore 100 meters.

Receiving station "B" has a different length, capacity and inductance. Its wave length is therefore, let us say, 90 meters. In order to properly get the signals from "A," "B" will have to raise his wave length to 100 meters. In order for "A" to receive signals from "B's" aerial "A" will have to shorten his wave length to 90 meters.

Certain instruments are required to readily change the wave length, especially of the receiving set, so it can receive from any sending station at will. The following instruments have effects as described:

**A VARIABLE CONDENSER**, connected in series with an aerial system, will shorten the natural wave length. The same instrument in parallel with an inductance (say a tuning coil) will lengthen the wave length.

**A LOADING COIL**, an inductance made by winding magnet wire in coils, with an air core, will lengthen the waves.

**A TUNING COIL**, really a loading coil, is a device for varying the wave length by switching in or out of the circuit, any amount of inductance.

**A LOOSE COUPLER, OR RECEIVING TRANSFORMER**, is simply a more efficient form of tuning coil.

**A VARIOMETER** is another form of tuner.

**A HELIX OR OSCILLATION TRANSFORMER** is a tuning coil for transmitting stations.

A good idea of the above instruments may be gained by perusing the pages of this catalogue.



## FOR YOUR IDEAL TRANSMITTER

### The Electro-set Co. Presents the Masterpiece

### 1-6 Kilowatt Closed Core High Tension Transformer

(FOR OIL IMMERSION)

Wherever alternating current is available the closed core transformer has almost universally superseded the induction coil for wireless telegraph transmission. The advantages of the transformer over the spark coil are too generally known to require repetition here. For the benefit of the novice, however, we might cite a few of the more important advantages such as less cost per mile of transmission radius; freedom from interrupter troubles; saving of dry or storage battery expense; greater power and therefore greater range, ease of securing high tones, etc.

Closed core transformers are connected in series with a suitable key, directly to the 110 volt, 60 cycle commercial current wires, as shown in Fig. 1. The "stepped up" voltage is lower than in the case of induction or spark coils, but the spark discharge is very hot and thick and represents many times more power than the long, thin sparks obtainable from spark coils.

Our new 1-6 Kilowatt Closed Core Wireless Transformer replaces our former popular 1-6 K. W. Transformer and is a great improvement over this well known instrument. Thousands of experimenters will welcome the advent of this new instrument, not only because of its very reasonable price, but also because of its splendid performance.

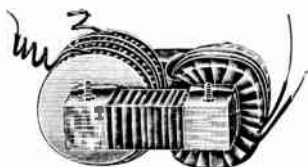
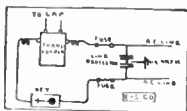
The entire transformer is fastened within a carefully planned, air cooled cast iron case, fitted with a cover and designed to be filled with transformer oil. This form of construction reduces the chances of breakdown to an absolute minimum and adds 100 per cent to the insulation efficiency. The cover may be screwed down tight after the oil is poured into the case. The whole instrument—appearance, construction and materials—follows the design of the best high-tension power transformers in use today.

The core is made of high grade Silicon transformer sheets. The windings are carefully taped and insulated, the best grade of magnet wire being used. The transformer is rigidly supported in the case by bent angle irons, screwed down, and cannot move a fraction of a millimeter. Secondary leads are brought out from the top of the case through porcelain bushings and are in the form of heavy rubber covered stranded wire. Primary leads, for connection to the A. C. current source, are similarly brought through either side of the case.

Our transformer represents the best buy possible for the experimenter at anywhere near the price. It will send from 5 to 10 times as far as a 2-inch spark coil costing approximately the same price. It compares with the best 1/4 K. W. instruments on the market, and will transmit further than many of them.

No other transformer you can buy today has the oil immersion feature, the strong, air cooled cast iron case, the advantages in price and performance. 35 mile transmission is common with our transformer. 100 miles has been successfully transmitted, but of course, only under "freak conditions." The 1-6 K. W. Closed Core Transformers are regularly furnished for 110 to 120 volts, 60 cycle current. Additional charges for other voltages and frequencies.

**NOTE**—No oil is furnished with the transformer, as it would involve shipping difficulties. We recommend any good transformer oil, castor oil or boiled linseed oil which can be procured at any drug, chemical or electrical house or from your lighting company, or from us. Prices quoted on application.



- NO. A-1001, 1-6 K. W. CLOSED CORE WIRELESS TRANSFORMER, as described, complete with air cooled case, wire terminals and special safety spark gap, shipping weight 20 pounds.....\$8.50
- NO. A-1000, 1-6 K. W. CLOSED CORE TRANSFORMER, without case, unmounted, shipping weight 10 pounds..... 7.50

**NOTE**—The secondary voltage of these transformers is about 6,300, thus making high tension leakage loss very low. Always keep the safety gap set at 3-16 inch.

## ANCHOR GAPS

This gap is useful for protecting the receiving instruments from damage by electrical storm, in which case it is connected directly between ground and aerial wires of the receiving set. Genuine hard rubber ring, adjustable brass spark points, strong construction.

The two-point gap is most generally used, but on loop antennae the three-point gap is required. Carefully made and insulated; fully adjustable.

- NO. 7844 TWO-POINT ANCHOR GAP, postage weight 1 pound.....\$0.6C
- NO. 7845 THREE-POINT ANCHOR GAP, postage weight 1 pound..... .75



## FLEXIBLE WIRELESS TRANSFORMERS

### MAGNETIC SHUNT REGULATION.

#### THE TRANSFORMERS THAT ARE MAKING LONG DISTANCE RECORDS.

This type of transformers is undoubtedly the most talked of step-up wireless transformer of its kind now manufactured.

Its new, efficient construction gives it the maximum transmitting range at lowest possible cost. It is so far superior to other types, in its field, that we honestly believe no adequate comparison can be made. Previously unheard of distances are daily being covered with Flexible Wireless Transformers. Numberless instances are on record where distances as high as 600 miles have been covered with 1 K. W. of energy using these wonderful transformers! While we cannot, of course, guarantee such ranges to every purchaser, we know and boldly claim that better results can be obtained than with any other transformers sold within double the cost of these. We cannot speak too highly of them.

These transformers are as near perfect in all respects as the present advancement of electrical engineering will permit. They are exceptionally neat, compact and businesslike in appearance. Their splendid performance is the marvel of the present day.

**DETAIL**—Flexible transformers are built on the magnetic shunt principle, equipped with a finely adjustable regulating device whereby any degree of power up to the maximum capacity may be used. That is, in the case of the  $\frac{1}{2}$  K. W. size you may draw from 1 to 5 amperes, or from 110 to 550 watts. Thus you can adapt or tune these transformers to any equipment, condenser, etc. No impedance coils or resistances are required. They may be connected to any A. C. current source, 100 to 130 volts, 60 to 133 cycles. Special voltages and windings furnished at once at slight additional cost.

These transformers are ideally built. They are mounted on a heavy protective metal casting, black enamel finish. The shunt yoke is of cast brass. Windings are most scientifically made, wrapped and baked in insulating compound. The secondary leads are brought out through genuine hard rubber bushings to an adjustable safety gap. The primary terminals are brought out to substantial brass binding posts. A suitable kick-back or surge preventer should always be used in connection (see index). These transformers are air cooled.

You cannot buy better instruments. A slight turn of the adjusting screw brings at your command the amount of power you need. The price is surprisingly low. In fact, up to the advent of these transformers, similar instruments could not be purchased at double their cost.

Flexible Wireless Transformers are designed for the highest type of wireless telegraph work.

No.	K. W.	Size, Inches	Ship. Weight, lbs.	Ampere Range	Secondary Voltage	Price
8900	$\frac{1}{2}$	12 x 8 x 6	40	1 to 5	5,000	\$15.00
8910	$\frac{3}{4}$	13 x 10 x 7	45	2 to 8	10,000	\$20.00
8920	1	11 x 12 x 8	69	$2\frac{1}{2}$ to 12	20,000	\$25.00

## ELECTRO-LYTIC INTERRUPTER

### MORE POWER—SAVES BATTERIES.

The illustration on the left shows our new model Electrolytic Interrupter. The upper right hand illustration shows the normal spark from a 1 inch spark coil, full-size, when operated with dry cells. The lower right hand cut shows the same coil operated on 110 volts, A. C. or D. C., with our Electrolytic Interrupter. Note the heavy flaming discharge; note the diameter of it. There is over three times the amount of energy in the Electrolytic Interrupter Spark. Your sending range will be tripled. You'll save the expense of constantly renewing dry cells. The diagram of connections is shown on the following page under the article on our 500 Watt Coil.

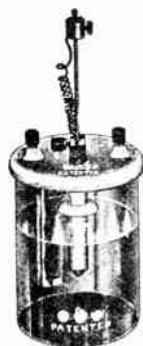
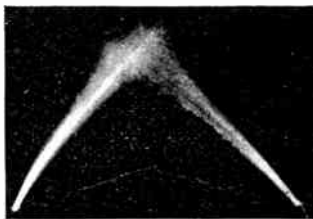
Our Electrolytic Interrupter is simple to use and ideal in operation. It will work equally well on alternating or direct current, 60 to 220 volts. It is automatic in action. The theory of operation is that of electrolytic polarization. The interruptions are extremely rapid and sharp. No primary condenser is required on the spark coils, and the vibrator, if any, should be screwed up tight when the Electrolytic Interrupter is used. If you have commercial current in your laboratory or shop you should not think of using anything else. **Electrolytic Interrupters are ideal.**

NO. 8008 INTERRUPTER, size 5x10 inches over all, shipping weight 8 pounds.....

NO. 80080 RENEWAL ROD, postpaid.....

\$2.25

.20



## ELECTRO-SET BOX TYPE SPARK COILS

### Fifty Per Cent More Than Rated Capacity

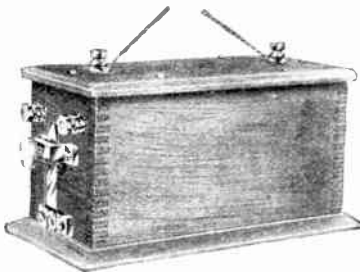
**ESPECIALLY DESIGNED FOR EXPERIMENTAL WORK AND WIRELESS TELEGRAPHY.**

The spark coil is one of the most useful and indispensable of instruments. Its uses are so varied that any attempt to enumerate them would be superfluous.

In the eyes of the experimenter the spark coil is an absolute necessity for wireless telegraphy transmission, X-ray operation, high frequency work, lighting Geissler tubes, exploding gunpowder, engine ignition and countless other applications.

Our spark coils are particularly handsome. They are equipped with extra heavy vibrators of the double tension type, large adjusting screws and contacts, beautiful cabinet finished cases. They are positively the finest coils made.

Don't try to save money on spark coils when you can buy the best for so little. Our spark length ratings are underestimated.



#### GUARANTEE

Electro-set Spark Coils are guaranteed to give 50 per cent more than their rated spark length. They are perfect in action, handsome in appearance and correct in every detail. If you are not satisfied in every way with your purchase after three days' trial return your spark coil to us for full credit.

The Electro-set Co.—

Medina, Ohio.

Gentlemen—I have been in constant wireless communication with Oberlin and Lorain this winter, having covered 25 miles and more with your No. 7002 1 inch Spark Coil. This is "some record" for so inexpensive a device. It is certainly a great instrument. I use one of your 6-volt storage cells.

(Name on request)

Very truly yours,

R. P. W.

There are dozens of makes of Spark Coils on the market at dozens of different prices. The essentials of a good Spark Coil are: Heavy fat spark, smooth acting vibrator, good insulation, strong construction.

Many spark coils rated at one inch only give this length of spark when they are used with a large number of batteries, and then only a pale, stringy discharge of little use in wireless work.

Our  $\frac{1}{4}$  inch Coil is the equal of many so-called  $\frac{1}{2}$  inch coils, marketed today at a deceivingly low price. You get in Spark Coils just what you pay for. Our coils work on a minimum number of batteries and draw little current, thus prolonging the life of the batteries. All our coils will give 50 per cent more than their rated discharge. Buy Spark Coils cautiously. Unreliable, cheap coils are deceiving. **ELECTRO-SET SPARK COILS ARE ABSOLUTELY GUARANTEED.**

If they are not better than any other make you have ever used, return them to us for credit. This is surely a risky guarantee for us to make if we were not sure that you will be more than satisfied.

There are lower priced coils and higher priced coils, but none "just as good."

NO. 7000	$\frac{1}{4}$ in. Spark Coil, shipping weight 4 lbs.	\$ 2.50
NO. 7001	$\frac{1}{2}$ in. Spark Coil, shipping weight 5 lbs.	2.95
NO. 7002	1 in. Spark Coil, shipping weight 7 lbs.	4.75
NO. 7003	2 in. Spark Coil, shipping weight 8 lbs.	7.45
NO. 7004	3 in. Spark Coil, shipping weight 19 lbs.	15.00

Prices on coils up to fifteen inches on application.

## 500 WATT TRANSFORMER COIL

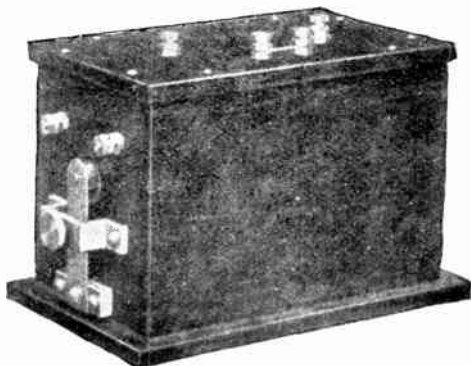
**FOR 110 VOLTS A. C. OR D. C. IN CONNECTION WITH ELECTROLYTIC INTERRUPTERS.**

(ALSO FOR BATTERY USE.)

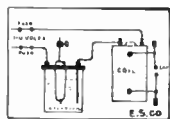
This instrument must not be confused with either the ordinary type of spark coils or with any kind of open or closed core A. C. high tension transformers. It is a new and specially designed coil giving comparatively short but heavy and powerful spark discharges for use in wireless telegraphy, Tesla Coil and high frequency operation, experimental work, etc.

Our 500 Watt Transformer Coil when used with an electrolytic interrupter on 110 volt current is equal in range to the ordinary 8 inch induction or spark coil, costing about \$80.00.

Two secondaries are wound with size 30 enameled magnet wire, and are built in two sections, each with separate binding posts, so that either secondary coil may be used alone,



or both may be connected in series or parallel for various kinds of work. The primary is wound with heavy enameled wire and is very carefully insulated from both the core and the secondary. A range of 25 miles is frequently reported and is quite common with our 500 watt coil. 100 miles have been covered.



When connected as shown in Fig. 1, with our electro-lytic interrupter, a spark about 1 inch long and  $\frac{1}{4}$  inch in diameter is obtained. The heaviness of this spark is always a surprise to new users.

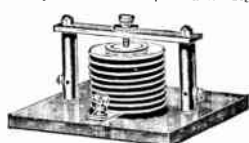
This coil is also furnished with a generous spring interrupter for use with batteries where line current is not available. The spark in this case is especially heavy and powerful for wireless work, compared to other battery operated devices. We especially recommend these coils where alternating current is not available, but where 60 to 220 volt D. C. is to be had.

- NO. 7005 500 WATT TRANSFORMER COIL, as described, without vibrator, for use on 110 volts with electrolytic interrupter .....\$6.50  
 NO. 7006 COIL, same as above, but furnished with spring vibrator, for battery use.....\$8.00  
 (Shipping weight either style 12 pounds).  
 (Size of box  $9 \times 5 \frac{1}{2} \times 4 \frac{1}{2}$  inches).

## MASCOT QUENCHED GAP

ENTIRELY ELIMINATES THE NOISE FROM SPARK.

For very much advanced amateur and professional use, the unusual efficiency of the quenched gap is almost too well known to need comment. It will increase the hot-wire ammeter reading from 25 to 50 per cent and produce louder, clearer signals than the ordinary form of gap. The results obtained by the use of a



quenched gap are so remarkable that it is hard to believe that the same equipment is being employed. The Mascot Quenched Spark Gap renders the emitted wave-length much sharper and will bring your equipment into compliance with the regulations of the Department of Commerce and Labor, and is absolutely noiseless in operation. It is therefore very popular where noise is undesirable.

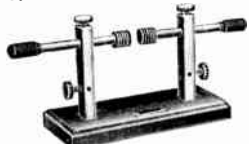
The gap sections are turned from solid brass castings and are provided with large radiating fins which effectively dissipate the heat. The separators are the best grade of India Mica. The frame of the gap is machined from heavy casting and provided with a set screw so that the sections may be properly compressed. The base is dove marble, highly polished.

Capacity up to and including 1 K. W.

- NO. 7797 QUENCHED SPARK GAP, shipping weight 25 pounds.....\$15.00

## SENIOR SPARK GAP

This little gap has been a great favorite with our customers, both because of its low price and its splendid appearance. It is a well made and thoroughly practical instrument, the equal of which it will be found difficult to secure at anywhere near the price. This gap is ideal for spark coil use and will even be found very satisfactory for use with transformers of  $\frac{1}{4}$  K. W. capacity. The spark points are of zinc and are fluted for air cooling. The standards are made of brass, highly nickled and polished. The base is of hard rubber composition, with a specially high insulating and dielectric strength, which conserves all the spark energy and does not allow leakage loss. This is a very important point and must not be overlooked.



Size of base  $2 \frac{1}{2} \times 4$  inches. Shipping weight 1 pound.

- NO. 802 SENIOR SPARK GAP, as described.....\$1.00

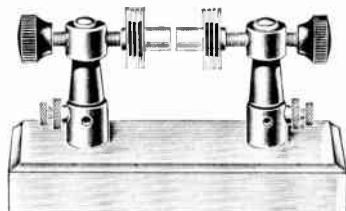
## ELECTRO-SET SPECIAL AIR COOLED SPARK GAP

The electrodes are built up of thin metal discs, separated by washers, thus offering a large cooling surface, eliminating wasteful arcing. This permits maximum radiation to the antenna circuit, little energy being dissipated in heat.

The Electro-set Special Gap is recommended as an exceptionally good instrument and will fulfill every reasonable expectation. Its appearance is especially handsome and it is sturdy and generous in size. We believe it to be the best instrument of its kind manufactured today. We highly recommend it.

Size over all  $5 \frac{1}{2} \times 2 \frac{1}{2} \times 4 \frac{1}{2}$  inches.

- NO. 803 ELECTRO-SET SPECIAL AIR COOLED GAP, shipping weight 2 pounds.....\$2.50



Dear Sirs: I received the Arlington Tested Mineral and the catalogue. In regard to the catalogue, I wish to state it is a wonderful book, full of bargains. I showed it to a number of fellows here and they are crazy about it. The N. A. A. Tested Silicon is certainly grand.

26 Merrimac St.

Nashua, N. H.

MARSTON FARNUM.

## TYPE "P" ROTARY SPARK GAP

FOR STATIONS UP TO 2 K. W.

Rotary spark gaps are universally conceded to be about the most efficient type of discharger that the amateur wireless operator can own.

While quenched gaps have many admirers, they are, nevertheless, quite difficult of adjustment and are subject to frequent short circuits and other working difficulties. Rotary spark gaps are reliable and in every way desirable and we recommend their use in almost all cases over any other form of spark gap.

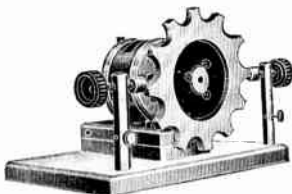
It has been many times proven by eminent investigators that the spark frequency has a great deal to do with the sending range of the transmitter. The high, whistle-like note of rotating gaps can be easily read, even when other stations are "interfering." Furthermore, the intensity of the signals increases greatly when the spark frequency is high. In many cases the sending efficiency of the station is doubled and tripled, and its signals are made much more distinguishable.

Another advantageous point is the air cooled quality of rotating gaps. The cool spark points eliminate wasteful arcing and allow a clean clear spark to pass, discharging the condenser properly and transferring a maximum of power to the antennae. Our Type "P" Rotary Spark Gap is made throughout of good materials and is properly designed. The spark frequency is between 800 and 1000 on ordinary line voltages, resulting in those clear high notes so desirable in radio practice.

The Motor is a heavy, well made machine, with generous commutator, bronze bearings, self feed brushes and automatic oil cups. It will stand the strain usually imposed on rotary motors. The speed is about 4000 R. P. M. It will operate equally well on A. C. or D. C. lines.

The rotary electrode is constructed of special aluminum alloy and is cast in one piece. It is mounted on a suitable insulating disc of high dielectric strength which is fastened to the shaft by a heavy brass bushing with a machine set screw. Stationary Electrodes are made of brass nicely lacquered and furnished with zinc spark points. They are fully adjustable by means of a screw thread. Composition rubber handles are supplied. The whole gap is mounted on a handsome mahogany finished wood base. Type "P" Rotary Gap is the best instrument of its kind that the market offers at the price. It is handsome, sturdy, efficient, and is designed for the highest type of experimental work. This year's models have been greatly improved, the price being only slightly advanced.

- NO. 480 TYPE "P" ROTARY GAP, shipping weight 10 lbs. .... \$12.00
- NO. 0480 TYPE "P" ROTARY GAP, same as above but with polished white marble base weight 15 pounds ..... \$13.50



## PARTS FOR TYPE "P" ROTARY GAPS

- NO. 481 ROTARY DISC ONLY, 5 inches in diameter, complete with bushing and set screw for 1/4 inch shaft, shipping weight 1 pound. .... \$2.85  
(Other size shaft holes, add 50c).
- NO. 482 STATIONARY ELECTRODES, complete with zinc points and composition rubber handles, per pair ..... \$1.25  
(Shipping weight 1 pound).

## TYPE "A" ROTARY SPARK GAP

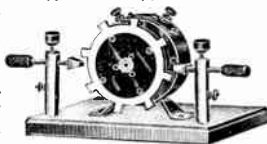
FOR POWERS UP TO 1/4 K. W.

Our Type "A" Gap is especially designed for use with our 1-6 K. W. Closed Core Transformer; however, we have many customers who have used it successfully on 1/4 K. W. transformers, and even, in several instances, in 1/2 K. W. stations. Type "A" Gap is built in every particular just as our Type "P" Gap, but is smaller in size and is furnished with a smaller motor. Otherwise the materials and workmanship are the same.

The motor is designed to operate in series with a 50 watt lamp on 110 volts, A. C. or D. C. current. It is exceptionally well made and has a speed of about 3000 revolutions per minute. The spark frequency of Type "P" Gap is about 400 per second. The rotary disc is 3 inches in diameter and is made of our special aluminum alloy. Stationary Electrodes are of brass, with zinc spark points, adjustable by a screw thread and mounted on lacquered brass posts. Insulating handles make adjustment easy.

Type "A" Rotary Gap must not be confused with cheap makeshifts that now flood the market. It is made in every particular with the greatest care and is a scientifically constructed little instrument. The price puts a splendid rotary gap well within the range of everyone. Our new models have been greatly improved and the price only slightly advanced.

- NO. 476 TYPE "A" ROTARY GAP, complete as described, wound to operate on 110 volts, A. C. or D. C., in series with lamp. .... \$6.00
- NO. 477 TYPE "A" ROTARY GAP, same as above but designed to operate on 3 dry cells or a 4 volt storage battery ..... \$5.50  
(Shipping weight, either style, 4 pounds).



## PARTS FOR TYPE "A" ROTARY GAPS

- NO. 478 ROTARY DISC ONLY, 3 inches in diameter, complete with brass bushing, and set screw, shipping weight 1 pound. .... \$1.50
- NO. 479 STATIONARY ELECTRODES, complete with zinc points, composition handles and uprights, shipping weight 1 pound. .... Pair \$1.00



## MOULDED TRANSMITTING CONDENSER

Moulded Transmitting Condensers make absolutely efficient condenser equipment. Bureau of Standard tests show superiority over every form of condenser in ordinary use with less internal losses than the best plate glass or jar condenser. It is far preferable in convenience to oil immersed condensers. There is absolutely no brush in the moulded condenser, thus saving for radiation the 20 to 30 per cent energy which is expended in brush in the usual glass plate condenser.

The use of these condensers with rotary or quenched gaps is urgently recommended. The installation of the moulded condenser invariably results in a noticeably increased radiation. Therefore, coupling this advantage with that of ease and convenience, it is difficult to see why any other type of condenser should be used in amateur installations.

We suggest the following capacities of this condenser for amateur use, basing the suggestions upon the condition that no wave greater than 200 meters is to be used.

For induction coils up to 2 inch, 2 sections No. 483, in parallel.

For  $\frac{1}{4}$  K. W. transformer, 3 sections No. 483, in parallel.

For  $\frac{1}{2}$  K. W. transformer, 4 sections No. 483, in parallel.

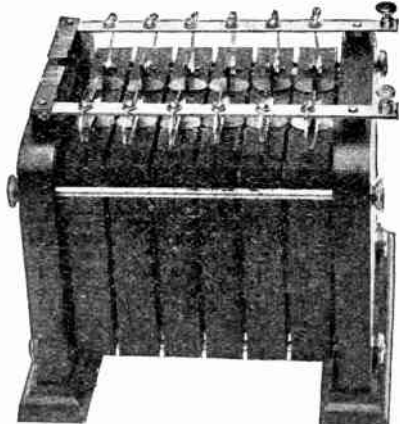
For 1 K. W. transformer, 6 sections No. 483, in parallel.

In all probability, if the wave is to be kept at 200 meters or less, no greater capacity than .01 mfd. or 6 sections of No. 483 condenser in parallel could be used, with the possibility of a smaller amount being required, depending upon the inductance used in the primary circuit of the transmitter. We believe and recommend that rotary gaps with a spark discharge rate of about 1000 per second may be used with from 3 to 6 sections of No. 483 condenser in parallel and keep the radiation at 200 meters with good efficiency for powers up to 1 K. W.

**DETAIL**—Capacity per section, .0017 mfd; copper foil sheets completely enclosed in a specially prepared dielectric compound; sections are extra strong physically and electrically; copper lugs, brass screws and nuts on connection posts; rack, dull black finish; brass bus bars; braided wire connectors. Sections may be had separately or in rack. Overall size, unit section,  $6\frac{1}{2}$  x  $6\frac{1}{2}$  x 1 inches. Shipping weights, per section, 3 pounds; rack only, 10 pounds; rack 4 section, 25 pounds.

### PRICES.

NO. 483 TRANSMITTING CONDENSER, per section, without rack, each.....	\$2.00
RACK only, smallest size, 4 section.....	5.00
RACK only, for each additional section up to 12, add.....	.50



## HIGH POTENTIAL CONDENSERS

Many different forms of transmitting condensers are in use, but we believe the glass plate type has proven its worth. Many amateurs will use no other kind and commercial stations almost universally employ them. These sections are built of specially selected glass and are so designed as to eliminate 50 per cent of the leakage and brush discharge to which most condensers are subject.

A sufficient number of plates are assembled together to form a unit of .01 M. F. ( $\frac{1}{4}$  K. W. .005 M. F.) with a wooden slab in the center which projects on all sides. These projecting edge, slide in grooves in the rack, forming a convenient mounting, readily accessible and with sections easily removable.

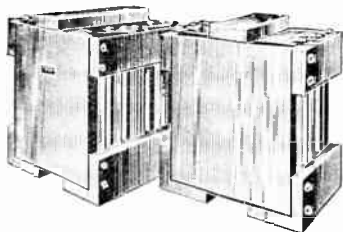
The sections, when assembled, are boiled for a considerable time in a non-hygroscopic compound with which they become thoroughly impregnated, thus preventing bushing at the edges with its attendant loss of power.

The  $\frac{1}{4}$  K. W. and  $\frac{1}{2}$  K. W. and 1 K. W. Condensers have a capacity of .01 M. F. to permit the use of a 200 meter wave length.

The  $\frac{1}{4}$  K. W. condenser consists of two of the improved type sections connected in parallel, the  $\frac{1}{2}$  K. W. four of the improved type sections connected two sets in series, each set two sections in parallel, and the 1 K. W. consists of nine sections connected three sets in series, each set three sections in parallel.

Condensers larger than 1 K. W. have a capacity of .03 M. F. unless otherwise specified, and have a series multiple connection. All racks are dull black finish.

NO. 811 $\frac{1}{4}$ K. W. CONDENSER, complete, in rack.....	\$ 8.00
NO. 812 $\frac{1}{2}$ K. W. CONDENSER, complete, in rack.....	13.00
NO. 813 1 K. W. CONDENSER, complete, in rack.....	27.50



## LEYDEN JARS

These instruments are used as condensers for wireless outfits and for many electrical experiments. They may be charged by any of our spark coils or our Static Machine, and increase the intensity of the spark many times. In buying Leyden jars too much care cannot be exercised as often the best appearing jars are the least efficient. Good results are obtained only if the best non-metallic hard glass is employed. The foil should be heavy and must be carefully applied by special process, so that it will not peel or blister.

Leyden jars are especially recommended as condensers for experimental wireless work where spark coils are employed. Our Leyden jars are made of the best hard Leyden jar glass, especially mixed for the purpose. Will withstand heavy voltage. Special care is exercised in their manufacture. Genuine mahogany covers; heavy tin foil coatings. Solid brass rods, chains and balls are used.

NO. 600 LEYDEN JAR, ½ pt., shipping weight 1 pound.....	\$1.00
NO. 601 LEYDEN JAR, 1 pt., shipping weight 2 pounds.....	1.25
NO. 602 LEYDEN JAR, 1 qt., shipping weight 4 pounds.....	1.50
NO. 603 LEYDEN JAR, 2 qt., shipping weight 8 pounds.....	2.00



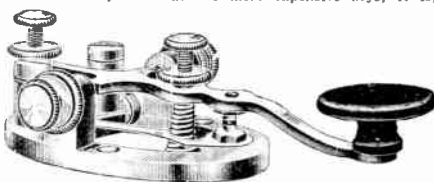
## ELECTRO-SET "TRANSO" WIRELESS KEY

We have brought out our "Transo" Wireless Key in answer to the demand for a low priced but meritorious key with large contacts. While this instrument is not as heavily built as the more expensive keys, it is nevertheless an exceptionally good key. It is built after the popular steel lever trunion pattern and is designed to be screwed down on the bench or table, holes being provided for this purpose. This key is adjustable in every respect, and practically any desired action can be obtained.

The contacts are made of genuine hardened silver, size 8 B and S gauge, and are heavy enough for practically any size spark coil. If carefully used this key will handle transformers up to ¼ K. W. capacity. The lever is made of steel, to give it strength and is handsomely nickled and polished. The frame, base supports and posts are of gold lacquered brass.

Our "Transo" Key represents one of the best values to be had in heavy contact wireless keys.

NO. 491 "TRANSO" WIRELESS KEY, as described, shipping weight 1 pound.....	\$1.40
---------------------------------------------------------------------------	--------



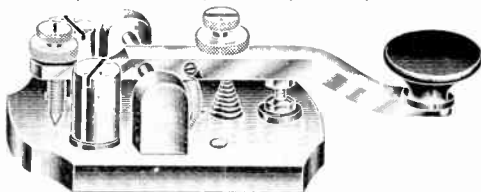
## STANDARD WIRELESS KEY

The cut shows our new model key for wireless telegraphy. This key is especially heavy and has an auxiliary conductor for leading heavy currents to the lever. It is provided with large contact points of pure coin silver, hardened. These contacts are size 6 B. and S. gauge and are fitted in removable holders to facilitate renewal. The whole key, including base and supports is made of gold lacquered brass and presents a fine appearance. It may be used with transformers having a capacity not to exceed ½ kilowatt. The key is fully adjustable and has a surprisingly easy action for a wireless key.

NO. 492 "STANDARD" KEY, shipping weight 1 pound.....	\$2.50
------------------------------------------------------	--------

NOTE—These keys are furnished in larger sizes as follows:

NO. 492A KEY, with ¼ inch contacts for 1 K. W. transformers, price.....	\$4.50
NO. 492B KEY, with ⅜ inch contacts for 2 K. W. transformers, price.....	\$5.40

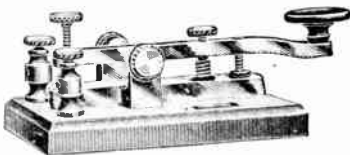


## ELECTRO-SET "LEADER" WIRELESS KEY

We present herewith our new model marble base wireless key.

Our "Special" key offers for the first time, an instrument of this type at a really reasonable price. Combining handsomeness of appearance with efficiency of design it is indeed an especially fine key, and one that we are proud to offer to our friends.

The frame, bearing the working parts of the key, is cast in one piece of solid brass, brush finished and lacquered. The lever is of heavy brass, square in shape, and is readily removable for ease in cleaning or filing the contacts. The contact points are of pure hardened silver, size 4 B and S. gauge. They may be readily renewed if necessary. The whole key is mounted on a piece of beautiful white polished marble, 1 inch thick and 3 x 5 inches in size. The appearance is especially handsome. The parts are generous in size. The key is designed for stations up to 1 K. W.

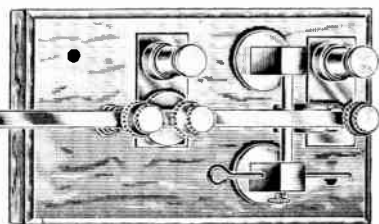


You will be glad to own our "Special" Wireless Key. It is built for satisfaction and service. There is no nearer instrument made and the action and efficiency are all that can be desired. It represents the best key value obtainable.

NO. 495 "SPECIAL" KEY, shipping weight 3 pounds.....\$3.50

## NO. 496 "SIGNAL SERVICE" KEY

For those who desire and will accept nothing but the very best, we present our "Signal Service" Wireless Telegraph Key. Until you have seen this wonderful instrument you never would believe that such care and accuracy could enter into the construction of a wireless key. We make this broad statement and challenge: No other key on the market today, no matter what its price or make, can compare in any way with the "Signal Service" Wireless Key. This is a bold claim, and we make it in full faith and knowing exactly what we are saying. It is the only way we can bring home to you an adequate description of the "Signal Service" Key.



and spring. Capacity, 2 K. W.; shipping weight, 5 pounds; size over all, 4 x 7 x 2 inches.

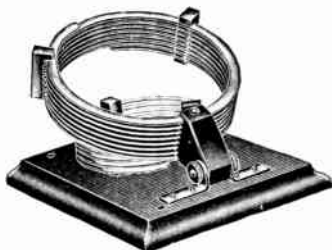
"Signal Service" Keys are in use in government and commercial, land and ship stations. They represent the acme of key construction.

NO. 496 "SIGNAL SERVICE" KEY, as described.....\$7.50

## CHELSEA OSCILLATION TRANSFORMER

You Cannot Desire a Better Instrument

One of the very important parts of any wireless station now-a-days is the Oscillation Helix or Transformer. This instrument serves the purpose of tuning the closed spark gap circuit of the transmitter with the open or antenna circuit. It also serves in a measure to vary the transmitting wave length.



There has been a keen desire on the part of amateurs in general for a variable coupling oscillation transformer which would permit the sharp tuning so necessary under present transmitting conditions. We believe that we have succeeded in placing at the command of these amateurs an exceptionally fine instrument of the type desired at a very low price. This new oscillation transformer, No. 424, is suitable for battery sets, but is really designed for all powers up to 1 K. W. It is big and sturdy, handsome and efficient and at its price has positively no rival in real value. This instrument will do well what apparatus of double the cost will do. It will last as long and serve efficiently every requirement. It will permit the precise tuning which is required by the radio law and which should be the ideal of every experimenter.

In an oscillation transformer it is important that the turns be well insulated and that the windings should have large carrying capacity. Do not determine on the purchase of a helix or an oscillation transformer of any kind until you have seen this instrument. We are sure that you will be satisfied that it is the best value you have ever seen. It is not necessary to spend more.

DETAILS—Variable coupling; primary, six turns and secondary eight turns edgewise wound copper strip; coupling varied by hinging of secondary away from primary; mounted on mahogany finished base; four clips furnished. Over-all size, 10x7½x3¼ inches. Shipping weight, 8 pounds.

NO. 424 OSCILLATION TRANSFORMER, capacity up to 1 K. W., each.....\$4.00

## OSCILLATION HELIX FOR SMALL STATIONS



A Helix is a sending tuning coil. It tunes the various parts of the sending circuits so that they act in unison (i. e., so that the oscillations in the antenna do not "buck" or oppose those in the condenser or spark gap circuit). A Helix will also vary the wave length or tune of the antenna. Our No. 606 Helix will add as much as 125 meters to the wave length of your station. Many interesting experiments in resonance can be performed. Our Helix will increase the efficiency of small sending station from 50 to 100 per cent. A sending condenser should always be used in connection with the Helix. Our Helix is made up of eight turns of polished No. 8 wire supported by a hard wood upright on a finished wood base. Two contact clips are furnished with each Helix. It is a neat looking and strongly constructed instrument; height over all, 7 inches; diameter, 4 inches. Suitable for spark coil installations of ¼ to 2 inches spark length.

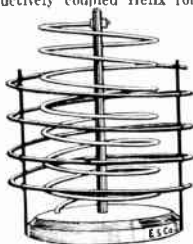
NO. 606 HELIX, as described, shipping weight 2 pounds.....\$1.50

## LOOSE COUPLED SMALL OSCILLATION HELIX

While our No. 606 Helix may be used on small stations whose sending radius does not extend beyond the state border, the Wireless Law requires that larger stations use a "loose" or inductively coupled Helix for sending. A loose coupled Helix or Transformer consists of two windings, a primary and a secondary. The oscillations are transferred inductively from one coil to the other and the resulting wave is "pure," i. e., has only one natural wave.

Our No. 607 Oscillation Transformer is designed to comply with the law in this respect and consists of two separate windings, one below the other. The lower winding is the primary. It consists of 4 turns. The upper winding of 8 turns is the secondary. This instrument is built very much like our No. 606 Helix, except for the extra primary winding. It is furnished with 4 Helix Clips. We strongly recommend its use in all instances. Our No. 607 Oscillation Transformer will often more than double the sending radius. It may be used on stations equipped with spark coils and also for transformer equipments up to  $\frac{1}{2}$  K. W.

While it is not as efficient or as handsome as our extraordinary Chelsea Oscillation Transformer, it will serve its purpose admirably and is scientifically constructed in every way.



**NO. 607 OSCILLATION TRANSFORMER**, shipping weight 3 pounds.....\$2.50

## NO. 610 ANTENNA SWITCH

This is the most popular type of inexpensive aerial switch in use today. It is quick and convenient in operation and only a 40 degree movement of the handle changes over from sending to receiving set. There are two contacts on the receiving side and three on the sending side. The third contact is for turning on or off the power circuit from the transformer or spark coil, thus absolutely protecting the operator and the receiving instruments from any accidental high tension surges while receiving.

Our No. 610 Switch, while in appearance it resembles other switches of this nature **must not be confused with them**. The bars on all our switches are sawed, not drawn, and are thicker and wider than on other makes. Special attention is given to the choice of wood for the base, it being chosen with reference to its insulating properties. It is treated with special compounds to make it moisture proof. Remember that careless buying of aerial switches may bring you an instrument that will waste half of your sending energy through leakage. Our No. 610 Aerial Switch, while inexpensive, will serve efficiently and conveniently in stations having a capacity up to  $\frac{1}{2}$  kilowatt (not over rated).



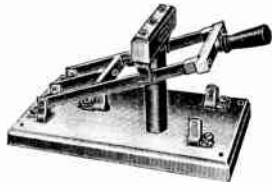
**NO. 610 ANTENNA SWITCH**, as described, shipping weight 4 pounds.....\$2.00

## NO. 611 ANTENNA SWITCH

This instrument is novel in design and convenient in operation. Although the price is not high we have sacrificed nothing in its appearance or workmanship that would in any way interfere with its being a mighty good instrument. The usual arrangement of blades and jaws is used, two for receiving and three for sending. The blades are especially heavy, being made of sawed copper bar (not the ordinarily used drawn bar).

The upright, supporting the receiving contact jaw, is constructed of special insulating composition of great mechanical and electrical strength. The wood base is selected for its insulating properties. Many kinds of wood are useless for this purpose. The base is impregnated with insulating compounds, making it moisture and leakage proof. Our No. 611 Switch is especially good looking, the wood parts being finished in mahogany and the metal parts being lacquered to prevent tarnishing. This is a feature seldom found in instruments of like nature.

We recommend this Switch as a high grade and practical device for stations up to 1 K. W. capacity.



**NO. 611 ANTENNA SWITCH**, shipping weight 5 pounds.....\$3.00

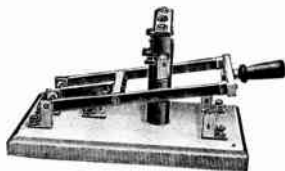
## MASTER ANTENNA SWITCH

We have the privilege of offering to our friends an instrument of unquestioned worth and merit in the form of our Master Antenna Switch. To those who can afford the best, and to those who will accept only the most efficient and finest instruments they can procure, we know our No. 612 Master Switch will make a very strong appeal. It is made and finished in every detail with the most exquisite care, and with materials selected for their worth and proved efficiency.

The base is of spotted gray marble, glass polished, with beveled edges and especially generous in size. The blades are made of sawed copper bar, machine polished and lacquered. The lugs or jaws are milled from solid copper and are accurate and sure of contact. The support for the receiving circuit is made of selected electrical composition. The whole switch presents such a splendid appearance and is so beautiful in workmanship that its value and worth are at once apparent.

It is an instrument designed for service and hard usage and one whose possession will give undoubted satisfaction. If you want the best it is useless to pay more and you cannot pay less for an instrument of this kind.

**NO. 612 MASTER AERIAL SWITCH**, shipping weight 10 pounds.....\$6.50



## ELECTRO-SET LIGHTING SWITCHES

### Marble Base

Perhaps one of the least looked for but most general sources of loss in Wireless Telegraph transmission is the ground or lightning switch. These switches are demanded by the Board of Underwriters for the purpose of grounding the aerial when not in use or during lightning storms.

A properly grounded aerial is a good lightning protector for the building in which it is located. No wireless installation should be without a suitable switch and special ground lead for this purpose—in fact no station will pass inspection that is not so equipped. All lightning switches hitherto offered have been furnished with slate bases but slate bases are absolutely worthless, as slate is a poor insulator, and the electrical oscillations readily pass through it to the ground, even when the switch is connected to the instruments. Asbestos bases are somewhat better than slate, but they warp readily; are subject to becoming water soaked, and are not fully weather proof. Our switches are therefore built on genuine marble bases, which, after long experience, we find to be the only suitable material.

The prices may be a trifle higher but the results are more than commensurate. Don't buy any other kind of switch. It is a poor saving indeed. **THE CODE REQUIRES THE 100 AMPERE SIZES.**

Our switches are heavily built, the blades being sawed from solid copper, the lugs being milled from castings. We feel free to say that no other switches offered today can compare with them in efficiency and ability to withstand the abuse that ground or lightning switches are subjected to. **Don't buy slate base switches.**

NO. 615 M LIGHTNING SWITCH, 60 ampere, for small installations, as described, shipping weight 3 pounds.....	\$2.25
NO. 616 M LIGHTNING SWITCH, 100 ampere, 250 volt, very heavy, shipping weight 6 pounds.....	3.00
NO. 617 M LIGHTNING SWITCH, 100 ampere, 600 volt, extra large, very efficient, shipping weight 10 pounds.....	3.60



### HOT WIRE AMMETERS

These instruments are used for the purpose of determining what condenser, spark gap and helix adjustments will radiate the maximum amount of energy in the transmitting set. The hot wire ammeter may be connected in series with the ground or aerial, and is shunted with a single pole switch when not in use. Many stations are not tuned properly, thus losing from 25 to 50 per cent of their radiating efficiency. With a hot wire ammeter the exact adjustments may be determined for best results. These instruments are a necessity in any up-to-date wireless telegraph station. Our hot wire ammeter is accurately calibrated and will stand a 100 per cent overload without harm to its windings or bearings. The base is made of hard rubber composition and all metal parts are handsomely nickel-plated. Size 3 inches in diameter by 1 1/4 inch depth. Range 0 to 0.5, or 0 to 3 amperes. State which reading is desired.

NO. 621 HOT WIRE METER, shipping weight 1 pound.....\$3.75

### "KICK BACK" PREVENTER

#### For Protection of Power Lines and Apparatus

##### FOR PROTECTION OF POWER LINES AND APPARATUS.

All wireless transmitting stations, using the commercial circuits for operating their transformers or spark coils, are required by the Fire Underwriters to furnish proper protection to the circuits against possible "Kick-back."

It sometimes happens that the high tension currents, generated by the wireless transformers, etc., will jump back into the house circuits, causing damage to the commercial supply transformer and blowing out fuses, breaking lamps or otherwise disturbing things. In order to prevent such occurrences, the Underwriters demand a suitable device to take care of accidental high tension surges and carry them off into the ground. They especially recommend two 1/2 microfarad condensers, connected in series and bridged directly across the primary circuit of the transformer. The series connection, joining the two condensers, is grounded to a water or steam pipe or other good ground.

Then, if any "Kick-backs" occur, they are carried harmlessly to the ground.

It is well to supply fuse blocks in the circuit of the line protector or "Kick-back" preventer.

Our No. 8001 Line Protector is made in strict accordance with the Underwriters' specifications. Two properly made condensers of the correct capacity are connected as described. Three binding posts are provided, the third post being connected to the series wire between the two condensers. The whole arrangement is carefully sealed in a single unit with insulating compound. Size 4x6 inches.

"An ounce of prevention is worth a pound of cure."

Get one of our line protectors at once—you may save yourself a great deal of money—and you'll be obeying the rules of the Fire Underwriters Laboratory.

NO. 8001 LINE PROTECTOR, OR "KICK-BACK" PREVENTER, shipping weight 8 pounds.....\$2.00



## MULTI-AUDI-FONE

**A WIRELESS TELEGRAPH AMPLIFIER**  
Increases Audibility of Received Signals  
1500 Times.

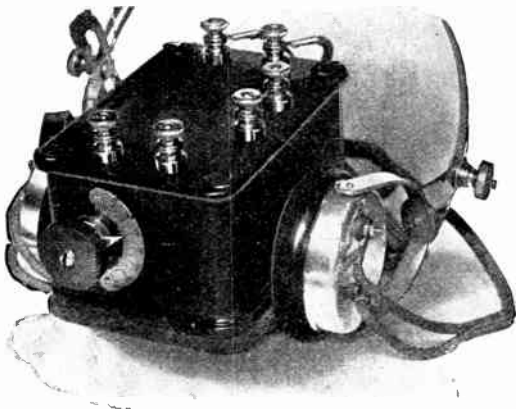
**NOW ONLY \$18.00—FORMERLY \$30.00**

Unsolicited testimonials tell more about the Multi-Audi-Fone than page after page of description. Now that this remarkable device is being sold at our new, low figure, it is placed within reach of a great many people who heretofore could not afford it.

The Multi-Audi-Fone is a compact little instrument, entirely encased in a moulded hard rubber composition case, measuring only 4¼x3x2½ inches.

It is a miraculous amplifier of any signals you may now be receiving and will render audible hundreds of stations that you never heard before.

The Multi-Audi-Fone is equally adapted to the amplification of signals from damped and undamped circuits, and will work equally well with any detector and receiving set. Its average maintenance cost is less than five cents per month.



### READ WHAT THEY SAY

Arthur B. Church of Lamonica, Iowa, says: "After a thorough trial of this remarkable instrument I do not feel as though I can afford to be without it. The results I have obtained have been simply wonderful and I have now begun to realize what Wireless signals really are."

"I have heard East San Pedro, Cal., in broad daylight enough to read distinctly."

"Steamers of every nationality on the Pacific, Gulf, Atlantic and lakes are heard and easily read."

"To say I am pleased with your instrument is putting it mildly and you may be sure of my constant recommendations of it to my numerous wireless friends."

M. B. Schwartz of Brooklyn, N. Y., writes: "With regard to results obtained on connecting the Multi-Audi-Fone in my radio receiving set as an Amplifier, I am glad to say that I was astonished by the roaring and whistling of myriads of stations, near and far, many of which I never heard before; the small amateur stations coming so loud that they were heard all over the room. It may also probably be of interest to you to know that I heard the S. S. Brazos every evening from the time she left San Juan, P. R. October 20, until she reached New York, during the run she came in with remarkable audibility."

"The above is precisely what happened after including the Multi-Audi-Fone. Signals were heard all over the house for a distance of from 50 to 100 feet from phones."

The above testimonials are representative of literally hundreds pouring in from all parts of the country.

**Don't they convince you?**

The Multi-Audi-Fone takes up little space—is easy to handle and adjust is especially attractive and handsome.

It is an ideal instrument for jewelers, as an advertising device to announce wireless time signals to their customers. For schools, colleges and similar institutions it is indispensable, as the whole class can hear the signals. The fortunate amateur who owns one will add double the interest to his station by its possession, increasing his receiving range and the legibility of his signals.

### TWO-STEP MULTI-AUDI-FONE

This model is nothing short of being the "Eighth Wonder of Science." Signals can be heard above the noise of city traffic, far out into the street. It is furnished with a special amplifying horn in addition to its double step amplifier device. It will "shriek" the signals if you want it to.

### INCREASE YOUR RECEIVING RANGE

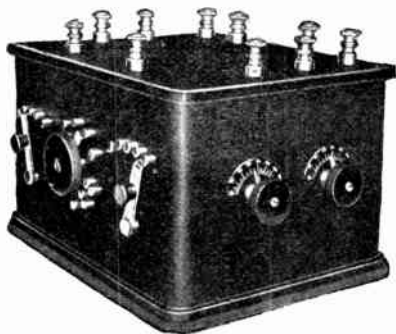
Do things you never dreamed of doing. Hear stations that "never touched you" before. Double the interest and fascination of wireless. Buy a Multi-Audi-Fone.

**REMEMBER**—It works on any wireless receiving equipment, with any detector, on damped or undamped circuits, with any telephone receivers, preferable low resistance phones, but any phones will do. Increase the audibility of signals 1500 times!

**TYPE A MULTI-AUDI-FONE**, former price \$30.00, less receivers, as described now.....\$18.00  
(Shipping weight 2 pounds.)

**TYPE B MULTI-AUDI-FONE**, same as above but with special 5 ohm receiver head set, as illustrated... 23.00

**TYPE C TWO-STEP MULTI-AUDI-FONE**, ultra amplification, complete with amplifier horn, and 5 ohm head set, formerly \$75.00, our new price..... 60.00  
(Size 8½x6½x5¼ inches.)



## THE AUDION DETECTOR

**NOTE**—The Electro-set Company are authorized agents and are prepared to give immediate service in supplying these splendid instruments. We ship in practically every case from stock and we guarantee to furnish only the newest models at the lowest possible prices.

This instrument represents the highest development of wireless detecting apparatus. It is the most sensitive and reliable detector in existence. Tests conducted by the United States Bureau of Standards have shown it to be fully 50 per cent more sensitive than any other form of detector (Bulletin, Bureau of Standards, Vol. 6, No. 4, P. 540).

One of its greatest advantages over other detectors is its reliability. When once the proper voltage and heating currents are determined, no further adjustment is required. The Audion Detector is not affected by any ordinary mechanical vibration and is not appreciably affected by the spark of the transmitting apparatus. It will stay in adjustment indefinitely and can be depended upon at all times. Its use enables the operator to receive over the greatest distances possible with any form of detector.

The Audion Detector will be found in all the best amateur stations. It is a device which can be fully appreciated only by advanced operators. It is extensively employed in navy stations of the United States and foreign governments and the high power commercial stations. Every Audion Detector and Amplifier is built by highly skilled mechanics and is carefully tested before leaving our factory. If used in connection with EFFICIENT tuning and in accordance with our instructions, we guarantee satisfactory results.

### THE NEW DE FOREST INSTRUMENTS

Radical CHANGES AND IMPROVEMENTS have recently been made, placing the new instruments in even a more superior position than the previous types, from both the standpoint of efficiency and that of service.

**FIRST OF ALL**—It must be understood that in every Audion Detector, Amplifier and Ultradion which which we are now offering for general use, there are two local batteries required, one of 4 or 6 volts, for lighting the filament of the bulb, known as the "A" battery, and one of 45 volts, for the secondary or telephone receiver circuit, known as the "B" battery. In the former instruments the "B" battery was enclosed in the instrument, and was furnished with it. Its voltage was varied by means of a "step by step" switch. In the NEW INSTRUMENTS no battery at all is supplied. Both the "A" and "B" batteries are furnished by the purchaser and connected to the binding posts so marked on the instruments. The "A" battery should be a 4 or 6 volt storage or 4 dry cells. We especially recommend our New Dry Storage Cells, described elsewhere in this catalogue. Two of these cells are required, connected in series. We believe that our dry storage cells are the most convenient and at the same time the least expensive source of current for Audion Filaments. See index.

The "B" battery may be composed of 12 three cell flashlight dry batteries, all of them carefully soldered in series, but we especially call to your attention our splendid Electro-set "Audion B" Battery, a self-contained unit of 50 volts, conveniently arranged and neatly set up. These new 50 volt batteries are especially designed for the wing and grid circuits of audions, and have a long shelf life. See page 20.

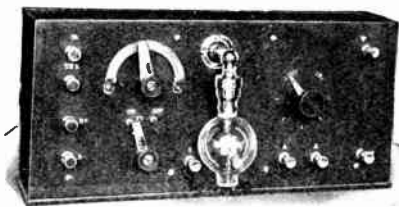
In the new instruments the "B" battery control is a POTENTIOMETER control, giving the finest possible adjustment, increasing the efficiency considerably.

**SECOND**—The new detectors and amplifiers are all PANEL TYPE instruments. All controls are directly in front of the operator. If it is desired to incorporate the Audion in a panel receiving set, this can be done readily, without injuring the efficiency of the Audion or changing its wiring. This new arrangement is therefore a marked advantage over that of the previous instruments, which had the "B" battery within the case.

## TYPE RJ-8 AUDION DETECTOR

(LICENSED FOR AMATEUR USE ONLY)

This new instrument excels every previous amateur type Audion Detector, thus placing it far above any other detector of any kind ever manufactured. It is provided with a Potentiometer Control for the "B" battery



potential by means of a special potentiometer designed especially for the Audion, thereby giving a closer regulation than ever before possible, resulting in greater efficiency and more service from the instrument and renewal bulbs.

The Type RJ-8 Audion Detector has a hard rubber panel, on which all the controls and potentiometer are mounted. The panel is set into a well finished oak cabinet measuring 13 $\frac{3}{4}$  inches long by 6 $\frac{1}{4}$  inches high by 3 inches deep. All of the metal parts are heavily nickel plated. The switch is of our well-known four ply construction. It cuts the "B" battery off from the potentiometer when the bulb is turned "off," preventing this battery for discharging slowly through the potentiometer.

The rheostat for regulating the intensity of the filament is on the rear of the panel and controlled by the "out" and "in" knob.

If the operator desires to incorporate this detector in a receiving cabinet, this can readily be done by removing the panel without disturbing any of the interior parts.

Full instructions are included with each instrument.

No batteries at all are furnished with this instrument as listed.

See page 20 for description of the batteries required.

RJ8 AUDION, shipping weight 10 pounds.....\$25.00

## TYPE RJ-9 AUDION DETECTOR

(LICENSED FOR AMATEUR USE ONLY)

This new panel type instrument is the lowest priced Audion Detector. All the controls are mounted on the front of the mahogany panel, which measures 5 by 13 inches.

The control for the "B" battery is a Potentiometer Control, giving very close regulation of the "B" battery potential. The switch controlling the filament brilliancy automatically cuts the "B" battery off from the potentiometer when the filament is turned "off."

The Type RJ9 Audion Detector is provided with brackets so that it can be screwed to a table. If the operator desires to incorporate it in a receiving cabinet, this can be done readily without disturbing the wiring and parts. The metal parts of this detector are of lacquered brass.

No batteries at all are furnished with this instrument at the price listed below. Full instructions for operating are furnished with all instruments. For information as to the batteries required see page 20.

**RJ9 AUDION**, shipping weight 8 pounds.....\$14.00  
 "Incomparably Superior to Any Other Known Form of Detector."



## TYPE EJ-1 AUDION AMPLIFIER

(LICENSED FOR AMATEUR USE ONLY)  
 SINGLE STEP

This instrument is used in connection with any receiving set and any detector, preferably a DeForest Audion Detector, for increasing the intensity of received signals from 5 to 10 times (actual). It is a relay without any moving parts.

Through its use not only is the intensity of received signals increased, but signals from distant stations can be heard which are entirely impossible of reception without it. This is not true in a practical manner of any mechanical or microphonic relay.

The Audion Amplifier is constant in operation, is not affected by any ordinary mechanical vibration or electrical disturbance, and remains in adjustment always.

The Type EJ1 Single Step Audion Amplifier illustrated above requires a 6 or 4 volt "A" battery for illuminating the bulb and also the "B" battery as required for the Types RJ8 and RJ9 Audion Detectors. These batteries are not supplied with instrument, but are to be furnished by the user. The "B" battery control is a Potentiometer Control, giving very close regulation.

When using an Audion Detector and an Audion Amplifier together, two separate and distinct "A" and "B" batteries must be used, one for each.

The Type EJ1 has a black composition panel on which the b.b. and controls are mounted. This is set into an oak cabinet with a high piano finish. All the metal parts are heavily nickel plated. The binding posts are of genuine hard rubber. It is a really beautiful instrument, and from the standpoint of efficiency, it has no competitor. There is nothing which can compare with a DeForest Audion Amplifier.

We can furnish the Type EJ-1 Single Audion Amplifier with the "B" battery contained within the cabinet and with "step by step" switch control, but without the "A" or lighting battery, at \$65, when so ordered.

To cover maximum receiving ranges, the Audion Amplifier must be used.

**TYPE EJ1 SINGLE STEP AUDION AMPLIFIER**, as described.....\$ 60.00  
**TYPE EJ2 TWO-STEP AUDION AMPLIFIER**, for extra long distance receiving and special amplification, each ..... 150.00

Brooklyn, N. Y.

Gentlemen: Some friends of mine so highly recommended your goods that I thought it advisable to have your catalogue.  
 1432 75th St.

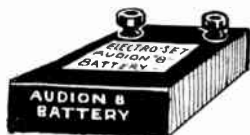
N. BRAINARD FOOT.

Ottumwa, Iowa.

Gentlemen: I received Type A. A. Detector and am pleased with the results.  
 201 E. Main St.

H. M. ENNIS.

## ELECTRO-SET NEW "AUDION B" BATTERY



### A NECESSITY FOR AUDION DETECTORS AND AMPLIFIERS

Here is the only ideal and thoroughly practical high-tension battery for wing and grid circuits on Audion Detectors.

The new model Audions are not furnished with batteries of any description (see articles on them in this catalogue).

Two separate batteries are required for Audion use. One lights the filament, usually a 4 volt storage cell, preferably two of our splendid dry storage cells (see index). The other battery must give an E. M. F. of 50 volts.

The old way was to solder into series contacts 10 to 12 flashlight batteries each giving a separate E. M. F. of 4.5 volts.

The new way is to use the neat, compact ready-to-connect Electro-set Audion "B" Battery. We were the first company to realize the necessity and demand for a self-contained 50 volt battery for Audion use.

**DESCRIPTION**—Our Audion "B" Battery was developed, at great expense, in the largest and most complete battery laboratory in the world by skilled research men. Many problems were met and conquered, and today we are proud to offer this fine battery to the wireless telegraph world. Our Audion "B" Battery consists of 36 separate little batteries, especially made for long shelf life at high voltage and low amperage, all properly soldered into contact, set into a containing case and immersed in aid and moisture proof compound. The guaranteed voltage is 50—the highest voltage single battery of its kind ever offered in such small volume and weight.

Owing to the special cell construction the life is long—from 6 to 12 months—if properly used.

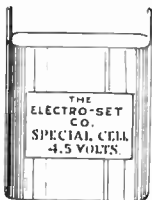
The outward appearance is very neat. Two hard rubber binding posts are furnished for connections. Size over all 6x3x2 inches.

**IMPORTANT**—This battery must not be used for closed circuit work of any kind. It must be used only on valve detectors, such as the DeForest Audion, in connection with the very high resistance potentiometer now furnished on all these instruments. Do not fail to switch off the Audion "B" Battery when through using.

For best results on Audion Detectors and Amplifiers, always use the Electro-set Audion "B" Battery for the wing and grid circuit and our Dry Storage Cells (2 required—see index) for lighting the filament.

**NO. 10 TYPE A B AUDION "B" BATTERY**, as described, shipping weight 3 pounds, each.....\$3.50

## SPECIAL AUDION FLASHLIGHT BATTERIES

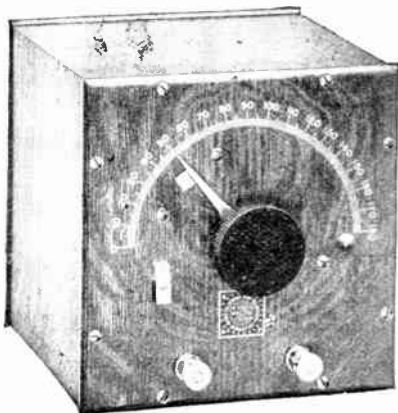


For those who own the old type of Audions (RJ4 and RJ5) or for those who buy the separate tubular Audion Bulbs and have no high resistance potentiometer we sell a very good grade of flashlight battery, ten or twelve of which are required, with a 4 or 5 point switch to regulate the number in use. We sell these batteries at a very low price in lots of 10 only. Less than 10 the price is 25 cents each. Shipping weight, 2 pounds for 10 cells. Voltage, 4½ per cell, 45 volts for 10 cells, 54 volts for 12 cells.

Our batteries have an especially long "shelf-life," which is the most important requirement for Audion use, as practically no current is consumed, the cells simply being used to maintain a potential difference.

**NO. 12 TYPE S. C. BATTERIES**, for Audion use, per set of 10 cells (45 volts) \$2.00  
Per set of 12 cells (54 volts)..... 2.35

## DE FOREST VARIOMETERS



DeForest Variometers represent one of the most modern and efficient means of tuning sharply to incoming signals. They have no "dead ends," as all the wire is used all the time. There are no switch points or sliding contacts to cause waste of the minute received currents through their resistance.

These Variometers are extremely sharp in tuning. They give excellent results through interference, and are recommended to every operator. They may be placed in a vertical position or horizontally as they are balanced so that they remain in any position where set. All adjustments are made with a single hard rubber knob, which simplifies tuning to a remarkable degree. The Variometers are provided with a short circuiting attachment on the pointer so that they may be cut out of circuit at will. They give excellent results when used as loading coils.

The Type RJ Variometer has a range of inductance corresponding to wave lengths from approximately 200 meters minimum to 1500 meters maximum, and of course this is increased by the inductance of the aerial of the stations, and with additional loading coils.

These Variometers measure approximately 7¼ inches square by 9 inches high over all. They are made up in polished oak cases, with genuine hard rubber knobs and nickel plated metal parts. For long waves,

**TYPE RJ DE FOREST VARIOMETER**, complete.....\$20.00

## A BIG ANNOUNCEMENT

Just as this issue goes to press we are fortunate in being able to list the

### NEW TUBULAR AUDION BULB

(SOLD SEPARATELY).

Read the following article carefully. It's great news for the wireless experimenter.

For the benefit of those amateurs who desire to experiment, and who do not wish to buy complete Audion Detectors with the necessary accessories, and for those whose limited means will not permit the complete instruments to be purchased, we have brought out the Type T Tubular Audion Bulb.

Commencing March 15th, 1914, this type of Audion will be sold separately, without the other parts necessary for a complete Audion Detector. It is licensed for amateur use only and is not interchangeable with the regular round Audion Bulbs.

This type of Audion Bulb gives very loud response to signals. Every bulb passes two tests by our experts and is thoroughly up to our standard of sensitive qualities. It is finished in only one grade—the best.

The life of the Type T Tubular Bulb is exceptionally long on account of the fact that the single straightline filament has no loops, and as there is no second filament, the Edison discharge to same is completely eliminated.

The plate or wing is in contact with the glass, preventing overheating. The filament is surrounded by a spiral grid.

This type of bulb is an excellent oscillator for the reception of continuous waves, being different in this respect than round Audion Detector Bulbs.

The grid is the spiral inside the tube and is connected to the green covered wire. The plate is connected to the red covered wire. The filament terminals are the white covered wires.

#### GUARANTEE.

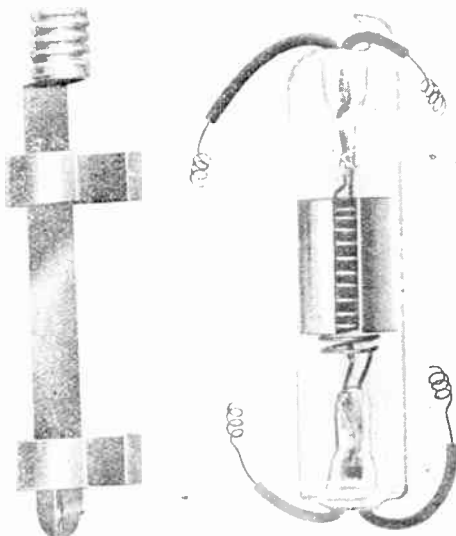
We guarantee the Type T Tubular Audion Bulb to have been tested by our expert and to have passed our standard which is fully 50 per cent more sensitive than any crystal or electrolytic detector, when leaving our factory.

We guarantee these bulbs to arrive in good condition. If a tubular Audion Bulb is broken in transit when shipped by us, and is returned at once, it will be replaced.

We will not replace any bulb for any other reason, whether due to breakage on account of negligence on the part of the operator or due to burning out of the filament.

No guarantee of life can be given as too much depends on the operator. Tests show an average life of over 800 burning hours when properly used.

**NO. 9010 TYPE T AUDION BULB**, as described, complete with full instructions (postage 10 cents) . . . \$5.50  
**NO. 9020 ADAPTER AND HOLDER**, to screw it to miniature socket, extra, (postage 4 cents) . . . . . .40



## CRYSTALOI DETECTORS

KNOWN FOR COMPACTNESS AND EASE OF ADJUSTMENT.

The CrystalOI Detector has long proven itself a most popular and dependable device. There are thousands of enthusiastic users ready to ring its praises in all parts of the world. Testimonials are daily arriving attesting to its merits. The Electroset Company were among the first to introduce this form of detector and have been selling them to satisfied customers ever since their introduction. A complete stock is always ready for shipment on the day order is received.

#### A GREAT RECORD.

On board ship in the harbor of Colon, Panama, the CrystalOI made the remarkable record of rectifying into audibility, signals that were sent from San Francisco, California, a distance of nearly 4,000 miles.

The CrystalOI is a radical departure from any of the well known types of detectors which depend on a metallic point in contact with an extremely minute portion of a sensitive mineral, which is subject to burn-outs, going dead, and the disadvantage of having to hunt around on the surface of the mineral for a sensitive point.





The principle of the Crystalol is exactly opposite from that of any other detector, inasmuch as instead of a fine point of metal coming in contact with a minute portion of a sensitive mineral, the Crystalol is constructed in such a way that a comparatively large surface of a very sensitive mineral is brought in contact with a great many points of a very light, finely divided alloy which becomes a conductor only when traversed by high frequency oscillations. This arrangement renders the receiving apparatus remarkably free from static and other interferences, which makes it an ideal summer Detector, and is wonderfully sensitive.

#### HOW THE CRYSTALOI IS OPERATED.

It is only necessary to put the Crystalol in circuit with a buzzer as shown in the hook-up on the back of this circular, and while holding the key down, rotate the cylinder until the signals are loudest in the ear phones, at which time you are ready to receive anything that is in the air. The Crystalol requires no battery or potentiometer and is ever ready to serve you under all conditions.

#### SENSITIVITY.

The Crystalol is wonderfully sensitive, owing to the fact that the alloy is very light in weight and makes a very delicate contact.

#### SELECTED CRYSTALOI.

The crystals used in the Crystalol are the most sensitive yet discovered. They are all carefully selected and tested for long distance which insures the one you get being absolutely perfect. We have found by actual tests that 90 per cent of the best crystals we can buy are worthless for our purpose and are discarded.

The Crystalol is a most compact and aristocratic looking little instrument that does work 'way out of proportion to its size. Made entirely of moulded hard rubber composition and finely finished metal parts.

#### DESIGN.

The Crystalol is an extremely sensitive instrument that will stand all kinds of hard usage without being injured. There is absolutely no way you can render it useless unless you take a hammer and break it up. It is beautifully finished in every detail and is an instrument of which every owner has just reasons to be proud and will last a life time. It is not one of those makeshifts which are so prevalent in the wireless apparatus of today.

#### PERPETUATION.

Extremely light contacts and many of them together with large radiating surfaces, afford great stability combined with sensitivity, and inasmuch as the sensitive elements are thoroughly protected from all external influences, the Crystalol is simply ideal.

#### NO. 8710 TYPE "O" CRYSTALOI DETECTOR.

This is the complete Detector, ready to operate, with no accessories. Size  $2\frac{1}{4} \times 1\frac{3}{8}$  inches. Price, . . . . \$3.50  
Postage 10 cents.

## NO. 8720 TYPE AA CRYSTALOI DETECTOR

#### MORE SENSITIVE THAN EVER.

This new type of Detector is provided with a specially wound stepped up cohering inductance which causes the alloy to cohere more closely, thereby reducing the internal resistance of the Detector about 25 per cent, which makes it just that much more sensitive. This is really a wonderful improvement as it makes it possible to hear much weaker signals which naturally increases your distance.

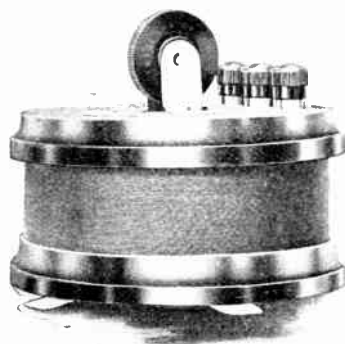
It is an extremely handsome as well as valuable instrument. The base and top are of hard rubber composition. The coils are wound with a bright and pleasing shade of green silk-covered copper wire. It is provided with three binding posts with bases of a silver alloy which prevents corroding and will not tarnish. The brackets that support the cylinder are of the same material. It is also provided with specially designed anti-shock feet, which renders it immune from all vibration, thereby causing it to hold its adjustment.

The dimensions are  $4 \times 3\frac{1}{2}$  inches, that is, it is 4 inches in diameter and stands  $3\frac{1}{2}$  inches high over all.

If you want the handsomest and most valuable piece of wireless apparatus that you ever saw you surely will want this instrument.

We could write a book on this new Type AA Crystalol Detector and then could not convince you what a splendid piece of mechanism it is. You must see it to appreciate it, and you must own it to know its full worth.

**NO. 8720 TYPE AA CRYSTALOI**, shipping weight 2 pounds, price, . . . . . \$6.00



#### IF YOU OWN AN AUDION

You'll be interested in turning to page 20. The Electro-set Audion "B" Battery is doing service in a great number of first class stations. We've yet to receive our first complaint. Want the best? Use our Audion "B" Batteries and our Dry Storage Cells to run your Audion. If the price of the Audion "B" Battery is a little beyond your purse, or if you own any of the old type Audions (RJ-4, RJ-5, etc.) you'll be interested in our splendid special Audion Flashlight cells—\$2.00 per set of 10. See page 20.

**NO. 8730 TYPE BB CRYSTALOI DETECTOR**

**A REAL INNOVATION IN WIRELESS.**  
**(A SELF-CONTAINED DETECTOR UNIT READY FOR USE.)**

In the type BB we have embodied in a single unit every element necessary to rectify into audibility any wireless signals you care to hear. This is a very broad statement, isn't it? But such is the fact.

This type BB consists of a highly finished African mahogany case in which is located a super sensitive Crystalloi cylinder of which the periphery protrudes through the top making it accessible for rotating to secure finest adjustment. A cohering inductance especially calculated and calibrated to the super sensitive cylinder. A fixed condenser with the exact capacity for this particular cylinder. A specially wound Buzzer of which the frequency is controlled by a knurled screw head mounted on the front of the case to produce a note that is best suited to assist in cohering the alloy in the cylinder. Two of the highest grade dry batteries to operate the Buzzer and a Buzzer control button which protrudes through the top of the case for accessibility.

This case is equipped with four binding posts, two of which are for the phones and two for the tuner leads and is provided with anti-shock feet which renders it immune from shocks and jars.

The specially wound Buzzer has an adjustable frequency range of 1000 to 2000 which can be regulated to your liking.

With this carefully designed and calibrated instrument you have but to set it on the table, connect your phones and leads from your tuning coil and you are permanently and thoroughly equipped to engage in the most serious wireless work of the present day. Of course Variable Condensers can be added if desired.

The fact that every part of this apparatus is designed, built and calibrated to work with each other makes it a sensitive piece of wireless mechanism that cannot be duplicated.

You need but a tuning coil, a pair of phones and a Variable Condenser with this type BB to give you a complete receiving station of the very highest order.

**NO. 8730 TYPE BB CRYSTALOI**, size  $7\frac{1}{2} \times 5\frac{1}{2} \times 3\frac{1}{2}$  inches, shipping weight 3 pounds.....\$12.00

**TURNEY PORTABLE RECEIVING SET**

After many months of exhaustive research and experimenting Mr. Turney has succeeded in producing a complete portable receiving set of the highest grade possible that possesses many features found in no other sets that we know of.

**INTERFERENCE.**

This receiving set was designed with the main thought of eliminating interference which is such a discouraging element in every receiving set. We found that a set that was good for long waves would not respond to short ones with any degree of efficiency. This was our big problem but we solved it thoroughly.

**DETECTOR.**

This set comprises the now famous Crystalloi Detector, which has piled up some very wonderful records for long distance work. The new Turney high-capacity Variable Condenser, which is a marvel for efficiency. Our Constant Amplitude Test Buzzer with full equipment. Three switch blades with large dielectric knobs, a total of 75 switch points and our special Selective Coupler with a short wave attachment.

**COUPLER.**

On all waves over 200 meters this Coupler is practically devoid of any capacity such as you find in all forms of loose couplers and in view of this feature the received signals come in clear and strong.

**SIGNALS YOU DO NOT GET.**

There are many signals you do not get with a loose coupler owing to the fixed capacity between the primary and secondary coils. This disadvantage is entirely eliminated in this set on waves of 200 meters or more.

**HEAD SET.**

The head set is the celebrated Brandes many type of 3200 ohms resistance which is acknowledged all over the world to be the most sensitive and highly efficient head set on the market.



**THE DIELECTRIC EMPLOYED.**

The panel is of Bakelite, which is the most expensive, and has the highest electrical qualities of any insulating material known. It is non-hygroscopic, which renders it immune from atmospheric conditions. This is an extremely valuable feature in a wireless set as any film of moisture that deposits on the surface of a dielectric which contains contact points will cause the current passing through them to short circuit which results in a loss of efficiency.

**GOVERNMENT TIME SIGNALS.**

In all our experiments with this set in receiving time signals from the Government Radio Station at Arlington, Virginia, we have never had a single interference while receiving these signals. This is entirely due to the method employed in our new coupler. We know of no other receiving sets that can boast of a record like this.

**NOT A CHEAP SET.**

This is not a cheap set in one sense of the word, as it is provided with the highest priced material and is made by the most skilled workmen we can secure. It is cheap in price only, extremely cheap when compared with sets that cost two or three times as much and which do not compare with it for actual work and durability.

**A HANDSOME INSTRUMENT.**

The entire set is enclosed in a strong genuine African mahogany case which is well varnished and rubbed to produce a pleasing and durable finish. It has strong brass hinges, a good safety lock and carrying handle.

**YOU CANNOT DO BETTER.**

If you want the very best there is in a wireless receiving set, a set that will give you service every day regardless of the weather and a set that you will be proud to show to your friends you will purchase this last word in the wireless receiving art.

An Ideal Jeweler's Time Set, a splendid private yacht set.

- NO. 8740 PORTABLE SET, complete with phones, as described, size 17x10x8 inches, weight 10 pounds, price ..... \$100.00  
 NO. 8750 PORTABLE SET, as above, without phones ..... 87.00

**"THE PERMANON"—PEER OF DETECTORS****SENSITIVE—IDEAL.**

Ever since the mineral type of detector was discovered and used it has been the object of experimenters to eliminate all unnecessary adjustments and to make the instrument as dust proof and permanent in adjustment as possible. There are several splendid detectors of this type now on the market.

However, the price of these instruments has been a drawback to the average amateur. In our effort to bring good apparatus within reach of all, we determined to devise an instrument at a lower price that would be as near perfect as present day wireless knowledge could make it.

We, therefore, take great pleasure in offering our New "Permanon" Detector which, after exhaustive tests, we believe will soon take a foremost place in its field.

The "Permanon" Detector consists of an insulating tube supported by two silver plated brass plugs. A selected piece of extremely sensitive mineral is soldered to one plug. The other plug is in contact with a mixture of pure platinum filings of special size and shape in combination with certain other necessary materials. The tube and plugs are supported between special contacts enabling the tube to be tapped or rotated into a sensitive condition. Considering its convenience and great sensitiveness the "Permanon" is a wonderful instrument. The price brings a remarkable detector within reach of the amateur and experimenter.

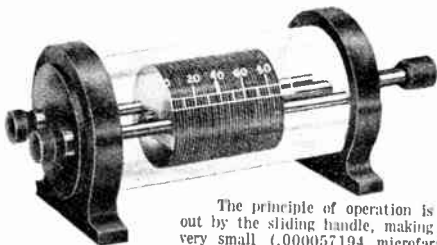
**DETAIL**—Fine moulded hard rubber composition base, size 2½x4 inches. Metal parts of handsomely polished and nicked brass. Height 1¾ inches over all. Especially solid and substantial construction. Very handsome. Extreme sensitiveness.

**YOU'LL LIKE THE "PERMANON"!**

It's new—it's efficient—it's handsome.

We cannot say too much for the "Permanon." Its appearance and workmanship are of the highest grade. Its performance will please the most particular and its price is phenomenally low. The Electro-set Co. is proud to be associated with the manufacture and sale of so splendid an instrument.

- NO. 1675 "PERMANON" DETECTOR ..... \$2.50  
 (Postage extra, 10 cents.)

**TURNEY VARIABLE CONDENSER**  
An Absolutely New and Scientific Design

This new variable condenser is a radical departure from the old rotary form. Mr. Eugene T. Turney, its inventor, claims for this condenser that it has more capacity, higher efficiency and a more handsome appearance than other instruments of like nature. The capacity is varied by means of a sliding rod which projects from one end of the case. The movement is extremely easy and free from friction. The plates are 1½ inches in diameter and are so arranged that it is impossible to short circuit them.

The principle of operation is entirely new. The plates are automatically cut in or out by the sliding handle, making a step by step adjustment. However, each step is so very small (.000057194 microfarad) that the closest tuning is possible. The entire

working parts are enclosed in a flint glass tube, mounted on handsome hard rubber composition ends. The scale is engraved in the glass and is easily read at a distance. The plates are made of special polished and burnished alloy and will not tarnish or corrode. The whole instrument presents a neat and handsome appearance.

Type 1-X Turney Variable has 35 plates. Type 1-XX Turney Variable has 50 plates. Shipping weight, either size, 1 pound.

TYPE 1-X TURNEY VARIABLE CONDENSER.....\$3.50  
TYPE 1-XX TURNEY VARIABLE CONDENSER.....5.00

## MINERAL DETECTORS

Mineral Detectors have long been popular because of their low price and undoubted sensitiveness when proper minerals are used. Probably nine out of every ten detectors now in use are of the mineral type. In fact many of the best long distance records have been accomplished with mineral detectors.

The Electro-set Company, because of their standardized grade, super-sensitive minerals, have undoubtedly done more to keep the mineral type of detector popular during the last year than any other influence. Don't use ordinary minerals. Demand and get only Electro-set Minerals. The prices are only slightly higher but the quality is unexcelled. Ask anyone that has used them.

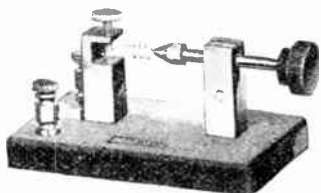
## ELECTRO-SET "SENIOR" DETECTOR

This excellent instrument is built along the lines demanded by a great many advanced amateurs and commercial stations. The crystal holder is of novel design, allowing the use of small pieces, and facilitating the instant removal and replacement of minerals. Another advantageous feature of our Senior Detector is the fact that the surface of the mineral lies in a vertical plane, thus eliminating the necessity of providing a dust-proof cover. The cat whisker contact wire is spiral in shape and is made of phosphor bronze, admittedly the best material for the purpose. This spiral wire is held by a three jawed chuck, operated by a knurled nut, so that any size or shape of wire may be used, removed or replaced at will. This chuck forms the most reliable and convenient holder ever offered and is most ingenious in construction.

The detector is mounted on a hard rubber composition base. All metal parts are made of brass, hand-somely nicked and polished.

We believe this detector, used in connection with our Arlington Tested Galena or Silicon, is of an extraordinary value, and will prove to be especially easy of adjustment and capable of the best kind of performance.

NO. 1603 SENIOR DETECTOR, shipping weight 1 pound.....\$1.50  
NO. 1603 S. C. SPECIAL CUP, for the movable rod, with spring pressure action, converting our Senior Detector into a perfect Perikon Detector for use with Zirconite and Hornite or Ferron, etc., each.... .50

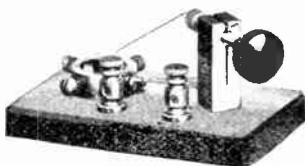


## STANDARD CAT-WHISKER DETECTOR

### POPULAR EVERYWHERE.

This form of mineral detector is too well known to require much description. The mineral is held in a large brass cup by means of three set screws. The phosphor bronze contact wire is held in our excellent three jaw chuck holder, and may be readily removed or replaced in a few seconds. The support post is a massive piece of square brass, polished and nicked. The movable rod may be set in any position and is adjusted by a knurled set screw. The base is our handsome composition hard rubber type, with beveled edges and high polish. This form of detector has many admirers and is well known among the amateurs. Its extreme simplicity and stability make it very popular. It is a simple matter to get perfect galena adjustments on our Standard Cat Whisker Detector. We call special attention to the very heavy brass cup which we use, and to the chuck type of wire holder, both of these being refinements usually not found in a detector at this price. Our No. 4371 Detector is a handsome, strong and practical instrument, very sensitive and generally popular.

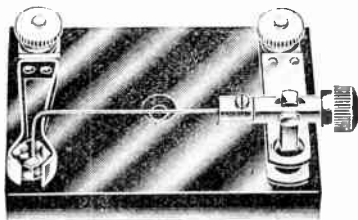
NO. 4371 STANDARD MINERAL DETECTOR, shipping weight 1 pound.....\$1.50



## THE "JOVE" CRYSTAL DETECTOR HOLDER

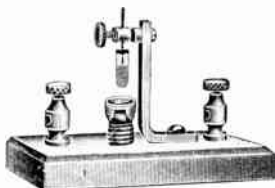
A simple, handy and low priced detector of great merit. Holds crystals of different forms and sizes without any clampscrews. Holds crystals of different minerals at same time—change of contact from one to the other may be made instantly and a sensitive point quickly found; the correct pressure held constantly, all without using a single screw or nut. The "Jove" is an ideal detector holder. It is beautifully designed and handsomely finished. The metal parts are finely nickel plated. The base is porcelain with a special black glaze finish that retains its lustre indefinitely. Two contacting spring wires of different forms are sent with each Jove Detector Holder.

NO. 8804 JOVE DETECTOR, shipping weight 1 lb. \$1.00



## ELECTROLYTIC DETECTOR

WITH SEALED-IN POINT.



(Must Be Used in Connection With Battery and Potentiometer.)

The Electrolytic Detector is one of the most interesting forms of detector in use. Its operation depends upon the effect of electrical waves on extremely small electrolytically polarized surfaces. A platinum wire of almost microscopic size is sealed in a glass tube. The end of the tube is then carefully ground off so that only the cross-sectional area of the wire is exposed. This glass tube is then immersed in a small vessel containing acid and provided with a platinum electrode. Connections for this detector are shown in the figure.

Our Electrolytic Detector has no fine and delicate wire exposed of their difficult adjustment. The Electrolytic Detector is very sensitive and makes a most satisfactory and interesting piece of apparatus for wireless receiving. We suggest that every station ought to be equipped with one of them as an auxiliary detector.

**DETAIL**—Hard rubber composition base, metal parts lacquered brass, removable sealed-point electrodes, brass binding posts, removable acid cup.

**NO. 1605 ELECTROLYTIC DETECTOR**, shipping weight 1 pound.....\$1.50  
**NO. 1606 EXTRA SEALED-IN POINTS**, prepaid..... .75

## POTENTIOMETER NO. 530

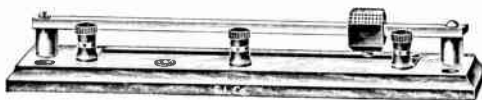


The Potentiometer gives an opportunity of properly regulating the current impressed upon the detector when detectors of the electrolytic, coherer, perikon, or carborundum types are used. Our No. 530 is a reliable, well made instrument fully worth the low price asked.

Many operators claim that all mineral detectors may be improved in sensitiveness by using them in connection with a good potentiometer and battery. This is especially so with carborundum and perikon. Every complete wireless station and experimental shop should contain a potentiometer.

**DETAIL**—Resistance rod, 400 ohms total; variation by suitable steps, metal contact on brass rings, certain and positive changes; base, hard rubber composition; nickelled binding posts. For use with detectors requiring battery current. To be placed in shunt with battery and detector. Over all size,  $4\frac{1}{2} \times 2 \times 1\frac{1}{2}$  inches.  
**NO. 530 POTENTIOMETER**, shipping weight 1 pound.....\$2.00

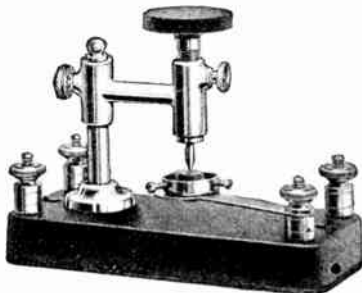
## NO. 1750 NON-INDUCTIVE POTENTIOMETER



A less expensive and more bulky form than our No. 530, but satisfactory in operation, appearance and design. Resistance 300 ohms; size  $10 \times 2 \times 2$  inches; polished wood base, nickelled trimmings. Efficient and good locking.

**NO. 1750 POTENTIOMETER**, shipping weight 1 pound.....\$1.25

## SILICON DETECTOR NO. 322



**DETAIL**—Genuine patented Silicon Detector, manufactured under license from owners of patents covering the use of silicon as a wireless telegraph detector. Hard rubber composition base; all metal parts heavily nickelled; element suspended on spring strip; adjustments, vertical or horizontal, in any degree and to numerous positions. No battery required. Size over all,  $4\frac{1}{2} \times 2 \times 3\frac{1}{4}$  inches.

The Silicon Detector has always been a favorite among amateurs for general service. It gives extremely sensitive results with the least bother and is superior to any other mineral detector in point of quick adjustment to some sensitive spot. The No. 322 Silicon Detector is an especially handsome and serviceable instrument. Its range of adjustment and its scientific construction assures excellence of service quite out of the ordinary.

This is the first Silicon Detector licensed for amateur use which has ever been offered at a low price, and in the past has been added to thousands of amateur stations. There is still remains the opportunity to other experimenters either as a first detector or as an auxiliary. We are confident that this detector will prove of exceptional sensitiveness, knowing as we do, its long distance records achieved in the last few years. No better mineral detector can be made.

**NO. 322 SILICON DETECTOR**, shipping weight 1 pound.....\$4.50



## ABOUT THE COHERER

As is well known, the Coherer was the first practical form of detector used in the transmission of wireless signals. While today many more sensitive detectors have replaced this classical instrument for practical use, the Coherer still remains the only simple device which can be used for such purposes as the distant control of power circuits, the operation of torpedoes, boats, submarines, etc., by wireless, and the wireless explosion of mines.

With the Coherer a great many things can be done that no other simple detector can accomplish. For instance, in lecture work and public or private demonstrations, the Coherer is invaluable. Bells, motors, lamps, guns, etc., can all be readily and visibly operated by wireless telegraphy when the Coherer is used.

The reason for this is that the Coherer is the only known detector which will operate a relay. All other detectors make the signals known by their action on telephone receivers. The Coherer allows sufficient current to traverse it to operate a sensitive relay, which, in turn, may be used to close the circuit for any electrical device.

It must be understood that the Coherer is not nearly so sensitive to wireless signals as the mineral or aulion type detectors. In fact 150 to 200 mile receiving is a difficult thing even when the best Coherers are used. However, for short distances (ordinarily from 1 to 5 miles in amateur use) the Coherer is a mighty interesting and fascinating addition to any wireless set. Furthermore, a very prolific field of research and invention still centers about the Coherer. It is today the only instrument to which we can look for the distant wireless control of power circuits. Many internationally famous experimenters are at work on this subject and the classical and honored Coherer may again come into its own.

## ELECTRO-SET NEW STYLE MAGNETIC COHERER

We herewith present the latest model of our new style Magnetic Coherer, a sensitive and practical design, developed and manufactured by us.

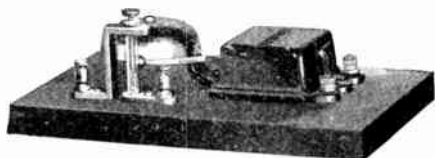
Instead of employing silver filings in contact with two horizontal metal plugs, as used in the old style coherers, we use a magnetized steel needle dipping vertically into a quantity of silver plated iron filings, which rest on, and make contact with a cup sunk into a brass plate. The working parts are enclosed in a thick glass tube. The magnetized steel needle is regulated by a brass thumb screw and lock nut, which project through the top of a heavy brass support. The usual decoherer (an electric bell whose hammer taps against the coherer) is supplied to decohere the filings after the passage of each wave.

We claim for our new style coherer that it is easier of adjustment, more reliable in action and fully as sensitive as the best types of commercial coherers (instruments which the general public have not been able to secure.) For lecture room and demonstration purposes, it is exceptionally desirable because of its reliability and simplicity.

**DETAILS**—Mahogany finished piano rubbed wood base; brass parts lacquered; regulation electric bell decoherer mounted on same base; size 5x8x2 $\frac{3}{4}$  inches over all.

Connections for coherer detector circuit (unrouted) are shown in Fig. 7, page 6. The screw "A" is lowered so that relay "B" is closed. It is then slowly raised until the relay just opens. If the relay has been hitherto adjusted to its most sensitive point the coherer will now operate the relay when electric waves are present. The decoherer is actuated by the relay used in connection with it. A potentiometer or rheostat should regulate the battery current flowing into the coherer.

**NO. 1012 NEW STYLE COHERER**, complete with decoherer, as described, and 1 bottle filings, shipping weight 3 pounds. . . . . \$2.50  
**NO. 1013 SILVER PLATED IRON FILINGS**, per small bottle. . . . . .25



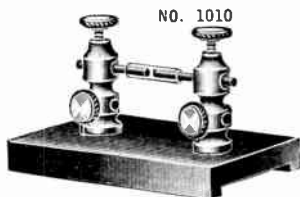
## ELECTRO-SET "STANDARD" COHERER

This little instrument is made up of nicely lacquered supporting posts on a polished wood base. The plugs are of brass, silver-plated. It may be used in connection with a relay, to explode gunpowder at a distance, operate sounders, motors, etc. It makes an interesting and instructive experimental instrument. We furnish the Coherer either alone, or with a Decoherer arranged on the same base. A bottle of filings (silver and nickel) is furnished free.

**NO. 1010 COHERER ONLY**; shipping weight 1 pound. . . . . \$ 75

**NO. 1011 COHERER AND DECOHERER**; shipping weight 2 pounds . . . . . 1.00

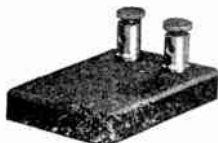
**NO. 1010 PRECISION COHERER AND DECOHERER**, regulation pattern, provided with special micro-meter plug adjustment, on handsome base, all parts beautiful lacquered and polished; suitable for best experimental and lecture work. . . . . \$2.50



Gentlemen: I have had the pleasure of listening to a 1 K. W. Set thirty-five miles distant with a piece of my Galena. It came in so loud that I could hold the phones three feet away from my head and hear.  
 224 Grant St. JACKSON, Mich.  
 LEON BARTHOLOMEW.

## ELECTRO-SET FIXED CONDENSERS

### IN HARD RUBBER COMPOSITION CASES



Electro-set Fixed Condensers are properly calculated in capacity for use in the detector and phone circuits in wireless telegraphy. Only the best grade of tinfoil and dielectric are used and every detail of construction is carefully superintended. These condensers are conveniently small in size, but not too small to allow of proper insulation and sealing. They combine compactness with good looks and are especially desirable for use in cabinet sets. Electro-set Fixed Condensers are mounted in handsome, polished, hard rubber composition moulded cases and are provided with nickeled binding posts of large size.

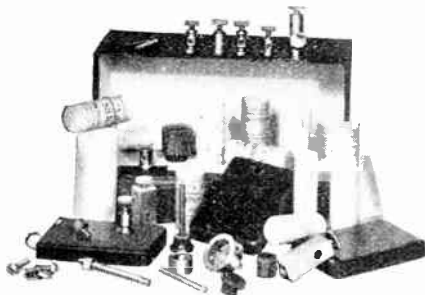
A good feature of these condensers is the provision made for fastening to cabinets or table. For this purpose holes are moulded in either side almost through the top. The thin layer of composition at the top may readily be punched through, if it is desired to screw the condenser down. However, if it is desired to leave the instrument free, the top surface of the case need not be marred by ugly holes.

Electro-set Fixed Condensers are strongly recommended both for their splendid appearance and proper capacity for best results.

**NO. 1678 CONDENSER**, size  $2\frac{1}{4} \times 3\frac{1}{4} \times 1$  inch over all, shipping weight 4 ounces.....\$0.50

## ELECTRO-SET DETECTOR OUTFIT

### CONTAINS 41 PIECES



The Electro-Set Detector Outfit is one of the finest devices ever marketed for the electrical and wireless experimenter. It brings within his reach a splendid array of materials for making and experimenting with almost all types of mineral detectors. Heretofore it required an outlay of from \$10.00 to \$15.00 to allow him to experiment in the fascinating field of detectors. With the Electro-set Detector Outfit he can determine for himself the advantages of the various minerals and crystals used today. He can make 10 to 12 different types of detectors with different adjustments and minerals.

Try out combinations and minerals for yourself. Not all the successful detectors have been invented yet. Possibly you are the one to discover a new type.

The Electro-set Detector Outfit will open up a new field of experiment for you. It is indispensable in any wireless station, no matter how far advanced. It may be used as an auxiliary detector set—for breakdowns, repairs, tests, replacements, etc. The Electro-set Detector Outfit is a veritable handy box in a wireless station. All the parts supplied with this set are **only the best**. Any detector constructed with our outfit will be practical and efficient and possess all the qualities of professional handsomeness and usefulness.

### LIST OF CONTENTS—41 PIECES

- 3 Hard Rubber Composition Bases, size  $2\frac{1}{4} \times 3\frac{1}{4}$ , with hollow bottom and beveled edges.
- 6 Nickeled Binding Posts.
- 1 Special Nickeled Brass Support Post with knurled thumb screw adjustment.
- 1 Special Massive Nickeled Brass Support Post (square) with thumb screw adjustment.
- 1 Square Brass Nickeled Side Milled Post with thumb screw (for mineral holder).
- 1 Crystal Cup with 3 screws for fastening minerals, 1 inch diameter.
- 2 Brass Stamped Crystal Cups, for soldered mineral contacts, with 8-32 screw thread shank.
- 6 inches 8-32 Threaded Brass Rod.
- 1 Wood Box containing low temperature alloy.
- 3 feet Phosphor Bronze Cat-Whisker Wire.
- 1 Hard Rubber Composition Handle, 8-32 brass bushing  $\frac{3}{4}$  inch long.
- 1 Hard Rubber Composition Handle, 8-32 brass bushing  $\frac{1}{2}$  inch long.
- 1 Small Hard Rubber Composition Knob, with 8-32 brass bushing.
- 1 3-Jawed Chuck and Rod, handsomely finished, for holding cat-whisker wires.
- 3 8-32 Brass Hexagon Nuts.
- 6 8-32 Machine Screws.
- 8 Wood Cartons containing minerals as follows:
 

Triple "A" Grade Galena.	Triple "A" Grade Zincite.
Triple "A" Grade Silicon.	Triple "A" Grade Copper Pyrites.
Triple "A" Grade Carborundum.	Triple "A" Grade Bornite.
Triple "A" Grade Molybdenite.	Triple "A" Grade Iron Pyrites.

All parts, please remember, are of the highest grade and are finished in the handsomest manner.

All metal parts are of solid brass. The complete outfit is packed in a neat wooden box, with slide cover.

This set represents the best value possible, and if you were to attempt to buy the parts separately they would cost you not less than \$5.00. We will ship our Electro-set Detector Outfit anywhere in the world upon receipt of the very low price we ask.

**NO. 10010-M ELECTRO-SET DETECTOR OUTFIT**, complete as described, shipping weight 3 pounds...\$3.50

# IMPORTANT!

Do not lose this supplement, always refer to it when ordering. Paste it in your catalogue.

## SPECIAL SUPPLEMENT

Applying to Catalogue B-2

CONTAINING

# REVISED PRICES

# NEW MERCHANDISE

EFFECTIVE JANUARY 15, 1917. ALL PREVIOUS PRICES WITHDRAWN.

## READ

The opening of the year 1917 finds the merchandise shortage more acute than ever. Prices of metals, rubber, fibre and other raw materials are soaring higher and higher. Factories are rushed with war orders. Deliveries of finished products have become painfully slow.

Because of these unprecedented conditions, The Electro-set Co. *in the interests of its customers*, has inaugurated this extensive revision to its catalogue.

Where absolutely necessary we have increased our prices. (In every such instance, however, we have met our customers half way.)

We have *added* new items to fill in the gaps made by discontinued lines and as substitutes for them.

Also we announce several new items which we know will interest you.

We are prepared to give your orders immediate attention under the new schedule.

The Electro-set Co. is bearing a great part of the burden of present conditions.

We trust that we will receive a continuance of your patronage.

## THE ELECTRO-SET CO.

CLEVELAND, OHIO

# IMPORTANT!

We urgently recommend that first and second choice be listed in your orders. Especially when ordering wire give alternate insulation and size

Page	Cat. Number	DESCRIPTION	New Price
7	A-1001	1/6 K. W. Closed Core Transformers.....	Discontinued
	A-1000	1/6 K. W. Closed Core Transformers.....	Temporarily
	7844	Anchor Gaps.....	Increase 10%
8	8900	1/4 K. W. Flexible Transformer.....	REDUCED TO \$12.25
	8910	3/4 K. W. Flexible Transformer.....	REDUCED TO 16.25
	8920	1 K. W. Flexible Transformer.....	REDUCED TO 19.75
	8008	Electrolytic Interrupter (greatly improved).....	2.85
	80080	Renewal Rod, each.....	.25
9	7001	1/2 inch Spark Coil.....	3.15
	7003	2 inch Spark Coil.....	8.25
10	802	Senior Spark Gap.....	1.15
11	480	Rotary Spark Gap (greatly improved and remodeled)	13.00
	0480	Rotary Spark Gap (Marble Base).....	Discontinued
	481	5 inch Rotary Disk Only, for 1/4 inch Shaft.....	3.00
	482	Rotary Gap Standards and Electrodes, complete....	1.50
	476	Rotary Spark Gap (greatly improved).....	7.00
	477	Rotary Spark Gap (greatly improved).....	6.00
	478	3 inch Rotary Disk Only.....	1.65
	479	Stationary Electrodes, complete, pair.....	1.15
12		Entire Page.....	NO INCREASE
13	600	Leyden Jar, 1/2 pint.....	1.50
	601	Leyden Jar, 1 pint.....	1.75
	602	Leyden Jar, 1 quart.....	2.00
	603	Leyden Jar, 2 quarts.....	2.50
	491	Transo Wireless Key.....	1.55
14	606	Helix.....	Discontinued
15	607	Oscillation Helix.....	Discontinued
	610	Antenna Switch (improved).....	2.70
16		Ground Switches.....	NO INCREASE
		These switches are now supplied only with our new, waterproof, non-warping asbestos brses at no extra charge.	
	621	Hot Wire Meter, 0 to 3 amperes.....	3.75
		Hot Wire Meter, 0 to 5 amperes.....	3.75
		Hot Wire Meter (600 mile amperes) 0 to 0.6 amperes.	4.50
	8001	Line Protector.....	2.50
17-19		Entire Pages.....	NO INCREASE
20	10AB	Audion Battery.....	Discontinued
		(NOTE: We recommend substitution of our special, long-life No. 12 Type S. C. batteries listed on page 20.)	
	12SC	Batteries for Audion, Correction in Ship. Wts. 10 Batteries weigh 1 lbs. 12 Batteries weigh 5 lbs.	
21-24		Entire Pages.....	NO INCREASE
25	8804	Jove Detector.....	1.25
26	1605	Electrolytic Detector.....	Discontinued
	1606	Sealed-in Point.....	Discontinued
	1750	Non-Inductive Potentiometer.....	Discontinued
27	1012	Coherer—Now supplied with special Non-Silvered Filings.....	Reduced to 2.00
	1013	Silver Plated Iron Filings.....	Discontinued
28	10010-M	Detector Outfit.....	4.00
29		Entire Page.....	NO INCREASE
30	1680	Radio Variable Condenser..... Mounted	3.75
	1681	Radio Variable Condenser..... Mounted	4.80
	1680	Radio Variable Condenser..... Unmounted	3.30
	1681	Radio Variable Condenser..... Unmounted	4.35
31	Type W	Navy Coupler, enlarged and improved.....	9.50
32		Entire Page.....	NO INCREASE
33	1692	Double Slide Tuner.....	2.25
	W-634	Blitzen Wave Meter, 150 to 500 meters.....	7.50
	W-634	Blitzen Wave Meter, 600 to 2000 meters.....	9.00
34	100-CA	Constant Amplitude Buzzer.....	.90
35		Red Head Receivers.....	NO INCREASE
36	56	Brandes Superior Phones.....	5.50
	56-A	Brandes Superior Phones (leather head band).....	5.00
	56-B	Single Superior Receiver.....	1.85
	56-C	Single Receiver Set (with band and cord).....	3.00
	57	Brandes Trans-Atlantic Phones.....	10.00
37	58	Brandes Navy Phones.....	14.00
	55-B	Murdock Single Head Set (1000 ohm).....	2.50
	55-E	Murdock Single Head Set (1500 ohm).....	3.00
	201	Single Leather Head Band.....	.60
	202	Double Leather Head Band.....	1.25

Page	Cat. Number	DESCRIPTION	New Price
	203	German Silver Head Band.....	1.75
	205	3 foot Cord.....	.18
	206	3 foot Cord.....	.18
	207	Double Cord.....	.55
	208	Double Cord.....	.55
38		Entire Page.....	Increase
39	801	Spark Gap.....	.60
	1601	Detector.....	.50
40	1690-A	Single Slide Tuner.....	Discontinued
	1691-B	Double Slide Tuner, greatly improved.....	1.75
41		Prices all Withdrawn. Note Prices on Individual Instruments.....	
42-43		Entire Pages.....	NO INCREASE
45	3-LD	Transmitter.....	1.50
46		Binding Posts, increase over List Prices.....	30%
	B-28	Midget Switch Points, per doz.....	.25
		Small Switch Lever.....	.08
47		Composition Nobs.....	NO INCREASE
		NOTE CORRECTION: No. C-3 Knob, priced through error at 10c should be 4c; No. C-4 Knob priced through error at 4c should be 10c.	
		Brass and Iron Machine Screws, Hexagon Nuts, Cap Nuts, Washers.....	INCREASE
48		Threaded Brass Rod.....	20%
		Tin Foil, per lb.....	.30
49	B-32-4	Sliders.....	.15
	B-32-16	Sliders.....	.15
	777	Small Vibrator.....	.40
50		Brass Strips, Rod, Tubing.....	INCREASE
		All Tubing over 1/4 inch Diameter.....	Discontinued
		All Rod over 1/4 inch diameter.....	Discontinued
51		Hexagon Brass Rod.....	Discontinued
		Brass Sheet.....	Discontinued
		Aluminum Sheet.....	Discontinued
		Copper Bar.....	INCREASE
		Zinc Rod.....	50%
		Hard Rubber Sheet 1/4 inch thick.....	NO INCREASE
		Hard Rubber Sheet will hereafter be sold only in 1/4 inch thickness. 1/8, 3/16 and 1/2 inch Sheet discontinued temporarily.	
52	1/2'	Vulcanized Fiber Sheet in 1/2 inch thickness only.....	Discontinued
		Vulcanized Fiber Sheet.....	60%
		Vulcanized Fiber Tubing, all sizes.....	Discontinued
	F-10	Transformer Iron.....	30%
	F-11	Iron Core Wire, per lb.....	.20
		Card Board Tubing, NEW QUALITY, greatly improved, extra strong, finest procurable.....	INCREASE
53		Cellulac Tubing.....	INCREASE
		(Not less than 3 inches sold)	
		MAGNET WIRE.....	INCREASE
		Not less than 1/2 lb. sold in sizes larger than No. 26.	
54		High Tension Cable.....	20%
55	12	Hard Drawn Copper Aerial Wire, lb.....	.55
	14	Hard Drawn Copper Aerial Wire, lb.....	.55
	L-44	Electro-set Stranded Cable, per 100 feet.....	.80
		Helix and Ground Wire, sizes 4, 6, 8, per lb.....	.55
	L-23	Iron Guy Wire, per lb.....	.16
	L-26	Annunciator Wire, per 75 foot Coil.....	.34
56	W-1	Key Socket.....	.30
	W-2	Attachment Plug.....	.20
	W-6	Separable Attachment Plugs.....	.25
	W-3	Cheat Receptacle.....	.12
	W-4	Snap Switch.....	.33
	950	S. P. S. T. Switch.....	.20
	951	S. P. D. T. Switch.....	.28
	952	D. P. S. T. Switch.....	.30
	953	D. P. D. T. Switch.....	.40
	W-6	Current Tap.....	.40
	W-7	Current Tap.....	.40
	G-56	Cartridge Fuses.....	.25
57		Detector Cups and Crystal Holders, all.....	INCREASE
		German Silver Wire.....	INCREASE
		Nichrome Wire.....	33 1/3%
		Convenient Parts.....	Discontinued
58		Entire Pages.....	20%
59-62		Entire Pages.....	NO INCREASE



## DESCRIPTION

Page	Cat. Number		New Price
63-69		NO INCREASE on our surprisingly low prices on Flashlights, Bulbs, Batteries, etc.	
70	150	Experimental Light Outfit.....	.70
	1213-P	Pear Push Button: Unable to secure inexpensive style now listed. New, handsome, ivory tipped Pear Push, each.....	.40
	250	Midget Push Buttons, each.....	.20
		Wood Base Switches, INCREASE on each Switch.....	.02
71	251	Composition Connecting Plug.....	.20
	256	Push Switch.....	.60
	257	Push Switch.....	1.15
	258	Push Switch.....	1.75
	1001	Miniature Porcelain Receptacle.....	.09
	1002	Candelabra Porcelain Receptacle.....	.09
	262	Ediswan Socket.....	.25
	263	Ediswan Socket.....	.35
72	1212-P	Pin Sockets.....	.10
73	8801	Telephone Induction Coil.....	.65
		Geissler Tubes.....	Discontinued
74	220	Electric Bell.....	.30
	222	Watch Case Buzzer.....	.50
75	380	Galvanometer.....	.40
	453	Rheostat.....	.70
76	88-L	Rheostat.....	.90
	107-L	Rheostat.....	6.75
	108-L	Rheostat.....	9.00
	1-J	Bell Ringing Transformer.....	REDUCED 1.75
	2-J	Little Jeff Transformer.....	REDUCED 2.24
78		Entire Page.....	NO INCREASE
79	102	Little Hustler Parts.....	.90
80	K-181	Knapp Leader Motor.....	2.50
	M	Peerless Motor.....	1.35
	R	Peerless Motor.....	2.25
	Y	Peerless Motor.....	3.60
81	B-62	Giant Electric Engine.....	1.50
82	129	Knapp Type S Motor Generator.....	4.75
83-85		Entire Pages.....	NO INCREASE
86	174	Induction Coil.....	1.75
87	177	Household Medical Coil.....	3.00
	175	Home Medical Coil.....	4.00
	178	Home Medical Coil.....	6.75
88	21	Vibrator.....	REDUCED TO 9.75
89-91		Entire Pages.....	NO INCREASE
92-93		Dry Storage Cells.....	Temporarily Discontinued
93		Electrolytic Rectifiers, greatly improved, sold only in sets of sets of four, per set.....	7.50
94		Type 62-63 Switch Board Meters, net.....	2.50
95	9000	Static Machine.....	Discontinued
97	0700	Experimenters' Tesla Coil.....	Discontinued
98	303-A	Learner's Telegraph Set, 4 ohm.....	1.50
	3030-B	4 ohm Sounder.....	1.00
99	305	20 ohm Relay.....	2.25
	306	50 ohm Relay.....	2.50
	307	100 ohm Relay.....	2.75
	555-X	Polarized Relay, 20 ohm.....	7.50
	556-X	Polarized Relay, 50 ohm.....	7.75
100-101		Entire Pages.....	NO INCREASE
102-105		Electric Trains: All prices withdrawn. Send for new catalogue showing complete line. We save you money on trains.	
105	3737	Chemcraft.....	2.50
106	0230	Pair Phones, per pair.....	9.00
107		Heating Apparatus: Prices withdrawn. Send for new list.	
108-109		Farm Lighting Plants.....	INCREASE 20%
110-112		Entire Pages.....	NO INCREASE
124		Tools, all.....	Discontinued

## NEW ITEMS OF INTEREST

Below we list a number of new specialties the quality of which is equal to the other splendid values listed in our regular catalogue. Feel free to order any of them with the understanding that the usual Electro-set guarantee goes with each one.

### HIGH RESISTANCE POTENTIOMETERS

Standard Clapp Eastham sector style, mounted on slate base. Size about  $2\frac{1}{2}$  x 1 inches. Three binding posts. 4000 to 5000 ohms, insuring long life of batteries. Especially designed for use with "B" battery in Audion and similar circuits. Has carbon contact rotary lever adjustment. The finest wireless potentiometer made. Shipping weight 2 lbs.

No. W-743 Graphite Potentiometer.....\$2.25

### POTENTIOMETER RESISTANCE SECTOR

4000 to 5000 ohms, same as used on above Potentiometer No. W-743. Semi-circle graphite sector, diameter of arc, 3 inches.

Ends are copper-plated to insure good contact or to solder connections.

No. 743-A Potentiometer, shipping weight, 1 lb., carefully packed to insure safe transit.....\$1.00

### JOVE RECEIVING TRANSFORMER

An exceptionally fine little coupler, as neat and efficient as any ever designed at the price.

Has 15 taps brought out to contact points mounted on the side of the primary cabinet and controlled by a quick acting radial switch, making rapid variation a feature.

The secondary is wound with fine silk covered wire having 6 taps brought out to the contact points on the end of the drum and controlled by a quick acting self-adjusting spring type lever.

The secondary is direct connected to binding posts mounted on the back of the primary cabinet, thus avoiding noises in the receivers and breaks in the messages due to loose and imperfect contacts.

Handsomely finished in cherry, having all metal parts highly finished in polished brass.

Has all the features of Receiving Transformers being sold at double the price.

Size over all 14 inches long by  $5\frac{1}{2}$  inches wide by  $1\frac{1}{2}$  inches high.

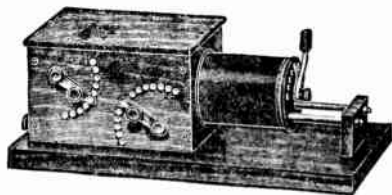
No. 8834 Receiving Transformer (postage weight, 8 lbs.).....\$9.00

### SOLDER AND SOLDERING PASTE

No. 7601 Aluminum Solder, for soldering aluminum. The finest and most efficient solder ever made for this purpose. Comes in convenient small rods for amateur use. Length, 2 inches; about  $\frac{3}{8}$  inch diameter. Prepaid, per piece.....\$0.20

No. 7602 Aluminum Solder Paste, for use with aluminum solder only. Makes solder flow freely and weld properly. Per 2 oz. can, prepaid.....\$0.13

No. 7603 Solder Paste, for all metals and solder excepting aluminum. Economical in use and perfect in performance. Per 2 oz. can, prepaid.....\$0.13



THESE TWO NEW BOOKS SHOULD BE IN EVERY LIVE SHOP

EXPERIMENTERS' LIBRARY—\$2.85

Order these two books now and get results. "Experimental Wireless Stations," 1916 Edition, shows how to make your own outfit and get messages everywhere. It is the only up-to-date book showing new amplifying and oscillating audions. Cloth, 272 pp.—\$1.50. "Experiments," by Edelman describes the new scientific wonders and inventions and shows how to make your own apparatus the way you want it. Cloth, 256 pp., fully illustrated, \$1.50. Both volumes (formerly \$3.50)—only \$2.85. Postage on 3 lbs. extra.

Both splendid volumes are up-to-the-minute in every particular. You take no risk in ordering, as you may have the privilege of return after three days' examination. **Order Now.**



NEW TYPE "R" THORDARSON WIRELESS TRANSFORMERS

The last word in wireless transformers. The handsomest in design and most efficient in operation that ever were brought to the notice of wireless amateurs. New magnetic leakage shunt adjustable by lever action. Safety spark gap. Fully mounted, ready for use. The big, long distance record breakers.

Cat. No.	Rating	Height	Width	Length	Amperes	Wt.	Price
4200	½ K. W.	9"	4½"	9"	1 to 6	28	\$20.00
4300	¾ K. W.	10"	5"	10"	2 to 9	31	25.00
4400	1 K. W.	14"	6"	12"	3 to 11	16	30.00

## Every Wireless Experimenter

*Should use our Famous Specialties*

**RED HEAD 2,000 OHM PHONES**

— AND —

**ARLINGTON TESTED MINERALS**

Known the world over as *the best* in their respective fields. Try them once you'll use them always

*They increase your receiving range.*

Send 25c cents with your next order for an individually sealed NAA Crystal. Specify whether Galena or Silicon is wanted.

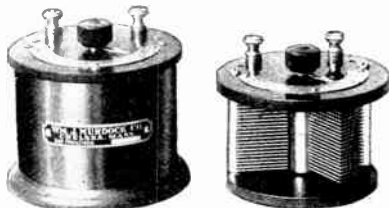
*Your Money back if you demand it.*

## ROTARY VARIABLE CONDENSER NO. 366MV

### GUARANTEED

The Best You Can Buy

We hereby guarantee our Rotary Variable Condensers to be the best you can buy for the money and are ready to back this statement by immediate adjustment of any unsatisfactory purchase.



The following claims by the manufacturers are quoted verbatim. They are substantially true in every particular.

Our production of a regulation vane type air dielectric condenser at a low price was a typical accomplishment. It is a condenser such as amateurs have always sought for at a price far below those which had been in force previously. This new condenser is, in spite of its low price, characterized by the qualities which have always been noted in our apparatus, namely, good materials, good design, and good construction. We believe that this condenser is superior in constructional detail and working efficiency to any on the market and offer it with our usual "money back" guarantee. In appearance it is decidedly attractive, and its sturdy construction insures lasting service. We are confident in our belief that this condenser is the cheapest and best variable condenser of this design ever offered for amateur use and unhesitatingly recommend it for such use in combination with any class of apparatus. Its capacity is such that it may be used effectively either in series with the primary or in parallel with the secondary. In addition, it is just the condenser for its effective use in a wave meter combination, if the amateur desires to wind an inductance and have the combination calibrated.

**DETAIL**—Maximum capacity .001 mfd., air dielectric; regulation type semi-circular metal plates, 43 in number, 21 movable, 22 stationary, separated 1-32 inch. Complete case and top, polished black hard rubber composition; knurled knob handle, arrow indicator, nickeled binding posts, 180 degree scale. Size, 4 1/4 inches diameter; 4 inches high; shipping weight 2 pounds.

This condenser is the only practical type for oil immersion, since its construction is absolutely leak-proof. By filling the moulded case with boiled linseed or castor oil the natural capacity may be increased five times. No transparent case condenser can be built that will give you this splendid characteristic. A variable condenser is indispensable in any advanced wireless station. It will increase your range and tuning power. Get a good one.

**NO. 366MV VARIABLE CONDENSER**, as described ..... \$4.00

## ROTARY VARIABLE CONDENSER NO. 368MV



This condenser has a capacity of .0005 mfd. and will be found suitable for use as a secondary multiple condenser for the average wave lengths. It is in every way a handsome, splendidly operating instrument and offers the best value obtainable for the price.

**DETAIL**—One-half size No. 367MV; 11 movable plates, 12 stationary; interior construction similar to No. 366MV; transparent case; hard rubber composition top with scale. Size 4 inches diameter, 2 3/4 inches high; shipping weight 1 1/2 pounds.

**NO. 368MV ROTARY VARIABLE CONDENSER** ..... \$3.00

## ROTARY VARIABLE CONDENSER NO. 367MV



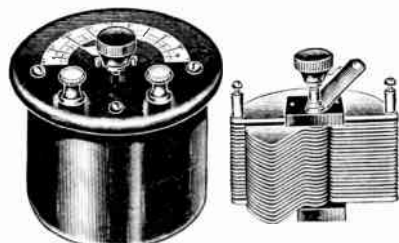
This condenser is precisely the same as our No. 366MV in essentials. It differs merely in the case. Some prefer a condenser which shows the movements of the interior parts and this instrument is offered to satisfy this demand.

**DETAIL**—Same construction interior as No. 366MV, described above. Capacity .001 mfd.; case transparent, exposing interior working of condenser. Size, 4 inches diameter; 3 3/4 inches high; shipping weight 2 pounds.

**NO. 367MV ROTARY VARIABLE CONDENSER** ..... \$4.00

**ROTARY VARIABLE CONDENSERS** will add 50 per cent to the tuning efficiency of your station. Used in various ways, they will either lengthen your natural wave or decrease it at will. It is easy to make a good wave meter with our Rotary Variable condenser. The indispensable book "How to Conduct a Radio Club," price 50 cents, will tell you how. Send for your copy today.

## ELECTRO-SET "RADIO" VARIABLE CONDENSERS



In presenting these excellent instruments to our customers we feel confident that we are offering one of the finest and most efficient types of rotary condensers that are made today. Not only is the workmanship exquisite but the design and general makeup are all that could possibly be desired.

These instruments are made in two sizes. No. 1680 has 21 plates and a capacity of .0005 microfarad. No. 1681 has 43 plates and a capacity of .001 microfarad.

A distinguishing feature of Electro-set Radio Variable Condensers, is the fact that they may be placed in a horizontal position, the movable plates remaining in any position without the use of counterweights or balances. This feature makes them especially

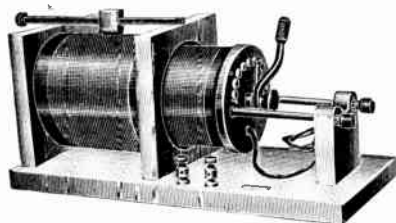
desirable for cabinet or panel sets. The case is made of hard drawn brass, dust proof, finished in rubbered black. The cover or top is made of genuine turned hard rubber, and is provided with a nickeled dial, pointer and stopping pins. The case may be filled with castor oil, thus increasing the working capacity 5 (five) times.

Variable condensers are indispensable in modern wireless work. Used in various ways they either increase or decrease the natural wave length. The tuning characteristics of any station will be improved from 50 to 100 per cent by the addition of one or more of these instruments.

Size over all, No. 1680, 3x4 1/4 inches. Size over all, No. 1681, 3 3/4 x 4 1/4 inches.

NO. 1680 ELECTRO-SET "RADIO" VARIABLE CONDENSER, shipping weight 2 pounds.....	\$3.30
NO. 1681 ELECTRO-SET "RADIO" VARIABLE CONDENSER, shipping weight 2 pounds.....	4.50
NO. 1680 CONDENSER, unmounted.....	2.80
NO. 1681 CONDENSER, unmounted.....	3.90

## ELECTRO-SET "SENIOR" LOOSE COUPLER



This instrument is priced at from 20 to 50 per cent lower than any other instrument equaling it on the market. Made throughout in the most approved style and of the best materials, it is indeed an instrument which we are proud to offer to our customers. The wood parts are finished in polished mahogany and are carefully screwed together, not nailed or glued. They will not fall apart or warp as do the instruments of some manufacturers. The care which we exercise in the manufacture of this coupler is the same painstaking care which we use in making our best and most expensive instruments. In fact our "Senior" Coupler has been used with the greatest success on long distance work, from 1000 to 1500 miles being covered with ease.

The windings are made over non-warping special tubing and only the best grade of silk covered copper wire is used. Silk covered wire is almost double the cost of enameled wire, but the results in loose-coupler instruments make its use very desirable. In fact enameled wire has a condenser effect due to its high dielectric value that makes it inefficient for inductively coupled wireless instruments.

Our "Senior" Loose Coupler will respond, naturally, to wave length of 1800 meters, which figure is increased by the wave length of the aerial system itself. A good loading coil will further increase the wave length to approximately 4000 meters.

**SPECIFICATIONS**—Wood parts mahogany finished and polished, metal parts gold lacquered brass. Primary varied by efficient slider. Secondary varied by rotary switch lever in ten steps. Windings of silk insulated wire. Size over all 5x6x14 inches.

Our "Senior" Loose Coupler is an excellent value, and has proven to be a most popular and desirable instrument. It has given universal satisfaction. This year's model has been greatly improved and will no doubt prove even more popular than in the past.

NO. 1695 "SENIOR" LOOSE COUPLER, shipping weight 10 pounds.....\$6.85

## NO. 1696 "A" "SENIOR" LOOSE COUPLER

This instrument is the finest type of receiving transformer built in the regulation slider pattern. In size and design it is almost identical with our No. 1695 Loose Coupler. However, there are many refinements that place it far above the ordinary run of instruments. The primary and secondary ends and the support post for the secondary slide rods are of genuine hard rubber, beautifully turned and polished. Every part where leakage is at all liable to occur is carefully insulated.

Our No. 1696 "A" Coupler is an extraordinary instrument. It is particularly and strikingly handsome and business-like in appearance. It is ultra-efficient by reason of the carefully selected materials and accurate workmanship. Silk covered wire is used throughout. The sizes and proportions are accurately calculated. Windings are made on non-warping, non-shrinking tubing. Details have received more than detailed attention. NO. 1696 "A" LOOSE COUPLER, as described, shipping weight 10 pounds.....\$12.00

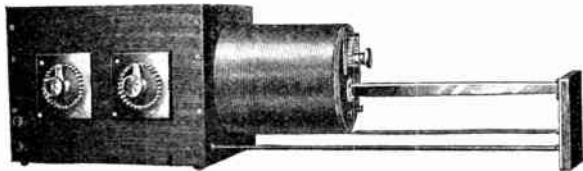
Gentlemen: I received your wireless minerals O. K. and will say that the Galena is the most sensitive mineral that has been my fortune to run across, and if used intelligently is a close second to the Audion.  
1046 44th St. Brooklyn, N. Y.  
CLARENCE WEST.



## THE CAMBRIDGE TUNER

FOR LONG WAVE LENGTH STATIONS

There is an increasing desire among those who are seriously interested in radio work to adapt their stations to those wave lengths which are used by the great transatlantic stations, such as Tuckerton, Sayville and others in process of erection. These stations have been the sole means of communication between this country and Germany during the great European struggle now in progress, and employ wave lengths running from 10,000 meters upwards to about 15,000 meters.



The general tendency in high power radio work is all in the direction of ares, alternators and other forms of maintained wave generators, and invariably toward very long wave lengths, which are essential to such equipments and the high powers used. It should be understood by the purchaser that many such stations are not audible without the use of a ticker, oscillating audion, as described by Armstrong and others, or some other means of breaking up the waves into audible groups or beats, but where such means are available, work of the most interesting character may be done, and several of our customers report reception of signals from Nauen, Germany, with fair regularity.

The Cambridge Tuner is designed only for these long wave lengths, that is 2000 meters up to about 15,000 meters. It is wound throughout with double silk covered wire, on cylindrical tubes, 6 $\frac{3}{4}$  inches and 7 $\frac{7}{8}$  inches in diameter respectively. Tuning is done entirely by switches and all sliding contacts are eliminated. The primary is entirely enclosed in a handsomely finished mahogany cabinet opened at one end to receive the sliding secondary. All metal parts are nickel plated brass, except switch contacts, which are silver plated to insure the highest degree of conductivity. The total length of the instrument is 36 inches, while the cabinet enclosing the primary is 10 inches square by 13 $\frac{1}{2}$  inches long. Primary has 34 taps brought out to switches. The instrument is designed to permit close tuning on the primary and very loose coupling between primary and secondary, which is quite essential for maintained wave reception.

The secondary coil is equipped with an 18 point switch for varying its inductance.

We can recommend this tuner to schools, colleges, students and electrical laboratories in general as opening a field of great interest and in line with the latest and best thought of the world's greatest radio engineers.

NO. W610 CAMBRIDGE TUNER.....\$40.00

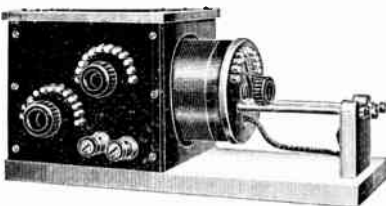
## ELECTRO-SET "NAVY" LOOSE COUPLER

YOU'LL BE PROUD TO OWN ONE

In response to the demand for a really good "Navy" type of receiving transformer at a within reason price we herewith present our newest product in this field.

The "Navy" type of coupler has been a very much abused instrument. Every "fly-by-night" mail order house (so-called) and a great many amateurs, posing as manufacturers, have produced what they termed "navy receiving transformers." Having photographed their model and advertised it, the uninitiated were often persuaded to buy, only to learn, to their sorrow, that it is mighty easy to advertise poor goods attractively.

It is not easy to build a good "Navy" type coupler. It is a precision job and requires high grade equipment and labor. The Electro-set Company have designed, and now offer to their friends and prospective friends, a really good navy receiving transformer at a reasonable price. It is not, by any means, the lowest priced. But we do claim that it is the lowest priced in the end. Our navy couplers were not built to meet a price. They were built first—the price was made later. The fact that the price is low is because of large and efficient production in practical and efficient shops.



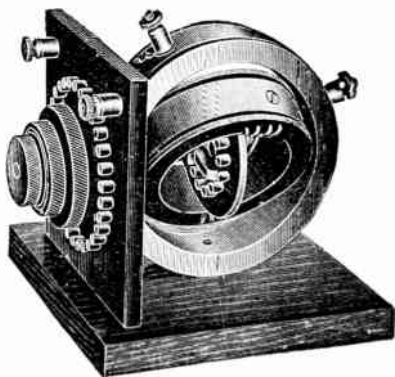
**SPECIFICATIONS**—Woodwork, hand polished, mahogany finished. Windings of best silk covered magnet wire. All metal parts gold lacquered brass. Primary variation by two sets of rotary turned brass contacts, adjusted by generous hard rubber composition knobs. Left side knob tunes in large jumps; right hand knobs tunes in very fine gradation. Secondary variation by a 10 point rotary contact set, with turned brass switch contacts. Natural wave length, approximately 2000 meters; loading coil will double this wave length. Size over all 6x6x14 inches.

Electro-set Navy Loose Couplers are made in two styles. Type "W" is made entirely of well seasoned wood, carefully stained and rubbed and selected for its insulating properties. It is undoubtedly the finest low priced coupler made today. Type "R" is made with all contact parts of genuine hard rubber, such as ends, secondary panel and rod supports. Type "R" is extra efficient and can be used for the most advanced kind of wireless work. Both types are beautifully made and finished and both of them represent values from 20 to 50 per cent greater than usual.

TYPE "W" NAVY LOOSE COUPLER, as described, shipping weight 10 pounds.....\$ 8.75

TYPE "R" NAVY LOOSE COUPLER, hard rubber construction, shipping weight 10 pounds..... 13.50

## BLITZEN RECEIVING TRANSFORMER



This is a variometer type coupler but it must be understood that it is not a variometer; the principle involved being entirely similar to that of the regulation models. The design is radical but in every way practical and efficient. Splendid workmanship and extraordinary ease of operation characterize this instrument. Windings and switch panels are of genuine hard rubber. Woodwork of genuine mahogany.

**SPECIFICATIONS**—Weight 24 ounces; shipping weight about 2 pounds; dimensions, 4 inches wide, 4 inches high and 6 inches deep; wave length up to about 1500 with average antenna; number of primary contact points, 30; number of secondary contact points, 12; switches, edge-wise instrument type; all connections soldered to lugs under heads of screws.

**NO. 1700 BLITZEN COUPLER**, as described. . . . \$12.00

**NOTE**—The above instrument is the identical coupler that hitherto sold everywhere for \$15.00. Our new price of \$12.00 makes our No. 1700 Blitzen Coupler an unusual value.

## THE "ELECTRO" LOADING COIL



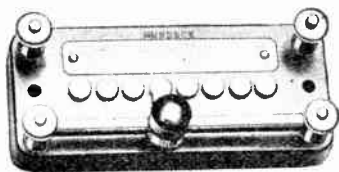
In order to receive messages from stations using very long wave lengths, it becomes necessary to use a loading coil in order to increase the natural wave length of the ordinary tuning coil or loose coupler. This loading coil has a wave length of approximately 5000 meters. If placed in series with either our No. 8486 or No. 9950 tuning coils, or our No. 12002 coupler (in series with the primary) or our "Interstate" outfit it becomes possible to catch time signals from the Arlington government station, using 2500 meters wave length. These stations cannot be heard with the ordinary tuner or coupler, as these instruments usually do not go beyond 600 or 800 meters wave length. The use of this loading coil enables one to receive messages from almost any station, no matter what its wave length, up to 5000 meters, the capacity of your outfit is increased enormously, as you can practically receive most any message from any radius.

There are six steps, each switch point representing approximately 800 meters wave length, and by simply revolving the knob most any wave length can be obtained. Of course, it must be understood that either a loose coupler or a tuner must be used in conjunction with this instrument, as it cannot be used by itself alone.

We cannot praise this wonderful instrument too highly and once used you will not do without it. It is made entirely of hard rubber composition with large hard rubber handle and hard rubber binding posts. All metal parts are nickel plated and highly polished; its size is 4 inches in diameter and 1½ inches in height. The diameter of the hard rubber thumb handle is 1 inch. The instrument is furnished in a neat box. Explicit directions and diagrams are furnished. **WE GUARANTEE SATISFACTION.**

**NO. 8487 ELECTRO LOADING COIL**, as described, shipping weight 1 pound. . . . . \$2.50

## LOADING INDUCTANCE NO. 510-M



With the increase of wave lengths which has become so common in modern practice of wireless, a need of building up the period of the primary of receiving transformers to wave lengths of 3000 to 4000 meters was apparent. The loading inductance illustrated here fills this need perfectly. Used in connection with the primary of the average receiving transformer, waves up to 4000 meters in length may be perfectly tuned. The instrument is easily connected and operated. Its excellent construction assures perfection of service and its handsome appearance adds to the dignity of any station.

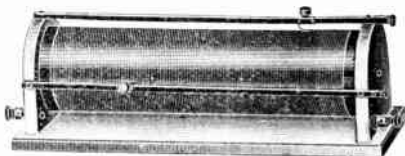
**DETAIL**—Loading coils contained in compact flat base and tapped to seven active contact points, with sliding contact of regular switch style; each active point represents approximately 400 meters; base, polished hard rubber composition; all metal parts heavily nicked. Size over all 4½x2x1½ inches. Shipping weight 1 pound.

**NOTE**—No. 510 Loading Inductance may also be efficiently used in connection with single or double slide tuning coils, and wherever a good loading coil is required.

**NO. 510 LOADING INDUCTANCE**. . . . . \$3.00

## ELECTRO-SET PROFESSIONAL TYPE TUNER

While loose coupled receiving hook-ups are widely used wherever amateur or commercial wireless installations exist, it must not be overlooked that the double slide tuning coil is one of the most practical and acceptable instruments for making up an efficient receiving set at a low price. In fact we certainly recommend a good double slide tuner over many of the poor and deceivingly low priced loose couplers flooding the market today. We also point out that, especially for novices and beginners, good results are always obtained with tuning coils, due to their simplicity.



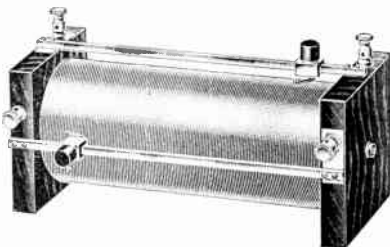
Of course we recommend in all cases that the best equipment possible be secured, and that the most modern and approved instruments should always be purchased, if the necessary funds are available. However, it is certainly true that the double slide tuner is still in accepted use, not only in amateur and experimental stations, but also in many commercial stations. It is not quite so selective as a good receiving transformer, but it will give good results, and work over extraordinary distances.

Our No. 1693 Tuner is an extra large instrument, designed for quite long wave lengths. It is made and finished according to the most approved designs. The winding is 15 inches long and 5 inches in diameter, made on a non-shrinking, specially treated tube. Two brass rods are furnished, with easily actuated sliders that will not harm the windings but that make perfect contact. The construction is solid and substantial. The instrument is especially pleasing to the eye. With proper aerial this tuner will respond to wave lengths over 2500 meters, thus allowing 99 per cent of all amateur and commercial stations to be tuned in. Wood parts are mahogany finished. Brass parts are gold lacquered. This attractive instrument will meet the most exacting requirements of the wireless operator. Size over all 6x6x18 inches.

**NO. 1693 TUNING COIL**, shipping weight 9 pounds.....\$3.50

## NO. 1692 DOUBLE SLIDE TUNER

This is the finest \$2.00 tuning coil made. It is wound with bare copper wire, spaced by winding on a special screw fed winding mechanism. A new process of shrinking the tube before winding make the wire retain its position indefinitely. Further precaution is taken by shelling the windings. The woodwork on this tuner is nicely finished. All metal parts are made of gold lacquered brass. The appearance of the tuner is greatly improved by the carefully concealed wiring, no connecting wires being visible. All lead wires to rods and posts are carried up through vertical holes drilled in the end pieces.



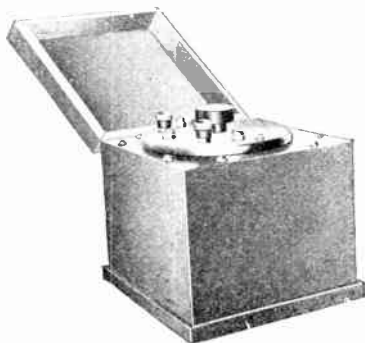
The wave length of this tuner is approximately 1000 meters. It may be "loaded" readily with any good loading coil, and in fact, we have frequently heard NAA (Arlington) with a wave length of 2500 meters on this tuner.

Size over all 4x4x9 inches.

**NO. 1692 DOUBLE SLIDE TUNING COIL**, shipping weight 3 pounds.....\$2.00

## THE BLITZEN WAVE METER

"The Blitzen" Wave Meter shown above is an accurate instrument designed for rapidly ascertaining the wave length, not only of your own transmitter but also of any incoming signals. It consists of a Blitzen rotary variable condenser mounted in a finely finished mahogany cabinet having a hinged cover. In this cover is mounted the inductance coil cleverly concealed from sight. The cover folds back exposing all connections to view and placing the coil and condenser in a convenient position for operation.



Full directions for use and a calibration curve sheet are furnished with each instrument. This meter is accurate to within three per cent, which is sufficient for all ordinary purposes.

When furnished with buzzer and battery the wave meter emits oscillations of known wave length, this wave length depending on the setting of the meter in accordance with the calibration curve furnished. When so used it provides a source of test signals of any desired wave length from which a receiving set may be calibrated or any other tests may be made. Furnished without detector or telephones. The instrument may be used in connection with any high grade 2000 ohm head set and any type of crystal detector the purchaser may have at hand.

**CAT. NO. W 634. BLITZEN WAVE METER**, with curves and directions, for 150 to 650 meters, price. \$.600

**CAT. NO. W 634. BLITZEN WAVE METER**, with curves and directions, for 150 to 2000 meters, price. 8.00

## ABOUT TEST BUZZERS

Test buzzers are used for locating sensitive spots on detector crystals and for testing detector circuits to determine whether or not everything is in proper shape. A single wire is led from the stationary contact of the buzzer. This wire is connected in to any section of the detector circuit. When the buzzer is operated, a buzzing sound is heard in the receivers, if everything is O. K. and a sensitive spot on the mineral is located. If this buzz is loud and clear you are sure that your detector is working properly. A good test buzzer is indispensable.

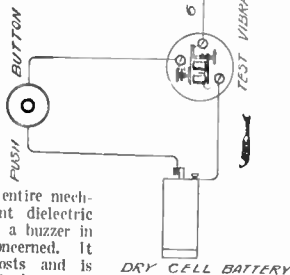
While any good electric door buzzer may be used for this purpose, it is much more desirable to use a regulation type of test buzzer. We describe two excellent types.

### CONSTANT AMPLITUDE TEST BUZZER

This special Constant Amplitude Test Buzzer contains some entirely new features and closely resembles the tone of a 500-cycle Telefunken set. This is due to the arrangement of the contact, which is provided with a lenient back-check, which prevents the armature from over-reaching and the amplitude becomes constant. This you will find in no other type of buzzer. The contact points are of pure silver, which prevents burning and the entire mechanism is enclosed in a non-resonant dielectric case. You will never know you have a buzzer in your circuit as far as attention is concerned. It is provided with three binding posts and is highly finished. Two dry cells required.



NO. 100-CA TEST BUZZER, size  $2\frac{1}{2} \times 2\frac{1}{4}$  inches (postage extra, 10 cents) .....\$0.75



## CENTURY WIRELESS TEST BUZZER

### VARIABLE PITCH

This exquisitely made little instrument was especially designed for the largest commercial wireless telegraph company in the world and is widely used by them. You would never believe that such perfection of workmanship and refinement of detail could ever be incorporated in a buzzer. Even the interior parts of the Century Test Buzzer are highly nicked and polished. The instrument is mounted on a genuine hard rubber base. It is furnished with a brass cover, for protection, easily removable by a slight turn.

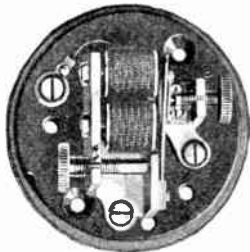


The cover is handsomely finished in dull black rubber imitation, which will not chip or tarnish and will always look well.

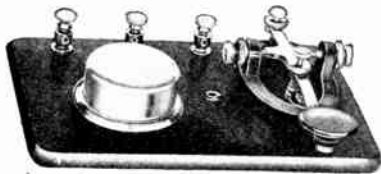
The contact points are genuine platinum metal, not an alloy or substitute. They are very large and rugged. The adjusting screw is especially large and easy of adjustment, having a head  $\frac{3}{8}$  inch in diameter, knurled for turning by hand. This is a great convenience. The tone adjuster is similarly built. A slight turn varies the pitch instantly. Double spring contact strips are used, making the tone even and of constant amplitude. Every part is built like a high grade watch.

Last but not least comes the actual tone itself. Here will be your big surprise. The pitch may be regulated from a soft, deep hum to a shrill, high whistle, perfectly reproducing the sound of the best tuned modern high power wireless stations. The mechanical noise of the buzzer may have little volume if so regulated, thus allowing its operation in close proximity to the detector while testing.

NO. 101-CT CENTURY TEST BUZZER, size  $1\frac{3}{4} \times 1$  inch (postage extra, 5 cents) .....\$2.00



## WIRELESS CODE PRACTICE SET AND TEST BUZZER

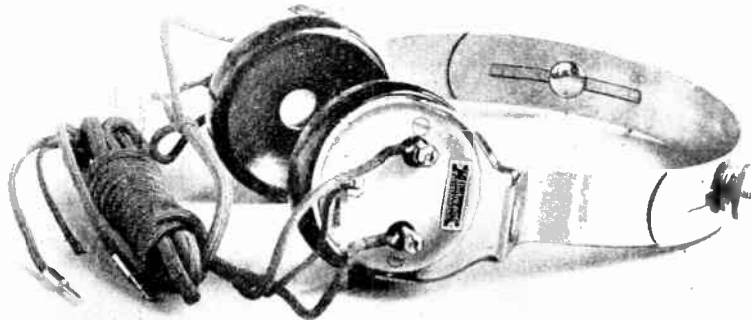


This set consists of a high grade telegraph key, with full adjustable features, and a handsome, gold lacquered, brass covered buzzer arranged on a beautiful, mahogany finished base. Three gold lacquered brass binding posts are provided so that either the key or the buzzer may be used separately, or both together. The quickest way to learn the wireless code is by the use of one of these outfits. The tone of the buzzer closely approximates that of a wireless telegraph set in operation. It is almost impossible to learn the wireless code by a regular key and sounder, as the dots and dashes sound altogether different. Anyone can learn the wireless code in buzzer at their command. By connecting a wire from the adjusting screw of the buzzer to the detector, it may be used as a test buzzer for minerals.

NO. 303 WIRELESS CODE PRACTICE SET, as above, size  $5 \times 7 \times 1\frac{1}{2}$  inches, shipping weight 1 pound...\$1.50

## \$5.00 NOW BUYS THE BEST WIRELESS RECEIVERS YOU CAN GET

THE ELECTRO-SET CO. PRESENTS RED-HEAD RECEIVERS  
THE NEW STANDARD IN APPEARANCE AND PERFORMANCE.



Everyone realizes the fact that good receivers determine in a very large measure the receiving range of wireless telegraph stations. The finest equipment will do poor work if the receivers and detectors are not sensitive. Everything depends upon both of them.

The Electro-set Co. therefore determined to produce the finest wireless receiver head set ever produced at a price everyone could afford to pay. We determined that no receivers, regardless of price, should excel them. We knew they must be handsome in appearance—who doesn't like good looking apparatus. We knew that in order to accomplish our ideal the price had to be low but that not one degree of sensitiveness could be sacrificed.

We took into consideration the good qualities of the most expensive phones made today. We eliminated their bad features. We incorporated their good ones. We paid the minutest attention to details—the little things that taken together mean everything.

**THE RESULT IS WHAT YOU HAVE BEEN WAITING FOR—WHAT YOU DREAMED OF—YOUR IDEAL.**

We now offer these wonderful receivers—the kind you need but could not afford formerly—at \$5.00 per pair, complete, ready to use.

This exquisite set of receivers is perfectly splendid to see. The old, brassy type of nicked head band that used to pull your hair out, is gone. Our head bands are not split, but they are so designed, that they fit, firmly and snugly to the head without pinching. They are adjustable to any head in a few seconds, without twisting into a mass of mixed parts. The receiver holders are mounted on a swivel joint to fit the ears. The head band is made of pure phosphor bronze, polished to a beautiful copper colored surface, finely lacquered. The contrast of this beautiful metal against the aluminum receiver shells is admirable. The "red" head band gives the phones their name.

The receivers are built after the most approved design. The backs are made of aluminum; frosted finish with bright contrasty nicked screw heads, showing through. Each receiver is wound to 1000 ohms (2000 ohms per pair) with electrolytic copper wire of the highest grade. The best magnet steel obtainable is used in the construction of Red Head Phones—and plenty of it. The interior parts of each receiver are highly nicked and polished. The diaphragms are extra thin.

The cord connections are made on the outside of each receiver, thus eliminating the necessity of tampering with the carefully adjusted interior. An important addition is the little strain post on the back of each receiver. The post carries the strain of the receiver cords, thus relieving the connection posts and insuring against loose contacts.

The cords are furnished with extra mercerized leads for the strain posts. These leads are tied firmly to the post. You'll find this refinement most convenient.

Next, the matter of ear caps received our attention. Ordinary ear caps are very fragile. They break on the least provocation. The threads tear out—they require "egg shell" care in handling. We didn't like these faults. So "Red Head" Receivers are fitted with genuine Bakelite Moulded Ear Caps. They cost us four times what other ear caps cost—they add no value to "Red Head" Receivers that you can see. But there are many refinements in these splendid

### *What Constitutes Good Receivers*

### *Why We Call Them "Red Head" Phones*

### *The Little Matter of Good Ear Caps*



Instruments that don't show on the surface. And so we furnish special receiver caps made of the highest grade Bakelite that will stand 10 times more abuse than ordinary ear caps. They are as near unbreakable as ear caps can be made.

Special attention is given to the shape of these ear caps. They are comfortable. They properly concentrate sound. They fit closely.

### Details That Count a Lot

Every part that goes into the manufacture of Electro-set "Red Head" Receivers is machined to a nicety. Precision is the by-word in their making. The pole pieces and shells are ground to the thousandth part of an inch. The windings and magnets are examined and tested by experts. The sizes and weights of parts are calculated mathematically for efficiency. The finish, even of the interior parts, is as high grade as that in a good watch.

#### WHERE THEY EXCELL.

Last, but not least, is the matter of tone and sensitiveness. These are the important points. You'll go far to find the equal of "Red Head" Receivers. We've tested them side by side with phones selling at \$7.75, \$8.50, \$9.75. "Red Head" Receivers excel. Distant stations, weak signals, trying conditions, record distances—under these circumstances "Red Head" Receivers show their true mettle.

#### THESE FIVE INSTRUMENTS SELL AT ONLY \$5.00.

With all these superior points, in spite of obvious excellent features, in spite of tests in which "Red Head" Receivers come out "head and shoulders" above more expensive sets, we offer these splendid head sets complete at only \$5.00.

You take no risk in buying. We gladly return your money if we have misrepresented "Red Head" Receivers in any particular.

#### GET THE BEST OUT OF WIRELESS.

Whether you're an amateur, a research experimenter or a commercial operator, try "Red Head" Phones. We've designed them to be best. They have come up to our highest hopes. They will come up to yours.

- NO. 2020 "RED HEAD" RECEIVER SET, complete, 2000 ohms, 2 receivers, 6-foot cord and phosphor bronze head band, shipping weight 2 pounds..... \$5.00
- NO. 2021 SINGLE RECEIVER ONLY, shipping weight 1 pound, each..... 1.75
- NO. 2022 SINGLE SET ONLY, with one receiver, single head band, 3-foot cord, shipping weight 1 pound 2.75
- NO. 2023 DOUBLE HEAD BAND, shipping weight 1 pound..... 1.40

## BRANDES SUPERIOR RECEIVERS

(2000 OHMS.)

"Splendidly good phones," writes one customer.

All the interior parts are nickel-plated and polished to prevent rust. Receiver shells are of aluminum; diaphragms of special, rust proof diaphragm plate, very thin and sensitive; caps of hard rubber. Split German silver head band, adjustable to fit any head. Strong 6-foot cord. Resistance, 1000 ohms each receiver, 2000 ohms per set.

These receivers are without question of the highest sensitiveness and quality. Many phones costing 50 per cent more are not half as desirable.



- NO. 56B SINGLE RECEIVER ONLY, 1000 ohms, no cord or head band, shipping weight 1 pound..... 1.65
- NO. 56C SINGLE RECEIVER, 1000 ohms, leather head band and cord, making complete single set..... 2.65

- NO. 56 SUPERIOR 2000 OHM HEAD SET, complete with two receivers, split German silver head band and 6-foot cord, shipping weight 2 pounds..... \$5.00

- NO. 56A SUPERIOR 2000 OHM HEAD SET, as above, but with leather covered head band, not split..... 4.50

## BRANDES TRANSATLANTIC RECEIVERS

(2800 OHMS.)

This is a professional type of wireless receiver set. They are smaller and lighter in weight than the "Superior" model, and are extremely sensitive to weak signals from great distances. The resistance, per set, is 2800 ohms. The finest materials are used in the construction of these receivers. Bobbins are wound with silk covered magnet wire of purest electrolytic copper, .002 inch diameter. The receivers are fastened to the head band by a special ball and socket connection, which assures instant and easy adjustment. These phones are surprisingly comfortable. They may be worn for long periods of time without discomfort.

**SPECIFICATIONS**—Aluminum cases; non-rusting diaphragms .005 inch thick; hard rubber ear caps; split head bands, hard rubber covered, 6-foot double cord.



- NO. 57 TRANS-ATLANTIC RECEIVERS, 2800 ohms, shipping weight 2 pounds, complete..... \$9.00

## IMPROVED NAVY STANDARD RECEIVERS

(3200 OHMS.)

Brandes Improved Navy Standard Receivers are the finest wireless head sets made. They are small, extremely light, ultra-sensitive and very comfortable to wear. Their soft but clear tone, combined with their extraordinary qualities of sensitiveness have made them most popular in commercial work and for high grade experimental and research work.

The diaphragms are only .004 inches thick. The receiver caps are therefore perforated with several small holes instead of one large one so that the delicate diaphragm cannot be bent or damaged.

The head bands are hard rubber covered, adjustable. They are fastened to the receivers by a ball and socket joint, making them instantly adaptable to any size or shape of head. The ear caps are genuine hard rubber.

Navy Standard Phones are very small and compact. They may be worn for hours without fatigue or undue pressure on the ears. Every detail has received the minutest attention, making these receivers absolutely the height of present day perfection. Every professional operator will find that no other receivers will give him splendid results that these will give. Every amateur will hold them up as his ideal to acquire.



**NO. 58 NAVY STANDARD RECEIVING HEAD SET, shipping weight, packed, 2 pounds.....\$13.00**

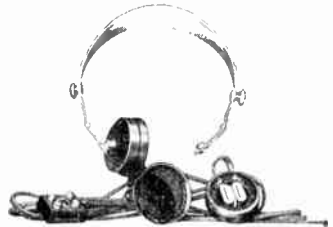
## MURDOCK WIRELESS RECEIVERS

SPECIAL, NO. 55.

At \$4.00 for a complete 2000 ohm set, and \$5.00 for a complete 3000 ohm set, every wireless operator can afford a pair of these 'phones.

Don't allow yourself to be convinced that minimum weight implies maximum efficiency in wireless receivers. An ounce or two makes little difference in comfort, but it may mean a whole lot in efficiency. If light weight is obtained by skimping on magnet steel for example, the small added comfort does not begin to compensate for the loss in sensitiveness and durability. **Murdock Receivers** have more good magnet steel than most wireless receivers, with the pleasing consequence that they are originally more sensitive than most, and keep that sensitiveness longer.

**DETAIL**—Complete double sets made in resistances of 2000 and 3000 ohms; bipolar receivers; cases, special processed hard rubber composition with lustrous and lasting finish; Murdock patented solid construction; magnets, best quality steel, in amount sufficient to guarantee dense and permanent magnetization; spool windings, enamel coated copper wire; diaphragm, thin, flexible, non-tasting and perfectly seated; cord five foot, mercerized, best quality; head band, nickel-plated German silver, split and adjustable. Weight, complete, double set, 14 ounces. Shipping weights: Complete double sets, 1 1/4 pounds; single set, 1 pound; receiver, only 1/2 pound.



### PRICES.

NO. 55 COMPLETE DOUBLE SET, 2000 OHMS.....	\$4.00
NO. 55A COMPLETE DOUBLE SET, 3000 OHMS.....	5.00
NO. 55B COMPLETE SINGLE SET, 1000 OHMS.....	2.00
NO. 55C COMPLETE SINGLE SET, 1500 OHMS.....	2.00
NO. 55D SINGLE RECEIVER ONLY, 1000 OHMS.....	1.50
NO. 55E SINGLE RECEIVER ONLY, 1500 OHMS.....	2.00

## HEAD BANDS, RECEIVER PARTS AND ACCESSORIES

NO. 201 SINGLE LEATHER HEAD BAND, for any receivers with side holes for prongs, shipping weight 4 ounces, \$0.50

NO. 202 DOUBLE LEATHER COVERED HEAD BAND, adjustable, shipping weight 1 pound, 1.00

NO. 203 GERMAN SILVER SPLIT HEAD BAND, finest quality, for Brandes Superior Phones or other receivers, shipping weight 1 pound, 1.50

NO. 204 "RED HEAD" HEAD BAND, as described under RED HEAD..... 1.40

EAR CAPS FOR ANY RECEIVERS..... 50  
(Send old ear cap or state plainly the make of receiver.)

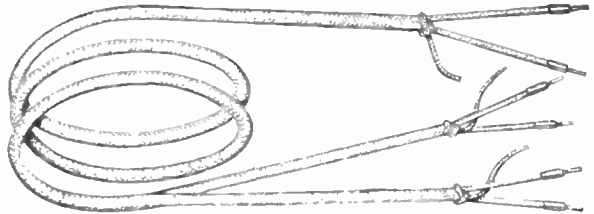
DIAPHRAGMS FOR ANY RECEIVERS, each..... 25

NO. 205 3 FOOT MERCERIZED CORD, 4 tips, green mercerized, each..... \$0.15

NO. 206 3 FOOT MERCERIZED CORD, 2 loops, 2 tips, each..... 15

NO. 207 5 FOOT DOUBLE CORD, green mercerized, 6 tips, each..... 48

NO. 208 5 FOOT DOUBLE CORD, green mercerized, 2 tips, 4 loops, each..... 48



## ELECTRO-SET "LEADER" RECEIVERS

The following line of telephone receivers offers to the experimenter and amateur a fine assortment of inexpensive but highly desirable phones. There are many uses to which low resistance phones may be put, and we list single and double pole receivers for these purposes wound to the 75 ohm standard. These are used for regular telephone work, and for such purposes they are unexcelled. Experimenters also obtain fair results in wireless telegraphy with low resistance phones.

Our double pole model, No. 1802, is ideal for amplifier and "Tikker" work, where 75 ohm phones of high quality are desirable.

### ELECTRO-SET SINGLE POLE RECEIVER



Inexpensive as they are these receivers are strong and sensitive. They are of the single pole type; made in metal cases with hard rubber composition ear caps. The 75 ohm type may be used for short distance wireless work. Two receivers connected together may be used as an inter-communicating telephone system for 200 feet or so. Talking into one receiver can be heard in the other with no battery whatever. The 1000 ohm type makes a really sensitive wireless phone. Prices are without cords.

**NO. 1800 75 OHM RECEIVER, shipping weight 1 pound.....\$ .50**

**NO. 1801 1000 OHM RECEIVER, shipping weight 1 pound..... 1.00**

### ELECTRO-SET DOUBLE POLE RECEIVER

These receivers are exceptionally well made and sensitive. They are fitted with beautifully nicked and polished cases, and the ear pieces are of hard rubber composition. These receivers are of the double pole type and have two magnets and coils. The magnets are especially strong. The 75 ohm type makes as fine a receiver for telephone work as could be desired. It may be used for wireless work up to 50 or 100 miles. The 1000 ohm type makes an inexpensive and excellent phone for wireless work for distances up to 1000 miles.

These receivers are the best inexpensive phones on the market. Every one is guaranteed to work properly or money refunded.

**NO. 1802 75 OHM RECEIVER, shipping weight 1 pound.....\$ .75**  
**NO. 1803 1000 OHM RECEIVER, shipping weight 1 pound..... 1.35**

**NOTE**—The illustration shows interior of the receiver with diaphragm and rubber cap removed.



### ELECTRO-SET SINGLE HEAD SET

This outfit consists of our 1000 ohm single pole receiver, leather covered German silver band and three feet green mercerized cord. It is suitable for small portable sets, stations and general amateur work. While we do not claim wonderful results with this outfit, we do claim that it is entirely satisfactory for beginners and experimenters. Messages 300 miles away have been heard on this phone.

**NO. 58 1000 OHM HEAD SET, shipping weight 1 pound.....\$1.60**



### ELECTRO-SET "JUNIOR" HEAD SET

We have especially designed a 2000 ohm Telephone Head Set for those that hitherto could not afford to pay for such instruments. It is a splendid outfit. Two single pole 1000 ohm receivers are furnished with double leather covered adjustable head band and 5 foot double cord with six tips. These receivers are marvelously sensitive, considering their low cost, and will give excellent satisfaction. In order that no wireless experimenter need go without a good pair of 2000 ohm phones we are specializing on the set and have priced it at the extremely low figure below. Shipping weight 2 pounds.

**NO. 1804 2000 OHM WIRELESS HEAD SET, complete as described.....\$3.15**



### GROUND CLAMPS

Used for grounding wires to water or steam pipes in telegraphy and wireless telegraphy or any other purpose. Don't try to wind wire around the pipe. It makes a poor ground. Our ground clamp consists of a pure copper band. It is bolt tightened and wedged to the pipe, making perfect and efficient grounds. Fits any size pipe up to 1½ inches.

**NO. B-43 GROUND CLAMP, shipping weight 4 ounces.....\$0.10**  
**NO. B-44 GROUND CLAMP, for 1½ to 3 inch pipes, weight for shipping, 1 pound..... .25**



## CLASS "B" WIRELESS INSTRUMENTS

Below we list a number of inexpensive but well made wireless instruments for beginners and amateurs and for auxiliary or experimental apparatus in advanced stations. These instruments are not cheaply made. They are really desirable in every way and compare very favorably with our better instruments. Adjustments are not so complete, nor are the sizes as large. Good work may be done with all of them.

### ELECTRO-SET 1-8 INCH SPARK COIL

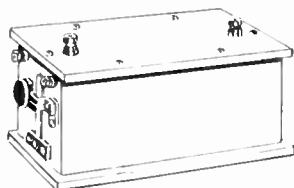
THE EQUAL OF MANY 1-4 INCH COILS

After long experimenting and a considerable outlay of time and money we are able to offer the lowest priced spark coil on the market. This fine little instrument is complete in every detail. It is enclosed in a highly finished genuine oak box. The vibrator is fully adjustable. The windings are as carefully made as on our larger coils. They are immersed in special insulating compound, eliminating break-down chances. Two binding posts are furnished for the secondary leads and two for the primary wires.

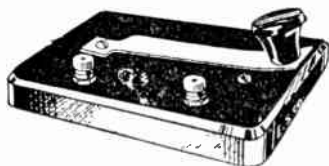
This little coil is ideal for very small portable sets. It weighs less than a pound. It measures only 2x1 $\frac{3}{4}$ x5 inches over all and will give a snappy spark over  $\frac{1}{8}$  inch long on only two dry cells. On 4 dry cells it will give a  $\frac{1}{4}$  inch spark. In fact many mail order houses would rate this coil as a  $\frac{1}{4}$  inch coil and sell it at \$2.00. We cannot conscientiously do this.

The Electro-set  $\frac{1}{8}$  inch Spark Coil will send wireless messages up to  $\frac{1}{4}$  mile under favorable condition. It will light Geissler tubes, explode flashlights and gunpowder, charge small condensers, etc. We especially recommend these spark coils to advanced experimenters for test work, and detector using. The coil is very neat in appearance. The vibrator has silver contact points and is nickel plated.

NO. F90 ELECTRO-SET  $\frac{1}{8}$  INCH SPARK COIL, as described, shipping weight 1 pound, each.....\$1.50



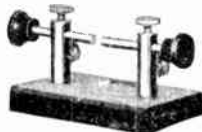
### THE TELE-KEY



This little strap key is just the thing for test buzzers and test circuits, experimental work, code practice and general use. It is recommended for use with our  $\frac{1}{8}$  inch Spark Coil No. F90. The Tele-key is a handsome little instrument finished in polished nickel. The base is genuine moulded hard rubber composition, as is also the key knob. The key strap is made of highly nicked spring brass. Size of Tele-key 2 $\frac{1}{2}$ x1 inches. Shipping weight 1 pound.

NO. F-91 TELE-KEY, each.....\$0.35

### NO. 801 SPARK GAP



This gap is designed for use on spark coils up to 2 inches capacity. It is without doubt the neatest small spark gap made. The posts are made of heavily nicked and polished brass. The spark rods are made of zinc, 3-16 inch in diameter. They are furnished with generous hard rubber composition knobs. The spark rods may be set at any distance spark length by means of two nicked set screws. The base is genuine hard rubber moulded composition, beveled edges, handsomely polished. Sizer over all 2x4x2 inches.

NO. 801 SPARK GAP, shipping weight 1 pound, each.....\$0.50

### NO. 1601 DETECTOR

THE GREATEST OF ALL DETECTOR VALUES

This detector is positively superior to any 50 cent detector on the market and is the equal of most \$1.00 detectors. The well known cat-whisker design is incorporated in this inexpensive instrument. Except for the matter of adjustment our No. 1601 Detector will do the work of almost any higher priced instrument. All parts are made of brass, finished in our usual style of heavy polished nickel plate. The cup will accommodate crystals of any mineral. The support post is furnished with a moulded hard rubber composition insulating handle. The contact wire is of phosphor bronze.

The base of our No. 1601 detector is made of moulded hard rubber composition with beveled edges and highly finished surface. This detector has all the refinements of material and workmanship usually found in expensive instruments. It is certainly a splendid value for so handsome and useful a detector. Size over all 2x2x1 $\frac{1}{4}$  inches. Shipping weight 1 pound.

NO. 1601 DETECTOR, with hard rubber composition base, as described.....\$0.45



Gentlemen: Wish to acknowledge receipt of your shipment to me and it is first class.

1435 Belvedere Ave.

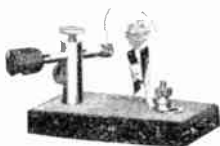
Detroit, Mich.  
BURTON L. DAVIS.

Dear Sirs: I receive Phono-Set this morning and I am very much pleased with it.

1742 Central Ave.

Memphis, Tenn.  
JAMES G. CHISM.

## NO. 1602 QUICK CHANGE DETECTOR



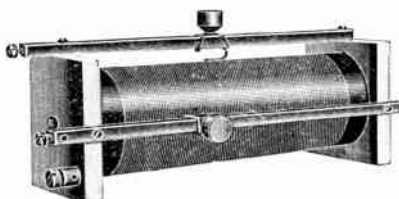
Here is a good detector at a low price, the equal of any dollar detector you can buy elsewhere. We call it our Quick Change Model because of the novel mineral holder which is incorporated in this detector. This mineral holder consists of a toothed spring clip. A slight pressure will release or enable you to replace any mineral in this holder in 3 seconds. It is therefore especially valuable as a mineral testing auxiliary detector in any station. The crystal is gripped firmly and surely with good electrical and mechanical contact.

Our regular nickeled support post is used, with nickeled contact rod and hard rubber composition insulating handle. A set screw, for holding the contact rod in any position is placed at the top of the support post. The base of this instrument is a handsome hard rubber composition moulding, highly polished. Two binding posts are furnished for connections.

Our No. 1602 Detector is pleasing to the eye, convenient in operation, efficient in use. It looks and acts like an instrument selling at double the price. We offer it as one of our "leaders" at the special price quoted below.

**NO. 1602 QUICK CHANGE DETECTOR, size 2x2x3¼, shipping weight 1 pound.....\$0.60**

## ELECTRO-SET AMATEUR TUNING COIL



This instrument places within the reach of moderate pocket books a reliable low priced tuning coil for beginners and amateurs. The only difference between this tuner and the more expensive types is one of size.

The Electro-set Amateur Tuning Coil is not a toy. It will do excellent work. Our single slide tuner may be used even in advanced stations, as a small loading coil and as such will be found very efficient. We have used these tuning coils in our research station with excellent results, receiving messages as far as 675 miles with ease. There is no reason why any beginner, with a reasonable aerial, cannot duplicate and even

exceed this performance.

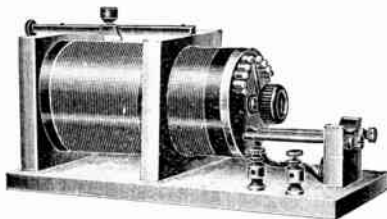
Our Amateur Tuning Coil is carefully made. The ends are finished in polished mahogany. The winding is enameled wire, 7 inches long on our special varnished tubing. The slide rods and sliders are pure brass; remember that many companies use steel, which rusts and has high resistance, and is generally inefficient for this purpose. The sliders on our Amateur Tuners are easy running and sure of contact. They are supplied with moulded hard rubber composition insulating knobs.

In our efforts to bring the pleasure and instruction of wireless within the reach of all, we are offering these fine little tuning coils at very moderate prices.

**NO. 1690-A SINGLE SLIDE TUNING OR LOADING COIL, size 2½x2½x8 inches, shipping weight 2 pound, each.....\$1.50**

**NO. 1691-B DOUBLE SLIDE TUNING OR LOADING COIL, for closer tuning, shipping weight 2 pounds 1.75**

## ELECTRO-SET JUNIOR LOOSE COUPLER OR RECEIVING TRANSFORMER



Loose coupled tuners are generally admitted to have many advantages over tuning coils, among which may be mentioned their better selectivity or ability to "tune out" unwanted signals and to "tune in" those you want to hear. Closer tuning may also be accomplished. Our Junior Loose Coupler is the result of careful design with with object of producing a really practical coupler having all the working advantages of more expensive instruments with the single exception of lower wave length. How well we have accomplished this you will readily agree when you have seen our Junior Coupler.

This instrument is certainly a handsome device and it works as well as it looks. In fact some really long distance work has been accomplished with this coupler. It is made in every detail with the greatest care. The wood parts are finished in the same manner that our larger instruments are finished, in highly polished dry, seasoned lumber, assuring good insulating and preventing any possibility of warping or splitting.

The windings are carefully calculated. They are beautifully and accurately wound on our special tuner tubing.

The brass parts are gold lacquered, making a pleasing and business-like contrast with the finely finished wood work.

The primary is varied by one of our sure-contact sliders. The secondary is varied by a large moulded rubber composition knob fastened to a brass switch lever. This lever passes over a series of brass switch points. Brass stopping pins prevent the lever from leaving the switch point radius. The secondary slide rods are also made of brass, as iron has a magnetic effect detrimental to efficient operation.

In every respect our Junior Loose Coupler is a meritorious instrument. Many companies would sell this coupler at a price 50 per cent higher than ours.

**NOTE**—The natural wave length of this coupler is 900 to 1000 meters, thus enabling the experimenter to receive from all amateur and most commercial stations. Size 4x4¾x12 inches. Shipping weight 5 pounds.

**NO. 1695 JUNIOR LOOSE COUPLER.....\$4.00**



## ELECTRO-SET JUNIOR WIRELESS OUTFITS.

We herewith list several excellent beginners' wireless outfits, for those who desire inexpensive sets to learn on. Every outfit will do good work. These sets are listed without aerial or ground wires. These outfits are only suggestions enabling beginners to select complete sets without difficulty.

NO. XI RECEIVING SET	
1 No. 1601 Detector .....	\$0.45
1 No. 1800 Telephone Receiver .....	.50
1 Special Receiver Cord .....	.10
1 No. 1678 Fixed Condenser .....	.50
1 Piece Arlington Silicon .....	.25
	<hr/>
	\$1.80

NO. XII SENDING SET	
No. F-90 1/2 inch Spark Coil .....	\$1.50
No. F-91 Tele-key .....	.35
No. 801 Spark Cap .....	.50
	<hr/>
	\$2.35

**NOTE**—The above sets are not tuned, but for a total cost of \$1.15 they will enable any one to start a small wireless station. To this price must be added the cost of aerial wires and batteries. The receiving range outfit of No. XI is from 5 to 10 miles. The sending range of Outfit No. XII is from 1000 feet to one-fourth mile. Range in each case depends on height and length of aerial wires. A small aerial 30 feet high, 40 feet long, with 2 wires, is satisfactory for above sets.

NO. X-2 RECEIVING SET	
No. 1602 Detector .....	\$0.60
No. 1678 Fixed Condenser .....	.50
No. 1801 Telephone Receiver .....	1.00
No. 1850 Telephone Cord .....	.15
No. 1691 Tuning Coil .....	1.75
1 piece Arlington Silicon .....	.25
	<hr/>
Total .....	\$4.25

(Shipping weight 4 pounds.) Range 25 to 200 miles.

For \$8.05 the combination of the above two sets will make a splendid outfit for beginners. Aerial wires and batteries are extra. See index and also information on aeriads, elsewhere in this book.

NO. X-3 RECEIVING SET	
No. 1695 Loose Coupler .....	\$4.00
No. 1678 Fixed Condenser .....	.50
No. 1804 Telephone Set .....	2.95
No. 1602 Detector .....	\$0.60
1 piece Arlington Galena .....	.25
	<hr/>
Total .....	\$8.20

For \$18.30 the above two outfits will make a fine station for you, with a receiving range up to 500 miles and a sending range of 5 to 8 miles and more.

NO. X-22 SENDING SET	
No. 7001 1/2 inch Spark Coil .....	\$2.95
No. F-91 Tele-key .....	.35
No. 801 Spark Cap .....	.50
	<hr/>
Total .....	\$3.80

(Shipping weight 5 pounds.)  
Range 1/2 to 1/2 mile.

NO. X-33 SENDING SET	
No. 7002 1 inch Spark Coil .....	\$4.75
No. 802 Spark Cap .....	1.00
No. 190 Amateur Key .....	.75
No. 607 Oscillation Helix .....	2.50
No. 600 Leyden Jar .....	1.00
	<hr/>
Total .....	\$10.00

Total .....

## ABOUT MINERALS AND MINERAL DETECTORS

### HOW TO USE AND MAINTAIN THEM

#### THE VERY HEART OF A WIRELESS TELEGRAPH RECEIVING SET IS THE DETECTOR

No matter how much money you have put into your outfit—no matter how up-to-date are your instruments—the receiving range is limited and governed by the sensitiveness of the detector. Few experimenters realize that extraordinary distances can and are being covered with simple mineral detectors. Because of their simplicity and easy operation they are widely used in every corner of the globe. Thousands of commercial stations use them for regular equipment. It is safe to say that practically every station in existence, amateur or commercial, has one or more mineral detectors on hand, either for regular equipment or as an auxiliary.

But the most important thing about a mineral detector is not the detector itself. Of course the better the detector the better you can make your adjustments and find sensitive spots. But the best detector is useless without sensitive minerals.

The Electro-set Company has done more to standardize wireless minerals than any other company catering to experimenters. It was the first company to say not how cheap were their minerals, but how good. More sensitive surface will be found in an ounce of Electro-set grades than in a pound of other grades.

Different minerals require various methods of handling. Some work well with very fine and light contact of phosphor bronze wire (notably galena). Silicon works best with a rather heavier wire, or pointed metal rod, and heavier pressure. Carborundum requires still heavier pressure, and the contacts may be quite blunt. And so on through all the known rectifying crystals.

**GALENA**—This mineral is extremely sensitive when properly selected. Most commercial galena is absolutely useless for detector work. It requires a very light wire contact. It is rather more difficult to adjust than other minerals, but is probably more popular than any other.

**SILICON**—This mineral is easier to adjust than Galena and maintains its adjustments longer. Most of its surface is sensitive. It requires a moderately light contact pressure. Its use is very wide spread.

**CARBORUNDUM**—Only specially selected crystals are sensitive. It is used by large commercial stations because of its ability to maintain adjustment. Its adjustment is not effected by nearby transmission. It is quite sensitive. Used with rather heavy pressure between springs or blunt surfaces. Especially recommended for portable installations.

**MOLYBDENUM**—Used with blunt point, moderate pressure. Quite sensitive and very stable in adjustment. An interesting mineral to try. Many experimenters prefer it.

**FERRON**—An interesting mineral used in many ways, but mostly in contact with other minerals, such as zincite, when it is very sensitive.

**BORNITE**—Extremely sensitive in combination with zincite. Recommended, when used in this way, as being rapidly adjusted and highly desirable for detector use. Said by many to be the most sensitive of all mineral combinations.

**COPPER PYRITES**—Similar to Ferron.

Mineral surfaces should not be exposed to dust. They must not be handled with the bare hands, as the natural oil will ruin their sensitiveness. Old and dirty minerals may be renewed and cleaned by washing in wood alcohol or benzine and rinsing with cold water. They should be laid on clean paper, in a warm oven to dry. The cat-whisker or contact wire should be filed off at the end occasionally to clean it.

#### USE ONLY ELECTRO-SET MINERALS

Determine for yourself, by experiment, what minerals are best for your purpose. Every completely equipped station should have a good assortment of minerals of all kinds on hand. Learn how to use all of them and discover by experiment the best methods of using. Always keep the detector dry and well cleaned. Dust it off frequently. Don't buy minerals by quantity—get quality. Use Electro-set minerals.

## ELECTRO-SET ARLINGTON TESTED MINERALS

FAMOUS EVERYWHERE

*This signature appears on every package of genuine Electro-set Standard Minerals. Always Insist on It.*

**GENUINE ELECTRO-SET MINERAL**  
 J.S. Newman

Why buy minerals on a gamble? Be sure of results—good results. Know when you put a crystal in your detector that it is absolutely and extremely sensitive.

You can be sure if you use our Arlington Tested Minerals. They cost more, of course. We discard a very large percentage of all our tested minerals. You buy only one crystal at a reasonable price—but you know the quality of that crystal. It has been selected and re-selected, and finally tested by experts for distant stations. It must come up to our high standard. Every Arlington Tested crystal must receive messages from far distant stations before you get it. It must "come in" loud and perfect. It must show performance—not ordinary performance—extraordinary performance.



Arlington Tested Minerals have been on the market one year. They have proved themselves. Scores of letters and testimonials are pouring in from every state and from foreign countries. Everyone that has used them praises them.

If, when you buy our Arlington Minerals, they are not exactly as we state, we will replace any crystal returned to us within one week.

Remember, that after all, even Arlington Tested Minerals are not expensive—so why buy quantity when you buy minerals when quality is the only thing that counts. Arlington Crystals are individually tested and packed. Each crystal comes to you in a neat, sealed wooden box, wrapped in tin foil, and labeled. Look for the signature on every package.

Accept Only Genuine Arlington Tested Crystals.

#### PRICES

N A A GALENA, individually packed and tested, per crystal.....	\$0.25
N A A SILICON, individually packed and tested, per crystal.....	.25
N A A ZINCITE COUPLE, individually packed and tested, per set.....	.50

## ELECTRO-SET TRIPLE "A" GRADE STANDARDIZED WIRELESS MINERALS

(IN BULK)

(Triple "A" grade crystals are subjected to bulk tests and are not individually examined, as are our Arlington crystals. One ounce is sufficient for from 6 to 15 renewals.)

These minerals are especially selected for wireless telegraph work. They are, without doubt, the finest and most sensitive minerals sold. Our buyers have literally scoured the world for these minerals. Every ounce must come up to our high standard.

Electro-set Minerals are considerably higher in price than most wireless minerals. We pay the highest prices for our minerals—we can't get our standard quality for less.

Electro-set Triple "A" grade bulk minerals come neatly packed in convenient round wood chemists boxes, which can be permanently used to keep the crystals in a clean dust proof place.

Every box is labeled and sealed. When buying minerals look for our mark and signature.

It is your insurance that you are getting the finest selected minerals that money can buy.

**A A A MINERAL PRICES, PREPAID, IN SEALED WOODEN CARTON**

Name of Mineral	Per 1 Oz. Box	Per 4 Oz. Box
GALENA .....	\$0.30	\$1.00
SILICON .....	.30	1.00
CARBORUNDUM .....	.30	1.00
MOLYBDENUM per 1/2 3.....	.25	1.25
IRON PYRITES .....	.30	1.00
COPPER PYRITES .....	.30	1.00
BORNITE .....	.35	1.25
ZINCITE .....	Per 1/4 Oz. \$0.40	Per 1 Oz. \$1.25

## ELECTRO-SET MINERAL ASSORTMENT

For the convenience of our patrons we have put up a neat little assortment of our Triple "A" grade minerals, comprising a selection of five different kinds, each mineral packed and labeled, in a separate chemist's box. We were the first company to pack such a selection and the demand for these little sets has been amazing.

A generous size crystal of each mineral is furnished. The selection enables the amateur to experiment and to understand the characteristics of the various minerals used today in wireless telegraphy. We heartily recommend the purchase of our complete detector outfit, described elsewhere in this issue. However, for those who are already supplied with sufficient apparatus, our mineral assortment will prove a splendid buy. Every crystal is our standard A A A grade, recognized everywhere as the highest grade minerals.

The outfit comprises the following: One crystal each of Galena, Silicon, Carborundum, Molybdenite, Iron Pyrites or Ferron. FREE, with each outfit, 1 foot phosphor bronze cat-whisker wire.

NO. 2150 MINERAL ASSORTMENT.....\$0.50  
(Postage extra, 5 cents.)



## ELECTRO-SET LOW TEMPERATURE ALLOY



This wonderful metal is an alloy of several soft metals and its melting is far below that of any of its ingredients. Our Low Temperature Alloy melts at a temperature lower than at which water boils. It becomes perfectly liquid in boiling water. Electro-set Low Temperature Alloy is the only practical thing for holding detector minerals in cups. The heat of solder is likely to spoil the sensitiveness. Our alloy does not. The heat of a match allows any crystal to be inserted. Contact is perfect and the efficiency of any mineral detector is greatly increased.

NO. 8100 ALLOY, in  $\frac{1}{4}$  ounce convenient wood chemist box.....\$0.15  
NO. 8100 ALLOY, per ounce, postpaid..... .50

## PHOSPHOR BRONZE CAT-WHISKER WIRE

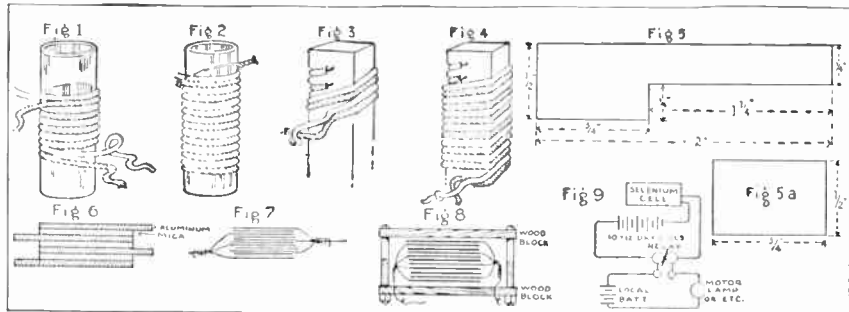
This wire is used for making contact with minerals in wireless detectors. It is admittedly the best material for this purpose and is universally used. We supply it in two sizes and furnish only the best grade obtainable. Our wire comes to you wound on neat little wooden spools made especially for the purpose. You do not have to spend an hour or more untangling the wire when you get it. This is just another little Electro-set convenience for its patrons.



NO. 8101 PHOSPHOR BRONZE CAT-WHISKER WIRE, small size, for Galena, per five foot spool.....\$0.10  
NO. 8102 PHOSPHOR BRONZE CAT-WHISKER WIRE, medium size, for Silicon, etc., per five foot spool..... .15  
(Postage extra, 1 cent.)

## SELENIUM CELLS AND HOW TO MAKE THEM

Selenium is one of the most peculiar and interesting of all the chemical elements. It was discovered in 1817 by Berzelius, a famous Swedish chemist. Selenium belongs to the same class of elements as sulphur. It exists in two forms, a brown amorphous mass usually purchased in the form of sticks and a gray metallic crystalline structure. Selenium has the peculiar property of being a conductor of electricity when exposed to light, and almost an insulator in darkness.



This effect is noticeable only in the crystalline condition of the element. Selenium Cells, for demonstrating the action of light, are ordinarily made by imbedding two electrical conductors of large surface area in a thin coating of selenium. The cell is then treated to an annealing process in a warm oven until the sensitive crystalline state is reached. This annealing process is the most important and the most difficult stage in the manufacture of Selenium Cells.

Often times the novice will have to make six or eight cells before securing a successful one. It is only by persistency and skill that really good cells are obtained. It is advised that books on this subject be procured at the library and carefully studied, in addition to the following directions. Once a good cell is obtained you will be amply repaid for any effort expended in its manufacture.

With the Electro-set Selenium Outfit is included enough materials to make three different kinds of cells, the Glass Tube Type, the Mica Sheet Type and the Metal Plate Type.

**The Glass Tube Selenium Cell.** This cell consists of a small glass tube about 2 inches long around which are wound 2 No. 30 enameled copper wires parallel to one another, as shown in Fig. 1. The two wires are best started in winding by tying them temporarily with a piece of thread to one of the tubes. With a little skill and patience the tube may be completely wound all its length (to within one-eighth inch of each end) with the two parallel conductors. Care must be taken to wind the wires evenly and smoothly, just as the thread is wound on a spool. When the end of the winding is reached, again bind the loose ends firmly with fine thread so that the wire will not unwind. With a piece of fine sandpaper scrape the enamel from the outside surface of the wire wound about the tube. This will leave exposed the two outside surfaces of the parallel windings. Or, in other words, it will leave two lengths of bare conductors wound about the tube with nothing but a thin layer of enamel between them. From this point proceed as in paragraph "X."

**The Mica Sheet Cell.** Cut a piece of stiff mica with a sharp pair of shears, one-half inch wide and about two inches long. For three-fourths of the length of this small sheet wind two No. 30 enameled copper wires parallel to one another, as in the Glass Tube Cell. The winding may be started by cutting a slot in one end of the small mica sheet and imbedding the two No. 30 wires in this slot to hold them. The other end of the wire may be similarly held by means of a slot, as in Fig. 2. When completed the cell will now have the appearance of Fig. 3, and will consist of two parallel electrical conductors wound in an even layer around the mica. Again the enamel on the outside surface of the two wires is scraped off with fine sandpaper. When the cell has reached this point it is well to test the windings with a telephone receiver and battery to see that neither of the two parallel wires are short-circuited. If no click is heard in the receiver everything is all right to proceed.

**Paragraph "X."** When the windings are completed it is now necessary to apply the selenium. This is done by placing the unfinished cell upon a small piece of tin held over a flame until the wire has become hot enough to melt the selenium. A small stick of selenium is now rubbed over the windings, leaving a thin coat of selenium covering them. You must learn by experiment just how hot it is necessary to heat the cell in order to melt the selenium. If the cell is too hot the selenium will collect in drops and will not spread properly. If it is too cool the cell will not be coated thin enough. The coating should be as thin as possible and still be continuous. When the cell has been coated on all sides it should be removed from the stove and allowed to cool. Its surface will now be smooth, like glass.

Next comes the annealing process. The Selenium Set contains a small oven within which is a shelf upon which the cell may be placed. Place this oven over a Bunsen Burner or a stove. The cell is now placed upon the shelf in the oven, the heat being turned down to a very low heat. The Selenium will soon assume a dull graphite like appearance. This is evidence of the crystallization taking place. This process will take about ten minutes. If crystallization does not commence within a few minutes, increase the heat a trifle, under no circumstances using enough heat to melt the selenium. You will have to watch carefully to insure good results. When the crystallization is completed (in five to ten minutes) the heat is gradually increased until the selenium just commences to show signs of melting and fusion. At this point the cell is instantly removed from the oven and in a few seconds will recrystallize. Now turn the heat just slightly lower than the point at which the cell showed signs of fusion and again place the Selenium Cell in the oven and let it remain there for two to three hours or more. Then commence cooling by lowering the heat a trifle every ten minutes until the flame is entirely extinguished. When the oven is cool the Selenium Cell may be removed.

Such cells as above described may have resistance in the dark from 25,000 to 75,000 ohms; in the light enough current will pass between the two windings through the selenium to operate a good relay, which can be made to light lights, ring bells and alarms or other devices. Connections are shown in Fig. 4.

**The Metal Plate Selenium Cell.** This cell is made by cutting twenty small pieces of metal sheet, as shown in Fig. 5, and twenty pieces of mica, as shown in Fig. 6. The mica and metal plates are piled up alternately, as shown in Fig. 7. The alternate metal plates are bound together by a piece of wire on each side, as shown in Fig. 8. The surface is then carefully ground off and polished smooth. The selenium is then applied in a thin layer and the cell is put through the annealing process as in Paragraph "X." The metal and mica plates are best handled by clamping them between two small pieces of wood, as in Fig. 9.

It is recommended that all three types of cells be made by the novice. With good care at least one of them should be successful. The many interesting things that can be done with the Selenium Cell will amply repay you for your trouble.

Selenium Cells are used for a large number of practical and experimental purposes. Its peculiar characteristic of being a conductor only when exposed to light allows many novel applications. Thus by connecting a sensitive relay in series with a Selenium Cell, a bell can be made to ring when the sun comes up in the morning, thus literally allowing you to "rise with the sun." Or you may fix it so that your furnace is turned on as soon as it becomes light.

Selenium Cells are used for receiving wireless telephone messages over a beam of light, whose brilliancy is varied by means of a microphone placed in the circuit. A telephone receiver, connected in series with the Selenium Cell at the receiving end produces every sound accurately. Selenium Cells are also used in reproducing photographs over wires. It must be remembered that Selenium Cells will only operate very sensitive polarized relays or telephone receivers.

Ruhmer's Wireless Telephone, Bell's Photophone, Korn's wonderful system of telegraphing photographs, all operate with Selenium Cells. When Television is finally accomplished (the science of seeing over wires) the Selenium Cell will undoubtedly be used.

**NOTE**—It is best to carry on your experiments in the basement or in a room with open windows as the selenium fumes are not healthful and they should not be breathed.

## MAKE YOUR OWN SELENIUM CELLS



- 1 Sheet Thin Brass  
1 Small Stick Genuine Selenium  
2 Glass Tubes

Everything comes packed in a neat box, ready for use. Three different kinds of cells may be made, as described in the article preceding this description.

Countless interesting experiments may be performed with Selenium Cells. Try it for yourself—you'll find it a mighty fascinating subject.

**NO. 450 SELENIUM CELL OUTFIT**, as described, pre-paid .....\$1.00

All the materials necessary to make three different kinds of Selenium Cells, with complete instructions.....\$1.00

The Electro-set Company, realizing the many interesting points about Selenium that will appeal to the experimenter, has devised an outfit so that anyone, with a little care and ingenuity, can make their own cells. Commercial Selenium Cells are very expensive, and just now are very hard to secure. Our outfit opens up a new and delightful field to every true experimenter.

The Electro-set Selenium Outfit consists of the following pieces:

- 1 Sheet Mica
- 1 Spool No. 30 Enamelled Wire
- 1 Sheet Sand Paper
- 1 Tin Annealing Oven
- 2 Wooden Clamp Boards
- 2 8-32 Machine Screws
- 2 8-32 Machine Nuts
- 4 Washers
- 1 Instruction Sheet

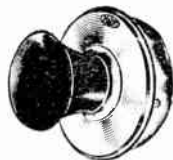
### SELENIUM

This peculiar element comes in moulded sticks,  $\frac{3}{8}$  inches in diameter. Only the vitreous form is suitable for experimenting. We sell the best grade, pure selenium. A stick 1 in. long will be sufficient for most purposes, very little being used for each cell. Not less than 1 inch sold.



**NO. 460 SELENIUM**, per inch, post paid .....\$0.35

## TELEPHONE TRANSMITTER



Regulation transmitter, for all kinds of telephone and experimental work. We also sell a great many of them for wireless telephone experimenting. It is recommended, for this purpose, that from two to six standard transmitters be connected in parallel, to handle the heavy currents.

Our transmitter is of the standard solid back, long distance type. In the instrument are involved principles that are original, which combined with recognized essential theories, have enabled the production of an article superior in every point of efficiency and durability.

Every part is as accurately made as the movement in a fine watch, and when once assembled and tested, requires no adjustment or attention. Time—the best of tests—has demonstrated its permanent efficiency. The claims of superiority in this instrument over those of others manufactured upon the same general lines is in the selection of material and unusual care and finish given to every detail of each individual part. The electrodes are made from the very best imported carbon, which is subjected to a special re-carbonizing process of our own, which increases the hardness and enables them to withstand the high current without the slightest injury; they are also submitted to a special polishing process in order to give the surface the same uniformity and leaves it as smooth as glass. We claim for the transmitter that it cannot possibly be packed, and that it will consume from one-half to one-third the amount of battery current of any long distance type transmitter made.

**NO. 3-LD TRANSMITTER**, as described.....\$1.25  
(Shipping weight 1 pound.)

# READ WHAT THEY SAY ABOUT N A A MINERALS

Gentlemen: I have found your Galena to be superior to any other mineral and I have recommended same to all my radio friends.  
444 7th Ave.  
Brooklyn, N. Y.

ELMER BAIER.

Atlanta, Ga.

Dear Sirs: The N. A. A. Tested Galena received and the piece is fine.  
221 E. 10th St.

ALAN WHITTAKER, JR.

Waterville, Me.

Gentlemen: The last two pieces of Galena I bought of you were the best I ever saw.  
160 College Ave.

HAROLD M. CLAFLIN.

Vandergrift, Pa.

Dear Sirs: Received your Galena and found it to be great. I never had better Galena.  
176 Grant Ave.

A. L. VAN TINE.



## RAW MATERIALS

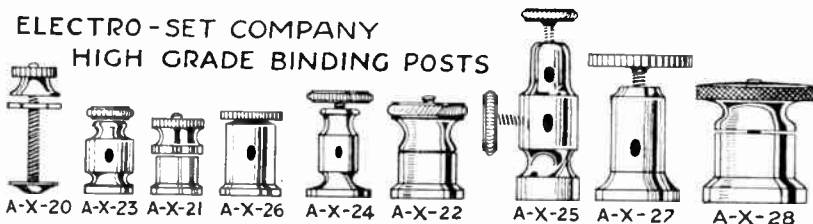
### PARTS—SUPPLIES—EXPERIMENTAL NEEDS.

We list herewith a splendid line of needed parts and raw materials. The prices are as low as consistently **GOOD merchandise will allow. WE SAVE YOU MONEY** on raw materials of the dependable sort. Buy raw materials from us and be assured of quick shipments and the best quality. We stock **heavily every item listed** and are ready to give real service at all times. **Save money in the long run!** Electro-set Raw Materials and Parts are high grade in every particular.

## BINDING POSTS

Our Binding Posts are made especially for us by one of the most completely equipped plants in the country. Every post is beautifully turned and finished. They will be a credit to your instruments. State whether gold lacquered brass or polished nickel finish is desired. Shipping weight, A-1 to A-5, 1 pound per dozen. A-6 to A-8, 2 pounds per dozen. Postage extra on less than 1 pound, each post 2 cents.

### ELECTRO-SET COMPANY HIGH GRADE BINDING POSTS



No.	Description.	Height, In.	Diameter, In.	Price, Ea.
A-X-20	BRASS POST, complete as used on dry cells.	$\frac{1}{2}$	$\frac{3}{8}$	<b>\$.03</b>
A-X-21	BRASS OR NICKEL, a neat post for general use.	$\frac{5}{8}$	$\frac{3}{8}$	.05
A-X-22	LARGE HEAVY HANDSOME POST.	$\frac{7}{8}$	9-16	.10
A-X-23	SMALL, WELL TURNED POST.	11-16	5-16	.05
A-X-24	A VERY POPULAR, HANDSOME POST.	$\frac{3}{4}$	$\frac{3}{8}$	.06
A-X-25	MEDIUM LARGE POST for general use.	$\frac{7}{8}$	7-16	.08
A-X-26	VERY LARGE HEAVY POST, neat, new design, especially large set screw.	1	$\frac{5}{8}$	.10
A-X-27	LARGE DOUBLE POST, very handsome.	$1\frac{3}{8}$	$\frac{1}{2}$	.10
A-X-28	EXCEPTIONALLY MASSIVE, HEAVY POST, for heavy current or ultra-efficient contacts, easily operated.	1	$\frac{3}{4}$	.15

NOTE—All posts furnished with 8-32 machine base screws, no extra charge.

## MIDGET SWITCH POINTS



Same as used on wood base switches. Nickled finish, 3-16 inch head, shank 7-16 inch long, 6-32 thread. Includes 2 brass nuts. Shipping weight 4 ounces per dozen.

NO. B-28 SWITCH POINTS, each....**\$.001 $\frac{1}{2}$**   
Per dozen ..... **.15**

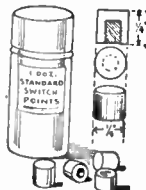
### SMALL SWITCH LEVER



Same as used on wood base switches. Polished nickel finish. Supplied with 2 nuts. Length  $1\frac{1}{2}$  inches. Price, each .....**\$.07**  
(Postage 2 cents.)

## SWITCH POINTS

We manufacture one special size and quality of Switch Points, adaptable to almost every purpose. We do not recommend posts with shanks narrower than the face as they catch and hold dust and dirt, lessening the efficiency of the apparatus. Our switch points are neat and accurate, making a fine appearance and good contact. They come in bright turned brass finish or in solid silver plate. They are drilled and tapped for 6-32 machine screws; the threads are guaranteed full and accurate and will not strip readily. Size  $\frac{3}{4}$  inch diameter, 3-16 inch high. Shipping weight 2 ounces per dozen. Packed in neat wooden boxes, standard packages, 12, 24, 36, 72 and 100 to the box.



NO. B-29 SWITCH POINTS, brass finish, per dozen, without screws .....**\$.018**  
Per hundred ..... **1.40**  
NO. B-29 S SWITCH POINTS, handsomely silver plated, for highest efficiency, per dozen, without screws .....**\$.30**  
Per hundred ..... **2.50**  
NOTE—For screws for above Switch Points see index. Less than 1 dozen add 20 per cent to prices of Switch Points.

## HARD RUBBER COMPOSITION KNOBS



C-5



C-1



C-2



C-3



C-4

These knobs are very useful in making electrical apparatus. They are used for switch handles and levers, binding post tops, handles, etc. Our knobs are guaranteed accurate. The finish is a high black polish. You are sure of getting clean, bright, perfect knobs when we ship them. Made of high grade hard rubber composition.



C-7



C-6



C-8

No.	Diam. In.	Height, In.	Ship. Weight	Price Ea.	Post. Ea.
C-1	7-16	3/8	3 oz. per doz.	\$0.04	\$0.01
C-2	3/4	1/2	4 oz. per doz.	.05	.01
C-3	1 1/4	5/8	2 oz. each	.10	.02
C-4	3/4	7/8	4 oz. per doz.	.04	.01
C-5	1 1/4	5/8	2 oz. each	.12	.02
C-6	2	3/4	3 oz. each	.20	.02
C-7	1 1/4	3/4	1 oz. each	.06	.01
C-8	1 1/2	1 1/4	1 oz. each	.05	.01

C-6 is an especially large and handsome knob, ideal for switch levers on couplers, loaders, cabinets, etc. C-7 is the standard key knob. C-8 is a handsome handle with 3-18 inch hole moulded clear through its length.

All knobs regularly are supplied with 8-32 thread. We can supply No. C-2 with 10-24 thread or No. C-1 with a 6-32 thread if so specified.

## IRON MACHINE SCREWS (ROUND HEAD)

Length	6-32 Thread	8-32 Thread
1/4 in.	\$.05 doz. \$0.35 gross	\$.05 doz. \$0.40 gross
3/8 in.	.05 doz. .37 gross	.05 doz. .44 gross
1/2 in.	.05 doz. .39 gross	.05 doz. .48 gross
5/8 in.	.05 doz. .42 gross	.05 doz. .52 gross
3/4 in.	.05 doz. .46 gross	.05 doz. .56 gross
1 in.	.05 doz. .55 gross	.07 doz. .65 gross
2 in.	.12 doz. .15 gross	.12 doz. 1.25 gross

Not less than 10c worth sold. Shipping weight per dozen, 2 ounces; per gross, 1 pound.

## BRASS MACHINE SCREWS (ROUND HEAD)

Length	6-32 Thread	8-32 Thread
1/4 in.	\$.05 doz. \$0.46 gross	\$.08 doz. \$0.65 gross
3/8 in.	.06 doz. .58 gross	.10 doz. .90 gross
1/2 in.	.10 doz. .74 gross	.13 doz. 1.10 gross
1 in.	.10 doz. .90 gross	.15 doz. 1.30 gross

Not less than 1 dozen sold. Weight per dozen, 2 ounces; per gross, 1 pound.

## HEXAGON BRASS NUTS



B-46

NO. B-46, 6-32 thread, per dozen	\$.10
NO. B-47, 4-32 thread, per dozen	.10
NO. B-48, 10-24 thread, per dozen	.12

Not less than 1 dozen sold. Weight, per dozen, 2 ounces.

## HEXAGON CAP NUTS



Used where a regular Hexagon Nut would be unsightly, such as on the outside of cabinets, coupler and tuner ends, etc. Handsomely nicked and polished. 3/8 inch diameter.

NO. B-458, 8-32 thread, each	\$.02 1/2
Per dozen	.25
NO. B-450, 10-32 thread, each	\$.02 1/2
Per dozen	.25

## BRASS WASHERS



For 6-32 or 8-32 machine screws, price either size, per dozen.....\$0.05

Order No. B-632 for 8-32 size. Order No. B-832 for 8-32 size. Shipping weight, 2 ounces per dozen.

## THREADED BRASS ROD



USED IN MAKING  
APPARATUS.

Our Threaded Brass Rod is guaranteed clean and straight as shafting.

NO. B-43, 6-32 thread, per inch.....	\$0.03
Per foot .....	.20
NO. B-44, 8-32 thread, per inch.....	.03
Per foot .....	.20

(Shipping weight, either size, 4 ounces per foot.)

## FINE PLATINUM WIRE

Used for delicate suspensions, electrolytic detectors, fine hot wire meters and experimental work of all kinds. This wire is extremely fine in size, being only .001 inch in diameter. It is guaranteed purest platinum. We take the usual careful Electro-set packing precaution — Every inch packed in a wooden box.



NO. H-10 PLATINUM WIRE, per inch, prepaid .....	\$0.20
Per wooden spool, containing 1 ft., prepaid .....	1.00

## SILVER ROD

Used for contact points on keys, circuit breakers, etc. Our Silver Rod is genuine sterling silver, hardened just enough for best results.

NO. S-10 SILVER ROD, 1-16 inch diameter, per inch, prepaid.....	\$0.25
NO. S-20 SILVER ROD, 3/8 inch diameter, per inch, prepaid.....	.40
NO. S-30 SILVER ROD, 3-16 inch diameter, per inch, prepaid.....	.60
NO. S-40 SILVER ROD, 1/4 inch diameter, per inch, prepaid.....	.75

(Add 20 per cent for less than 1 inch orders.)

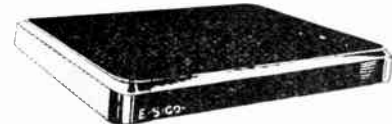
## Improve the Appearance and Efficiency of Your Instruments USE

### ELECTRO-SET HARD RUBBER COMPOSITION BASES (HOLLOW BOTTOMS.)



These handsome bases are of highest efficiency for mounting electrical instruments of all kinds, such as detectors, etc. They may also be used as panels for mounting rotary switch levers, with contacts, as used on cabinets, loading coils, couplers, etc.

Our bases have hollow bottoms which adapt them for use in making your own fixed condensers, loading coils and other similar instruments. They may be readily drilled with any metal drill, so as to adapt them to the different styles of instruments. A splendid feature of Electro-set Hard Rubber Composition Bases is the provision made for screw holes to fasten them to tables or boards. These holes are moulded into the bases so that they almost pass through to the top. A thin layer is left at the top so that the upper surface of the base is unmarred if it is not desired to fasten the instrument down. However, should you care to use these holes, they may readily be drilled clear through or "knocked



out" from the bottom with the proper tool. Our bases are highly finished and polished. They will not only add to the efficiency of any instrument, because of their high insulating value, but they will give any apparatus a handsome, business-like appearance that no wooden base, or saved rubber base can approach. Use Electro-set Moulded Hard Rubber Composition Bases on all your instruments.

NO. 50 CR BASE, size 2x3x3/8 inches, with 3-16 inch sub bottom, each.....	\$0.20
(Postage, extra 4 cents.)	
NO. 51 CR BASE, size 2 1/2x1x3/8 inches, with 3-16 inch sub-bottom, each.....	.30
(Postage, extra 5 cents.)	

### EMPIRE CLOTH

Universally used for insulation on high tension transformers, spark coils, motor and dynamo windings and other electrical work. Break down strength 7500 volts. Made by immersing a very fine grade of thin fabric in a special insulating compound.

NO. D-33 EMPIRE CLOTH, per square yard.....	\$0.60
Per square foot.....	.10

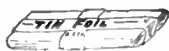
(Not less than 25 cents worth sold.)

Postage extra, per foot, 5 cents. Shipping weight per yard, 1 pound.



### TIN FOIL

For making condensers, Leyden Jars, etc. We sell only a very high grade, with good tensile strength, of the proper thickness. Comes in rolls 6 inches wide; 1700 square inches to the pound. Shipping weight per pound, 2 pounds.



NO. D-9 TIN FOIL, per pound.....	\$0.25
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## ELECTRALLOY FOIL

The finest metal foil ever produced for making condensers. It has an exceptionally firm body, and does not tear as readily as tin or lead foil. It is made of a special aluminum alloy, very strong and light. The Electro-set Co. are the first to introduce this new foil to the trade. We highly recommend it to experimenters as being easier to handle, less subject to blistering and peeling, and as being less readily oxidized than commercial tin foils. This foil remains clean and bright indefinitely. Comes in strips 6 inches wide.

NO. D-22 ELECTRALLOY FOIL, in 10 foot rolls, per roll.....\$0.25  
 NO. D-22 ELECTRALLOY FOIL, in 25 foot rolls, per roll..... .50  
 (Postage extra, 4 cents.)



## MICA

The best insulating material known. Dozens of different grades sold. We handle only high quality Mica, readily separable into smooth sheets. Used for fixed condensers, high tension insulation, etc. Comes in irregularly shaped pieces from 2x3 inches to 3x4 inches in size. Can be split into very thin layers. One ounce will make as much as 200 square inches and more, and as it is very light in weight, an ounce constitutes a considerable quantity of Mica.

NO. D-16 MICA, per ounce, postpaid.....\$0.25  
 NO. D-17 MICA, cut to size 2x3 inches, best quality, per ounce..... .50



## ELECTRO-SET STANDARD SLIDERS

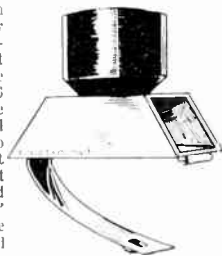


No better sliders are offered anywhere. These sliders are made from solid brass bar, milled out to size. The springs are of high grade phosphor-bronze metal. They are pivoted at one end. The other end is doubled back over a small tension pin and extends below the sliding bar for contact with the windings. The contact end is shaped so as to make sure contact without harming the windings. These sliders are handsomely

gold lacquered. They are furnished with large shapely insulating knobs for adjusting.

NO. B-33-4 SLIDER, for ¼ inch square rod each.....\$0.25  
 NO. B-33-16 SLIDER, for 3-16 inch square rod, each..... .20  
 By mail, extra, either size, 2 cents.

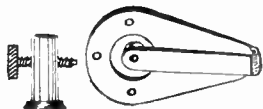
## ELECTRO-SET "PERFECT" SLIDERS



These sliders are the lowest priced sliders on the market. Yet they are thoroughly practical, efficient and neat looking. They are made in two sizes to fit 3-16 inch or ¼ inch square brass rod. The novel shape enables them to run smoothly, without jerking. The contact springs may be replaced if worn. "Perfect" sliders are made of pure brass tubing, furnished with spring brass contacts and hard rubber composition knobs. They are good sliders.

NO. B-32-4 SLIDER, for ¼ inch square rod.....\$0.12  
 NO. B-32-16 SLIDER, for 3-16 in. square rod..... .12  
 By mail, extra, either size, 2 cents.

## SMALL SPARK COIL VIBRATOR OR INTERRUPTER



As used on our small ⅛ inch spark coil and on induction, medical and shocking coils. Consists of fine nickeled post ⅜ inch diameter by 1¼ inches high, generous knurled contact screw (with knurled lock nut) fitted with silver contact point, hammer vibrator, with soft iron head, arranged to screw on to the wooden coil end. Contact post fitted to 8-32 screw at bottom. All handsomely nickeled and polished. Not to be used on coils designed for over ¼ inch spark. Exceptionally fine for the highest grade medical and home induction coils. Size over all 2x1¼ inches.

NO. 777 VIBRATOR, complete, as described.....\$0.35  
 Postage extra, 3 cents.)

## ELECTRO-SET ROTARY SWITCH LEVER

This lever is used for rotary switches of all kinds such as are common on cabinet wireless sets, couplers, loaders, tuners, potentiometers and other similar instruments. It is furnished with a large hard rubber composition knob, 1½ inches in diameter. The contact lever is of spring brass, 1½ in. long, buffed and gold lacquered, or highly nickeled and polished. The threaded rod is 1 inch long; any length rod may be ordered at an additional cost of 5 cents for the first inch and 3 cents for each additional inch. Two nuts and two washers are furnished without charge.



A sure-contact lever; good looking and strong.

NO. B-31 SWITCH LEVER, shipping weight  
 3 ounces.....\$0.20

## TEST AND HELIX CLIPS



We sell two kinds. These clips are used for making contact with any section of the windings of helices or oscillation transformers. They are used for test clips, at the end of battery or line wires so that they may be clamped over binding posts in no time, to operate or test instruments. Your test batteries in your shop should be equipped with flexible wires and clips. Try it once and you'll never be without them.

**B-34 HELIX CLIP**, "Grips like a bulldog," powerfully built; exceptionally heavy spring, yet very easy to operate. Takes round or flat wire from size 36 to 00 B and 8 gauge. Made of pure copper, size  $2\frac{1}{4} \times \frac{1}{2}$  inch. Shipping weight 2 ounces. In our opinion the only good helix or test clip made. Price, each.....\$0.15

**NO. B-35 HELIX CLIP**, a much smaller and lighter clip. Useful in many ways and on almost any helix or oscillation transformer. Jaws spread  $\frac{1}{4}$  inch. Makes a good crystal holder. Length  $1\frac{1}{4}$  inches. Weight, for postage, 1 ounce. Price, each..... .05

## SWITCH JAWS



Used for making knife switches, ground switches and aerial switches.

**NO. B-36 JAW**, 25 ampere, accommodates  $\frac{1}{2} \times 1-16$  inch bar, shipping weight 1 ounce.....\$0.10

**NO. B-37**, 100 ampere, accommodates  $1 \times \frac{1}{8}$  inch bar, shipping weight 3 ounces..... .15

**NOTE**—The above switch jaws are code passed and inspected. They are made of pure copper and are high grade. Hinge jaws, with holes, add 10 per cent.

## BRASS STRIP OR RIBBON

Used for helices, oscillation transformers, connecting strips, straps, etc. Not less than 2 feet sold.

Width	Thickness	Price per Foot	Postage per foot	Shipping Wt. of 20 Feet
1-2 inch	1-32 inch	\$0.10	\$0.03	2 pounds

## SQUARE BRASS TUBING



Used for sliders, etc. Cut to any length. For less than 6 inches figure price by the inch. Walls are 1-32 inch thick. Guaranteed accurate.

Inside Size	Price per Inch	Postage per Inch	Price per Foot	Shipping Wt. per Ft.
3-16x3-16 inch	\$0.04	\$0.01	\$0.25	1 pound
1-4x1-4 inch	.05	.01	.30	1 pound

## BRASS TUBING—ROUND SEAMLESS



Inside Diam.	Outside Diam.	Price, In.	Postage, In.	Price, Ft.	Shipping Wt., Ft.
$\frac{3}{8}$ In.	3-16 In.	\$0.02	\$0.01	\$0.14	3 Oz.
3-16 In.	$\frac{3}{4}$ In.	.05	.01	.16	3 Oz.
$\frac{1}{4}$ In.	5-16 In.	.05	.01	.18	3 Oz.
1 In.	$1\frac{1}{8}$ In.	.10	.02	.57	1 Lb.
$1\frac{1}{8}$ In.	$1\frac{1}{4}$ In.	.12	.02	.68	1 Lb.
$1\frac{1}{2}$ In.	$1\frac{3}{4}$ In.	.14	.02	.82	2 Lb.

**NOTE**—The smaller sizes are handy in constructing apparatus. The larger sizes are useful in making tubular variable condensers. Good variable condensers can be made by covering a brass tube with Empire Cloth and sliding it into a larger tube. A better way is to fit the smaller tube with wooden or rubber ends and drill holes in them to slide over brass rods into the larger tube.

## SQUARE BRASS ROD



Size, Square	Price per Inch	Postage per Inch	Price per Foot	Shipping Wt. per Foot
3-16 In.	\$0.02	\$0.01	\$0.15	1 Lb.
1-4 In.	.05	.01	.20	1 Lb.

## ROUND BRASS ROD



Diameter	Price per Inch	Postage per Inch	Price per Foot	Shipping Wt. per Foot
1-8 In.	\$0.01	\$0.01	\$0.04	4 Oz.
5-32 In.	.01	.01	.06	4 Oz.
3-16 In.	.01	.01	.07	1 Lb.
1-4 In.	.02	.01	.10	1 Lb.
1-2 In.	.04	.02	.28	3 Lb.
1 In.	.18	.05	1.50	6 Lb.



### HEXAGON BRASS ROD

Cut to any length. For less than 6 inches figure by inch price.

Size	Price per Inch	Postage per Inch	Price per Foot	Shipping Wt. per Foot
7-16 In.	\$0.05	\$0.02	\$0.35	2 Lb.



### BRASS SHEET

Useful in making many instruments. Not less than ¼ square foot sold. For less than 1 square foot add 20 per cent to the foot price.

Thickness	Price per Square Foot	Shipping Weight per Square Foot
1-64 In.	\$0.32	1 Lb.
1-32 In.	.51	2 Lb.

### ALUMINUM SHEET

Used for making variable condensers, electrolytic rectifiers, etc. Not less than ¼ square foot sold. For less than 1 square foot add 20 per cent to foot price. Comes 12 inches wide only, any length.

Thickness	Price per Square Foot	Shipping Weight per Square Foot
1-64 In.	\$0.35	1 Lb.
1-32 In.	.55	1 Lb.
1-16 In.	.95	2 Lb.

### COPPER BAR

Used for making knife switches, ground switches, detector supports, stands, bus bars, etc. For less than 6 inches figure price by the inch. Cut to any length. Not less than 15 cents worth of copper bar sold.

Thickness	Width	Price. In.	Postage. In.	Price. Ft.	Shipping Wt., Ft.
1-16 In.	½ In.	\$0.01	\$0.01	\$0.15	4 Oz.
1-8 In.	½ In.	.02	.01	.25	1 Lb.
1-8 In.	1 In.	.04	.02	.38	1 Lb.

### ZINC ROD

Used for spark gap ends, rotary studs, stationary electrodes, batteries and experimental work of all kinds. For less than ½ foot figure at the inch price. Not less than 10 cents worth of a size sold.

Diameter	Price. In.	Postage. In.	Price. Ft.	Shipping Wt., Ft.
3-16 In.	\$0.02	\$0.01	\$0.18	4 ounces
3-8 In.	.04	.02	.35	1 pound

### HARD RUBBER SHEET

Used in high grade electrical apparatus where perfect insulation, highest efficiency and neat looks are desired. Cut to any size (not curved or circular). For less than ½ square foot price is figured by the inch. Our hard rubber is polished on both sides and is a very high grade.

Thickness	Price, Sq. In.	Postage, Sq. In.	Price, Sq. Ft.	Ship. Wt., Sq. Ft.
1-8 In.	\$0.01½	\$0.01	\$1.55	2 pounds
3-16 In.	.02	.01	2.35	3 pounds
1-4 In.	.02½	.01	2.95	3 pounds
3-8 In.	.03¼	.01	4.25	5 pounds

### HARD RUBBER ROD (POLISHED)

Used for supports, standards, insulating feet, handles, high tension, insulators, etc. Cut to any length. For less than 1 foot figure price by the inch.

Diameter	Price. In.	Postage. In.	Price. Ft.	Shipping Wt., Ft.
¼ In.	\$0.02	\$0.01	\$0.15	4 ounces
½ In.	.03	.01	.25	1 pound
1 In.	.12	.02	1.00	1 pound

### HARD RUBBER TUBING (POLISHED)

Very useful for many purposes and indispensable in the manufacture of certain instruments. Especially used for "lead-in" bushings and for insulation of high tension wires through wood work, etc.

Outside Diameter	Inside Diameter	Price, In.	Postage, In.	Price, Ft.	Shipping Wt., Ft.
¼ In.	½ In.	\$0.04	\$0.01	\$0.20	4 ounces
½ In.	¾ In.	.05	.01	.40	1 pound
1 In.	¾ In.	.10	.02	.80	1 pound

**Red Head Receivers** *They're good!!!*  
*We've made them to be best. They ARE best.*

## BLACK VULCANIZED FIBRE SHEETING

Used for insulating and making instruments, switch bases and for panels, cabinets, etc. Very tough and strong. Best quality. Thin sizes valuable for making insulating washers, gaskets, etc.

Thickness	Price, Sq. In.	Postage, Sq. In.	Price, Sq. Ft.	Ship. Wt., Sq. Ft.
1-64 In.	\$....	\$....	\$0.15	4 ounces
1-8 In.	.01	.01	.50	2 pounds
1-4 In.	.01	.01	.85	3 pounds
1-2 In.	.02	.02	1.80	5 pounds

Cut to any dimension (excepting curved or round). For less than  $\frac{1}{2}$  square foot, price is figured by the inch. 10 per cent discount in 2 square feet lots.

## VULCANIZED FIBRE TUBING

Largely used for insulating primary from secondary and core on induction coils, for winding magnet spools and solenoids, and for general experimental use. For less than 6 inches figure price by the inch. Over 2 feet, discount 20 per cent.

Outside Diameter	Inside Diameter	Price, Ft.	Ship. Wt., Ft.	Price, In.	Postage, In.
$\frac{3}{8}$ In.	$\frac{1}{2}$ In.	\$0.30	4 Oz.	\$0.03	\$0.01
$\frac{1}{2}$ In.	$\frac{3}{8}$ In.	.40	4 Oz.	.05	.01
$\frac{3}{4}$ In.	$\frac{1}{2}$ In.	.50	4 Oz.	.08	.01
1 In.	$\frac{3}{4}$ In.	.65	1 lb.	.10	.01
$1\frac{1}{4}$ In.	1 In.	.85	1 lb.	.15	.01

(Not less than 5 cents worth of one size sold.)

## TRANSFORMER IRON

Used for transformer cores, impedance and choke coils. Comes in sheets 20x30 inches; 1-64 inch thick. Sold only in full sheets weighing 3 pounds each; shipping weight, per sheet, 4 pounds.

**NO. F-10 TRANSFORMER IRON**, highest quality, per sheet.....\$0.30  
Discount in 5 sheet lots, 20 per cent.

## SOFT IRON CORE WIRE

For cores of spark and induction coils, choke coils, etc. Best quality annealed wire. Comes in 1 pound rolls only. This wire may be readily cut to length. Each piece may be flattened perfectly straight by rolling it between two flat wooden boards. This is a better and cheaper way of buying core wire than getting it cut to length as you can cut it exactly to size yourself, thus saving expense. The following table will enable you to calculate your wants.

The amount of wire necessary for a given size core may be computed from the following table:

The weight of a core 1 inch long and  $\frac{1}{2}$  inch diameter is .041 lbs.

The weight of a core 1 inch long and  $\frac{3}{4}$  inch diameter is .094 lbs.

The weight of a core 1 inch long and 1 inch diameter is .167 lbs.

The weight of a core 1 inch long and  $1\frac{1}{2}$  inch diameter is .315 lbs.

Thus, a core  $\frac{3}{4}$  of an inch in diameter by 10 inches long will require 10 times .094 pounds, equaling .94 pounds, or practically 1 pound of core wire.

**NO. F-11 SOFT IRON CORE WIRE**, per 1 pound coil.....\$0.14  
(Shipping weight per coil, 2 pounds.)

## CARD BOARD TUBING



These tubes are used for making tuning and loading coils, loose couplers, Tesla coils, inductances and all windings of this nature. Our tubes are guaranteed round. They are seamless and when wound will give a smooth, even surface. When winding cardboard tubes always warm them before starting. This will shrink them so that after winding, when they resume their normal size, the wire will be tight and will stay tight. Keep them as dry and warm as possible while winding.

Our tubes are made especially for us. The price we ask is very low, quality considered.

No.	Outside Diameter	Inside Diameter	Thickness of Wall	Price, Ft.
H-10	2 In.	1 $\frac{3}{4}$ In.	$\frac{1}{8}$ In.	\$0.10
H-20	2 $\frac{3}{4}$ In.	2 $\frac{1}{2}$ In.	$\frac{1}{8}$ In.	.12
H-30	3 $\frac{1}{2}$ In.	3 $\frac{1}{4}$ In.	$\frac{1}{8}$ In.	.15
H-40	4 $\frac{1}{4}$ In.	4 In.	$\frac{1}{8}$ In.	.18
H-50	5 In.	4 $\frac{3}{4}$ In.	$\frac{1}{8}$ In.	.20
H-60	6 In.	5 $\frac{3}{4}$ In.	$\frac{1}{8}$ In.	.25

Shipping weight, any size, up to 4 inches diameter, 1 pound per foot. Shipping weight, 4 to 6 inches, 2 pounds per foot.

**NOTE**—Not less than 1 foot of any size sold. When cardboard tubing is ordered without other merchandise an extra charge of 5 cents must be remitted with each order to cover cost of special packing so that tubing will not crush in the mails.

Baltimore, Md.

Gentlemen: Your piece of Arlington Tested Galena has been received and I wish to say that it is the most sensitive crystal that I have ever had occasion to use. One particular feature that I have noticed is that there is not a "Dead Point" on the crystal. I will always be ready to say a good word for your products.

Old City Hall.

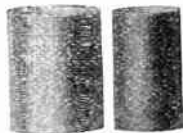
C. WARFIELD KEEFER, Eng. Div.

## The Electro-set Co. Presents CELLULAC TUBING

THE FINEST OF ALL WINDING TUBES.

Perfect Shape—Highest Insulation—Best Appearance.

For those experimenters who desire only the finest and best materials in their instruments we offer, for the first time to the experimental public, Cellulac. This wonderful material has been adapted by the largest wireless company in the world as its standard. While it is high in price it is certainly high in efficiency. It absolutely cannot shrink, warp or expand. It is impervious to oil, moisture or dampness. It has a breakdown value of 50,000 volts per millimeter. The tubes are as accurately round as metal turnings and as hard and resonant as metal. Cellulac Tubes are perfectly finished in a high polish. They are a dark, rich brown in color. No other material is as suitable for making tuners, couplers and inductances as Cellulac. No loose windings, warped tubes, poor fits or bad surfaces. The most efficient, handiwork and most easily worked tubing on the market is Cellulac, sold and introduced by the Electro-set Co.



No other material is as suitable for making tuners, couplers and inductances as Cellulac. No loose windings, warped tubes, poor fits or bad surfaces. The most efficient, handiwork and most easily worked tubing on the market is Cellulac, sold and introduced by the Electro-set Co.

When building a good coupler, tuner or loader, order Cellulac.

### PRICE LIST OF CELLULAC TUBING.

(Better and Cheaper Than Rubber, Fibre or Bakelite.)

Cat. No.	Outside Diam.	Inside Diam.	Thickness of Wall	Price, Ft.	Shipping Wt., Ft.
H-70	3½ In.	3¾ In.	1-16 In.	\$0.80	1 pound
H-80	4¾ In.	4½ In.	1-16 In.	1.00	1 pound
H-90	5 In.	4¾ In.	1-16 In.	1.50	2 pounds
H-100	6 In.	5½ In.	1-16 In.	2.00	2 pounds

Less than 1 foot, add 10 per cent on finishing price.  
"CELLULAC—FOR EFFICIENCY AND LOOKS."

## MAGNET WIRE

A WORD TO OUR CUSTOMERS.

The Electro-set Co. offer or sell no seconds, job lots, soiled or inferior grade wires. All our magnet wire is drawn from pure Electrolytic Copper of highest conductivity and insulation. Electro-set prices are always as low as good merchandise can be sold for. Good electrical apparatus requires good wire—and there's a big difference in wires. For the best you can get at lowest prices buy our carefully selected goods.

"A square deal for the experimenter—always."

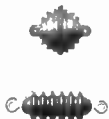


### THE ELECTRO-SET CO.

Size		Feet	SINGLE COTTON		Feet	DOUBLE COTTON		Price
B. & S. Gauge	Per Lb.	Per Lb.	Price	Price	Per Lb.	Price	Price	Price
		Per Lb.	½ Lb.	¼ Lb.	Per Lb.	Per Lb.	½ Lb.	¼ Lb.
12.....	.....	\$0.37	\$0.21	.....	.....	\$0.40	\$0.24	\$.....
14.....	.....	.37	.21	.....	.....	.42	.26	.....
16.....	125	.37	.21	.....	122	.43	.27	.....
18.....	200	.40	.23	.....	189	.45	.30	.....
20.....	311	.45	.26	.....	298	.49	.32	.....
22.....	491	.47	.30	.....	461	.55	.35	.....
24.....	778	.51	.35	.18	745	.70	.39	.21
26.....	1188	.57	.36	.21	1118	.70	.42	.26
28.....	1903	.68	.42	.24	1759	.83	.51	.30
30.....	2893	.73	.46	.28	2534	.96	.58	.32
32.....	4231	.92	.57	.32	3737	1.10	.66	.34
34.....	6317	1.19	.73	.43	6168	1.42	.84	.46
36.....	9511	1.45	.85	.52	7877	2.00	1.15	.63
38.....	.....	2.15	1.50	.88	.....	3.75	2.00	1.20
40.....	.....	3.50	2.00	1.52	.....	5.75	3.00	1.88
Size		Feet	SINGLE SILK		Feet	ENAMEL		Price
B. & S. Gauge	Per Lb.	Per Lb.	Price	Price	Per Lb.	Price	Price	Price
		Per Lb.	½ Lb.	¼ Lb.	Per Lb.	Per Lb.	½ Lb.	¼ Lb.
16.....	.....	\$0.61	\$0.40	.....	.....	\$0.44	\$0.30	\$.....
18.....	.....	.67	.42	.....	.....	.44	.30	.....
20.....	317	.70	.44	.....	.....	.46	.31	.....
22.....	501	.74	.46	.....	.....	.50	.32	.....
24.....	799	.82	.51	.27	810	.51	.34	.18
26.....	1263	.96	.60	.32	1286	.64	.40	.20
28.....	1988	1.12	.70	.36	2042	.73	.46	.21
30.....	3148	1.36	.85	.44	3240	.86	.54	.26
32.....	4913	1.73	1.08	.58	5132	1.02	.62	.32
34.....	6446	2.32	1.45	.75	8093	1.38	.80	.36
36.....	11889	3.14	1.97	1.00	12813	1.65	.98	.50
38.....	.....	4.46	2.79	1.45	.....	2.62	1.45	.88
40.....	.....	6.51	4.07	2.30	.....	3.70	2.00	1.40

NOTE—The shipping weight of wire is, of course, always more than its actual weight to allow for packing. Shipping weight of 1 pound of wire is 2 pounds; of ½ pound or ¼ pound, is 1 pound. Add 1 pound to any weight of wire up to 25pounds.

## ELECTROSE INSULATOR



Unless your aerial is well insulated you will lose more energy through leakage than in any other way. It is safe to say that not one aerial out of three is properly insulated. Do not try to save money on your aerial insulation. Use plenty of good insulators. Electro-set insulators are carefully chosen. We especially recommend the genuine Electroset grade, used by most government and commercial installations. Electroset possesses the highest possible insulating qualities combined with an amazing tensile strength. It is moisture and water proof.

**NO. D-1 CORRUGATED ELECTROSE INSULATOR**, 45,000 volts, each.....\$0.25  
(Shipping weight 1 pound.)

**NO. D-2 CORRUGATED ELECTROSE INSULATOR**, extra heavy tensile strength, break down value 50,000 volts, length 4 inches, each..... .30  
(Shipping weight 1 pound.)

**NO. D-3 COMMERCIAL CORRUGATED ELECTROSE INSULATOR**, 10½ inches long, tensile strength 1000 pounds, break down value 75,000 volts..... .50

**NO. D-3-EL COMMERCIAL INSULATOR**, ELECTROSE, length 22½ inches, tensile strength 1500 pounds, break down value 120,000 volts, each..... 2.00  
(Shipping weight 6 pounds.)

## ELECTRO-SET PORCELAIN INSULATORS



Do not confuse these with those you have seen listed elsewhere, that look the same. Our porcelain insulators are twice the size of those ordinarily sold at 10 cents each. They have a correspondingly higher tensile and insulative strength. Size 3 inches long, 2½ inches diameter. Especially fine for strain insulators. Three hundred per cent better than cleats for small aeriels. While these insulators are not quite so desirable as Electroset grade, they are recommended as being the "next thing to it."

**NO. D-65 PORCELAIN INSULATORS**, shipping weight 1 pound, each.....\$0.12

## ELECTROSE LEAD-IN BUSHINGS

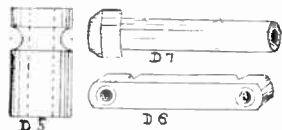


The importance of a safe and efficient insulator for leading the aerial wires through the wall into the building is universally conceded. The point of entrance is usually the place of greatest leakage for the high tension currents or for the weak electrical oscillations when receiving. Electroset Lead-in Bushings are the finest devices for this purpose that can be secured.

**NO. D-4 LEAD-IN BUSHINGS**, with patented ring for clamping to wall or sash; size 4 9-16 inches long, 2 inches diameter, ¼ in hole. \$0.73  
(Shipping weight 2 pounds.)

**NO. D-10 LEAD-IN BUSHING**, with lock ring, diameter 2½ inches, length 6¾ inches, hole ½ inch diameter, break down value 60,000 volts, each.....1.48  
(Shipping weight 5 pounds.)

## PORCELAIN CLEATS, KNOBS AND TUBES



## USED FOR WIRING OF ALL KINDS

The cleats are widely used by amateurs for aerial construction. While they have only a normal tensile strength, they are reasonably good for small aeriels if several are connected in series at the end of each strand. The tubes are sometimes used for lead-in bushings.

**NO. D-6 PORCELAIN CLEATS**, shipping weight 2 pounds per dozen pairs, price per pair...\$0.02  
(Not less than \* pairs sold.)

**NO. D-5 PORCELAIN KNOBS**, for inside wiring, shipping weight 1 pound per dozen..... .02  
(Not less than 6 sold.)

**NO. D-7 PORCELAIN TUBES**, ¾ x 3½ inches, shipping weight 2 pounds per dozen, each... .02  
(Not less than 6 sold.)

**NO. D-85 PORCELAIN TUBES**, 6x¾ inches, shipping weight 4 pounds per dozen, each... .05  
(Not less than 2 sold.)

## FLEXIBLE HIGH TENSION CABLE



Should always be used as leading-in wire to wireless instruments. Used also for all high tension leads in Wireless, X-ray and High Frequency Work. Extra heavy double rubber and triple braided insulation. Also used for automobile wiring. Recommended for helix, lead-in spark gap and condenser leads. No leakage—less danger of damaging kick-backs—high efficiency.

**NO. L-21 HIGH TENSION CABLE**, 3-16 inch diameter, per foot.....\$0.05  
**NO. L-22 HIGH TENSION CABLE**, 7-16 inch diameter, per foot..... .10

## BARE COPPER AERIAL WIRES

Size 14 pure copper Hard Drawn Wire is the best moderate priced wire for antenna purposes. All our copper aerial wires are hard drawn, making their tensile strength higher and their ability to withstand storms and weather greater. Do not compare our wire with copper clad or antennium wire, which is not pure copper but copper plated iron. This wire is frequently offered as pure copper. We charge no more for pure copper than the prices at which the inferior wires are sold.

NO. 14 B. & S. GAUGE HARD DRAWN AERIAL WIRE, 85 feet to the pound, per pound.....\$0.35  
 NO. 12 B. & S. GAUGE HARD DRAWN AERIAL WIRE, 65 feet to the pound, per pound..... .35

## ELECTRO-SET STRANDED HARD DRAWN COPPER CABLE

The best wire obtainable for antenna use at a reasonable price. Made especially for us by a conscientious wire factory whose product is beyond reproach. This wire consists of 4 strands of No. 22 hard drawn copper wire braided together. It has the lowest skin resistance present impossible price of Phosphor Bronze is its greater tensile strength. This feature is only valuable on extremely large commercial aersials. Our special stranded cable is used whenever high efficiency is paramount.

NO. L-44 ELECTRO-SET SPECIAL STRANDED COPPER CABLE, per 100 feet.....\$0.70  
 (Shipping weight per 100 feet, 1 pound.)

## GROUND WIRE—HELIX WIRE (Pure Copper—Not Copper Clad)

Size 4 B. & S. Gauge Copper is demanded by the underwriters for ground wires. A good ground on your wireless set is not less important than a good aerial. Our ground wire is pure electrolytic copper. Nos. 6 and 8 are extensively used for helixes and oscillation transformers.

NO. L-45 GROUND WIRE, 8 feet to the pound, per pound.....\$0.35  
 Per foot ..... .05½  
 NO. 8 HARD DRAWN COPPER, 20 feet to the pound, per pound..... .35  
 NO. 6 HARD DRAWN COPPER, 12½ feet to the pound, per pound..... .35  
 Per ½ pound, either size..... .20

## GUY WIRE

For guying aerial poles. Made of galvanized iron, size 14 B. & S. gauge, about 60 feet to pound.

NO. L-23 GUY WIRE, per pound.....\$0.10  
 (Not less than 1 pound sold.)

## RUBBER COVERED CONSTRUCTION WIRE NEW CODE.

Used for all house wiring. Consists of No. 14 copper wire with heavy rubber cover and braided fibre insulation.

NO. L-24 CONSTRUCTION WIRE, per foot.....\$0.02  
 Per 100 feet..... 1.60  
 (Shipping weight per 100 feet, 3 pounds.)

## ANNUNCIATOR WIRE



Double cotton covered, paraffin insulation for wiring bells, telephones, buzzers, signals, annunciators, etc.

NO. L-26 ANNUNCIATOR WIRE, per coil of 75 feet, size 18.....\$0.28  
 (Shipping weight 1 pound.)



**FRICTION TAPE**  
 Used for insulating joint and for binding cores of spark coils, transformers, etc. Comes in 2 ounce coils.

NO. D-15 FRICTION TAPE, shipping weight 3 ounces per coil, each.....\$0.07

## NEW CODE

## FLEXIBLE LAMP CORD (Double Twisted)

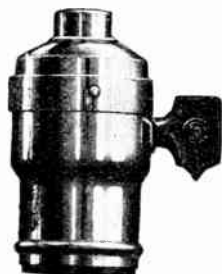
Used for connecting motors, lamps, transformers, etc., to 110-120 volt lines from socket. Green and yellow twisted cover, rubber insulation, stranded copper core, 2 wires.

NO. L-25 LAMP CORD, NEW CODE, per ft.\$0.03  
 (20 per cent discount in 25 foot lots.)

NOTE—Beware of old code wires offered at lower prices. They will not pass inspection and are dangerous.

Baltimore, Md.  
 Gentlemen: I have heard so much talk about this Galena that I have been forced to send for a piece.  
 Bancroft Park. RUDOLPH DEMLING.



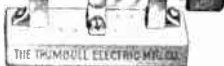
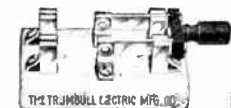


## WIRING NEEDS

	Price	Postage
NO. W-1 KEY SOCKET, Edison screw, brushed brass finish, best make, 3/8 inch thread.....	\$0.25	\$0.03
NO. W-2 ATTACHMENT PLUG, Edison Screw, hard rubber composition, patented, non-separable type, screws into socket without twisting cord.....	.20	.03
NO. W-6 SEPARABLE ATTACHMENT PLUG, standard model, porcelain type, as illustrated each.....	.18	.04
NO. W-5 NON-SEPARABLE ATTACHMENT PLUG, same as No. W-6, but not separable, each.....	.12	.03
NO. W-3 CLEAT RECEPTACLE, porcelain base, Edison screw.....	.10	.04
NO. W-4 SNAP SWITCH, nickel finish, screw to wall.....	.25	.04

## PORCELAIN BASE SWITCHES

These switches are all 15 ampere capacity. They find many uses about the shop and experimental laboratory. Our switches are first class in every particular. Strong blades and jaws, large insulating handles of moulded composition. Neat glazed porcelain bases of great strength.



- NO. 950 SINGLE POLE, SINGLE THROW SWITCH, shipping weight 6 ounces, each...\$0.18  
 NO. 951 SINGLE POLE, DOUBLE THROW SWITCH, shipping weight 8 ounces, each... .28  
 NO. 952 DOUBLE POLE, SINGLE THROW SWITCH, shipping weight 10 ounces, each... .28  
 NO. 953 DOUBLE POLE DOUBLE THROW SWITCH, shipping weight 1 pound, each... .35  
 NOTE—No. 953 Switch is used in small wireless stations as a change-over aerial switch.

## CURRENT TAP

This useful device allows you to operate a lamp from any socket at the same time that you operate an electric motor, heating device, transformer or other instrument. The current tap simply screws into the socket. A lamp may be placed in the tap, while the side plug is wired with flexible cord to go to your apparatus. These plugs come wired either in parallel or series, that is, so you can run your apparatus in series with the lamp or in parallel.

For all 110 volt devices you require the parallel tap. For small "series" motors, dentist lamps, etc., you require the series tap. Our plugs are especially strong and substantial.

- NO. W-6 PARALLEL CURRENT TAP, complete.....\$0.35  
 NO. W-7 SERIES CURRENT TAP, for special apparatus, where is necessary to reduce the current by connecting lamp in series, complete..... .35  
 (Shipping weight No. W-6 or W-7, 1 pound.)

## FUSE WIRE

Postage extra, 2 cents for any 10 feet, 4 cents for any 100 feet.

For open fuses, refilling fuses, fuse blocks, Edison refillable fuses, etc. Guaranteed accurate sizes. Wound on wooden spools of 5 feet each.

NO. G-50, 1 AMPERE, per 5 feet, prepaid.....	\$0.10
NO. G-51, 5 AMPERE, per 5 feet, prepaid.....	.10
NO. G-52, 10 AMPERE, per 5 feet, prepaid.....	.12
NO. G-53, 15 AMPERE, per 5 feet, prepaid.....	.15
NO. G-54, 25 AMPERE, per 5 feet, prepaid.....	.20

## CARTRIDGE FUSE



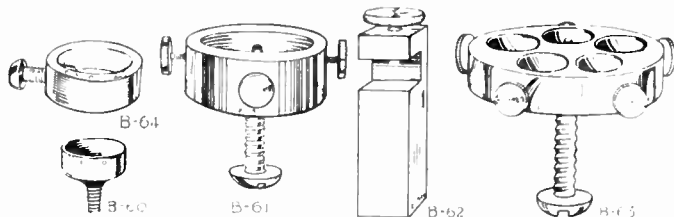
- NO. G-56, for clip contact fuse blocks or cabinets. Fit any cabinet. Sizes 5, 10, 15, 20 amperes. Price, any size, prepaid, each.....\$0.10



## EDISON FUSE PLUGS

- NO. G-55, screw into any Edison base fuse cabinets, receptacles or blocks. Price, any size up to 25 amperes, prepaid.....\$0.10

## DETECTOR CUPS AND CRYSTAL HOLDERS



- NO. B-64 CUP, solid turned brass cup, size  $\frac{3}{8}$  inch high by  $\frac{5}{8}$  inch diameter, with 6-32 set screw, tapped at bottom for 8-32 screw, each.....\$0.15  
(Postage 2 cents.)
- NO. B-60 CUP, for permanently fastening in crystals with alloy or solder. Brass cup with  $\frac{3}{8}$  inch threaded brass shank, 6-32 thread. Diameter  $\frac{1}{2}$  inch, height 5-16 inch; each......04  
(Postage extra, 1 cent.)
- NO. B-61 CUP, heavy turned brass, handsomely nicked and polished. Diameter  $1\frac{1}{2}$  inch, height  $\frac{1}{2}$  inch. Walls  $\frac{1}{8}$  inch thick. Furnished with three blister head screws to hold crystals. Drilled and tapped in bottom for 8-32 machine screw. Heavy walls prevent stripping of threads. A splendid hand turned cup; each......35  
(Postage extra, 4 cents.)
- NO. B-62 CRYSTAL HOLDER, as used on our popular No. 1603 Senior Detector. An ideal way of mounting crystals. Consists of a heavy nicked brass standard 9-16 inch square,  $1\frac{1}{4}$  inches high,  $\frac{3}{4}$  inch milled slot and set screw. (See picture of No. 1603 detector for idea of use.) Furnished with 8-32 machine tapped thread at bottom for fastening down; each......20  
(Postage extra, 4 cents.)
- NO. B-63 MULTIPLE CRYSTAL HOLDER, for mounting 5 crystals at once. The holder may be revolved, bringing any crystal into use. Exceptionally accurate and well turned. Beautifully finished in polished nickel. Diameter  $1\frac{1}{2}$  inches, depth  $\frac{1}{2}$  inch. Fitted with shank 3-16 inch in diameter, 1 inch long; each......55  
(Postage 10 cents.)

## GERMAN SILVER RESISTANCE WIRE

Most companies today offer for sale the 18 per cent grade German Silver Wire. The Electro-set Co. sells only the 30 per cent grade, with a resistance 35 per cent higher than the 18 per cent alloy. This wire is used for resistances, rheostats, potentiometers, etc. It is the highest grade German Silver Wire made. You need only 65 per cent as much as of the 18 per cent grade.

Size	Carrying Capacity in Amperes at 200 Degrees F.	BARE WIRE		COTTON COVERED		
		Ohms per Foot	Price per 10 Ft.	Price per 100 Ft.	Price per 10 Ft.	Price per 100 Ft.
R. & S. Gauge						
16	7.44	.1123	\$0.20	\$1.50	\$0.25	\$2.10
20	3.76	.2839	.10	.75	.12	1.00
24	1.84	.7178	.05	.35	.07	.50
30	.66	2.823	.05	.18	.05	.20

Postage extra, 2 cents, for any 10 feet; 4 cents for any 100 feet. Not less than 15 cents worth of any size sold.



## NICKEL CHROMIUM RESISTANCE

"NICHROME"

This wire is the only known metal (excepting platinum) that will stand a brilliant red heat in air without oxidizing or burning up. It is therefore used on all electrical heating apparatus, such as irons, toasters, heaters, etc. It is also used on small electric resistor furnaces and in all cases where resistances are to be used under load conditions that will make the wire red hot. It is an easy matter, with Nichrome wire to make toasters or small experimental electric furnaces, heaters, etc. Nichrome wire makes splendid rheostats.

Comes only in bare wire, uninsulated.

Size	Ohms per Foot at 72 Degrees F.	Price per	
		10 Feet	100 Feet
R. & S. Gauge			
20	.631	\$0.25	\$2.00
22	1.015	.20	1.50
24	1.608	.15	1.25
30	6.500	.10	.75



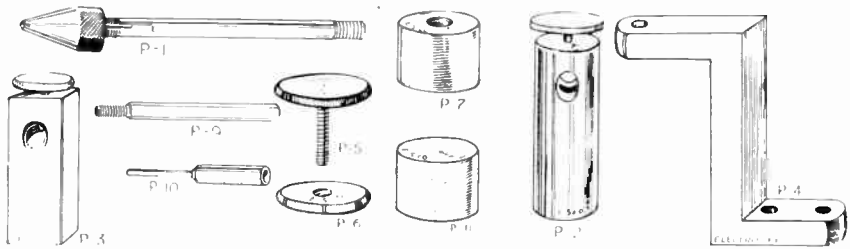
Milan, Ohio.

Dear Sirs: The Arlington Tested Galena Crystal that I bought of you some time ago has given the best of service by far of any crystal I have yet used.

Corner Huron and William St.

RALPH H. SAYLES, Jr.

## CONVENIENT PARTS



The Electro-set Co. herewith presents a number of excellent ready-made parts, the uses of which will readily suggest themselves to the experimenter. These parts are carefully and accurately made. They are finished and polished, ready for use.

- NO. P-1 ROD AND CHUCK**, used for holding cat whisker wire on detectors and for any purpose where a small holder is desirable. The rod is 3-16 inch diameter, 2 1/4 inches long, with a knurled chuck at one end, threaded 10-24 at the other. Handsomely nicked and polished. Fits into Nos. P-2 and P-3 posts. Price, each.....**\$0.25**  
(Postage extra, 2 cents.)
- NO. P-2 POST**, 3/8 inch diameter, 1 1/4 inches high, 3-16 inch hole at top and large knurled set screw. Threaded at bottom for 8-32 screw. Useful for spark gap standards, detector posts, stationary electrode holders on rotary gaps, etc. Handsomely finished in polished nickel, price each.....**\$0.16**  
(Postage extra, 2 cents.)
- NO. P-3 POST**, 1/2 inch square, 1 3/8 inches high. Fitted with 3-16 inch hole near top and large knurled set screw. Takes 8-32 machine screw at bottom. A very handsome, massive square support post for many uses. Beautifully nicked. Price each.....**\$0.20**  
(Postage extra, 3 cents.)
- NO. P-4 STANDARD**, made of a solid brass casting, ground, finished and gold lacquered. 1 5/8 inches high, 3/2 inch wide, 7-32 inches thick. Accommodates 8-32 machine screw at top. Two holes at base for fastening. Used for detectors and for all uses where a good support is necessary. Price each.....**\$0.35**  
(Postage extra, 3 cents.)
- NO. P-5 KNURLED SET SCREWS**, used for countless electrical devices for countless purposes. Sold in various sizes. Made of solid turned brass, handsomely finished in gold lacquer. Price each.....**\$0.05**  
(Postage extra, 1 cent each.)
- | No.  | Thread | Height    | Diameter of Head | Price  |
|------|--------|-----------|------------------|--------|
| P-5A | 8-32   | 1/2 In.   | 1/2 In.          | \$0.05 |
| P-5B | 8-32   | 3/4 In.   | 3/8 In.          | .06    |
| P-5C | 8-32   | 1 In.     | 5/8 In.          | .08    |
| P-5D | 6-32   | 1 1/2 In. | 3/2 In.          | .05    |
| P-5E | 6-32   | 3/4 In.   | 1/2 In.          | .06    |
| P-5C | 6-32   | 1 In.     | 5/8 In.          | .08    |

**NO. P-6 KNURLED LOCK NUTS**, used for locking a set screw in any position. Gold lacquered finish. Price each.....**\$0.05**  
(Postage extra, 1 cent each.)

No.	Thread	Diameter	Price
P-6A	6-32	1/2	\$0.05
P-6B	8-32	5/8	.06

**P-7 BRASS BUSHINGS OR PILLARS**, used to support rotary switch levers and for other instrument requirements. Made of machine turned lacquered brass. Price each.....**\$0.10**  
(Postage extra, 1 cent each.)

No.	Diameter	Height	Diameter of Hole	Price
P-7A	1/2 In.	3/8 In.	5-32 In.	\$0.05
P-7B	1/2 In.	3/4 In.	5-32 In.	.10

**NO. P-9 ZINC RODS**, for spark gaps. 3-16 inch in diameter, 2 inches long. Threaded at one end for 8-32 thread. Will fit any of our knobs, price each.....**\$0.10**

**NO. P-10 CORD TIPS**, for telephone cords or for connecting cords used in hooking up apparatus, price each.....**\$0.03**  
(Postage extra, 1 cent.)

**NO. P-11 ZINC SPARK POINTS**, for spark gaps. 3/8 inch in diameter, 3/8 inch high. Threaded for 8-32 machine screw. Each.....**\$0.05**  
(Postage extra, 1 cent.)

## BOOKS

The quickest and easiest way to know wireless telegraphy and electrical things is to read good books. If you do not read books you are missing half the good results you obtain by following out new and efficient hook-ups, and new methods of working. Electrical and wireless books, to those interested, are exceptionally fascinating to read. They are furthermore extremely educational and instructive. Learn more about your hobby and get renewed interest, better results, new methods. Read Books.

No one should attempt to start a wireless station without owning one or more "A B C" books on the subject. No one should attempt to maintain one without keeping up to the minute by reading.

**LESSONS IN WIRELESS TELEGRAPHY**—A complete course in the design, theory and construction of wireless telegraphy, starting with magnetism and electricity and finishing with wireless circuits and diagrams, laws, instruments, etc. The latest detectors, tuners, aeriads and devices are described in detail; 82 pages. Price, postage paid, \$0.25.

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**OPERATION OF WIRELESS TELEGRAPH APPARATUS**—This book shows how to obtain the very highest efficiency from any station and how to comply with the law; how to tune, adjust detectors, spark gap, phones, etc. How to use test buzzers, variometers, condensers, transformers. How to tune various wave lengths and how to obtain sharp waves. Also describes how to make and use wave meters. If you want good results, here's your opportunity. Price, postpaid, \$0.25.

**COMPLETE WIRELESS COURSE**—The four books listed above are the finest publications of their kind. Every experimenter ought to own all four of them. The set makes a complete course in wireless telegraphy—a course for which a correspondence school would charge \$25.00. The complete set of four books, prepaid, \$1.00.

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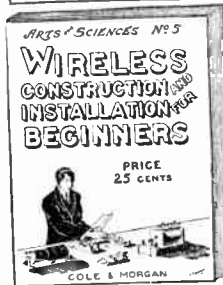
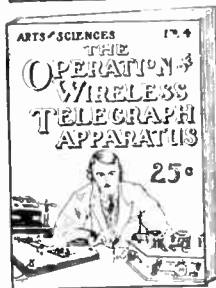
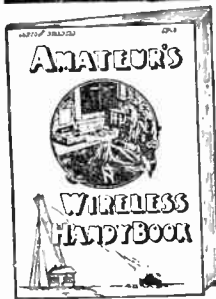
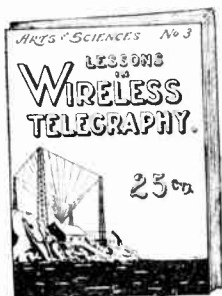
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**DO YOU KNOW HOW TO** design and build a magnetic leakage transformer for radio telegraph or other high frequency work? Calculate the number of turns required for the primary and secondary of a transformer of any kind to operate at a given voltage? Construct an induction coil to give a heavy one-inch spark with only a pound of wire in its secondary? This book at \$0.25 will show you how. **New Revised Third Edition CONSTRUCTION OF INDUCTION COILS AND TRANSFORMERS**, by Thomas Stanley Curtis. Contains information hitherto unpublished in book form, written in plain English for the practical worker. Chapters on the construction of transformers of various types, such as high tension, low voltage for experimental work, open and closed core, magnetic leakage, etc. A chapter on high frequency apparatus, and another on experiments with high frequency current. Designs for interrupters, condensers, spark gaps, etc. Unique among the many features of the book is a chapter which tells the amateur how to design his own transformer; how to figure the number of turns required for a core of any size; how to determine the quantities of materials needed; and all this may be done by a simple application of arithmetic. If you are an experimenter, this book will give you the transformer information you need in a lucid and convenient form; send for it.

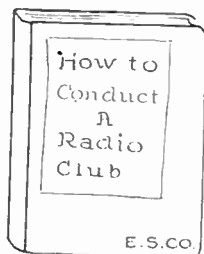
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'THE INDISPENSABLE BOOK.'  
\$0.50 PREPAID



The most remarkable success on record attended the publication of this tremendously popular book on wireless telegraphy.

**HOW TO CONDUCT A RADIO CLUB** contains more splendid material, more accurate explanations and more detailed descriptions on wireless telegraph construction, operation, theory and design than any book hitherto published at the price. The book is written by E. E. Bucher, instructing engineer, The Marconi Wireless Telegraph Co. His masterly but simple chapters are indispensable to all experimenters who have advanced a little beyond the beginner's stage. Experts, commercial operators, amateurs—all need this book. Radio clubs are especially fortunate in its publication; 144 large pages, 7x10 inches; fully illustrated. We herewith submit only a partial list of contents. Order today.

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**Chapter VI—The Measurement of the Logarithmic Decrement**—Calculation of the Decrement of the Decrementer; Definition of a Pure and Sharp Wave.

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**Chapter VIII—Receiving Tuners**—Receiving Tuners; Coils and Condensers of Measured Wave Length; Tuned Buzzer Tester; Test Buzzers; Preferred Circuits for Radio Telegraphic Detectors.

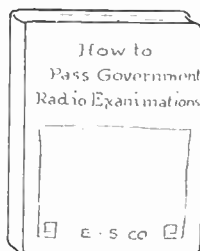
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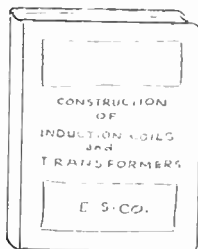
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This book is indispensable to prospective operators, commercial or advanced amateurs. The title is self-explanatory. One hundred and eight questions and answers are described, answered and explained. When you know the contents of this book you know wireless telegraphy. Fully illustrated; size 6x9 inches. Price, postpaid, \$0.50.



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BY STANLEY K. CURTIS

This book describes and explains, in a simple and understandable way, how to construct and use spark coils and open and closed core transformers for use in wireless telegraphy, X-ray, high frequency and other work.

It is the most popular work of its kind. A complete book, giving the details of design and construction of coils from 1/4 to 12 inch spark rating. Full information on high tension transformers, Tesla coils, condensers, etc. Also tables of core dimensions, sparking distances, wire values, etc. Size 5x7 inches; 100 pages; 72 illustrations. Price, prepaid, \$0.25.



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BY WM. L. WEBER, M. E.

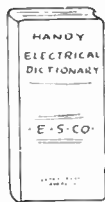
CLOTH, RED EDGES, INDEXED—PRICE \$0.25

Contains upward of 4800 words, terms and phrases employed in electrical profession, with their definitions given in the most concise, lucid and comprehensive manner.

It also embodies many of the features of these cumbersome volumes of electrical encyclopedias, which are only accessible in public or private libraries and which, by reason of their ponderous dimensions, are rendered impossible as aids to the average electrician in the daily routine of his profession. Much thought and great care has been exercised in the preparation of this unique work by the author, Mr. William L. Weber, M. E.

All the scientific principles which constitute the foundation of electrical engineering are contained in the definitions given in this work, and while necessarily appearing in a concise or abstract form, they are stated in terms so simple and with such freedom from ambiguity, that the reader of average intelligence and limited education cannot fail to comprehend their full meaning.

Although the book is small (vest pocket size) we venture the assertion that there is contained within its covers more reliable and useful information for the electrician than was ever before published in a single volume, and the busy electrical worker will find it to be of inestimable value in his work, for the reason that he can carry it with him every day, and have it to refer to whenever a perplexing problem comes up. At the close of the book are given illustrations of the various kinds of circuits used in wiring also diagrams showing the connections of the series dynamo and the compound wound dynamo.

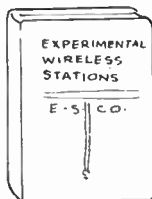


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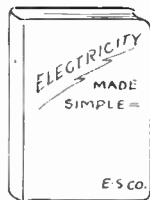
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A book devoid of technicalities. Simple, plain and understandable. There are many elementary books on electricity upon the market, but this is the first one presenting the matter in such shape that the layman may understand it, and at the same time not written in a childish manner. For engineers, dynamo men, firemen, linemen, wiremen and learners. For study or reference.

Students and electrical workers whose opportunities for gaining information on the underlying principles of electricity have been limited will find this book to be of inestimable value to them for the reason that the author has endeavored throughout the book to bring the subject-matter down to the point where the layman and the earnest seeker after knowledge may be able to understand it. Starting with the subject of static electricity, what it is, how produced, etc., many interesting experiments are described and illustrated, and instructions given for conducting them. A section is also devoted to atmospheric electricity and its effects. Chemical batteries are treated upon a length and their action clearly explained. The underlying principles of the dynamo are explained, and its construction and action are described in terse, simple language. A section is also devoted to a discussion of the elementary principles of light and power, including the arc and incandescent lamp, also wiring systems.



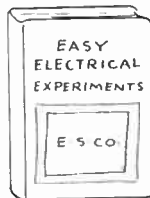
## EASY ELECTRICAL EXPERIMENTS AND HOW TO MAKE THEM

BY L. P. DICKINSON

220 PAGES, 110 ILLUSTRATIONS, 12 MO, CLOTH BINDING—PRICE \$1.00

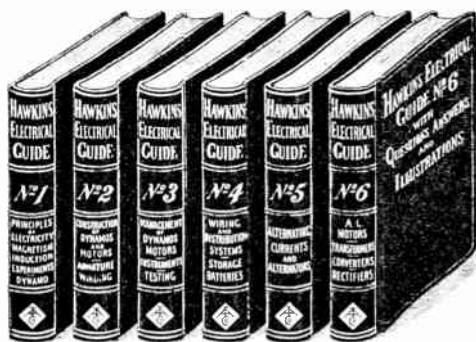
The many and varied purposes for which electricity is now used and the rapid advancement being made in the knowledge of its laws, renders it necessary that every young man of today who would succeed in any mechanical line should have a good working knowledge of its principles, and in presenting the present volume to the public, the author has made an easy attainment of this knowledge possible.

It is the very latest and most valuable work on electricity for the amateur or practical electrician published. It gives in a simple and easily understood language everything one should know about galvanometers, batteries, magnets, induction coils, motors, voltmeters, dynamos, storage batteries, simple and practical telephones, telegraph instruments, rheostats, condensers, electrophorus, resistance, electroplating, electric toy making, etc.



The construction of the voltmeter is described at length, and a clear explanation given of the principles controlling its action. Instructions are also given concerning the adjustment and use of voltmeters, either stationary or portable. Quite a large section is devoted to an explanation of the principles of the dynamo, and detailed instructions given regarding the design and construction of one. The process of building a dynamo from start to finish is plainly described and illustrated. The principles of the arc lamp are explained in detail and instructions given how to make one. The student is also told how to make a model fire alarm telegraph, and also how to build an electric locomotive.

## STUDY ELECTRICITY AT HOME



THESE SPLENDID ELECTRICAL VOLUMES, THE FINEST AND MOST COMPLETE BOOKS EVER PUBLISHED, LEATHER BOUND...

Read about these wonderful books. They are as clear and simple to understand as possible. Bound in soft leather, gold edges. Handsome and practical; 260 pages, profusely illustrated; size 5x7 inches. You must be satisfied when you get these books. We guarantee it. Return the books in three days if you don't feel that you have received twice their value. We'll return your money gladly.

They are not only the best, but the cheapest work ever published on electricity. The books are sold at \$1 each or \$10 for the ten numbers.

**ELECTRICAL GUIDE, No. 1**—Containing the principles of Elementary Electricity, Magnetism, Induction, Experiments, Dynamos, Electric Machinery.

**ELECTRICAL GUIDE, No. 2**—The construction of Dynamos, Motors, Armatures, Armature Windings, Installing of Dynamos.

**ELECTRICAL GUIDE, No. 3**—Electrical Instruments, Testing, Practical Management of Dynamos and Motors.

**ELECTRICAL GUIDE, No. 4**—Distribution Systems, Wiring, Wiring Diagrams, Sign Flashers, Storage Batteries.

**ELECTRICAL GUIDE No. 5**—Principles of Alternating Currents and Alternators.

**ELECTRICAL GUIDE No. 6**—Alternating Current Motors, Transformers, Converters, Rectifiers.

**ELECTRICAL GUIDE No. 7**—Alternating Current Transmission Systems, Current Regulators, Circuit Breakers, Measuring Instruments.

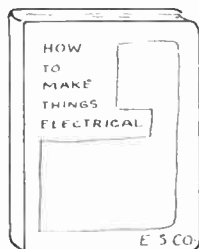
**ELECTRICAL GUIDE No. 8**—Power Wiring, Power Stations, Installation and Management. A. C. Switch Boards, Wiring.

**ELECTRICAL GUIDE No. 9**—Telephony and Telegraphy. Wireless Telegraphy, Electric Lighting, Electric Railway Systems, Bells, Wireless Telephone.

**ELECTRICAL GUIDE No. 10**—Modern Practical Applications of Electricity and Ready Reference Index to Complete Guide.

## HOW TO MAKE THINGS ELECTRICAL

THIS BOOK WILL SHOW YOU  
COMPLETE DIRECTIONS FOR BUILDING OVER 100 PIECES OF ELECTRICAL APPARATUS  
TOGETHER WITH A SERIES OF ELECTRICAL EXPERIMENTS



A Workshop Manual for the student or experimenter, showing the construction of everything electrical, from a simple battery cell to an electric starter for a balky horse, including such useful household appliances as motors, electric toasters, stoves, clocks, bell transformers, immersion water heater, soldering iron, etc., in addition to a wide range of new and novel devices that every experimenter would like to know how to make.

Clear, concise directions and over 180 careful drawings are features of this book that should not be overlooked. No other work contains in such compact form as many up-to-date designs of apparatus that can be made by the experimenter of ordinary ability. Only ordinary tools are required to do the work.

Read this partial list of articles covered—many other articles, too:

To Take Your Photograph; Firing Flashlights Electrically; Ruby lamp for Dark Room; Construction of a Dry Cell; Homemade Battery; Crowfoot Gravity Battery; Closed Circuit Cell; Bichromate Cell; Storage Batteries; Adjustable Water Rheostat; A Simple Magnet Motor; How to Build a Simple Magnet Motor; How to Build a Simple Electric Motor; Miniature Alternating Current Motor; Construction of a Laminated Motor; How to Build a 1/2 Horsepower Motor Without Castings; Simple Controller for Toy Motors; How to Make a Direct Current Dynamo; To Make a Small Magneto; To Make a Selenium Cell; Watch Demagnetizer; A Simple Static Machine; Odd Static Generator; Reversing Switch Reversing the Polarity; An Odd Telegraph Set; Telegraph Sounder from an Old Bell; Telegraph Key; How to Make a Polarized Relay; To Make a Simple One-way Telephone; How to Make an Electric Bell; Electric Bedroom Alarm; Burglar Alarm Circuit; A Simple Door Alarm; Office Bell; Tell-tale for the Ice Box Drip Pan; Bell as Shocking Device; Shocking Outfit

from Electric Engine; How to Construct a Shocking Coil; How to Build a Simple Induction Coil; Shocking Push Button; A Step Down Transformer; Two Hundred Watt Closed Core Transformer; How to Make a Bell Ringing Transformer; Construction of Ring and Core Type Transformers; Construction of a Tesla High-frequency Apparatus; An Electric Pendulum Clock; How to Make an Electric Furnace; Electric Stove and Toaster; Immersion Water Heater; Making an Arc Lamp; How to Make a Speaking Arc; How to Make an Electric Gas Lighter; Construction of a Simple Microphone; Making a Galvanometer; A Hot Wire Meter; Unique Ammeter; How to Make a Direct Current Ammeter; Electric Soldering Iron; Wind Direction Indicator; Leyden Jar Made from a Fruit Jar; Construction of an Adjustable Condenser; How to Build a Variable Condenser; Electrolytic Rectifier; Wehnelt Interrupter; Luminous Goblet; Interesting Experiments in Magnetism; The Traveling Wheel; To Make an Electrophorus; Shocking Money; Electro-Magnetic Rotation Experiments; Experimental Geissler Tube; Formation of Imitation Crystals; Simple Experiments With Electricity; A Test Bell; An Electrical Scarecrow; Electric Starter; For Balky Horses; Bed Warmer; Electric Counting Machine; Homemade Night Watch Lamp; Hearing the Telephone Bell; Clock Operated Time Switch; Floor Tread Switch. 200 Pages, 184 Illustrations. Price, Postpaid, \$1.50.

## Save Money on FLASH LIGHTS GET WHOLESALE PRICES BY ORDERING FROM US

**FINEST STYLES  
BEST MAKES**

A STRONG LIGHT IN  
WIND OR RAIN.  
"JUST PRESS THE  
BUTTON."

**LOWEST PRICES  
YOU SAVE 40 %**

There isn't a person anywhere that can't use electric pocket flashlights. No matter what business you are engaged in—no matter what you may be doing—a flashlight will prove the handiest little thing you ever bought.

The business man, housewife, electrician, plumber, carpenter, farmer, stock boy, deliveryman, banker, workman, experimenter, mechanic, camper, hunter, fisherman—all find flashlights convenient and even indispensable.

### OUR FLASHLIGHTS ARE HIGH GRADE.

We do not carry a single number that will not give good service and good light. Our batteries are specially selected for long life and use. We furnish only genuine National Mazda Bulbs. They cost us more—they cost you less because they are as perfect as bulbs can be made today.

COMPARE OUR PRICES with any other you have seen. For the quality of merchandise we furnish the cost to you is less than you can get flashlights elsewhere.

NOTE—In line with other goods of this nature, the manufacturing costs on flashlights and batteries have risen from 25 per cent to 75 per cent. Note our prices. In spite of the rise in costs we are still furnishing the highest grade products at the very lowest figures. Tremendous purchasing power explains it.

BUY FLASHLIGHTS AND FLASHLIGHT GOODS FROM THE ELECTRO-SET CO.

## FIBRE CASE FLASHLIGHTS

Our Fibre Case Tubular Flashlights are made in one of the largest and best equipped factories operating today. They are exceptionally well constructed and are built for service. In appearance no line can excel them. In workmanship the smallest details show exquisite care. The reflectors are shaped properly, giving a strong penetrating light for many feet. The end caps are made of handsomely finished nicked brass. The screw threads are large and easy to turn, an important feature. Most flashlights on the market have the annoying characteristic of poor threads, making the replacement of batteries and bulbs a disagreeable task.

The contacts on our Tubular Fibre Cases are of the slide pattern. They are large and sure in action and will not work loose. They are firmly riveted into the fibre case.

These flashlights come in five convenient styles, enabling you to pick out the most suited to your needs.

### NO. R-1 BABY TUBULAR FLASHLIGHT

YOU PAY \$1.00 MOST PLACES—OUR PRICE \$0.60.

A handy size for pocket use. Powerful lens; splendid light. Furnished with genuine Mazda lamp and long-life battery. Size  $1\frac{1}{4} \times 5\frac{1}{4}$  inches. Shipping weight 1 pound.



NO. R-1 BABY TUBULAR FLASHLIGHT, Fibre case, nicked metal parts. . . . . \$0.60  
NO. R-11 RENEWAL BATTERY, shipping weight 1 pound. . . . . 22  
NO. R-111 RENEWAL 2.8 VOLT BULB, Mazda. . . . . 13

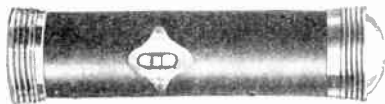
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### A STITCH IN TIME

may save a valuable table full of wireless instruments. Sometimes your high tension transformer will "kick back" into the power lines, blowing fuses and generally "cutting up." Our No. 8001 Line Protector is cheap insurance. See page 16.

## NO. R-2 FIBRE TUBULAR FLASHLIGHT

YOU REGULARLY PAY \$1.25—OUR PRICE \$0.75.



This is an especially good size for home use, to look into closets and dark spaces, tend to the furnace, see time at night, etc. It is larger than our R-1 Flashlight and will therefore require less battery renewal. A practical light for every purpose. Furnished with genuine Mazda Bulb and long-life battery. Size  $1\frac{1}{2} \times 6\frac{1}{2}$  inches. Shipping weight 1 pound.

NO. R-2 FIBRE TUBULAR FLASHLIGHT.....	\$0.75
NO. R-22 RENEWAL BATTERY, for above, shipping weight 1 pound.....	.22
NO. R-222 2.8 VOLT MAZDA BULB, renewal for above.....	.13
(Postage extra, 2 cents.)	

## NO. R-3 FIBRE TUBULAR FLASHLIGHT

REGULARLY PRICED AT \$1.50—OUR PRICE \$0.95



This is a large style flashlight for heavy work about the barn, for camping and fishing, professional uses and for general house use. It has a pressed fibre black case with handsome nickled trimming. Genuine Mazda lamp and long-life battery are furnished. A fine value. Size  $1\frac{1}{2} \times 8\frac{1}{2}$  inches. Shipping weight 2 pounds. 3 cell battery.

NO. R-3 FIBRE TUBULAR FLASHLIGHT.....	\$0.95
NO. R-33 RENEWAL BATTERY, for above, shipping weight 1 pound, each.....	.28
NO. R-333 RENEWAL MAZDA BULB, 3.8 volts, each.....	.13
(Postage extra, 2 cents.)	

## NO. R-4 MINER STYLE FLASHLIGHT

YOU REGULARLY PAY \$1.75—OUR PRICE \$1.18



This flashlight is built to the same dimensions as our popular R-2 style but is furnished with a clear, powerful lens and reflector  $2\frac{1}{2}$  inches in diameter. It is a very strong and powerful light, throwing its rays over a wide area. For heavy duty work it is especially desirable. Campers find this style very convenient. Metal parts are highly nickled. Size  $1\frac{1}{2} \times 6\frac{1}{2}$  inches. Shipping weight 2 pounds, 2 cell battery.

NO. R-4 MINER FLASHLIGHT.....	\$1.18
NO. R-44 RENEWAL BATTERY, shipping weight 1 pound.....	.22
NO. R-444 RENEWAL BULB, 2.8 Volts.....	.13
(Postage extra, 2 cents.)	

## NO. R-5 MINER STYLE FLASHLIGHT

OTHERS ASK \$2.00—OUR PRICE \$1.45



This flashlight is our regular R-3 style, furnished with a  $2\frac{1}{2}$  inch clear, powerful lens and silvered reflector. It will throw a fine, strong light in a large radius. The most practical style of flashlight for farm or camp use. It is handsomely finished. Furnished with genuine Mazda Bulb and long-life battery. Size

$1\frac{1}{2} \times 8\frac{1}{2}$ inches. Shipping weight 2 pounds. 3 cell battery.	
NO. R-5 MINER FLASHLIGHT.....	\$1.45
NO. R-55 RENEWAL BATTERY, shipping weight 1 pound.....	.28
NO. R-555 RENEWAL MAZDA LAMP, 3.8 volts.....	.13
(Postage extra, 2 cents.)	

### EVERY WIRELESS EXPERIMENTER WANTS THE BEST RECEIVERS HE CAN GET

It's natural that this most important part of his wireless equipment should receive the most careful attention. Red Head Phones will solve the problem of extreme sensitiveness at moderate price. You take no risk when you buy Red Head Receivers. We gladly refund your money on demand.

Dear Sirs: I am pleased with your promptness.  
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Columbus, Ohio,

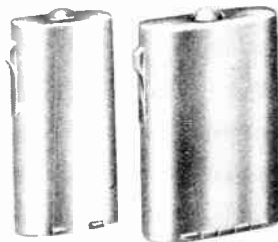
O. D. STEPHENSON.

## VEST POCKET FLASHLIGHTS

(NICKEL FINISH.)

These are the smallest and most convenient styles of flashlights for the business or professional man to carry in the vest pocket or for ladies' use. They are compact and light and may be easily carried in a lady's purse or in your vest pocket.

These flashlights are made of seamless drawn brass, finished in the finest quality of nickel plate, highly polished. They are neat as a watch and fully as easy to carry and as convenient. Furnished with genuine opal backed Mazda Lamps and special long-life batteries.



R-6-S

R-7-S

### NO. R-6 VEST POCKET FLASHLIGHT

75 CENTS ELSEWHERE—OUR PRICE \$0.48.

This is the 2 cell style of case, the smallest practical flashlight made. We do not sell the midget size cases as the batteries are so small that they are impractical and expensive to renew. With proper use the batteries in the R-6 Flashlight will give 2 to 6 months' service without renewal. (See "How to Use Flashlights.") Others would charge you 75c for this light. Size  $2\frac{1}{2} \times 1\frac{3}{8} \times \frac{3}{4}$  inches.

NO. R-6 VEST POCKET FLASHLIGHT, shipping weight 8 ounces.....\$0.48  
(Push button contact on above for intermittent use.)

NO. R-6-S VEST POCKET FLASHLIGHT, same as above but with slide contact, for permanent light without holding down button......59

NO. R-66 RENEWAL BATTERY, for above, shipping weight 4 ounces......22

NO. R-666 RENEWAL OPAL BACK BULB, for above; Mazda 2.8 volts......13  
(Postage extra, 2 cents.)

### NO. R-7 VEST POCKET FLASHLIGHTS

OTHERS WOULD CHARGE YOU \$1.00 TO \$1.25—ELECTRO-SET PRICE \$0.68.

This is the same general type as our R-6 light but wider and uses a 3 cell battery. It will therefore give more light and longer service with each battery. Size  $2\frac{7}{8} \times 2\frac{3}{8}$  inches. Shipping weight 1 pound.

NO. R-7 VEST POCKET FLASHLIGHT, push button contact, for intermittent light.....\$0.68

NO. R-7 S VEST POCKET FLASHLIGHT, same as above but with slide contact switch for permanent light......75

NO. R-77 RENEWAL BATTERIES, for above, shipping weight 6 ounces......28

NO. R-777 RENEWAL OPAL BLACK BULB, for above, Mazda 3.8 volts......13  
(Postage extra, 2 cents.)

### TUBULAR NICKELED FLASHLIGHTS

The Handsomest Flashlights Made

Nickel plated Tubular Flashlights are the newest development in the flashlight industry. They are made of seamless drawn brass tubing, finished in the most beautiful polished nickel plate, triple thickness. The lenses and reflectors are designed and built with the finest possible workmanship. The bulbs are Genuine National Mazda Quality, assuring you the longest service and the best light. The batteries we furnish are without doubt the longest lived and most serviceable make that can be procured.

**OUR PRICES ARE LOWER.**

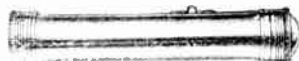
As with all our flashlight line, you cannot get better values. In spite of the high cost of this kind of merchandise today, our contracts enable us to furnish them at very low prices. Remember, please, that our Nickel Plated line of Flashlights is the very highest quality. We challenge you to buy better ones. The brass used is extra heavy, double strength tubing. The finish is beyond reproach. The switches, contacts, lenses, bulbs, batteries—all are unexcelled.

**SAVE MONEY—GET THE BEST.**  
Buy Flashlights from Us at Dealers' Prices.

### NO. N-1 BABY NICKELED TUBULAR FLASHLIGHT

DON'T PAY \$1.25—OUR PRICE \$0.95.

Please don't confuse our splendid nickeled flashlight cases with the cheap, thin, brass, soft drawn styles that you sometimes pay full price for. You never saw better flashlights than these we offer you at cut prices. Our "Baby" style is small in size but big in performance. It is daily proving more popular. Its handsome exterior and no less desirable interior places it in a class of its own. The size is  $1\frac{1}{4} \times 5$  inches. The shipping weight is 1 pound.



NO. N-1 BABY TUBULAR FLASHLIGHT, nickeled hard drawn brass case, complete.....\$0.95

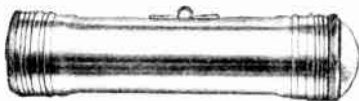
NO. N-11 RENEWAL BATTERY, shipping weight 1 pound......22

NO. N-111 RENEWAL MAZDA BULB, 2.8 volts......13  
(Postage extra, 2 cents.)



## NO. N-2 NICKELED TUBULAR FLASHLIGHT

DON'T PAY \$1.50—OUR PRICE \$1.10.



This splendid flashlight, handsome to a degree, useful in a thousand ways, is a very popular size and model. See the general description of our famous Nickeled Flashlights, compare our price, consider quality. The size of this flashlight is  $1\frac{1}{2} \times 6\frac{1}{2}$  inches. The shipping weight is 1 pound. It takes a renewal 2 cell battery and 2.8 volt lamp. Throws a light powerful ray for many feet.

NO. N-2 NICKELED TUBULAR FLASHLIGHT, with hard drawn case, complete with battery.....	\$1.10
NO. N-22 RENEWAL BATTERY, shipping weight 1 pound.....	.28
NO. N-222 RENEWAL MAZDA BULB, 2.8 volts.....	.13
(Postage extra, 2 cents.)	

## NO. N-3 PROFESSIONAL TYPE NICKELED FLASHLIGHT

DON'T PAY \$1.75—OUR PRICE \$1.35.



This size flashlight, because of its long battery life and fine light is largely used by autoists, professional workmen and others who must have a strong, extra-lasting light. Its non-short-circuitable feature allows you

to lay it in a bag of tools without burning out the battery. Its fine appearance will make you proud to own it. Size  $1\frac{1}{2} \times 8\frac{1}{2}$  inches. Shipping weight 2 pounds. Furnished with genuine Mazda Bulb and our regular high grade battery.

NO. N-3 PROFESSIONAL TYPE NICKELED FLASHLIGHT, complete.....	\$1.35
NO. N-33 RENEWAL BATTERY, 3 cell, shipping weight 1 pound.....	.28
NO. N-333 RENEWAL MAZDA BULB.....	.13
(Postage extra, 2 cents.)	

## NO. N-4 MINER STYLE NICKELED TUBULAR FLASHLIGHT

DON'T PAY \$2.00—OUR PRICE \$1.45.

This flashlight is similar to our No. N-2 type (Postage extra, 2 cents.)

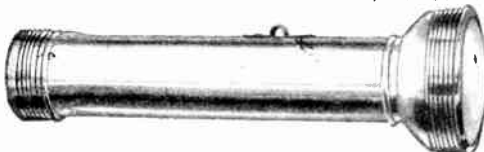


but is furnished with a 2 inch silvered reflector and large, powerful lens. Size  $1\frac{1}{2} \times 6\frac{1}{2}$  inches. Shipping weight 2 pounds.

NO. N-4 MINER STYLE FLASHLIGHT.....	\$1.55
NO. N-44 RENEWAL BATTERY, shipping weight 1 pound.....	.22
NO. N-444 RENEWAL MAZDA BULB, 2.8 volts.....	.13

## NO. N-5 MINER STYLE NICKELED FLASHLIGHT

DON'T PAY \$2.50—OUR PRICE \$1.60.



Same as our N-4 Flashlight but with 3 cell battery, larger and more powerful. Size  $1\frac{1}{2} \times 9$  inches.

NO. N-5 MINER STYLE FLASHLIGHT, shipping weight 2 lbs.....	\$1.70
NO. N-55 RENEWAL 3 CELL BATTERY, shipping weight 1 pound.....	.28
NO. N-555 RENEWAL MAZDA BULB, 3.8 volts.....	.13

(Postage extra, 2 cents.)

## THE FOUNTAIN PEN LIGHT

(NICKEL FINISH.)

YOU REGULARLY PAY \$1.00—ELECTRO-SET PRICE \$0.85.



a fountain pen is held. This clip serves also the double purpose of a switch for turning on or off the light. A strong piercing ray of light is always at instant command if you carry a Fountain Pen Light. You'll wonder how you ever did without it when you own one.

NO. R-8 FOUNTAIN PEN LIGHT, with genuine Mazda bulb and battery.....	\$0.85
(By mail, extra 8 cents.)	
NO. R-88 RENEWAL BATTERY, shipping weight 3 ounces.....	.25
NO. R-888 RENEWAL MAZDA BULB, 2.8 opal back.....	.13
(Postage extra, 2 cents.)	

## ELECTRO-SET FRIAR'S LANTERN

YOU REGULARLY WOULD PAY \$1.50—OUR PRICE \$0.98.

This neat little Electric Lantern is so far ahead of the old fashioned oil type that every person ought to own one. It is novel in shape, for an electric lantern, being in appearance exactly like the old friar oil lamps or signal lanterns. No smell, grease, dirt or fire. Just slide the switch over for a splendid light.

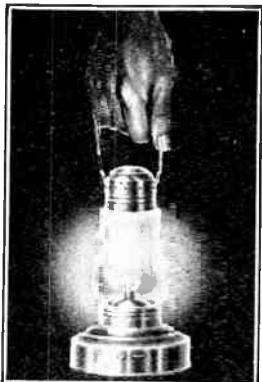
The metal parts are finished in handsome black enamel, baked to a high polish. The glass shade is readily removable so as to replace the lamp should it become necessary. A high grade long-life battery is furnished and the bulb is genuine Mazda make, the best bulb made.

At the price we ask for this lantern you are getting mighty fine value. In fact many dealers pay more for it than you can buy it from us at retail.

REMEMBER, we never sacrifice Quality for price. Size over all 4x6 inches. Shipping weight 1 pound.

- NO. R-9 FRIAR'S LANTERN, black enamel finish, each.....\$0.98
- NO. R-9N FRIAR'S LANTERN, made entirely of nicked brass, an exceptionally beautiful lamp..... 1.45
- NO. R-99 RENEWAL BATTERY, for above lanterns, shipping weight 1 pound..... .28
- NO. R-999 RENEWAL MAZDA BULB, for above, 3.8 volts.... .13

(Postage extra, 2 cents.)



## ELECTRIC STORM LANTERN

YOU'LL PAY \$1.65 ELSEWHERE—OUR PRICE \$1.00.

WILL BURN STEADILY FOR 50 HOURS AND MORE WITHOUT RENEWAL.

Here's a safe, practical, low priced and economical lantern, for farmers, railroad men, housekeepers, deliverymen, campers and all who desire an especially strong and efficient portable lantern.

The case is made of black, japanned metal, accommodating any standard No. 6 dry cell with the regular brass binding post cap on the carbon pole. One of these batteries will give over 50 hours of continuous service in our Storm Lantern and many more hours of intermittent service—a cost of from ¼ to 3-5 cents per hour. A large silvered reflector and very powerful lens are furnished on this splendid lantern. A special genuine 1½ Volt Mazda Lamp is used, giving a fine clear light. A heavy handle for carrying is included. We do not furnish the dry cells with our Storm Lanterns as their weight would increase shipping charges. You can buy them in your own town and at almost every crossroads store; but for the benefit of those who desire to buy the batteries, we list them below.

- NO. R-10 STORM LANTERN, size 2½x6¾ over all, shipping weight 2 pound, less battery.....\$1.00
- NO. R-1010 NO. 6 DRY CELL, for above, extra..... .35 (Shipping weight 3 pounds.)
- NO. R-1011 RENEWAL MAZDA LAMP, 1½ volts, special .15 (Postage extra, 2 cents.)



## ATTACHO!

TURN ANY DRY CELL INTO AN ELECTRIC LANTERN.

25c

This novel little device can be attached to any dry cell in 30 seconds, converting it at once into an efficient electric lantern. "Attacho" consists of a timed metal frame with reflector, bulb and socket. The cut will readily show how it is used. You can secure either an intermittent or permanent light with "Attacho." It is practical and inexpensive. Anyone can afford to buy one—you can't afford not to buy one! Think of it! 25 cents enables you to own this fine little attachment. Buy one today. Connect it to any dry cell. No bother, fuss or trouble.

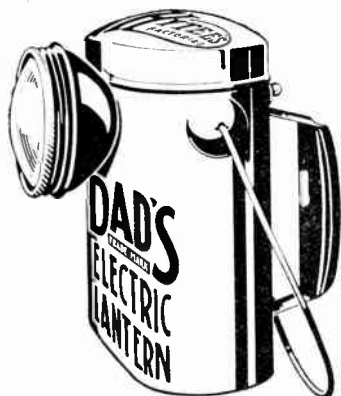


- NO. R-13 "ATTACHO" (postage extra, 4 cents).....\$0.25
- NO. R-13B RENEWAL MAZDA BULB (postage extra, 2 cents)..... .15

Gentlemen: Order No. 409 received O. K. and working fine.  
38 Woodward Ave.

Quincy, Mass.  
LOWELL READ.

## DAD'S ELECTRIC LANTERN



### "THE LIGHT FOR A THOUSAND USES."

This famous make of lantern throws a beam as bright as an automobile headlight. Dad's Electric Lanterns are the acme of skillful workmanship, high class design and beautiful appearance. As an all-around emergency light, it penetrates dark corners, roadways, mines, barns, storerooms, warehouses—no danger, smoke, fire, oil or flickering.

Dad's Electric Lantern is a real, full sized lantern. It stands 7½ inches high, 5¼ inches wide and 2¾ inches thick, excluding handle or headlight. A big, sturdy, sure action switch turns the light on or off in a jiffy. You may either carry the lantern by the bail handle or by the heavy, fit-the-hand handle at the back.

**THE CASE**—Made of heavy gauge steel, tinned over and heavily coated with baked-in enamel. Re-enforced throughout.

**SWITCH**—Double interlocking; brass, nickel plated. Can't jar out or work loose.

**BULB**—Specially made for this lantern, 3 volt, sealed with platinum, drawn Tungsten filament, double illumination.

**LENS**—Large 3 inch wide concave-convex shape, bull's eye effect of double strength, ground edges, high power.

**INSULATION**—Highest grade gutta-percha fibre.

**TRIMMINGS**—Bright red baked-in enamel finish with contrast trimmings of jet black. Very hand-some and durable.

### DAD'S LANTERS STAND WEAR AND TEAR

**REFLECTOR**—Adjustable focus, a new feature. Made of solid polished aluminum with searchlight finish, polished to the nicety of a French glass mirror.

Dad's Lanterns take two No. 6 Ignitor style dry cells. These are not included in the price of the lantern. They may be secured anywhere. We recommend you buy them in your home town, as the cost of shipping makes buying them from us unprofitable. However, we furnish the best grade Columbia Cells at 35c each. After the European war we judge the prices will go down to 25c again.

### HOW LONG WILL THEY BURN?

Reports from all over the country show from 70 to 140 hours' life on one set of cells.

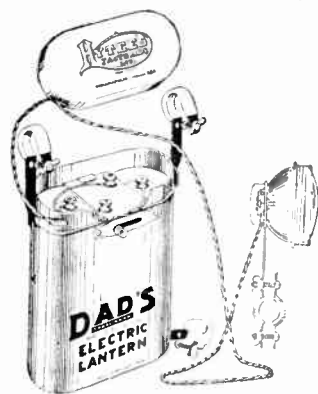
**NO. 11-R DAD'S ELECTRIC LANTERN**, as described.

shipping weight 2 pounds, less batteries.....\$2.00

**NO. 11-B EXTRA HIGH EFFICIENCY TUNGSTEN**

BULB, 1½ volts, for renewal, each......30

(Postage extra, 2 cents.)



## DAD'S ELECTRIC VEHICLE OR BICYCLE LAMP

Same features as Dad's Lantern, but bulb and reflector are arranged separately from battery case and are provided with attachments for fastening to bicycle or motorcycle bars or carriage frame. The best electric lantern for bicycle, carriage, motorcycle, automobile, etc.; battery case also has fastening attachments.

**NO. 12-R DAD'S VEHICLE LAMP**, shipping weight 3

pounds, less batteries.....\$2.25

**NO. 11-B RENEWAL BULB**......30

(Postage extra, 2 or 4c.)

## FLASHLIGHT BATTERIES

SAVE 20 TO 33-1-3 PER CENT—ORDER BY MAIL FROM US

Our batteries were selected by comparative tests with every other battery made in the United States. They were chosen because of their long life, high efficiency, and good workmanship. In our opinion they are better than others. We furnish two grades. The "A" grade is regularly supplied. The "B" grade is the equal of most other batteries sold as high as double their price.

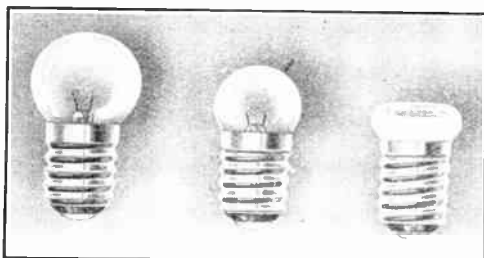
### ELECTRO-SET BATTERIES ARE THE BEST.

No.	Voltage	Shape	Size	For Flashlight	Grade "A"	Grade "B"	Ship. Wt.
100B	2.8	Vest Pocket	2¼ x 1 5-16 x 11-16	Any 2 cell V. P. size	\$0.24	\$0.19	4 Oz.
200B	3.8	Vest Pocket	2¼ x 2 x 11-16	Any 3 cell V. P. size	.32	.24	6 Oz.
300B	2.8	Tubular	1 x 3¼	Any Baby Tubular	.24	.19	6 Oz.
400B	2.8	Tubular	1¾ x 1¾	Any Rebular 2 cell Tubular	.24	.19	1 Lb.
500B	3.8	Tubular	1¾ x 7	Any Regular 3 cell Tubular	.32	.25	1 Lb.
600B	2.8	Tubular	½ x 3¼	Any Pen Light	.25	..	3 Oz.
700B	3.8	Pocket	2 7/8 x 2 7/8 x 3/4	For 3 cell Lights	.32	.24	1 Lb.

Another Section of Big Flashlight and Bicycle Lantern Values elsewhere in this book. See Index.

## FLASHLIGHT BULBS

Save  
 $\frac{2}{3}$  of  
Your  
Battery  
Bills



Use  
Genuine  
National  
Mazda  
Bulbs

We sell Genuine National Mazda Flashlight Bulbs; drawn Tungsten filament; accurate voltages; brightest light. Fit all flashlights.

No.	Voltage	Style	For Flashlights	Price	Postage
101-F	2.8	Clear	Any 2 Cell Flashlight	\$0.13	\$0.02
102-F	2.8	Opal Back	Any 2 Cell Nickered Vest Pocket Flashlight	.13	.02
103-F	3.8	Clear	Any 3 Cell Flashlight	.13	.02
104-F	3.8	Opal Back	Any 3 Cell Vest Pocket Style	.13	.02

## SINGLE CELL MAZDA BULBS

1.5 VOLTS.

Will light on any single cell, dry or wet battery. For storm lanterns, "Attacho," etc. Fits miniature receptacle. Genuine drawn wire Mazda filament. 1 candle power. Diameter 11-16 inches.

No. 105-F 1½ VOLT BULB, each.....\$0.15  
(Postage extra, 2 cents.)

## MINIATURE MAZDA LAMPS

For decorative purposes, experimental work, candle sticks, night lights, searchlights, automobile use, etc.

No.	Volt.	Diameter In Inches	Style of Base	Diameter of Base, In.	No. of Cells to Light	Candle Power	Amperes	Price	Post.
105-F	1.5	11-16	Miniature	11-32	1 Dry or Wet Cell	1	0.6	\$0.15	\$0.02
106-F	3	11-16	Miniature	11-32	2 Dry or Wet Cells	2	0.8	.15	.02
107-F	2	11-16	Miniature	11-32	1 2 Volt Storage Cell	1.5	0.7	.21	.02
108-F	4	11-16	Miniature	11-32	3 Dry Cells or 4 Volt Storage	2.5	0.35	.21	.02
109-F	6.2	11-16	Miniature	11-32	4 Dry Cells or 6 Volt Storage	3.5	0.35	.13	.02
110-F	6 to 8	1	Candelabra	7-16	4 Dry Cells or 6 Volt Storage	4	0.81	.21	.02
111-F	6 to 8	1½	Candelabra	7-16	4 Dry Cells or 6 Volt Storage	12	2.0	.27	.03
112-F	12 to 16	1½	Candelabra	7-16	8 Dry Cells or 12 Volt Storage	15	1.0	.30	.03
113-F*	6 to 8	1½	Candelabra	7-16	4 Dry Cells or 6 Volt Storage	.24*	4.0	.50	.03
114-F*	12 to 16	2-16	Candelabra	7-16	8 Dry Cells or 6 Volt Storage	.40*	2.0	.75	.04
115-F†	14	1½	Miniature	11-32	.....	2	.....	.20	.02

\*This is the latest style Type "C" gas filled lamp for powerful searchlights and head lights.

†This bulb is a regulation series bulb for Christmas tree festoons; 8 light to each festoon. For colored lights add 3 cents.

NOTE—Any bulbs from 110-F to 114-F may be furnished with single or double contact bayonet bases for automobile use at no extra charge. Send 2 cents for our complete miniature and large lamp lists, with full data on other lamps for every purpose.

### WE CARRY 147 STYLES OF BULBS

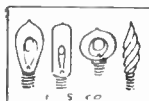
We cannot list them all here. Send 2 cents in stamps for complete catalogue of automobile, experimental, sign, miniature and other lamps.

## CARBON LAMPS

NO. 120-F CARBON LAMPS, 16 C. P., Edison base, especially used for temporary illumination, for resistance lamps, lamp banks, series lamps, etc. Draw 0.6 amperes at 110 volts each.....\$0.13  
(Postage extra, 5 cents.)

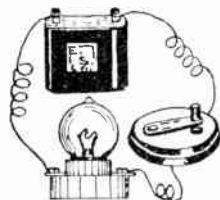
20 per cent discount in lots of 10 lamps.

NO. 121-F CARBON CANDELABRA LAMP, runs direct from 100-120 volt lighting current. Size only 1¼ inches high, 1 inch diameter. Useful for decorative work, candle sticks, fixtures, lighting of instrument panels, small meters, switchboards, etc. Pear shape, candelabra base, each..... .20  
(Postage 3 cents.)



NO. 122-F CARBON TUBULAR CANDELABRA LAMP, very handsome; runs on 100 to 120 volt commercial current; 2 inches long; $\frac{5}{8}$ inch diameter; candelabra base. Useful for decorative work, switchboard and meter lighting; each.....	.28
(Postage 3 cents.)	
NO. 123-F CARBON FLAME LAMP, candelabra base, 110 to 120 volt; 2 inches long, $\frac{3}{4}$ inch diameter; each.....	.35
(Postage 3 cents.)	

## A COMPLETE EXPERIMENTAL ELECTRIC LIGHT SET



This little outfit consists of all the materials necessary to connect up and operate a real electric lamp.

A fine experimental set for beginners and a practical outfit for many uses, such as lighting up dark closets, seeing time at night, reading meters, etc. Burns 50 to 100 hours on one charge.

Consists of a one candle power bulb; miniature porcelain socket; polished wood base switch; wire and battery. Shipping weight 3 pounds.

NO. 150 EXPERIMENTAL LIGHT, complete.....\$0.60

## SWITCHES, PLUGS, MINIATURE LIGHTING GOODS AND EXPERIMENTAL NEEDS



The following articles are constantly in demand. Our line is carefully chosen for workmanship, finish and general utility. Each little item is our usual high grade quality. Again, in spite of the price rises, our prices are very low, in most cases representing no addition to your charge, or perhaps only a penny or two to help us cover our additional costs.

### PEAR SHAPED PUSH BUTTONS

Designed to connect to the end of flexible cord. They may be held in the hand while using. Indis-

pensible to lecturers for signaling to stereophonic operators. Used under dining room tables to call the maid, etc. Our Pear Pushes are extra

neat, strong and well finished.

NO. 1213-P PEAR BUSH BUTTON, each.....\$0.14  
(Postage 2 cents.)

## WOOD BASE SWITCHES

For cut-outs, shunts, starting switches, miniature lighting, etc. These switches are exceptionally well made, mounted on highly finished hard wood bases. Metal parts hand-somely nickeled.

NO. 231 (1 POINT), diameter 2 inches, each.....	\$0.08
NO. 232 (2 POINT), diameter 2 inches, each.....	.10
NO. 233 (3 POINT), diameter 2 inches, each.....	.12
NO. 234 (4 POINT), diameter 2 inches, each.....	.13
NO. 236 (6 POINT), diameter 2 inches, each.....	.16

(Shipping weight, any size, 3 ounces.)

## NO. 237 BRASS PUSH BUTTONS

Beautifully finished tough brass, black hard rubber button, fibre base, substantial contacts. For operating bells, buzzers, signals, etc. Screws for fastening are included.  
PRICE, each, 2 inches diameter.....\$0.10

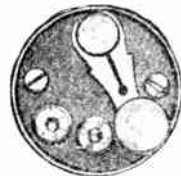
## MIDGET FLUSH PUSH BUTTONS

Small, neat looking, well made little pushes with hard rubber buttons, nickeled metal parts. Made to be inserted in a  $\frac{5}{8}$  inch hole in wood work of any kind, or any material that can be drilled. Flush type. Has screw binding posts for connections in back. These are much neater, easier to push, stronger and heavier than the ordinary types. Excellent for cabinets and panels.

NO. 250 FLUSH PUSH BUTTON, rim diameter 1 inch, each.....\$0.15  
(Postage extra, 2 cents.)

## HARD RUBBER COMPOSITION BASE SWITCHES

### With Removable Keys

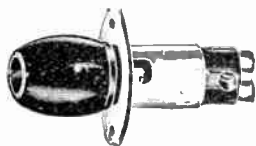


These switches are far more desirable than the wood base type. Their appearance is handsome and their contact is better. They are also more efficient, especially in wireless work, because of their better insulating qualities. The switch lever is of key pattern and may be removed or replaced in an instant. Carry it with you so that no one can tamper with your set. Diameter  $2\frac{1}{2}$  inches. Nickeled parts all highly finished.

NO. 253 REMOVABLE KEY SWITCH, 1 point, each.....	\$0.20
NO. 254 REMOVABLE KEY SWITCH, 2 point, each.....	.23
NO. 255 REMOVABLE KEY SWITCH, 3 point, each.....	.25



## FOR PLUGGING IN YOUR PHONES YOU NEED THIS



**NO. 252 FLUSH TYPE SEPARABLE PLUG.** one end sets into cabinet, panel or wall. Other end plugs into it. The finest possible arrangement for plugging head phones into wireless cabinets, panels or tables. Metal parts nickeled. Neat and practical. For  $\frac{1}{2}$  inch hole. Price, each.....\$0.35

## COMPOSITION CONNECTING PLUGS (Separable)



For collecting wires and for plugging in instruments, telephones, detectors, shunts, lamps, etc. Two wire style. Very neat and well made. For battery use only. Size  $2\frac{1}{8}$  inch. Made of hard rubber composition.

**NO. 251 CONNECTION PLUG,** separable, each, \$0.15 (Postage extra, 4 cents.)

## SMALL PUSH BUTTON SWITCHES

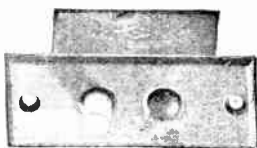
These are the handsomest little switches we have ever seen. They are designed to fit flush with the surface of the wood work. A heavily nickeled brass plate fits over the working parts. The white button indicates "ON," the black button "OFF." This switch will prove a handsome and useful refinement whenever used. The interior mechanism is extra strong. Size of single switch  $1\frac{1}{2}$  inches. Depth  $1\frac{3}{8}$  inches. For battery use only.

**NO. 256 PUSH SWITCH,** 1 gang, each.....\$0.50

**NO. 257 PUSH SWITCH,** 2 gang, each.....1.00

**NO. 258 PUSH SWITCH,** 3 gang, each.....1.50

(Postage extra, each gang, 4 cents.)



### BRASS CANDELABRA SOCKETS

Fit Standard  $\frac{1}{8}$  Inch Pipe Thread

Used for fixtures, candlesticks, goosenecks, decorations, etc. For candelabra bulbs (screw  $7-16$  inch diameter). Our sockets are approved 110-220 volt, and are built to carry this voltage or less. These are

not battery sockets, often offered at lower prices, without mentioning voltage. Battery sockets are distinctly dangerous.

**NO. 259 CANDELARA SOCKET,** brush brass finish, each.....\$0.25 (Postage extra, 3 cents.)



### FIBRE KEYLESS PENDENT SOCKETS

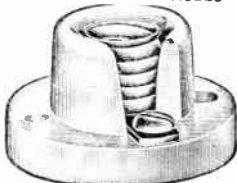


For Christmas tree lights, strings, pendants, etc. Wires  $6$  inches long. Fibre exterior. For battery or 110 volt use.

**NO. 260 FIBRE MINIATURE SOCKET**...\$0.10

**NO. 261 FIBRE CANDELABRA SOCKET.** .12 (Postage extra, 2 cents.)

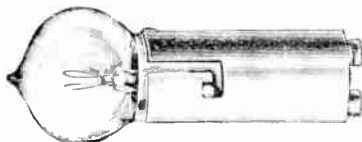
### PORCELAIN RECEPTACLES



For miniature and candelabra lamps. Our receptacles are not the cheapest you can buy. But every one of them fit. The binding screws are large, the porcelain is strong, the insulation is right.

**NO. 1001 MINIATURE RECEPTACLE,** for lamp base,  $11-32$  inch diameter, each.....\$0.06  
**NO. 1002 CANDELABRA RECEPTACLE,** for lamp base,  $7-16$  inch diameter, each.....\$0.07

### EDISWAN SOCKET

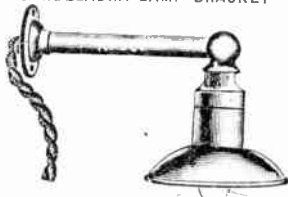


For automobile double or single bulbs. Nickeled finish.

**NO. 262 EDISWAN SOCKET,** each.....\$0.15

**NO. 263 EDISWAN SOCKET,** flush type, for setting into wood or metal surface, each... .25 (Postage extra, 3 cents.)

### CANDELABRA LAMP BRACKET



Nickeled finish, complete with shade and fully wired. Also furnished, if desired, with Ediswan lamp socket, if so specified.

**NO. 58-C LAMP BRACKET,** complete.....\$0.90 (Postage extra, 8 cents.)

## MINIATURE "PIN" SOCKETS

For any miniature base lamp. Occupies very small space. Furnished with "pin" to nail or press into wood work.

NO. 1212-P PIN SOCKET,  
each.....\$0.08  
(Postage extra, 2 cents.)



## GOLD LEAF

Made of pure 24 karat gold—extremely thin. Used for making gold leaf electroscopes and for other electrical experiments. Comes in sheets about 3 inches square, carefully packed for shipment.

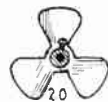
NO. 6760 GOLD LEAF, per sheet, postpaid...\$0.25

## NICKEL PLATED FAN BLADES

Fit any of our small motors. Give strong breeze. Also useful in an experimental way for cooling spark gaps, small engines, etc.

These fans are beautifully nickelled and polished. Furnished with brass bushings and set screws.

Shaft holes are  $\frac{1}{8}$  inch in diameter; shipping weight of Nos. 20 and 21, 4 ounces; No. 22, 1 pound.



NO. 20  $3\frac{1}{2}$  inch fan for Rex Motor.....\$0.20  
NO. 21  $4\frac{1}{4}$  inch fan for Ajax Motor......25  
NO. 22  $5\frac{1}{2}$  inch fan......50

## SOLDER WITH A MATCH! HERE'S GOOD NEWS FOR THE EXPERIMENTER



Every experimenter knows how difficult it is to solder. It almost takes an expert to do a good job with the old fashioned solder and soldering iron. But there need no longer be any trouble. Solderall consists of a wonderful solder in combination with a non-corrosive soldering paste. Just press a little Solderall on a joint, hold a torch or match over it, and the solder flows into the crevices, making a tight fastening. Indispensable to the electrician, experimenter, jeweler, etc. Experimenters can do good strong soldering jobs with Solderall and with no previous experience. May also be used with a soldering iron. It's not expensive. A large tube will suffice for a countless number of joints, fastenings, repairs, etc.

SOLDERALL, large size, 1 times as large as 25 cent tube; weight 8 ounces.....\$0.50  
SOLDERALL, shipping weight 4 ounces, per tube......25

## SELF-ACTING TORCH

This torch is an absolutely safe and reliable one, even for boys to use.

No air pressure is needed; no pumps or complications. The heat of a match generates it and an extremely hot flame four inches long is thrown from the jet. Useful for soldering; fine for chemists, electricians, experimenters and all other trades that need a hot flame in their work.



NO. 455 TORCH, shipping weight 1 pound.....\$1.00

Oskaloosa, Iowa.

Gentlemen: I got your catalogue this morning. It's full of bargains.  
818 A Ave. E.

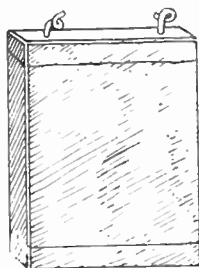
HOWARD TETER.

## CONDENSERS—HIGH CAPACITY—LOW TENSION

Used for every purpose where a high capacity condenser is required and excessive E. M. F. is not present. Especially adapted to telephone and ringing circuits, phonon circuits, artificial cable work, winders, duplex telegraphy, etc. Very desirable as spark coil vibrator condensers.

Our condensers are made of fine materials, compound impregnated. Terminals are brought out in a neat manner. The whole condensers are very compact and are supplied in japanned metal cases for protection of the delicate foil and dielectric. Experimenters, generally, find many interesting uses for them. You can make your own kick-back preventers with two of our  $\frac{1}{2}$  M. F. condensers.

NO. 8804 CONDENSER,  $\frac{1}{2}$  M. F., size  $4\frac{1}{2} \times 2 \times \frac{3}{4}$  inches, shipping weight 2 pounds, each.....\$0.60  
NO. 8805 CONDENSER, 1 M. F., size  $4\frac{1}{2} \times 2 \times \frac{3}{8}$  inches. Shipping weight, 2 pounds, each......75  
NO. 8806 CONDENSER, 2 M. F., size  $4\frac{1}{2} \times 3\frac{1}{2} \times \frac{7}{8}$  inches, shipping weight 2 pounds, each..... 1.00

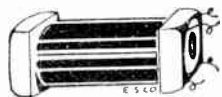


# RED-HEAD RECEIVERS

represent the realization of every wireless experimenter's dreams. Supreme sensitiveness, combined with good looks and extra sturdy construction—and the price is less than you ever paid for such quality. See page 35.

## TELEPHONE AND EXPERIMENTAL INDUCTION COILS

Used in telephone work, principally, to increase the working range. Experimenters find many uses for them, such as making small shocking coils, etc. These coils are well made. Cores are of best Norway iron. Secondaries are wound with silk covered wire. Neat wooden end pieces. Windings carefully insulated. Outer cover of neat standard black cover cloth.



**NO. 8801 TELEPHONE INDUCTION COIL**, size 4x1x1 inches, 150 ohms resistance, shipping weight 1 pound, each.....\$0.55

## ELECTRO-SET GEISSLER TUBES

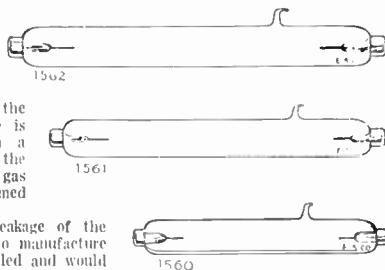
(AMERICAN MADE)

These classical and well known instruments are in many respects extremely interesting. As is generally understood, a partial vacuum is a fairly good conductor of high voltage currents, such as generated by spark coils, static machines, etc. The Geissler or Vacuum Tube is simply an exhausted glass container, provided with suitable electrodes for passing the current through the residual gases still remaining in the tube. The discharge is accompanied by a beautiful colored glow, ranging from a greenish blue to orange, pink and red, depending on the degree of vacuum and on the structure of the residual gas contents. Many interesting experiments may be performed with Geissler Tubes.

Our customers have had considerable difficulty in breakage of the frail imported Geissler Tubes. We, therefore, determined to manufacture our own tubes in such form that they could be easily handled and would not break at the least jar or bump. Our tubes are made of heavy glass and are straight walled to contribute to their strength. They light up on any size coil and send forth a beautiful soft glow of light that is a delight to see. The brass connecting caps are especially large, to prevent excessive heating, and are firmly fastened. They will not break off as will the imported tubes.

Geissler tubes when connected in series with the wireless sending aerial act as hot wire ammeters. The helix is adjusted until the tube shows brightest when the key is pressed. The set is then in tune and working efficiently. Every station, to get best results, should use one of these tubes. The tube is shunted, when actually sending, by a small switch. Despite our many improvements, our tubes are no more expensive than the imported variety.

**NO. 1560 GEISSLER TUBE**, 4 inches long.....\$0.30  
**NO. 1561 GEISSLER TUBE**, 6 inches long......38  
**NO. 1562 GEISSLER TUBE**, 7 inches long......45  
 (Shipping weight, any size, 4 ounces.)



## POLISHED CARBON GRANULES

Every true experimenter ought always to have a box of these granules on hand. They are used for microphonic work of all kinds, such as making of telephone transmitters, wireless telephone transmitters, dictaphones, microphones, auto coherers, microphone amplifiers and many other things. Experimenting with microphonic contacts offers a large, interesting field.

Our carbon grains are identically the same as those used in the finest commercial telephone and microphone instruments. Each little granule is highly polished, very hard and will not stick. Guaranteed pure and free from the slightest taint of grease or dirt. Comes in small wooden boxes, 1 3/4 x 3/4 inches. Enough grains for 6 standard transmitters.

**NO. 8808 CARBON GRANULES**, per box, prepaid.....\$0.25



## CARBON RODS

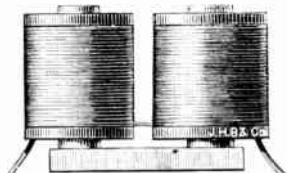
Used for arc lamps, resistances, batteries, microphones, amplifiers, wireless telephone arcs, etc. Comes in 12 inch rods. Best grade drawn carbon.

**NO. 8810 CARBON RODS**, diameter 1/8 inch, each.....\$0.10  
**NO. 8811 CARBON RODS**, diameter 1/4 inch, each......12  
**NO. 8812 CARBON RODS**, diameter 1/2 inch, each......16  
 (Shipping weight, any size, 1 pound.)

## ELECTRO-MAGNETS

For experimental work of all kinds. For making small telegraph sounders, relays, electric bells, independent interrupters, magnetic releases, magnet motors, magnetic fields, etc. Wound to 4 ohms per pair. Size 1x1 1/2 inches. Drilled and tapped at lower end of core for 8-32 screw. Weight, each, 3 ounces.

**NO. 8821 ELECTRO MAGNETS**, as described, each.....\$0.15  
 Per pair, with yoke......30



## CARBON DIAPHRAGMS AND CUPS

Used for telephone transmitters, wireless phone transmitters, microphones, etc. Diameter  $2\frac{1}{4}$  inches. Thickness 1-32 inch. Very strong and hard.

- NO. 8813 CARBON DIAPHRAGM, each, prepaid ..... .25  
 NO. 8814 CARBON TRANSMITTER CUP, standard grooves,  $\frac{3}{8}$  inch high, 1 inch diameter, each, prepaid .25

### NO. 220 ELECTRIC BELL



A strongly constructed bell with 21 $\frac{1}{2}$  gong. Just right for house bells signaling, etc. Shipping weight 1 pound.

PRICE, each .....\$0.25

**NOTE**—The above is an adjustable contact bell, not to be confused with the cheaper non-adjustable types. The adjustable feature is invaluable.

Box pattern, steel case and frame. Used for signals of all kinds. May be used as a test buzzer in wireless work. Loud, clear sound.

PRICE, shipping weight 1 pound, each .....\$0.30

### NO. 222 WATCH CASE BUZZER



Neat, small, light buzzer, in handsomely nickel-plated, bell shaped case; for signaling and general use. Shipping weight 1 pound; diameter  $1\frac{3}{4}$  inches. Makes a splendid inexpensive test buzzer.

PRICE, each .....\$0.39

FOR SPECIAL TEST BUZZERS SEE INDEX

### NO. 221 BUZZER



A very good buzzer for any kind of signal use. Entirely enclosed in a handsomely japanned metal case, cover removable for inspection and adjustment.

These buzzers are frequently used as test buzzers and are satisfactory for this work. They are also used experimentally in place of spark coils to send wireless messages, considerable distances being covered by connecting a ground wire to the armature contact and connecting the aerial to the adjustable or permanent contact. Buzzers are used also for portable wire signal use, the make and break spark being shunted into the lines. This high voltage will effect a telephone receiver at a distance of from 2 to 10 miles.

NO. 221 BUZZER, shipping weight 1 pound .....\$0.30

### GENUINE COLUMBIA DRY CELL



The price on dry cells has greatly advanced. We do not look forward to a reduction for many months. However, we believe that after the war they will go to normal again. We sell only the recognized best—Columbia Cells. The voltage is  $1\frac{1}{2}$ ; amperage 24 to 30.

NO. 202 COLUMBIA IGNITOR CELLS, weight 3 pounds, each.....\$0.35

### NO. 241 MAGNETIC COMPASS

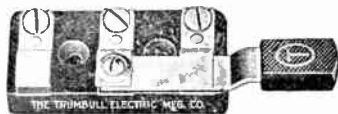


Useful about the Laboratory for making galvanometers, exploring magnetic fields, determining poles, directions, currents, etc. Diameter 2 inches. Plain dial. Handsome brass case. Very sensitive. Guaranteed accurate.

PRICE, each.....\$0.15

(Shipping weight 3 ounces.)

### THEMAC SWITCHES

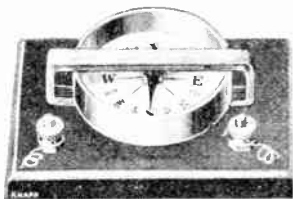


A neat, side action switch, with copper blades and jaws, hard rubber composition base. Useful for many purposes, such as detector and dead end shunts, miniature light work, starting switches, etc. Genuine Trumbull make. Fine finish. Extra good appearance. Very popular.

NO. 958 SINGLE POLE SINGLE THROW, base 1-11-16x 2-1-16 inches; shipping weight 4 ounces, each.....\$0.16

NO. 958-A SINGLE POLE DOUBLE THROW, base 1-1-16x3 inches; shipping weight 4 ounces, each... .25

## KNAPP GALVANOMETER



The student who wishes to carry out electrical laboratory experiments of his own will find the Knapp Galvanometer very useful and instructive. The needle is deflected by a very slight current on account of its sensitiveness. The compass and coil of the galvanometer are mounted on a polished base  $3\frac{1}{4} \times 2\frac{3}{4}$  inches, with binding posts for connections.  
**NO. 380**, complete, with compass, each.....\$0.35

## X GRADE WHITE WAXED PAPER

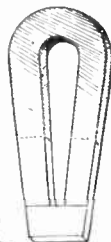
Used for making fixed condensers, telephone condensers, kick back preventers, spark coil primary condensers, etc. We handle the very finest quality, guaranteed free from pin holes and having a very high dielectric and mechanical strength. Ordinary paper is useless for efficient work. Our X Grade White Waxed Paper comes in sheets 12 inches wide by 36 inches long, carefully packed to prevent damage in the mails and rolled, not folded. Folding waxed paper is liable to crack it, thus making the liability of breakdowns possible. Therefore, we roll this paper. We do not sell less than 2 sheets. It is most important, in making spark coil condensers, that the highest grade dielectric waxed paper be used, of uniform thickness and absolutely free from abrasions. Our X Grade Dielectric Paper measures up to this standard.

**NO. 6765 X GRADE WAXED PAPER**, per roll of 2 sheets, 864 square inches.....\$0.12  
 (Postage extra, 5 cents.)

## PERMANENT HORSESHOE MAGNETS

Indispensable to any experimenter. Used for audions to increase sensitiveness, for Marconi Magnetic Detectors, magnetic fields in wireless telephone aces, and for general interesting experimenting. Our magnets are very strong and are nicely finished.

<b>NO. 245 MAGNET</b> , 2 inches long, shipping weight 3 ounces.....	\$0.10
<b>NO. 246 MAGNET</b> , 3 inches long, shipping weight 4 ounces.....	.11
<b>NO. 247 MAGNET</b> , 4 inches long, shipping weight 4 ounces.....	.15
<b>NO. 248 MAGNET</b> , 6 inches long, shipping weight 1 pound.....	.40
<b>NO. 249 MAGNET</b> , 8 inches long, shipping weight 2 pounds.....	.65



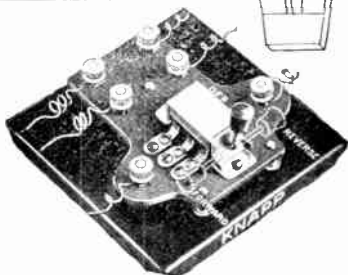
## KNAPP REVERSING SWITCH

There has long been wanted a first class reversing switch for battery circuits; positive in its action and with such directions and drawings as to enable the average boy to connect the switch with any motor.

After several attempts we have succeeded beyond expectations. No little device has ever been marketed that will so assist in developing the idea of motor current paths as this, and in a practical way.

The accompanying directions show drawings of motors connected in shunt, series and reverse.

**NO. 195 REVERSING SWITCH**, price.....\$0.75  
 (Shipping weight 8 ounces.)



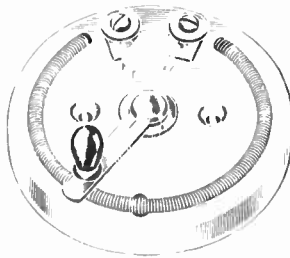
## BEEKO MINIATURE RHEOSTAT

These Rheostats are mounted on porcelain bases, with all metal parts heavily nickel-plated, and are suitable for regulating the filament voltage of the "Audion" Detector, Miniature Lamps, the speed of small motors or wherever a variable resistance is desired.

The resistance coil has about 150 convolutions, and as the change in resistance on movement of the lever is by single convolutions, it will admit of very fine adjustment.

Resistance, 11 ohms, continuous capacity, 2 amperes.

**453 RHEOSTAT** .....\$0.60  
 (Postage weight 1 pound.)



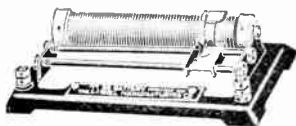
## SLATE IS A POOR INSULATOR

for high tension currents such as are used in wireless telegraphy. When you use a slate base ground switch you are actually shunting a clear electrical path between your aerial and ground. Does it pay to save a few cents by using slate base ground switches? No material is as good as marble for ground switch bases. See page 16.



## LIONEL BATTERY RHEOSTAT NO. 88-L

OTHERS CHARGE \$0.75—OUR PRICE \$0.60.



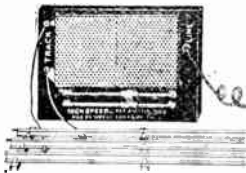
Use these with dry or storage batteries, and it will give a gradual increase or decrease of current in operating trains, motors, etc. A porcelain tube is wound with a small resistance wire of the correct gauge. This is mounted on a steel frame and has a sliding finger which increases or decreases the speed of the trains. All parts are of the best quality. Resistance about 11 ohms. Used for any battery resistance work. This Rheostat cannot overheat as the coil is entirely exposed to the air—insuring free circulation, consequently

rapid cooling. The steel base is beautifully enameled and other parts are nickel plated. Size 5 inches long, 2 1/4 inches wide and 1 inch high. Shipping weight 1 pound.

NO. 88-L—Price, packed one in a box, complete with all connecting wires.....\$0.60

## NO. 107-L DIRECT CURRENT REDUCER

OTHERS CHARGE \$7.50—OUR PRICE \$5.95.  
FROM 110 VOLTS TO 5 AND UP. (D. C. OR A. C.)



This is constructed of four porcelain tubes wound with best quality of resistance wires. These porcelain tubes are mounted on a substantial slate base measuring 8x10 inches and 3/4 inch thick. The porcelain tubes are protected by a perforated Russian iron cover—the latter lined with heavy asbestos. The sliding lever regulates the voltage, the reducer is connected with the house current by a screw plug with 9 feet of flexible cord. In addition, four porcelain supports or legs with long screws are supplied so that reducer can be screwed to wall or table. Shipping weight 9 pounds.

NO. 107-L, price complete.....\$5.95  
NO. 108-L, for 220 volts D. C. or A. C.....\$7.95

## BELL RINGING TRANSFORMERS

DON'T PAY \$2.50 TO \$3.00—OUR PRICE \$1.95.

THEY SAVE MONEY—THEY AVOID TROUBLE.

THEY LAST A LIFE TIME—CONSUME PRACTICALLY NO CURRENT.

If you have A. C. current in your home you need never have more expense, trouble or annoyance with your electric bell. No more worn out dry cells. No more "Bell-out-of-order" signs. No more battery expense.

Just connect one of our Bell Ringing Transformers on the line. You'll never have to touch your electric bell again (unless the bell itself is broken, which seldom or never occurs.)

These transformers connect right on to the 110 Volt A. C. line, the secondary leads being substituted for your battery wires. They have a secondary voltage of 6 volts and will ring any ordinary household door bell, buzzer or signal. Experimenters also use them for lighting miniature lamps, running very small battery motors and general electrical experimenting. Capacity 6 volts—12 to 15 watts.

Our transformers are entirely enclosed in a cast iron case and the windings are immersed in good insulating compound. They will never wear out and if properly used will never burn out. No danger or trouble. Any child can connect one up. Size 3x5x2 1/4 inches. Shipping weight 4 pounds.

NO. 1-J BELL RINGING TRANSFORMER, complete, with lead wires, posts and directions, each.....\$1.95

# If You have Commercial Alternating Current in Your Home Don't Use Dry Cells! Save Battery Expense! Use Electro-Set Flexible A. C. Transformers "TOY" SIZE

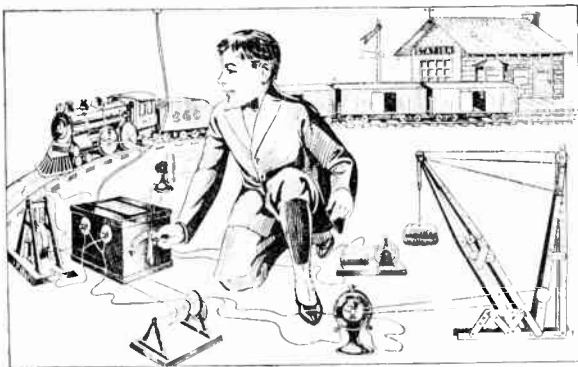
FOR OPERATING ELECTRIC TOYS, SMALL MOTORS, LIGHTS, ELECTRICAL APPARATUS AND GENERAL BATTERY DEVICES FROM 100 TO 120 VOLT ALTERNATING CURRENT SOCKET.  
WE SAVE YOU MONEY ON THESE TRANSFORMERS.

They save you money after you buy them. Everyone knows that dry cells will wear out, especially when used on small motors, toy electric trains, etc. One of our transformers will last a life time with proper use. They connect into any light socket, reducing the voltage to a figure suitable for a small battery device. The amount of current they consume is very small and they will cost you only a few cents a month to operate. In fact the operating cost is about one-tenth the cost of dry cells. You will save your original investment over and over again.

Our transformers are up to the usual Electro-set standard. They are built scientifically of tested and approved materials, put together with skilled workmanship; their appearance is exceptionally neat; their bulk is small.

The windings are made on laminated cores of properly calculated size and material; they are immersed, after the most careful insulation, in a special dielectric compound.

Our transformers give the highest wattage for their prices, and are as serviceable as transformers priced as high as 100 per cent more.



## "LITTLE JEFF" TOY TRANSFORMER

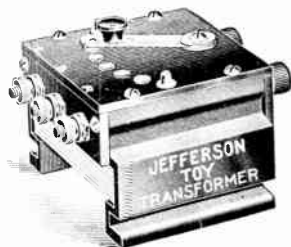
OPEN FRAME TYPE.

The Jefferson "Little Jeff" Toy Transformer is a small powerful transformer that will operate practically any electrical toy on the market. It will give satisfactory results on the small or larger toys. Operates on 100 to 130 volts, 60 to 133 cycle.

This transformer is clamped between heavy grey iron castings. It is furnished less attachment plug and cord. The switch and voltage buttons are mounted on the heavy black fibre top. The primary leads are brought out to two rubber-covered binding posts on one side of the transformer, and on the opposite side, the secondary leads are brought out to three brass binding posts. Voltage is varied by a 6 button control switch and by special post arrangements.

This transformer is a little wonder. Nothing on the market to compare with it. We have embodied in the "Little Jeff" Transformer our flexible construction and master connection post. It generates voltages in 3 volt steps from 3 up to 24 volts. It is sturdily built and presents a very handsome appearance. Capacity about 75 watts. Dimensions—4x3½x3 inches high.

- NO. 2-J "LITTLE JEFF" TRANSFORMER, shipping weight 3 pounds.....\$2.80  
 NO. 22-J 8 FOOT DOUBLE FLEXIBLE LAMP CORD AND PLUG, for attaching above to any 100 to 130  
 volt socket ..... .50  
 (Postage extra, 7 cents.) (Ask for price on special 25 cycle windings.)



## NO. 3-J TOY TRANSFORMER

DON'T PAY \$6.00 to \$8.00—OUR PRICE \$4.95

CAPACITY 75 WATTS.

This splendid transformer is just the thing to operate electric toys, spark coils, motors, magnets, solenoids, miniature lights and every kind of experimental work.

The entire transformer is enclosed in a solid sheet steel case, handsomely finished with baked-in black enamel. The windings are immersed in special insulating compound and are entirely covered. A generous flexible cord and plug for attaching the transformer to any light socket (100 to 130 volts) is included free.

Several different devices may be run from this transformer at one time, if desired. Thus you can run an electric train from one set of parts, some miniature lamps, let us say, from another, and a motor on a third, etc.

A fine control switch enables you to use the exact voltage regulation you desire from 1½ volts to 24 volts.

This transformer will run the largest electric trains and toys of all kinds with ease. A better instrument for the purpose never was built. We highly recommend this fine device to every one. We have sold a great many of them in our wholesale and retail departments without complaint of any kind and with frequent testimonials of their worth. Absolutely no danger to the youngest child. Anyone can use it.

Size 4x6x3½ inches. Shipping weight 8 pounds. Watt output 75 watts. Minimum voltage 1½. Maximum voltage 24. Operates on 100 to 130 volts, 60 to 133 cycles.

- NO. J-3 TRANSFORMER, complete with cord and plug, directions, neatly packed.....\$4.95  
 NO. J-4 TRANSFORMER, same as above, but smaller, 50 watt capacity up to 15 volt. Shipping weight  
 5 pounds ..... 3.50



## MOTORS

### RECOGNIZED STANDARD MAKES—LOW PRICES—GUARANTEED SATISFACTION

The following motors represent an assortment from which you may select practically anything to fit your needs. You may rest assured, when you buy from us, that you are getting your money's worth.

Our small motors and dynamos are, every one of them, recognized standard makes. We welcome comparison with any other makes, both as to price and quality.

If, after receiving any motor, you are not entirely satisfied, you may return your purchase for full credit. This is as fair and strong a guarantee as you could ask anyone to make. We could not afford to make it if we did not know the reputation of the manufacturers of our motors and the fine quality of their goods.

### NO. 37 REX MOTOR

A very attractive little motor, built as accurately as a watch. Neat in design and well made—a great favorite with boys. Runs efficiently at high speed, on one cell, dry or other battery. Finished in black enamel; screws and other trimmings nickel plated. Polished wood base.

The Rex Motor is packed in a neat box, size  $3 \times 3\frac{1}{2} \times 3\frac{1}{2}$  inches, properly labeled. Weight 12 ounces.

NO. 37 REX MOTOR.....\$1.00

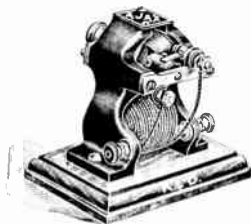


### NO. 39 AJAX MOTOR

A high grade toy motor, heavier and more powerful than No. 37. Well and substantially made. Finished in black enamel, nickel plated trimmings. Mounted on polished wood base. The Ajax Motor runs efficiently on a single cell, dry or other battery. A very popular smooth running motor.

Weights about one pound and occupies a space  $3 \times 3\frac{1}{4} \times 4$  inches.

NO. 39 AJAX MOTOR.....\$1.50



### NO. 34 K. & D. MOTOR

This is the No. 36 motor without switch, reducing gears, or end covers. In this form it affords a very light motor for the power it is capable of developing. Desirable for running boat models, and other purposes where minimum weight is an object. This motor has mica insulated commutator, gauze brushes and the same high class of work as No. 36. Weight about 14 ounces. Stands  $3\frac{1}{4}$  inches high. Excellent for very small experimental rotary gaps.

Finished in black enamel and nickel, very handsome.

NO. 34 K. & D. MOTOR.....\$1.75



### NO. 16 ELECTRIC TOP

#### AMUSING—INSTRUCTIVE.

Will run at high speed for hours. Four color disks are furnished. When one is applied and the top is in motion, a slight pressure of the finger on the edge of the disk, or on the wooden handle, produces most beautiful color effects—interesting and instructive to both old and young. When the top is at rest, the current is automatically shut off—no danger to the battery from this cause.

It may be used equally well as a motor, and small mechanical toys may be operated by a belt from the grooved pulley on shaft. Runs efficiently on one cell, dry or other battery. Finished in red enamel; polished nickel trimmings.

NO. 16 ELECTRIC TOP, prepaid.....\$0.75



## NO. 14 K. & D. MOTOR

No cast iron is used in the construction of this machine. Best charcoal iron fields, with annular field coil carefully taped and shellaced. Laminated armature, slot wound. Steel shaft with adequate bearings, so constructed as to always remain in perfect alignment. The bearings are self-lubricating and have neat dust-proof covers.

The commutator segments are of hard copper, insulated with mica, as carefully as is done in large machines—a distinctive feature of K. & D. high grade small motors. K. & D. dependable self-adjusting brushes. Grooved brass pulley,  $\frac{5}{8}$  inch in diameter—it runs true. This machine stands about  $3\frac{3}{4}$  inches high, and weighs 18 ounces. Finished in black enamel, brass trimmings. A powerful small motor.

**NO. 14 K. & D. MOTOR**, wound for battery or toy transformer use.....\$2.50

**NO. 14-S K. & D. MOTOR**, wound to run in series with a 16 C. P. Lamp on 110 volts commercial current..... 3.00

(The above motors are excellent for small rotary spark gaps, as they run smoothly and will readily turn our 3 inch rotary disc.)



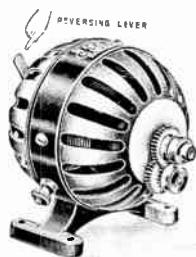
## NO. 36 K. & D. MOTOR

**WITH STARTING, STOPPING AND REVERSING SWITCH, AND SPEED REDUCTION GEARING.**

A high grade small motor, with starting, stopping and reversing switch. Also by a simple arrangement of gears, two reductions of speed are obtained, making three speeds in all. The gears are cut from solid metal and run smoothly. Electrically and mechanically the motor is well designed. The field pieces are of the best wrought metal. The armature is of the best charcoal iron, laminated, slot wound, perfectly balanced. The commutator has extra heavy, hard copper segments, carefully insulated with mica in the same durable manner as is done in large machines. The K. & D. dependable brushes are used.

This motor is wound for battery current only; it runs to full efficiency on 3 to 5 volts. The reversing and reducing speed features of this motor make it particularly desirable for propelling models, etc. Weight about one pound. Stands  $3\frac{1}{4}$  inches high. Finished in black enamel, nickeled trimmings.

**NO. 36 K. & D. MOTOR**.....\$3.50



## LITTLE HUSTLER MOTOR PARTS

Many boys have a burning desire to become electricians and to build a motor of their own. Our superior facilities and experience enable us to offer as finely made materials for this purpose as is possible.

Here is a complete set of all parts needed to build and assemble a fine Electric Motor. When this motor is finished it will run well on one cell of dry battery or on any toy transformer, storage cells, etc.

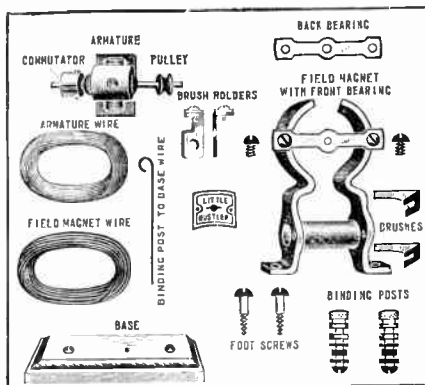
This outfit will teach you the principles of the electric motor and will afford lots of good fun in assembling.

Explicit directions accompany each set, showing how to wind and assemble.

Success is guaranteed if instructions are followed.

**NO. 102 (NO STARTING SWITCH.)** regular price 90c, our price.....\$0.79

(Postage extra, 15 cents.)



### SAVE BATTERY EXPENSE

You can run your small motors, toy trains and experimental apparatus at a fraction of the cost of dry cell expense by using our small Toy Transformers, if you have commercial A. C. current in your home (see page 77). If you have D. C. current, use our D. C. Reducer (see page 76). If you haven't commercial current in your home, use our Dry Storage Cells (see page 92).

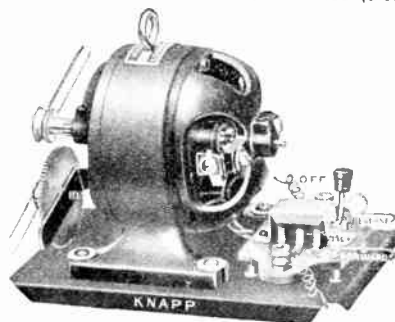
Newark, N. J.

Gentlemen: The secondary I bought from you is very satisfactory.  
15 Humboldt St.

CHAS. BREDER, JR.

## NO. K-181 KNAPP LEADER MOTOR

REGULAR PRICE \$2.50—ELECTRO-SET PRICE \$2.05.



NO. K-181 KNAPP LEADER, special price .....\$2.05  
(Shipping weight  $3\frac{3}{4}$  pounds.)

"Bigness" fairly radiates from this little motor. Consider the detailed reproduction, the resemblance to motors of "grown-ups," its power-plant effect, efficiency and completeness. A boy can get more fun, more instruction from operating one of these motors than in any other way.

The interest of parents in this motor is a tribute to its great assistance in studying electricity, the fascinating subject of the hour.

The motor will drive from either pulley. The reducing gear easily thrown in and out of mesh with the pinion on the shaft, transforms the high speed at the shaft to greater force and slower speed.

The reversing switch is positive in action, and operates either as a starting switch, or to reverse the direction of the motor, at will.

The finish is black enamel with nickel plated trimmings. The armature is laminated,  $1\frac{3}{4}$  in. diameter, three poles. Shaft .118 diameter. Pulley 9-16 in. Height, with metal base,  $4\frac{1}{2}$  in. Volts 2 to 4.

## NEW PEERLESS BATTERY MOTORS

BIG VALUE AT LITTLE COST

FAMOUS LIONEL MAKE.

Here's extra power, speed, lightness, handsomeness!

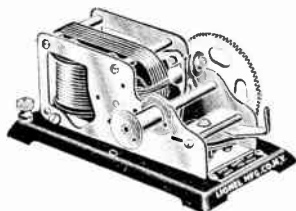
These new, splendid, novel design motors are wonderfully fine. Read about them.

Great for model work, building toys, Mecamo, Structiron, Erector, etc.

**NEW LINE**—In design, construction, and general efficiency these motors are far superior to many of the small toy motors now offered. They are mechanically and electrically correct, and their hauling and lifting power is certainly surprising—considering the low current consumed.

**OPERATION**—These motors run on either 2 or 3 dry batteries or on house current with any good toy transformer (see Index.)

**STRUCTURAL SETS NEED THESE MOTORS**—These sets now so popular require motors for operating the arms of derricks, to raise and lower bridges, etc. For operating work shops, Ferris wheels, carousels, derricks, etc., they are ideal. We prepay express on these motors.



### PEERLESS MOTOR TYPE "M"

This is a one speed motor and operates in one direction only. Has one pulley. Base is solid steel. Frame is steel throughout, nicked and polished. Brushes are easily removed, as they are made of radial gauze, having spring feed which regulates pressure against commutator. Size of motor  $5 \times 2\frac{1}{2}$ .

TYPE "M," price, packed in box ready to run, prepaid, each.....\$1.25

### PEERLESS MOTOR TYPE "R"

This motor will operate either backward or forward. Has pulley and drum with double reduction gear; also a reversing controller which can be used as a brake. Construction is similar to Type "M." This motor will operate several models at the same time, as the gearing reduces the speed and increases the pull. Two speeds can be obtained at the same time. Size of motor  $5 \times 3 \times 2\frac{1}{2}$  inches. Will lift 5 pounds.

TYPE "R," price, packed in box ready to run, prepaid, each.....\$2.00

### PEERLESS MOTOR TYPE "Y"

This is a surprising motor for it has remarkable lifting power considering the amount of current it consumes. It has three speeds. Has two pulleys, a drum with triple reduction gear and a reversing controller. The gearing is mechanically correct. Easily operates large models which require high power and slow speed. Will run toy elevators, models, etc. Will lift 20 pounds or more! A very fine motor.

TYPE "Y," price, packed in box ready to run, each.....\$3.00

Newport, R. I.

Dear Sirs: The Galena I bought of you recently turned out to be the real dope. It was the most sensitive Galena I have ever tested out, not just in certain spots, but all over the pieces.

3241 New port Ave.

ARTHUR W. MANCHESTER.



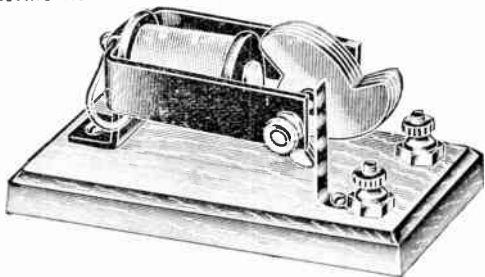
**MONOCOIL MOTOR**

HERE'S SOMETHING INTERESTING FOR YOUNG EXPERIMENTERS.  
A REAL ELECTRIC MOTOR ONLY \$0.40.

This novel little toy will run at 3,000 revolutions per minute for hours on any dry or wet battery. A new principle of design enables us to offer a real electric motor at this low price. It will run at great speed and on two cells will actually develop enough power to run any model made with the One Dollar construction toys.

Furnished with grooved pulley, mounted on a finished wood base. Well made and finished throughout. A wonderful piece of mechanism. Send for one today and surprise yourself. Great fun for boys—a fine gift for Mr. Experimenter's younger brother.

NO. B-60 MONOCOIL MOTOR, postage weight 4 ounces.....\$0.40

**AN ELECTRIC ENGINE FOR 50 CENTS**

REVERSIBLE—CONTROLLED SPEED.

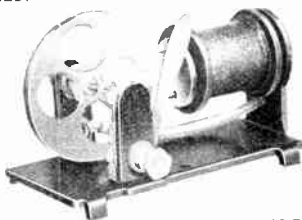
Develops great speed on one cell or more of battery. Built on the reciprocating steam engine principle. A fine little toy engine, handsomely built and well made in every particular.

Don't judge by price. You've paid much more for engines not half as good.

This little engine has a large copper finish cast fly wheel, powerful solenoid magnet coil, reversing switch and speed control (by varying position of reversing lever.) Runs very economically on battery of any kind.

Built entirely of metal. Furnished with large nickel plated binding posts. Neat stamped steel frame, handsomely enameled. Grooved pulley on fly wheel. Size over all  $3\frac{3}{4} \times 2\frac{1}{2} \times 2\frac{1}{4}$  inches. The neatest toy engine ever constructed.

NO. B-61 PEERLESS ELECTRIC ENGINE, shipping weight 1 pound.....\$0.50

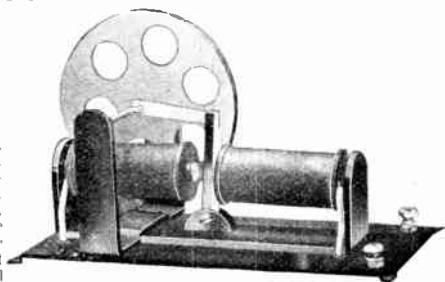
**"GIANT" DOUBLE RECIPROCATING ELECTRIC ENGINE**

This engine develops more power than any other electric engine its size or price. It has double pull magnet motive power, and owing to its special design and heavy fly wheel it runs with exceptional pulling power.

The fly wheel is very large and is made of steel, not cast lead, thus obviating breakage. This wheel is beautifully finished in bright copper plate. The frame and base are made of stamped steel, extra heavy. The magnet solenoids are large and powerful.

The engine is reversible and its speed is controlled by a metal hand lever located on one side. Large binding posts are furnished for connections. The workmanship and finish are excellent. We are frank to say that we have never seen a finer electric engine than the "Giant." On four dry cells it develops amazing speed and power although it will operate nicely on only one cell. A neat grooved pulley is furnished for belting the engine to models.

Size over all  $6 \times 3\frac{3}{4} \times 1$  inches. It is the most economical of all types of motors to operate.  
NO. B-62 "GIANT" ELECTRIC ENGINE, shipping weight 2 pounds, each.....\$1.25

**"TESLA" MAGNETO—A DANDY FUN MAKER**

Here's a dandy magneto—a fine little shocking machine—a miniature electric dynamo demonstrating the principles of electric generation. This carefully made device will afford endless amusement and instruction.

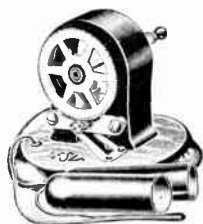
This little instrument can be regulated by the speed of turning the crank to give anything from a very mild shock to a very severe one.

It has an invigorative effect on the body when the current is taken in mild form.

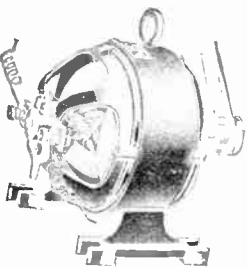
A great fun maker, amusing, instructive, and absolutely harmless. No batteries are required.

Operated by crank; wheel and pinion have cut teeth, insuring smooth action. Substantial brass bearings. Well made throughout. Finished in red enamel, nickel trimmings. Polished wood base, with neat bushings for flexible conducting cords. New and neat design, the best in this class.

NO. 16 TESLA MAGNETO, postage weight 1 pound.....\$1.00



Regular Price

**\$5.00**And Worth Every  
Cent of It

Our Special Price

**\$3.90**The Biggest of All  
Dynamo Bargains**DYNAMO-MOTOR, TYPE S. S.**

The Dynamo places the boy in possession of current at will. By its use he learns the lesson and method of conversion of mechanical energy—begins to understand the great fundamental laws of mechanics, and all in a delightful way, which constantly spurs him on to renewed experiment and endeavor.

With current at hand he can electroplate, charge storage batteries, run lamps, motors, trains of cars, induction coils,—in fact, the number of his experiments is only limited by his knowledge and desire.

**THIS IS OUR OLD STAND-BY, THE TYPE S DYNAMO MOTOR,** with a new commutator made from drawn copper bars, insulated with mica. It runs more smoothly and is more efficient than the Type S. The price remains the same.

As a dynamo it may be driven at the pulley end by a gas engine, sewing machine or other power that will furnish the desired speed.

No change necessary to run as a shunt connected motor from batteries.

If desired to run through a transformer on 110 volts A. C. current, the field connections should be changed to series as per diagram furnished.

**POINTS OF CONSTRUCTION** Field, cast solid, with coils turn wound and connected in multiple. Oil Cups, Atmature, 1 1/2 in. diameter, drum type, six slots, laminated. Shaft 1/4 in. diameter. Commutator six drawn copper segments insulated with mica.

Brushes, adjustable with set screw. Rocker Arm, for turning the brushes to the best lines of commutation. Pulley, 1 in. diameter, grooved for 3-16 in. round belt. Height, 5 in.; Finish, black enamel.

Approximate output at 3000 revolutions, open circuit 6 volts.

Safe maximum load 6 volts, 4 amperes.

As a motor Type S. S. runs well on 4 to 6 volts. It will also drive a 10 in. fan in a "breezy" manner by placing the motor where the blades will clear the edge of a shell.

**NO. 129 KNAPP TYPE S. S. DYNAMO MOTOR,** shipping weight 6 pounds, special price, ..... **\$3.90**

## A Better Small Dynamo Never Was Built NO. 9 K. & D. GENERATOR

### A WONDERFUL MACHINE FOR ANY SMALL DYNAMO USE.

Built like the highest grade power generators, with the same fine materials, workmanship and regard for detail. It is particularly desirable for experimental purposes. It will light to full power 12 6-volt 3-ampere power lamps. For electro-plating purposes, it will operate a 5 gallon solution successfully.



The field is of the ring type, cast solid with the frame. The coils are form wound, carefully taped and shellaced; they are entirely safe from mechanical injury or breakdown. The armature is of the drum type, laminated, slot wound it does not heat. The commutator is of hard copper, carefully insulated with mica. The brush holders are of new design of the radial type, mounted on an adjustable yoke. The brushes are of woven wire, self adjusting—they do not spark. The bearings are of hard bronze, nicely fitted; workmanship throughout the best. Finished in black enamel. Fitted with 1 1/2 inch grooved or flat pulley as desired. Length of shaft 6 inches. Occupies space 6x4 1/4 x 6 inches. At speed of 2200 R. P. M. the output is 36 watts. (6 volts, 6 amperes.)

We can wind it to give different volts and amperes within its capacity. Two windings frequently called for are: 3 volts, 12 amperes exact data, voltage, amperage, watts, size of frame, etc. We'll send literature and quote prices on generators from 1/4 to 10 K. W. Especially able to quote attractive figures on motor generator sets for charging batteries or for wireless telegraph work. Try us. Enclose stamped, self addressed envelope for immediate reply.

You cannot buy a better dynamo. The Kendrick & Davis Co., manufacturers of the No. 9 K. & D. Generator, are the most skilled makers of small motors and generators in the world.

**NO. 9 K. & D. GENERATOR,** our special price, ..... **\$8.00**

(Shipping weight 10 pounds.)

## LARGE DYNAMOS AND MOTOR GENERATORS

We can furnish any style or capacity dynamo or motor generator. Write us your needs, giving exact data, voltage, amperage, watts, size of frame, etc. We'll send literature and quote prices on generators from 1/4 to 10 K. W. Especially able to quote attractive figures on motor generator sets for charging batteries or for wireless telegraph work. Try us. Enclose stamped, self addressed envelope for immediate reply.

## TYPE MM 110 VOLT UNIVERSAL MOTOR

FOR A. C. OR D. C.

We present herewith what we consider a splendid small Universal Motor at a very low price. In fact we have never seen as fine a motor at less than 50 per cent more than the list cost of our Type MM. Note that our special price to you is 18 per cent less than you would pay for this motor elsewhere.

For operating small models, jeweler's lathes, winding machines, rotary spark gaps, fans, phonographs, music boxes, slot machines and similar devices we recommend this motor very highly. We are especially pleased with its characteristics as a rotary spark gap motor, its size power and speed being ideal for the purpose. We furnish the motor on our popular Type "P" Gap.

Universal Motors have the same general characteristics as series wound motors. They will operate with equal satisfaction on either direct or alternating current, 100 to 130 volts, 60 to 133 cycles.

Our Type "MM" Universal Motors are very low in price considering their quality. At our special price they can't be beat.

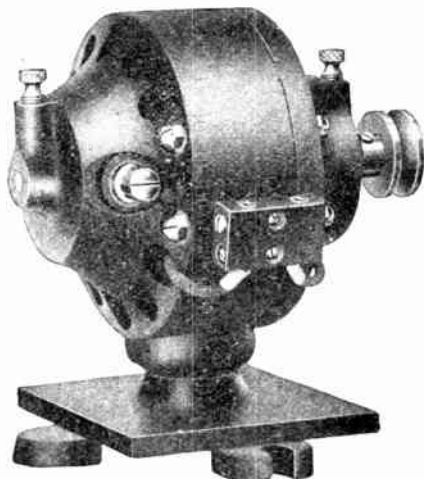
**DETAIL**—Cast iron frame finished in glossy black baked enamel. Field Coils wound, taped and dipped in moisture and oil proof varnish. Armature built of Norway sheet laminations. Armature Coils impregnated thoroughly and absolutely moisture proof. Shaft is of high grade hardened steel, ground and polished. Commutator is of hard drawn copper, mica insulated. Bearings, pure phosphor bronze. Lubrication by oil cup and wick oilers.

These motors are tested under 50 per cent overload. They will stand long periods of running without excessive heating. Size of motor over all, 4½ inches long, 4¾ inches high, 3¾ inches wide.

R. P. M., no load, 6000; full load, 3000. Horsepower 1-10. Pulley ¾ inches diameter. Shaft ¼ inch diameter. Net weight 4½ pounds. Shipping weight, packed, 6 pounds.

**THE BEST MOTOR VALUE WE EVER OFFERED.—THE BEST MOTOR VALUE YOU CAN SECURE.**

**NO. 10 TYPE MM UNIVERSAL MOTOR**, as described, reg. price \$7.00 to \$8.00. Our special price... \$5.75  
**NO. 11 TYPE MM MOTOR**, same as above but larger, 1-20 H. P. Same general characteristics, each... \$11.00



## ABOUT TYPE MM MOTORS

Type MM Motor No. 10 is a most desirable motor for operating rotary spark gaps. The height of the shaft from the base is just right for this purpose. Why spend \$10.00 to \$18.00 for a rotary spark motor when our Type MM Motor No. 10 will do the finest kind of work for you? Remember, too, that you formerly had to pay for \$8.00 to \$10.00 for a motor equal to ours at \$5.75.

Use Type MM Motors for operating medical and chemical instruments, centrifuges, oscillators, small buffers, grinders, polishers and a hundred other uses.

## WHITE CROSS MOTOR—UNIVERSAL TYPE

WOUND EITHER FOR BATTERY OR 110 VOLTS A. C. OR D. C.

This little motor was introduced by us to the experimental market a year ago. It has proven its value, in this time, and has given general satisfaction in every way.

Considering the very low price of this motor it is a most remarkable little machine. In fact we have never seen a motor designed to operate on regular house lighting current, that sold for so moderate a price.

In spite of its low cost the White Cross Motor is thoroughly well built.

It will stand up under any reasonable operating conditions and will give excellent service.

It is especially designed for operating fans, small blowers, models, adding machines, rotary spark gaps, phonographs, regulators and similar uses. An excellent motor for operating model making sets, such as Mecanno and Erector, as it requires no transformers or batteries, and is most economical to run.

The White Cross Universal Motor connects into any 100 to 120 volts A. C. or D. C. socket without resistance of any kind. We recommend for very smooth running or long continued running, that a 32 C. P. lamp be used series with it, although this is not necessary. Note the following specifications:

**DETAIL**—Stamped steel case with metal base attached, finished in copper oxide. Laminated disc armature of Norway iron; machine wound, silk insulated armature coils; laminated Norway iron field's; form wound, silk insulated field coils; mica insulated pure copper bar for commutator; accessible brush holder; graphite brushes; phosphor bronze bearings; tool steel shaft; self feeding oil cups.



READ the above specifications carefully—note the refinements of the White Cross Motor, usually found only in motors selling at much greater prices. You'll like the handsome little White Cross Motor. It's just the thing wherever an inexpensively reliable small motor for 110 volts direct or alternating (Universal) current is required. Shipping weight 4 pounds. Height 4 inches. Width over all 5 inches. Grooved pulley.  $\frac{3}{4}$  inch shaft.

- NO. 16 RED CROSS UNIVERSAL MOTOR, for 100 to 120 volts, alternating or direct current, 60 to 133 cycles ..... \$4.00  
 NO. 17 RED CROSS UNIVERSAL MOTOR, same as above but furnished with speed regulator on frame and finished in polished nickel plate; very handsome ..... 5.00  
 NO. 18 RED CROSS MOTOR, wound to operate on 4 to 8 volts storage cell or 3 to 6 dry cells, each ..... 4.00

NOTE—Other voltage or cycle windings at slight additional charge.

## EVERY EXPERIMENTER READ THIS

### A BIG 25 CENTS WORTH

Send us twenty-five cents in stamps or coin for this big offer of needed printed matter for your wireless station. It's the greatest value you ever bought. We get it out as an advertising stunt—no profit for us—just to let you KNOW us.

Here's what you get:

4 HANDSOME PRINTED SIGNS, as illustrated, to hang in your station, each printed on heavy bristol board, size 4x8 inches.

1 LARGE CLEAR CODE CHART, with Morse and Continental Code, symbols and abbreviations. Size 8x12 inches.

1 PAD RADIO TELEGRAPH BLANKS, as shown. Very useful and novel. Size 3x5 inches.

Every wireless experimenter needs this outfit. Send 25 cents today! We prepay postage. Extra pads of radio blanks 10c prepaid.

Hour RADIO TELEGRAM Station

Date.....

Mr.....

# DANGER! HIGH VOLTAGE

## WIRELESS STATION

of.....

Call Letter.....

License No.....

## HOURS

THIS STATION IS IN OPERATION

From ..... to ..... A. M.

From..... to ..... P. M.

.....Operator

### INTERNATIONAL MORSE CODE

A .....	N .....	Z .....
B .....	O .....	[ ] .....
C .....	P .....	[ ] .....
D .....	Q .....	[ ] .....
E .....	R .....	[ ] .....
F .....	S .....	[ ] .....
G .....	T .....	[ ] .....
H .....	U .....	[ ] .....
I .....	V .....	[ ] .....
J .....	W .....	[ ] .....
K .....	X .....	[ ] .....
L .....	Y .....	[ ] .....
M .....	Z .....	[ ] .....

Period .....

Interception .....

Double dash .....

Wax .....

Received O K .....

Interruption in transmission go ahead .....

Attention call to precede every transmission .....

From (dir) .....

End of each message (rom) .....

Transmission finished (end of work) (receipt) .....

use of correspondence .....

**PLEASE BE  
QUIET  
WHILE THE  
OPERATOR  
IS  
RECEIVING**

## ELECTRO-SET "IDEAL" MOTORS

UNIVERSAL TYPE.

FOR A. C. OR D. C.—THREE SPLENDID MODELS.

WONDERFUL VALUES.

We herewith present a line of Universal Motors that are without doubt the finest machines of their kind produced. They are not cheap motors. On the contrary, they are the highest grade Universal Motors made. And yet the price is within your reach.

## USES.

These motors will find countless uses in the home, laboratory, station, shop, office. For running sewing machines, grinders, jewelers' lathes, winders, models, rotary spark gaps, fans, blowers, dental machinery, mixers, vacuum cleaners, and all other small motor uses. Schools, colleges, laboratories—all will find these motors superior to any other they can purchase.

## APPEARANCE.

The appearance of Electro-set Ideal Motors at once will indicate to you the marvellous care exercised in their manufacture. When you see their shining frames, their smooth castings, their wonderful beauty, you will at once recognize their worth. They are as different from the ordinary motor as day from night.

## HOW THEY RUN.

Electro-set Ideal Motors run like watches. No jerks, squeaks, or bearing trembling. They run with surprising power and smoothness—as silent as small motors can be. Every turn indicates silent, reserve power. **WE GUARANTEE "IDEAL" MOTORS.—They must do service—they must be right or we will replace them for you.**

The following standard sizes are carried in stock at all times ready for shipment. **TYPE "A."** 1-25 H. P., with cord and plug. Will operate any standard sewing machine. Ideal for rotary spark gaps. Speed 2000 to 200. Size about 4.5x5 inches. Shipping weight 7 pounds.

**TYPE "C."** 1-16 H. P., Rheostat control; with 8 ft. cord and plug, arbor, pulley, emery wheel and buffer. For jewelers, dentists, hotels, homes, etc. Speed 2,000, 4,000, 6,000. Size about 6x7x7½ inches. Shipping weight 14 pounds.

**TYPE "D."** ¼ H. P., complete with cord, plug, pulley, emery wheel and buffer. Rheostat control; speed 2,000, 4,000, 6,000. May be used for any kind of work requiring power, lightness, speed. Size about 7x7½x8 inches. Shipping weight 20 pounds.

Universal Motors are coming into play more and more every day. They are absolutely necessary when it is desired to turn out an article that is to be portable. They should also be used in connection with articles going into the home. Specialties in the home are in the hands of people who are not versed on technical points of electricity, and motors must therefore be built as near fool-proof as possible. In the construction of the Ideal Motors special attention has been given to the vital parts, such as the armatures, fields, bearings, etc. The oiling system employed on each particular motor is that which is best suited to it. With reasonable care no bearing or lubricating trouble will be experienced.

Each of the motors illustrated on this page can be furnished in several ways, such as leaving off arbors, leaving off base, supplied without cord or simply with leads coming out of the casing. They can also be wound special so as to be better adapted for certain work. All of this comes under the head of Special Motors. We would be glad to give suggestions upon receipt of data in regard to your requirements.

## PRICES.

NO. 7015 TYPE A UNIVERSAL MOTOR, as described.....	\$ 8.50
NO. 7020 TYPE C UNIVERSAL MOTOR, as described.....	16.00
NO. 7025 TYPE D UNIVERSAL MOTOR, as described.....	27.00

Let us quote on special models—no obligation.

# EXPERIMENTERS,

inventors, model makers, etc., who desire the best small universal motors in their work will be delighted with our "Ideal" Motors. They represent the latest advance in universal motor manufacture. They'll pass every fair test.

## POWER MOTORS

INDUCTION MOTORS—LARGE MOTORS.

WE CAN SAVE YOU MONEY.

Write us regarding any motor or generator you contemplate purchasing. We represent large factories and sell highest grade products at lowest prices. Don't buy until you hear from us. We cannot attempt to list the lines at our command but we will willingly send you special information, descriptions and prices on any motors for any purposes from 1-200 to 200 H. P.

If you want to get the best at lowest prices—write to us about your needs.

—THE ELECTRO-SET CO.



## SMALL INDUCTION AND SHOCKING COILS

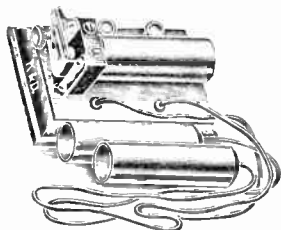
HOUSEHOLD MEDICAL COILS.  
VIBRATORS—HIGH FREQUENCY COILS.

All the above devices are of deep interest to the experimenter and also are recognized curative agents for many ailments. Thousands of people ally the pains and sufferings of rheumatism, lumbago, and other ailments, with medical coils and high frequency machines. The latter are also very useful in the home treatment of skin diseases and eruptions. They are used in the most advanced hospitals and sanitariums.

High frequency machines generate "Tesla" currents, a phenomenon of deep interest to the experimenter. These wonderful currents disobey many of the electrical laws. Although their voltage is very high they are absolutely harmless. Sparks may be taken into any part of the body without disagreeable feelings of any kind.

Such famous physicians as Kellog, Osler, Heidman, Huston Brown, M. L. H. Arnold and others declare that massage by vibration has most beneficial effect on the heart, arteries, blood, veins and capillaries.

Our smaller shocking coils are much in demand by experimenters. They are true induction coils in every sense and demonstrate the principles and action of induction. Much innocent amusement may be derived from them among your friends such as seeing who can stand the strongest shock, innocent practical jokes, etc. Every instrument we offer is handsome, well made, well designed and low in price.



### NO. 25 K. & D. HOUSEHOLD MEDICAL COIL AND EXPERIMENTAL INDUCTION COIL

This apparatus will work efficiently on one cell, dry or other battery. Gives a smooth, even current and has perfect regulation. Mounted on a polished wood base  $2\frac{1}{2} \times 3\frac{3}{4}$  inches. Handles and other parts nicked and highly polished. Full directions accompany each coil. A splendid inexpensive instrument for experimenters, live boys and grown-ups.

NO. 25 INDUCTION COIL, shipping weight 1 pound.....\$0.90



### NO. 28 HOUSEHOLD MEDICAL COIL AND INDUCTION COIL

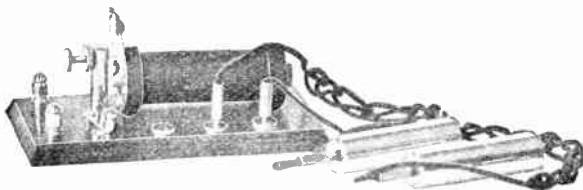
This is the best coil of its kind made anywhere. Three different strengths of current may be obtained, which may be further regulated by drawing out the removable core shield.

This coil is a useful and beneficial device in any household and is a dandy experimental induction coil.

Beautifully finished on polished mahogany base with bright nicked trimmings.

NO. 28 HOUSEHOLD COIL.....\$2.50  
(Shipping weight 2 pounds.)

### NO. 174 HOUSEHOLD MEDICAL AND INDUCTION COIL

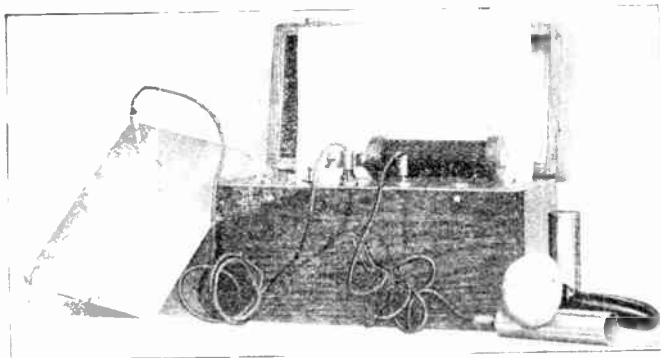


A low priced, practical medical coil of unquestioned worth. Operates on a single cell of any kind. Gives a smooth, even current. Very handsome in appearance and well made in all details. Metal parts nicely nicked. Two cords and electrodes furnished complete with this coil. We believe our No. 174 to be the lowest priced practical medical and induction coil made.

NO. 174 INDUCTION COIL, shipping weight 1 pound.....\$1.45

## SPECIAL VIOLET RAY AND HIGH FREQUENCY CATALOGUE

Send 2 cents in stamps for our complete catalogue of High Frequency and Violet Ray Machines, ranging in price from \$14.50 to \$35.00. Also a large selection of glass vacuum tubes, etc. Send for it today.



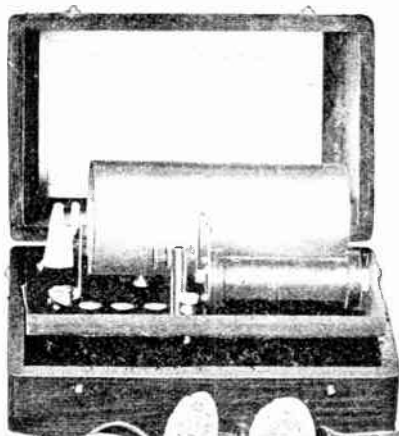
### NO. 177 HOUSEHOLD MEDICAL BATTERY

This beautiful cabinet enclosed medical coil, for home treatment, would easily cost you from \$3.50 to \$4.00 in any store. A more complete and desirable outfit would be difficult to find at our price of \$2.60. The case is finished in handsome mahogany hand rubbed stain. The special battery compartment, with connections, is enclosed in the bottom of the case. Works on any dry cell. Metal parts handsomely nickel-plated. The case has a lock and handle for carrying. Two hand electrodes, one sponge electrode and a metal foot plate with cords are furnished. Free with each outfit comes a complete book for the treatment of ailments with the coil. One of the greatest values on the market.

NO. 177 MEDICAL COIL, less battery.....\$2.60

### NO. 176 HOME MEDICAL BATTERY

Comes in a very compact, highly finished oak cabinet. Has special battery compartment for standard dry cell, and separate hinged door cabinet for accessories. Comes complete with cords 2 sponge electrodes, 2 hand electrodes, foot plate and instruction book. Generates both primary and secondary currents, singly or together. Very powerful for its size. Simple to operate, few parts, nothing to break. Should last for years if properly used. Beneficial in the home treatment of eruptive skin diseases, ulcers, swellings, rheumatism, enlarged joints, etc. Very restful for tired people. Excellent in treatment of numerous diseases. Beneficial to complexion, eye sight and general health. Every family ought to own one of these fine home coils and the book of home treatment included with each instrument. Size 9x5x4 3/4 inches. Shipping weight 4 pounds.



(Shipping weight 8 pounds.)

NO. 175 HOME MEDICAL COIL, less battery.....\$3.45

NO. 178 MEDICAL COIL, for two batteries, larger and more powerful, furnished with hair brush, reversing switch and special rheostat as additional equipment, less battery.... 5.75

## Home Electrical Treatments

are universally recognized as being very beneficial in the relief and treatment of many human ailments. Our line of instruments is reliable and complete and the prices are very low—quality considered.

## WHITE CROSS ELECTRIC VIBRATORS



Cat. No. 21

instruments in their class. They are easy splendid styles.

Vibration has long been recognized by leading physicians as a remarkable health producer. Vibration stimulates the muscles; relieves pains, nervousness, stiffness, congestion, pressure and other ailments; acts beneficially on the heart, arteries, blood, veins and capillaries.

Athletes regularly use vibration to stimulate the muscles and to relieve soreness.

Vibratory massage is a wonderful help to the skin and complexion.

White Cross Electric Vibrators are positively the best



Cat. No. 25

to use and will prove a health boon to every family. We list three

### WHITE CROSS VIBRATOR NO. 21.

Operates on 110 volts direct or alternating current, 60 to 133 cycle. Gives both percussion stroke and rubbing motion. Put up in a neat case with four applicators: Facial, button, scalp and ball. The regular price is \$15.00. We save you 25 per cent.

**NO. 21 W. C. VIBRATOR**, prepaid anywhere... \$11.50

### WHITE CROSS VIBRATOR NO. 25.

A finer, handsome instrument than our No. 21. It will meet every kind of a first class vibrator. May be regulated from very faint to very heavy vibration, suitable to all parts of the body. Comes in a fine carrying case, with handle and locks. Includes button, ball, scalp, facial, disc and sponge applicator. Operates on 100 to 120 volts A. C. or D. C. current. Add \$1.25 to price for 220 volt sets. The regular price is \$20.00. We save you 25 per cent.

**NO. 25 W. C. VIBRATOR**, as described, prepaid \$15.00

### NO. 26 WHITE CROSS VIBRATOR.

The finest kind of instrument for general home use. Almost noiseless in operation. It gives percussion, angular and lateral side stroke. Is provided with a speed control rheostat and six special applicators. Includes a fine carrying case, silk lined. Runs on 100 to 120 volt A. C. or D. C. current. Add \$1.25 to price for 220 volt instrument. We save you 25 per cent.

**NO. 26 W. C. VIBRATOR**, as described, regular price \$27.50, our special price, prepaid... \$20.00

Full instructions accompany each machine. Free, also, with each set, a complete book on home treatment by Dr. Benjamin Brown.

Special battery vibrators also carried. Send 6c in stamps for complete large vibrator catalogue.



Cat. No. 26

### WHITE CROSS ELECTRIC VIBRATORS

The Recognized BEST in Vibrators

You have seen White Cross Vibrators advertised all over the country in every national magazine. This famous make is standard value at regular prices. Note our big savings to you.

## THE TELE-SET

(Patents Granted and Others Applied For)

A COMPLETE TELEGRAPH OUTFIT—TWO STATIONS—POSTPAID \$1.00.

The Tele-Set is a fine little electric telegraph outfit for learners, Boy Scouts, experimenters, and every live boy who is interested in electricity or who wants to be.

Never before has anyone offered as fine and practical a set as this at less than double the price.

The Tele-Set is not a mere toy, although its price brings it within reach of all. The Tele-Set is a scientific little outfit, designed by an experienced electrical expert.

Its clicks are loud and easily read across a large room. You could not tell the difference between its sound and the sound of regulation pattern instruments. In fact, we have frequently surprised professional telegraphers by operating a Tele-set outfit in the next room and showing it to them afterwards.

### WHAT THE OUTFIT CONTAINS.

The Tele-Set comes to you in a neat, attractive box and contains the following equipment:

Two telegraph instruments, each making a complete station and each consisting of an ingenious magnetic electric sounder and a strap key.

One coil insulated copper wire for connecting up the two stations. Enough wire is included for practicing "back and forth" signaling between the stations.

One Morse Code Chart for learning the code.

Miniature telegraph blanks for writing out the received messages.

One instruction pamphlet, giving full and detailed instructions for learning telegraphy, written so anyone can understand it.

### THE TELEGRAPH INSTRUMENTS.

Each little telegraph instrument is a marvelous, loud sounding, handsome, electric key and sounder. Mounted on a neat wood base, size 2 1/4 x 3 1/2 inches, black rubber finish. The metal frame is beautifully nicked and polished. The magnet windings are made of enameled wire and add greatly to the attractiveness. Two binding posts are furnished on each instrument. Two such instruments are included in each Tele-Set. Handsome, nicked adjusting screws with hexagon lock-nuts regulate the height of the sound levers. The key straps are of nicked and polished brass. The finger button is of genuine mounded hard rubber composition.

Never before has such a fine little outfit been offered at the price. Anyone can learn telegraphy with the Tele-Set.

Every boy can have many dollar's worth of entertainment and instruction with it.

### FUN AND EDUCATION FOR ALL.

Put up a station between your friend's home and yours, or between your house and barn, up and down stairs, across the street. The Tele-Set will operate for many hundreds of feet if you have enough wire and batteries. One dry or wet cell will operate the Tele-Set for short distances. A good toy transformer will operate both stations for a long distance. While we do not claim that anyone can do it we have frequently covered distances of 1/4 mile between stations. Use No. 18 or No. 16 copper wire or No. 12 iron wire. Lines may be strung along fences, posts, houses, etc.

### SEND FOR A TELE-SET TODAY.

Learn telegraphy. Telegraph operators are always in demand. Our biggest railroad and business men, electricians and inventors have been telegraphers. We will send the Tele-Set prepaid anywhere in the world on receipt of price.

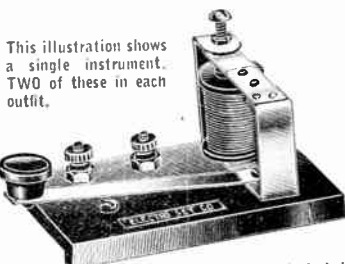
NO. 4000 TELE-SET OUTFIT, complete, without batteries, postage paid.....\$1.00

NO. 4001 KEY AND SOUNDER, single instrument or station for code practice, including code and instructions, no wire or batteries, prepaid..... .55

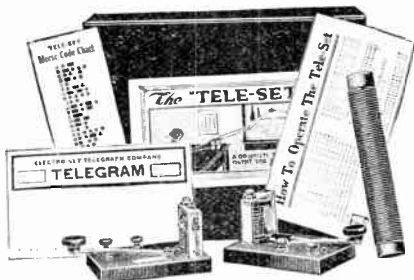
NOTE—Do not confuse the Tele-Set with outfits sold at a higher price for only one station. Remember the Tele-Set is an intercommunicating set with two stations at \$1.00. We sell the single key and sounder at 55 cents. We recommend the purchase of the complete two station set.

NO. 4002 TELEGRAM BLANKS, miniature, size 3x5 inches. Per hundred, prepaid.....\$0.20

**Boys! Put up a Tele-set between your friend's house and your own. Learn Telegraphy.**



This illustration shows a single instrument. TWO of these in each outfit.



TO OUR CUSTOMERS: The Tele set is the original Dollar Telegraph outfit. As is always the case in meritorious devices, the Tele set has several imitators. NO one of our imitators has produced a telegraph half as good as the original TELE-SET. The original Tele-set is sold by reputable Mail Order, Department, Toy, Hardware and Electrical Stores all over the world.

# Any One Can Have a Telephone

THE WONDERFUL PHONO-SET, POSTPAID, \$1.00.—THIS IS SOMETHING NEW.

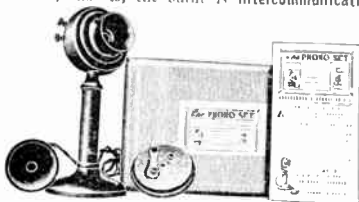


A handsome, perfect working, miniature desk telephone that stands 7½ inches high and will talk for hundreds of feet between rooms, houses, house and barn, etc.

This outfit consists of a regulation pattern desk phone with carbon grain transmitter, and hand-come little telephone receiver wound to 50 ohms resistance and furnished with a flexible double conductor cord for connections.

The set comes packed in a strong, neat box with full instructions for setting up and operating. A cutout switch of hard, polished wood and nicked brass is furnished free with each outfit.

If a single outfit is purchased you can talk one way for several hundred feet by connecting the transmitter at one end of the line and the receiver at the other. By purchasing two outfits you can talk and hear at each station, that is, the outfit is intercommunicating.

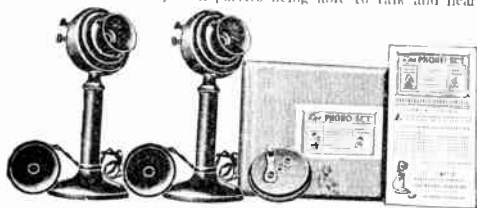


Because of its extraordinary low price no signaling device is included with these phones. Any ordinary buzzer or door bell can be connected for experimenting and when the set is used as a toy for younger children.

The Phono-Set is a true electric telephone in every sense. The receiver is of the magnetic type, wound with silk covered magnet wire, with a tempered steel magnet post. The transmitter consists of a stamped tin diaphragm with brass cup containing highest grade microphone granules. The entire instrument is handsomely finished in imitation hard rubber enamel and makes a striking appearance.

## HOW THE PHONO-SET IS USED

The Phono-Set comes in single and double form, i. e., one and two station outfits. The single set may be used as a demonstrating or toy set for talking in one direction only. That is, the transmitter may be set in one place and the receiver in another. Anyone talking in the transmitter will be plainly heard in the receiver, even though they be connected many hundreds of feet apart. The double set will talk in both directions, back and forth, both parties being able to talk and hear. This set is inter-communicating.



While we do not recommend the Phono-Set as a practical instrument it is interesting to note that we ourselves used one of these sets between our retail store and our factory, a block away, with great success, transacting all our telephone business between these two places.

However, we recommend our splendid Inter-Phones, described elsewhere, for practical purposes.

The Phono-Set perfectly demonstrates the principle of telephoning. The voice is clear and distinct and easily heard and un-

derstood. It is only after months of experimenting and by manufacturing very large numbers that we are able to offer this telephone at the previously unheard of price of \$1.00.

Surely the longing of every boy for a telephone can now be granted.

The Phono-Set is the electrical sensation of years.

- NO. 4200 PHONO-SET, as described, postage paid..... \$1.00  
 NO. 4300 PHONO-SET, including two complete desk sets with one one point switch and diagram of connections, complete, postpaid..... 2.00



## SEE PAGE 92

For a description of the most interesting NEW electrical product of the year—the Dry Storage Cell. Every experimenter, automobilist, inventor, manufacturer and model maker will welcome the advent of this remarkable storage cell.

Our Dry Storage Cells are inexpensive in first cost and the maintenance upkeep is ridiculously low. They ought to find a place in every experimental shop and wireless station. Turn to page 92.



# Are You Starting to Experiment

## SCORES OF FASCINATING ELECTRICAL STUNTS WITH THE ELECTRO-SET

Any Boy Can Start His Own Electrical Laboratory For \$1 00  
HERE'S THE LIST OF PARTS:

### CURRENT ELECTRICITY

- One Piece Copper
- One Piece Zinc
- Four Pieces Connecting Wire
- Two Binding Posts
- One Magnet Spool
- One Magnet Core
- One Coil Wire
- One Box Sal-Ammoniac

### MAGNETISM

- One Magnet
- One Keeper
- Three Steel Needles

- One Box Filings
- Three Sheets Blue Print Paper
- One Instruction Pamphlet

### STATIC ELECTRICITY

- One Glass Rod
- One Electrophorus Plate
- One Electrophorus Cover
- One Piece Fur
- One Electro-Stand
- Four Cork Balls
- One Silk Tassel
- One Piece Silk
- Two Sheets Tin Foil



Nothing is quite so interesting to the average boy and young man as the inspiring subject of electricity. This strange and useful power offers the most extraordinary opportunities to young men. Electricians and electrical engineers are receiving big salaries and their work is agreeable. It is far from necessary to urge the modern boy to learn something about electricity. The average person finds the study and experimenting so intensely fascinating that he can't keep away from it. No matter who you are, or what you intend to be, you cannot lose by knowing what electricity does and how it does it.

Now comes the **Electro-set** the biggest dollar's worth you ever bought.

It consists of a neat box in which are carefully packed thirty five pieces of material and apparatus for performing a large number of electrical experiments. Full instructions are included for dozens of experiments and this number represents only a few of what can be done. Anyone can readily figure out and perform a great many more.

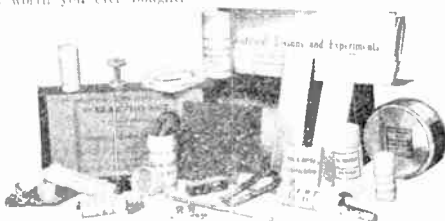
The various parts all come packed in separate neat wadded boxes, so that you can keep them and put them in the proper places after using.

**EVERY BEGINNER WANTS AN ELECTRO-SET.**

It is not necessary to spend a large amount of money to start your little electrical laboratory. The **Electro-set** does it for you at a cost of \$1.00.

You will get \$10.00 worth of fun and education out of it. There are materials for making batteries, electric magnets, compasses, electroscopes and many other things. Think of it! The cost is only \$1.00.

NO. 300 ELECTRO-SET, complete as described, post paid.....\$1.00



# MECCANO

## The Structural Building Toy

Fascinating — Instructive. Sets from \$1.00 to \$35.00. With Meccano any boy can build his own toys, machines, clocks, railway bridges, cranes, derricks, buildings, etc. The Electro-set Co. are authorized agents and carry a complete line of Meccano at all times. Send 2c for the latest Meccano catalogue.



# A BOON TO EXPERIMENTERS

The Electro-set Co. Introduce

## THE DRY STORAGE CELL

READ EVERY WORD ABOUT IT

### CLAIMS

We claim for this battery that it has greater output in watt hours per pound than any other known storage battery. That, due to its construction where in the electrolyte is held absorbed, it cannot shed its active material. That, due to its construction, the sheets of lead which take the place of the ordinary cast plates in other storage batteries cannot buckle. Therefore that it has longer life in cycles and discharge. In that the basic principles of storage batteries are used in this battery, we offer nothing new in its action, but we offer something entirely new in construction whereby we eliminate characteristic battery troubles of all other makes.

A comparative test between the No. 6 Dry Carbon Battery and the No. 6 Dry Storage Battery shows that in watt hours, which is the true light and power factor, it is ten times better in output.

As received from the manufacturer, this cell is within 90 per cent of its rated capacity, which rated capacity never grows less up to its final consumption by electrolysis of the positive lead support.

### COMPARISON

Between first and ultimate cost of the No. 6 Dry Carbon Battery and the No. 6 Dry Storage Battery:

Ratio between renewals and charge of the No. 6 Dry Carbon Battery and the No. 6 Dry Storage Battery is 7 to 1.

Cost of recharging storage battery is 5 cents.

	Waste	Efficiency
	No. 6 Dry Carbon Battery	No. 6 Dry Storage Battery
First cost, $7 \times 30c$ .....	\$2.10	\$2.50
Second cost .....	2.10	.05
Third cost .....	2.10	.05
Fourth cost .....	2.10	.05
Etc., up to 300 cycles of charge and discharge.		

Investment ..... \$2.10  $\times$  300 = \$630.00

Dry Carbon Battery

vs.

Investment .....  $300 \times .05 + 2.50 =$  \$17.50

Dry Storage Battery

Saving (plus your comparative renewal cost)

is ..... \$612.50

2100 No. 6 Dry Carbon Batteries

vs.

1 No. 6 Dry Storage Battery

Recharged 300 times

**NOTE**—Dry cells now sell at 35 cents everywhere and probably will not lower in price until after the war. The comparison is therefore still more advantageous.

### CAPACITY.

Each Dry Storage Cell gives 2.5 volts an open circuit, which rapidly falls in use to 2 volts where the E. M. F. remains constant until full discharge.

### Single Charge Characteristics.

$\frac{1}{2}$ ampere	for 40 hours.
1 ampere	for 18 hours.
2 amperes	for 8 hours.
3 amperes	for 5 hours.

This battery contains no plates or free liquids, yet it is the most powerful, inexpensive and efficient storage cell ever produced.

### USES.

General experimental work, automobile, gas engine, motorcycle, motor boat, aeroplane, hydroplane, ignition; automobile, motorcycle, boat, bicycle and canoe lighting; wagon, buggy and carriage lamps; hand lantern use; emergency house and building lighting; auto horns and signals; general signal operation; door bells; electric toys, fans, phones, telegraphs, wireless telegraphs; dictaphones; small motors; models; meter reading and inspection lanterns; reading lamps; hundreds of other uses.

**THE DRY STORAGE CELL** holds its charge longer and can be recharged indefinitely for much less than the cost of a carbon battery. It has 50 per cent higher working voltage, 600 per cent greater watt-hour output, 10 times greater working capacity. Over 2 volts E. M. F., over 7 amperes per pound and 14 watts per pound on 1 ampere discharge. On short circuit through ammeter over 400 amperes.

### AUTOMOBILE USES

The Dry Storage Cell is ideal for many uses on automobiles and motor boats. It surpasses dry cells in cost and performance for ignition. As a lighting battery for tail and instrument lights on Ford cars or other automobiles it is ideal. Fine for headlights on autos, motorcycles, bicycles and launches.

### AUDION DETECTORS.

Dry Storage Cells are ideal for filament use in Audion Detectors. Two cells are needed (4 volts). You will find them unexcelled for this work, being much more economical than dry cells, steadier and better in every way. Compare the cost with other good storage cells.

### ELECTRIC TOYS—SMALL MOTORS.

Lamps, hand lanterns and similar devices will operate better and more economically on Dry Storage Cells. Allow one cell for every two volts required.

Spark Coils will double their sending power when operated on Dry Storage Cells.

### EVERY EXPERIMENTER NEEDS THEM.

You can charge them yourself or have them charged for you at low cost at any garage. Our small dynamos are fine for charging these cells. If you have D. C. current in your home, office or factory, charging will cost you less than 2 cents per cell! You can't beat this! Dry Storage Cells will revolutionize the battery industry.

### TRY THEM!—BE CONVINCED!

Any good 6 volt storage cell of the wet type will cost you from \$10.00 to \$25.00. Three of our Dry Storage Cells (6 volts) cost \$7.50. You save at least 30 to 100 per cent.

### CONSTRUCTION.

The term "dry" is used in the sense of meaning a non-flowing electrolyte or a cell in which the liquid is held absorbed by the elements of the cell and the separators. A non-crystallizing snow-white substance having a wonderful absorbing power is used and when packed in the container receives 90 per cent of the liquid capacity of the container.

The absorbent separator can be boiled in the strongest sulphuric acid electrolyte, then exposed to the air and it will not carbonize or darken in color. Nothing in storage battery separators has ever approached closely to this and it adds practically no resistance to the cell. In its sheet form

it is made to fill the predetermined space between the positive and negative elements when dry, and leaves no space for washing or shedding or loss of active material so long as a string of metallic lead support is left to the cell element. This spongy absorbent separator holds the electrolyte pressed against the active material of the cell.

An "oasis" or "tube well" in the center of the cell is provided for supplying or feeding needed water to the cell. It is this innovation taken in connection with the flexible absorbent separator that has made possible the obtained results. Positive and negative elements are made from rolled strips of lead which are corrugated and perforated. The active material is pasted into the corrugations and noles and the absorbent separator is placed between the lead sheets. The whole is then assembled under pressure in a cylindrical form and placed in a non-breakable container with a coal black glossy finish. The general appearance of the cell as described is of the photograph opposite, which is identical in size and shape to the No. 6 Dry Carbon Battery, 2½ inches in diameter by 6 inches in height, weight 3 pounds.

#### DIRECTIONS.

Standard charging outfits will be found in all garages. Where these are not available and direct current is, use the following combination: a series current tap, a two-way plug receptacle, two 100 watt lamps and a suitable length of lamp cord. This arrangement can be placed in any socket on D. C. current and directly connected to the battery for charging after the positive wire has been found; it is absolutely necessary that the positive wire be connected to the positive terminal of the battery.

otherwise instead of charging, the battery will discharge out on the line. It is easy to determine which is the positive wire by placing the two ends of the lamp cord in ordinary drinking water. The wire which has bubbles around it is the negative wire.

Storage batteries can only be charged with direct current. All garages have D. C. current for charging. This is available either from main lines or through rectifiers or motor generator sets. Any resident in an A. C. current district can have our battery charged at a garage. We recommend that the battery be charged from 30 to 40 ampere hours at a 2 ampere rate until a voltage of 2.5 is reached. When gases are rapidly released, the central tube vent will be an indicator of these conditions. Always place, when charging, enough water in the central tube vent to about half fill it. If the battery is to be left on discharge any length of time, the central tube vent should be half filled with water.

**CAUTION**—A too liberal use of water in the tube and the emptying of it after each charge will impoverish the acid strength of the electrolyte. Bottle the expelled liquid and use it again if possible. Should the battery show a decrease in output it will be due to weakened acid, and electrolyte of a specific gravity of 1.300 should be used in flushing until capacity is restored.

#### PRICE.

NO. 6666 DRY STORAGE CELLS, 2 volts each, shipping weight, packed 4 pounds. \$2.50 (Discount in 10 cell lots 10 per cent.)

NO. 66 2 VOLT MAZDA LAMP, miniature base, 2 C. P., especially designed for single cell, burns 40 hours on 1 charge \$0.21 (Postage extra, 2 cents.)

## ELECTRO-LYTIC RECTIFIER

For the convenience of our patrons we list the following inexpensive but excellent Electrolytic Rectifiers, quoting, verbatim, the manufacturers claims which are not at all exorbitant.

This article fills a demand, which of late has become burning. For the past years we have been flooded with mail to supply a rectifier to change alternating current to direct. As is well known, alternating current cannot be used to charge storage batteries and for a great many other purposes also, direct current only can be used. This especially is the case with spark coils for wireless, etc. On the other hand, the experimenter who has an alternating current supply, when using our rectifier can perform many experiments otherwise impossible.

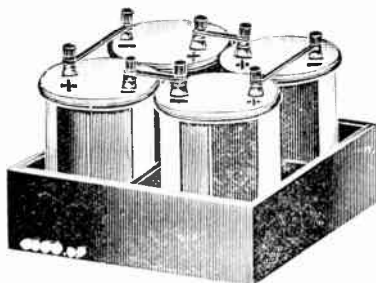
Our rectifier works on any cycle alternating current up to 110 volts. It must be used in connection with a lamp or water resistance and cannot be connected to the current supply without the resistance in series with it. And there is no leakage such as is usually found in other rectifiers. The 4 Jar Rectifier furthermore uses both sides of the cycle, which accounts for the high efficiency. Of course, a one or two jar outfit may be used successfully, and even one jar alone rectifies alternating current to direct but the efficiency is necessarily low, as only one-half of each cycle is used.

However, for experiments using little current, the one jar type is very satisfactory. The 4 jar type passes as much as 5 amperes and can be used continuously (as for instance charging storage cells) with 2½ amperes. The one and two jar types pass 1-3 of the above amperage. Our rectifiers come ready for use. All you have to do is to dissolve the salts in hot water and fill in jars, and the rectifier is ready. The 4 jar type comes with a wooden tray (see illustration) which holds the jars. No tray is furnished if jars are bought separately. The covers are of heavy porcelain with polarity marks in plain sight. Binding posts are hard rubber, impossible to short-circuit or to shock you. The lead and aluminum plates are very substantial and the latter will last for months. If used up they can be renewed at small cost and replaced with new ones in a few minutes.

New aluminum plates will not be sold separately except to users of the rectifier. When ordering renewal plates it is absolutely required that you give us your order number or date of purchase.

Other parts are not sold. Directions and diagrams only furnished with rectifier. Every rectifier is guaranteed.

NO. 1250 FOUR JAR RECTIFIER, as described, with tray, size 8½x10½x10½, shipping weight 30 pounds \$5.00  
 NO. 1251 ONE JAR RECTIFIER, as described, size 8x5½, shipping weight 5 pounds 1.25  
 NO. 1252 RENEWAL ALUMINUM OR LEAD PLATES, shipping weight 1 pound, each .20  
 NO. 1253 RENEWAL SALTS, (charge for one jar), shipping weight 1 pound .25

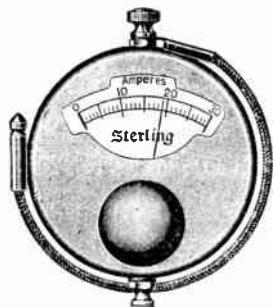


The efficiency of the 4 Jar Rectifier is 85 per cent. The 4 Jar Rectifier furthermore uses both sides of the cycle, which accounts for the high efficiency. Of course, a one or two jar outfit may be used successfully, and even one jar alone rectifies alternating current to direct but the efficiency is necessarily low, as only one-half of each cycle is used.

## METERS

Every user of electric current should possess good measuring instruments to determine voltage, amperage, charge and discharge current conditions. Our line is selected with care. Our prices are very low. Our instruments are all high grade, well constructed, well finished.

## STERLING BATTERY METERS—POCKET TYPE



"Sterling" Meters are the result of ten years of successful meter manufacturing. They are strong and accurate. Nickel-plated brass cases, neat design, handsome instruments.

The working parts are scientifically constructed of finest materials, in a complete meter laboratory, manned by competent workmen. Every instrument is fully guaranteed to give satisfaction or your money back. We save you 50 to 100 per cent on Battery meters.

NO. 124 STERLING AMMETER, (0 to 40 amperes), regular price \$1.25 to \$1.75, our special price.....\$0.75  
(Postage extra, 7 cents.)

NO. 134 STERLING VOLTMETER, (0 to 10 volts), regular price \$1.50 to \$2.00, our special price.....\$0.90  
(Postage extra, 7 cents.)

NO. 144 STERLING VOLT-AMMETER, (0 to 40 amperes, 0 to 10 volts), regular price \$1.75 to \$2.50, our special price.....\$1.10  
(Postage extra, 7 cents.)

## STERLING SWITCHBOARD TYPE BATTERY METERS

## CHARGE AND DISCHARGE TYPE.

(A Necessity for Every Owner of Storage Cells.)

These instruments are especially designed for experimental use and for charging storage cells. Long screw connections at the back serve for attaching the meters to the switchboard. Handsomely finished in nickel; 2¼ in. diameter, ¾ in. deep.

We guarantee all meters and will gladly replace them if unsatisfactory in any way.

TYPE 62 STERLING SWITCHBOARD AMMETER, (0 to 30), regular price \$2.50 to \$3.00, our price.....\$2.00

TYPE 67 STERLING SWITCHBOARD VOLTMETER, (0 to 16), regular price \$2.50 to \$3.00.....2.00  
(Postage extra, 10 cents.)

NOTE—Other dial readings furnished on our meters at extra charge. Write for information. The above meters are for direct current use only.



## COMMERCIAL CURRENT METERS

0 TO 660 VOLTS.

0 TO 1000 AMPERES.

Roller Smith, Weston, Hickox, Westinghouse and Other Famous Makes.

The Electro-set Company will make quotations on all types of Switchboard and Portable Meters for commercial current use, laboratory, school, college and research work.

Owing to the almost unlimited uses and requirements of such meters we have deemed it best not to list them as it would take too much space and probably would not include the special type for your needs. Write us your wants and let us quote you. The chances are we will save you money. Send stamped, self-addressed envelope for reply.

We can also furnish laboratory Hot Wire Meters, and commercial, research or Wireless Telegraph Hot Wire Meters of the highest grade. Try us.



## THE "ELECTRO" STATIC MACHINE

To use the most modest expression, we believe that our new "Electro" Whimshurst Static Machine is the best ever placed on the American market and priced to be within the reach of all.

To begin with, the only materials embodied in the construction consist of metal, glass and hard rubber, no wood or other flimsy material being used. The 7 inch plates we use are made of Electrite and are all machine moulded with sectors pressed right into the plates. A tabulation of the advantages possessed by heavy sectors pressed into the plates is hardly necessary in the limited space at hand.

The base is of enameled cast iron, as well as the two pulley wheels. The neutralizers are of nicked steel, while the horizontal arm carrying the collector discharges from the brushes, is of hard rubber. The handles on the discharge arms, as well as the handle of the crank, are of the same material.

The two Leyden jars are made of the best Bohemian glass, free from lead and other mineral salts, to withstand the mechanical and electrical strains.

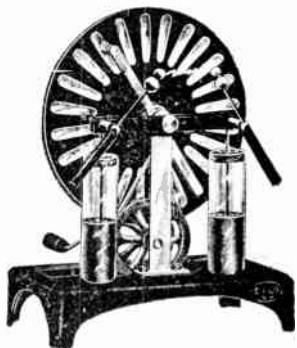
All the metal parts are nickel plated and highly polished, while the cast iron base is beautifully finished in highly polished black enamel. The plates are of Electrite, which enables the machine to give excellent results under any weather conditions, and we positively guarantee it in this respect. If directions, which accompany each machine, are carefully followed, success is always obtained. Hard rubber is used to obtain the highest insulation, and electrical current. The machine will give  $2\frac{1}{2}$  to 3 inch sparks under all conditions.

We cannot recommend this machine too highly, and unfortunately the illustration does but poor justice to the neat and trim appearance of the machine itself. It must be seen to be appreciated, and to notice the contrast of the polished rubber and nickel plated fittings.

Our machine is shipped fully assembled, and we guarantee to deliver it in good shape and working condition.

There is nothing to be replaced, as nothing can wear out. Naturally, all the interesting experiments as found in text books can be performed with our machine, such as: Interesting experiments in charging Leyden jars, experiments in resonance circuits, lighting Geissler tubes, attraction and repulsion of light bodies, firing powder or igniting substances, charging persons by standing them on an insulated platform, so that on being approached by other persons walking on the floor sparks can be drawn from any part of the face of the insulated person, or raise the person's hair by holding the hand over the head. There are countless experiments which may be performed, not only possessing value as means of studying, but furnishing plenty of entertainment as well. To persons not familiar with static electricity, we recommend our really excellent book, "Static's Electricity," finely illustrated with 52 engravings, 88 pages, sent postpaid for 25c. It contains a variety of interesting experiments which may be performed readily with our Static Machine.

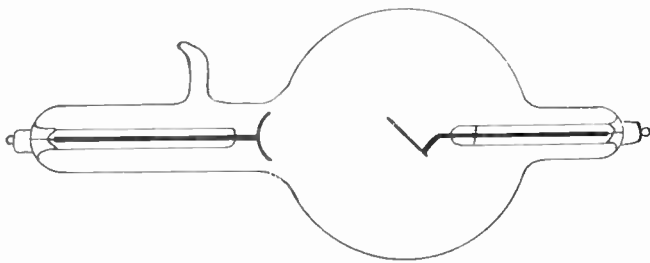
NO. 9000 ELECTRO STATIC MACHINE, as described, shipping weight 6 pounds.....\$4.50



## X-RAY TUBES

The X-Ray presents one of the most interesting and wonderful fields open to the electrical experimenter, but we believe nearly, if not all, of the equipments offered for general use, except those intended for the medical profession, are mere toys, and not of sufficient power to fully demonstrate the many marvels of this science in a satisfactory manner.

The Blitzen X-Ray Tubes should not be confused with very small imported tubes sometimes offered, as they are made in America by skilled workmen who for many years have made nothing but the highest grade X-Ray Tubes for physicians, hospitals, etc. These tubes will make excellent photographs of the hand, wrist, forearm, toes, etc., as well as of small animals and will show the bones, joints and other parts very clearly. They will also take pictures of coins or other metal objects through several inches of hard wood. No camera is required, the object to be photographed being merely laid on top of the plate holder or envelope containing an ordinary dry plate or film and the rays projected from above, for a sufficient time to make the exposure, which a few experiments will quickly determine. As the X Rays are invisible themselves, it is necessary to use a fluorescent screen, called a fluoroscope, when it is desired to actually see through the hand or other object without making a photograph. Our fluoroscope is made with a screen coated with the best grade of Platinum Barium Cyanide crystals, and for those who wish to construct their own fluoroscopes we also supply the screen only which may be mounted in any box or holder to suit the purchaser. While the above material is the best and will give the most brilliant image, screens coated with Tungstate of Calcium will give satisfactory service for all ordinary purposes. Our No. W 727 Tube is intended for use on spark coils only and will operate on any coil giving a spark three inches or more in length. It has a bulb four inches in diameter and will give a very powerful ray for all laboratory purposes. Our No. W 728 Tube is a double focus tube and is





intended only for use on Tesla High Frequency Coils. It has a bulb four inches in diameter and will give a very powerful ray on any of our high frequency coils. The No. W728 Tube is also equipped with a vacuum regulator for lowering the vacuum when it becomes too high, as it will do in time. The vacuum of the No. W727 Tube may also be lowered by carefully lowering the tube in an oven for a short time but it is not equipped with the vacuum regulator.

We wish to caution the purchaser of these tubes against continuously exposing themselves to these rays as they produce very serious burns which often do not appear for several weeks after the exposure. There is no danger, however, in short exposures such as required for making a picture, and where the rays are to be used for considerable periods of time a lead shield will protect the operator from all harm.

The addition of a Tesla Coil and X-Ray Tube will quickly transform any wireless telegraph set operating with a transformer into a complete X-Ray outfit for making pictures and will greatly add to the pleasure and fascination of your electrical laboratory.

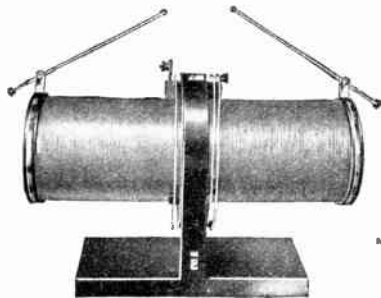
As X-Ray Tubes are extremely fragile, we cannot guarantee their safe arrival or their life except that they may be sent by express insured at three times the usual first class rate.

CAT. NO. W-727 X-RAY TUBE, for use on Spark Coils, giving a three inch spark or more.....\$ 5.00

CAT. NO. W-728 X-RAY TUBE, for use on Tesla High Frequency Coils, giving a three inch spark or more..... 10.00

## BLITZEN TESLA HIGH FREQUENCY COILS

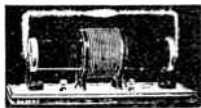
GIVE SPARKS UP TO 30 OR MORE INCHES—ELECTRICITY'S GREATEST WONDER—LOW IN PRICE AND HIGH IN QUALITY—PLACE HUNDREDS OF MYSTIFYING EXPERIMENTS WITHIN YOUR REACH.



Probably the most amazing and spectacular of all electrical apparatus is the Tesla Coil and no experimental laboratory is complete without such an equipment. Your friends will open their eyes in astonishment when they see you draw coiling, flaming, burning sparks nine inches or more in length through your body without the slightest injury or discomfort.

You can perform hundreds of the most interesting experiments, such as lighting large numbers of vacuum tubes of various brilliant colors, by merely holding them in your hand near the coil without any wires whatever. The ordinary incandescent lamp when held near the coil or connected to it, will glow with a pale greenish light. Various minerals and many precious stones will glow with strange lights and colors under its influence. Its sparks when occurring over large flat areas produce a large quantity of ozone. By balancing a wire bent in the shape of a letter "S" so that it will rotate from its center on the point of a pin or needle and connecting the pin to one pole of the coil, it will rotate as a static motor and have the appearance of an electric pin wheel with flames shooting in a stream from revolving points. All of these experiments and many more may be performed without the slightest danger as the frequency of the current is so high as to render it harmless. You cannot even feel the spark when it is allowed to jump to a piece of metal held in the hand, but where the spark jumps directly to the skin it gives a pricking sensation only on the spot where the spark strikes.

These coils are built by us in several sizes, the smallest of which may be used on any spark coil or transformer up to  $\frac{1}{4}$  K. W. capacity and is designed to operate on a condenser of .01 M. F. capacity. It has a movable contact on the primary for tuning the primary to the secondary which is very necessary for securing the greatest spark length.



The  $\frac{1}{4}$  K. W. Tesla Coil will give a nine inch flame when operated at its full capacity and when the electrodes are separated at a greater distance, each is surrounded by a fan of coiling sparks several inches in length. The next larger size may be used on any spark coil or transformer up to 1 K. W. capacity and is listed below with both  $\frac{1}{2}$  and K. W. outfits. It gives a spark 16 inches long and is designed to operate on a condenser of .02 M. F. capacity.

The larger coils of 2 and 3 K. W. capacity are designed to operate on a condenser of .03 M. F. capacity, will produce sparks thirty inches or more in length and are designed principally for lecture and stage performances.

The Tesla Coils are well constructed and particular attention is given to guarding against breakdown from the very high potentials present.

The entire frame work is of well seasoned wood covered with a black insulating paint, the primary coil is edgewise wound copper ribbon, the secondary coils are wound on special smooth paper drums with a wire specially made for this purpose. The terminals carrying the discharge rods have ball and socket joints for adjusting the length of the spark gap.

The workmanship and entire construction of this apparatus is high grade and should not be confused with much smaller coils giving feeble sparks and intended only for use on spark coils operating from dry cells.

The central point of the secondary coil is brought out to a small spring binding post on the back of the central upright support and it is very important that this binding post be grounded by means of a wire connected to a water pipe, radiator, or other ground, such as a metal plate buried in the earth. Care should also be taken not to allow the high frequency current to jump from the secondary coil to any part of the primary circuit as such a spark is very apt to cause a burned out transformer or a broken down condenser.

All of this apparatus is positively as well constructed as it is possible to make it and will not break down electrically if properly used, but owing to the impossibility of our guarding against careless use, we cannot make any guarantee except that it leaves our factory in perfect condition and will give the utmost satisfaction if properly used.

CAT. NO. W-600  $\frac{1}{4}$  K. W. TESLA HIGH FREQUENCY COIL, as above, suitable for any transformer or spark coil of not over  $\frac{1}{4}$  K. W. capacity.....\$10.00

CAT. NO. 601 1 K. W. TESLA HIGH FREQUENCY COIL, as above, suitable for any transformer or spark coil of not over 1 K. W. capacity.....	16.00
CAT. NO. W-602 COMPLETE 1/4 K. W. HIGH FREQUENCY OUTFIT, consisting of the Blitzen 1/4 K. W. Tesla Coil, 1/4 K. W. Spark Gap, Blitzen, 1/4 K. W. Transformer and 1/4 K. W. Glass Plate Condenser, for use on 110 volt, 60 cycle alternating current.....	35.00
NO. 07000 "EXPERIMENTER" TESLA COIL, size 16x7x6 1/2 inches, shipping weight 11 pounds, for spark coil operation from 1 to 3 inch spark or for transformer operation. A fine low priced instrument.....	5.50

## THE ELECTRO-PHORUS

A fascinating instrument that has heretofore been denied the experimenter.

The Electro-Phorus is the simplest instrument for making static electricity in quantity. It was the earliest "static machine."

The Electro-Phorus depends, for its operation, on the well known principle of electrical friction. It consists of an electro-phorus "plate" of the finest grade of polished, dielectric ebonite, 6 inches square, a handsome nickel and polished collector plate, made of stamped metal and provided with an insulating handle and a generating "rubber" of genuine fur.

The ebonite plate is vigorously rubbed with the fur in a dry warm place. This generates a strong electric charge on the surface of the ebonite plate. A charge is then induced in the metal cover by properly applying the "cover," with its insulating handle, to the surface of the charged plate.

Countless amazing experiments may be performed with the Electro-Phorus. You can draw long sparks from the charged cover, demonstrate the principle of attraction, magnetize steel needles, charge Leyden jars and many other things.

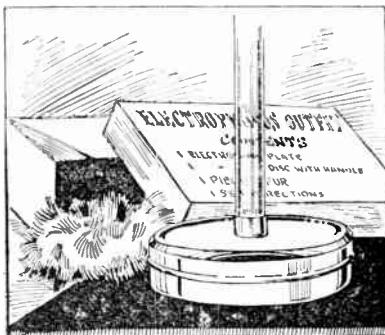
**DIRECTIONS**—Warm and dry all the parts of the Electro-Phorus to drive off any moisture. Lay the ebonite plate on a table. Rub it several seconds very briskly with the piece of fur. Now carefully follow this procedure:

1. Holding the metal cover by its handle set it upon the charged electrite plate, being careful not to touch to metal itself.
2. When the cover is in place, touch the metal at any point for a moment with your finger.
3. Remove your finger from the metal cover.
4. Lift the cover from the plate by its insulating handle.

A strong static charge is now held by the metal cover. Apply the knuckle of your other hand to the metal cover. A bright spark will leap to your knuckle causing a slight stinging sensation. If a metal key is presented to the cover, no sensation is felt and the spark will be somewhat brighter. The electrite plate will charge the cover dozens of times without re-rubbing with the fur. Large or small Leyden jars may be heavily charged by setting same on a grounded tin plate or piece of tin foil or by holding the outer coating in the hand and applying the ball or inner coating to the charged cover a number of times. The larger the jar the greater number of separate sparks must be discharged into it to fully charge it.

The Electro-Phorus is a device that every true experimenter ought to own. Read any good electrical book on Static Electricity. You'll find many interesting things that you can do with the static charges so readily generated on this little instrument. We are the first company to offer a good Electro-Phorus at anywhere near a reasonable price.

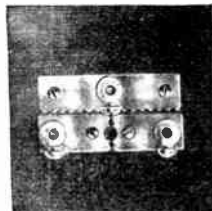
NO. 80 E. S. ELECTRO-PHORUS, complete, with plate, cover, rubber and directions, in a neat box, shipping weight 1 pound, each.....\$0.50



## LIGHTNING ARRESTER

For protecting all outside line, telegraph and telephone wires from lightning. An excellent form for small amateur and short experimental lines. Nicely finished in polished nickel and mahogany stain.

NO. 4-LA LIGHTNING ARRESTER, size 3x5x1 inches, each.....\$0.35  
(Shipping weight 1 pound.)



Errie, Pa.

Gentlemen: I found my receiver very satisfactory and I endorse your goods very highly.  
2917 Peach St.

LEONARD BAMBAUER.

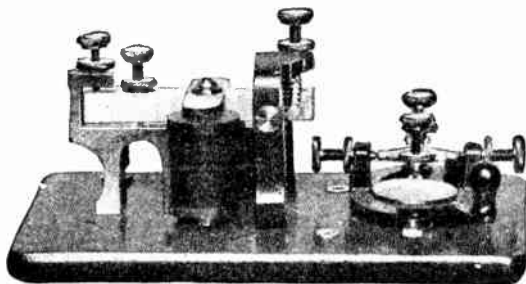
Dear Sirs: I am satisfied with the K. & D. No. 9 Generator, as it has come up to all the requirements.  
Lachute, N. S.  
C. N. POTTER.

## TELEGRAPH GOODS

### KEYS—SOUNDERS—LEARNERS' SETS—RELAYS.

**READ THIS**—All Telegraph Goods look alike in pictures. They do not look alike when you get them. A catalogue illustration may or may not tell everything. Many mail order houses use "cuts" indiscriminately, picturing one make of instruments and shipping another. Therefore, in looking over the following line just remember this: If you do not get your money's worth when you buy telegraph instruments from us you will be doing a good act by sending them back. We take all the risk. Can we say more?

## ELECTRO-SET LEARNER'S TELEGRAPH SET



This excellent set consists of a very neat 4 ohm sounder and a standard type telegraph key mounted on a well finished, round beveled wood base, mahogany stained and polished. The frames are not stamped from steel sheet but are cast from solid metal, thus eliminating the "clanging" sound and giving fine, clear dots and dashes. The sounder lever has the well liked yoke suspension. Every movement and contact on the sounder is fully adjustable. The sounding bar, sounder lever and adjusting screws are of solid gold lacquered brass. The key is also fully adjustable, mounted between adjustable brass bearings on a solid cast metal base. The key lever is handsomely nicked and polished and is made of steel for strength. Contacts are hardened platinum. The whole instrument sets on brass sounding pegs. Key and

sounder are standard size.

If you desire a good learner's set, do not try to save 20 to 30 cents only to get a non-adjustable, poorly finished stamped steel outfit. It doesn't pay. You never saw a neater and better made set at the price we ask. We guarantee satisfaction. Others ask more for the quality we sell. Our instruments are splendid for short telegraph lines.

**NO. 303-A LEARNER'S TELEGRAPH SET.** 4 ohms, for lines up to  $\frac{1}{4}$  mile, shipping weight 2 pounds. **\$1.45**

**NO. 304-A LEARNER'S TELEGRAPH SET.** 20 ohms, lines up to 1 mile, shipping weight 2 pounds. . . **1.75**

**FREE** with each outfit, a complete telegrapher's hand book with codes, diagrams, instructions and lessons.

## NO. 3030-B TELEGRAPH SOUNDER

This sounder is identical with the one illustrated on our No. 303-A Learner's Set. It is mounted on a separate base without key, and furnished with a set of binding posts. A very handsome instrument.

**NO. 3030-B TELEGRAPH SOUNDER,** 4 ohms, shipping weight 1 pound. . . . . **\$0.90**

**NO. 3040-B TELEGRAPH SOUNDER,** 20 ohms. . . . . **1.10**

## NO. 4090 TELEGRAPH KEY

**OTHERS ASK 90 CENTS FOR THIS KEY. OUR PRICE \$0.75**



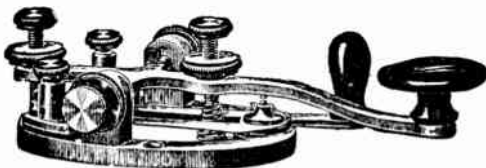
The best key at its price, beyond any doubt, that the market affords. It is the same key used on our Junior Learner's Outfit, mounted on a separate base with separate binding posts. Makes an ideal key for wireless telegraph use in small spark coil stations using up to 3 inch spark.

This key is made exactly after the same patterns as expensive commercial keys. It is fully adjustable, handsomely finished and wholly desirable in every way. No stamped metal frames with non-adjustable levers. Everything is built in the approved, modern fashion. An

exceptionally good key at a very reasonable price.

**NO. 4090 KEY,** hardened, platinum contacts. . . . . **\$0.75**

## NO. 4095 TELEGRAPH KEY



This key is built on the "legless" pattern, designed to screw down on to any base, table or cabinet. It is made entirely of solid brass castings with the exception of the lever, which is made of highly nicked and finished wrought steel to insure strength. The contacts are of hardened platinum. All actions fully adjustable. Standard in size. A professional type instrument of surpassing appearance. Excellent for spark coil wireless telegraph instal-

lations. The price, for this type of key, is ridiculously low.

**NOTE**—This key is sometimes used on transformer wireless sets up to  $\frac{1}{4}$  K. W. While we do not particularly recommend it for this use we understand that many experimenters have secured excellent satisfaction on such powers.

**NO. M-100 L. P. KEY**, as described, shipping weight 1 pound. . . . . \$1.10  
See page 13 for larger keys especially adapted to wireless work.

## ELECTRO-SET PONY RELAY

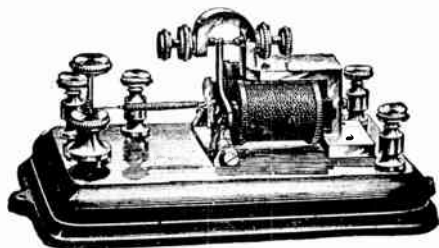
When an electric current, after traveling through a considerable length of wire, reaches its destination, it is often too weak to operate the desired instrument.

This is because the resistance in the wire consumes some of the energy.

A relay must then be used. A relay is simply a sensitive electric switch. The weak current pulls over a delicately suspended armature, on the end of which is a platinum contact which "switches in" a new current from a local battery. This new, strong current operates whatever instrument is desired.

Relays are used on telegraph lines that are more than a mile long and for operating selenium cells, coherers, wireless telegraph outfits, etc.

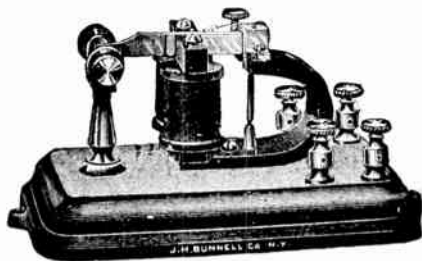
The higher the resistance the more sensitive the instrument. Electro-set Pony Relays are exquisitely made instruments, balanced to extraordinary sensitiveness and handsome to a degree. All metal parts are made of ground brass castings, instrument lacquered, highly finished. Bearings, contacts and tensions have double adjustment throughout. Mounted on mahogany base with cast metal under-base. "Head and shoulders" beyond ordinary pony relays. Supersensitive. Our prices are lower.



<b>NO. 305 RELAY</b> , 20 ohms, for telegraph lines up to 15 miles. . . . .	\$2.00
<b>NO. 306, RELAY</b> , 50 ohms, for telegraph lines up to 40 miles. . . . .	2.20
<b>NO. 307 RELAY</b> , 100 ohms, for telegraph lines up to 75 miles. . . . .	2.40
(Shipping weight 2 pounds.)	

## ELECTRO-SET POLARIZED RELAYS

Polarized Relays are many times as sensitive as Pony Relays. The armature switch lever is balanced against a permanent magnetic field and the slightest current will move it. Polarized Relays are especially useful for long distances, coherer wireless work (for distance from one to fifty miles), and for selenium cell operation, long distance telegraphy, etc. Our Polarized Relays are splendidly sensitive. Do not confuse them with the cheaper relays. You may as well purchase a good Pony Relay as a cheap polarized one. Our relays have been made by the same manufacturer for forty years. They are precision instruments, beautiful in appearance and exceptionally well made.



<b>NO. 555-X POLARIZED RELAY</b> , 20 ohms. . . . .	\$5.25
<b>NO. 556-X POLARIZED RELAY</b> , 50 ohms. . . . .	5.50
(Shipping weight 3 pounds.)	

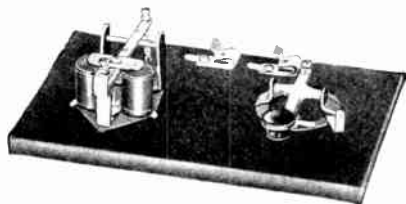
## ELECTRO-SET JUNIOR TELEGRAPH SET

This little outfit, while somewhat less complete as regards adjustments and action than our standard Learner's Set, is certainly a splendid combination at an attractively low price.

It is surprisingly well made—so well, indeed, that we know you'll like it. In fact, we guarantee satisfaction, or we will gladly return your money.

In appearance it closely resembles the standard telegraph instruments in general use today.

Its construction is most ingenious and its appearance very attractive. For those who cannot afford the larger sets it makes quite a fair learner's outfit. It certainly is a fascinating experimental set. It compares favorably with many of the learner's sets offered by other firms at higher prices, although it is somewhat smaller in size.



<b>NO. 557-X JUNIOR TELEGRAPH SET</b> , each. . . . .	\$1.00
<b>NO. 558-X SOUNDER ONLY</b> , shipping weight 1 pound. . . . .	.65
<b>NO. 559-X KEY ONLY</b> , shipping weight 4 ounces. . . . .	.45

The outfit consists of a neat little key and sounder mounted on a finished wood base with connecting posts. Size over all 2x4x6 inches. Shipping weight 1 pound.

## Learn Morse and Wireless Codes on THE OMNIGRAPH An Automatic Telegraph Teacher

The Omnigraph is a device for teaching you the telegraph codes in the simplest, easiest, quickest and pleasantest manner possible.

It is a machine that can be used in connection with any telegraph sounder or learner's set for teaching the Morse Code or in connection with any door, test or signal buzzer to teach the continental wireless telegraph code. Anyone can connect it; anyone can learn rapidly and accurately on the Omnigraph.

The Omnigraph has the official sanction of telegraph superintendents everywhere. It turns out splendid operators in a minimum of time. No need of going to an expensive telegraph school.

### LEARN TELEGRAPHY AT HOME

Telegraph and wireless telegraph operators get good pay and permanent position. Wireless telegraph experimenters and amateurs lose half the pleasure of their stations if they cannot read the code rapidly.

There's an Omnigraph to fit every purpose.

Connect up an Omnigraph with a battery and sounder or buzzer. It will send messages to you, perfect in code at any speed you desire. Simple code records to start with. Fast railroad messages to finish with.

## THE OMNIGRAPH NO. 3



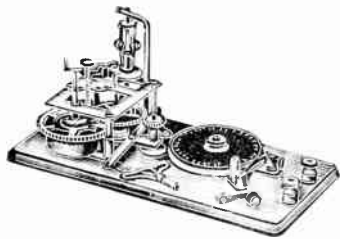
Measures  $10\frac{1}{2} \times 5\frac{1}{4} \times 3\frac{1}{2}$  inches. Weight 2 pounds. Guaranteed to work perfectly with any instrument or on any line. Extra dials 10 cents each.

We have for our No. 3 numerals twelve extra dials containing punctuations and different messages. Also a dial for each letter, 20 in number; they send single letter continuously.

These dials can be exchanged by mail, 2 cents per dial, to cover mailing and packing. Both Morse and Continental Codes.

**NO. 3 OMNIGRAPH**, to operate by hand, as described, each.....\$2.50

## OMNIGRAPH NO. 5 (With Spring Motor)

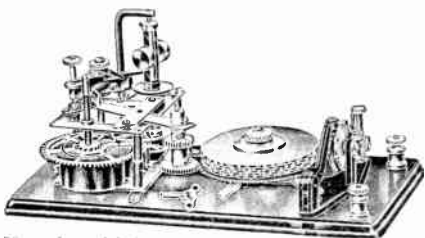


The spring motor shown in this cut is the same as we use on our more expensive models. Will run 45 minutes with one winding and takes but half a minute to rewind. We have Morse and Continental dials, and our No. 5 will work perfectly with any line, or with any sounder or buzzer.

Additional Morse or Continental dials 10 cents each, or they can be exchanged by mail on payment of 2 cents per dial, postage and packing.

**NO. 5 OMNIGRAPH**, complete, includes transmitter arranged for hand or motor, spring motor with governor for varying the speed, booklet "How to Become an Expert Operator" and 2 dials, price.....\$6.00  
(Shipping weight  $3\frac{1}{4}$  pounds.)

## THE NEW OMNIGRAPH NO. 2 JR.



Our Omnigraph No. 2 Jr. embodies all our latest improvements.

Sends perfectly at any speed, from 5 to 100 words per minute. You can change the message in the fraction of a second, even while the machine is running. You can send the same message continuously or a fifth part repeatedly.

The Omnigraph No. 2 Jr. is provided with five message changers. Each dial is divided into five equal parts, making the dials, so far as changing the message is concerned, equal to 25 dials. Starting the record when the dials are placed on the spindle from "A" to "E," having the dial marked "A" on top, it sends a comprehensive message of

50 words, and before repeating the first dial, it is equal to 100 words.

To change the message, you move No. 1 message changer (the lever under the letters) in, so that it does not engage with the star wheel, and move No. 2 out; this will transpose ten words. By making this change with the five different message changers, it will transpose fifty words. Now by putting 1 and 2 so that they engage with the star wheel, this will make twenty changes, and by making this change five times, using different message changers each time, you make 100 changes. This same kind of manipulation can be done



with three message changers, or with four or with five, which will make the same proportion of changes in the message. Now remove the dials, shuffle them up, replace them on the spindle, and you begin all over again with new messages, so far as practice is concerned. If you will make the above combinations with the dials, you will readily agree with us that the Omnigraph will send thousands of new messages.

If you should record on paper tape the different messages this instrument will send to you, it would cost you hundreds of dollars for tape alone.

All parts of the Omnigraph are made of metal, and will last indefinitely. The instrument is always ready to send. Just move the starting lever, and it will send perfect Morse or Wireless at any speed you desire for 45 minutes, and it then requires but one-half minute to rewind the spring motor.

The ability to read messages, Wireless or Morse, is 90 per cent of the art. If you should attend a telegraph school, 90 per cent of your time would be devoted to receiving. We will bring the operator and school to you. You cannot learn telegraphy without hearing the messages. We positively guarantee the Omnigraph No. 2 Jr. to teach you more quickly, better and more surely than any other way. It will give you unlimited practice.

A number of Telegraph Schools throughout the country have purchased Omnigraphs and use them to send to their students in preference to hand sending. The United States Government examines all applicants for wireless licenses, as to their ability to receive, by means of the Omnigraph. This we consider our strongest endorsement, and must prove that we have pre-eminently the best instrument on the market. We guarantee the Omnigraph in every particular. In fact, we guarantee it to teach you telegraphy, Morse or Wireless.

**NO. 2 JUNIOR OMNIGRAPH**, as described.....\$11.00

## Electric Christmas Tree Outfits

### Money Saving Prices—Highest Quality

DON'T RISK A FIRE IN YOUR HOME

Electric lights on your Christmas tree are absolutely safe. Not the least danger, dirt or smoke. No grease or tallow. Electric tree lights are more beautiful and more brilliant than candles. The pretty assorted colored lamps shine brightly from the tree foliage.

There are Christmas tree lights AND Christmas tree lights. You get just what you pay for. It is safe to say that 50 per cent of the Christmas tree light outfits sold today are troublesome. The bulbs are the very cheapest procurable. They are crooked and poorly made. The sockets and wiring are bad.

In spite of these difficulties electric tree lights, yes, even the poorest of them, are far superior to dangerous and dirty candles and are very popular. Therefore, when you buy these outfits from the Electro-set Co. you will be doubly pleased.

Our Christmas Tree Lighting Sets are positively superior to most products of their kind. We have tried the cheaper grades and found them more expensive in the end. It does not pay. An initial saving of a very few cents will soon be overbalanced by the replacement of parts. Every set we ship is tested. Every set is packed safely and is guaranteed to reach you in perfect condition. Is this insurance worth anything to you? Our outfits are characterized by the neatest workmanship, heaviest wiring, longest leads and best bulbs obtainable. The prices are lower than you can procure these same outfits elsewhere.

Anyone can connect these sets and decorate the tree with them—even a child. Simply screw each bulb into place and place the plug into any 110 volt A. C. or D. C. light socket.

- NO. 10-E-5 CHRISTMAS TREE SET**, 8 light, complete, ready for use; 4 colors of bulb; shipping weight 2 pounds. Others charge \$3.00. Our price.....\$2.26
  - NO. 11-E-6 CHRISTMAS TREE SET**, 16 light, complete as above; shipping weight 3 pounds. Others charge \$6.00. Our price.....4.52
  - NO. 12-E-7 CHRISTMAS TREE SET**, 24 light, complete as above; shipping weight 5 pounds. Others as \$9.00. Our price.....6.76
  - NO. 13-E-8 CHRISTMAS TREE SET**, 32 light, complete as above; shipping weight 7 pounds. Others ask \$12.00. Our price.....9.04
- Brightest Light. Longest Life. Least Cost. When You Buy Electro-set Tree Lighting Outfits



## BATTERY TREE SETS

For those who have no electric light service, we offer these battery operated tree sets. While 3 cells, connected in series, will run them, we suggest 6 cells connected in series multiple as being more economical. Much better still, use 2 of our famous Dry Storage Cells (see index.) They are most economical.

- NO. 14-E-8 BATTERY LIGHT SET**, 8 lights, complete with switch, ready for use, less batteries.....\$2.25

Monroeville, O.

Gentlemen: I purchased one of your half inch spark coils and it will give a three quarter inch spark with ease, and have sent ten miles with same.

Box 77.

H. F. BUCKINGHAM.

## LIONEL ELECTRIC TRAINS

WE SAVE YOU 20 TO 30 PER CENT

THE BEST LINE

THE LOWEST PRICES

Little need be said here about the fine quality of this well known make of toy electric trains. Lionel advertising has taught you this and Lionel performance has kept up the reputation.

Dollar for dollar you get more and better equipment when you buy "Lionel." The motors—the most vital point—are wonderfully made in every detail. The finish on the cars, track, accessories, parts, is beyond criticism. By all means insist on Lionel Electric Trains. **You cannot buy better goods.** You invest your money in established reputation, high grade workmanship, fine materials, unexcelled finished products. And best of all we **save you money.** Our large purchasing power, our policy of low margins and frequent sales, enables us to offer this splendid line of trains at unheard of savings for so standard a product. **Prove it to yourself before buying.**

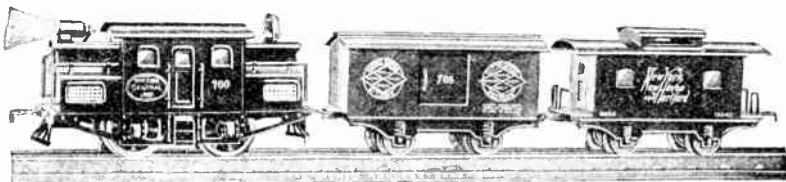
We do not list the complete Lionel line. We have chosen what we consider the **best numbers and the greatest values.** No need of selecting from a confusing array of trains. Our wide experience has taught us what numbers make the **best possible buy.** They are listed below. Make your choice from them, assured that you are getting 20 to 30 per cent more than full value. Lionel Trains, even at regular selling prices, are full value.

### SIZES OF TRACK

Lionel Trains come in two distinct and separate sizes of track. The "O" gauge track is 1 1/4 inches wide. All cars, locomotives, wheels and parts of "O" trains fit the "O" gauge track only.

The Standard Gauge track is 2 1/4 inches wide. All Standard Gauge trains and parts fit this track.

Of course the Standard Trains are larger than "O" trains. However, there is absolutely no difference in construction, finish or workmanship.

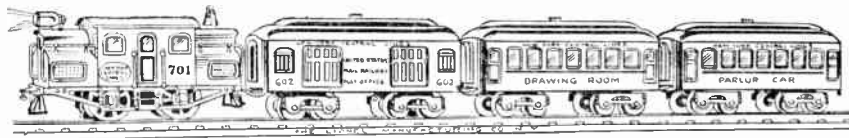


### ELECTRIC TRAIN NO. 90-ES

THE REGULAR PRICE EVERYWHERE IS \$5.00 TO \$6.00. OUR PRICE \$3.95  
("O" Gauge 1 1/4 inches Wide.)

Comprises one N. Y. Central type electric locomotive with real electric headlight, two finely finished freight cars; 8 sections of curved track; making a circle 28 1/2 inches in diameter, with terminal section for connecting current; one speed controlling rheostat for starting, stopping and regulating speed; one instruction book. Length of complete train with cars, 20 1/2 inches. Shipping weight 8 pounds. Operates on 3 dry cells, 2 dry storage cells, or any of our Toy Transformers or D. C. Reducer No. 107 L.

NO. 90-ES Train, complete, in strong box, regular price \$5.00 to \$6.00; our special price.....\$3.95  
NO. 70-ES Train, as above, but with passenger cars, regularly \$5.00..... 3.95



### ELECTRIC TRAIN NO. 77-ES

THE REGULAR PRICE EVERYWHERE IS \$8.50 TO \$9.50. OUR SPECIAL PRICE \$6.85  
("O" Gauge 1 1/4 inches Wide.)

This outfit is larger and more complete than our No. 70-ES. The locomotive is longer and higher and is fitted with a **reversing switch enabling it to go forward or backward.** More track and cars are included. The outfit comprises a fine N. Y. Central electric locomotive, with electric headlight; 8 sections of curved track; 2 sections of straight track; 2 large Pullman cars; one baggage and mail car; one speed controlling rheostat; book of instructions. Makes an oval of track 39 inches long, 28 1/2 inches wide. Shipping weight 11 pounds.

NO. 77-ES TRAIN, others ask \$8.50 to \$9.50, our price.....\$6.85  
NO. 76-ES TRAIN, same as above, but with only two cars, and 2 less sections of track, others ask \$7.50 to \$8.50. Our price..... 5.95  
NO. 71-ES TRAIN, same as No. 76-ES, but engine is not reversible. Train is 23 1/2 inches long. Others ask \$6.50 to \$7.50. Our price..... 5.25

NOTE—Steam type locomotive and tender at 50 cents extra will be furnished if desired on trains Nos. 70-ES and 71-ES only.

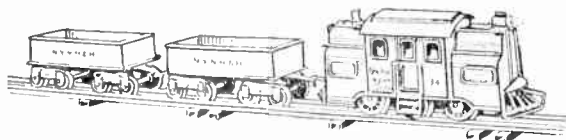
## ELECTRIC TRAIN NO. 92-ES

OTHERS ASK \$7.50 TO \$9.00. OUR PRICE \$5.95

(7" Gauge Track 1 1/4 Inches Wide.)

This outfit is similar to our No. 76 E. S. trains, but has 3 freight cars (one cattle car, one box car, one caboose), making it a freight instead of a passenger train. A fine outfit, complete with speed controller, track, instructions.

<b>NO. 92-ES TRAIN</b> , as described, shipping weight 11 pounds. Value at least \$7.50. Our price.....	\$5.95
<b>NO. 95-ES TRAIN</b> , same as above, but with more powerful locomotive that runs either forward or backward; regular price \$10.00 to \$12.00. Our price.....	7.95
<b>NO. 401-ES TRAIN</b> , same as No. 92-ES, but with steam type locomotive. Special price.....	6.40



## ELECTRIC TRAIN NO. 37-ES

OTHERS ASK FROM \$8.00 TO \$10.00. OUR SPECIAL PRICE \$6.65

(Standard Gauge Track 2 1/4 Inches Wide.)

This is a very large train for its price and its handsome appearance, together with its attractive flat cars, make it a most pleasing outfit.

The set consists of a large N. Y. Central type locomotive with electric headlight; length of locomotive 11 inches; two fine, big flat cars, upon which "freight" may be carried; 8 sections of curved standard gauge track, making a circle 3 1/2 feet in diameter, with terminal section, and an instruction book, all packed in a strong box. The train is 31 inches long, as fine and complete a set as ever was offered at double the price. The cars are 9 1/2 inches long, 3 inches wide. Shipping weight of complete set 12 pounds.

<b>NO. 37-ES TRAIN</b> , as described, others ask \$8.00 to \$10.00. Our price.....	\$6.65
<b>NO. 39-ES TRAIN</b> , larger locomotive (12 inches long) has reversing control switch for running train in both directions, cars are of the dump bottom type. Others want \$10.00 to \$12.00 for this set. Our special price.....	7.95
<b>NO. 34-ES TRAIN</b> , same as No. 37-ES, but equipped with two beautiful passenger cars (one Pullman and one observation). An extra attractive set. Others ask \$11.00 to \$13.50. Our special price.....	\$8.80

## ELECTRIC TRAIN NO. 41-ES

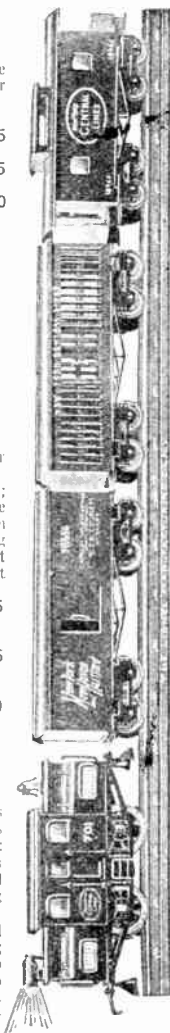
OTHERS CHARGE \$14.50 TO \$18.00. OUR SPECIAL PRICE \$11.60

(Standard Gauge Track 2 1/4 Inches Wide.)

This extraordinary, complete and handsome freight train is one of the best values we offer. Any boy will be proud to own this fine set and will gain endless hours of wholesome fun and education with it. The set comprises 18 pieces as follows:

One N. Y. Central type large locomotive with reversing switch for running backwards or forwards and real electric headlight; 8 sections of curved standard gauge track and 4 straight sections, making an oval 5 3/4 feet long, 3 1/2 feet wide; 5 cars, consisting of 1 mining car, 1 box car, 1 flat car, 1 cattle car and caboose. The whole train is over 5 1/4 feet long and is most imposing and natural looking. To the smallest detail all the characteristics of real railroads are incorporated in the parts, even showing the steel rivets used on modern cars. You can't beat this outfit. Toy boys who want a fine electric train set cannot do better than this. The set will run on 5 dry cells, 4 dry storage cells, or our Toy Transformers (75 watt size). If you want the best that a reasonable amount of money will buy, send for this splendid outfit—save from \$3.00 to \$6.00 by buying from us. Shipping weight 20 pounds.

<b>NO. 41-ES TRAIN</b> , complete as described, regularly priced at \$14.50 to \$18.00. Our price.....	\$11.60
<b>NO. 41-ES TRAIN</b> , same as above, but with large steam type locomotive.....	13.90
<b>NO. 52-ES TRAIN</b> , the most powerful train we offer. Has locomotive 13 inches long, 5 inches high. Has 3 cars (2 Pullmans and one observation). Extra fine finish. Extra large cars, 11 inches long. Others ask \$20.00 to \$25.00. Our price.....	\$15.00



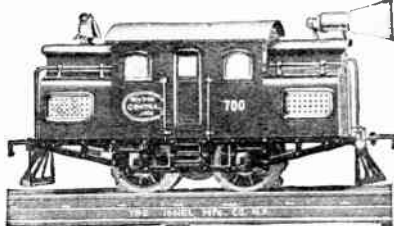
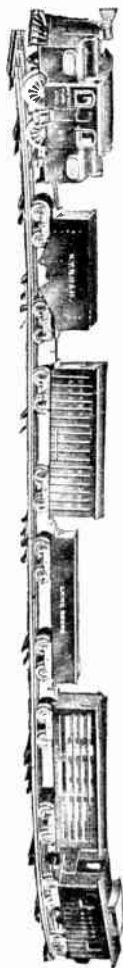
No. 92-ES

## HOW TO SAVE MONEY

Don't use ordinary batteries for your electric trains or other electrical toys. It's expensive. Run your toys right from the electric lighting wires by using our Toy Transformers (page 77) or our D. C. Reducer (page 76) or our Dry Storage Cells (page 92).

# ELECTRIC LOCOMOTIVES AT BIG SAVINGS

( $0$ ' GAUGE for  $1\frac{1}{4}$  Inch Track.)

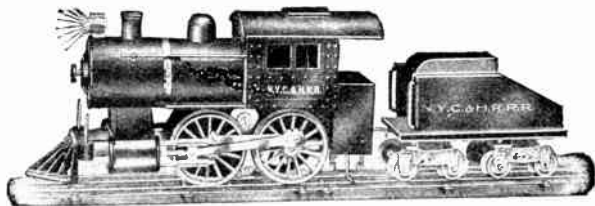


**NO. 700-ES LOCOMOTIVE, N. Y.** Central type; 7 inches long;  $3\frac{1}{4}$  inches high;  $2\frac{1}{2}$  inches wide; electric headlight; 4 wheels; runs in one direction; shipping weight 2 pounds. Regular price \$3.50. Our price..... \$2.80

**NO. 706-ES LOCOMOTIVE, N. Y.** Central type; 8 inches long;  $3\frac{1}{2}$  inches high;  $2\frac{1}{2}$  inches wide; reversing switch to run backwards or forward; electric headlight; shipping weight 2 pounds. Regular price \$5.00. Our price..... 3.95

**NO. 704-ES LOCOMOTIVE, N. Y.** Central type; 9 inches long; 4 inches high;  $2\frac{3}{4}$  inches wide; has 8 wheels; reverser, and electric headlight; very powerful; shipping weight 3 pounds. Regular price \$9.00. Our price..... 7.20

**NO. 710-ES LOCOMOTIVE, steam type; electric headlight; runs in one direction;  $7\frac{1}{2}$  inches long; handsome finish; complete, with tender; shipping weight 2 pounds. Others ask \$8.50. Our price..... 4.35**



(STANDARD GAUGE LOCOMOTIVES FOR  $2\frac{1}{4}$  INCH TRACK)

**NO. 33 LOCOMOTIVE, N. Y.** Central type; 11 inches long; 3 inches wide;  $1\frac{1}{2}$  inches high; electric headlight; runs in one direction; very fine finish; shipping weight 5 pounds. Others ask \$5.50. Our price..... 4.45

**NO. 38 LOCOMOTIVE, same as above but longer and wider; has reverse to run backward or forward; 12 inches long;  $3\frac{1}{2}$  inches wide; 5 inches high; shipping weight 6 pounds. Others ask \$7.00. Our price..... 5.60**

**NO. 42 LOCOMOTIVE, N. Y.** Central type; very powerful; 8 wheels;  $15\frac{1}{2}$  inches long; 6 inches high; 4 inches wide. Any boy who gets this locomotive can consider himself fortunate. Electric head light and reverser included; shipping weight 10 pounds. Others ask \$14.75. Our price..... 9.40

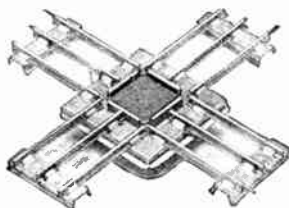
**NO. 5-ES LOCOMOTIVE, steam type; 11 inches long;  $5\frac{1}{2}$  inches high; splendidly made and finished. Electric headlight; reversing controller; double truck tender; 7 inches long; a beautiful locomotive; shipping weight 9 pounds. Others ask \$9.50. Our price..... 7.65**

## "O" GAUGE CARS

(Shipping weight, any size, 1 pound.)

The most beautifully finished cars made. Baked enamel; bright colors; fine embossing and lithographing; smooth wheels. Locomotives will pull from 4 to 8 cars, depending on size.

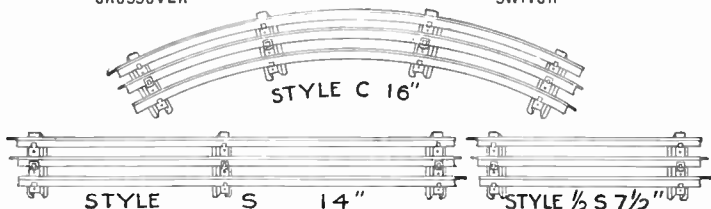
<b>NO. 0800 BOX CAR, 6x2x3 inches.</b>	Regular price \$0.40.	Our price.....	\$0.32
<b>NO. 0820 BOX CAR, <math>7\frac{1}{2}</math>x2<math>\frac{3}{4}</math>x3<math>\frac{1}{2}</math> inches; double truck.</b>	Regular price \$0.75.	Our price.....	.60
<b>NO. 0802 CATTLE CAR, 6x2x3 inches.</b>	Regular price \$0.40.	Our price.....	.32
<b>NO. 0821 CATTLE CAR, <math>7\frac{1}{2}</math>x2<math>\frac{3}{4}</math>x3<math>\frac{1}{2}</math> inches; double truck.</b>	Regular price \$0.75.	Our price.....	.60
<b>NO. 0801 CABOOSE, 6x2x3<math>\frac{1}{4}</math> inches.</b>	Regular price \$0.40.	Our price.....	.32
<b>NO. 0822 CABOOSE, <math>7\frac{1}{2}</math>x2<math>\frac{3}{4}</math>x3<math>\frac{1}{2}</math> inches; double truck.</b>	Regular price \$0.75.	Our price.....	.60
<b>NO. 0600 PULLMAN, 6x2x3 inches.</b>	Regular price \$0.40.	Our price.....	.32
<b>NO. 0601 PULLMAN, <math>7\frac{1}{2}</math>x2<math>\frac{3}{4}</math>x3<math>\frac{1}{2}</math> inches; double truck.</b>	Regular price \$0.75.	Our price.....	.60
<b>NO. 0602 MAIL CAR, <math>7\frac{1}{2}</math>x2<math>\frac{3}{4}</math>x3<math>\frac{1}{2}</math> inches; double truck.</b>	Regular price \$0.75.	Our price.....	.60



CROSSOVER



SWITCH



TRACKAGE

Lionel track is made on the 3-rail principle. It is exceedingly strong both physically and electrically. This trackage is all tested for 110 volts. Our prices are far below normal.

**"0" GAUGE TRACK (1 1/2 INCHES WIDE)**

No.	Lenh, In.	Shape	Reg. Price	Our Price
C	14	Straight	\$.20	\$.16
CC	16 1/2	*Curved	.20	.16
1/2 S	7 1/2	Straight	.15	.12 1/2
22	16 1/2	Switch	2.00	1.60
20	12	Crossing	1.00	.80
23	14	Bumper	1.00	.80

**STANDARD GAUGE TRACK (2 1/4 INCHES WIDE)**

No.	Length, In.	Shape	Reg. Price	Our Price
OS	10 1/4	Straight	\$.10	\$.08
OC	11 1/2	*Curved	.10	.08
O22	11 1/2	Switch	1.50	1.20
O20	10 1/4	Crossing	.75	.60
O23	10 1/4	Bumper	.75	.60

\*8 curved sections make complete circle.

State whether left or right hand switches are desired, when ordering; 1 left and 1 right make a pair.

Shipping weight of tracks 1 pound for 2 sections. Shipping weight of switches and crossings 3 pounds each.

## CHEM CRAFT

### A COMPLETE BEGINNER'S CHEMICAL LABORATORY

Chemistry is one of the most important of the sciences because of its application to all the industries. It goes hand in hand with electricity. Electro-chemistry and electro-chemists are in great demand. No subject is more fascinating—nothing better lends itself to fascinating experiments. Chemical experiments are startling and mystifying.

In **Chemcraft** the various phases of chemistry have been combined into a fascinating series of experiments which will furnish amusement and education to young and old. **Chemcraft** contains no dangerously poisonous chemicals. With ordinary care, and even carelessness, no danger of any kind need be apprehended, even to younger boys and girls.

The instructions are most interesting and complete. They comprise a large 30 page book, written so anyone can understand it.

#### WHAT CHEM CRAFT CONTAINS

You never received a neater and more complete package. Everything is sent to you in perfect shape. All packed in neat, separate wooden boxes and bottles, in a very strong partitioned box.

- 36 Different chemicals in boxes and bottles.
- 3 Mystery Tubes
- 5 Assorted Test Tubes
- 1 Stirring Rod
- 1 Glass Tube
- 1 Spatula
- 1 Forceps
- 1 Candle
- 1 Spoon
- 1 Complete Chemical Book

Rare chemicals are included, such as genuine metallic sodium and others. Enough chemicals are included for countless experiments. Everything neatly labeled to prevent mistakes.

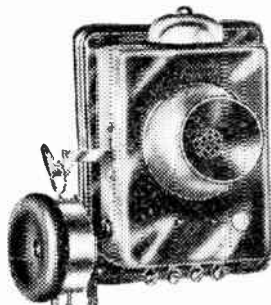
A more satisfactory chemical laboratory never was devised. The price is extremely low. And for this big outfit today. Educate, fascinate, amuse and instruct yourself with the wonderful science of chemistry.

**NO. 3737 CHEM CRAFT**, as described, size of box 12x12x3 inches; shipping weight 5 pounds.....\$2.00





## "CROWN" INTER-PHONES



These instruments have been on the market for years. They are the lowest priced practical phones and will give absolute satisfaction. Thousands of them are in use and they seem to last indefinitely—will last for many years, in fact. The cases are made of stamped steel with a durable black rubber baked finish. Standard construction throughout, with excellent receiver and transmitter; fine workmanship; complete bell signal with push buttons. The action is entirely automatic. The voice is very loud and clear. The phones are neat, compact, durable and highly efficient.

These popular phones are in thousands of shops, stores, homes, factories and experimenter's laboratories. They are good, all around phones and are thoroughly practical and fool proof. We cannot recommend them too highly. Run on dry cells or wet batteries.

- NO. 275 CROWN TELEPHONE**, single station only, shipping weight 3 pounds..... **\$2.00**  
**NO. 277 CROWN TELEPHONE**, two stations, a most remarkable inter phone set, shipping weight 6 pounds..... **3.75**

## THE ELECTRO-SET PAIR-PHONE

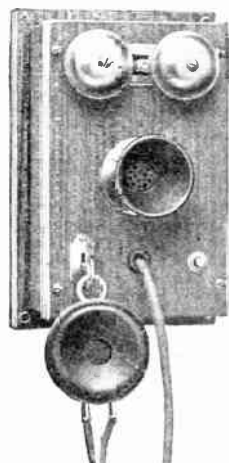
FOR TWO PARTY INSTALLATIONS

The Electro-set Pair-Phone is the result of years of experience and conscientious endeavor to meet the demand for a substantial, yet simple and easily installed instrument for two party use at a moderate price. It is a marked improvement on anything heretofore devised. An examination of this instrument shows many desirable details of construction not before offered on similarly priced phones.

Its outside terminals, at the bottom (where inconspicuous) make installation easy. It is, therefore, unnecessary to expose the mechanism when attaching, and all working parts are thus protected from dust and accidental injury. Its parts are all mounted upon the front, which may be removed by taking out the four front screws. If, for any reason, it is desirable to examine the mechanism after installing, this may be accomplished without removing it from the wall and thus the danger of defacing the wall or causing the plaster to break away is eliminated. It has machine screw terminals, permanent adjustable bell, self contained switch hook, guaranteed transmitter and receiver and, in fact, all are such as to insure permanent service for years. The Electro-set Pair-Phone may be used between house and garage, office and shipping room, up stairs and down stairs, your house and neighbors, and thousands of similar places. These phones are exceedingly handsome in appearance. We go on record as saying that, in our opinion, no finer inter-phones are manufactured.

Don't pay exorbitant prices, when these phones will serve so well. Finished in gold oak. For use in pairs only. Siz 5 $\frac{3}{8}$  x 3 x 8 inches. Shipping weight 10 pounds per pair.

- NO. 0230 ELECTRO-SET PAIR-PHONES**, complet, 2 instruments..... **\$7.50**



## ELECTRO-SET INTER-PHONES

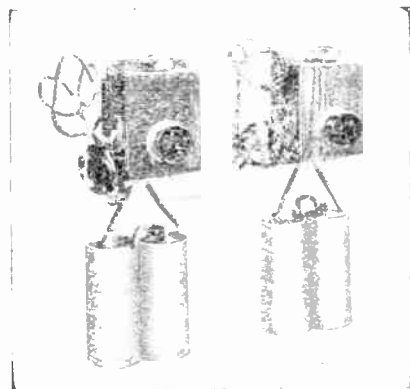
These hand-one and efficient little telephones are ideal for any short telephone lines up to  $\frac{1}{2}$  or  $\frac{3}{4}$  mile. Any one can connect them up for use, as the wiring is extremely simple.

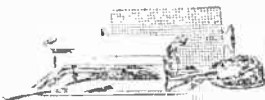
The talking qualities of Electro-set Inter-Phones are remarkable for their loudness and clearness of tone. The exterior finish of these phones is very durable and hand-one. The boxes are made of fine quarter-sawed oak, polished to a piano finish. The metal parts are neatly nickel plated. The workmanship is of the highest grade. Electrically and mechanically these phones are ideal.

The transmitters and receivers are scientifically constructed of fine materials. The phones, when once set up, are automatic in action and cannot readily get out of order. With proper care they will last for years of constant use. They are economical of current and, for their quality, are very low in price.

- NO. M-1014 ELECTRO-SET INTER-PHONES**, less batteries or wire, each..... **\$2.50**

Per pair ..... **4.85**  
 (Shipping weight 8 pounds per pair.)





## HOUSEHOLD NEEDS

We carry in stock at all times a most complete and high grade line of electrical heating devices. We especially call your attention to the Westinghouse Devices pictured on this page. These items are the finest devices of their kind made today. Westinghouse Heating Apparatus is the world's standard in low initial cost, handsome appearance, and most practical design.

Each piece is so beautiful in appearance that you will be delighted with Westinghouse apparatus at first sight. But the most pleasing feature about these splendid devices is the way they operate.

### THEY EXCELL IN PRACTICAL USAGE.

Every piece of Westinghouse Heating Apparatus is guaranteed.

The Electro-set Co. are authorized agents. We will serve your needs accurately and quickly with latest models and newest goods. Send for circulars. Enclose self-addressed and stamped envelope.

### PRICES.

The prices on all heating apparatus throughout the U. S. have been revised and in some cases slightly raised. Do not be deceived by old price lists in out-of-date catalogues. Electro-set prices always save you money.

NO. 6101 HEATING PAD, 3 heat, prepaid.....	\$ 6.50
NO. 6102 COFFEE PERCOLATOR, 5 cup, prepaid.....	7.00
NO. 6103 MILK WARMER, prepaid.....	7.50
NO. 6104 COFFEE PERCOLATOR, 7 cup, prepaid.....	9.00
NO. 6105 TRAVELER'S IRON, 3 pound, prepaid.....	3.50
NO. 6106 RADIANT TOASTER, prepaid.....	2.25
NO. 6107 LUMINOUS HEATER, prepaid.....	13.50
NO. 6108 CHAFING DISH, prepaid.....	12.00
prepaid.....	8.25
NO. 6109 HOUSEHOLD IRON, 6 pound, prepaid.....	9.50
NO. 6111 "COZY GLOW" LUMINOUS HEATER, prepaid.....	10.00
NO. 6112 COFFEE PERCOLATOR, Urn type, prepaid.....	10.00
NO. 6113 COFFEE PERCOLATOR, glass top, prepaid.....	7.00
NO. 6114 TEA SAMOVAR, prepaid.....	13.00
NO. 6115 SAUTE PAN, prepaid.....	11.50
NO. 6116 DISC STOVE, 4 inch, prepaid.....	4.50
NO. 6117 DISC STOVE, 6 inch, prepaid.....	4.75
NO. 6117 DISC STOVE, 6 inch, 3 heat, prepaid.....	6.25
NO. 6118 TOASTER STOVE, prepaid.....	6.00

The items are listed in the order illustrated, beginning at the top left hand corner and continuing down and around the page.

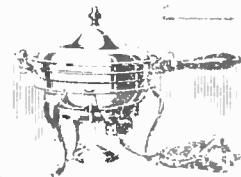
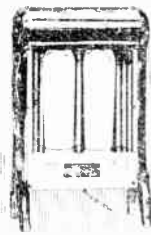
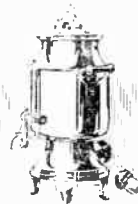
Send 2 cent stamp for complete bulletin.

Other less expensive Heating Appliances always on hand—none as good as Westinghouse.

Irons, \$1.95 up.

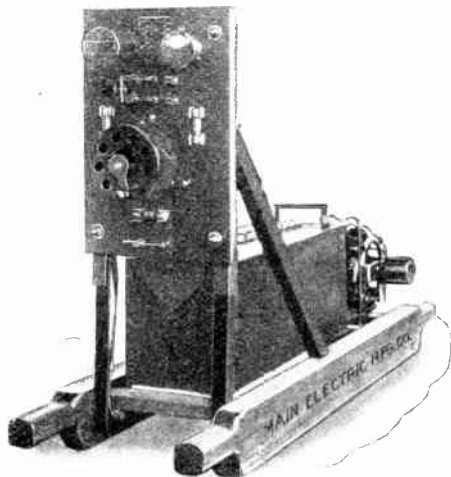
Toasters, \$1.50 up.

Disc Stoves, \$2.50 up.



# ELECTRIC LIGHT PLANTS

## For Isolated Homes, Farms, etc.—7 Light to 1000 Light



### ELECTRIC LIGHTING AND POWER PLANTS.

No longer need you live in the city to enjoy the conveniences and advantages of clean, bright electric light and power. Every farm, isolated home, store, factory or other building can now have electric conveniences of every kind.

The Main Electric Lighting and Power Plants bring these city conveniences right into your own home.

The cost is most moderate; the operation is simplicity itself; the installation may be made by anyone without previous electrical knowledge.

Money invested in a Main Electric Lighting Plant is well invested. It increases the value of any home, and pays large returns in the way of saving time, labor, eyesight, etc.

### ENJOY ELECTRICAL CONVENIENCE AT 1-10 COST.

Electric heating devices of all kinds for the home may be operated from an electric light plant and the cost of producing current is so small, as compared to Central Station current that the owner of a private plant can enjoy these luxuries at 1-10 the cost of the average city resident. The average city resident pays from 10 to 15 cents per K. W., whereas a Main Plant will produce current for about 1½ cents per K. W. using gasoline, and even less using kerosene, crude oil or natural gas.

### WHAT ONE CENT WILL DO.

One cent's worth of electricity from a Main Electric Plant will operate—

A 16 C. P. Lamp for 19 hours.

An Electric Washing Machine for 2 hours.

A Sewing Machine for 8 hours.

A Heating Pad (for sick room) for 6 to 8 hours.

An Electric Curling Iron (once each day) for 31 days.

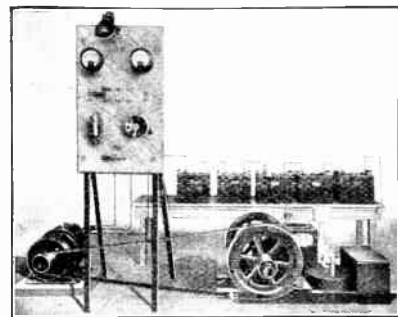
Will make 25 slices of toast on an Electric Toaster.

Will make 12 cups of coffee in a percolator.

Will heat a 6 pound Flat Iron for 1 hour etc.

The many uses to which an Electric Lighting Plant may be put places this system of illumination in a class by itself.

Main Electric Plants are favorably known in every corner of the world. They are an accepted standard in original value and ultimate performance. We list here-



with only two small outlets. The line comprises a very complete selection.

Send 8 cents in stamps for our big, handsome book showing many styles of plants, engines, batteries and equipment. Full of valuable information. Your copy is waiting for you.

### MAIN MIDGET, TYPE XX, 7-LIGHT PLANT—\$69.95

The sensation of the times, a high grade, well constructed, practical 30 volt, Main Electric Lighting Plant, now within the means of all who desire the better light.

It is a quality product, like all the larger Main Plants. If it is large enough for your requirements, it will be as successful as the larger Main Plants. It is built to furnish light only (will not operate electrical devices or furnish power.)

For small homes it is ideal, but most farm homes require a larger plant, such as our 37 light size and upward, which we most strongly recommend, as then power for the churn, washing machine, etc., can be had, as well as for electrical devices for the household.

The Main Midget is a 30 volt plant. (A 30 volt is the lowest voltage the Main Electric Mfg. Co. will put out, as anything under it is not practical or satisfactory in our judgment.)

It has a 15 cell, 30 volt, enclosed in hard rubber jars, 35 ampere hour battery, a 40 volt, 175 watt dynamo, and slate folding type switchboard with double pole, double throw, and single pole, single throw switches, with cartridge fuses, thermostat, automatic circuit breaker and double reading ammeter completely wired up, mounted on skids ready for immediate use on its arrival, as the battery is fully charged, and all that is necessary is to connect two wires from the lamps to the switchboard and light is immediately available.

NO. 7 TYPE XX PLANT, as described, no engine.....	\$69.95
NO. 7-E TYPE XX PLANT, with 1½ H. P. engine, mounted on same skids.....	98.95
NO. 50XX ENDLESS BELT, best grade leather.....	1.50
NO. 100-XX HYDROMETER, for battery test.....	1.50

### LARGER MAIN ELECTRIC PLANTS

The finest products of their kind manufactured today. Send for complete catalogue, 8 cents in stamps.

Type	Dynamo	Switchboard	Capacity	Price Without Engine	Price With Engine
AA	250 Watt	Vermont Marble	25 S C. P. Lamps or 12 16 C. P. Lamps	\$142.00	\$168.00
1-A	¾ K. W.	Vermont Marble	75 S C. P. Lamps or 37 16 C. P. Lamps	190.00	265.00
2-B	1 K. W.	Vermont Marble	100 S C. P. Lamps or 50 16 C. P. Lamps	275.00	350.00

### OTHER SIZES UP TO 1000 LIGHT PLANTS

These plants come furnished complete with highest grade storage cells, switchboard, meters and controls if you have an engine or waterpower on the premises, no additional engine is necessary.

### MAIN LIGHTING PLANTS ARE BEST

Send 8 cents in stamps for the Big Catalogue and Instruction Book.

# THE FAMOUS WALLACE LAMPS

FOR STUDENTS      FOR TRAVELERS      FOR HOMES

HANGS, STANDS, STICKS OR CLAMPS ANYWHERE

The Wallace Patented Adjustable Electric Lamp is the handiest lamp in the world and the only lamp which can be collapsed and carried in a grip.

Concealed in the base of lamp is an automatic spiral clamp spring by means of which you can hang lamp on the wall or clamp it instantly to bed-rod, dressing table, desk or chair; iron grip rubber suction cup, for sticking lamp to mirror, window pane or any other non-porous surface; ten feet of extension cord and patent plug which connects with any electric fixture. You can stand the Wallace anywhere; hang or stick it any place; tilt lamp and shade up or down or sideways. No matter where you want light, the Wallace will concentrate the light just there.

Think of the convenience of reading, writing or working in a strong and steady light, with your eyes always in shadow; of moving from one occupation to another and having the same comfortable light always at your elbow; of reading in bed or working at your desk, without straining your eyes in the least. That's the Wallace.

Use the Wallace in your home or office and be sure of always having light just where you need it. Carry the Wallace with you wherever you go. It overcomes inconvenient lighting arrangements in hotels and dressing rooms and takes up practically no room in your grip, folding into a compact ball when not in use (see illustration.) The Wallace is adaptable to a hundred uses, and is truly a marvel of comfort and convenience.

If you use your eyes you need a "Wallace."—You are bound to buy one eventually—better do it now. Eye-strain is dangerous and is almost invariably caused by poorly placed lights. Heed the warning sounded by tired eyes and get a "Wallace."

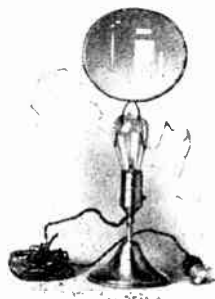
Use it ten days. If you are not entirely satisfied, return it and your money will be immediately refunded. The Wallace Lamp, set up, stands about 10 inches high. Collapsed, for traveling, it measures about 4½ inches square over all.

The ideal light for students, readers, shop work, bedroom light, etc. Excellent as a shaving lamp. Everyone needs the Wallace. Buy one for your shop, home, office, store. It's the only original portable collapsing lamp—the handiest thing in the world. Comes neatly packed, without bulb, and with complete directions.

NO. 7710 WALLACE LAMP, nicked brass.....	\$2.50
NO. 7720 WALLACE LAMP, brushed brass.....	2.50
NO. 7730 WALLACE LAMP, bronze finish.....	2.50

(Prices include shipping anywhere in the world.)





### THE WALLACE TWO-LIGHT EXTENSION ARM.

A fixture that is indispensable wherever a double connection is desired. Especially useful where an electric iron or sewing machine motor is employed, offering current for both light and power at the same time. It also makes a two-light fixture of any Wallace Lamp and is most attractive on the dressing table or for general boudoir use. In brush brass, bronze or nickel.

NO. 104—each ..... \$1.50

Fancy Shades—All shades are fitted with our patent spring, which clamps solidly on any bulbs of ordinary size, and may be tilted to any angle.

NO. 105 SILK SHADE, with brocaded border, in pink, old gold and light blue, each.....\$1.00

NO. 106, CRETONNE, in attractive patterns; predominating colors, pink or blue, each..... .75

### THE WALLACE SHAVING MIRROR.

This unique shaving mirror is designed especially for the Wallace Lamp, although it will fit any standard electric light bulb. The very handiest of shaving mirrors. It is fitted with the Wallace patented spring clamp, and may be instantly adjusted and as quickly removed. Tilts to any angle. May also be used as a stand mirror, as it has an easel back.

NO. 107—each.....\$0.50

### THE WALLACE SHADE.

Made in brushed brass, bronze or nickel, fitted with the Wallace patented spring clamp instantly adjustable to any standard electric light bulb.

NO. 109—each.....\$0.50

### THE WALLACE SUCTION CUP.

The Suction Cup, being of rubber, will deteriorate eventually. When it fails to adhere properly, remove it and screw in a new one.

NO. 108—each.....\$0.10

### THE WALLACE CORD.

NO. 110—Same grade as supplied with lamp, per foot.....\$0.05

NO. 7740 DOUBLE WALLACE LAMP, complete with extension arm and two handsome cretonne shades, as illustrated. A beautiful bedroom lamp. Prepaid.....\$4.50

NO. 7750 DOUBLE WALLACE LAMP, complete with extension arm and two brass shades. A splendid desk or reading lamp. Complete, prepaid 4.00

### LIKE TO READ IN BED?

The Wallace Lamp clamps right on the bars or wood in two seconds. Throws a strong light over your shoulder. Saves eyes. Comfortable. Convenient.

## THE WALLACE LAMP IS THE ORIGINAL COLLAPSIBLE PORTABLE LAMP

It is known and advertised in all the big periodicals and publications. It is the most convenient little portable electric lamp ever offered to the public. Hundreds of thousands of Wallace Lamps are in daily use in every corner of the globe. If you want to give your friends or family a novel, useful gift, order a Wallace Lamp from us today.

Dear Sirs: I have used your N. A. A. Tested Galena for a long time and find that it is the best mineral on the market.

701 N. Kickapoo St.

Lincoln, Ill.

ELMER L. LATHAM.

Lancaster, N. Y.

Gentlemen: I am in receipt of your shipment of goods and I am very much pleased to find that they were just as I ordered.

1 Aurora St.

STANLEY E. BROWN.



# BOYS: THIS SECRET SERVICE WRITING OUTFIT IS GREAT FUN



## EVERYBODY CAN USE THIS SET ONLY 35 CENTS COMPLETE

Here's a new, interesting little outfit for sending messages, letters, plans, diagrams, etc., in invisible ink. No one can read or understand them—no one can see anything excepting the bare paper—unless he or she knows the special process for making the writing visible.

Anyone can use this set. You write with it just as with ordinary ink. But the writing won't show until it undergoes a certain treatment.

This Secret Service Writing Outfit is designed for Boy Scout field use, sham battles, maneuvers, etc., for communicating between troops so that the "enemy" cannot read "secret" plans if the scout message bearer is "cap-

tured." Secret ink is used in warfare for just such purposes as described above. There are many uses for secret ink that are of a practical nature. Thus, the numbers representing safe combinations may be kept without fear of any undesirable persons learning them. Countless other uses will suggest themselves.

Hours of fine amusement are afforded the whole family by drawing invisible pictures, later to be "developed" and made visible to all. Many interesting games and other amusements will readily be suggested to everyone. Any paper may be used.

Entertainment, instruction, practical uses in every outfit.

The set consists of the following:

- 1 Box Secret Ink Powder.
  - 1 Box Developer Powder.
  - 1 Small Bottle for Making Ink.
  - 1 Small Bottle for Making Developer.
  - 10 Sheets Colored Paper.
  - 2 Blotters.
  - 1 Pen Wiper.
  - 1 Special Non-Corrosive Pen.
  - 1 Large Substantial Pen Holder.
- Directions and Neat Box.

All the above for only 35 cents, postage paid. Send for a set today. Indispensable to Boy Scout Troops—great fun for boys, girls—all the family. It's new—nothing to hurt you—extremely simple when you know how.

NO. 6665 BOY SCOUT SECRET SERVICE WRITING OUTFIT, size of box 2½x3½x6 inches, postpaid .....\$0.35

# Delta Electric Bicycle and Vehicle Lamps

FINEST IN MATERIAL AND WORKMANSHIP

HANDSOME AND PLEASING DESIGN ADDS GRACE TO ANY BICYCLE OR MOTORCYCLE

Throw strong concentrated and wide diffused light. Have distant control switch. No troublesome Edison socket. Headlight will not jar down.

Operate 50 to 100 hours on one charge.

### POINTS OF SUPERIORITY

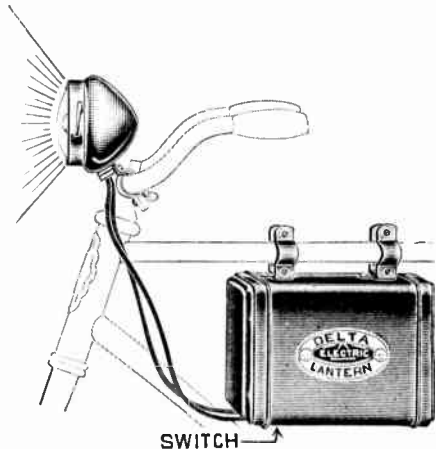
**GENERAL DESIGN**—Headlight is not over-size, making it look bulky and unsightly. It is a graceful size and shape.

**LENS**—Three inches in diameter, extra heavy, extending considerable beyond front of the lamp.

**REFLECTOR**—Parabolic curve, drawn extra deep. Made out of special brass silver plated and polished to a mirror finish. Designed to throw powerful search light and in addition throws a wide diffused light for turning.

**BULB**—Delta Bulbs are now recognized as the highest grade ones on the market. Drawn tungsten wire is used in the filament and the bulb is carefully tested for current, candle power and mechanical construction, is aged and rested before being shipped. Has miniature screw base which is now universal for hand lanterns. Our regular two cell electric lantern bulb fits our bicycle lamps.

**HEADLIGHT CLAMP**—Fastens to handle bar by a vise grip which can be tightened with a thumb nut. Clamp is not long enough to cause the headlight to jar down which is common trouble with most bicycle lamps. **HEADLIGHT** can be turned on clamp as it is held by a spring washer. Thus the light can always be thrown exactly in front of the wheel.



**CONNECTIONS**—Ordinary wires are attached to lamp and battery with ordinary screws which can be done with any kind of a screwdriver or even a pocket knife. The troublesome Ewswan screw connections have been eliminated.

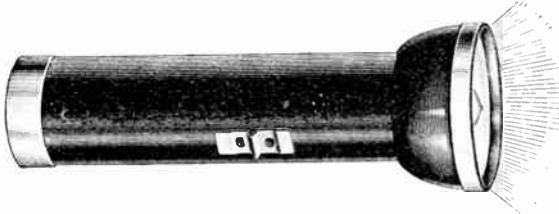
**SWITCH NOT LOCATED ON HEADLIGHT**—The switch is on the battery case where it belongs. Not necessary to jam and push the headlight to turn it on and off. The wires enter on the bottom side, eliminating all mechanism on the lamp proper.

<b>NO. 28 DELTA BICYCLE OR MOTORCYCLE LAMP</b> , complete, as illustrated, without batteries, 2 cell style, shipping weight 3 pounds, each.....	<b>\$1.75</b>
<b>NO. 27 DELTA BICYCLE OR MOTORCYCLE LAMP</b> , same as above, but accomodates only 1 cell of battery, shipping weight 2 pounds, each.....	<b>1.50</b>
<b>NO. 288 RENEWAL BULB</b> , Mazda 3 volt, for No. 28 lantern, postage weight 2 ounces, each.....	<b>.21</b>
<b>NO. 277 RENEWAL BULB</b> , Mazda 1½ volt, for No. 27 lantern, postage weight 2 ounces, each.....	<b>.15</b>

## MAXIMUM FLASHLIGHT VALUE 94c

### THIS SPLENDID ELECTRIC SEARCHLIGHT FOR

HERE'S OUR BIG FLASHLIGHT SPECIAL.



Here's the greatest flashlight value we've ever had the good fortune to offer to our customers. It's strong in construction, handsome in appearance, practical in use. It throws a piercing beam of light for many feet and will give a maximum amount of service at minimum cost to you. No flashlight selling at 50 per cent higher price can equal the performance of this

remarkable special which we offer at only 94 cents, complete, ready for use.

The size is convenient. We can recommend this flashlight to autoists, campers, workmen, inspectors, housekeepers, electricians and for literally thousands of other uses.

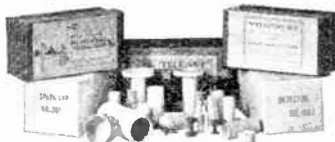
You'll have to see this fine flashlight to appreciate it. The splendid silver plated reflector, highly polished black metal case, handsome nicked trimmings, sturdy switch, convenient renewal provisions—all eloquently indicate **VALUE**. You'd say it ought to sell for \$2.00 when you see it.

The scientific construction insures lasting service. The case is non-short circuitable. The bulb is properly focused. The lens is clearly and accurately ground—double convex—2 inches diameter. Size of flashlight 6½ inches long. Diameter of case 1½ inches. It's an ideal flashlight at an ideally low price. Order one today.

<b>NO. D 1 SPECIAL FLASHLIGHT</b> , shipping weight 1 pound, complete.....	<b>\$0.94</b>
<b>NO. D-11 RENEWAL BULB</b> , 2.8 Mazda.....	<b>.13</b>
(Postage extra, 2 cents.)	
<b>NO. D-12 RENEWAL BATTERY</b> , 2 cell.....	<b>.22</b>
(Postage weight 1 pound.)	

## YOUR CONVENIENCE MEANS A GREAT DEAL TO US

The growth of our big business is founded upon your good will.



A GROUP OF ELECTRO-SET PACKAGES

We are anxious at all times to please our customers — We go out of our way to do so.

The details of boxing and packing receive our careful attention. Good materials and instruments are often ruined by poor packing. We take especial pains to box and pack everything so that it reaches you in convenient form. Does this mean anything to you?

## WIRE TABLES

The following table is invaluable to every person engaged in the study, practice or experimentation of electrical things. The American Standard B. & S. gauge is used universally in this country. The even size wires are in most general use. Note the valuable appendix to this table.

## AMERICAN WIRE GAGE TABLE

Properties of Copper Wire: Specific Gravity, 8.878; Specific Conductivity, 1.765 at 75° F.

Gage No.	SIZE		WEIGHT AND LENGTH			RESISTANCE			Carr't Cap. 2,000 Amp. P. Eq. in. sec Amperes
	Diam- eter in Mils.	Square of Diameter or Circular Mils.	Grains per Foot	Pounds per 1000 Feet	Feet per Pound	Ohms per 1000 Feet	Feet per Ohm	Ohms per Pound	
0000	460.000	211600.0	4477.2	639.60	1.561	.051	10029.7	.0000785	430
000	409.640	167804.9	3559.5	507.22	1.971	.063	15804.9	.000125	262
00	364.800	133079.0	2815.8	402.25	2.486	.080	12531.2	.000198	208
0	324.950	105592.5	2236.2	319.17	4.133	.101	9945.3	.000315	165
1	289.300	83694.49	1779.9	252.98	3.952	.127	7882.8	.000501	130
2	257.630	66373.22	1404.4	200.63	4.994	.160	6251.4	.000799	103
3	229.420	52633.53	1113.6	159.09	6.285	.202	4957.3	.001268	81
4	204.310	41742.57	883.2	126.17	7.925	.251	3931.6	.002016	65
5	181.940	33102.16	700.4	100.05	9.995	.324	3117.8	.003206	52
6	162.020	26250.48	555.4	79.34	12.604	.404	2472.4	.005098	41
7	144.280	20816.72	440.4	62.92	15.893	.509	1950.6	.008106	32
8	128.490	16509.68	349.3	49.90	20.640	.613	1555.0	.01289	26
9	114.430	13094.22	277.1	39.58	25.265	.741	1233.3	.02048	20
10	101.390	10381.57	219.7	31.38	31.867	.923	977.8	.03259	16
11	90.742	8234.11	171.2	24.89	40.176	1.289	775.5	.05181	13
12	80.808	6529.93	138.2	19.74	50.659	1.626	615.02	.08237	10.2
13	71.691	5178.39	109.6	15.65	63.898	2.048	488.25	.13087	8.1
14	64.084	4106.75	86.87	12.41	80.580	2.585	386.80	.20830	6.4
15	57.068	3256.76	68.88	9.84	101.626	3.177	306.74	.33133	5.1
16	50.820	2582.67	54.67	7.81	128.041	4.582	243.25	.52638	4.0
17	45.257	2048.19	43.33	6.19	161.551	5.183	192.91	.83744	3.2
18	40.303	1624.33	34.37	4.91	203.666	6.536	152.99	1.3312	2.5
19	35.390	1252.45	26.50	3.786	264.136	8.477	117.96	2.2392	1.96
20	31.961	1021.51	21.60	3.086	324.015	10.394	96.21	3.3438	1.60
21	28.462	810.09	17.14	2.448	408.497	13.106	76.59	5.3539	1.28
22	25.347	642.47	13.59	1.942	514.933	16.525	60.51	8.5099	1.08
23	22.571	509.45	10.77	1.539	649.773	20.812	47.98	13.331	.80
24	20.100	404.01	8.55	1.221	819.001	26.284	38.95	21.524	.63
25	17.900	320.41	6.77	.967	1034.126	33.135	30.18	34.298	.50
26	15.910	254.08	5.38	.768	1302.083	41.789	23.83	51.410	.40
27	14.195	201.49	4.26	.608	1641.737	52.687	18.98	86.657	.31
28	12.641	159.79	3.39	.484	2066.116	66.445	15.05	137.283	.25
29	11.257	126.72	2.69	.384	2604.167	83.752	11.91	218.104	.20
30	11.257	126.72	2.69	.384	2604.167	83.752	11.94	218.104	.20
30	10.025	100.50	2.11	.302	3311.258	105.641	9.466	349.805	.16
31	8.928	79.71	1.67	.239	4184.100	133.191	7.508	557.286	.13
32	7.950	63.20	1.33	.190	5263.158	168.001	5.952	884.267	.098
33	7.080	50.13	1.06	.151	6622.517	211.820	4.721	1402.78	.078
34	6.304	39.74	.847	.121	8261.463	267.165	3.743	2207.98	.062
35	5.614	31.52	.658	.094	10638.30	336.81	2.969	3583.12	.049
36	5.000	25.00	.525	.075	13333.33	424.65	2.355	5561.71	.039
37	4.453	19.83	.420	.060	16666.66	535.33	1.868	8922.20	.031
38	3.965	15.72	.315	.045	22222.22	675.22	1.481	15000.0	.025
39	3.531	12.47	.266	.038	26315.79	851.789	1.174	22415.5	.020
40	3.144	9.88	.210	.030	33333.33	1074.11	.931	35803.8	.015

## WIRE TABLE APPENDIX

Following is a table of relative resistances for common metals. With this table and the preceding copper wire table you can figure the resistance of the important electrical conductors, any size. Thus, the relative resistance of copper is 1.000. Copper is the standard. The relative resistance of 30 per cent German silver is 28. If you want to know the resistance of 1 foot of No. 36 German silver, 30 per cent grade, simply multiply the resistance of 1 foot of No. 36 copper by 28. This gives  $.4246 \times 28 = 11.88$  ohms per foot (approximate). The figures given are accurate enough for most calculations.

## TABLE OF RELATIVE RESISTANCES.

Copper (Pure Annealed).....	1.00
German Silver (30 per cent).....	28.00
German silver (18 per cent).....	18.30
Nichrome (Nickel Chromium).....	62.50
Iron (Commercial Wire).....	6.10
Aluminum (Commercial Wire).....	1.67
Steel.....	8.62
Brass.....	4.50
Nickel.....	7.73
Platinum.....	6.85
Carbon (Arc Light).....	2778 to 5376

**METRIC SYSTEM LENGTH.**

10 Millimeters (mm) = 1 Centimeter (cm)
10 Centimeters = 1 Decimeter (dm)
10 Decimeters = 1 Meter (m)
10 Meters = 1 Decameter (Dm)
1000 Meters = 1 Kilometer (km)

**METRIC WEIGHT.**

10 Milligrams (mg) = 1 Centigram (cg)
10 Centigrams = 1 Decigram (dg)
10 Decigrams = 1 Gram (g)
1000 Grams = 1 Kilogram (kg)

The gram is the weight of 1 cu. cm. of pure water at 39.2 F. The kilogram is the weight of 1 liter of water. A liter is one cubic decimeter 1000 cu. cm.

**APPROXIMATE SPECIFIC GRAVITY TABLE.**

Water = 1.00.

This table shows the comparative weights of metals with water as a standard. Thus, Sp. Gr. of Aluminum = 2.70; of Copper = 8.90. Therefore, copper is over 3 times as heavy as aluminum.

Metal	Sp. Gr.	Wt. Per Cu. In., Lbs.
Aluminum	2.66	.096
Brass	8.50	.307
Copper	8.87	.321
Gold	19.26	.695
Cast Iron	7.21	.260
Wrought Iron	7.78	.281
Lead	11.33	.409
Mercury	13.58	.491
Silver	10.47	.378
Steel	7.83	.286
Zinc	7.10	.260

**MELTING POINT OF METAL.**

Metal	Fusing Point F°	C°
Aluminum	1,160	627
Carbon	Infusible	Infusible
Copper	1,931	1,054
Gold	1,913	1,045
Iridium	3,542	1,950
Iron (cast)	2,192	1,200
Lead	617	325
Nickel	2,642	1,450
Platinum	3,225	1,774
Silver	1,749	954
Woods Metal	149	65
Tin	551	233
Tungsten	Above 3,120	Above 1900

To convert Fahrenheit (F°) Degrees to Centigrade (C°) Degrees subtract 32 and multiply by 5-9. To convert C° to F° multiply by 9-5 and add 32.

**DIELECTRIC STRENGTH OF INSULATING MATERIALS.**

Giving the Voltage Required to Break Down a Thickness of 1 Centimeter .3937 Inch.

Olive Oil, 82,000 volts; Kerosene, 56,000 volts;
Paraffin Oil, 87,000 volts; Solid Paraffin (Wax),
130,000 volts; Beeswaxed Paper, 510,000 volts.
Vulcanized Fibre, 10,000 volts for 1/8 inch.
Hard rubber, 500 volts for 1/1000 inch.

**AVOIRDUPOIS WEIGHT.**

137.5 Grains = 1 Ounce
16 Ounces = 1 Pound
2000 Pounds = 1 Ton
7000 Grains = 1 Pound

**TROY WEIGHT.**

24 Grains = 1 Pennyweight
20 Pennyweights = 1 Ounce
12 Ounces = 1 Pound
1 Pound = 12 Ounces = 240 Pwt. = 5760 Grains

**CONVERSIONS.**

One Meter = 39.37 Inches
One Decimeter = 3.937 Inches
One Centimeter = 0.3937 Inches
One Millimeter = 0.03937 Inches
One Kilometer = 2,265 Pounds

**BREAKDOWN VOLTAGES OF AIR.**

Showing the number of volts required at 125 cycles frequency to jump an air gap between needle points at various distances. Use this table to estimate the voltage of your spark coil, transformer, etc. Use very sharp needles, take accurate measurements. See that the points are kept cool.

Distance Between Needle Points in Inches	Voltage Required to Jump
1/2 Inch	10,000
1 Inch	20,000
2 Inch	36,000
3 Inch	46,000
4 Inch	54,000
5 Inch	62,000
6 Inch	70,000
7 Inch	76,000
8 Inch	85,000
9 Inch	94,000
10 Inch	102,000
15 Inch	142,000 . . .

**SPECIFIC INDUCTIVENESS OF SUBSTANCES.**

AIR = 1.

Material	Ordinary pressure	Inductivity (K) .9997 to 1.00026
Air	1.00000	
Manilla Paper	1.50	
Paraffin (oil)	1.68	to 2.32
Beeswax	1.86	
Paraffin (wax)	1.9936	to 2.32
Resin	1.77	to 2.55
Hard Rubber	2.05	to 3.15
Waxed Paper	3.65	
Shellac	2.74	to 3.60
Glass, such as phot. dry plate glass	3.013	to 3.258
Olive Oil	3.00	to 3.16
Mica	4.00	to 8.00
Porcelain	4.38	
Flint Glass	6.57	to 10.10

**A WIRELESS HINT**

Other things being equal, with an average condenser, your station will radiate maximum energy when the rotary gap is operated at low speed. For best efficiency at high speed use a small sending condenser.

**GROUND SWITCH EFFICIENCY**

Details count in wireless telegraphy. For instance, why spend money for a good wireless set only to cut your results in two by using poorly insulated slate base switches? A few cents more will buy our splendid marble base switches - extra strength, extra insulation, extra efficiency. Don't buy slate base switches. Demand Electro-set Marble Base Ground Switches. See page 16.

Length of Spook Gap Inches	Length of Core, Inches	Diameter of Core Inches	Primary Wire, B. & S. Gauge	Number of Layers in Primary Coil	Secondary Wire, B. & S. Gauge	Secondary Wire, Pounds	Condenser Number of Sheets	Area Each Sheet, Square Inches	Voltage of Battery
1/8	3	1/4	23	12	36	1/4	25	2 x 1	2
1/4	3 3/4	3/8	23	12	36	1/4	40	2 x 1 1/2	2
3/8	4 3/4	1/2	22	12	36	3/4	45	4 x 12	4
1/2	6	5/8	19	12	36	5/8	50	4 x 12	4
5/8	7	3/4	16	12	36	3/4	60	4 x 4	6
1	8	1	16	12	34	1	100	7 x 5	6
1 1/2	10	1 1/8	14	12	34	3	100	9 x 7	12
2	11 3/4	1 1/4	14	12	33	5	150	9 x 7	12
3	14 3/4	1 1/2	12	12	33	10	200	9 x 9	16
6	19	1 5/8	10	3	33	20	260	12 x 8	20

## INDUCTION AND SPARK COIL DATA

### WINDING INFORMATION.

For Tuning, Loading and Coupler Coils.

The following table shows the number of turns of copper wire, when wound in a single layer, to cover a space of one inch length. Use this table to calculate the amount of wire required to wind any size tube as follows:

$$D \times 3.1416 \times T \times L$$

F =

12

Where F = No. of ft. of wire required (unknown).

D = Diameter of coil in inches.

T = No. of turns per inch (see table).

L = Length of winding in inches.

Example—How much wire, in pounds, must I have to wind a tube 10 inches long, 3 inches in diameter with No. 20 enameled wire?

Now D = 3

L = 5

T = 30 (as shown by the table)

$$3 \times 3.1416 \times 30 \times 10$$

P =

12

2827.44

$$\frac{2827.44}{12} = 235.6 \text{ feet}$$

Now, by the wire table, there are 315 feet per lb. You will need

235.6

= .72 pounds, or about 3/4 pound.

315

### NUMBER OF TURNS PER SQUARE INCH OF WINDING CROSS-SECTION.

This figure may readily be obtained by squaring the number of turns per linear inch. Thus: Number of turns of No. 30 bare wire per square inch cross section = 100 = 10,000 turns. The calculation of turns per square inch is useful in magnet windings. Knowing the cross-sectional area of any winding space you can figure turns required.

Note—Area cross section of winding space is obtained by multiplying the length of winding by the depth of winding (i. e. distance from edge of bobbin to the core).

### CALCULATION OF COIL WAVE LENGTHS.

An Approximate and practical figure for the wave length of any tuning coil may be arrived at as follows:

$$W. L. = F \times 12 \times 4$$

39.4

Or Wave Length = Number of feet of wire in the coil times 12, divided by 39.4 and the result multiplied by 4. In other words the wave length of any tuning coil (approximate) is the number of feet of wire in it, reduced to meters, multiplied by 4.

Example—What is the approximate wave length of a coil having 500 feet of wire?

500 feet = 6000 inches = 152.27 meters.

152.27 x 4 = 609 meters = answer.

Note—Above method applies only to tuning and loading coils and not to loose couplers.

### URNS OF WIRE TO THE LINEAR INCH\* The Following Figures Are Accurate for all Practical Work

Size, B. & S. Gauge	Bare Wire Turns per Inch	Single Cotton Turns per Inch	Double Cotton Turns per Inch	Enamel Turns per Inch	Double Silk Turns per Inch	Single Silk Turns per Inch
20	31.3	27.7	25.0	30	27.7	29
22	39	34.4	30.3	37	34.4	35
24	50	41.4	35.5	46	41.4	44
26	62.5	50.2	41.8	58	50.2	56
28	79	60.2	45.8	73	60.2	69
30	100	71.4	55.5	91	71.4	84
32	125	84.0	62.8	116	84	103
34	159	97.0	69.9	145	97.0	125

\*Use the above table in connection with the formula preceding it and fully explained. This table is theoretically correct. In actual use it is well to allow that 10 per cent less turns can actually be wound on the given space.

Elizabeth City, N. C.

Gentlemen: I received the Galena I ordered and can say that it is the most sensitive piece I have ever used.  
P. O. Box 324. E. KERMIT KRAMER.



## AERIAL WAVE LENGTHS.

Although it is recommended that a wave meter (see index) be used to accurately calculate aerial wave lengths the following information will be invaluable for closely estimating.

Vertical aeriads (Marconi original type) have a wave length closely approximating  $4\frac{1}{2}$  times the actual length of the aerial plus ground wire in meters. For "L" type aeriads length is taken from end of "L" plus lead-in plus ground length. For "T" aeriads only  $\frac{1}{2}$  of flat top is considered.

If the inductance of your helix is known (actual turns in use) and the sending condenser capacity is known, for tuned systems use the following:

$$W = 59.6 \quad L \times C$$

Where W = Wave length in meters.

L = Inductance of helix turns in use expressed in centimeters.

C = Capacity in Micro-farads of the condenser and its leads.

NOTE—1 centimeter equals 1-1,000,000 henry inductance.

The following table is fairly accurate for 4-wire aeriads, inverted "L" type. For "T" aeriads divide flat top length by 2 to get actual value for wave length.

## NATURAL WAVE LENGTH TABLE

FOUR-WIRE AERIALS  
(SPACED TWO FEET APART.)  
Flat Top Height in Feet.

Flat Top Length in Feet	30	40	50	60	70	80	90	100
40	125	143	157	181	200	220	239	260
50	137	163	177	200	219	238	263	279
60	162	181	200	219	239	263	281	300
70	175	200	219	237	263	281	300	319
80	200	219	238	258	283	300	324	338
90	214	237	259	275	300	321	340	358
100	237	257	281	300	321	338	363	375
110	252	275	300	319	340	362	385	400
120	275	296	324	337	363	376	400	418
130	294	312	337	356	382	400	419	438
140	312	335	360	375	400	419	439	455
150	337	350	375	400	420	438	455	475

NOTE—To come within the law, and not use waves over 200 meters in length, note that the helix or oscillation transformer will add to the above wave lengths. Better allow 30 to 50 meters for this purpose.

It is found that an aerial may be "loaded" efficiently by means of additional inductance to the extent of 3 to 4 times its natural wave length. Similarly it may be reduced to about 1-2 to 2-3 of its natural length by a series condenser.

From the following two practical examples the capacity of fixed condensers for receiving and sending may be roughly arrived at.

## CONDENSER CAPACITY

A glass plate condenser with plates 1-16 inch thick and 100 square inches of tin foil will give approximately .0005 microfarads capacity.

## SENDING CONDENSERS

A fixed condenser with 100 square inches of tin foil and waxed paper dielectric .01 inch thick has a capacity of approximately .008 microfarads.

## RECEIVING FIXED CONDENSERS

A fixed condenser with 100 square inches of tin foil and waxed paper dielectric .01 inch thick has a capacity of approximately .008 microfarads.

## WAVE LENGTHS

Commercial stations, both land and ship, work on a wave length of approximately 600 meters. Government stations usually are tuned from about 1000 to 2500 meters. Amateur stations are limited to 200 meters.

The wave length of an aerial may be roughly calculated at four and one-half times the length of the aerial and ground and lead in wires combined, expressed in meters.

RADIO INSPECTORS are located in the following cities: (Cleveland, O.; Chicago, Ill.; Boston, Mass.; New York, N. Y.; Baltimore, Md.; Savannah, Ga.; New Orleans, La.; Seattle, Wash.; San Francisco, Cal.)

LICENSES—We recommend that you get a license for your sending set as soon as possible. All that is required of you is that you be able to send and receive at a moderate speed and that you know the wireless law. If you live far away from a radio inspector, it is only necessary for you to swear before a notary that you can use the code and know the law. Mail this to your radio inspector and he will send you a license.

## HOW TO FIGURE CONDENSER CAPACITIES.

Let "K" stand for the inductivity of the dielectric used (see table). Let "A" be the area of the dielectric in square inches (i. e. the area actually between the condenser plates or foil). Let "D" be the thickness, in inches, of the dielectric. Let "C" be the capacity in Micro farads.

$$\text{Then } C = \frac{2248 \times K \times A}{D \times 10,000,000,000}$$

Problem—What is the capacity of a condenser with glass dielectric, 1-16 inch thick, size 15x20 inches, with tin foil size 13x8 inches on both sides? "K" in this case is 3.013 (inductivity of glass).

"A" = 13 in.  $\times$  18 in. = area of active dielectric.

$$"D" = 1-16 = .0625.$$

$$C = \frac{2248 \times 3.013 \times 234}{.0625 \times 10,000,000,000} =$$

$$\frac{625,000,000}{1,584,934,416} = .00253 \text{ Micro farads}$$

Therefore, the capacity of the above condenser is .00253 M. F.

The capacity of condensers connected in parallel is the sum of the individual capacities =  $C^1 + C^2 + C^3$ , etc.

The capacity of condensers connected in series is the reciprocal of the sum of the reciprocals of the individual capacities, that is:

$$C = \frac{1}{\frac{1}{C^1} + \frac{1}{C^2} + \frac{1}{C^3}}, \text{ etc.}$$

If you desire to calculate the area of active dielectric necessary to make a condenser of a given size, use this formula:

$$A = \frac{D \times C \times 10,000,000,000}{K \times 2248}$$

Where A = Unknown area of the dielectric.

D = Thickness of dielectric.

C = Known capacity in Micro farads.

K = Inductivity of dielectric used, see table.

The quantity "A" represents the unknown area of dielectric and therefore shows the area of tin foil coating to be placed on each side of the dielectric. In other words it represents, when its value is calculated, the area of each sheet of foil. Two such foil plates are, of course, required on the condenser.

## THE WIRELESS LAW

The government of the United States permits anyone to put up and operate a wireless station. For receiving instruments only, no license is needed.

For sending stations that are so situated that they will not send outside the boundary of the state or interfere with government stations no license is required. If you live in the center of a state like Texas or Ohio you can set up a sending station of considerable power with no license. If you live near the state border or near a government station you must have a license.

Licenses cost nothing. Anyone can get a license by applying to the U. S. Radio Inspector, who will give you the necessary information. Your congressman or representative will give you his address.

A license is very easy to get. By writing to the Radio Inspector a description of your set he will give you a temporary license by mail until you are able to get your regular license.

Send to the Government Printing Office, Washington, D. C., for the invaluable book, "Radio Communication Laws of the United States." The cost is very small.

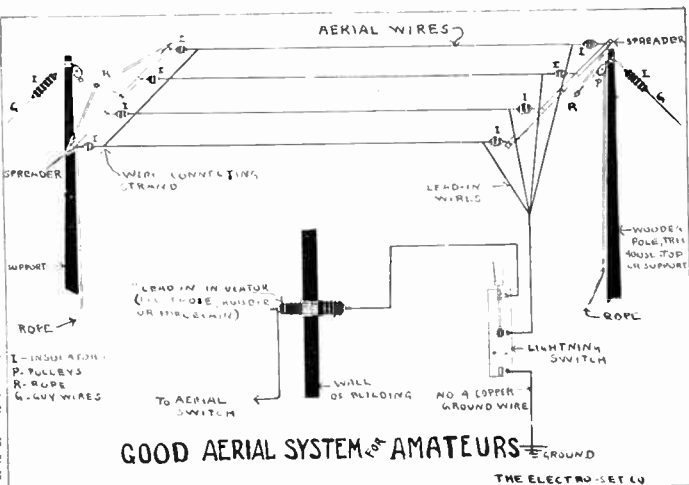
## INTERNATIONAL MORSE CODE

A	• —	N	— •	1	— — — —
B	— • • •	O	— — — —	2	• • — — —
C	— • — •	P	• — — •	3	— • — —
D	— • •	Q	— • — —	4	• • • • —
E	•	R	• • • •	5	• • • • •
F	• — • •	S	• • • •	6	— • • • •
G	— — • •	T	—	7	— • • • •
H	• • • •	U	• • — —	8	— • • • •
I	• •	V	• • • —	9	— — — • •
J	— • — —	W	— • — —	0	— — — —
K	— • • •	X	— • • •		
L	— • • •	Y	— • — •		
M	— —	Z	— • • •		

Period	• • • • •
Interrogation	• — — — •
Double dash	— — — —
Wait	• • • •
Received (O. K.)	• • — —
Invitation to transmit (go ahead)	• — — —
Attention call to precede every transmission	— — — — •
From (de)	• • • •
End of each message (cross)	• — — •
Transmission finished (end of work) (conclusion of correspondence)	• • • — —

## HOW TO PUT UP AN AERIAL

The purpose of the aerial or antenna is to radiate wireless waves when used for sending and to "pick up" or absorb waves from other stations when receiving. It should be as long and high as possible and well insulated. Upon the aerial, more than almost anything else, depends the success of your station. We illustrate herewith a good standard form for a amateur aerials. The length and height may be varied, of course, where conditions demands it. The size given comes within the law.



Select two wood spreaders 6 feet long and 2 inches in diameter or thickness. Either copper, aluminum or bronze wire may be used. Four strands or lengths should be used and each strand must be insulated from the wood spreaders by insulators. The strands should be 2 feet apart. Porcelain knobs and cleats may be used for small stations, but electrose insulators are much preferred. The wires should each be about 70 feet long if possible. This allows plenty of leeway in wave length for oscillation helix, lead-in wires and ground. You see the law requires that for sending purposes the amateur must NOT use a wave length over 200 meters. The wave length is roughly figured at four and one-half times the length of the aerial in meters, including lead-in and ground.

Let us assume, then, that we have the following proportions:

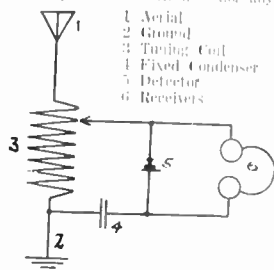
Length of aerial paper	70 feet
Length of lead in wire	35 feet
Length of ground wire	10 feet
Total	100 feet

One hundred and thirty feet is equal to about 35 meters actual radiating length. Four 40 meters is 158 meters wave length. If we now use a helix or oscillation transformer in series with the aerial we may tune up 40 meters without conflicting with the law. The only other points of interest are these: The aerial should be hung by tarred rope on pulleys, if possible, so that it may be lowered for repairs. The aerial may be supported on trees, poles, chimneys, houses, buildings or any convenient place. It should never run through trees or near metal work; if it is possible, keep it at least 10 feet away from any objects. The lead-in wire should be led from the aerial as shown and should be run into the house through a rubber or porcelain tube, or better, through an Electrose Lead-in Insulator. Joints should be soldered; or, if this is impossible, they should be wrapped with tin foil and friction tape to prevent corrosion. An aerial, built as described, will have a receiving range of as high as 1500 to 2000 miles, or even more, with sensitive instruments. On an aerial of this description a  $\frac{1}{4}$  inch spark coil has sent as far as 7 miles, although, of course, ordinarily 1  $\frac{1}{4}$  K. W. as far as 60 miles or more, if other conditions are good. A 1 inch coil might send as far as 18 miles or more.

**NOTE** Put up a good aerial. Upon the aerial, more than any other one thing, depends how far your receiving or sending range will be.

## WIRELESS HOOK-UPS

We herewith illustrate a few of the accepted standard hook-ups for wireless telegraph stations, showing the instruments necessary, and how they are connected. Choose the instruments from the large selection illustrated in our catalogue. Remember that the simplest and least expensive instruments will give good results for the beginner. The better instruments will, of course, give better results, larger ranges and more selective tuning. Certain of the sending hook-ups here illustrated can only be used in certain localities. The receiving sets require neither licenses nor any special hook-ups. Read copy of the Wireless Law. See index.



- 1 Aerial
- 2 Ground
- 3 Tuning Coil
- 4 Fixed Condenser
- 5 Detector
- 6 Receivers

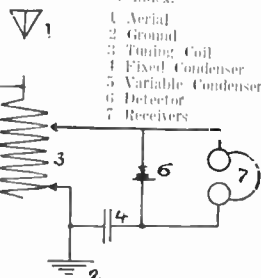
**For Best Results  
with any hook-up**

USE

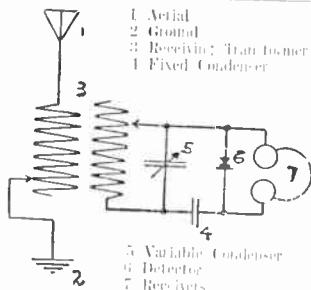
**The Electro-Set Co's  
Red-Head Receivers**

**Read about these  
wonderful phones**

—Page 35



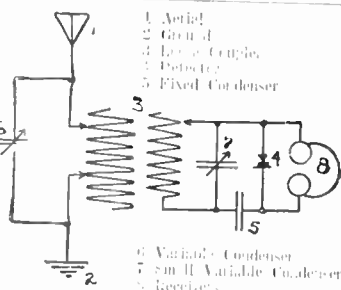
- 1 Aerial
- 2 Ground
- 3 Tuning Coil
- 4 Fixed Condenser
- 5 Variable Condenser
- 6 Detector
- 7 Receivers



- 1 Aerial
- 2 Ground
- 3 Receiving Transformer
- 4 Fixed Condenser

- 5 Variable Condenser
- 6 Detector
- 7 Receivers

**Everyone  
Is Talking  
About  
Arlington  
Tested  
Crystals.  
See Page 42**



- 1 Aerial
- 2 Ground
- 3 Receiving Transformer
- 4 Fixed Condenser

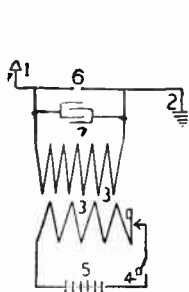
- 5 Variable Condenser
- 6 Detector
- 7 Receivers

Dear Sirs: Your taps received and I must say that the illustration really takes away the real value of them. Remaining your future customer, I am,

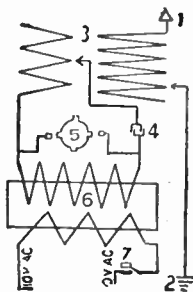
Hotel Phoenix.

Galion, Ohio.

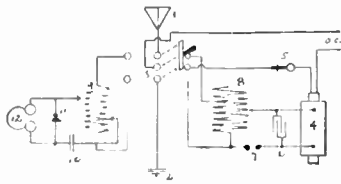
MARCUS GREEN.



- 1 Aerial
- 2 Ground
- 3 Spark Coil
- 4 Key
- 5 Batteries
- 6 Spark Gap
- 7 High Potential Condenser



- 1 Aerial
- 2 Ground
- 3 Oscillation Transformer
- 4 Condenser
- 5 Rotary Gap
- 6 Transformer
- 7 Key



- 1 Aerial
- 2 Ground
- 3 Antenna Switch
- 4 Spark Coil
- 5 Key
- 6 Condenser
- 7 Spark Gap
- 8 Helix
- 9 Tuning Coil
- 10 Fixed Condenser
- 11 Detector
- 12 Phones

## ELECTRICAL UNITS

**A Simple Treatise on Electrical Measurements**  
(The Electro-set Co. acknowledge, with thanks, the kindness of The Kendrick & Davis Co., who privilege us to publish this splendid treatise—the finest thing of its kind ever published.)

We often read and hear nowadays of volts, ohms, amperes, or other electrical terms, but few of us have a really clear idea of their exact meaning. This is partly due to the mystery of electricity itself; we shall make no attempt to define it, further than to say that it is one of the various forms in which energy is manifest. We shall try to explain the most commonly used terms in simple language.

It is interesting to note that of all branches of science, Electricity is the one most honoring its pioneers in its fundamental terminology, as we shall see in the following definitions.

**Volt**, the practical unit in which the pressure of electric current is measured; or to be more exact, the electro motive force which causes the current. Strictly speaking, the pressure is behind the current. This unit is named after Alessandro Volta, Italian philosopher and scientist.

**Ampere**, the practical unit in which electric current is measured. It expresses the intensity or strength of the current flowing and not quantity. The ampere does not involve a consideration of time. (See coulomb.) Ampere is in honor of Andre-Marie Ampere, French mathematician and scientist.

**Ohm**, the practical unit in which resistance of any electric conductor of circuit is measured. Resistance is anything opposing the electric flow. Ohm is in honor of George Simon Ohm, German scientist and electrician.

**Coulomb**, the practical unit of electric quantity one ampere flowing for one second is one coulomb. Named after Charles Augustin Coulomb, French scientist, inventor of the torsion balance.

**Farad**, the practical unit of electric capacity, as of a condenser. Named after Michael Faraday, celebrated English experimental philosopher and scientist.

**Watt**, the practical unit of electric power. Named after James Watt, Scotch inventor and mechanical engineer. A watt is the volt X ampere. A current of one ampere strength with pressure of one volt, represents one watt. In any electric current, the volts multiplied by the amperes equal the watts.

The first three of these units may perhaps be best explained by likening the electric current to a current of water flowing through a pipe.

We will consider first water pressure, which we will find to resemble electro motive force in electricity.

Second: Rate of water flow, representing amperes.

Third: Length and size of pipe; an important element in the size of stream flowing. This will be found to resemble resistance in an electric circuit.

Case 1. Suppose we have a pipe supplying water, and our pressure is one pound per square inch, and the size of our pipe a one inch hole, and is 100 feet long. A certain quantity of water will flow which we will call X."

"We use X here to represent a certain quantity of water, as one gallon or five gallons. It makes no difference just how much X represents, but if X represents five gallons, 2X would represent twice five gallons or ten gallons.

Now instead of a pipe supplying water we have a wire supplying current, and our electro-motive force is one volt, and the size of our wire is X", and is 100 feet long. A certain rate of flow will occur which we will call one ampere.

Here we use X to represent a certain size of wire, as No. 18 wire gauge. It makes no difference just what size X represents, but if X represents a No. 18 wire, 2X would represent a wire of twice the sectional area of a No. 18 wire.

### RATE OF FLOW

Case 2. Now we will consider as in Case 1, we have one pound pressure, and instead of one pipe with a one inch hole, and 100 feet long, we have two pipes of the same size and length. Instead of two streams of one pound pressure, and consequently twice as much water must flow as would in Case 1, and we have a quantity of 2X water flowing.

In the same way the more pipes added, or as you might say, the larger the pipe, a corresponding amount of water will be added. Thus it will be seen that a change in the size of the pipe changes to a corresponding degree the amount of water that flows.

In this, as in Case 1, we will use electricity instead of water, and have one volt pressure, and instead of one wire X size and 100 feet long, we

have two wires of the same size and length. Instead of one current we have two currents of one volt pressure, and consequently twice the rate of flow will occur as would in Case 1, and we have a quantity of two amperes flowing.

In the same way the more wire added, or as you might make it, the larger the wire, a corresponding amount of current will be added. Thus it will be seen that a change in the size of the wire changes to a corresponding degree the rate of current flow.

### PRESSURE

Case 3. Now, as in Case 1, we have a pipe with a 1 inch hole, and 100 feet long, but we double the pressure to 2 pounds, then the water will flow faster, and twice the amount of water will flow as did before, which will make 2X, and a corresponding difference will be found for each pound added.

Thus it will be seen that a change in the pressure changes to a corresponding degree the amount of water that flows.

Again, we will change to a current of electricity. As in Case 1, we have a wire of X size, 100 feet long, but we double the voltage to 2 volts, then twice the rate of flow will occur, which will make 2 amperes, and a corresponding difference will be found for each volt added.

Thus we see that a change in the voltage changes to a corresponding degree the rate of current flow.

### RESISTANCE

Case 4. Again, as in Case 1, we will have a stream flowing through a 1 inch pipe at a pressure of 1 pound, but instead of the 1 inch pipe being 100 feet long we will make it only 50 feet. Our pipe now offers only one-half the resistance to the water, giving us a quantity of 2X water flowing. So you see by decreasing the length of the pipe, we increase the rate of the flow of the water, and increasing the length, we decrease the rate of flow.

Also, in Case 2, instead of one wire 100 feet long, we have two pipes the same length, these two pipes allow twice as much water to flow at 1 pound pressure as did one pipe. So we see that enlarging the conductor decreases the resistance, and vice versa.

Thus it will be seen that a change in resistance changes in an inverse degree in the strength of current flowing.

Also using electricity we have a current flowing in a No. X wire at an electro-motive force of one volt, but instead of the No. X wire being 100 feet long we make it only 50 feet.

Our wire now offers only one-half the resistance to the current, giving us two amperes of current.

Thus we see that by decreasing the length of the wire we increase the rate of flow of the current, and increasing the length, we decrease the rate of flow.

Case 5. Instead of one wire 100 feet long as we have in Case 3, we have two wires the same length. These two wires allow twice the rate of flow at 1 volt pressure as did one wire. So you see that enlarging the conductor decreases the resistance, and vice versa.

**Ohm's Law.** A pressure of 1 volt will carry a current of 1 ampere through 1 ohm resistance.

From Ohm's law we see that the three units of electricity are dependent upon each other. The current varies directly as the voltage, and varies inversely as the resistance. That is, the current increases when the voltage increases, and decreases when the resistance increases, so allowing

$$C = \text{Current.}$$

$$E = \text{E. M. F. or voltage.}$$

$$R = \text{Resistance.}$$

We obtain the well known formula,

$$E =$$

$$C = \frac{E}{R}$$

From this formula we may derive two formulas:

$$E = C \times R$$

(2)

$$R = \frac{E}{C} \quad (3)$$

### EXAMPLES

Example 1:

What current will flow through a resistance of 2 ohms at a pressure of 6 volts?

Solution:

Substituting in formula 1, we have,

$$C = \frac{6}{2} = 3$$

Therefore C = 3 amperes, answer.

Example 2:

We have a lamp, the resistance of which we know to be 10 ohms. In order to light this lamp at the rated candle power we are obliged to pass through it 2 amperes, what E. M. F. would be necessary?

Solution:

Substituting in formula 2, we have,

$$E = 2 \times 10 = 20.$$

Therefore, E = 20 volts, answer.

Example 3:

What is the resistance of a spark coil through which a current of 6 amperes will pass at 15 volts pressure?

Solution:

Substituting in formula 3, we have,

$$R = \frac{15}{6} = 2\frac{1}{2}$$

R = 2½ ohms, answer.

### THE WATT

One other very essential unit in electric measurement is the watt.

The watt is the power unit of electric current. The work an electric current is capable of doing is expressed in this unit.

An ampere flowing at a pressure of 1 volt = 1 watt = W.

Therefore we derive the formula:

$$W = C \times E. \quad (4)$$

746 watts equal one horsepower.

(5)

Example 4:

A battery fan is taking a current of 2 amperes at 4 volts E. M. F., how many watts of current does it consume?

Substituting in formula 4, we have,

$$W = 2 \times 4 = 8.$$

Therefore W = 8 watts, answer.

If a sewing machine requires 6 amperes at 6 volts, what portion of a horsepower of electric energy does it take?

Solution:

Substituting in formula 4, we have,

$$W = 6 \times 6 = 36.$$

Therefore, W = 36 watts.

Now, according to statement 5, we get horsepower 36÷746 or about 1-16 of a horsepower.

Abbreviations:

Ampere = Amp.

Electro-motive force = E. M. F.

Resistance = R.

Current = C.

Horsepower = H. P.

### PART III

#### THE POWER OF THE ELECTRIC MOTOR

There are many mistakes made by persons not familiar with electricity regarding the power developed by the electric motor. Some imagine that if the motor is running, even with a very small battery, it is capable of running any piece of machinery, from a sewing machine to a saw mill. The following explanation will enable anyone to calculate for himself how much power he is getting from his motor.

The available power of a battery motor (or any other motor) is not determined by the size and efficiency of the motor as much as it is by the available current of the battery. The electric motor



simply transforms the electrical energy to mechanical energy.

We learn in Part 1 that 746 watts of electrical energy is equal to 1 horsepower. So any fractional part of a H. P. of electrical energy would be that fractional part of 746 watts.

For instance,  $\frac{1}{4}$  H. P. expressed in watts is  $\frac{1}{4}$  of 746 watts, or 186 $\frac{1}{2}$  watts. If this number of watts was to be used for power it could be divided into volts and amperes, as would be most practicable for use in the case required, but should be divided according to the formula, volts  $\times$  amperes = watts,  $E \times C = W$ .  
Example:

A man wishes to run a sewing machine by an electric motor, and believes that 1-16 H.P. will run it at the speed he wishes. What battery current will be required?

Solution:

$$H. P. = 1-16 \text{ of } 746 \text{ watts.}$$

$$1-16 \times 746 = 46 \text{ watts.}$$

This number of watts can be used in any practicable voltage. For instance, if he had 10 volts what current would be required?

$$\text{The problem would be, } W = C \times E.$$

$$C = \frac{W}{E}$$

$$C = \frac{46}{10} = 4.6 \text{ amperes, answer.}$$

Or if he had 6 volts, the problem would be:

$$C = \frac{46}{6} = 7.2-3 \text{ amperes.}$$

If the above man used batteries having two volts per cell, he would be obliged to use in the first case five cells large enough to deliver a steady current of 4.6 amperes. In the second case, three cells large enough to deliver 7.2-3 amperes.

Now we have found that it is current that is required for energy and not the motor. We must use a motor large enough to transform this electrical energy into mechanical energy. It must not be too small, for if it is it will heat under the load and will not work efficiently. If it is much too large it will absorb a great deal of power in friction, and will not be efficient.

The best way is to write to The Electro-set Co. and tell them how many watts you wish to transform into mechanical energy, and they will be able to tell you what style motor is best adapted to use this current most economically.

## Electrical Lessons and Experiments

See description of the complete set of apparatus required, and furnished in The Electro-set at \$1.00, postpaid, page 91.

What is electricity?

No one knows!

Many scientists have told us what they thought electricity was. But no one really knows. We do know, however, a great many things about electricity. We know how to use it and how to manufacture it. We light our homes and run our shops with it. We warm ourselves and cool ourselves with it. We send messages thousands of miles with it.

What a truly wonderful thing electricity is! Every boy, and every girl, too, for that matter, ought to know something about electricity. It's not like ordinary studies. Everything about electricity is intensely interesting. Well, let's start in at the beginning. With the help of the apparatus in our Electro-set we'll soon learn many things.

### STATIC ELECTRICITY.

When a dry, clean glass rod is vigorously rubbed with a piece of dry, warm silk, a charge of electricity accumulates on the rod. It is called "static" electricity.

#### EXPERIMENT NO. 1.

Rub the glass rod in your Electro-set with the piece of silk cloth, both having been previously warmed and dried. Hold the charged rod next to several tiny pieces of tissue paper. The paper will hop up towards the glass rod and stick to it, Fig. 1-A. Thus we see that a glass rod when rubbed with silk has a certain power which an ordinary glass rod has not. It has been "charged" with electricity.

#### EXPERIMENT NO. 2.

Rub the electrophorus plate (Piece No. 2) with a piece of warm, dry fur. Hold the rubbed surface of the plate near several small bits of tissue paper. The paper will again jump up towards the hard rubber plate and stick to it. Thus we see that a piece of hard rubber when vigorously stroked with a piece of fur accumulates a charge of electricity.

Experiments No. 1 and 2 showed us how to "generate" or make "static" electricity. We used glass and silk or rubber and fur.

Any two different substances when rubbed together generate static electricity. Some substances generate better than others. In our experiments we used substances that would generate readily.

### HOW TO MAKE AN ELECTROSCOPE.

An electroscope is a simple instrument for detecting electric charges. Cut a piece of pure silk thread 6 or 8 inches long and at each end of it tie a tiny cork ball  $\frac{1}{4}$  inch in diameter. When finished the two balls should be 4 inches apart. Cut off all loose ends of silk and then support the silk thread, at the center, on the Insulating Stand (piece No. 5) as shown in Fig. 1 B. Our electroscope is now made.

#### EXPERIMENT NO. 3.

Rub your glass rod once more with the silk, thus "charging" it with electricity. Bring the rod next to the two suspended cork balls on your electroscope. The balls jump towards the rod and stick to it for a moment and then are violently repelled. They try to avoid the glass rod. The two balls also avoid one another and hang apart. Now touch the balls with your finger. Their dislike for one another vanishes and they once more hang peacefully side by side.

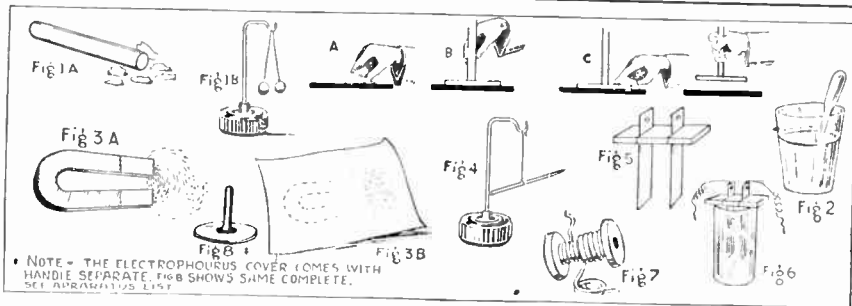
#### EXPERIMENT NO. 4.

Repeat experiment No. 3, but instead of using the glass rod, rub the hard rubber electrophorus plate with fur and use it. The cork balls on the electroscope act exactly the same as they do for the glass.

#### EXPERIMENT NO. 5.

"Charge" the cork balls on your electroscope with the rubbed glass rod until they hang apart and are repelled both by the rod and by one another. Now bring the electrophorus plate near the balls (the plate having been again charged by rubbing with fur.) The balls, instead of being repelled, as they were by the charged glass rod, are now greatly attracted by the hard rubber plate. This is strange. The glass rod and the rubber plate seem to have different kinds of electricity on them. One of them attracts the cork balls and the other one repels them. You are quite right. The glass rod is charged with a different kind of electricity than the rubber plate.

We thus learn that there is more than one kind of static electricity. When a glass rod is rubbed with silk it accumulates a charge of "positive" elec-



NOTE - THE ELECTROPHORUS COVER COMES WITH HANDLE SEPARATE. FIG. 6 SHOWS SAME COMPLETE.

fricity. When a piece of hard rubber is stroked with fur it accumulates a charge of "negative" electricity. We now come to an important electrical law and after performing the above experiments we will readily understand it.

An electric charge, whether positive or negative, will attract any uncharged substance, like cork, for instance.

A positive charge will repel any substance already charged with positive electricity.

A negative charge will repel any substance already charged with negative electricity.

A positive charge will attract any substance charged with negative electricity.

This electrical law is usually quoted as follows: Like charges repel one another. Unlike charges attract one another.

A pretty way to show how like charges of electricity repel one another may be shown by the following experiment:

#### EXPERIMENT NO. 6.

Hang the silk tassel in your Electro-set on the insulating stand so that the loose threads all hang evenly downward. Charge the rubber electrophorus plate by stroking it with fur and bring the charged plate next to the silk tassel. All the threads will be attracted to the rubber plate. They will all become charged with negative electricity by coming in contact with the charged rubber plate and will soon be repelled by the plate, because, according to our electrical law, like charge repel one another. When the silk threads are all fully charged, with negative electricity, remove the rubber plate. They will now all stand out apart from one another, like the bristles on the back of a porcupine, each one repelling the other and keeping as far away as it can.

#### EXPERIMENT NO. 7.

Charge the silk tassel with negative electricity, as in experiment No. 6. When the threads are repelling one another stroke them all with an ordinary metal table knife. The silk threads will again hang peacefully side by side.

What does this experiment show? The metal knife carried all the electricity away and left the silk threads uncharged. Why didn't the wire on the insulating stand carry the electricity away? This is a good question.

Some substances carry electricity just as a water pipe carries water. The electricity flows away through them. They are called "conductors." Other substances will not carry or "conduct" electricity. They keep it stored on their surface and it stays there. Such substances are called "insulators." Metals, water, damp wood, etc., are conductors. Glass, hard rubber silk, etc., are insulators. The human body is a fair conductor. Therefore, when we held the metal knife in our hand in experiment No. 7 the electricity was carried away from the silk through the knife, through the body, through the wooden floor and down into the ground. But the wire on our

insulating stand was "insulated" from the ground by its rubber base and the electricity could not flow away.

#### THE ELECTROPHORUS.

An electrophorus is an instrument for collecting large charges of electricity. It consists of a hard rubber plate and a round metal sheet or cover, with an insulating handle.

Follow instructions carefully and see how it operates.

#### EXPERIMENT NO. 8.

1. Lay the electrophorus plate on a flat table in a warm, dry room. Rub it vigorously with a piece of fur so as to charge it. 2. Hold the electrophorus cover by its handle and set it down on the charged plate. 3. While the cover is resting on the plate touch the metal cover for a second with your finger. 4. Remove your finger and lift the cover by its handle. The metal cover now has a large charge of electricity. If you bring your knuckle close to the edge of the cover a tiny, bright spark will leap across from the cover to your knuckle. The above directions must be carefully followed in order to insure success.

#### HOW TO MAKE A LEYDEN JAR.

Get an ordinary glass tumbler with thin walls. Coat the inside and outside with the tin foil that comes with your Electro-set. The tumbler should be coated within one inch from the top, both inside and outside. The tin foil should be glued on and should fit smoothly and evenly with no rough spots or sharp edges, as shown in Fig. 2. Now take a teaspoon and set it inside the coated glass so it touches the inside coating. We now have a Leyden jar or "electric pail." It may be filled with electricity, just as a pail may be filled with water.

#### EXPERIMENT NO. 9.

Hold your Leyden jar in one hand by grasping the tin foil coating. Charge your electrophorus as explained in experiment No. 8 and when the cover has received its charge bring its edge close to the top of the teaspoon in the Leyden jar. A tiny spark will jump across to the spoon. Recharge the cover of the electrophorus and repeat the spark to the spoon six or eight times. (The cover of the electrophorus may be charged many times from the electrophorus plate without again stroking the plate with fur.) When several sparks have passed between the electrophorus cover and the spoon the Leyden jar will be charged with a large amount of electricity. Quite a large shock may be felt by holding the outside coating of the jar in one hand and touching the teaspoon with the other.

Charge the Leyden jar again, and, holding the outside coating, bring the tip of the teaspoon close to a water or gas pipe. A bright, crackling spark will leap from the spoon to the pipe.

Let us now review what we have learned about static electricity. We have discovered the following facts:

1. When glass and rubber are stroked with silk or fur they become charged with electricity and will attract uncharged objects.

2. There are two kinds of static electricity, positive and negative.

3. Like charges repel one another.

4. Unlike charges attract one another.

5. There are two kinds of substances, conductors and insulators.

6. Conductors carry or conduct electricity.

7. Insulators resist the passage of electricity and any charges of electricity accumulating upon them stay on their surfaces and do not flow away.

8. The electrophorus is an instrument for generating larger charges than may be made by friction or rubbing only.

9. The electrophorus is charged by:

a. Rubbing the plate with fur.

b. Applying the metal cover.

c. Touching the cover for an instant.

d. Removing the charged cover by its handle.

10. A Leyden jar is a piece of glass (for instance a tumbler) coated on both sides, to within an inch from the edge, with tin foil.

11. A Leyden jar accumulates large quantities of electricity when charged.

12. A Leyden jar may be discharged through the human body or by allowing its inside coating to be held close to a water pipe or any other grounded object.

#### MAGNETISM.

All of you have seen the small horseshoe magnets that may be obtained in any corner store. They surely seem to have a deep interest for most of us. What wonderful and unseen force gives these little pieces of steel the power to always attract iron to them?

Like electricity, no one really knows what magnetism is. We shall discover, however, that magnetism has something to do with electricity.

#### EXPERIMENT NO. 10.

Mix up several small pieces of brass with some iron tacks. The iron is attracted and the brass is left behind. We therefore see that there are magnetic and non-magnetic metals. Brass, copper, gold, silver, zinc and many other metals are non-magnetic. Iron, nickel and cobalt are magnetic.

#### EXPERIMENT NO. 11.

Dip the horseshoe magnet into iron filings. The filings stick to the magnet and stand out in tiny bristles like stiff grass, Fig. 3A.

#### EXPERIMENT NO. 12. N

Take a small piece of glass in your hand and on top of it sprinkle some iron filings. Run the horseshoe magnet below the glass. The little filings dance and move about with the magnet. We thus learn that glass allows the magnetic force to pass right through it without opposition.

#### EXPERIMENT NO. 13.

Repeat the last experiment, using the small copper plate that comes with your Electro-set instead of the glass.

#### EXPERIMENT NO. 14.

Repeat experiment No. 12, using a piece of tin instead of the glass.

#### EXPERIMENT NO. 15.

Repeat, using zinc.

#### EXPERIMENT NO. 16.

Repeat, using cardboard.

We learn from the above experiments that magnetism seems to pass through everything excepting tin (which is really iron). The iron absorbs the magnetism because, being magnetic, it is itself attracted and allows no magnetism to go beyond it.

#### EXPERIMENT NO. 17.

Lay the magnet on a flat surface and on top of it lay a sheet of paper. Sprinkle a thin layer of iron filings on the paper over the magnet. Tap the

paper gently. The iron filings will arrange themselves in an even design of parallel curves, as in Fig. 3B. These filings represent the "lines of force" of the magnet, as they are called.

#### EXPERIMENT NO. 18.

A pretty experiment may be performed by taking a picture of the magnetic lines of force, as made in experiment No. 17. A package of photographic "blue print" paper will be found in your Electro-set. Open this package in a dimly lit room and place a sheet of the paper, colored side up, over the magnet, which has previously been laid on a book. Sprinkle iron filings over the paper and tap them into position. Now set the whole arrangement in the sun for a few minutes. The paper will become dark blue in color. It must not be disturbed in any way until fully "printed." When the paper has become dark blue quickly carry it into the house and brush off the filings. Hold the paper under a water faucet for a moment and then allow it to wash in running water for 15 minutes. A perfect picture of the magnetic lines of force will be permanently printed on the paper.

#### EXPERIMENT NO. 19.

Try to magnetize a nail by rubbing it firmly in one direction only with one pole of the magnet. It will not remain permanently magnetized. While it is in contact with the horseshoe magnet it will pick up iron filings, but when removed it loses its magnetic power. Soft steel will not retain magnetism. Hard steel will.

#### EXPERIMENT NO. 20.

Repeat experiment No. 19, using a steel needle instead of a nail. The needle retains the magnetism and becomes a tiny magnet itself. It will pick up iron filings at either end.

#### EXPERIMENT NO. 21.

Tie a piece of silk thread to the center of a magnetized steel sewing needle so that it exactly balances. Hang the other end of the thread to the hook on your insulating stand, as in Fig. 4. The needle will turn until it points north and south. This is the principle of the magnetic compass used on boats to determine directions.

#### EXPERIMENT NO. 22.

Bring one pole of your horseshoe magnet near the suspended magnetic needle. The needle will whirl violently about until it points at the magnet. Now present the other pole of the horseshoe magnet to the needle. The needle will again turn about until its opposite end points to the magnet.

Any magnet when freely suspended between its poles will point in a north and south direction.

Thus we learn that there is some difference between the poles of a magnet. One of them attracts one end of the magnetized needle and repels the other end. The second pole does just the opposite.

Just as in static electricity, we find the following law:

A magnet has a positive and a negative pole (north and south.)

Like poles repel one another. Unlike poles attract one another.

#### CURRENT ELECTRICITY.

Static electricity, you will remember, may be either positive or negative. There is still another kind of electricity and this new kind may also be either positive or negative. It is called current electricity, because it always flows just like water, through metal wires.

#### HOW TO MAKE AN ELECTRIC BATTERY.

You will find, in your Electro-set, a piece of copper, a piece of zinc, a box of white salt called "sal ammoniac" and two little sets of screws called "binding posts." Each piece of metal is drilled with a hole and the binding post must be tightly screwed into these holes.

Take an ordinary glass tumbler and fill it with water to within one inch from the top. Dissolve the sal ammoniac in this water and set the zinc and copper plates into the solution, facing one another, but not touching anywhere. A good plan is to put a blotter between them so they will not touch. Another good way is to cut a strip of wood from a cigar box and make the arrangement shown in Fig. 5. Fig. 6 shows the complete battery.

#### EXPERIMENT NO. 23.

Take two pieces of copper wire about 8 inches long and fasten one end of each of them to the binding posts on your battery. This is done by first scraping off the thread covering for an inch or so that the bare copper shows.

Put the other ends of these wires into your mouth, one under and one over the tongue. You will experience a sour, vinegar taste. Now, plain copper wires don't taste sour. These copper wires do. We therefore know that they must be different. They are carrying electricity generated by our battery.

#### HOW TO MAKE AN ELECTRIC MAGNET.

You will find in your Electro-set a small wooden spool, a short piece of iron rod and a coil of insulated copper wire. Leaving 3 inches of wire free for connections, start winding the wire on the small spool, evenly in layers, just as thread is wound, as in Fig. 7. Wind as many layers as you can get on the spool and then twist the last end and the first end together so that the wire will not unwind. Scrape 1 inch of each end of the wire coil free from covering, so that we may connect it to the battery. Slip the small iron rod or core into the hole on the spool. Our electro-magnet is now complete.

#### EXPERIMENT NO. 24.

Connect one end of your battery wires to one end of your electro-magnet wire by twisting the two together. Now connect the other end of the magnet wire to the remaining battery wire. The iron core

of the electro-magnet will now pick up a tack or iron filings, just as our horseshoe magnet did. We thus see that electricity and magnetism have a great deal to do with one another, for we can make a magnet out of copper wire and an electric current.

#### EXPERIMENT NO. 25.

In our study of magnetism we made an electric compass by hanging up a magnetized needle. Use this same magnetic needle again and bring our electro-magnet next to it. Our electro-magnet acts just as our horseshoe magnet did.

#### EXPERIMENT NO. 26.

See if you can discover whether or not an electro-magnet has two different kinds of poles.

#### EXPERIMENT NO. 27.

Remove the iron core from our electro-magnet and see what effect this has upon its strength.

**NOTE**—Never use the battery in the Electro-set for more than a few minutes at a time. Always remove the metal plates when through using. When the current gets weak the battery may be recharged by renewing the solution. Sal ammoniac may be purchased at any drug store. You will probably want a stronger battery after you start your experiments. "Dry batteries" may be purchased at any hardware store at from 15c to 25c each. They are ten times as strong as the battery in the Electro-set and will make very strong electro-magnets.

We have now learned something about static electricity, magnetism and current electricity.

Many more experiments will suggest themselves to you with your Electro-set. It is hoped that you will continue your researches and will be able to buy more elaborate apparatus, such as motors, dynamos, static machines and finally telegraph and wireless telegraph instruments. All these things are intensely fascinating and are not expensive or difficult to handle.

## A FEW USEFUL TOOLS

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Valdosta, Ga., May 22, 1916.

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WILLIAM C. HOLDER,

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Western Reserve University, U. S. Government,  
U. S. Naval Militia, North Platte  
High Schools, National Electric Lamp Association,  
Cleveland Fire Department, Cleveland Board of Education—*

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J. S. Newman, Pres.  
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J. S. NEWMAN, PRESIDENT

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