15 cents

Modern Electrics & Mechanics

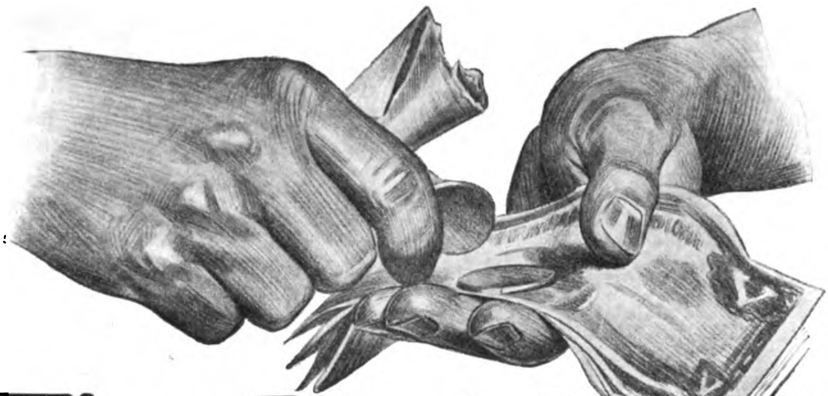
MODERN ELECTRICS AND MECHANICS

ORLAND J. RIDENOUR, President. W. G. RIDENOUR, Secretary. AUSTIN C. LESCARBOURA, Editor.

Volume 28. **April, 1914** **No. 4**

Contents

COVER ILLUSTRATION: *A Modern Monoplane in Oversea Flight.*



MODERN ELECTRICS and MECHANICS

ADVERTISERS' INDEX

MODERN ELECTRICS and MECHANICS

ORLAND J. RIDENOUR

Publisher

Expiration We enclose a renewal blank with the last copy sent out on each subscription. To avoid missing valuable numbers, renewals should be made at once.

Change of Address When you change your address notify us promptly, giving old as well as new address. Also notify your former postmaster, as it often happens that our mailing list is made up when your notification reaches us. In such cases the magazine will go to your old address, but the postmaster will forward copy to your new address upon request. No copies sent after expiration of subscription.

Magazine issued monthly. Yearly subscription in U. S., $1.50. Manhattan and Canada, $1.85. Foreign, $2.00 in Gold. SINGLE COPY, 15 cents.

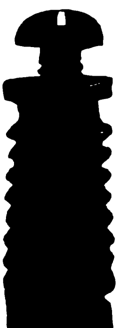
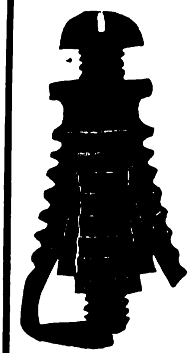
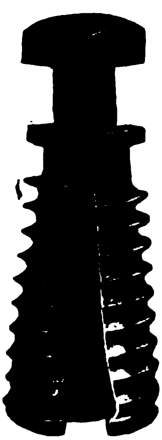
MODERN ELECTRICS AND MECHANICS may be had at all news stands in the United States and Canada; also at Brentano's, 37 Avenue de l'Opera, Paris.

Original contributions of timely interest pertaining to the electrical and mechanical arts, or on any branch of popular science and invention, especially with practical working directions, drawings or photographs are solicited. No manuscript returned unless postage is enclosed.

Forms close the 1st of the month preceding date of publication. Advertising rates on application. Entered as second class matter March 31, 1908, at the New York Post Office, under the Act of Congress of March 3, 1879.

MODERN ELECTRICS AND MECHANICS should be on the news stands on the 15th of the month preceding the date of issue. Readers unable to get the magazine on the 17th will confer a favor by notifying the Publishers. News stand patrons should instruct their Newsdealer to reserve their copy of MODERN ELECTRICS AND MECHANICS, otherwise they are likely to find the magazine "sold out."




Johnson's Wood Dye
In 17 shades—for the artistic coloring of wood —soft and hard.
Johnson's Prepared Wax
A complete finish and polish for all wood—floors, woodwork and furniture.
Use This Coupon
for Free trial packages and Instruction Book, "The Proper Treatment for Floors, Woodwork and Furniture."
S. C. Johnson & Son
"The Wood Finishing Authorities"
Racine, Wis.
PRESENT THIS COUPON TO YOUR DEALER IN PAINTS
45c—Value FREE—45c
To Paint, Hardware or Drug Dealer: Furnish the bearer, free of all expense, with
1—25c Instruction Book
1—10c Bottle Johnson's Wood Dye
1—10c Can Johnson's Prepared Wax
S. C. Johnson & Son, Racine, Wis.
(Must be presented by an adult.)
ME & M-4
JOHNSON'S WOOD DYE
S.C. JOHNSON & SON

Modern Electrics and Mechanics

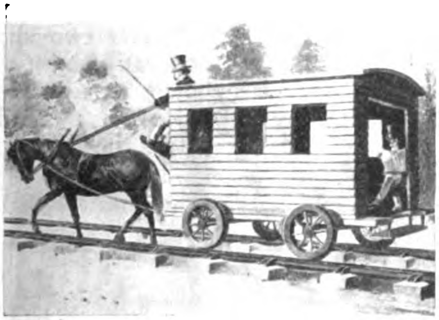
VOL. XXVIII. April, 1914 No. 4

Evolution of the Steam Locomotive

One Hundred Years Have Elapsed Between the First Locomotive and the Present Day Successors

By Austin C. Lescarboura

LAST year marked the centenary of the first practical steam locomotive used on a railroad for hauling trains—the "Puffing Billy," built in 1813 and employed in an English colliery for the transportation of coal. This first



A FORM OF HORSECAR EMPLOYED ON THE EARLY AMERICAN RAILWAYS

locomotive, crude as it was, furnished the incentive to scores of inventors who have contributed towards the realization of the fast passenger and the powerful freight locomotives of the present day.

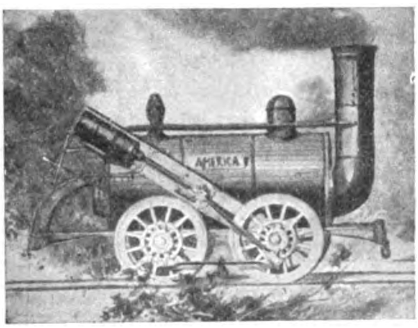
Although the first steam locomotive to turn a wheel on a railroad for practical purposes, the "Puffing Billy" was preceded by several attempts at steam locomotion, both for traveling on ordinary highways and for operating on wooden or steel rails. But it is with the "Puffing Billy" that the development of the practical railroad locomotive began; the previous efforts in this direction being for the most part of a purely experimental nature and possessing little commercial value.

It was the use of rails for transportation that led to the introduction of the steam locomotive. As early as 1673, wooden rails were employed at the collieries near Newcastle-on-Tyne, England.

ONE OF THE EARLY AMERICAN LOCOMOTIVES OF THE VERTICAL BOILER TYPE

Over these wooden rails four-wheeled carts were drawn by horses. Iron rails were first introduced in 1738 at Whitehaven, followed shortly by a second iron railroad laid near Sheffield in 1776, and a third in 1786. The motive power on all these railways was furnished by horses. The smooth rails enabled one horse to haul a weight equivalent to that which required 40 horses on a common highway.

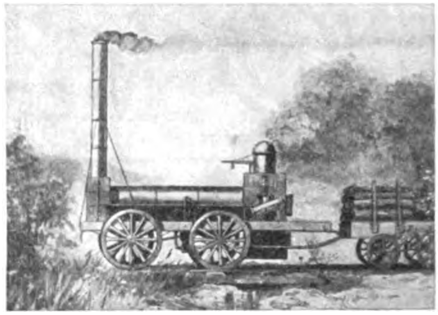
At a period when several models of steam locomotives had been tried with varying success, an enterprising gentleman named Christopher Blackett, principal owner of the Wylam Colliery, near Newcastle-on-Tyne, became interested in substituting steam for horse-power in the mines. Blackett directed the superintendent of the colliery, William Hedley, to experiment in this direction. The first locomotive built under the direction of Hedley did not prove a success, but it served as a guide in designing a second locomotive which was built in 1813 and named the "Puffing Billy." This



THE "AMERICA"—THE FIRST LOCOMOTIVE IN THE UNITED STATES

locomotive was of the so-called "grasshopper" type, a design that became popular and was universally employed until 1829, when the success of a machine built on a different principle caused its abandonment.

Following the introduction of the "Puffing Billy," numerous locomotives of similar design were built, although the period was not a very encouraging one for locomotive builders, for the public did not place much confidence in steam engines and most railroads in existence at that time adhered to the use of horses. In the spring of 1829, the directors of the Liverpool & Manchester Railway decided to test the merits of the various locomotives produced by the pioneer builders before finally adopting their plan of fixed engines and movable cables for motive power. A prize of £500, sterling, was offered to the builder of a locomotive that proved most successful in the competitive trials. After several delays the trials were held at

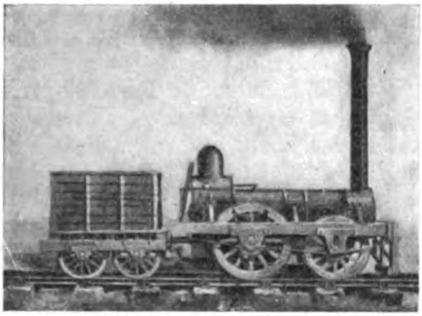


THE "WEST POINT"—SECOND LOCOMOTIVE TO DRAW A TRAIN OF CARS IN AMERICA

Rainhill, near Liverpool, on October 8th. Four locomotives were entered in the contest, the "Rocket," "Novelty," "Sanspariel" and the "Perseverence." The last-named entry was withdrawn after being found unfit to participate in the trials. The "Rocket," constructed under the supervision of Robert Stephenson, passed through all the trials successfully and won the prize. Without load the "Rocket" attained a speed of 29½ miles per hour, and 28 miles per hour with a car carrying 36 passengers—a speed that was regarded as remarkable at the time. The other entries did not prove so successful, the "Novelty," after two short runs, was rendered inoperative by a disabled part. After being repaired this engine attained a speed of 21 1/6 miles an hour. The last entry, the "Sanspa-

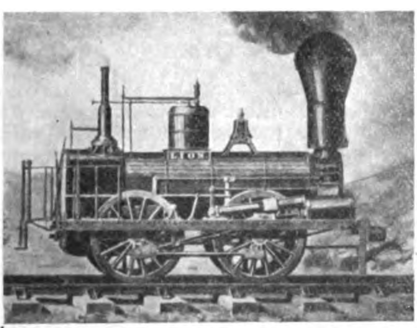
THE "DE WITT CLINTON"—FIRST LOCOMOTIVE IN SERVICE IN NEW YORK STATE

reil," developed a cracked cylinder and, although seriously impeded by the great loss of steam, ran at an average speed of 13.88 miles per hour for a total distance of 22½ miles until it was compelled to stop by the breakdown of the feed pump.



THE "OLD IRONSIDES"—ONE OF THE EARLIER LOCOMOTIVES THAT BECAME FAMOUS

The "Rocket," weighing about 4¼ tons, founded a new era in locomotive designing. Previous to the Rainhill trials the locomotives in existence were complicated machines with many intricate parts. Their construction presented no little degree of ingenuity, but the mechanism required constant attention and in many instances became deranged when traveling over uneven rails. But with the remarkable performance of the "Rocket" the builders became convinced that simplicity was a paramount quality and accordingly abandoned the "grasshopper" design, with its exceedingly complicated mechanism, in favor of the slanting side cylinders with the piston rods directly connected through rods to

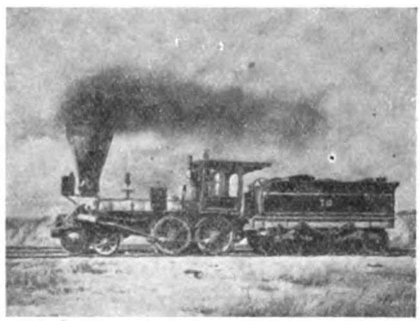


THE "LION"—AN EARLY TYPE OF LOCOMOTIVE BUILT IN NEW ENGLAND

the driving wheels—a practice that has been continued to the present time, although greatly modified.

In the United States, railroads were constructed and operated with horses for a considerable period before the introduction of the locomotive. The first railroad in America was constructed in 1826, running between the quarries at Quincy, Mass., and the nearest tidewater, a distance of four miles including branches. This railway was built at a cost of $50,000. Wooden rails were used, spaced five feet apart and mounted on stone crossties. The second railroad in America followed in the succeeding year and was used between the coal mines at Mauch Chunk and the Lehigh River, a distance of nine miles. Both of these early railroads were used for freight transportation only and employed horses for motive power.

In April, 1827, the Baltimore & Ohio Railroad was organized. It was the first

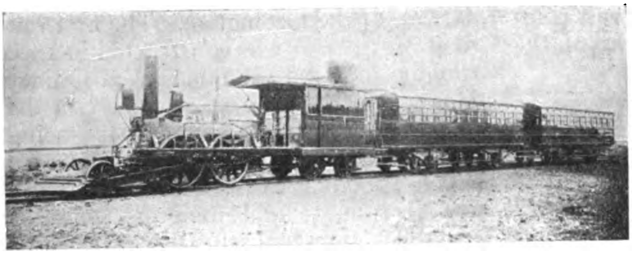


A CONVENTIONAL DESIGN OF LOCOMOTIVE LARGELY EMPLOYED PRIOR TO THE CIVIL WAR

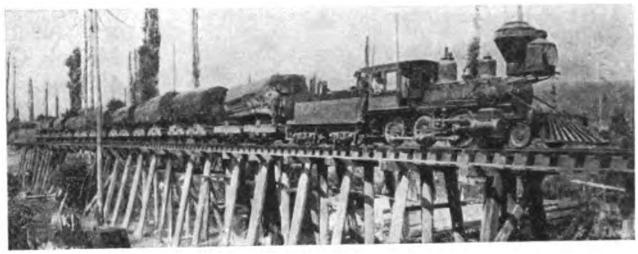
railway in America for general transportation purposes and was partly opened to the public in 1830. The second railroad for passenger and freight service was opened in August, 1830, between Albany and Schenectady, followed by a third between Richmond and Chesterfield, Va., after which the railways grew rapidly into the network of the present day. On all of these railways horses were used, although in England the steam locomotives were already employed on some railroads.

In 1828 the growing interest in English locomotives prompted the Delaware & Hudson Canal Company to send Horatio Allen to England for the purpose of placing orders for three or four engines. One of the locomotives was ordered from Robert Stephenson & Company and three more from Foster, Rastrick & Company, of Stourbridge.

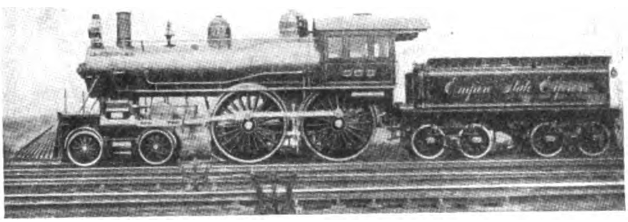
The "America"—the first locomotive



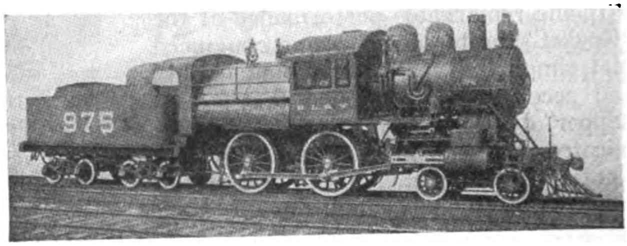
THE "JOHN BULL," BUILT IN ENGLAND IN 1831 AND BROUGHT TO THE UNITED STATES FOR USE ON THE CAMDEN & AMBOY RAILROAD



A TYPICAL WOOD-BURNING LOCOMOTIVE POPULAR MANY YEARS AGO, BUT STILL FOUND IN USE IN THE LUMBERING DISTRICTS

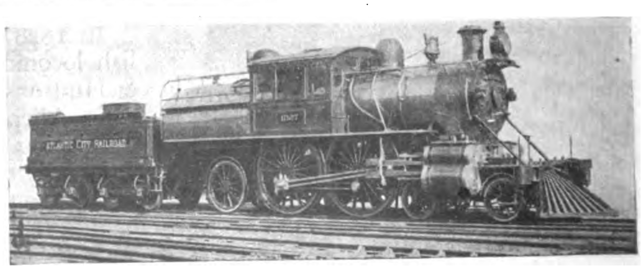


THE "999"—A FAMOUS LOCOMOTIVE THAT CREATED SPEED RECORDS IN HER DAY WHEN HAULING THE EMPIRE STATE EXPRESS



A CAMELBACK LOCOMOTIVE OF THE AMERICAN TYPE WHICH WAS LARGELY USED A DECADE AGO, BUT IS NOW CONFINED TO LOCAL TRAFFIC

THE BICYCLE TYPE LOCOMOTIVE WHICH WAS DESIGNED FOR HIGH SPEEDS AND WAS THE FORERUNNER OF THE ATLANTIC AND PACIFIC DESIGNS



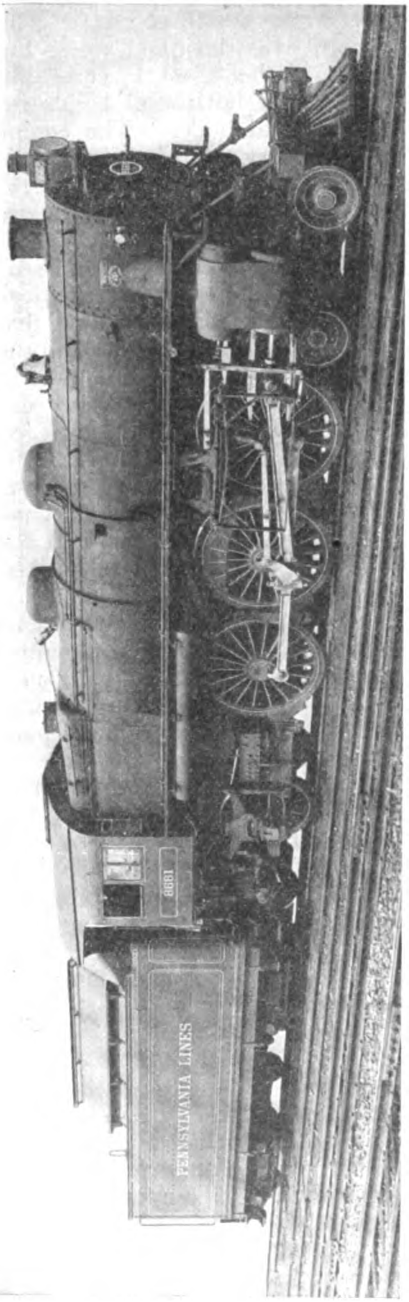
AN EARLY TYPE OF ATLANTIC LOCOMOTIVE OF THE CAMELBACK DESIGN WHICH BECAME FAMOUS FOR ITS HIGH SPEEDS BETWEEN PHILADELPHIA AND ATLANTIC CITY in America—arrived from England on January 17, 1829. It was the locomotive ordered from Robert Stephenson & Company. On May 13, 1829, the "Stourbridge Lion" arrived in New York City and after being assembled at the shops of the West Point Foundry Association, was transported by water to Carbondale, Pa., where it was tried on the railroad of the Delaware & Hudson Canal Company. On August 8, 1829, the "Stourbridge Lion" made the first trip ever made by a locomotive in America. It was of the "grasshopper" type and weighed seven tons. It was reported by Allen to be too heavy for the trestles of the railway and was consequently abandoned.

American ingenuity displayed itself immediately after the arrival of the English locomotives. The first locomotive built in America was that of Peter Cooper in 1830, named the "Tom Thumb." It was constructed at the Mont Clare shops of the Baltimore & Ohio Railroad at Baltimore. This engine was radically different from the English locomotives, employing a vertical boiler and a single cylinder for driving the wheels through gearing. It was first tried on August 28, 1830, and was able to haul 4½ tons at a speed of 12 miles per hour. During the same year another locomotive was constructed and named the "Best Friend." This locomotive, built at the West Point Foundry Shops, New York City, weighed about 4½ tons and was equipped with a vertical boiler and two slanting cylinders driving the four wheels. It was placed in service on the Charleston & Hamburgh Railroad, proving highly efficient and hauling four or five cars containing 40 or 50 passengers at a speed of from 16 to 21 miles per hour. Without load, the "Best Friend" attained a speed of 35 miles an hour. After being about seven months in actual use, the negro fireman, in the absence of the engineer, became annoyed by the noise of the safety valve. In fastening down the valve, the steam pressure rapidly reached tremendous proportions, with the result that the boiler exploded. Thus the "Best Friend" distinguished itself in two respects: primarily, as the first locomotive to draw a train of cars in America, and secondarily, as the first locomotive boiler to explode.

The "West Point" was the second locomotive to draw a train of cars in America, and was built at the West Point Foundry Shops. It was operated on the Charleston & Hamburgh Railroad during the winter of 1830-1831. The "West Point" was designed along the general lines of the "Best Friend," but was fitted with a horizontal boiler instead of a vertical boiler. The engine proved satisfactory and in one public trial it hauled four passenger cars carrying 117 passengers, nine persons more on the engine, and a "barrier" car loaded with six bales of cotton, a distance of 2¾ miles in 11 minutes. The "barrier" car derived its name from the fact that it was placed between the engine and the passenger coaches so as to offer protection to travelers should the boiler explode. It became a regular feature of all passenger trains at that time.

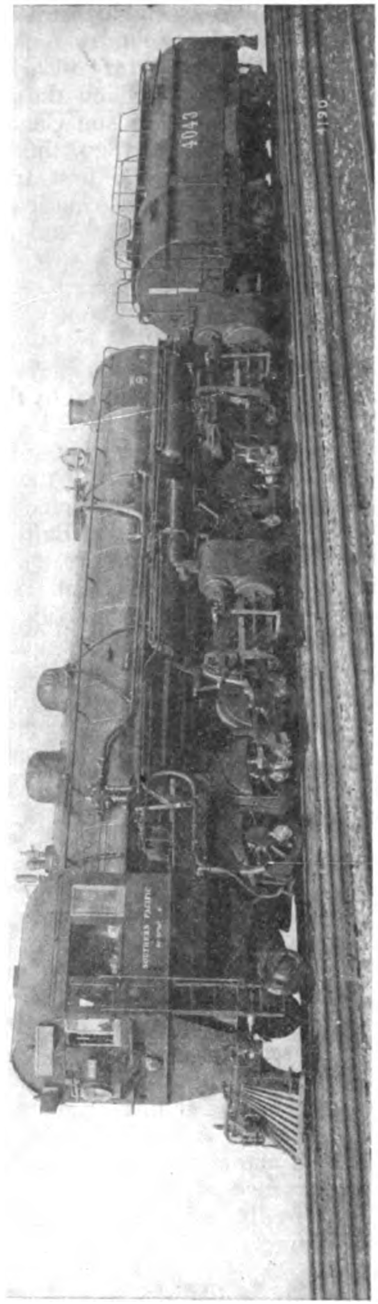
After the "West Point" came the "South Carolina," built at the same shops, and intended for service on the South Carolina Railroad. It was finished in 1831 and was the first eight-wheeled engine built in America. It was practically composed of two separate engines back to back and, as was the case with most freak locomotives of the period, did not prove satisfactory and spent most of the time in the repair shops.

Another famous American locomotive was the "DeWitt Clinton," the third engine built by the West Point Foundry Association. It was placed on the Mohawk & Hudson River Railroad in 1831. The "DeWitt Clinton" weighed approximately 3½ tons, without water, and developed a speed of 30 miles an hour with three to five cars. It was the first locomotive used on a railroad in the State of New York. Equally famous was the "John Bull," built by George Stephenson at Newcastle-on-Tyne, in 1831, and intended for the Camden & Amboy Railroad. It arrived in America in August and began running on the 12th of November, 1831, at Bordentown, N. J. The weight of this engine was about 10 tons. In subsequent modifications, the "John Bull" was equipped with a so-called "cow catcher" for removing any obstacles that might be on the track. The "cow catcher" has remained to this day on all locomotives used on American railroads —with the exception of those used in freight yards—and is one of the distinc-



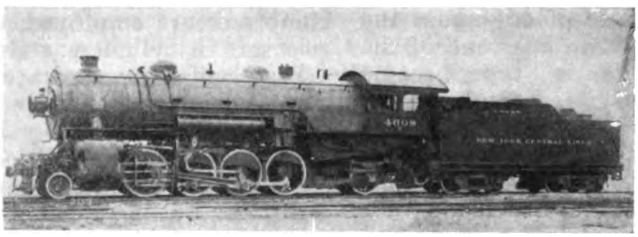
AT THE TOP, A MODERN HIGH SPEED PASSENGER LOCOMOTIVE OF THE PACIFIC TYPE EMPLOYING COMPOUND CYLINDERS

BELOW, A HUGE MALLET COMPOUND FREIGHT LOCOMOTIVE THAT BURNS OIL AND TRAVELS WITH THE CAB FOREMOST



tive features of American engines. The "John Bull" was the first locomotive used in the State of New Jersey and proved efficient.

In November, 1832, M. W. Baldwin, founder of the well-known Baldwin Locomotive Works of Philadelphia, constructed a locomotive, named the "Old Ironsides," for the Philadelphia, Germantown & Norristown Railroad. It weighed about 5 tons and was patterned after English engines that had been imported for use on the Newcastle & Frenchtown Railroad. It is reported that the "Old Ironsides" attained high speeds, on one occasion covering a distance of one mile in 58 seconds and on another, 2¼ miles in 3 minutes and 22 seconds. This locomotive rendered good service for about 20 years.



A TYPICAL FREIGHT LOCOMOTIVE OF THE PRESENT DAY

It is interesting to note that the Baltimore & Ohio Railroad employed a type of locomotive using a vertical boiler and "grasshopper" beams, known as the "Atlantic," during the latter part of 1832. This engine hauled 50 tons from Baltimore to a point 40 miles away over heavy grades at a rate of 12 to 15 miles per hour. The locomotive weighed about 6½ tons.

From 1832 to 1840, rapid progress was made in the building of locomotives and numerous engines were built for practically all the railroads then in existence. Aside from a few freak designs attempted from time to time, the general details of all the locomotives were more or less standardized; the "E. L. Miller," built in 1834 by Baldwin, having set the example followed by all succeeding locomotives until recent years. Gradually the "American" type of engine became universally employed for fast passenger traffic in the United States, this engine being distinguished by the wheel arrangement—two sets of leading wheels mounted on a swivel truck and two sets of driving wheels. The large diamond-shaped funnels that were so popular during several decades gradually gave way to the straight funnel which became shorter and shorter until in the present American locomotives it is less than a foot in height on the huge engines. Along with the elimination of the large smokestacks or funnels, came the increase in the size of the boilers. The air brake, invented by George Westinghouse, was first tried on the Pennsylvania Railroad in April, 1869, and rapidly gained in popularity over all other systems, being fitted on practically every American locomotive.

Prior to 1895 the American type, and the so-called "ten-wheeler," with a wheel arrangement of two sets of wheels on a leading truck and three sets of driving wheels, were employed for fast passenger service. The requirements of high-speed service and the introduction of longer and heavier trains were met for a time by building longer boilers on the locomotives. The width of the firebox was limited to the width of the track and driving wheels. Lengthening the fire-box made it difficult to secure proper stoking, and was therefore unsatisfactory. It was owing to these conditions that the "Atlantic" type

HUGE MALLET COMPOUND FREIGHT LOCOMOTIVE FOR HEAVY HAULING of engine was introduced, in which a larger grate area and fire-box were secured by placing the two sets of driving wheels nearer to the center, enabling the fire-box to be extended beyond the width of the rails. A small pair of trailing wheels were placed under the fire-box to support the rear end of the boiler. The "Atlantic" type became immediately popular and displaced the "American" design. Until quite recently, the "Atlantic" locomotive answered all the requirements of fast passenger service, but the demands for still greater speeds, heavier trains and longer hauls, gave birth to the "Pacific" type, which has a similar wheel arrangement with the addition of one set of drivers. Simple cylinders that had been used from the time of the first locomotive gave way to the compound cylinders, which permit of a greater economy in fuel and water.

For freight service, compound cylinders have also displaced simple cylinders. Modern practice in freight locomotives approves of the use of many wheels of small diameter so as to obtain the maximum adhesion with the rails. Wide fire-boxes are obtained by using small trailing wheels under the rear end of the boiler as in the instance of the passenger locomotives. For extremely heavy trains and for hauling over grades, the Mallet compound locomotives are employed, consisting of two sets of cylinders, rods and wheels —practically two separate locomotives employing one boiler and one set of controls in common.

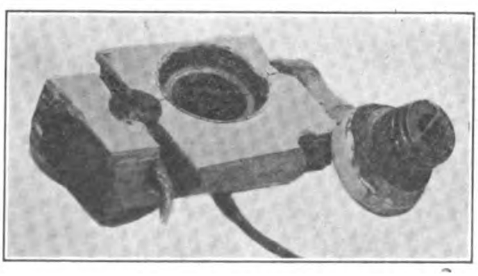
In the matter of fuel, coal predominates in the United States. In the southwestern portion of the country oil is largely employed because of its abundance. In certain lumber districts, wood-burning locomotives are used on logging railroads, but the wood-burner has elsewhere practically disappeared.

This, briefly, has been the development of the locomotive of the present day. It is not the invention of one man or nation, but scores of inventors belonging to several nations have contributed to the gradual evolution of the huge passenger and freight steam locomotives of modern times.

A Relic of Pioneer Electrical Wiring.

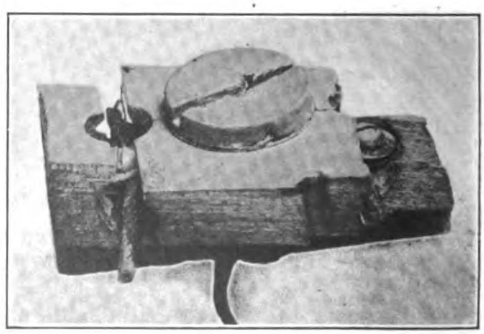
By Irving Crump

ONE of the oldest and most interesting relics of the old days in electrical history was brought to light



AN OLD-TIME WOODEN FUSE BLOCK AND FUSE PLUG

recently in New York City when electricians started to overhaul the wiring of the building located at No. 142 Front street. The building is one of the oldest of that section of the city and was among the first to be wired for electric service when Edison began to generate current from his first Pearl street station. The wiring installed at the time was more or less crude, and from time to time new wiring was done in various



WOODEN FUSE BLOCK WITH FUSE PLUG IN PLACE

parts of the building.

Recently, however, the electricians

visited the top floor of the structure to do some new wiring and found what remained of the original wiring still in place. Besides the sections of copper wire with cotton insulation, two old wooden fuses were found. These fuses, when compared to the up-to-date porcelain fuses, appear very crude indeed. However, according to records the wiring and fuses on the top floor of the Front street building were used as late as 1912, which speaks well for their durability in spite of the crude construction.

The fuse plugs in each case are made in the form of a wooden screw with metal threads. This screw was inserted into a wooden fuse block through which the wires ran, thus forming the connection.

It was in the days when these antiquated wooden devices were used that electricity was blamed for most of the fires. And if one looks carefully at the fuse block shown in the accompanying illustration, it is not difficult to determine why fires *did* occur.

Forcing Crops by Electricity

By Felix J. Koch

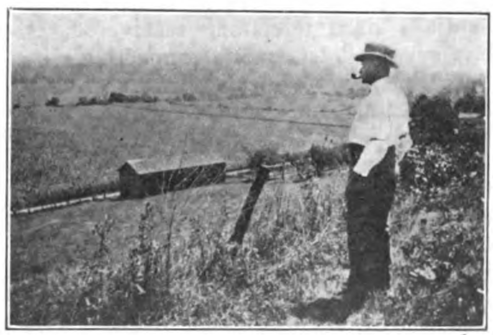
FROM Dayton, Ohio—that bustling little city that scarcely a year ago won the sympathies of the world for its flood-losses and is now winning its admiration for its experiments with city managers—there comes the word of a new science, electro-culture, which is proclaimed as something new in the agricultural world and destined to extend the growing day for plant-life to a full twenty-four hours.

"Whether it does or not," one of its enthusiasts told the press recently, "depends upon experiments now being conducted. Among other places such work is being tried on the farms of Governor James Cox, of Ohio, near Dayton, and of E. A. Deeds, the general manager of one of the largest local firms."

"Electricity," it seems, "as indicated in the name of the new farming system, is the agent whereby these wonders are to be accomplished. It is to furnish sun when clouds or night interfere with that source of light and heat, during the colder seasons, and is even counted on to coax the raindrops from the clouds. By comparison of results in fields with and without electro-culture, soil experts expect to determine the old question as to whether or not plants and seeds rest or sleep.

"Farmers say that they long ago determined by a series of measurements that corn and some other plants grow at night; corn especially on hot nights. But experiments in electro-culture are to settle that question for all plant-life. Experiments are being tried on land so fertile that it was believed nothing else remained to be done except to control the flood-waters of the Great Miami.

"In fields of cabbage, on the Morraine farm, tremendous growth has been shown under electro-culture, even in unfavorable seasons. Two boxes of vegetables, planted at the same hour, in the same soil and watered the same, were put



ONE OF THE FIELDS WHERE ELECTRICAL CULTURE IS BEING EMPLOYED

under the closest test. One was found to have grown 12 hours; the other 24 hours. The result of the experiment has not yet been determined. High-tension wires and various sorts of light are being used above the garden-plots in this experimental work of forcing plant-life. It is planned later on to apply electric current in sub-strata experiments.

"Some experts declare that not only will harvest-time be hastened, but that the quality will be enhanced in the products!"

Meanwhile the agricultural world

awaits with interest the outcome of the experiments; only too willing to imitate, should they prove an unqualified success.

A POCKET WIRELESS SET

There has lately been placed on sale in Paris a pocket wireless receiving set of unique construction. Although many portable sets have been introduced from time to time in the past, this is undoubtedly the most compact instrument ever designed.

THE RECENTLY INVENTED POCKET RECEIVING SET

The portable receiving set is of the same size and weight as the usual watch case telephone receiver. It consists essentially of a telephone receiver, sensitive crystal detector and connecting wires and clips. The connecting wires are each six feet long and equipped with a device to take up any slack if the entire length is not required. The detector is of extremely efficient and sensitive construction and can be readily regulated while listening to incoming signals. No tuning is required with this set, all signals—irrespective of wave length—being heard.

For receiving messages with this set, it is only necessary to connect both leads to a suitable insulated metallic structure and the ground. It is said by the maker that messages from the Eiffel Tower can be heard in any part of Paris by attaching the instrument across a gas and water pipe, a telephone wire and gas or water pipe, or an umbrella and ground connection. Any such metallic structures as water leads, iron balconies, etc., can be used to good advantage as antennæ. For receiving long distance messages it is necessary to employ one or more elevated wires; the distance covered depending upon the length, height and number of wires used. Ranges of over 600 miles have been covered with this portable receiving set when using an aerial comprising two wires 200 feet long and 75 feet high.

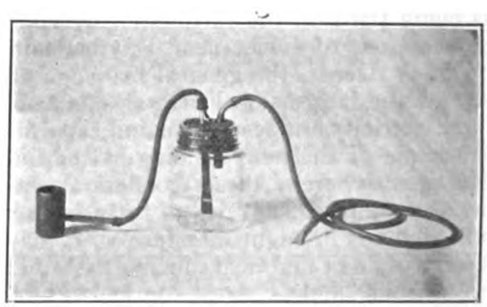
A HOME-MADE TURKISH PIPE

The object of a Turkish pipe or "Hookah" is to filter the smoke through water, thereby removing the "bite" and —it is also claimed—the nicotine. The accompanying illustration shows the construction of such a pipe better than words.

To make a Turkish pipe, procure a shallow and wide-mouthed bottle with a cork to fit; about half a foot of copper gas tubing with an inside diameter of ⅛ inch; some rubber gas or nursery tubing; and a pipe or cigar holder, all as shown in the illustration.

Cut a piece of the copper tubing two inches in length and another piece four inches in length; also sharpen a piece of the same tubing as a tool for boring the holes through the cork.

Fill the bottle about one-fourth full of water and insert the tubes in the cork as shown in the photograph. Connect pieces of rubber tubing to the copper tubes, joining the pipe to the tube passing to the bottom of the bottle and the



AN EASILY MADE TURKISH PIPE OR "HOOKAH"

mouth-piece to the short end. A mouthpiece may be made of a piece of the copper tubing or a pipe stem.—*Charles I. Reid.*

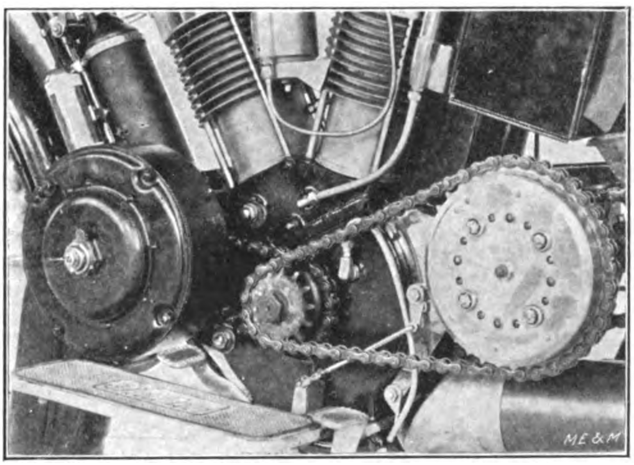
The paper used by the government printing office each year requires approximately 125 million pounds of rag pulp and 490 million pounds of wood pulp.

Electrical Equipment for Motorcycles

A Description of the Compact Electric Starting and Lighting Equipment of a Modern Machine

By John Glending

ALTHOUGH electric starting and lighting systems have been used for at least two years on all the leading automobiles made in the United States, the equipping of a 1914 motorcycle with such a system has recently aroused no little interest for the reason that it is the first time a motorcycle has been thus equipped. If the difficulties that had to be overcome in fitting an automobile with an electric starting and lighting system were numerous, those encountered in the motorcycle were tenfold, since this vehicle has little room available for extra equipment and each pound of additional weight counts. But, as in the case of the automobile, the task has been thoroughly accomplished and once more the motorcycle is placed on the same level as the automobile in the matter of convenience and comfort to the driver.



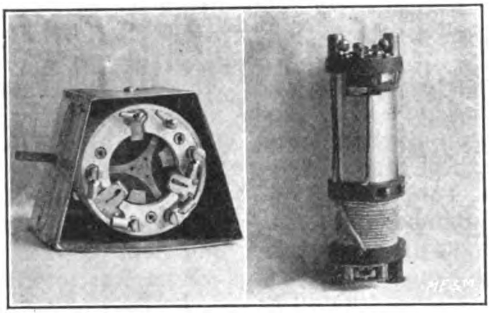
THE COMBINATION GENERATOR AND MOTOR FOR STARTING AND LIGHTING A MOTORCYCLE, SHOWING THE METHOD OF DRIVING

Undoubtedly, the most interesting part of the Indian motorcycle's electric system is the electric starter which is rated at approximately 1½ horsepower using direct current at 12 volts. It is completely enclosed. Aside from acting in the capacity of a motor, it is also employed as a compound wound generator of the multipolar type as it has four poles. The drive is direct to the gasoline engine shaft through an enclosed roller chain and a cone clutch to absorb jerks. The chief features of this motor-generator are an inverted commutator which permits very compact construction, more brush contact surface, better protection of the brushes and neat disposition of all parts.

As a starting device the motor works under a compound field, using both series and shunt windings. As a charging dynamo, it operates with the shunt winding only. Thus, thru the medium of the controller switch arrangement, the combination of a compound motor and shunt dynamo is obtained.

The motor-generator weighs 25¼ pounds and the armature shaft runs on imported, self-aligning ball bearings, the shaft being exceedingly short and rugged. The main bearings, which are the only parts of the device requiring lubrication, are packed with non-fluid oil before leaving the factory, which insures ample lubrication for 2,000 miles running. The armature construction is of the iron clad Gramm ring type with inside connections—a feature of great value because by being enclosed in the magnetic circuit of the armature core, arching or sparking between the commutator or brushes is entirely eliminated under all loads; furthermore, burning of the brushes and cutting of the armature, all of which are injurious elements, are prevented, and the life of the brushes and commutator are lengthened.

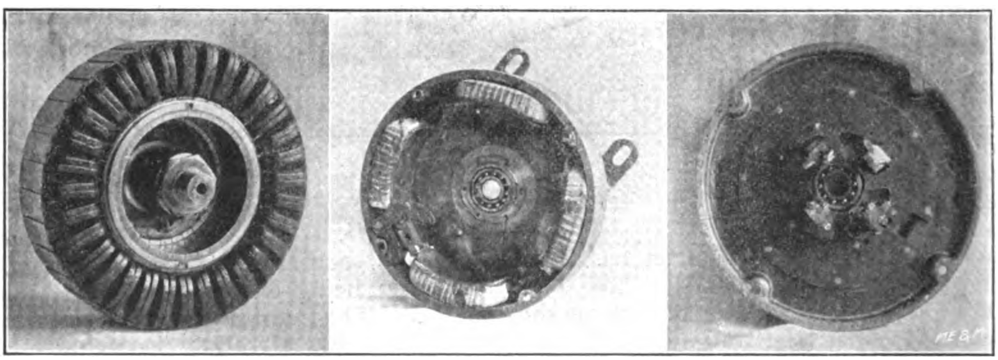
The condenser in the armature winding is of ample proportions, so that the machine, as a motor, will withstand an overload of 100 per cent, without burning out or causing injury to the winding. The power required to drive the electric starter is from 1-20 to 1-16 h. p., according to transmission losses. The starter is geared 2 to 1 and will "spin" the engine 500 r. p. m. when the batteries are at their maximum strength.



TWO OF THE COMPONENT PARTS OF THE SYSTEM: At the left, the controller switch; at the right, the magnetic regulator.

Another feature of the system is the magnetic regular. This device really consists of two instruments in one—a reverse current cut-out and a vibrator field regulator. The cut-out comes into operation when the speed of the motorcycle falls below 12 miles per hour on high gear, or 8 miles on low, and prevents the batteries discharging themselves through the motor-dynamo. The instrument is a dual one, the magnetic regulator being embodied in the upper part and the battery cut-out in the lower section. The cut-out normally is open, and is closed automatically by the magnetism created by the current from the armature passing through the fine shunt winding on the cut-out end of the magneto regulator. The cut-out closes when the armature voltage becomes greater than that of the batteries, the closing point being at the predetermined pressure of 7 volts. The cut-out is operative on the charging line only, the circuit being open on the starting line.

The magnetic regulator governs the armature output, giving the correct charging rate which is predetermined with relation to the construction of the batteries. No matter what speed is attained with the motorcycle, the batteries will not heat from excessive rate of charge, as the flow of current is held down within safe limits. The charging rate is 9 amperes per hour, a figure determined to be absolutely safe for the type of batteries employed, regardless of speed.



ESSENTIAL PARTS OF THE COMPACT GENERATOR: From left to right: The armature showing the unique commutator; the field coils and one of the bearings; and the remaining bearing and brushes.

The controller switch is of the conventional two-way type. When the switch is in the extreme forward position, the entire system is connected in series for starting. When it is in the extreme rear position the entire system is connected in parallel for charging.

(*Continued on page 488*)

The Arc Generator for Radio Frequencies

A Review of the Theory, Characteristics and Methods of Applying the Arc Generator to Radio-Communication

By Julius Weinberger

Illustrations from drawings made by the author.

IN 1900 Mr. W. Duddell discovered that when a suitable inductance and capacity were placed in shunt around an ordinary direct-current arc lamp, as in Fig. 1, a musical tone was given out; that is, continuous oscillations of an audible frequency were produced. Some years later, Salomonson showed that radio frequency oscillations could be produced, and Prof. Fessenden, in 1902, proposed an arc fed by direct current as a source of radiation for wireless telegraphy. Since then the arc method for producing continuous high frequency oscillations has been developed by V. Poulsen and others into an important variety of radio transmitter and among the stations operating with arcs to-day, are Arlington and the Pacific Coast stations of the Federal Wireless Telegraph Co.; while the Austrian government also uses the system extensively. It is the purpose of this article to give a brief outline of this method, with its theory and practice.

I. GENERAL CONSIDERATIONS.

The requirements which oscillations obtained by the arc method must satisfy, if they are to be used in radio communication, are:

(1) Their *frequency* must be within the limits of the frequencies used in the field of radio-communication (*i. e.*, about 1,000,000 per second to 40,000 per second, corresponding respectively to 300 meters and 8,000 meters wave length).

(2) The *energy* that can be drawn and the *constancy* of amplitude and frequency must be such as to make their use practical.

The arrangement with which it is possible to obtain these high frequency oscillations in a condenser circuit is that of Fig. 1, where A is the high frequency circuit and where L1 may be coupled to another condenser circuit (or antenna), B. Whether undamped or damped oscillations are obtained in A is a problem. It depends on the nature of the condenser circuit, the gap C, the D.C. voltage supplied to the arc, the resistance and inductance of the feeder circuit, and lastly, if and how closely circuit A is coupled to a secondary system.

This problem was first decided by V. Poulsen. He showed that undamped oscillations of the frequency and power necessary for radio communication are obtained in the circuit of Fig. 1, providing these requirements are observed:

(1) The arc must take place in hydrogen gas, or in a gas containing hydrogen (alcohol vapor is now extensively used).

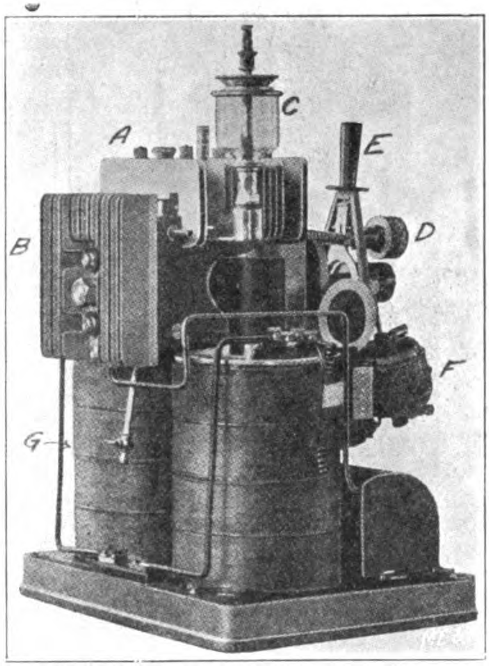


FIG. 8.—A 4 KW. COMMERCIAL ARC GENERATOR

(2) The anode of the arc is to be made of copper, preferably cooled by running water, and the cathode of carbon.

(3) A magnetic blow-out is to be used across the arc.

(4) For good regulation the carbon electrode or the arc itself may be slowly rotated.

The Poulsen arrangement is in principle that of Fig. 2, the apparatus for rotating the carbon electrode being omitted. The two magnets, through whose coils direct current is sent, supply the magnetic blow-out.

These requirements of Poulsen are not all of equal importance. The hydrogen-containing atmosphere and electrode materials are sufficient to give the frequency and constancy of oscillations required in radio communication. The magnetic blow-out is only necessary when a large amount of energy is to be drawn from the condenser circuit.

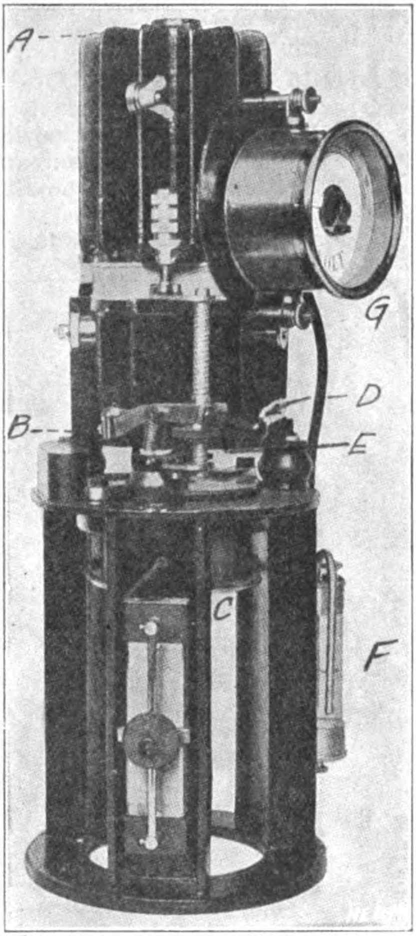


FIG. 9.—A SMALL ARC GENERATOR FOR LABORATORY PURPOSES

II. THEORY.

(A) "CHARACTERISTICS" OF THE ARCS

By a "characteristic" of the arc (or of another conductor carrying a current) is meant a curve showing the relation between *current* through the arc and *voltage* across it. For the arc two such characteristics can be drawn, viz.:

(1) The *static* characteristic, or the curve obtained when the arc is fed by *direct* current.

(2) The *dynamic* characteristic, or the curve obtained when the arc is fed by *alternating* current.

(1) *The Static Characteristic*: It is well known that the relation between voltage and current in an ordinary conductor is given by Ohm's law.

$$I = \frac{E}{R} \qquad (1)$$

This does not hold, however, for an arc. Within certain limits the relation becomes

$$E = a + \frac{b}{I} \qquad (2)$$

where a and b are constants. Now, if equation (1) be plotted (Fig. 3.A) we obtain a straight line, while if equation (2) be plotted a curve of the form shown in Fig. 3.B is obtained. This second curve is the static characteristic of the arc. It will be noted that for an increase in current (I) the voltage (E) *falls*. The curve is then known as a *falling* characteristic, and the behavior of an arc is thus seen to be entirely opposite to the behavior of an ordinary conductor (in which current and voltage rise or fall together).

For very large currents, from equation (2), the voltage becomes appreciably equal to the constant a; for very small currents it does not, however, become infinite, but approaches a finite value, E_s, which is just sufficient to start the arc (in this case to spark across the arc gap). This value of E_s depends upon the form and separation of the electrodes and the gas in which the arc is to take place. It is, of course, very much higher than the voltage across the arc when the latter is burning well. The constants a and b have been found for the direct current arc to be

For carbon electrodes
$a = 38.88 + 2.074\,f$ Volts
$b = 11.66 + 10.54\,f$ Watts
(H. Ayrton)
For copper electrodes
$a = 21.38 + 3.03\,f$ Volts
$b = 10.69 + 15.24\,f$ Watts
(Guye and Zebritoff)

where f is the separation of the electrodes in millimeters.

(2). *The Dynamic Characteristic*: This is in the form of the curve shown in Fig. 4. Two points are to be noted here:

(a) The voltage corresponding to any given value of current when the current is *rising* is not identical with that corresponding to the same value of the current when this is *falling*. That is, the current and voltage are out of phase; at the time the current is a maximum, the voltage is not. This is similar to the relation existing between magnetic induction and magnetic field strength in iron—in fact, the curve of Fig. 4 appears much like a "hysteresis"

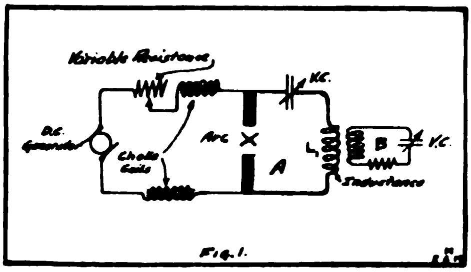


Fig. 1.

curve for iron. Hence this phenomenon has been named "arc-hysteresis."

(b) The arc-lighting voltage, Es (in this case the voltage at the time the current goes through zero), is very small, since the gap still remains conductive (or ionized) after the current has ceased.

(B) The Production of Oscillations: It is as a result of these peculiar characteristics of the arc that we may obtain oscillations in a condenser circuit shunted around it. For, if the arc automatically permits the condenser to charge and then allows it to discharge, then this discharge will be oscillatory in character. The way in which the arc's characteristics allow it to act as such a controller is the following:

Let us imagine the arc as burning, simply a direct current flowing through it; at the same time the condenser in the shunt circuit is accumulating energy. It reaches a given potential and discharges across the path formed by the arc, first in the same direction as the D. C. Thus a greater current now flows through the

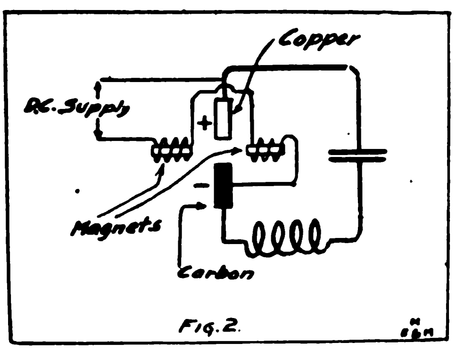


Fig. 2.

arc than previously, and, observing its static characteristic, its resistance drops. Now, as the direction of condenser discharge reverses, the arc current grows smaller and smaller, and the arc's resistance rises quite high. This gives the condenser a chance to again store up energy, and the whole process is repeated. Thus by the variation of the arc's resistance between wide limits, the energy of the D. C. circuit is first thrown into the condenser, and then from this it is shifted to the shunt circuit, to be finally transferred to and used up in the antenna. The arc acts all along simply as an automatic switch for the D. C. energy, putting it at one time into the condenser, from the feeder circuit, and at another time drawing it out into the shunt circuit. The steady and undisturbed operation of the arc as such an automatic switch is only possible when it responds quickly and promptly to changes in current. Any excessive hysteresis (as shown by the dynamic characteristic), or lag in response, will hinder or even wholly destroy its action as a generator for high frequency oscillations. Thus all provisions which tend to reduce this "arc-hysteresis" will

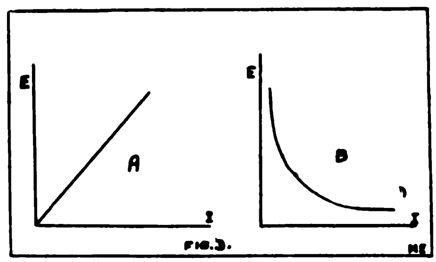


Fig. 3.

aid in the production of oscillations of higher and higher frequency; a number of these, as suggested by Poulsen, have already been given in (1).

We will pass on, then, to the varieties of oscillations that may take place in the shunt circuit under various conditions. There are three of these and they are known respectively as oscillations of the first, second and third orders.

(1) *Oscillations of the First Order*: These are distinguished by the fact that their amplitude is smaller than that of the direct current feeding the arc (Fig. 5). They are produced when the inductance of the shunt circuit is made very large and the capacity quite small, the direct current through the arc being at the same time rather small. They are nearly sinusoidal in character and their wavelength is practically that of the shunt circuit. They may therefore be of value for measuring purposes, but are quite useless for radio communication on account of their small energy content.

(2) *Oscillations of the Second Order:* These have an amplitude slightly greater than or equal to that of the direct current

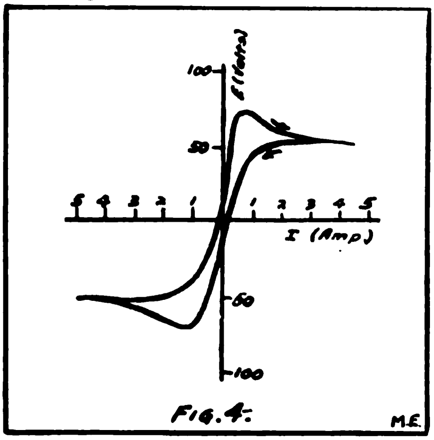


Fig. 4.

supply. They consist of a series of regular current *impulses,* broken by short periods of no current (Fig. 6). On account of their larger energy content they are the oscillations most sought after in an arc set. They may be obtained by a proper adjustment of inductance and capacity in the shunt circuit, so as to obtain the required relationship between current in the shunt circuit and feeding direct current, and their production is aided by

(a) A high arc voltage.
(b) Cooling of the metallic arc anode.
(c) A hydrogen-containing atmosphere around the arc.
(d) Rotation of at least one electrode, or of the arc itself (the latter is used in small arcs, and is obtained by use of a magnetic field in a direction parallel to the arc path).
(e) Use of magnetic blow outs, in larger arcs.

The purpose of these practices is to render the arc path non-conducting immediately after the condenser has discharged, as well as to reduce arc hysteresis.

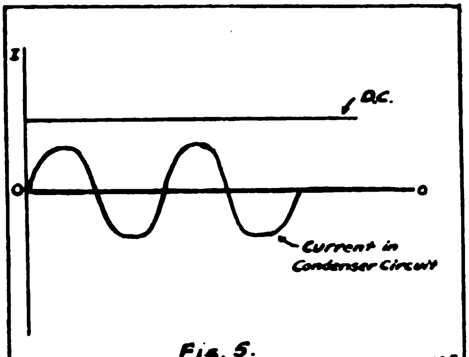


Fig. 5.

The rendering of the arc path non-conducting forces the condenser to charge up to a voltage sufficient to relight the arc, when it again discharges its energy.

It will thus be seen that the arc here is acting much as a very good quenched gap—quenching the condenser discharge practically at the moment it passes through its first zero value. Hence the condenser circuit may be employed as a quenched gap circuit and used to "shock" a circuit coupled to it into vibrations. The frequency of these impulses depends entirely on the time taken up in charging the condenser up to a discharge voltage; i. e., it depends upon the character of the feeding D. C. circuit. The frequency alters immediately with any change in the arc-lighting voltage—which depends upon the separation of the electrodes and the current through the arc.

(3) *Oscillations of the Third Order:* These occur when the quenching apparatus of the arc works imperfectly and does not cut off the condenser oscillations at their first zero value. The current in

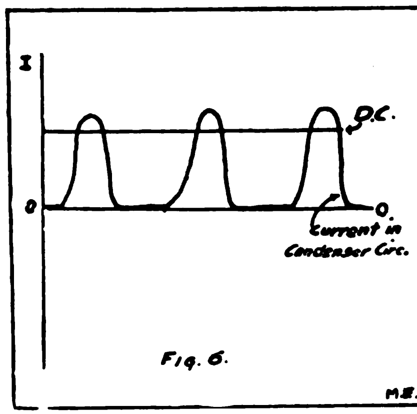


Fig. 6.

the condenser circuit then becomes an ordinary damped oscillation which decays until a point is reached where the arc quenches it (Fig. 7). These oscillations are frequently intermixed with those of the second order. Their frequency is practically the natural frequency of the shunt circuit. (By frequency here is meant the frequency of the damped oscillation forming a single wave train, and *not* the number of wave trains per second, as is the case for oscillations of the second order, in which a wave train is reduced to a single impulse). The presence of the arc has no material influence upon it, and hence the frequency is constant.

(C). Practical Considerations for Oscillations of the Second Order: The oscillations of the first order are practically negligible, because of their small energy content. For radio communication with continuous oscillations, those of the *second order* only are used. For practical usage it is important that, (a), a large amount of energy be transferred to the oscillations and, (b), that their frequency remain constant.

(a). The requirement that a large amount of energy be carried over into the oscillations leads to the requirement of a high arc-lighting voltage. This may be satisfied by:

(1) A long time allowance for charging the condenser so that the ionization of the gas in the arc crater has time to disappear.

(2) That one uses special means to remove this ionization rapidly.

Now, if a long time is given the condenser to charge, the frequency will not remain constant, since then the presence of enough ions to cause the arc to light is not at all certain. Hence we are reduced to the necessity of making the charging period quite small, but using

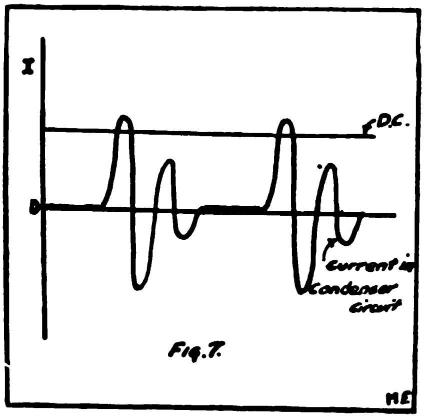


Fig. 7.

means to remove a large number of the ions (so that the arc shall not light until quite a high voltage is reached), yet, at the same time, leaving sufficient ionization to cause this lighting to take place at regular intervals. For the last purpose the practices mentioned in (1) as given by Poulsen, are used.

As a corollary to these practices, it is interesting to see what the size of condenser used in the shunt circuit has to do with the arc's operation. If a large capacity is used (so as to give large energy to the oscillations), then large current in the shunt circuit will result. Since this must not be much greater than the D.-C. through the arc, the latter will have to be large. Hence strong ionization in the arc crater will result and cause difficulties. One is therefore compelled to use a *small* capacity, with a large inductance, in the shunt circuit.

III. TECHNICAL APPARATUS AND METHODS

(A). Apparatus: Fig. 8 shows a 4KW commercial arc generator. The arc

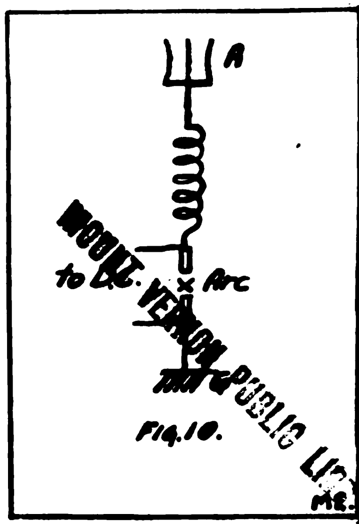


Fig. 10.

chamber is enclosed by the cooling flanges, A, B; alcohol is fed into the chamber from the cup, C, which, when vaporized by the arc, gives the necessary hydrogen containing atmosphere. The carbon electrode is controlled by the adjustment handle, D, and may be brought into contact with the copper electrode, so as to start the arc, by means of the handle, E. The small motor, F, serves to rotate the carbon electrode slowly. A strong transverse magnetic field is furnished by the coils, G. This arc is operated on 500 volts D. C., obtained by means of a special motor generator, and takes about 6 amperes. At a wave length of 2,000 meters the entire

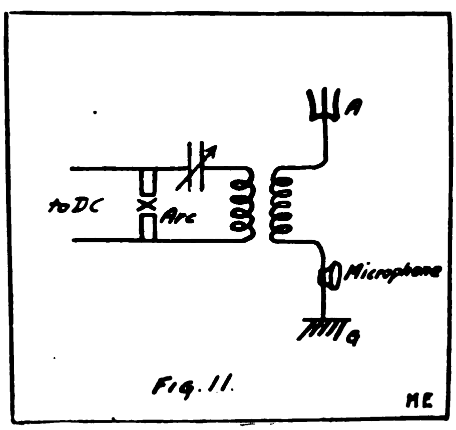


Fig. 11.

apparatus will operate at about 20 per cent. efficiency.

Fig. 9 shows a small arc for use as a

generator of continuous waves for measuring purposes. Here the arc chamber runs from A to B, and is enclosed in the usual cooling flanges. Instead of rotating the carbon electrode, as in the larger arc, the arc itself is rotated by a magnetic field parallel to it. This is provided by the coil, C. The arc can be started and its length adjusted by the handle, D, and locking nut, E. The alcohol vapor in which the arc burns is fed in from the cup, F. A voltmeter, which is connected across the arc-gap, is shown at G. This is permanently attached to the arc, and serves to indicate whether it is burning steadily or not. It also indicates variations in the wave length of the oscillations in the shunt circuit since this varies with the voltage across the arc. The apparatus operates on 220 volts. The arc usually has a drop of about 70 volts across it and takes about 3 amperes. Its output is about 100 watts at 2,000 metres wave length.

Both of these instruments are of the types constructed by the Poulsen Company for the Amalgamated Radio Telegraph Co.

(B). METHODS:

(1). *Circuits*: In the usual circuits used with the arc, the latter is fed by direct current through an adjustable resistance and choke coils; it is shunted by its condenser circuit, which in turn is coupled to the antenna. However, the arc may also be placed directly in the

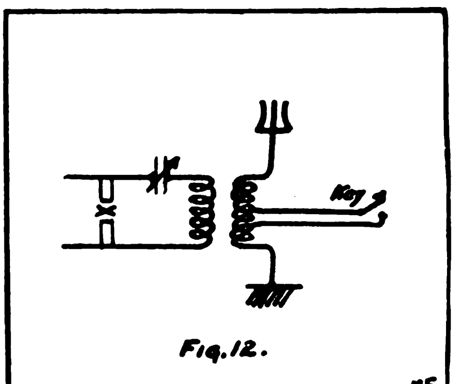


Fig. 12.

antenna circuit (Fig. 10) when the antenna used has a capacity which would make it equivalent to the proper condenser to be used with the particular arc in question.

For radio-telephone work, coupled circuits are usually used and the microphone placed in the antenna ground lead (Fig. 11).

(2). *Methods of Sending*: In ordinary spark sets it is sufficient, for sending purposes, to insert a key in the primary of the transformer to make and break the circuit. With an arc, however, this is not so simple. If the key were to break

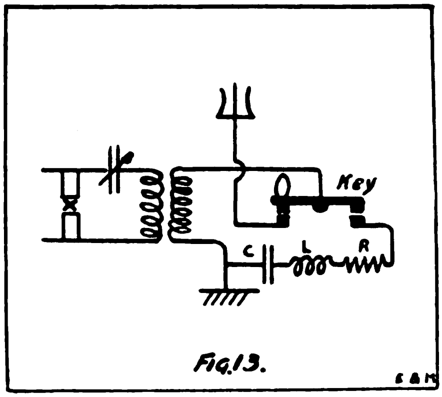


Fig. 13.

the arc feeder circuit the arc would go out and it would be a troublesome matter to relight it. It is therefore necessary to allow the arc to remain burning and start and stop the antenna vibrations. This result is obtained by short circuiting a turn or two of the antenna inductance by the sending key (Fig. 12), thus reducing the wave length and throwing the antenna in or out of time with the arc circuit. This has, however, a bad influence on the arc (since it throws a sudden load on or off it) and hence Pedersen has suggested the idea of throwing the arc from the antenna to an equivalent energy-consuming (but non-radiating) circuit (Fig. 13). This keeps a constant load on the arc and permits of good regulation.

(Note): For some of the data in this article I am greatly indebted to J. Zenneck's "Drahtlose Telegraphie."—*The Author.*

ELECTRICITY AND THE RECKLESS RAT

The rat that made electrical experiments with his sharp teeth on the insulation of the live wires is shown herewith as a "horrible example" to all other rodents and careless creatures, including humans. Mr. J. B. Middleton, Manager of the Home Telephone and Telegraph Company, of Portland, Ore., states that in inspecting a private branch exchange this little fellow was found with his incriminating evidence. He had used his teeth on the insulation until a voltage of fifty, or possibly the ringing voltage of

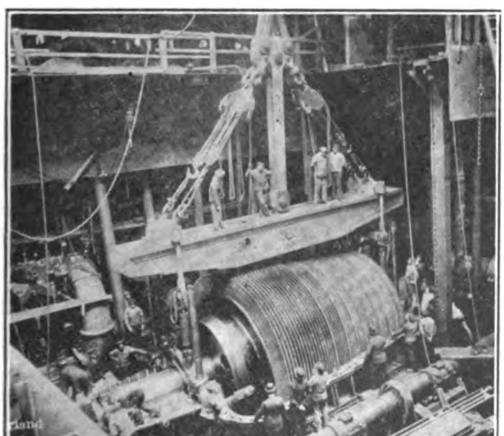
100 passed through his body and death ensued. The position of the tail is al-

THE RAT'S PUNISHMENT FOR GNAWING ELECTRIC WIRES

ways in evidence in rodents that have been killed by an electric shock.—*C. L. Edholm.*

A GIGANTIC MARINE TURBINE

The machinery of the S. S. *Vaterland,* the largest ship in the world, is the most powerful ever installed on shipboard. The liner is propelled by four enormous screws driven by great turbines. One of the forward rotors of the *Vaterland* is shown in the accompanying illustration being lowered into position. The group of workmen surrounding it is completely dwarfed by the rotor which measures 17½ feet in length and 17 feet in diameter. The *Vaterland* is a sister ship of the famous *Imperator,* but surpasses her in every dimension, measuring 950 feet in length, 100 feet in beam and is 58,000



LOWERING THE ROTOR OF ONE OF THE "VATERLAND'S" TURBINES INTO PLACE

tons burden. The *Imperator* with a length of 919 feet, a beam of 98 feet and a tonnage of 52,000, is in turn 5,000 tons heavier than any other ship afloat. The *Vaterland* will reach New York early in June, sailing on her first Eastern trip on June 16th. A third sister ship is now building.

SUSPENSION OF A RADIO OPERATOR'S LICENSE

On August 17, 1913, a wireless operator, holding a Government license, operating on a steamship in the North Atlantic coasting trade, was reported to the Bureau of Navigation for indulging in unnecessary and unauthorized conversation by means of the wireless apparatus. This report was entered on the operator's personal record kept in the bureau and a warning was issued.

On January 4, 1914, the same operator repeated the offense and was reported to the bureau.

In accordance with Section 3 of the Act of August 13, 1912, "An Act to Regulate Radio Communication," the Secretary of Commerce suspended the operator's license for a period of 30 days, and the operator was warned that if he operated any apparatus for radio communication during the period of suspension of his license, he would be guilty of a misdemeanor, and on conviction thereof, would be punished by a fine of not more than $100, or imprisonment of not more than two months, or both, in the discretion of the court, for each and every such offense.

This is the second operator's license suspended by the Secretary of Commerce within the last two or three months, and is equivalent to a fine amounting to a month's pay if the operator cannot find other employment during the period of suspension.

A general warning has been issued to operators through radio inspectors that the Regulations Governing Radio Communication must be complied with in all particulars. Future violations will not be so leniently dealt with.

Roadside signs, each containing a single catchy sentence in large type, are proving effective in warning against fires in western forests. They give the essentials and tell the importance of protection against forest fires.

A High Speed Vibrating Key

The Construction of a Simple Vibrating Key for Sending Telegraph Messages at High Speed

By P. Mertz

Illustrations from drawings made by the author.

AN instrument of great value to the telegraph operator, amateur or professional, line or wireless, is the high speed vibrating key, since it permits of extremely high speed in transmission with but comparatively little effort. The principle of operation of this key is as follows:

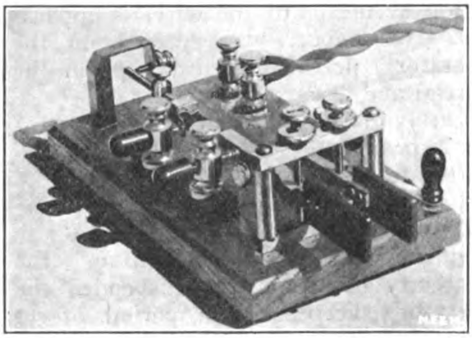


FIG. 1.—VIEW OF THE COMPLETED HIGH-SPEED VIBRATING KEY

Two handles, one at the right for making dashes and another at the left for making dots, are used in working the instrument. The former works like an ordinary key; that is, when depressed a contact is closed and remains so until the pressure is removed. The left-hand, or dot lever, when depressed causes a weight fastened at the end of a spring to vibrate. This weight carries a contact point which touches a fixed contact at each vibration. This produces a series of dots, the number of which is determined by the length of time the key is depressed. The speed at which the dots are made can be varied by shifting the weight along the spring to which it is attached. There are several well-known makes of this type of key on the market, but the price prevents many amateurs who would otherwise be glad to experiment with it from owning one.

The key here described and illustrated can be readily constructed from discard-

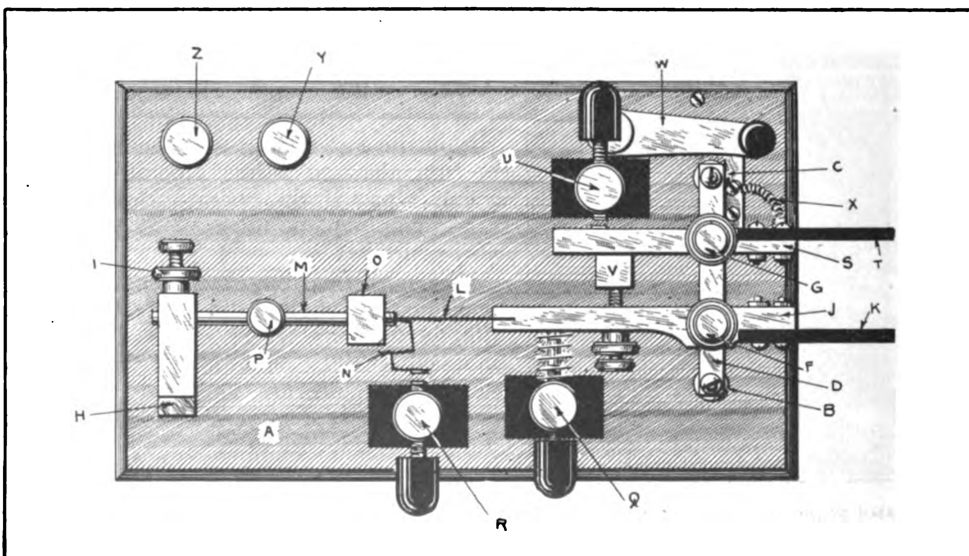


FIG. 2. PLAN VIEW

ed parts of other instruments or machined from raw materials with the aid of few tools.

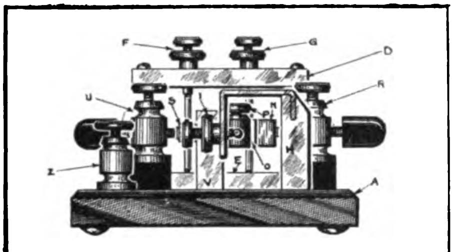


Fig. 4 Rear Elevation

The photograph, Fig. 1, shows the completed instrument while the plan view, side elevation and end elevation are shown in Figs. 2, 3 and 4, respectively. The other illustrations are working drawings of the parts.

The first part to be constructed is the base, A, shown in Fig. 5. It may be made of almost any non-conducting material, such as mahogany, oak, or other wood, fibre, hard-rubber, etc. In the instrument shown in the photograph the base is made of oak. After the base has been beveled, drilled, etc., attention should be given to the bearings, shown in Fig. 6. These consist of two uprights, B and C, of brass tubing, separating the two brass cross bars, D and E, which hold the bearings proper. The adjustable bearing screws, F and G (fitted with thumb-check-nuts, as shown), are screwed upon the upper cross-bar, D. The ends of the screws have conical holes drilled in them, to receive the pointed ends of the pivots. To obviate the drilling of these holes, which is a pretty difficult job, the bearing screws from an old sounder were used. The lower bearing consists of conical holes drilled in the lower cross-bar, E. A simple method of getting these holes exactly opposite those on the upper cross-arm is as follows:

When ready to drill the holes in the upper cross-bar, clamp the lower one against it, but place separators about 1/16-inch thick between the two. Then drill the required holes—it is a simple matter to see when the upper bar has been drilled through, on account of the air-space between the two bars—drilling the end holes clear through both pieces, but the other holes only far enough to just make the required conical depression. The two cross-arms are fastened to the base by means of two long 8/32 screws, tightened under the base with two nuts.

At the back, in order to check the return stroke of the swinging rod and also to protect the latter, is mounted the upright, H, given in detail in Fig. 7. It consists of two pieces as shown, one forced into the other. The dotted lines give the position and shape of the one before being bent and after being forced into the slot in the other. A screw, I,

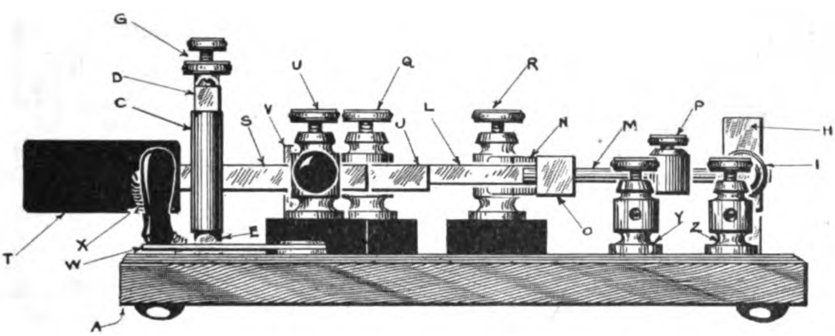


Fig. 3. Side Elevation.

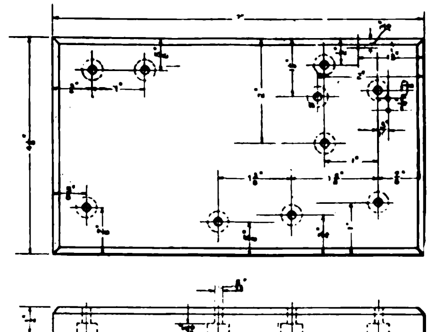


Fig. 5 Base, A 1 req.

carrying a thumb-check-nut is mounted, as shown, to check the return motion of the vibrating bar. In order to stop the

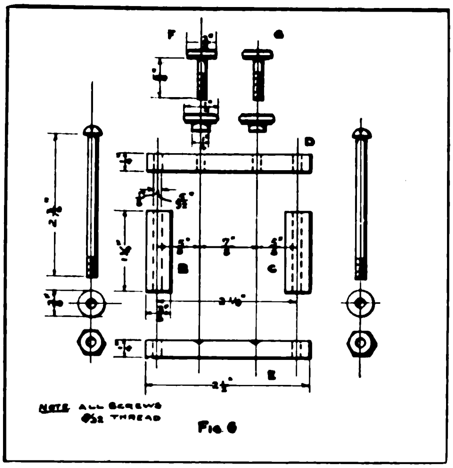


Fig. 6

sharp sound which occurs when the bar strikes the end of the screw, a small disk of heavy paper is glued to the end of it. The upright is fastened to the base by means of a screw coming up from under the base, passing through the latter.

The next part to be constructed is the vibrating mechanism for producing the dots, shown in Fig. 8. This consists of an arm, J, which, in the instrument shown in the photograph, consists of the lever from an old sounder. To this arm is attached, by means of two small bolts and nuts, the hard-rubber manipulating handle, K. The sounder arm is allowed to retain its pivot which just fits the distance between the bearings. At the other end of the arm, J, a slot is cut with a hack-saw, as shown, to admit a small piece of clock-spring or corset steel, L, which is soldered in place. Over the other end of the spring is forced and soldered a small length of 5/32-inch brass rod, M. In soldering these parts great care must be taken not to heat the spring too highly, as it will lose its elasticity and cause trouble if excessive heat is applied. In the same slot a small bent piece of spring brass or copper carrying the contact point is also forced and soldered. The contact point consists of a small silver disk about ⅛-inch in diameter and 1/16-inch or less in thickness soldered

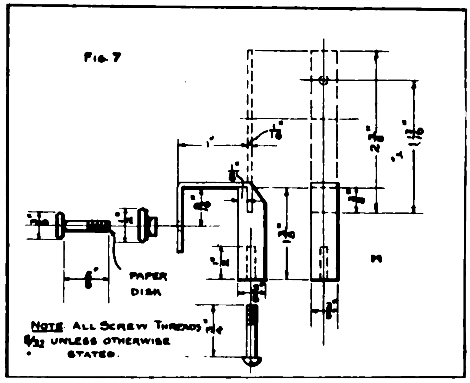


Fig. 7

to the spring, N. A small brass block, O, acting as a weight, is forced over the rod and moved to the place it is shown in Figs. 1 and 2. Another weight, P, this one made movable in order to

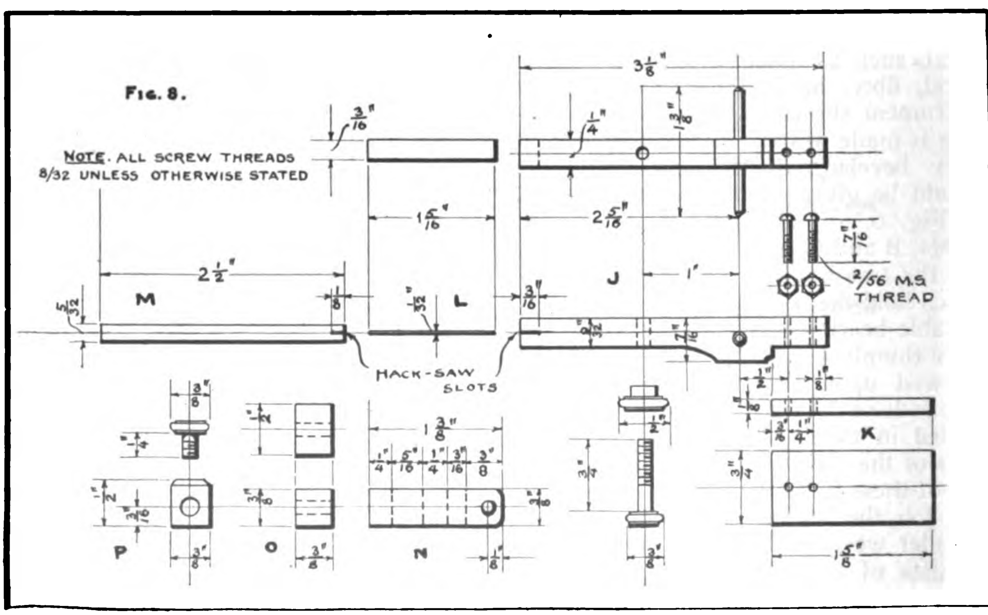


Fig. 8.

regulate the speed at which the dots are made, consists of a binding post, fastened to the rod by its clamping screw.

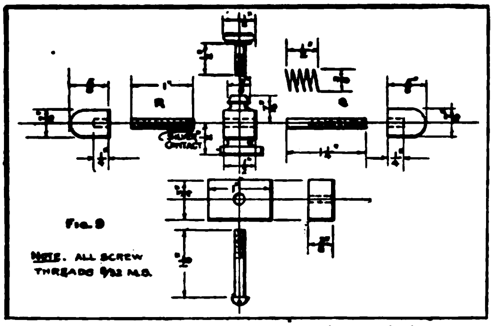


Fig. 9

Note. All screw threads 8/32 M.S.

In order to limit the motion of the arm, J, a large binding post, Q, is mounted on the base to the left, over a block of hard rubber, fibre, wood, or any other suitable

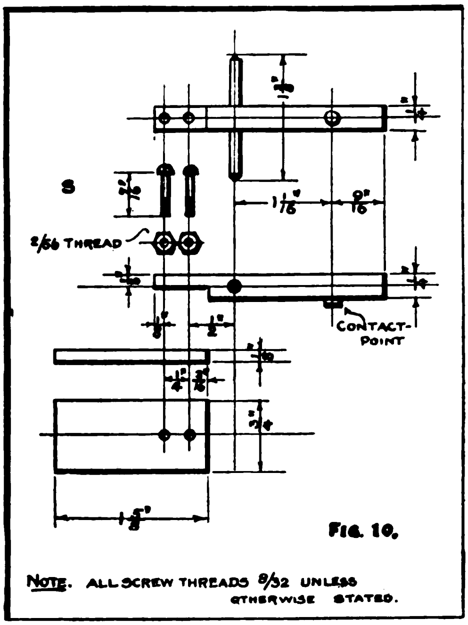


Fig. 10.

Note. All screw threads 8/32 unless otherwise stated.

material to raise it to the required height. This binding post carries a short length of threaded brass rod fitted with a hard rubber or composition handle at one end.

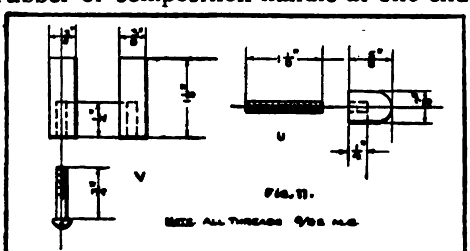


Fig. 11.

Note. All threads 8/32 M.S.

for adjusting. A spring is compressed over the rod between the binding post and the arm, K, to keep the latter to the right when no pressure is exerted on the operating handle. A short distance away another binding post, R, similar to the one just described, is mounted and carries the contact point. This latter, a small piece of silver, is soldered to the end of the threaded rod in the post. The vibrating lever can now be mounted in position by unscrewing F a short distance, placing the lower pivot in its corresponding conical bearing, then screwing down F over the upper point of the pivot so as to lock it in place by means of the check-nut.

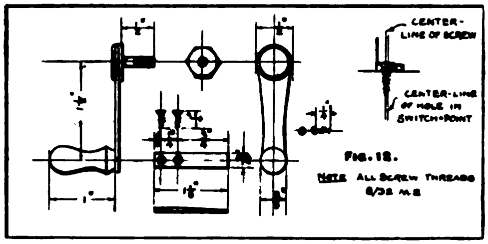


Fig. 12.

Note. All screw threads 8/32 M.S.

The lever for producing the dashes, S, consists of a short length of ¼-inch square brass rod, filed away at one end to admit the operating handle, T, which is fastened in place by means of two small bolts and nuts. A short distance away a hole is drilled in the lever to admit the pivot, which consists of an iron or steel rod, such as a nail, having conical points filed at each end. A short distance away is soldered the contact point, the same as was used on the spring, N. The other contact point and its mounting, U, are exactly the same as at R. In order to limit the motion of the lever, S, to the left, a post, V, is mounted on the base

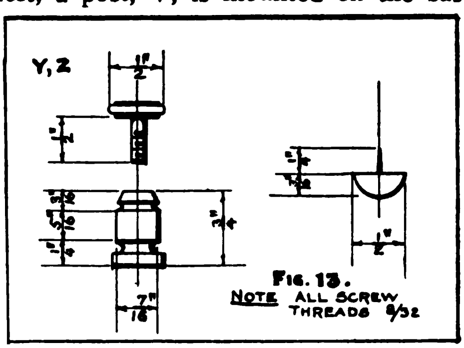


Fig. 13.

Note. All screw threads 8/32

at the place shown. This also serves to limit the motion of the arm, J, to the right, by means of an adjusting screw as illustrated. In order to keep the lever, S, against the post, U, a small, but long spring, X, is fastened under one of the screws holding the handle, T, in place;

while the other end is clamped under a screw on the base. This spring can be plainly seen in the plan view, Fig. 2, and side elevation, Fig. 3, but is not visible in any of the other illustrations.

If it is desired to use the key for ordinary telegraphic purposes, either permanently or only for part of the time, a circuit closer, W, should be fitted. This consists of an ordinary switch lever with handle, shown in Fig. 12. The switch point is a small strip of brass screwed to the base by two small oval-headed screws. This switch point is pressed against the side of the cross bar, B. In Fig. 12 is shown how, by slightly offsetting the screws, a good pressure may be had against this cross bar.

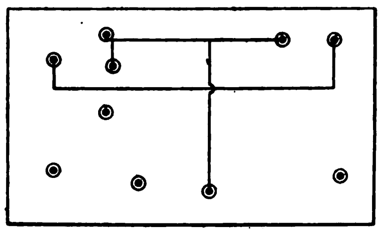


Fig. 14. Wiring Diagram (under side of base).

Two binding posts, Y and Z, shown in Fig. 13, are mounted upon the base at the back. Rubber feet, such as illustrated in Fig. 13, are fastened to the under side of the base to slightly raise it from the surface of the table.

All the parts should now be finished, the metal parts being lacquered and the wood stained and waxed or varnished and then assembled. The wiring, underneath the base, is shown in Fig. 14. The finished instrument is connected in the circuit in the same way as any ordinary key, and is operated as was explained earlier in this article. For making dots the thumb of the right hand is pressed against the left key and held there until the required number of dots have been made. For dashes the fore-finger is pressed against the right hand key and held there as long as the dash is desired. To gain speed the two key handles are always lightly grasped between the thumb and fore-finger in transmitting.

Importance of Protection by Trade Mark

By George William Miatt

ANY man is entitled to make his mark in these present times, but he must be original in order to succeed, particularly if he is a manufacturer; otherwise he himself becomes an "easy mark" for the unscrupulous. In art and literature, imitation may be considered the most consummate flattery, and plagerism is even condemned to a certain extent. But commercial plagerism is illegal, even if not immoral, in fact, it is piracy of the most flagrant kind, and he who attempts to appropriate or share another man's commercial prestige by imitating a well-established trade-mark renders himself liable to triple damages and other unpleasant consequences. The distinction, however, between a trade-*mark* and a trade-*name* does not seem to be very clear to the public, nor even to many business men; and perhaps the best definition to be had is that in the case of Ball v. Bazar, Court of Appeals, N. Y., 87 N. E. 674, i.e.: "A trade-mark may be tersely defined to be any sign, mark, symbol, word or words which indicate the origin of ownership of an article as distinguished from its quality, and which others have not the equal right to employ for the same purpose. In its strictest sense, it is applicable only to a vendable article of merchandise to which it is affixed." Hence, it will be seen that a trade-*mark* is *"applicable only to a vendable article of merchandise* to which it is affixed," whereas, on the other hand, a trade-*name* applies to a business as a whole, although that business may involve the commercial exploitation of many vendible articles. For instance, in greater New York at least, "Macy's" is a well-known trade-name, while Macy's five-pointed star is a well-known trade-mark for certain specific goods made for and sold by the firm, which latter, moreover, deals in an infinite variety of other goods, many of them bearing trade-marks owned by other manufacturers. "Wanamaker's" is

(Continued on page 494)

Construction of Small Alternating Current Motors

Complete Working Instructions for the Building of Small Alternating Current Motors in Several Sizes*

By A. E. Watson, E. E.

Illustrations from drawings made by the author

AS shown in the drawings that appeared in the preceding articles, the motor is partially enclosed, but if extra ventilation is desired, means are suggested in Fig. 11. A row of ½" holes can be drilled near the outer edge of each end-shield, or the patterns of shield and frame can be cut away so as to provide four elongated openings. This latter is the more effective method but makes the lathe work rather more difficult.

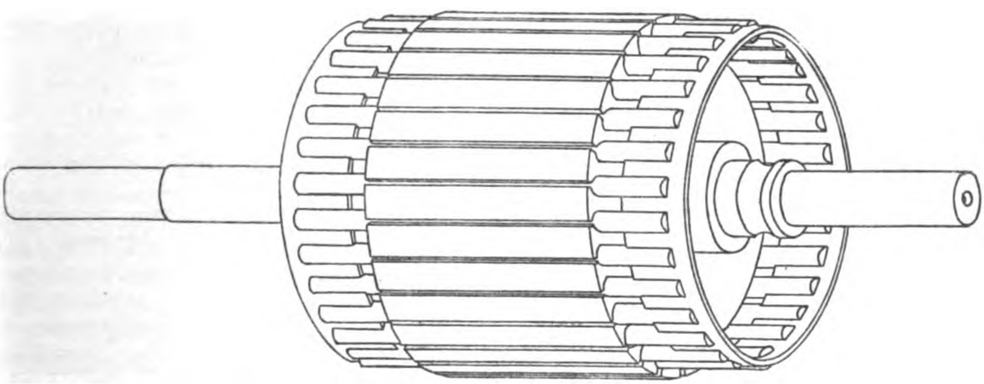


FIG. 13.—PERSPECTIVE VIEW OF A COMPLETED ROTOR OF THE SHORT-CIRCUITED OR "SQUIRREL-CAGE" TYPE

4.—CLAMPING RING

This, too, is of cast iron. Though light, it is sufficiently strong for its purpose. With the pattern properly made, there should be no necessity for machine work or even filing to permit its entry into the frame. If filing is required, it should be reserved until after the drilling and tapping of the holes for the eight stove-bolts. Once tapped, filing can actually meet the threads without much impairing their holding power.

To locate the holes, one of the stator sheets may be laid upon the casting and a scratch made all around it, for this diameter of 7¼" must be given proper clearance. Since the bolts are 3/16" in diameter, the prick-punch marks must not be nearer the circle than 3/32". The diameter of 7 9/16" given on the drawing of the ring in Fig. 12 and of the frame in Fig. 7 therefore admits a clearance of 1/16". After marking the locations, make the holes with a No. 24 drill, and tap them 10-24 machine-screw size.

The corresponding holes in the flange of the frame casting can be located by dropping the clamping-ring into place and using it for a guide or "jig." Use first a No. 24 drill that may be sufficiently lengthened for the purpose by solder-sweating it into the end of a rod. After drilling the first hole, put a pin through the two castings to prevent slipping during the rest of the drilling.

* This series began in the February issue. It is necessary to refer to the February and March issues for complete working details and drawings.—THE EDITOR.

From the outside, enlarge these holes by use of a No. 10 drill, then countersink them to fit the heads of the stove bolts. It will be a good plan to countersink slightly the inside edges of the holes in the clamping-ring, for then guidance will be given to the bolts when assembling the parts.

If the stove-bolts have threads that have been rolled rather than cut, it will be necessary, in order to fit the threads just tapped, to run on a standard 10-24 die.

should be taken to turn the eight screws alike, for otherwise the clamping ring may be broken.

If tissue paper has been used for separating the iron sheets, the superfluous portions can now be removed by cutting and burning, but if the better provision of varnishing the iron has been used, this inconvenient operation will be avoided. Some filing in the slots and their openings will, however, be inevitable. Step-by-step punching operations are never sufficiently accurate to

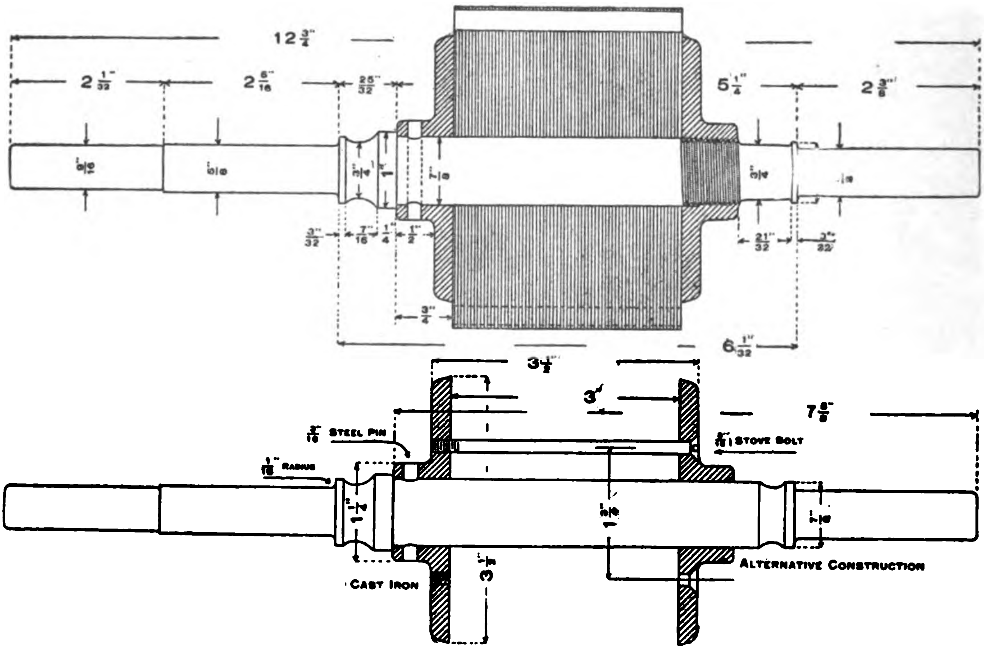


FIG. 14—CONSTRUCTIONAL DETAILS OF SHAFT AND ROTOR CORE

5.—ASSEMBLING THE STATOR IRON

One of the fiber discs first being placed in the frame, the sheet iron is to be stacked in, one sheet at a time, due reference being given to the location of keyway and distinguishing mark, or their equivalent. The sheets should not be so loose as to fall into place merely by their weight, nor so tight as to require vigorous pressing at the four ledges against which they rest. This latter condition would surely involve "buckling." Some experimenting may be necessary to determine just how many sheets are required to give a total length or thickness of three inches. During the clamping process care

permit all the sheets to coincide at their edges, and the filing should be carried to a point where a sample stick that has been planed to the assigned dimensions of the slot will readily pass entirely through the core in all the twenty-four places. Such sticks will be found useful during the winding operations as a substitute for more elaborate fixtures, as will be described in connection with that part of the work.

6.—SHAFT AND ROTOR

A perspective view of the "squirrel-cage" rotor as mounted on the shaft is given in Fig. 13. It represents solid copper rods embedded in slots in a laminated core and connected to two copper end-rings. Though simple to understand, the small clearance from the stator along with the requirement for freedom from vibration permit no relaxation in workmanship. In making and fitting the shaft especial care is required, for the life and efficiency of the motor depend in no small degree upon the excellence of this particular detail of the work.

Ordinary black machinery steel or "cold-rolled" steel is suitable material for the shaft. If the former is selected, it should be a little over an inch in diameter in the rough, then sufficient stock will be provided to permit the centering and turning. If the other sort is used, it need be of but just one inch in diameter, whence by use of chuck, center rest, and hand-tool, exact centering can be done and therefore no turning will be required on the part that is to be left full size. A piece about 12⅞" in length should be provided.

In its purchased form a bar of steel is apt to be under internal stresses, and to ensure the straightness of the shaft when approaching its final dimensions, precautionary steps should be observed. One method is to anneal the stock, but another that is quite as effective and does not involve softening the steel consists in turning the shaft to approximately its dimensions in all places before attempting the final chips. The stresses exist mostly near the outside surfaces, and as these are turned off the material is permitted to assume its relaxed condition.

Two methods of mounting the rotor core are shown in Fig. 14, both of which are identical in the respect of having one cast iron head or flange tightly fitted and pinned against a shoulder on the shaft, but in one case having the other head threaded on the shaft, and in the alternative construction drawn up by two slender screws extending through the laminations. If the first method is selected the cutting of the threads should be next to the last of the lathe operations, and the threads should be rather fine, say about twenty or twenty-four to the inch. A coarser thread would interfere with the provision for a shoulder that is important both for limiting the end motion and serving as an oil-deflector. The very last of the turning should be for the bearing portions proper, but these parts should remain until after the bearing linings have been finished, then properly fitted to them. It will be noticed that the design calls for a diameter for the pulley 1/16" smaller than in the bearings. This is an important provision, for in the first place it locates the inner end of the pulley hub that is to serve as a more effective shoulder than the small one just mentioned; and in the second place, it serves, even if the pulley does not reach it, for an oil deflector; then in the third place, any burring over of the end of the shaft or roughing due to use of set-screws will not be injurious to the bearing surface of the lining when the rotor is removed or assembled. Even if the bearing portions of the shaft become so rutted or rough as to require a skimming cut and the making of new linings, it will not be necessary, in addition, to make a new pulley.

If it is decided to adopt the construction shown in upper part of Fig. 14, the iron castings may first be chucked, bored and turned, one of them having a ⅞" diameter reamed hole, the other about 13/16". While this latter is still held in the chuck, the interior threading can be done, until nearly sharp threads are cut. Since it is desirable that the rotor be exactly balanced, these castings should be machined on all their surfaces, a very light finishing chip being possible on the outside surfaces after the various parts have been assembled. In finishing the bearing portions, use a sharp tool, a fine feed, and a "dead" flat file, but no emery. In order to screw the head into the shaft, two holes may be drilled through the castings at such a distance from the center as will fit some spanner wrench. Though of somewhat larger size than the screw holes shown in the other construction, they can be in essentially the same location. When threading the shaft, it is not important that exactly a full "V" cut be made, for even less will have all the strength desired. It should be cut merely until the head will fit. Just outside the threaded portion the shaft is to be left 13/16 inch in diameter, then after threading, all but the very shoulder is reduced to ¾ inch.

The construction that provides for clamping the core by the two slender bolts saves the trouble of threading the shaft and, furthermore, gives a more adequate shoulder for taking the end thrust, but this latter feature is of no particular value if the pulley is made as recommended. In tightening such clamping screws, care must be observed to screw them alike, for a difference in this respect has a surprising effect on the straightness of the shaft. An important quality, not possessed by this construction, is that it does not readily permit the "skewing" of the rotor rods—a factor that will be mentioned in a later section.

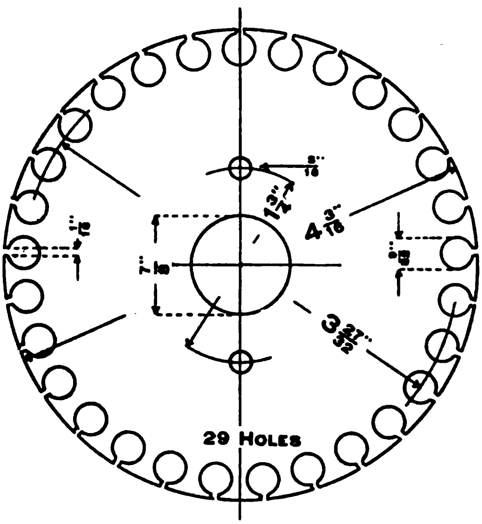


FIG. 15.—SHEET IRON FOR ROTOR

If sheet iron properly punched can be procured for the rotor core at a reasonable price, the builder will be able to escape a detail almost as tedious as that of providing the stator iron. The most effective form is shown in Fig. 15. Of course, the centers resulting from punching out the stator sheets may be available for this part of the motor, but if special provision is required, the iron need not be of such fine quality, nor need it be so thin, though it is not desirable to use thicker than .025 inch. An odd number of holes for the rotor rods is shown, and this is an important feature, else there will be a magnetic locking with the unavoidable even number of stator teeth. With the odd number in the rotor, there will be no position in which the motion is appreciably hindered by this cause. If the threaded-shaft method of construction is adopted, at least one hole will still be needed in the sheets in addition to that for the shaft, and this for a pin or rod for preventing the core from slipping against the heads. Though ordinarily the clamping may be sufficient to prevent this and can be entirely relied upon in many cases, in others, either due to improper workmanship or to the particular application, there may be actual slipping. By having two holes in the castings matching those in the punchings, iron rods can be driven in and headed over whereby security may be insured. In the second construction, of course the screws provide for both the clamping and this locking. Instead of the small holes for the rods or stove-bolts a keyway might be substituted, but the amateur may have less opportunity for cutting such, and for the step-by-step notching process for cutting the 29 conductor holes, the use of the smaller hole quite as easily fits the punch-press fixtures. For properly assembling the discs a "building" mark should be provided, so that whatever inaccuracies exist in the indexing device will not affect the matching of the holes. As long as the inaccuracies come always in the same place, they are of little importance. A sufficient mark for the purpose will be a notch cut as a sort of keyway, or simpler, by having a single bolt-hole only and locating this a little off an exact center line through either a tooth or slot. By this expedient only one possible position will be found in which to place the discs and have the outer holes at all match.

If the builder is to make his own rotor iron, a little different construction is advisable, for a suitable fixture must be provided in which he can turn off the outer portion of the iron and drill the conductor holes. Square sheets measuring about 4½ inches on a side may be taken, the mass clamped between two castings on a face plate of a lathe or on the platen of a large drill press, and a 1¼ inch hole made in the center. An arbor of cast iron such as shown in the upper part of Fig. 16 should then be made. This consists of two parts, one with a flange and another to screw onto it, so that the sheets can be clamped between them. For the first steps the outer diameter of these castings can be left 4½ inches and the sheet iron turned to match. In making the threaded flange, the outer surface is marked off in a 3 27/32 inch circle and this carefully divided into 29 parts. If a milling machine is available this division may be readily and accurately accomplished, but a substitute method is to draw the divisions on a piece of cardboard, stick it to the iron and then prick-punch through, following this with a small drill and finally enlarging to the final size of 9/32 inch. The drilling is to be done through the entire mass, the first hole being at once fitted with a rod that will prevent any dislocation during subsequent drilling. One or two holes may also be drilled for the pins or stove-bolts just mentioned. For all this drilling, a reasonably accurate drill press will be required, and of course no one would think of using other than twist drills, and with such equipments it is surprising how faithfully the holes preserve their parallel arrangement. As for the amount of iron required, there should be about 2⅞ inches when clamped without insulation and this latter can be provided in identical manner with that for the stator. However, many small rotors are not at all insulated in this manner and when running at full speed are quite as satisfactory. In starting, however, the motor requires a larger current though with diminished torque.

After thus drilling the rotor iron, the entire mass is to be turned to a diameter of 4 3/16 inches. The slots or openings to the holes are next provided and a milling machine is the most acceptable tool for the purpose. If this is lacking and hand operations are required, a keyway cutting hack-saw blade will be found effective; an ordinary blade being of only about one-half the desired thickness. If the sheets are to be separated by insulation, as is advised, and this part has not been anticipated, the sheets must be removed from the arbor, varnished and replaced. The outer diameter of the cast iron flanges is now to be reduced to the dimensions shown for the regular heads in Fig. 14, so that when reassembled the solid iron will be quite removed from the direct magnetic path.

Though the construction just described is tedious, it gives good results and has the peculiar advantage that the core is quite independent of the shaft, so if a new shaft is required, it may be substituted for the old one without disturbing the electrical portion. To provide for this contingency the arbor should not be pinned to the shaft, but keyed, then by proper pressure, a shaft may be inserted or removed.

With the sheet iron core assembled and on the shaft, provision for the conductor rods may next be made. Though essentially a part of the electrical features of the motor and properly classed as belonging to the winding, the rods are so different in appearance from wires and require preparation so purely mechanical as to warrant their inclusion at this point.

Twenty-nine round copper rods, 5 inches in length and ¼ inch in diameter are required. If looks are of any consideration to the builder, he can improve the appearance of the ends by rounding them. This can easily be done in a lathe that has a hollow spindle and is fitted with a good chuck. A hand-tool will suffice for the shaping, but for handling a large number of such rods a hollow end mill would be useful. Ends of the rods are to be slotted for a distance of ⅝ inch, the cut being 1/16 inch wide. Here again a milling machine is desirable, but an ingenious mechanic could make some acceptable fixture to use in a lathe. For hand cutting, a satisfactory jig can be made as shown in the upper portion of Fig. 16, where one of the rods is seen clamped between two cast iron blocks; a V-groove extends lengthwise in each piece having such dimensions as will permit the rod to be pinched just before the iron blocks themselves come into contact; at each end the metal is cut away so as to permit the entrance of a 1/16 inch thick keyway-cutting hack-saw blade. If patterns are to be made for such a jig, no allowance for machine finish is required; mere cleaning with a file being sufficient. To use the device, a stop must be put at one end so that at the other the saw-cut will be made to the proper depth. After cutting one end of all the rods, the same stop can be changed so as to serve as well for ensuringg the parallelism of the other slots. The figure represents such a provision, the strip of iron or brass that is held by two screws being reversible, the first cuts being made when the other edge is at the top, then, in the second position as shown, the remaining cuts will surely come in the required relation.

For the end connections two strips of soft copper ribbon may be used, each 12 1/16 inches long, 7/8 inch wide and .06 inch thick. This is just sufficiently less than the width of the saw cuts to permit easy assembling. In almost any workshop something is likely to be found—something of the right diameter around which to bend the strips into a circle. The ends are merely to be butted, not lapped.

After having made sure that all the rotor holes will freely admit a rod 9/32 inch in diameter, they may be insulated and the copper conductors pushed into place. Fuller board, a quality of cardboard largely used for covers of pocket memorandum books, is excellent material for this purpose. Pieces about 3¼ inches long and 1¼ inches wide can be taken, formed over a lead pencil and slipped into the slots, there being sufficient width to the strip to permit the two edges to protrude through the narrow slots and be held by the fingers. If the ends of the rods have been rounded there should be no difficulty in slipping the conductors in place, and the papers may be held from slipping along with them; still, if the paper is too thick there may be some difficulty in getting the desired arrangement. Possibly a little mucilage or shellac may be of advantage, but if any adhesive is used, the rods must be inserted before drying takes

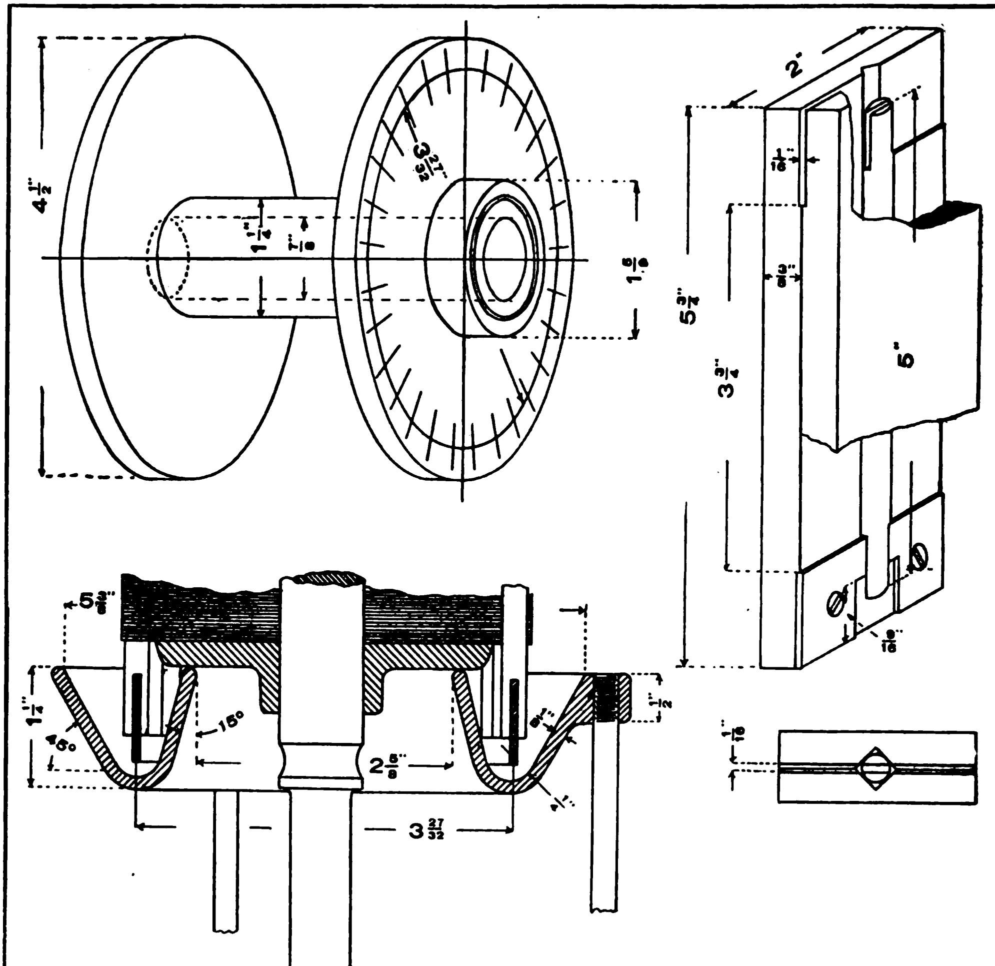


FIG. 16.—SOME OF THE APPLIANCES USED IN CONSTRUCTING THE ROTOR

place. The end-rings are next slipped into place; this ordinarily being a simple matter. The joint should be made to come within one of the rods. Portions of the paper protruding from the slots may next be cut off.

As thus explained, the rotor conductors will lie quite parallel with the shaft. This is a common method of construction, and really required if keyways and key are used for preventing slipping between core and shaft. For this very reason a keyway has not been called for in this description, for without this limitation it is possible to give the conductors a slight spiral direction. Such a departure from the expected parallelism is frequently adopted, with the gain that in addition to assisting in avoiding the locking action between stator and rotor, there is reduction in vibration and noise. A hum is objectionable in domestic or office machinery and this simple provision is remarkably effective in ensuring noiseless operation. After the rotor is assembled but with the joints as yet unsoldered, the builder can, if he desires, forcibly twist the whole laminated structure until the rods are offset at one end by about the width of one tooth. Further twisting will be difficult and unnecessary.

Nothing short of thorough soldering of the end connections will suffice for the electrical circuits; the entire twenty-nine rods should be soldered at one operation. For this purpose a special cast iron melting pot for the solder is recommended, as shown in the lower portion of Fig. 16. It is to be mounted on three legs, and except for the difference that it is trough-shaped rather than flat, it quite resembles the tripods commonly used in chemical laboratories. Two or three Bunsen gas burners directed against the trough will readily melt the solder, and a sufficient quantity should be used nearly to fill the "pot." Ends of the rods and the copper ring should be swabbed with soldering fluid then set directly into the melted solder, the heat still being applied until the copper has also been raised to the required temperature and the solder readily adheres. Further swabbing with the fluid may be advisable, and perhaps momentary removal of the rotor for purpose of inspection or for more effective swabbing of the interior of the ring. The other ends of the rods are then to be treated in similar manner, but in consequence of the general heating of the entire structure the second soldering will be accomplished in much less time than the first. Haste is desirable, for during such an operation the paper insulation is certainly near the scorching point. If globules of solder appear on the rods or rings after removal from the pot, they may be wiped off while still melted. Further danger to the insulation should at once be removed by running water onto the metal ends; this also washes off most of the excess soldering fluid, but to ensure this removal, a wiping with a cloth wet in alcohol is desirable. Finally, see that the shaft is dry; then, to prevent rusting while awaiting the completion of other parts, thick oil or vaseline may be rubbed on the bearing portions. It is assumed that a suitable pulley has been made, so with the soldering stage passed, as described, all work on the rotor will have been completed.

(Continued in May issue)

A NEW WIRELESS TELEPHONE SYSTEM

According to reports that are now attracting considerable attention in the New York newspapers, it appears that Mr. Irving Vermilyea, wireless operator aboard the S. S. *Northland* plying between New York and Portland, Me., has perfected a wireless telephone system which he is now employing with great success on that steamer. It is said that many land stations as well as ships have heard him conversing through his wireless telephone and play phonographic music. Reports have it that Mr. Vermilyea regularly communicates with his wife in Mount Vernon, N. Y., when the *Northland* comes within range, both by wireless telegraph and telephone.

Mr. Vermilyea is rather reluctant as regards furnishing any details concerning his system of wireless telephony. He states that his apparatus will cover a distance of 25 miles and costs but $100 to build. At a later date, when he has secured patent rights on his invention, Modern Electrics and Mechanics hopes to have the privilege of publishing the details of this system for the benefit of its readers.

Wireless in the North

By J. Walter F. Chipman

AT the best, Northern Ontario is a desolate forest. Yet there are thousands of men depending upon its resources for their food and sustenance; chief of their labors being mining and, of course, lumbering. As, for the most part, these busy little hives of humanity are situated a good distance from the railway serving this part of the country, all news of the outside world is late in reaching them. As an instance, the Montreal and Toronto newspapers do not reach their destinations till sometimes four and even five days after date of publication.

The aerial of the station consists of three No. 12 aluminum wires; two being 250 feet long, spaced 6 feet apart, and the other strung off at a 90 degree angle, 1,500 feet long. The pole is 90 feet high, and is on a hill that overlooks the surrounding forest. For the ground an iron pipe is used, imbedded in the bottom of a lake about 100 feet from the station. All the apparatus is set up in a corner of one of the numerous residences. It consists of a Navy type tuner, one sliding-plate and two rotary condensers, a fixed condenser, two sets of 2,000 ohm phones, a loading coil, buzzer

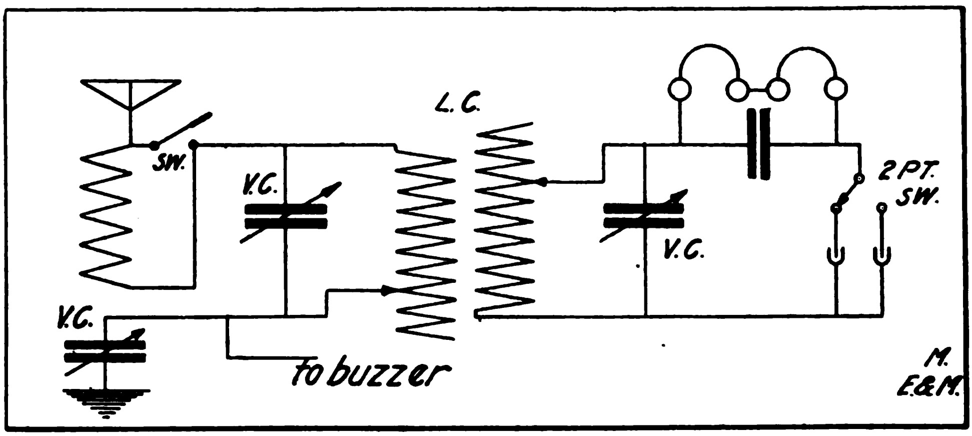


DIAGRAM OF CONNECTIONS FOR RECEIVING APPARATUS

and two detectors. As, by the long length of the aerial, it is almost impossible to tune in short wave stations, the sliding-plate condenser is put in the ground circuit to reduce the natural wave length.

Not the least of these centers is the Miller Lake Silver Mine, nearly thirty miles from the nearest station on the railway. Here the miners have to read their newspapers when they are two days old, and in case of heavy rainstorms, making travel slow, or the wind blowing scores of giant trees across the forest thoroughfares, thus necessitating the use of the stage-driver's axe, the mails are delayed another day.

But now the men are not so handicapped, as far as news is concerned, for there is installed on the property a complete wireless receiving set. As yet, owing to lack of sufficient electrical energy, there is no sending equipment, but it is planned to put in a 10 kw. set within the next three months, in order that business may be done with Toronto, the manager's headquarters.

With this outfit, all the world's important doings are received direct from New York through the Sayville station and the mine's clocks are checked by Washington. Early each morning the news, as received the previous evening, is typewritten on sheets and posted up on the bulletin boards and eagerly read by the couple of hundred men employed by the mine. After the press is through, a half hour or so is spent in picking up different stations. So far, no trouble has been experienced to get Pensacola,

(Continued on page 495)

Experimental Department

This department is maintained for the purpose of encouraging the experimenter to develop new ideas. Every reader is welcome to contribute to this department. Contributions should be written on one side of the paper only, using as many sheets as are necessary. Typewritten contributions employing double spacing are preferable. Good sketches are not necessary, as our art department can work up rough sketches that are clear enough to illustrate the idea. Sketches must be made on separate sheets from those containing the description. Return postage must be enclosed if return of unused manuscript is desired.

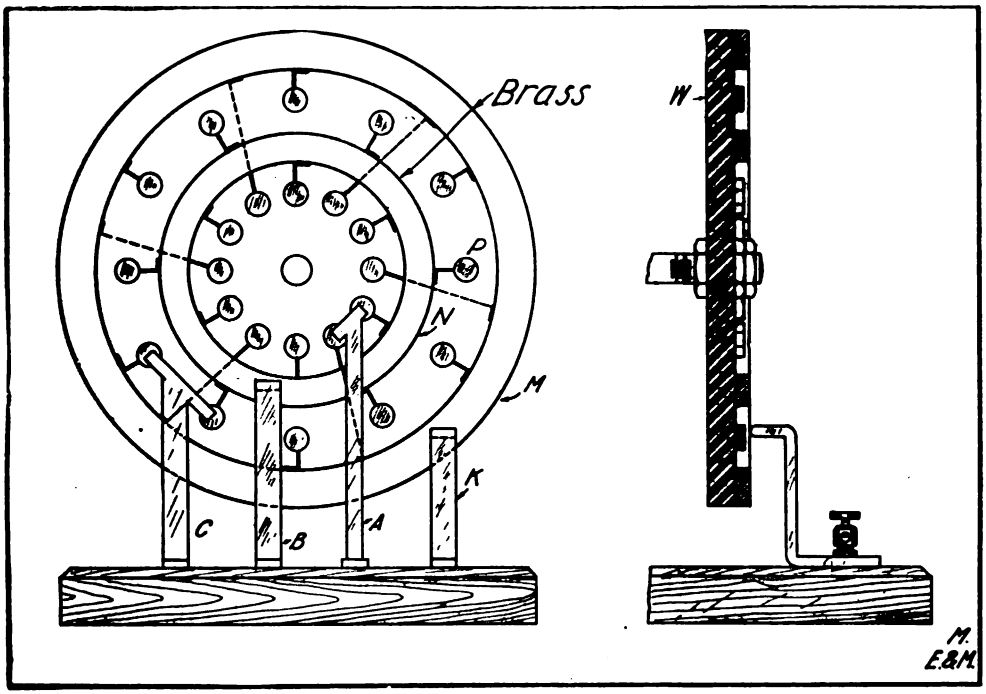
Three prizes of Five, Two and One-Half Dollars and One Dollar are awarded for the three best ideas published each month. Other contributions are paid for at space rates.

FIRST PRIZE

A MECHANICAL CONVERTER

Since all amateurs must now have a pure wave, the following description of a simple converter for spark coils will doubtlessly be of interest. A quenched gap can be used with this apparatus with exceedingly fine results. The material that is needed is a speedy motor, twenty-four switch points, a fiber disc and a few odds and ends.

Referring to the drawing, the round disc W is about three and a half inches in diameter and one-eighth inch thick. The circumference is divided into twelve equal parts and then the necessary holes are bored. The outer ring is placed one inch in from the rim, and the other 1¼ inches. The corresponding points must be exactly on the same radii of the disc. Now a brass ring is cut out of about No. 20 gauge sheet brass, with an external diameter of 3½ inches and an internal diameter of 3 inches. This is then glued on to the fiber disc as shown at M. Another brass ring is then cut with external and internal diameters of 2 inches and 1½ inches, respectively. This second ring is glued into place as shown at N. In doing this task care must be taken to insure good work.



The next step is to connect the points

to their respective rings. A close study of the drawing will show how this is done. The connecting wires must not be too large; No. 18 bare copper wire being a good size. One end is slipped under the head of the point before it is tightened. The other end is brought up flush with the edge of the ring and soldered in that position. Be careful to avoid getting any solder on the surface of the ring.

The next step in the work is to arrange the brushes. This is the most important part of the whole apparatus and must be done with care if a first class article is desired. The shape of the brushes can be seen in the drawing, as well as the part of the disc they are to bear upon. The material used for these brushes should be quite heavy and springy. The brushes must bear down with quite a little force when the disc is revolving so that the current will have no difficulty in passing through the contact. It is a good idea to mount them on a strip of rubber—or at least a piece of hard wood. The brushes C and A must be made so that they will always be touching some contact point, and for an instant two points. Just as one point leaves one end of the brush another point must be coming under the opposite end. This must be allowed for, otherwise the current will be irregular. The other brushes, B and K, must press against the two rings with a little pressure. Care should be taken that the brushes do not hit the soldered places. Binding posts are mounted on the sub-base to connect with the different brushes. A side view of the arrangement is shown in the drawing.

A hole is now bored in the exact center of the disc of the size of the shaft of the motor on which it is to be used. The end of the shaft is threaded and the disc fastened on with two nuts. The disc should run absolutely true.

To use the converter, connect the battery current to the brushes B and K. Then take the current from the brushes A and C. This current will be alternating with a frequency depending on the speed of the motor. There will be twelve alternations or six cycles for each turn. If the motor runs at the rate of 3,500 r. p. m. or 58 turns per second, the frequency will be 58 multiplied by 6, or 348. If a small quenched spark gap is now made and used with this set, a very pleasing spark tone will be obtained as well as the advantages gained by using a quenched system. The number of plates to be used in such a gap will have to be found by experiment. The regular hook-up is used as far as the other pieces of apparatus are concerned, with the exception that the vibrator on the coil is screwed up tight. There is no need of the vibrator when this current converter is used. If one employs this coil and gap with an oscillation transformer of suitable size, a neat and highly efficient sending set will be the result. If a dynamo is used for the source of current, the disc should be mounted upon its shaft.

Contributed by

K. W. Nicholson.

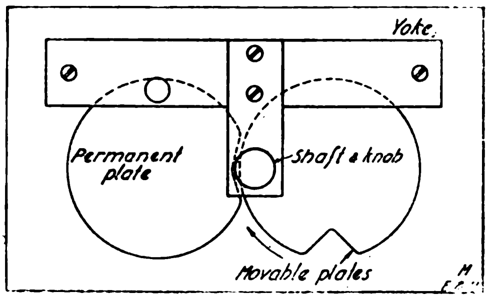
SECOND PRIZE

A NOVEL ROTARY CONDENSER

Many articles have appeared on rotary condensers in the past, the most common types employing either semi-circular or triangular plates. These condensers are exceedingly difficult to line up and the spacing of the plates often presents a baffling problem.

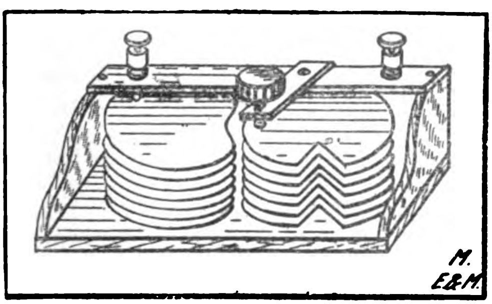
In the accompanying illustration is shown a new design that has but one shaft to hold the movable plates and one pillar for the permanent plates. In this condenser the permanent plates, with the exception of the top plate, are insulated on both sides with linen or other material, held on with shellac and brought close to the edge of each plate so that no electrical contact can be made when the rotary plates are moved in or out. The movable plates need not be insulated.

There are 14 movable plates and 15 permanent plates in this condenser. The plates are cut in the form of circles measuring 3¼ inches in diameter. After the plates have been made, the notches are cut in them as shown in the sketch. The movable plates have a V-shaped notch cut in the edge so as to allow them to turn without touching the shaft of the permanent plates. The permanent plates are also cut with a broad V-shaped notch so as to clear the shaft of the movable plates which is placed very close in order to permit the plates to intermesh completely. The plates are then assembled by means of nuts and threaded sections of brass rod in the usual manner. The methods of securing the shafts is shown in the diagram, where Y is a yoke of



hard wood or rubber joining the sides of the uprights together. The binding posts are mounted on this yoke. The shaft of the movable plates rests on a piece of brass while the upper end is carried through a brass piece which is made fast to the yoke. The bottom of the permanent shaft is made square in order to prevent the plates from turning. It is set in a brass piece. While the foregoing methods have been employed by the author, the reader can change the design to suit himself.

In this condenser it is not necessary to have the movable plates clear the permanent ones, since the insulated plates prevent any electrical contact should they



slightly rub against each other. It is possible to do very sharp tuning with this instrument. When the plates are entirely intermeshed the condenser is short circuited.

Contributed by

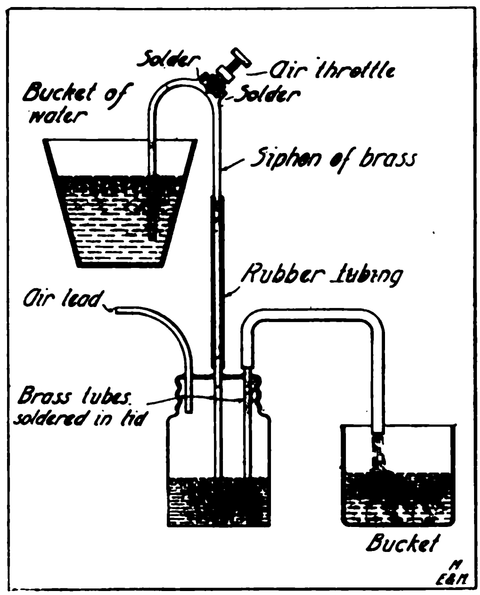
Malcolm S. Keyes.

THIRD PRIZE

AN INTERESTING COMPRESSED AIR EXPERIMENT

Having read with considerable interest the article on a novel compressed air system that appeared in the February issue of MODERN ELECTRICS AND MECHANICS, I decided to conduct experiments with this system on a small scale.

In the accompanying illustration is shown the arrangement of the apparatus for producing compressed air in small quantities. All the necessary parts are shown and I do not believe that an extensive description is necessary. The apparatus is started in the same manner as an ordinary syphon, the throttle valve being kept closed until the downward



stream of water has obtained its maximum velocity. It is then opened slowly in order to allow the proper amount of air to enter. A piece of glass tubing may be inserted in the rubber tubing in order to show the amount of air being compressed as well as the size of the bubbles. One-quarter inch tubing can be used throughout.

Contributed by

Dan Oschs.

Forest fires in the United States have caused an average annual loss of 70 human lives and the destruction of 25 million dollars worth of timber.

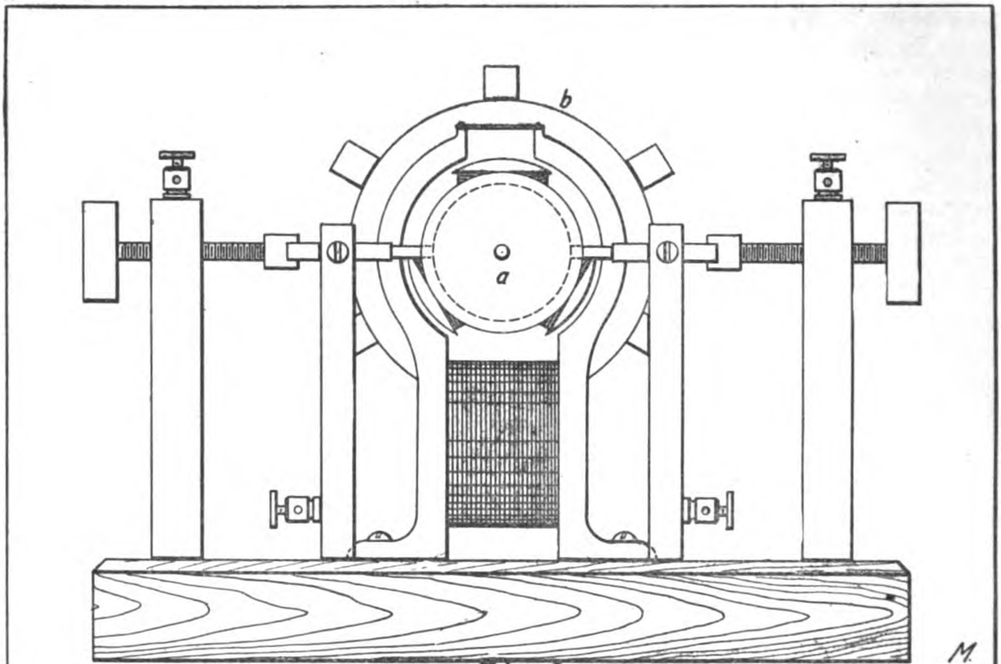


Fig.-1

A SYNCHRONOUS SPARK GAP FOR SMALL COILS

The accompanying drawings represent a simple apparatus for obtaining a synchronized spark of fairly high frequency from a battery-operated spark-coil.

The drawings are practically self-explanatory. B is an ordinary rotary spark-gap with six zinc plugs on the circumference of a brass wheel. A is the circuit breaker, which takes the place of the vibrator on the spark-coil. It is made from a copper or brass wheel, 1 inch in diameter and ⅝ inch wide. Six slots are filed at equal distances apart on the circumference, and into these slots are placed sprips of fiber, hard rubber, or mica, preferably the latter. The whole is held together by two fiber rings that fit closely on the brass wheel.

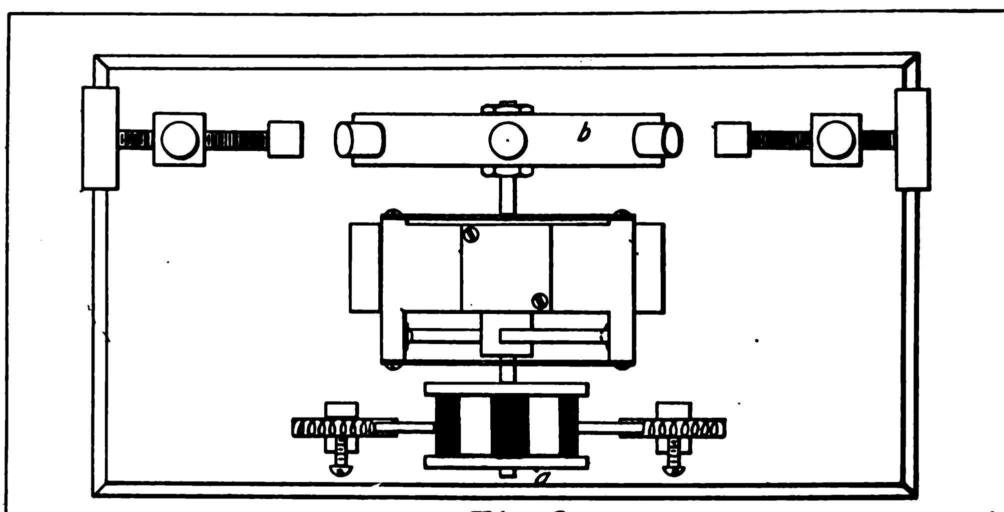


Fig.-2

The surface must then be sandpapered down smooth, as in any other commutator.

The brushes are of a common type, consisting of a roll of copper gauze held against coiled brass wire. Set-screws hold the brushes in place.

The circuit breaker should be set in such relation to the wheel of the gap that the break occurs just as the plugs on the wheel are approaching the stationary electrodes. The quicker the action of the spark-coil, the shorter must be the distance between the plugs when the break is made. With a little experimenting the right distance will be found.

The apparatus is driven by a little inexpensive battery motor which almost every experimenter possesses. Since these motors run about 2,000 revolutions per minute, a spark-frequency of 200 per second will be obtained.

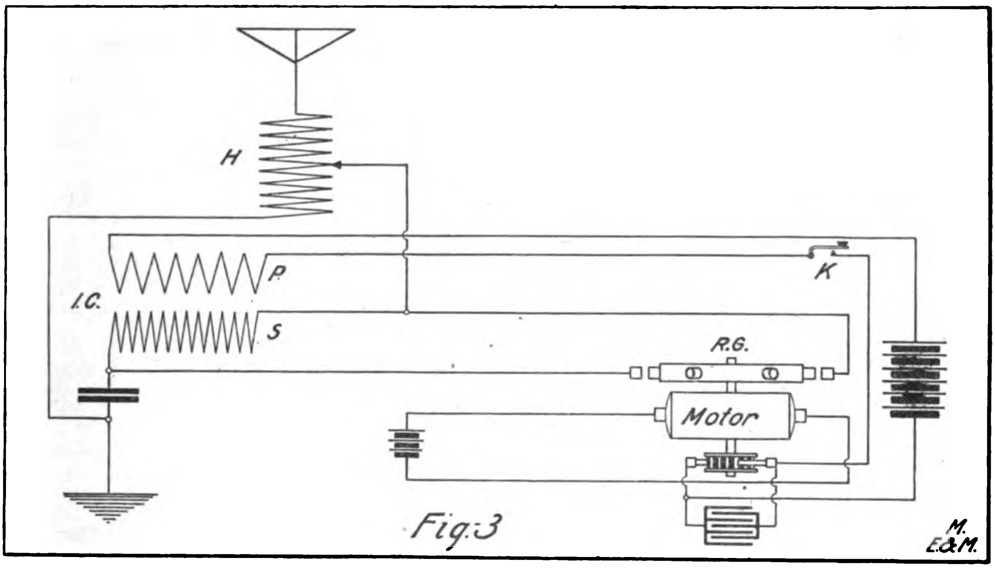


Fig. 3

The operator of a small station depending on batteries for power will find that this machine will give him a much higher pitched spark than an ordinary vibrator, and as the small motor does not require much current to run it, he will find this gap well worth while to construct.

Contributed by

Carl H. Norlin.

Receipts from the use of national forest resources were greatest in Arizona last year.

A WORD OF CAUTION

In the Experimental Department of Modern Electrics and Mechanics for February, there appeared an article on the making of hydrogen from acid and zinc.

In the performance of this experiment, as in many others, the chemical action quickly heats up the generator or tube that is used and in that way there is a great danger of explosion.

To prevent this take a cloth or towel and wet it, or better still, just put the generator in a basin of water. One good thing about using the towel is that in case some explosion does result, it prevents the glass from scattering about and causing injury.

Although very simple, if this caution is always observed you will never have a chance to regret taking the little extra trouble.

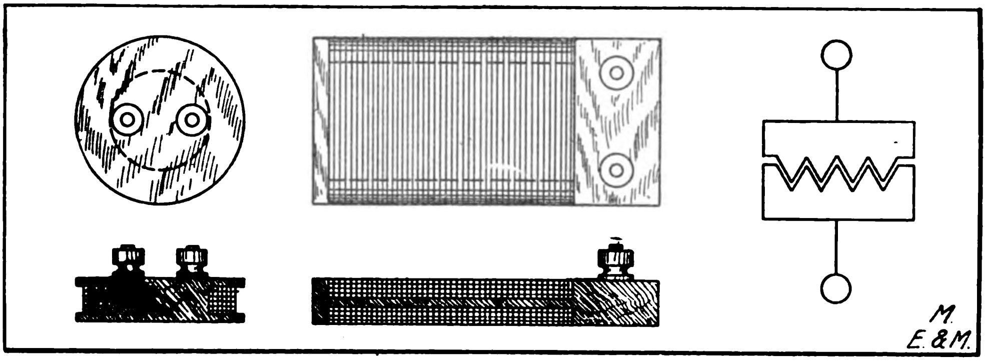
Contributed by

A. MacDonald.

A NOVEL FIXED RECEIVING CONDENSER

In the accompanying illustrations are shown two condensers employing a rather odd design. The principle involved in their construction is that of two fine wires wound close together with only the insulation of their covering between the turns.

A suitable size of wire to use in making one of these condensers is that taken from the secondary of a discarded spark coil. The thinner the insulation, the higher will be the capacity. The two wires should be wound very tight and no paper must be placed between the layers unless it is found necessary to do so in order to have the windings even. Both ends of the windings are connected as shown in order to eliminate any inductive effects.



This form of condenser is easier to make and, I believe, it will prove more efficient than the tinfoil variety. However, if old secondaries from which the wire can be procured are not available, it may be a trifle more expensive to build. Two forms are shown in the sketches.

Contributed by

Brentford Mackey.

INTERFERENCE PREVENTER

An interference preventer has practically become a necessity to the amateur of to-day. The following is a description of a double primary type which can be constructed at a reasonable sum.

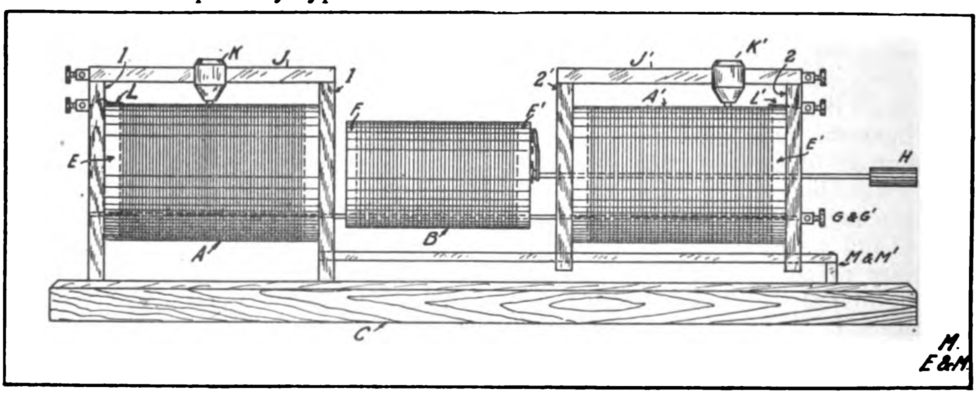
Obtain two fibre tubes, A, A', 4 inches in diameter and 6 inches long, threaded for No. 20 wire, as well as a fibre tube for the secondary measuring 3½ inches in diameter and 5 inches long.

Wind the primaries with No. 20 bare copper wire, leaving a space of ½ inch at one end and 1 inch at the other end. Wind the secondary with No. 28 enameled wire, taking the taps off every ½ inch to within ½ inch of each end.

Cut the following pieces from any suitable wood: Four pieces 6x6x½, 1, 1', and 2, 2'; two round pieces of the same size as the inside diameter of the primary tube, E, E'; two round pieces of the same size as the inside diameter of the secondary, F, F'; and a base board, C, 20x 6x½.

Cut a hole, of such size as to allow the passage of the primaries in the pieces marked 1' and 2'.

E and E' are to be fastened to 1 and 2. F and F' are the ends for the secondary. Fasten the end piece marked 1 with screws which go through tube to E. Fasten end marked 1' with screws or glue. Do likewise with primary A'. M and M' are rods which primary A' slides on. G and G' are rods on which the secondary slides, while H is a rod to move the secondary and to vary the multiple switch. The secondary winding is connected to the rods G and G'.

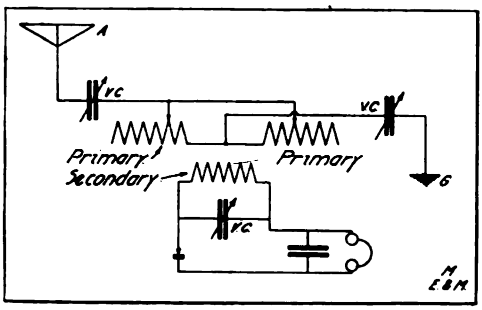


Attach binding posts to the ends of G and G′ for connecting to the other apparatus. Mount a slider on each primary at any suitable position. Connect the end of the wire marked L L′ to one of the binding posts and the slider to the other.

One primary is stationary while the other moves on rods. M and M′ are ¼ inch supporters for the rods upon which slides one of the primary windings.

Sandpaper all wooden parts and finish to suit. Mount the primaries on the base and the instrument is finished.

Care should be exercised in making and assembling the different parts, as otherwise any defects in the construction will greatly hinder the manipulation of the instrument. Paper tubes may be used instead of fibre ones, in which case enamel wire should be used.



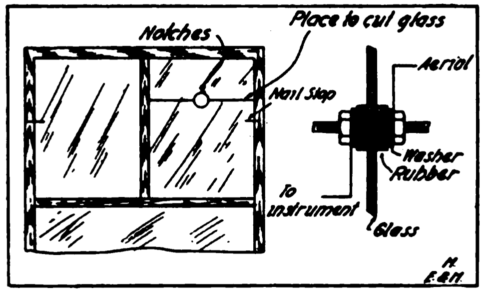
The sketch explains the different parts. with the hook-up given and with aid of the variable condensers, very sharp tuning may be accomplished.

Contributed by

F. D.

A SIMPLE LEAD-IN

From time to time I have noticed in these columns directions for making "lead-ins" but have never noticed one described which could compare to the one illustrated herewith for simplicity. Most amateurs have the material needed for it, but if it must be bought it will cost only a few cents. A hole must first be cut in a pane in the upper part of the window near the top. This is most easily done by cutting the pane in two, or in the case of a large pane, cut the corner off; removing the glass pieces from the window frame. Then cut, with a file, notches in the edges of the pane opposite each other, so that when these are fitted together and placed back in the frame, a hole is formed. Next thread for its full length a 3/16 or ¼-inch brass



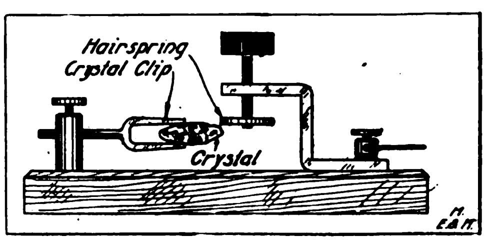
or copper rod three inches long. Slip the rod into the hole and push a soft rubber washer 1½ inches in diameter up against the pane on both sides to keep out the moisture. It is made from a scrap of gasket rubber which can be found around any plumbing shop. Over each rubber gasket a brass washer is slipped and the whole is screwed tight by a nut on each side. The wires are connected to the posts and should be soldered. This lead-in works fine even on small transformers since the size of the rod can be changed according to your power. Be sure to put a nail in the groove where the window slides so that the lower sash will not hit the wire.

Contributed by *Malcolm B. Mayers.*

Although almost every practical form of lead-in has been described in the past in these columns, the above idea will probably prove of interest because of its neatness, practicability and simplicity.—*The Editor.*

A DETECTOR SUGGESTION

I find that a small alarm clock hairspring soldered on the end of the adjusting screw in the ordinary silicon detector, so that the edge of the outer convolution rests on the silicon, makes a detector that is easy to get a point on and one that does not lose its sensitiveness quickly. It is very sensitive.



Contributed by

J. M. Rolston.

A HIGH-FREQUENCY BUZZER

Below is a description of a high-frequency buzzer which I have made from an old bell, and which I am using successfully on a lighting current circuit.

The bell is first removed and the hammer arm straightened out and securely fastened to the neck at A. The contact tongue is also fastened flat to the armature at B. Both these operations may be performed with small magnet wire, which I have found more satisfactory than metal clips or any other method. The contact C is then connected to the proper binding post by stranded wire, and a small wooden block glued under it to make it firmer. Without this block it will not keep its adjustment. A lock nut of some kind is also necessary on the adjusting screw. The connections

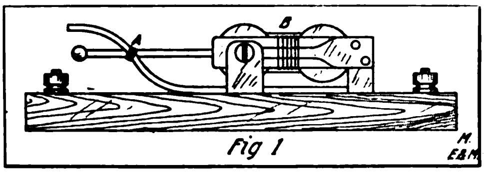


Fig 1

are shown in Figure 2. An oscillation transformer is absolutely necessary, as the line is grounded, and if the buzzer contacts are connected directly to the aerial and ground, a short circuit will be formed through the contacts and the key will have no effect on the buzzer.

With one 16 c.p. lamp in series the spark is irregular, but with two lamps, as shown in the diagram, it is steady, and averages about 1/16 of an inch in length. When using two 16 c.p. lamps in parallel one ampere passes through, so I rate my station at .1 kw. Different bells may vary in the amount of current required, and some may work well on only one lamp. Such bells then draw one-half ampere and therefore can be noted as .05 kw. Do not connect the buzzer to the line without a lamp in series, or you

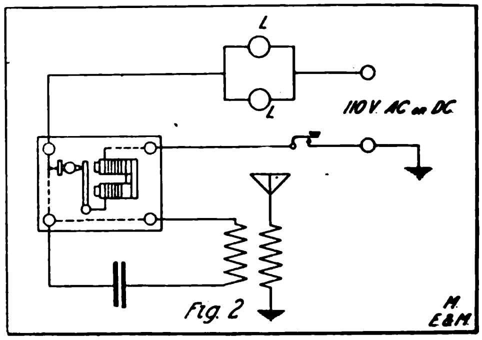


Fig 2

will have to get another bell and start all over.

Contributed by

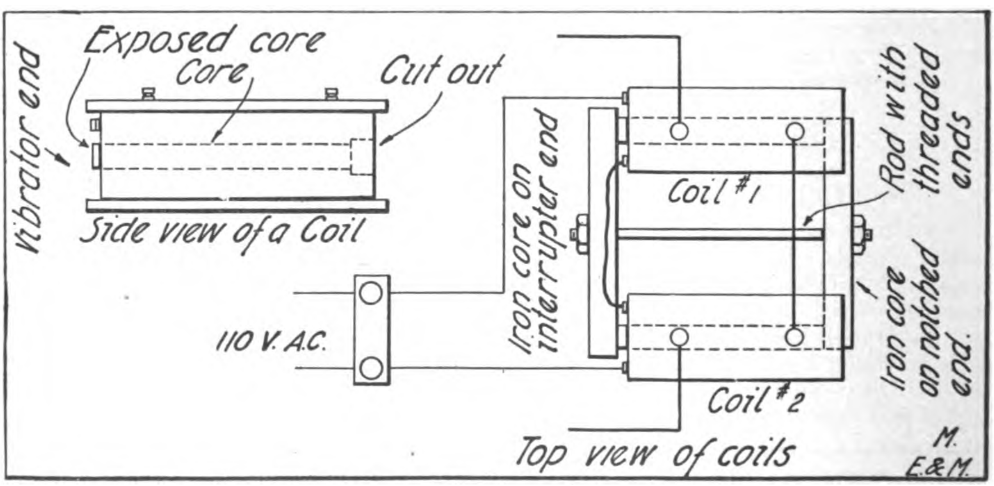
Brentford Mackey.

TRANSFORMER FROM SPARK COILS

The explanation that follows and the accompanying sketch relate to the making of a closed core transformer from two one-inch spark coils.

First, remove the vibrator from both coils. Chisel a channel across the opposite sides of the coils so as to have the cores exposed at both ends. The width of the channel should be the same as the diameter of the core and extend across the entire end of the coil. It should be deep enough to reach the core.

Then cut strips of stove pipe about 1½



inches wide and long enough so that when the two coils are placed side by side, the sheets will reach to the outside of each core. Cut enough of these sheets to form a stack of the thickness of the diameter of the core. Fasten these sheets together with three bolts.

A ¼-inch hole is then bored in the center of each of the sheet iron bundles. A rod threaded at each end is then slipped through the center holes in the sheet iron bundles and nuts screwed on so as to press them against the ends of the cores of both coils. If the cores of the coils do not happen to be exactly the same length, file one of them until they are equal.

The dimensions are left to the builder since any sized coils may be used. Most coils that are arranged in this manner can be connected directly to a 110-volt alternating current circuit, but some may require a resistance.

Contributed by

Ralph A. Hiteshew.

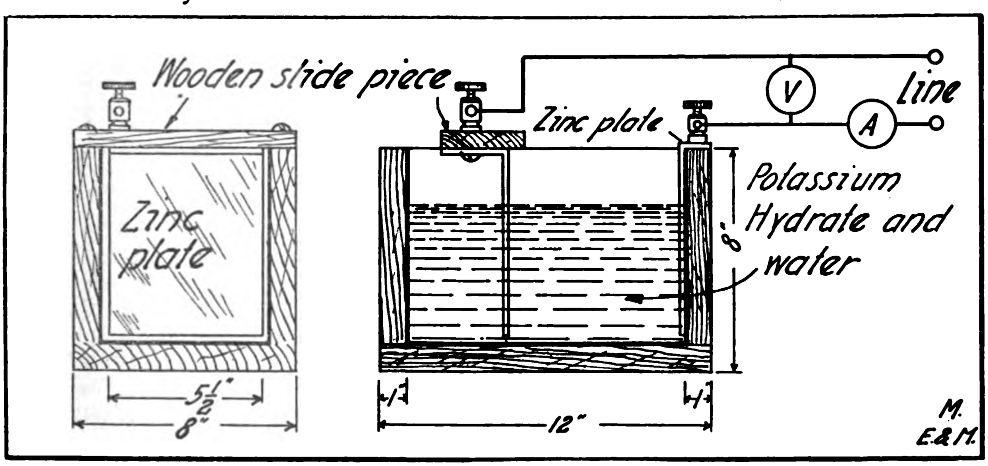
A GOOD WATER RHEOSTAT

The rheostat shown in the accompanying illustration, may be constructed very easily and without great cost. The box is eight inches square without the top and twelve inches long. The zinc plates are 5½ inches square when finished, but ½ inch is left on one end to be bent into the shape of a right angle, so that it may be fastened onto the wooden slide. The slide piece is 8 inches long, about 1½ inches wide and any convenient thickness. The other zinc plate is fastened to one end of the box by screws or nails and a binding post is connected on top. The box should be painted with a thick coat of pitch or tar to make it waterproof. The accompanying table will give the reader an idea as to the resistance of the rheostat according to readings taken at the different stages, beginning with one inch and continued up to nine inches. For the solution, the box is filled with water and a small amount of potassium hydrate is dissolved in the solution.

Amperes	Volts	Resistance	Distance in inches
3.5	110	31.4	9
3.75	"	29.4	8
4.1	"	26.8	7
4.6	"	23.9	6
5.25	"	20.9	5
6.25	"	17.6	4
7.75	"	14.3	3
10.2	"	10.7	2
14.75	"	7.33	1

Contributed by

Frank C. Justice.



BATTERY MOTORS ON LIGHTING CIRCUITS

Many amateurs have battery motors which they would like to use on 110 volts. To make a small battery motor suitable for 110 volts, unwind the coils and then rewind with fine wire, No. 28 to 36 gauge, either S. C. C. or S. S. C., using the series winding as shown in the accompanying diagram, Fig. 1. A motor thus wound will run well on a 110-volt direct current circuit, in series with one or more lights.

This same motor will also run satisfactorily on 60 cycle alternating current, if the field and armature are laminated. Even if these pieces are solid, but small, the motor will work fairly well.

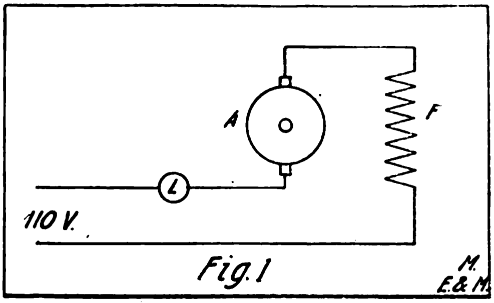


Fig. 1

Some of the motors need mechanical improvements to run continuously for any length of time. Good brushes can be made of fine copper strip; commutators can be insulated with mica; and oil

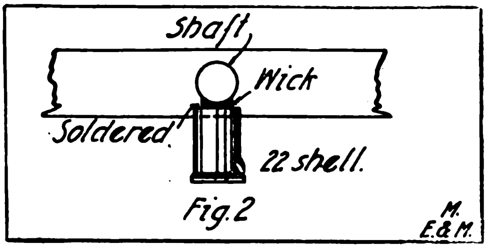


Fig. 2

cups can be made from 22 calibre cartridge shells, soldered on the ends as shown in Fig. 2.

The writer has rewound several of these small motors and uses them on a 110 volt 60 cycle alternating current circuit. They do not heat at all when used in series with an 80-watt light, although they are wound with No. 36 wire.

Contributed by

P. H. Greeley.

Incense cedar is proving valuable for piling on the Pacific Coast where marine borers are particularly troublesome.

PROTECTING BOTTLE LABELS

The protecting of labels on bottles is quite a problem, especially when one does not want to spend the time to melt up the protecting material, such as, for example, paraffine wax. This is rendered quite simple if we make use of some solvent for the wax, as the solution may then be kept ready for use in a bottle. A very satisfactory solvent for paraffine is common ether. If a little of the wax be dissolved in a bottle of ether and the solution brushed over the label, a fine, practically transparent coating of paraffine will be left upon the evaporation of the ether. Care must be taken, however, not to perform this operation near an unprotected flame, for the fumes of ether are quite explosive when mixed with the oxygen of the air.

Contributed by

C. W. Schwartz.

A NOVEL AERIAL

The aerial described in this article is the invention of an Atlantic City amateur and presents several new features that render it unusually interesting.

This aerial consists of a cylindrical-shaped arrangement, 13 inches in diameter, wound with one thousand turns of seven-strand No. 22 copper wire. The frame-work of this aerial consists of four ropes, each 20 feet long, as shown in the illustration. The lead-in is taken from the bottom of the winding.

With this type of aerial the wireless station at Key West has been distinctly heard on the board walk at Atlantic City; in this case the aerial was supported by means of an oar. In sending with this aerial the amateur who invented it has reached over 60 miles, using ¼KW.

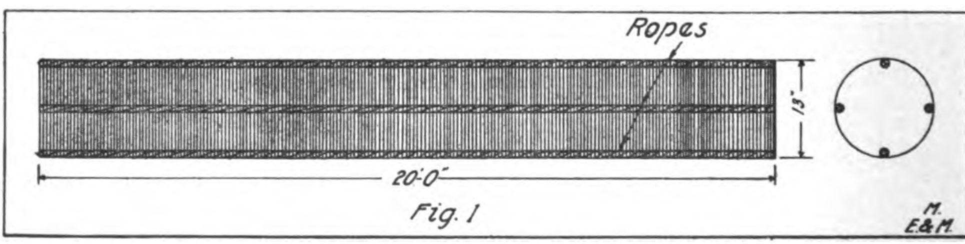


Fig. 1

Amateurs who adopt this form of aerial will find it superior to the small aerial generally used.

Contributed by

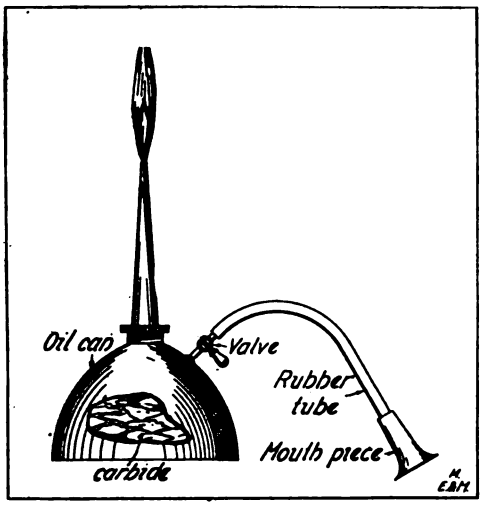
William Meyer.

Practical Hints

This department is devoted to contributions that deal with new tools, machinery, methods of simplifying different tasks and other similar subjects of interest to the electrician and mechanic in particular, and everyone in general. Contributions to this department should not exceed 200 words. A rough sketch is desirous in instances where the idea will be rendered more comprehensible by its use. All contributions will be paid for at regular space rates on publication.

AN ACETYLENE BLOW TORCH AND LIGHT

An efficient and readily made acetylene blow torch and light can be made from the following materials:



An oil can that is airtight; about a foot of small rubber hose; a small valve such as used on miniature steam engines; and a can of calcium carbide.

Take the oil can and either bore or punch a small hole near the top. Solder on the small valve and attach it to the rubber hose on the other end of which is placed a wooden mouth piece.

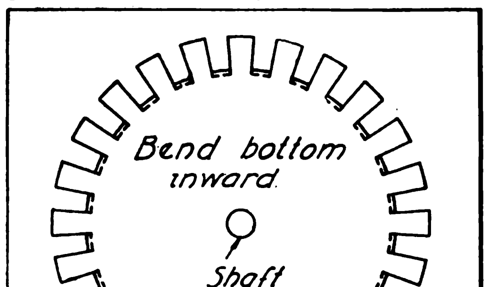
The torch is then ready for use. It is partly filled with carbide and the spout is tightly screwed on. Fill the mouth full of water, open the valve and blow the water into the can through the tube. The valve should then be closed. The water coming in contact with the carbide will form a gas which escapes through the hole in the spout. This gas can be ignited and it will be found to burn with considerable heat when air pressure is applied through the rubber tube. A flame of nearly a foot in height can be secured by blowing into the rubber tube for soldering and other work requiring a hot flame. If the torch is desired for lighting, no pressure is applied. The flame will then be only about an inch in height and pure white.

Contributed by

Fred Squier.

FIBRE ARMATURE DISCS

The following method will be found convenient for making discs for armature ends in order to keep the windings from grounding on sharp corners of the core. When stamped discs cannot be secured, they are usually made of 1/16 inch fibre. I believe that the method suggested below is simpler and consumes



about half the time that would be required following the usual procedure.

From a sheet of fibre 1/16 inch thick, saw out a round piece of the same size as the armature core and bore or cut out a hole in the center to accommodate the armature shaft. This disc is then shellacked and pressed firmly against the end of the core by being held in a vise. When dry the slots can be cut in the fibre to correspond with the slots in the core. In the case of larger armatures, the discs can be placed on the ends of the core and the slots cut while the armature is held in an armature rack.

This method insures absolute accuracy since the slots in the fibre are cut so as to line up with the slots in the core as shown in the accompanying illustration.

Contributed by

F. W. Schmidt.

A DIRECT COUPLING DEVICE

Desiring to eliminate the losses in speed and power of a belt-driven dynamo and motor, I devised a simple and yet efficient direct-coupling device which

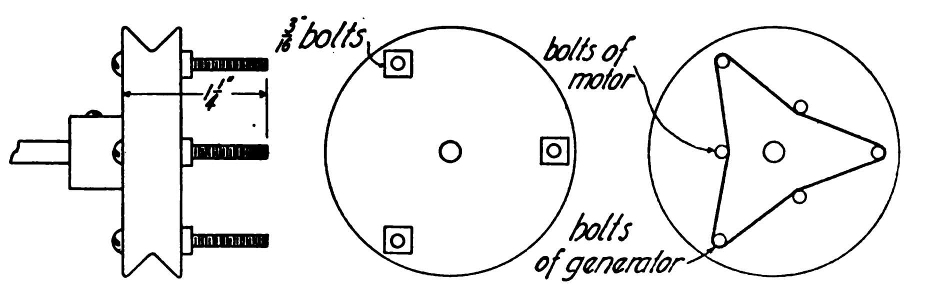


Fig. 1 Fig-2 Fig. 3

was made as follows:

I drilled three 3/16-inch equidistant holes on the face of both the pulleys, as per Figure 2. In these holes were inserted stove bolts, tightened with nuts on the face. The nuts may be eliminated by using a smaller drill and taping the holes with a 3/16-inch stove bolt tap. The pulleys of both machines to be coupled and placed are treated in this manner, flush with the end of their respective shafts. The pulleys of both the machines are then brought face to face, leaving about ⅛ inch between the bolts of one and the face of the other. A piece of soft leather of a suitable length and width was then placed alternatively over and under the bolts of the pulleys, as per Fig. 3; the ends being fastened tightly together with small wire hooks.

This simple device has proven very satisfactory where small power is to be transmitted and where the required speed of the machine to be driven is the same as that of the driver, such as small motor-generator sets, blowers, etc.

Contributed by

R. T. Whipple.

HOW TO WIND LARGE TUNING COILS WITH BARE WIRE

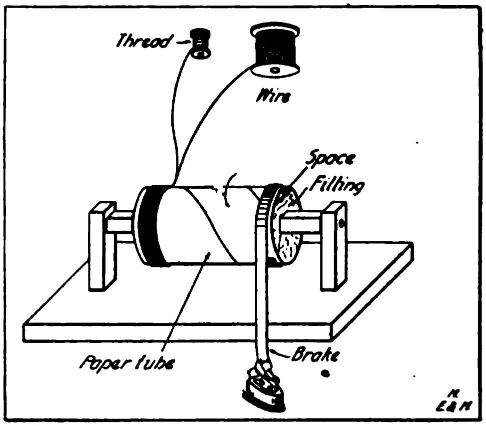
Most amateurs experience difficulty in securing long wave length signals. The reason is that the proper loading coils are not used because they are too difficult to make. A simple method of winding these coils is as follows:

First secure a base board longer than the coil to be wound. Then fasten two uprights to the base. Use nails or screws to act as centers for swinging the work as shown in the sketch.

Next, get a strip of cloth, canvas or burlap, about 2 inches wide and 4 feet long. Fasten this strip to the tuner tube in such a way that when you start to wind by turning the tube, the direction of motion will be toward the weight which is to be fastened to the other end of the cloth strip.

The stick for holding the core should be a little longer than the tube so the tube's ends will swing freely between the two uprights. The ends of the coil are cut flush when the winding is completed. The space between the coil and inside of the tube should be filled with newspaper or other paper so as to make the tube solid.

After all has been assembled as shown in the sketch, the winding can be begun. Start at the left hand side by drilling a small hole through the tube and insert the end of the wire leaving about a foot of lead. Also pass the thread through the hole and make fast with sealing wax on the inside. Wind the thread so that each turn of bare wire will be insulated from its neighbor. When nearing the



end it may be necessary to move the cloth strip or brake back upon the wire; if so, place it as near the beginning as possible. Finish the winding similar to starting.

If taps are to be taken from the windings it will be found that only a temporary core is required, and in placing the paper filling, be sure and leave a space through which the taps may be brought as shown in the smaller sketch.

When the coil is finished remove the core and filling. Determine the correct switch points to which the taps are to be connected and mark. The wooden core can then be cut to proper length and inserted in the center of the cardboard tube, after which the coil is ready to mount. Apply three or four good coats of orange shellac to the winding and mount in usual way.

Contributed by

Lee Manley.

ALUMINUM CASTINGS FOR LATHE WORK

No metal can be more readily machined in a small or light lathe than aluminum. It is often difficult to secure the aluminum in just the form desired, but it can be easily cast in approximately the shape needed if one has access to a steam or hot water heating system. The metal can be procured as "pig" aluminum and is readily melted in a graphite crucible placed well down among the coals in a hot fire. Aluminum disks may be cast by pouring the melted metal into the round tops taken from tin boxes of suitable size, while longer cylinders may be cast in the box itself used as the mold. The contraction of the aluminum on cooling usually loosens it from the mold. Other forms may be cast in sand molds. When the metal is to be turned smooth, the final turning is done at high speed with a hand tool. A convenient tool for this purpose is made by grinding the end of a flat file to a smooth straight edge.

Contributed by

F. R. Goston.

PREVENTING WOOD FROM SPLITTING

Many amateur craftsmen who undertake to do fine work, find that when they drive a nail or work a screw into some piece of thin wood it splits.

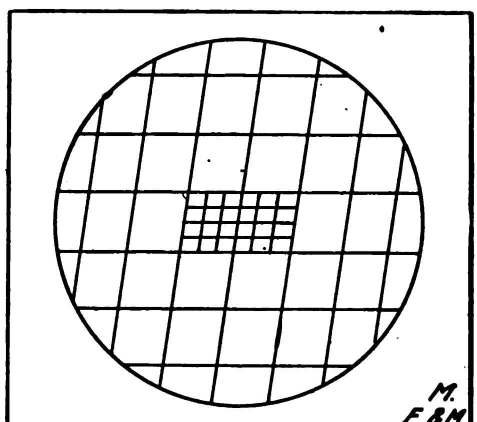
Before driving a nail or placing a screw in a piece of wood that is liable to split, run it through a cake of soap. There will then be little danger of splitting the wood. I have tried this procedure myself and find it very effective.

Contributed by

Carl Bishop.

CUTTING LARGE HOLES IN GLASS

A round or square hole of large size may be cut in a pane of glass in the following manner: Starting with a glass



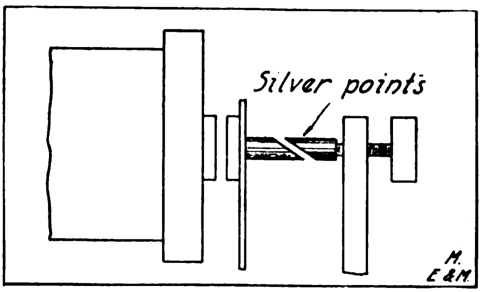
cutter that will produce a clean scratch without much pressure, make a cut around a pattern of the right shape prepared from wood or cardboard. Make a large number of scratches across each other in the area to be removed as shown in the figure, and then divide one or two of these small areas into very small sections, being sure not to extend the scratches across the limits of the large hole. By supporting these smallest areas against a firm piece of lead, the glass can be crushed into powder by means of a small hammer. With care, a small hole is soon started and the small sections will break out with ease. The hole will now be large enough so that the remaining sections can be broken loose. The edges can be smoothed by the aid of a file or whetstone.

Contributed by

F. R. Goston.

SELF-CLEANING CONTACT POINTS

The expense of platinum often makes its use prohibitive for contact points of



electrical apparatus. Silver is usually employed in place of platinum but trouble is experienced because of its rapid corrosion.

The accompanying sketch illustrates the principle of arranging silver contact points where a spark occurs. It will be noted that the contact faces are beveled so that they are not only self-cleaning, but present a larger surface than if they were made parallel.

Contributed by

S. G. Ryder.

THE RADIO CLUB OF HARTFORD

A score of amateur radio operators gathered together at the rooms of the Hartford Automobile Club and formed "The Radio Club of Hartford." One of the main objects of the organization is to improve interference conditions which are rather bad in this vicinity. Plans are now being made to aid its members in the radio science and a very interesting program is assured for the meetings which are to be held once a fortnight. Mr. David L. Moore was elected president of the club and Mr. Clarence D. Tuska was chosen secretary-treasurer. Any correspondence may be directed to the secretary in care of the Automobile Club of Hartford, Trumble street, Hartford.

FALLS CITY WIRELESS CLUB

At a meeting held January 5th, an organization was effected of the Falls City Amateur Wireless and Electrical Club. Wallace W. Smith, 190 Pennsylvania avenue, was elected secretary.

The purpose of the club is to bring together all amateur wireless experimenters and those interested in electrical experiments, both in Louisville and within a radius of 150 miles of Louisville.

As the average experimenter is hampered by the lack of suitable instruments to carry out his experiments, it is proposed to fit out an up-to-date electrical laboratory including a modern wireless station for long distance work. As Louisville is located so far inland from any high power stations, it is almost impossible for the average amateur to erect a station for the reception of long distance signals except at great expense. It is to overcome this that a central station is proposed for the use of the club members. In addition, if they so desire, each member may install a low power set at his home and thus communicate with other members and the central station. The secretary will be glad to hear from anyone interested.

THE GLENOLDEN WIRELESS ASSOCIATION

The Glenolden Wireless Association was organized on January 2, 1914. The following officers were elected: Everett MacConnell, president; Raymond Zickel, vice-president; Thomas Bonsall, secretary, and Albert Rose, treasurer.

All communications should be addressed to the Secretary, T. F. Bonsall, Glenolden, Pa., and will receive prompt replies.

High Frequency Current Apparatus

A Series of Articles Covering the Theory, Making and Operation of High Frequency, X-Ray and Ozone Apparatus.*

By Frank Brewster

CHAPTER 3—UNIPULSATORS

X-RAY tubes have never realized the perfection in operation that they should when excited from induction coils, owing to the reactive effects of the inverse current present, which could not be totally eliminated even when high tension rectifier or valve tubes are inserted between the secondary terminals and the tube. To overcome this unsatisfactory condition of affairs, there have been produced numerous devices and arrangements intended to supply an ideal X-ray current which shall be at once high tension, steady, reliable, of good volume, and lastly, unidirectional in nature. The ideal current, in other words, should be a unipulsating or direct one, and so a machine capable of delivering such a current is termed a unipulsator. There has been a simple arrangement for producing a high potential, unidirectional X-ray current, in use here and abroad for some time, the action of which may be more clearly interpreted by glancing at the diagram Fig. 14.

In the place of the usual induction coil for producing the necessary potential, a specially designed step-up transformer of the closed core type is used. This transformer steps up the primary or supply voltage, of 110 or 220 volts, to a value of 100,000 volts or more in the secondary winding. The rectifier valve cell of the familiar iron-aluminum type is connected into the primary circuit for the purpose of suppressing one-half of every cycle of alternating current, thereby allowing only the half-waves or impulses in one direction to reach the transformer primary coil: thus causing the

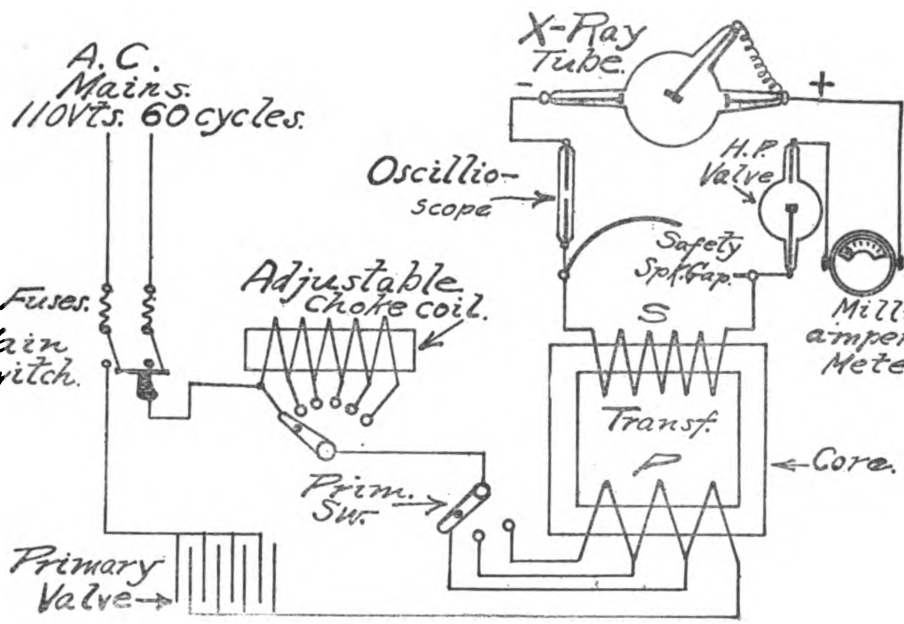


FIG. 14—ARRANGEMENT OF APPARATUS FOR THE PRODUCTION OF UNIPULSATING CURRENTS

* This series began in the February issue

secondary winding to deliver a current composed of similar but high potential unidirectional impulses or a unipulsating current.

An adjustable inductance in the form of a choke coil, is generally inserted in the primary circuit to regulate the amount of current passing therein, and simultaneously the strength of the secondary current. The primary winding of the transformer is also made adjustable by bringing out taps or leads from tive terminal of the machine, providing the current is flowing in one direction only; but if counter direction or inverse current happens to be present, both electrodes become more or less fluorescent, the magnitude of the inverse current present being indicated by the length of the fluorescent band. The high potential valve tube generally suppresses most of the inverse current, but if not, the vacuum of the valve tube or the X-ray tube is possibly too great and should be

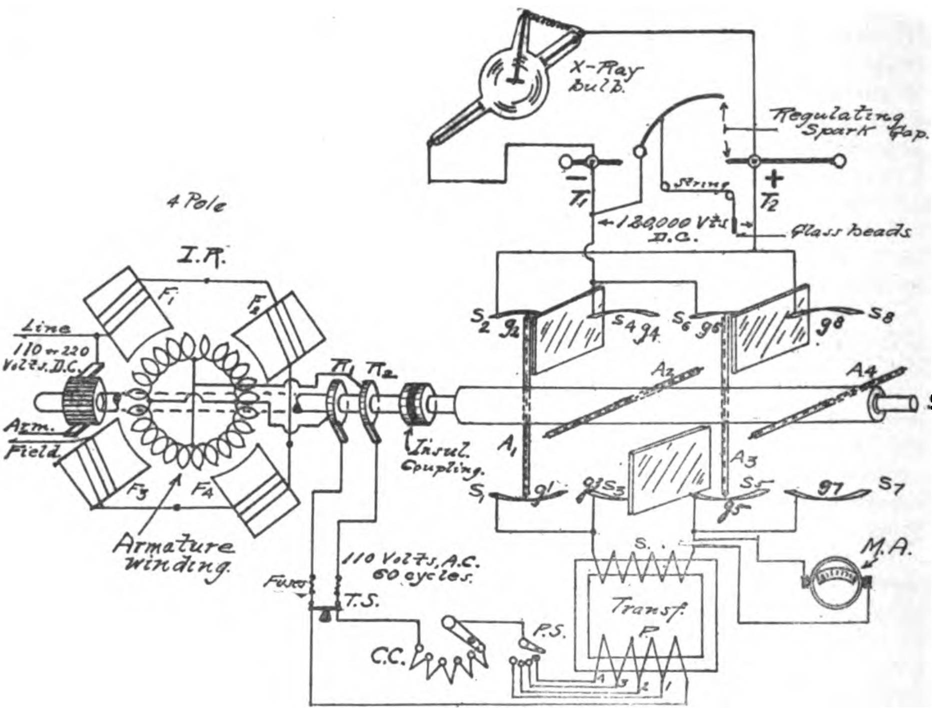


FIG. 15.—WIRING DIAGRAM OF THE NECESSARY APPARATUS FOR PRODUCING NON-INTERRUPTED, UNIDIRECTIONAL CURRENTS

each layer to a multi-point switch.

In the secondary circuit is placed the safety spark gap across the secondary terminals to prevent puncturing the X-ray bulb or unduly straining the secondary winding. The oscillioscope is an instrument comprising two aluminum wires mounted in an exhausted glass chamber about 1½ by 8 inches, with a small gap left between the ends of the wire. Its function is to indicate the presence and quantity of inverse current existing in the X-ray tube circuit.

Its mode of action is as follows: A purple fluorescence envelops the electrode connecting to the cathode or nega- lowered until a clear oscillioscope is shown.

The milliampere meter should be of a good make and provided with a set of shunts so as to be able to read from zero to 50 milliamperes.

Some construction details for a set of this type, which is capable of covering quite an extensive field, are given in the next chapter, which also includes data for the special step-up transformer utilized in place of the induction coil, the capacity of which is 5 kilowatts. This set is to be operated from a 110 or 220 volt, 60 cycle alternating current circuit, but may be run on direct current of similar potential by using a motor-generator set or rotary converter of sufficient capacity. The amount of alternating current energy required is 6½ to 7 horse-power; one horse-power being equivalent to .746 kilowatt.

The foregoing method of attaining the results desired is not entirely perfect or satisfactory for heavy professional duty which demands the very best results, for the reason that all of the inverse current in the secondary circuit cannot be eliminated.

On a superficial inspection of the arrangement described it might seem as if the secondary current would closely approach the ideal or unidirectional current, but the electro-magnetic reaction occurring in the transformer windings sets up inverse half-waves at every pulsation of the primary current, which is at the rate of 60 times a second on a 60-cycle alternating current.

To offset the poor efficiency and other disadvantages of this scheme, an elaborate form of machine has been evolved, which can deliver a true unidirectional X-ray current, devoid of any inverse functions.

There are numerous equipments built to-day which are claimed to produce such a current, but probably the best known at the present time, is that named the "Interrupterless" set, manufactured by a New York firm. The machine is so built that it is readily adapted to operate on 110 or 220 volts, either alternating or direct current. Such a machine produces excellent results for all classes of work; the light in the X-ray bulb being extremely clear and steady.

The simplest form of this apparatus is that involving the use of an inverted rotary converter running as a direct current motor on a D. C. supply circuit and delivering alternating current to excite the transformer. The scheme of connections for this set operating from direct current mains, is seen in Fig. 15.

The inverted rotary converter—which is simply a four-pole D. S. shunt motor, with two leads or connections taken off at points 180 degrees apart on the armature to two collector rings R1 and R2—is started up by means of a regular starting box. When full speed is reached, the transformer switch T S, is closed and the adjustable choke coil C C regulated to give the desired secondary current. The primary coil switch P S is also adjusted, thus controlling the number of primary layers cut into circuit and directly influencing the value of the secondary voltage.

The potential of the alternating current supplied by the rotary converter armature, can be 100 to 150 volts, at a standard frequency of 60 cycles per second. The special transformer is of 5 kilowatts capacity and sometimes more.

The production of a true unidirectional, high voltage, X-ray current is assured in this machine by the action of a special commutator, in the form of a rectifying spindle S P, fastened to the rotary shaft by an insulated coupling; the spindle thus rotating in synchronism

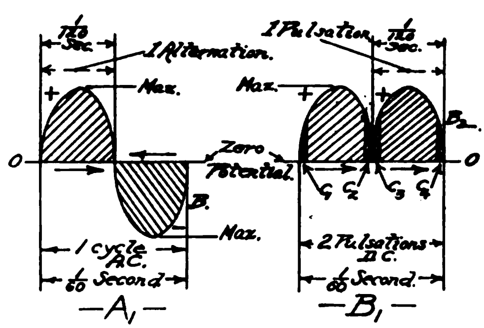


FIG. 16.—CHART SHOWING THE NATURE OF CURRENTS

with it. This spindle, of hard wood about 3 feet long and 3 inches in diameter, carries 4⅛ inch brass rods or rectifying arms, A1 A2 A3 and A4, which are covered with hard rubber ¼ inch thick and pass through the spindle at an angle of 90 degrees with each other, as well as projecting 10 to 11 inches on either side of it. The ⅛ inch arms of brass are bare for ½ inch at the extreme ends and are placed about 9 inches apart along the spindle. They are securely keyed in position so as to withstand the strain put upon them while rotating at full speed, which is 1,800 revolutions per minute. This speed is necessary to generate 60 cycles per second by the four pole machine, which is equivalent to two cycles or four alternations for every revolution of the armature.

At the top and bottom of the spindle, eight metal segments are set, their dimensions being about 9 inches long and

½ inch wide, leaving a small clearance of 1/32 inch between their faces and the ends of the rotating arms.

Now if a positive half-wave or impulse passes into the primary coil of the transformer and out of the secondary coil, it will travel over the shortest path, *i. e.*, from segment S1 to gap g1, along the spindle arm A1 to gap g2, segment S2 to positive terminal T1 and thence to the anode or positive terminal of the X-ray tube. When the next quarter revolution of the rotary converter armature and spindle S P has taken place or the terminal. It is evident from a perusal of the foregoing explanation and the diagram that for the design of the rectifying device here utilized, the A. C. must change its direction four times for every revolution of the spindle or two cycles; one cycle consisting of two changes of current direction as exhibited in Fig. 16.

Referring to the chart, at A is plotted the time of duration and behavior of one cycle of alternating current whose frequency is 60 cycles a second or the equivalent of 7,200 alternations per minute.

The function of the correct unipulsat-

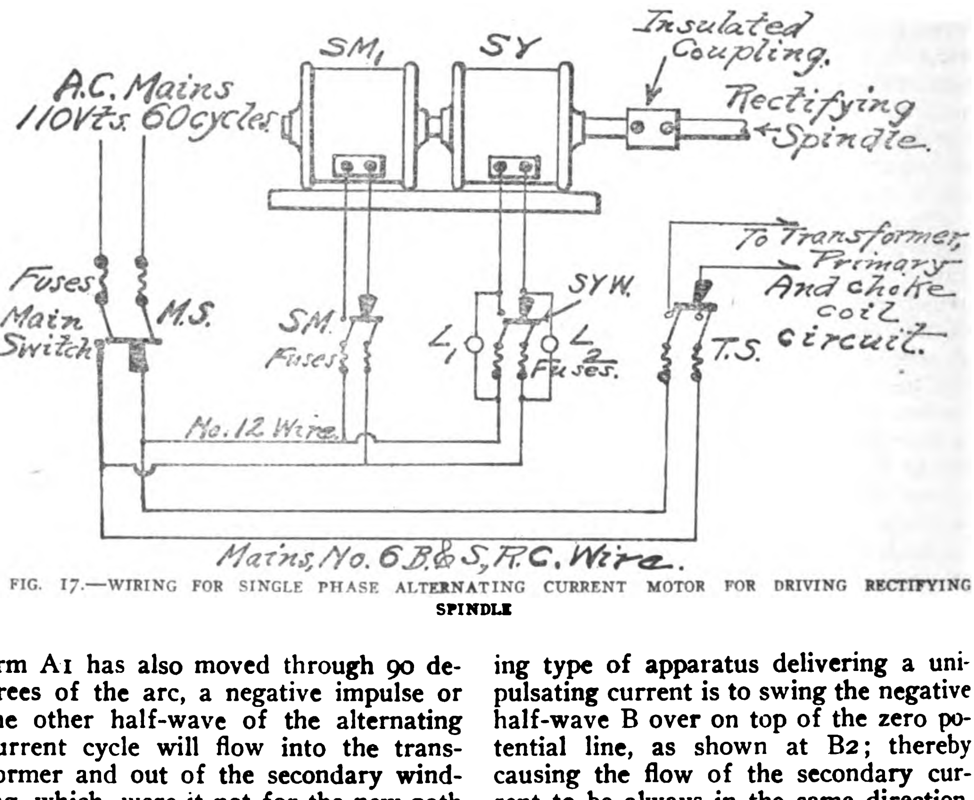


FIG. 17.—WIRING FOR SINGLE PHASE ALTERNATING CURRENT MOTOR FOR DRIVING RECTIFYING SPINDLE

arm A1 has also moved through 90 degrees of the arc, a negative impulse or the other half-wave of the alternating current cycle will flow into the transformer and out of the secondary winding, which, were it not for the new path provided for it by the rectifying spindle and its arms, would follow the same course as the positive impulse. But instead, it now finds a path provided for it over the segment S3, gap g3, arm A2, gap g4 and segment S4 to the negative terminal of the machine T2, and cathode of X-ray bulb.

Thus the constantly revolving spindle and arms succeed in always directing the positive impulses or half-waves to the positive terminal of the machine, and all the negative half-waves to the negative ing type of apparatus delivering a unipulsating current is to swing the negative half-wave B over on top of the zero potential line, as shown at B2; thereby causing the flow of the secondary current to be always in the same direction. The portions of the pulsations divided off by the dotted lines and indicated by arrows C1 C2 C3 C4, are the small sections of each rectified alternation lost in commutation due to the gaps existing between the top and bottom segments of the rectifying device, which are necessary to prevent the high voltage current flowing in these parts from jumping across to other parts and form short-circuits.

Where the machine of this type is energized from alternating current supply

(*Continued on page 489*)

Simple Home-Craft Furniture

The Third of a Series of Articles Describing the Making of Various Pieces

By G. Lane

Illustrations from drawings made by the author.

THIS mission library table will be found suitable for one's own room as well as for the library or living room. While the design is simple and offers no difficult problems in the making, it will please the eye. The design is one that can be easily changed to suit the special needs of the maker; for instance, 31 inches is considered too high by some people, and this dimension, of course, can be readily made lower. Or perhaps the size of the top may need to be changed to fit a certain space in the room; in this case, remember to increase or decrease the length of the other pieces proportionately. If casters are to be used, the posts should be made 1½ inches shorter.

The stock bill given below states the sizes to order from your lumber dealer. It will be found considerably cheaper to order the pieces this way than to order them in the exact length.

OAK.

Top, 1 pc. 1¾" x 28" x 42", made by gluing strips 6" wide underneath the edges of a piece ⅞" x 28" x 42"; grain parallel. (See drawing.)

Posts, 1 pc. 3" x 3" x 10', soft wood core veneered with 3/16" or ¼" oak. (See section drawing.)

Shelf, 1 pc. ⅞" x 12" x 36".

Top rails and drawer front, 1 pc. ⅞" x 4" x 12'.

Lower end rails, 1 pc. ⅞" x 3" x 3'.

Slats, 1 pc. ⅜" x 3" x 6'.

WHITE WOOD OR WHITE PINE.

Sides of drawer and drawer slides, 1 pc. ½" x 3½" x 6'.

Bottom and back of drawer, 1 pc. ¼" x 6" x 6'.

Braces underneath top, 1 pc. ⅞" x 3½" x 6'

Be sure the dealer understands that the grain in the strips glued underneath the ends of the top is to run parallel to the top. A top glued up in this way answers the purpose just as well as a 1¾ inch solid top and costs considerably less. The posts should be glued up with a pine core and each side veneered with thick oak veneer. Posts glued in this manner look just as well as solid oak posts and make a much lighter table.

After securing the lumber from the mill, the first thing to do is to put in place the two soft wood braces underneath the top, screwing each piece down with six or seven 1½ inch flat head screws. It will be seen by the drawing that these pieces fit underneath the top, between the strips glued on the edges and directly above where the sides of the drawer come; helping in no little degree to keep the top from warping.

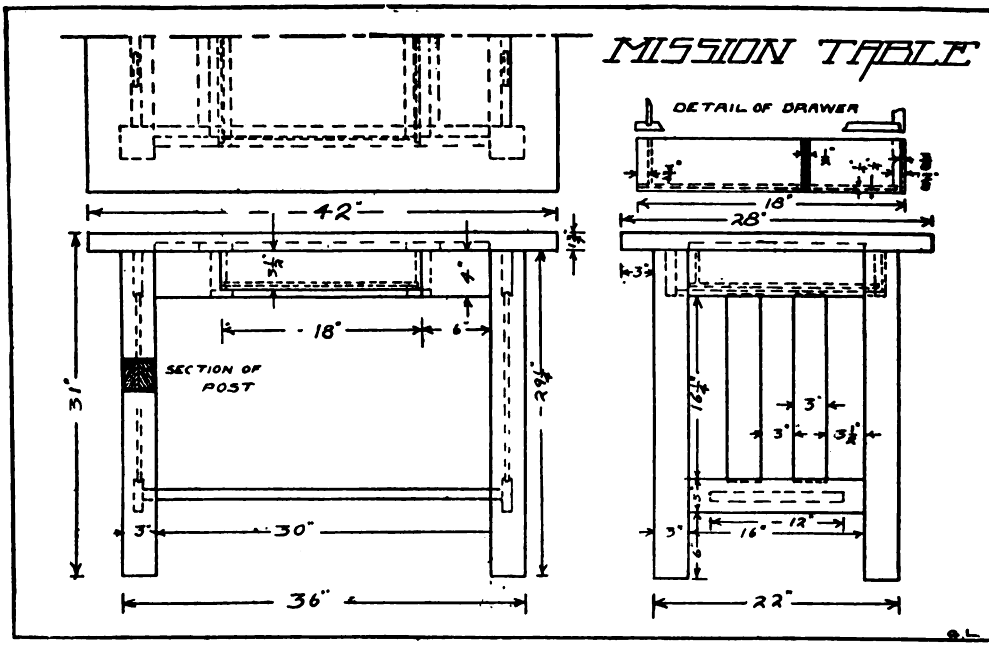
In constructing a table of this type, the ends are put together first. Cut off and square the four posts to the right length, and plane carefully with a smoothing plane. Either mortise and tenon joints may be used in making the table, or ⅜ inch blind doweled joints. If mortise and tenon joints are to be used, add 3 inches to the total length of the rails for the tenons. Make tenons on upper rails ½ inch x 3 inches; on lower rails, ½ inch x 2 inches. In case doweled joints are used, employ two ⅜ inch dowels for each joint. Cut square the upper and lower rails for the ends, smooth up, and make joints very carefully. Clamp ends together to see if joints come together tight. Take apart again, and clamp upper and lower pieces for both ends together, and lay out mortises to receive slats. Cut these ⅜ inch deep. Now put each end together and if all joints fit tight, take apart and apply hot glue or the best grade cold glue. Have the furniture clamps adjusted to the proper length and use softwood blocks between clamps and wood. Use two clamps on each end. Allow the work to dry for 24 hours, and then carefully scrape off the glue. Cut out and smooth up the side rails and make joints. If doweled joints are to be used lay out so the dowels from the side rails do not hit those from the end rails. Clamp together, making sure that the table is square before the glue sets.

Put in place the lower shelf after its edges and top have been carefully smoothed up. Two 2 inch round head blued screws may be put in from each end, or 1½ inch screws may be put in on the slant from the under side.

Next lay out the drawer opening and bore a ½ inch hole in one of the lower corners. Saw down to the hole with a fine-toothed saw and then cut length-

and screwing a three-cornered strip in the corners made with the side rails.

The next step is to make the drawer. The front is made of oak, 1/16 inch shorter than the opening. Bore the holes for drawer pulls or knobs. Cut the two sides from the ½ inch stock and cut a groove ¼ inch deep and ¼ inch wide. Measure ¼ inch from the bottom edge and cut a similar groove on the lower edge of the front. These grooves may be made with a circular saw or a grooving plane. Cut notches in the back of the drawer front to receive the sides, as shown in drawing, and also cut a ¼ inch groove ¾ inch from the end of the side to receive the back of the drawer. Nail



wise with a compass saw. Smooth up afterwards with the chisel. Screw the drawer slides together. Each drawer slide, as shown in drawing, is made by cutting a ⅞ inch piece of soft wood, 3½ inches wide, just long enough to fit in between the side rails, and screwing on the bottom edge of this a ½ inch piece of the same length, making an L-shaped piece. One of these is placed on each side of the drawer opening, the ½ inch piece coming behind the strip left under the drawer opening, so that the drawer can rest on them. These must be squared accurately between the side rails, or the drawer will not fit between them. Fasten these slides in by gluing

the drawer together, using 1½ inch finishing nails, keeping the drawer square. Cut the pieces for the bottom of the drawer and slip them in from the back. Nail in only the last piece. This permits of closing up any cracks in the bottom of the drawer, caused by shrinkage. Fit the drawer so that it slides easily.

There are many ways to fasten on the top of the table. One way is to make a slanting cut with a ¾ inch gouge, having the end of the cut about ¾ inch from the top of the rail and deep enough to allow a gimlet hole to be bored through into the top. Locate on the under side of the top the position of the posts and put three screws in each end.

four in the back rail, and two in each side of the drawer opening. Screw down in the same way the drawer slides to the braces underneath the top. Smooth up with a plane and sandpaper the edges of the top. Use a plane on the top if the grain is straight; otherwise use a scraper.

Look over the table and remove all the scratches and rough places that can be detected by either the eyes or fingers. Stain and finish the table to match the rest of the furniture in the room. Put a finish of some kind on the underside of the top to keep out the moisture.

The drawer pulls or knobs should harmonize with the finish used. Domes of polished steel or hardened felt are suggested for the posts in place of casters.

Institute of Radio Engineers

AT the regular monthly meeting of the Institute of Radio Engineers held in Fayerweather Hall, Columbia University, on February 5, 1914, a paper by C. Tissot entitled "The Influence of Alternating Currents upon Certain Fused Metallic Salts, with an Application to a Radio Detector," was read. The topic considered in the paper was the effect on the conductivity of salts in a nearly solid state (salts which had been fused and then cooled nearly to solidification) of radio-frequency oscillations, provided a constant potential was applied to these salts. It was found that under certain conditions this conductivity which was quite high as long as the constant direct current potential was applied, was suddenly dropped to a very low value the moment radio frequency oscillations were caused to pass through the salts, and was restored to its former high value when these ceased.

The substances investigated were lead, thallium and silver chlorides, silver iodide and acetate and cadmium bromide. These were each placed in a porcelain dish between two sheets of platinum. The platinum sheets were about four or five millimeters long, bent to a right angle, and were separated by a space of about one millimeter. Around the whole was piled some refractory material such as asbestos. The dish was then heated until the salt fused and then it was allowed to nearly solidify.

The little cell, or salt lozenge, was then placed in a circuit with a galvanometer and a variable resistance operating as a potentiometer. A few volts of D. C. potential were applied to it. At ordinary temperatures such a salt lozenge was found to possess a resistance of about a megohm. This remains constant so long as the applied voltage is below a certain critical value (ordinarily about one volt), but above this it diminishes, at first slowly and then more rapidly until it finally reaches a constant value of several thousand ohms. The final condition is hastened by applying a gradually increasing potential, and is established more quickly with thin layers of salt than with thick ones.

Now, the moment rapid electrical oscillations are applied to a salt in this condition, the resistance jumps to a very high value. The conductivity is, however, instantly restored when the oscillations cease. To obtain this instant restoration it is necessary to adjust the constant applied potential difference to its critical value, otherwise the action is not so sensitive.

The device described in the paper is, of course, applicable to use as a radio detector in an obvious manner. Besides, the experiments discussed may help to clear up the form of the reaction taking place in other varieties of detectors; at least, the discussion following the paper tended along these lines and also concerning the use of the device as a quantitative apparatus.

Further business transacted at the meeting included the appointment of a committee to look after the interests of the "amateur" members of the Institute, as well as to consider ways and means by which the amateurs of the country might aid in the development of the art of radio communication—notably in the gathering of data concerning the transmission of electric waves over the earth. The committee consists of Messrs. Armstrong, Hebert and Moore.

The Editor's Desk

The leading article in this issue of MODERN ELECTRICS AND MECHANICS is that describing the evolution of the steam locomotive. Although a history of the steam locomotive in the limited space that can be devoted in this magazine must necessarily be very brief, as far as possible the important steps in its development have been cited. The illustrations have been secured through the courtesy of *Dun's International Review.*

A most interesting article is that describing the construction of a high speed vibrating key. The readers of MODERN ELECTRICS AND MECHANICS are quite familiar with the excellent work of its author, Mr. P. Mertz, who has written many articles for this magazine in the past, so that further comment is hardly necessary.

All of the installments of the regular serial articles appear in this issue. Dr. Watson gives further constructional details on the alternating current induction motor; the homecraft installment consists of a description of an attractive mission table; and further details are given regarding the construction of high frequency current apparatus.

A new department will be found in this issue. This department is headed "Correspondence" and will be devoted to publishing letters of general and timely interest received from our readers.

The wireless readers will undoubtedly find the article entitled, "The Arc Generator for Radio Frequencies," an unusual one. It covers the important subject of the arc generator in a thorough manner and the information imparted will greatly aid those who are either experimenting at present, or contemplate experimenting, with the wireless telephone using the arc method.

The remaining articles in this number are all worthy of special mention, but space does not permit of more than passing comment here.

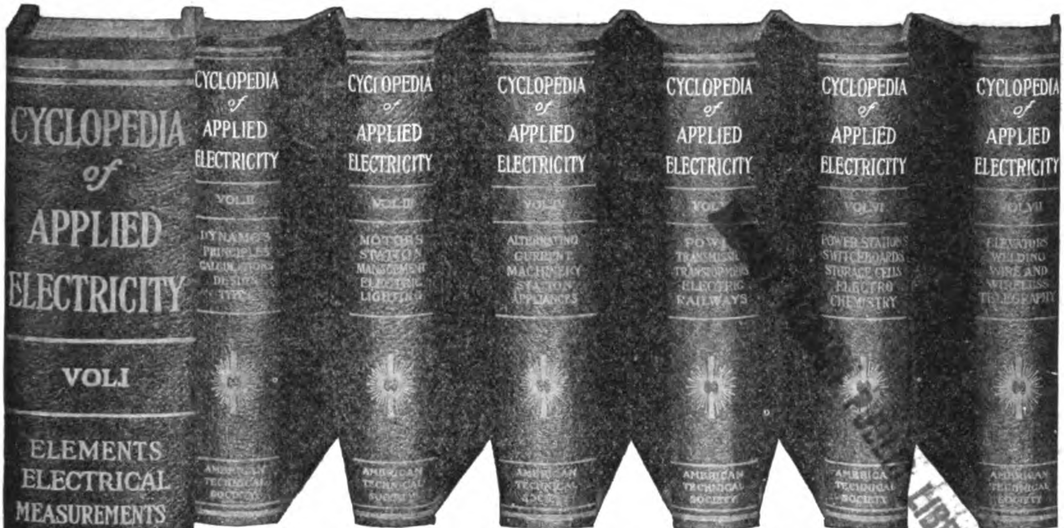
In the article entitled, "The Edison Effect in Wireless Telegraphy," that appeared in the March issue, the third sentence in the paragraph commencing "Let us proceed to an analysis . . . . ." should read "Curve No. 1 shows the curve distorted . . . ." instead of "Curve No. 6 shows." Mr. Stone, the author of the article, states that he has received many letters from readers of MODERN ELECTRICS AND MECHANICS asking for information regarding valve phenomena. He will be pleased to answer all queries regarding valves, in so far as he is able to, which were not treated in his article. His address is 317 Lee Street, Oakland, Cal.

The recent snowstorm and gale which played havoc in and about New York City has taught several lessons of great importance. Probably one of the most important lessons derived from this storm was the shutting off of electric power from wires when the latter were broken down and strewn about the streets. In the suburbs and surrounding cities of New York, several fatalities were reported; in many instances persons were electrocuted by broken wires dangling in the thoroughfares. Many horses were also killed by coming in contact with electric wires. The action of several municipalities in ordering the electric lighting companies to turn off the power from their lines so as to avert further loss of lives, is indeed commendable. Although this action caused several cities to be thrown into complete darkness with the resultant inconvenience to many, it served to save many lives which might otherwise have been lost.

The number of Apparatus Exchange advertisements received are increasing rapidly and owing to the limited space devoted to this department, it is necessary to hold advertisements one or two months before they can be published. Every advertisement is taken in rotation. In view of the foregoing facts, readers sending in advertisements for the Apparatus Exchange section should bear in mind that their advertisements cannot be published in the first or second issue appearing after the advertisement has been sent in.

Have you any suggestions to make that would perhaps serve to better MODERN ELECTRICS AND MECHANICS? At all times we welcome suggestions of any kind that can serve to make this magazine more interesting to our readers. Of course, every reader must bear in mind that this magazine caters to three classes of readers: The readers mechanically inclined and interested mainly in mechanics; those who are only interested in electricity; and finally, the wireless amateurs who read this magazine mainly for its wireless articles It is therefore evident that each issue must contain articles that will interest each class

YOURS FOR $2 a month. This $35 set now only $19.80



Here's a real opportunity! You can buy at almost half price the most complete and comprehensive work on electricity ever published—the **world's greatest electrical library** is now offered to you on easy monthly payments. This plan brings these valuable books within the reach of all. Be an Electrician—start now. From these wonderful books and with the help of our consulting experts you can get a complete electrical education in a short time. Whether worker, engineer or expert, this Cyclopedia will add to your knowledge, add to your job and add to your salary.

Cyclopedia of Applied Electricity

Contains 3,200 pages, 7x10 inches; 2,600 illustrations, full page plates, diagrams, etc.; hundreds of valuable tables and formulas; carefully cross-indexed for quick, easy reference. The books are substantially bound in half red morocco, gold stamped, and are printed in large, clear type on special quality paper.

Shipped Free

The complete seven volumes, not a sample volume, will be sent, express prepaid, for seven days' free examination; returnable at our expense if they fail to meet with your expectations. If you keep them, pay $2 seven days after receipt and then $2 a month until you have paid the special sale price of $19.80. Fill in and mail the coupon—today. It won't cost you a cent to examine these books, so get them into your home, shop or office and look them over at your leisure. Remember, if you don't like them **they may be returned at our expense and you won't be out a penny. This is one of the most liberal offers ever made. You can't afford to pass it by.**

What These Books Cover

Theory, Calculation, Design and Construction of Generators and Motors—Electrical Measurements—Electric Wiring—Electric Welding—Types of Generators and Motors—Management of Generators and Motors—Storage Batteries—Electric Lighting—Alternating Current Machinery—Station Appliances—Power Stations—Power Transmission—Central Station Engineering—Electric Railways, including Single-Phase—The Electric Telegraph—Telephone Equipment, Systems and Operation—Wireless Telegraph and Telephone—Telautograph, Telegraphone, etc.

Consulting Service Free

With every set is included absolutely free a year's Consulting Membership, regular value $12, entitling you to the advice of a staff of electrical experts. These men are no farther from you than your nearest mail box. They stand ready to solve your perplexing problems, to offer suggestions, to point out the things you should avoid. Absolutely no limit to their assistance—ask as many questions as you wish for a whole year. This service alone will be worth more to you than the entire cost of the books.

Don't wait. This means $15.20 saved if you act now. Remember, you take no chances whatever—it costs nothing to inspect and you are nothing out if you do not care to buy. This offer may mean your success, so mail the coupon today—now—before you turn the page.

American Technical Society, Chicago, U. S. A.

FREE COUPON Worth $15.20 to you

American Technical Society
Chicago, U. S. A.

Please send me Cyclopedia of Applied Electricity for seven days' free examination. If I keep the books, will send $2 within seven days and $2 a month until $19.80 has been paid, when $35 books and $12 consulting membership will be mine. Otherwise will notify you and hold books subject to your order. Title not to pass until fully paid.

M.E.&M. 4-14

NAME ....

ADDRESS ....

As I have had no previous dealings with you, I refer you to

....

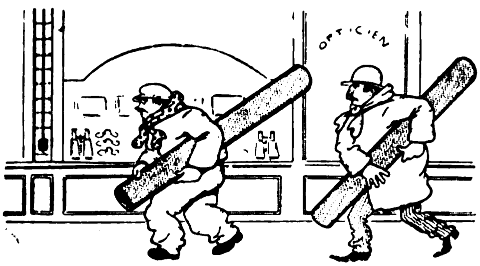
FLYING SPARKS

HIS PROSPECTS

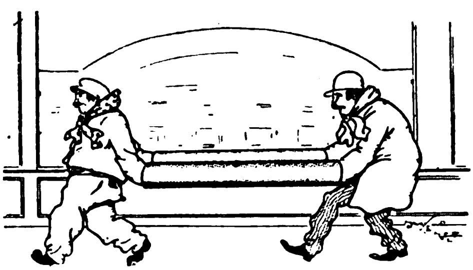
"Has that young man who is calling on you any prospects?"

"Yes, mother. He told me last night that he had filed his application for a position with the Ford."—*Detroit Free Press.*

COLD WEATHER SUGGESTION



B-r-r! What cold weather! In carrying these pipes there is no way to put our hands in our pockets. If we only had muffs!



Ah! Here we are!—*Le Pele Mele.*

NO COMPLAINT

It was at the vaudeville. The girl with the excruciating voice had just finished her song.

"Just think!" groaned Brown, to the stranger beside him. "We paid real money to hear that!"

"I didn't," was the placid response. Came in on a 'comp.'"

"But you had to spend the carfare to get here, did you not?" asked Brown.

"Nope," replied the uncomplaining one. "I live in walking distance."

"But," persisted Brown, desperately, "at least you hoped to be entertained, not punished."

"No. I didn't care," grinned the stranger. "I came to get away from home. My wife is cleaning house."—*Judge.*

HE WAS—AND HE WAS NOT

"Do you know the gentleman who is standing behind me?"

"Yes: He is a very high official.—*Le Pele Mele.*

PROBABLY NOT

Practical Father—Has that young man that wants to marry you any money?

Romantic Miss—Money! He gave me a cluster diamond ring studded with pearls.

Practical Father—Yes, I know. Has he any money left?—*Chicago Ledger.*

A CANADIAN WIRELESS CLUB

The Winnipeg Boys' Club Wireless and Science Society recently held its inaugural meeting at the club rooms on January 7th, when the following officers were elected: Honorary president, Harvey Farmer; honorary vice-presidents, N. T. McMillan, F. Cambridge, G. J. Glassco, Prof. E. P. Featherstonhaugh, Sir Daniel McMillan, and E. D. Brown; president and instructor, H. H. Pratt; vice-presidents, J. H. R. Fineghan, J. A. Coleman; secretary, George Cormack (Suite 18 Orris Blk.), and treasurer, H. Peters (925 Sherbrooke St.).

The society has been founded to increase the knowledge of its many members in matters pertaining to wireless telegraphy and general science—especially in the former subject. It has the support of the City Light and Power Department as well as many of the most prominent business men of Winnipeg. The society commenced with an enrollment of 17 enthusiastic members.

Any other wireless or scientific clubs wishing to communicate with this society are requested to correspond with the secretary.

FINDING LOST RADIUM

From a recent press report, it appears that a tube of radium worth $5,000 that was lost among the sweepings of a hospital, was located by means of an electroscope.

According to the report, the tube of radium was lost in the Royal Infirmary of Liverpool, England. The tube had been previously used with bandages and applied on the face of a patient, for the night. The next morning the tube was missing. The doctors were all certain that the tube had probably fallen out of the dressing to the floor and had been swept out. The sweepings for the entire building filled a big cart, which was just stopped in time.

Professor Wilberforce, one of the hospital staff, placed an electroscope on the edge of the cart and was immediately able to determine that the radium was present. The rubbish was then taken out in buckets and at the twelfth bucket Professor Wilberforce detected the presence of the radium tube which was soon found.

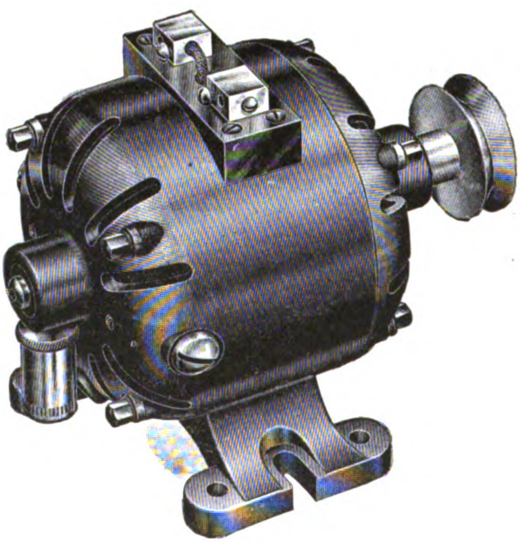
NEW THINGS

Electrical—Wireless—Mechanical

Small Dynamos and Motors

The Carleton Company, 172 Summer Street, Boston, Mass., has recently placed on the market a new generator which is designed for use on motor cars, cycle cars, motorcycles and motor boats. It is also suitable for use in small stationary plants and for the charging of storage batteries. This generator, which is illustrated in the accompanying illustration, weighs only 9½ lbs. and is 5 inches high and 6 inches long. At the normal speed of 1,800 revolutions per minute, the output is 8 amperes at a pressure of 6 volts. The pulley is 3 inches in diameter.

Aside from the foregoing-described generator, The Carleton Company has also placed on the market two new motors rated at 1/10 and 1/15 horsepower, respectively. These motors are designed for running small lathes, sewing machines, grinders and polishers, motion picture machines, washing machines, churns, rotary spark gaps, experimental apparatus and other similar work. These motors operate on 110 volt circuits, either direct or alternating. The 1/15 horsepower motor weighs 6½ lbs. and is 5 inches high and 5¼ inches long. The 1/10 horsepower motor is 1 inch longer and weighs a trifle more.



A 110 VOLT A. C. OR D. C. MOTOR MADE BY THE CARLETON COMPANY

For further information concerning the generator and motors as well as other products made by The Carleton Company, communications should be addressed as above.

Cardboard Tubes for Wireless Purposes

Cardboard tubes are widely used for the construction of loose couplers, tuners, oscillation transformers, loading coils, wave meters, Tesla coils, and many other wireless and electrical apparatuses. Cardboard tubes present many advantages not possessed by wooden cores, and fibre or rubber tubes, among them comparatively low cost, lighter weight and the ease with which they can be handled; the last feature being especially pronounced in the construction of loose couplers, Tesla coils and other apparatus in which two coils, placed one within the other, are used.

Among the leading manufacturers of cardboard tubing is the firm of Beetle & Maclean, 21 Bromfield St., Boston, Mass., which is prepared to furnish this material in all diameters, thicknesses and lengths. Prices, specifications and other information can be secured by addressing the firm direct.

A Modern Telegraph School

Prominent among the leading telegraph schools is the New England School of Telegraphy, located at 32 Warren St., Roxbury, Boston, Mass., which has just announced the completion of its wireless station. This station will work with local amateur stations every Monday, Wednesday and Friday evenings, from seven to nine o'clock.

This school has been accomplishing commendable results in all branches of telegraphy, namely, wireless, railroad and commercial. Having an ideal location, directly opposite the Dudley Terminal—the starting point of all the street car transportation lines—it is readily accessible from any part of Boston and suburbs.

The conditions under which students of the New England School of Telegraphy work are perfect; all the rooms being sanitary, well illuminated and thoroughly ventilated with fresh air. The courses are as complete as possible. They are given under competent instructors. The cost of tuition is exceedingly reasonable and within the means of anyone desiring to learn telegraph operating or become a wireless operator.

Anyone interested in any branch of telegraphy will do well to investigate this school before enrolling in any institution. By addressing a request to the school, full details as to the courses and rates, as well as other information, can be secured.

Wireless Map of the U. S.

An interesting map of the United States

showing all of the wireless telegraph stations of over one kilowatt capacity has recently been published and is now offered for sale by B. Francis Dashiell, Irvington, Baltimore, Md. The map not only includes commercial and Government stations, but also those of amateurs. Ship routes upon the high seas and Great Lakes are also shown with the approximate path followed by the steamers, the names of the steamship companies and the calls of their steamers. The sea is divided into degrees so that the location of any ship can be ascertained at a glance. Another valuable feature is the standard time divisions which are marked on the chart so that differences in time between distant points can be quickly estimated. The distance between any two points can be readily and accurately determined by means of a scale furnished with each map.

The size of the map is 28 x 38 inches and is mailed postpaid in a substantial tube to any address for $1.00. The present edition dates from January 1st, 1914, and whenever sufficient changes warrant the publishing of a second edition, the author will do so. In reality, this map is a practical wireless encyclopedia which will be found invaluable to any wireless operator whether he is operating an amateur or commercial station. A free circular describing the chart will be sent on request.

Mr. B. Francis Dashiell is interested in receiving any data on stations over one kilowatt, which will be incorporated in subsequent editions of the wireless chart.

Brooklyn Telegraph School

There is a constant increased demand for telegraphers and there is no occupation as pleasant and fascinating as that of telegraphy. It is a business as well adapted to young ladies as young men and much more preferable and better paying than the average office or store duties. The progressiveness of the young people of to-day and their desire to equip themselves with a knowledge of some practical science both in a scientific and in a business way, has popularized to a wonderful degree the art of telegraphy.

The Brooklyn Telegraph School, located at 313 Fulton Street (Western Union Telegraph Building) is a busy place these days teaching young men and women not only the rudiments of telegraphy but all of its branches, such as wireless, commercial, railroad and stock broker telegraphy, and the growth of this school has been so continuous during the past few years, that it is now one of the largest telegraph schools in the United States.

Any one can easily learn and in a comparatively short time. Any boy or girl fourteen years of age who is capable of learning anything can learn "telegraphy."

The pay of telegraphers is much higher than any other clerical line. Telegraphers receive salaries ranging from $14 to $30 per week, sometimes higher.

Every opportunity is offered at the Brooklyn Telegraph School for young men and women to acquire quickly the knowledge of this important and valuable occupation. The recent enactment of the eight-hour law has greatly increased the demand for telegraph operators everywhere, and the graduates of the school are certain of obtaining positions immediately. The school is equipped with a complete wireless station, and messages are received from ships at sea and from other distant points. The instruction at the school is thoroughly practical, the aim being to fit young men and women to take positions of responsibility and to advance as rapidly as possible.

ELECTRICAL EQUIPMENT FOR MOTORCYCLES

(*Continued from page* 438)

When series connection is made the full current flows from both batteries together. When parallel connection is made, the current is "split" and flows from both batteries to the lights. When the switch is thrown forward to obtain the series combination for starting, 12 volts, the maximum energy of the batteries is obtained. When the switch is in starting position, after hand pressure is released, the lever automatically swings to charging position, its normal setting, and bringing into line the parallel combination which permits a charge of 4½ amperes per hour to enter each battery.

The batteries used are of the starter type, each battery containing three compartments and have an unusually high capacity—6 volts and 35 ampere hours. An ingenious construction of the safety vent prevents loss of electrolyte by leakage, if the machine becomes upset. However, this safeguard is operative only when the battery does not become inverted. While leakage of the battery contents is prevented under normal conditions, the free escape through the vents of the gases generated is provided for.

All exposed wiring is armored, so that it will withstand chafing and vibration indefinitely. It is heavily insulated to carry the highest voltage of the system without short circuiting. The wiring, motor-generator, switch box, connection cable block, and battery cases are absolutely waterproof.

The complete electrical system weighs 62¾ pounds. The individual weights are: motor-generator, 25¼ pounds; batteries, 14½ pounds each; head light, 2¼ pounds; tail light, ½ pound; signal, 2 pounds; regulator, 1½ pounds; switch block, 1 pound; connecting block, ¼ pound; wiring, 1¼ pounds.

The motorcycle is fitted with two electric lamps—a head light of 9 candlepower and a tail lamp of 2 candlepower. If the batteries are kept fully charged, each battery has a steady lighting capacity of 15 hours. As there are two sets of batteries, one may be used at a time until run down with the other held in reserve. Aside from electric lamps, the motorcycle is also equipped with an electric signal horn.

HIGH FREQUENCY APPARATUS

(*Continued from page 476*)

circuits, the general arrangement is somewhat different; the principle, however, remaining the same.

The transformer can now have its primary winding connected direct to the A. C. circuit mains with an adjustable impedance or other resistance in series, preferably in the form of a reactance coil having an iron core; common resistance coils being unsuited to A. C. work.

To drive the rectifying spindle in step with the alternating current feeding the transformer, a small synchronous A. C. motor, either single or polyphase, as the case may be, of about ½ horse-power equipped with an accelerating motor or device, is made use of. The synchronous motor is always in step with the changes in direction of the alternating current supply. With the four arm spindle illustrated in the direct current diagram, the speed of the synchronous motor must be 1,800 revolutions per minute or 30 revolutions per second, thus allowing each spindle revolution to occupy two cycles of A. C. duration, or 1/30 second; one cycle taking 1/60 of a second for its development. These motors are standard commercial apparatus.

A diagram illustrating the general arrangement of a single phase, 110 or 220 volt, 60 cycle A. C. equipment is shown at Fig. 17, where M S is the main switch controlling the current fed to the motor and transformer; S M the starting or accelerating motor switch; and T S the transformer switch.

The operation of such a set is, in general, as follows: In starting up the main switch is first closed. Then the switch S M is closed feeding the starting motor, and causing the rectifying spindle and rotor of the motor to be brought up to synchronous speed or in step with the A. C. supply. When full speed has been attained, the synchronous motor SY, can be connected to the A. C. mains by closing its switch S Y W, but at this juncture the synchronous motor must be in exact step or phase relation with the exciting A. C. before it is connected. This is usually ascertained by the employment of some form of synchroscope; an automatic self-connecting synchronizer being built by one of the leading electrical manufacturing firms.

The common method of indicating when synchronism is attained by the revolving motor is to connect incandescent lamps into circuit in the manner shown at L1 and L2 in Fig. 18, the lamps remaining dark for several seconds when the motor is in synchronism and its switch should be quickly closed during one of these dark intervals. The lamps grow light and dark at regular intervals, the intervals becoming less in number as synchronism is approached. The voltage of each lamp should be the same as that of the supply circuit.

The disadvantage of the lamp test, although it is used in many large central stations and power-houses, is that the time sometimes required before the motor can be synchronized and connected is considerable, which would not be conducive to the best humor of the operator—particularly if he were in a hurry.

The automatic synchronizer which connects the motor to the supply circuit at the proper instant, or an automatically synchronizing motor such as the "Watson" motor built by the Mechanical Appliance Company, of Milwaukee, Wis., is much to be preferred and gives the best satisfaction in the end.

The "Interrupterless" X-ray generator, supplies a unidirectional current of 120,000 volts pressure, and 40 to 50 milliamperes, this current being able to jump an air gap 11 to 12 inches long, between pointed electrodes. The discharge is in the form of a hissing flame of great volume, taking the form of stringy, crackling sparks at certain periods, when the transformer primary current is being raised from zero to the required strength.

BLOW PIPE BLOWER

In using a blow torch or blow pipe on illuminating gas the usual foot pump or bellows is found to be inconvenient, troublesome and somewhat irregular. To overcome these difficulties the writer hit upon the following scheme of using the family vacuum cleaner to supply the air blast needed:

The cleaner in question was a portable one in which the vacuum was maintained by means of a small six-blade high-speed fan and in which the air on the pressure side was discharged into a dust receiving bag. This bag was readily detachable from the discharge pipe leading from the fan chamber. The problem then was to pipe the half-inch rubber hose leading to the torch to this 2-inch pressure supply pipe. A sudden reduction in diameter was found to destroy the available air pressure so that a gradual reduction was essential.

To accomplish this a tube of decreasing cross section was made of cardboard. This was constructed in the shape of a truncated cone about 10 inches long, with cylindrical extensions on the ends, one of which fitted over the delivery pipe of the cleaner and the other inside the torch tubing. The cleaner end was then lined with felt so that it made a snug and fairly tight fit over the cleaner tube, while on the other end a piece of the same material was glued for a similar purpose.

This was found to serve the purpose admirably and eliminated all blower troubles.

Contributed by

L. C. F. Horle.

A NEW ELECTRICAL CLUB

The Y. M. C. A. Electrical Club, of Nashua, N. H., was organized January 7, 1914. Under Director Allan Pollock as temporary chairman, the following officers were elected: Winslow Cole, president; Leo Jeannotte, secretary and acting vice-president; and Allan Pollock, treasurer. There were eight charter members. The first task to be undertaken by the club is the installation of an up-to-date wireless outfit. Semi-monthly meetings will be held regularly besides occasional lectures and demonstrations. All communications for this club should be addressed to the secretary, 126 Ash street, Nashua, N. H.

IMPORTANCE OF PROTECTION BY TRADE MARK

(*Continued from page* 450)

another well-known trade-name, while "Kodak" is a trade-mark, pure and simple, with a snap in it obvious to all. In a broad sense any device for identifying a specific manufacturer of a product is a trade-mark, and its value is dependent upon the quality, popularity, sale and profit in the commodity to which it is affixed. Attractiveness or distinctiveness of mark alone, however, is of little or no value if used on inferior or unprofitable goods.

According to the antiquarian the Greeks and Romans were not the first of ancient trading peoples to adapt trade-mark usage, and the mark as a distinctive designation of individual work accomplished may be traced through masonic and other sources to time immemorial. In England particularly, for centuries after the Norman conquest, all manufactured articles were the products of craftsmen belonging to guilds, and the trade-mark was a recognized means of protection. The guilds may now be considered as of the past tense, but the trade-mark has survived and has increased in importance and value, particularly when well chosen and properly protected.

A year or so ago, when the American Tobacco Company dissolved into separate companies, under the order of the Supreme Court, the trade-marks of the combination were estimated to have a value of $45,000,000, out of total assets of $227,000,000. It is, furthermore, a safe assumption to venture that the aggregate value of well-known trade-marks registered in the United States Patent Office may be estimated in the hundreds of millions of dollars. But a trade-mark is a species of commercial property inseparably attached to the business from which it emanates so that it cannot be transferred independent of that business, and hence the intrinsic value of a trademark is necessarily problematic in most cases. Nevertheless, there are many well authenticated instances in which a trademark, originally a mere caudal apendage, has grown to such importance as to be of more value than the body itself, which could not exist without it in a commercial sense. Perhaps the most valuable trade-mark in existence is that of the Royal Baking Powder Company, which considers its distinctive mark worth at least $1,600,000 per letter, although it is rivalled by other marks that have attained national and international distinction, such as "Coco-Cola," "Ivory," "Uneeda," etc., to supercede which in the public favor would involve the expenditure of vast sums of money and exceptional energy. In fact, *"selling by trade-mark"* has evoluted to the highest degree of efficiency during the past century—has become one of the greatest of modern commercial miracles. Thus, a trade-mark has become a symbol of Good-Will, representing built-up reputation, and the medium of confidence between the manufacturer and the ultimate consumer.

Good, bad, and indifferent, there are over 40,000 trade-marks registered in the United States Patent Office. Comparatively few of these are "good," and fewer still are excellent. By far the larger proportion are bad or of questionable utility. The qualifications of an effective trade-mark may hereafter be considered in these columns, as well as the prerequisites for registration.

WIRELESS IN THE NORTH

(*Continued from page* 458)

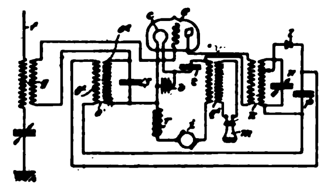
Key West, Guantanamo Bay and many coast stations.

As may be expected, the station has had not a few visits from interested as well as curious and even unbelieving callers from the different mines around. Recently a prominent member on the staff of a Cobalt paper took the time and trouble to come over the 150 odd miles to spend the evening listening to the dots and dashes.

The forest service is compiling a new volume table for calculating the board contents of standing western yellow pine trees in the Southwest. It is based on actual measurements of 6,000 trees.

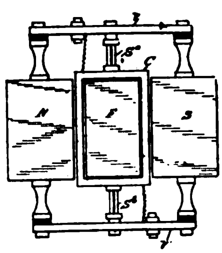
Recent Novel Patents

1,087,892. MEANS FOR RECEIVING ELECTRICAL OSCILLATIONS. Wilhelm Schloemilch and Otto v. Bronk, Berlin, Germany. Filed Mar. 14, 1913. Serial No. 754,287. (Cl. 250—8.)



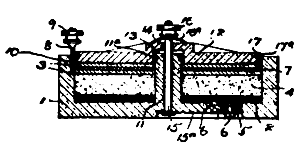
1. In an arrangement for receiving oscillations, the combination with means for receiving high frequency oscillations, of means for intensifying such oscillations, comprising a vacuum tube containing a permanently ionised gas and a circuit for conducting said oscillations through said gas, a second circuit containing a direct current source and the ionised gas, whereby said oscillations are superimposed upon the direct current passing through said gas, causing the generation of an intesified pulsating direct current of the same frequency as the high frequency oscillations, and means for perceiving the said intensified pulsations, comprising a detector placed in coöperative relation with said second circuit and means connected with said detector and responsive to low frequency current impulses only for observing the impulses produced by said detector.

1,088,283. TELEPHONE. Peter L. Jensen and Edwin S. Pridham, Napa, Cal., assignors to Commercial Wireless & Development Co., San Francisco, Cal., a Corporation of Arizona. Filed Mar. 19, 1912. Serial No. 684,718. (Cl. 179—114.)



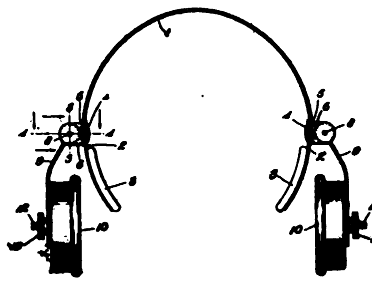
1. A telephone embodying a magnet having an air gap forming a dense magnetic field, a diaphragm, an oscillatory coil forming part of the line circuit connected with the diaphragm and located in the air gap, and a support for said coil formed of thin flat resilient parts arranged in intersecting planes parallel with the axis of oscillation of the coil, whereby the coil is held rigidly against bodily movement, but is free to oscillate by torsional flexure of the support.

1,086,437. DRY-CELL BATTERY. William Broad, Beaver Falls. Pa. Filed Sept. 17, 1912. Serial No. 720,824. (Cl. 204—34.)



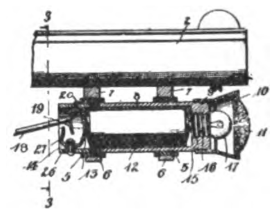
1. A refillable dry cell battery including a receptacle, a movable pressure member therefor, a battery element within said receptacle comprising complementary electrodes and a suitable filling there-between, resilient means for forcing said pressure member against the battery element whereby the electrodes and filling are held together under compression, and means for adjusting this compression to keep it substantially uniform.

1,087,704. HEAD-SUPPORT FOR TELEPHONE-RECEIVERS. Charles Adams-Randall, Boston, Mass. Filed Feb. 19, 1913. Serial No. 749,432. (Cl. 179—156.)



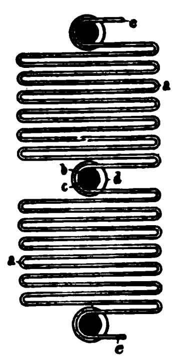
1. In a device of the character described the combination with a head band, supports secured thereto, shafts mounted within said supports, levers mounted upon said shafts, spring washers carried by the said shafts on each side of the levers, movable bearings for said shafts and means for moving said bearings substantially as and for the purpose specified.

1,088,502. SEARCH-LIGHT FOR PISTOLS. Joseph B. Williams, Oakdale, Tenn. Filed Apr. 19, 1913. Serial No. 762,279. (Cl. 42—81.)



In an illuminating attachment for fire-arms, a revolver including an electric circuit, an illuminating lamp arranged in the circuit, a circuit closer arranged in the circuit and including yielding normally-spaced contacts, an actuating rod having sliding connection with the firearm and operatively connected with one of the contacts, and a manipulating portion on the rod and disposed immediately in advance of the trigger of the firm-arm.

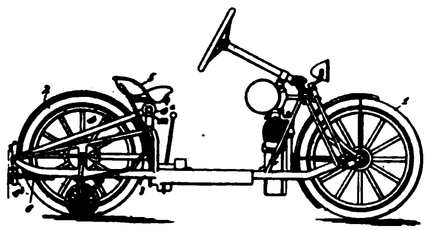
1,088,157. MANUFACTURE OF ELECTRICAL RESISTANCES. Alfred Walter Maley, West Bromwich, England. Filed Oct 8, 1910. Serial No. 586,030. (Cl. 219—69.)



1. A multiple-unit rheostat, comprising a series of units forming a continuous integral-conductor, each unit comprising a grid having terminal loops constituting attaching means and terminal connectors.

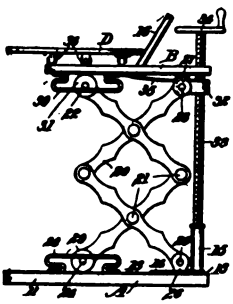
Recent Novel Patents

1,088,028. SEAT-SUPPORT FOR MOTOR-CYCLES. David James Johnston, Toronto, Ontario, Canada, assignor to The Militaire Auto Company Inc., Cleveland, Ohio, a Corporation of Ohio. Filed Jan. 29, 1913. Serial No. 744,853. (Cl. 208—100.)



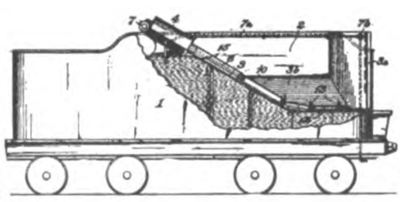
1. A motor-cycle seat support consisting of the combination of a telescopic post, a seat bracket support attached to said post, levers pivoted to the cycle frame and held under spring tension, links attached to the bracket support and connected with said levers, and means for regulating the friction in the lever and link joint, whereby a more or less flexible connection is formed.

1,088,419. CHAIR. Heinrich Heyer, Bremerhaven, Germany. Filed Apr. 16, 1913. Serial No. 761,572. (Cl. 155—41.)



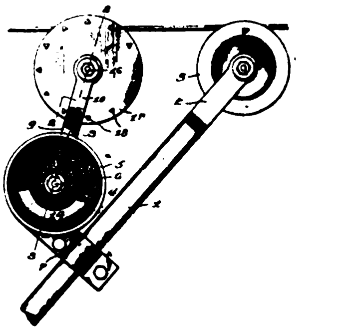
A chair of the character described, comprising a base, a seat, lever frames connected at their lower ends to the base and at their upper ends to the seat, means for operating the lever frames to raise and lower the seat including a screw threaded shaft and an arm having connection with the screw threaded shaft and extending into engagement with the under side of the seat adjacent the forward edge of the latter so as to brace the same and take up slack in the joints of the lever frames.

1,088,418. COAL-PASSER FOR LOCOMOTIVE-TENDERS. Charles L. Heisler, Schenectady, N. Y. Filed July 3, 1913. Serial No. 777,138. (Cl. 105—260.)



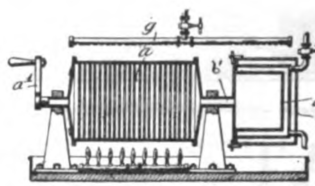
1. In a locomotive tender coal passer, the combination of a fluid pressure operating cylinder adapted for attachment to a tender tank, a piston fitting therein, and a coal passing mechanism comprising a plurality of articulated sections coupled to said piston and adapted to be traversed, by the movements thereof, forwardly and rearwardly over the floor and rear wall of a tender coal bin.

1,086,879. ICE-CLEARING TROLLEY. Charles G. Woods, St. Louis, Mo. Filed May 27, 1912. Serial No. 700,097. (Cl. 19—62.)



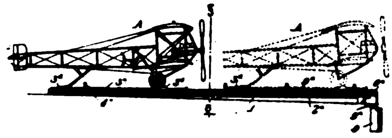
An ice clearing wheel for trolley wires, comprising a journal, a pair of spaced apart disks carried by the journal, there being a plurality of non-circular openings in each disk adjacent its periphery, a plurality of trolley wire engaging elements, non-circular in cross section, held in the openings in the disks, and means for holding the disks against axial movements.

1,088,513. METHOD OF REFRIGERATING LIQUIDS. Leopold Bichler, Innsbruck, Austria-Hungary. Filed Jan. 21, 1911. Serial No. 603,990. (Cl. 62—6.)



An absorption refrigerating process which consists in maintaining a large body of liquid consisting of an aqueous solution of a hygroscopic salt in a closed vessel and a smaller body of the same liquid in another closed communicating vessel, evaporating the greater part of the water from the first body of liquid and driving the steam into the second-named vessel and condensing it by the application of a cooling medium to the outside of such vessel, then applying a cooling medium to the outside of the first named vessel and thus enabling the hygroscopic medium in the first-named vessel to rapidly re-absorb water vapor from the second-named vessel whereby the solution in said second vessel is cooled by reason of the evaporation, and constantly agitating both bodies of liquid during both the distillation and absorption operations.

1,088,511. LEVITATING APPARATUS FOR STARTING AND STOPPING AEROPLANES AND THE LIKE. Emile Bachelet, Mount Vernon, N. Y., assignor of one-half to Miles R. Bracewell, North Adams, Mass. Filed Feb. 15, 1912. Serial No. 677,777. (Cl. 244—2.)



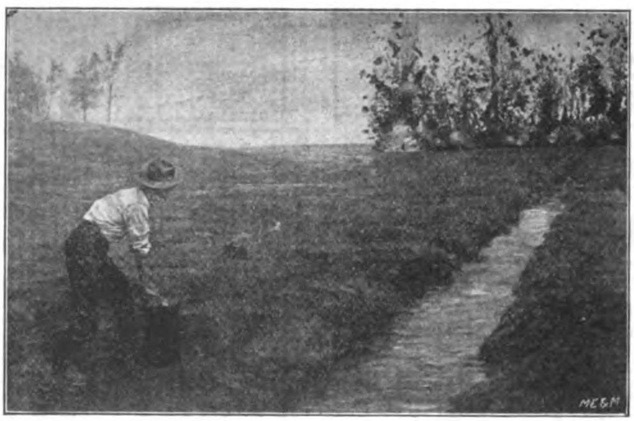
1. In apparatus for starting aeroplanes, means for producing a periodic magnetic field, and means operative in such field for levitating the aeroplane to permit it to start without friction.

Agricultural Blasting

A New Profession which is Offering Attractive and Profitable Employment for Many.

A NEW profession has recently sprung into existence through the extensive advertising of one of the large powder companies. It is agricultural blasting. Dynamite has been extensively used for a number of years for clearing land of stumps and boulders. In very recent years, it has been discovered that it is also an effective and economic agency for the excavation of ditches, in the drainage of swamps, for the planting of trees, the rejuvenation of run-down orchards, the regeneration of partially exhausted soils and the subsoiling of ground underlaid with hardpan and compact soils which render it less productive than it otherwise could be made.

It is astonishing what a demand there is among farmers and fruit growers for the services of agricultural blasters. The powder company which instituted the advertising campaign and awakened an interest in the use of dynamite in agriculture receives, on an average, more than three hundred inquiries per day from farmers asking for enlightenment on this subject. The company has a system of referring these inquiries to independent blasters who offer their services to the farmers interested.



BLASTING DITCHES WITH DYNAMITE

The use of dynamite in agricultural pursuits is very simple and easily learned. Subsoiling and tree planting are the largest fields for exploitation. These two classes of work are so simple that a man can learn to do them in an hour. The question may be asked, "If it is so simple as that, why would a farmer employ a professional to do the work?" Simply because he is afraid to use dynamite himself. There is something in the word itself that inspires terror, yet properly handled it is no more dangerous than gun powder, blasting powder, acetylene gas, gasoline, and many other things which farmers very commonly use but which they do not fear because they have become accustomed to them.

In order to show the ease with which blasting contracts may be obtained from farm owners, we will tell the story of a young man who called at the office of a manufacturer of dynamite recently stating that he would like to take up agricultural blasting as a trade but that he did not feel there was any work to be had in that line in his particular locality. Fields always look greener far from home. This man felt that he would have to go off somewhere a thousand miles or more in order to obtain blasting work. He was told that as much of that kind of work could be developed right in his home community as could be found anywhere else. To test it, he said, "Well, I will take an automobile and go out on a two days' trip, distributing farming with dynamite literature and talking to farmers and will then return and report results."

He found that he would be unable to use an automobile because of bad roads, so he took a horse and wagon. Instead of remaining out two days, he was gone just about six hours. He went less than

eighteen miles from home and the next day returned to the office of the dynamite company all excited and proclaimed that he had secured so much blasting work to do that he was actually compelled to run away from the locality to avoid taking more business than he could handle. In his little trip, he had secured contracts to blast out six acres of stumps, to clear three acres of boulders and to plant three hundred trees.

The few farmers he saw said he was just the man they were looking for to do that work and told him they knew of neighboring farmers who were also looking for someone for the same purpose. He didn't wait to see the neighbors but came back to town to purchase blasting equipment and get help.

Opportunities similar to this exist practically everywhere in the United States. The farmers are looking for the man that can handle their blasting contracts. The work pays well, is not dangerous when instructions are followed, and offers opportunities for the excitement and variety that many a man feels are necessary to his contented existence.

It is astonishing to one unfamiliar with the proposition how many different kinds of work can be done with dynamite. Below will be found a summary of such work:

There are still millions of acres of land in the United States which must be cleared of stumps before they can be farmed. There will be enough of this kind of work to keep blasters busy for the next fifty years at least.

Hundreds of thousands of acres of farm land, especially in New England and in the West, are worked with difficulty because of boulders of various sizes lying upon them. Farmers will clear up these boulders gradually as they can afford it.

There is hardly a section in the United States where ditching work cannot be found. The only reason these ditches are not being dug with dynamite at present is because the property owners do not know of the method or do not know how to do it. Wherever irrigation is practical, miles of ditches are necessary.

It has been estimated by competent authorities that there are seventy-five million acres of swamp land in the United States. Some of it is in every state. Much of this land could be reclaimed by ditching or by subsoil blasting to break up the impervious strata. There are wet spots of varying areas on fully half the farms of the country which could be remedied in the same manner.

There are about five thousand nurseries in the United States selling millions of trees, etc., annually. Soil conditions are such that fully two-thirds of these should be planted with dynamite.

It is impossible to estimate how many millions of fruit and shade trees in this country are not doing as well as they should because of impervious subsoils, but it is certain that there are enough of them to keep an army of several thousand blasters busy for the next twenty years.

Work of blasting post, telephone and telegraph pole holes is obtainable wherever dense soils abound.

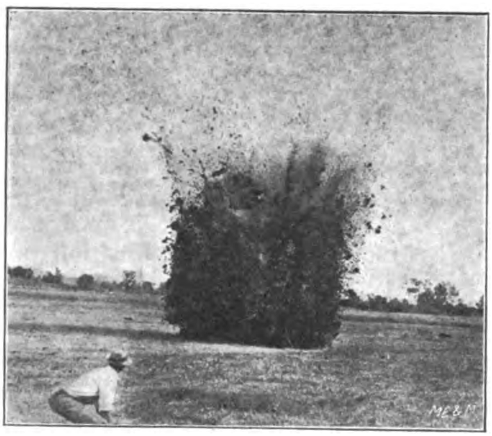
Occasional jobs of splitting logs can be secured by blasters.

Work of blasting wells is obtainable not only when new wells are being put down, but whenever old wells show a tendency to dry up because of drought.

Occasional jobs of blasting ice jams can be obtained every winter.

The blasting of log jams is another occupation, but this work is seldom obtainable and is found only in logging regions.

In localities where hard soils abound, contractors have to employ crews of men to pick the earth before it can be scraped out or loaded on wagons. Cellars are blasted in much the same way as ditches.



SUBSOILING ON A FARM WITH DYNAMITE

What has been said regarding cellars applies to the blasting of trenches, sewers, gutters, etc.

Much time is consumed by crews of men in taking down old brick and stone buildings and concrete walls that could be saved by blasting.

Elimination of mud holes in roads can also be effected. Such mud holes can be found in country roads all over the United States. Road commissioners are the parties to apply to for such jobs.

Much valuable farm land can be reclaimed by straightening the course of rambling streams.

Road contractors need the services of a blaster on almost every road job they undertake. Stumps, boulders, gravel banks and

(*Continued on page* 506)

BOOK REVIEWS

Any book reviewed in these columns may be secured through our Book Department.

Electrical Instruments and Testing

Under the title of "Electrical Instruments and Testing" * a very interesting and comprehensive work has been prepared on the subject of modern measuring and detecting instruments, as well as their manifold uses.

Even a hurried review of the book does not fail to reveal the masterful way in which the author approaches the subject he has chosen and the systematical manner in which each topic is taken up and discussed. The work opens with an instructive introduction on the elements of electrical measuring and testing, rapidly followed by a chapter on galvanometers in which the many types are described as well as their operation. Then follow descriptions of rheostats, keys, shunts, standard cells, voltmeters, ammeters, Wheatstone bridges, portable testing sets, testing with galvanometers, potentiometers, condensers, cable testing, testing with a voltmeter, testing telephone lines, and a chapter containing numerous tables. An appendix prepared by Jesse Hargrave is included in the work, and covers the subject of the testing of telegraph wires and cables, as well as the locating of faults in telegraph and telephone circuits. The appendix has been written by one who is well grounded in the subject discussed, and accordingly represents the latest practice in that branch of electricity.

"Electrical Instruments and Testing" is a book that will be found useful by the student, the electrical engineer and the practical electrician.

* *Electrical Instruments and Testing*, by N. H. Schneider and Jesse Hargrave. Published by Spon & Chamberlain, 123-125 Liberty Street, New York City. Contains 256 pages and 133 illustrations. Cloth bound. Price, $1.00.

Electric Toy Making

Another valuable addition to the rather limited number of works devoted to the construction of electrical apparatus for amateurs is found in the twentieth edition of "Electric Tov Making for Amateurs." *

This work is indeed a most interesting one, for it comprises numerous descriptions of all kinds of electrical experiments and apparatuses that may be readily made with simple tools and materials usually available in the average household. The fact that the present book is the twentieth edition of the same work is an indication of its widespread popularity. One of the striking features that will be immediately noticed is that the illustrations represent the designs of electrical appliances used two or three decades ago. However, rather than detract from the value of the work this feature enhances it, since many of these old-time experiments are appliances that have long been forgotten and are now quite novel to the youthful students in electricity.

"Electrical Toy Making for Amateurs" is a book that will undoubtedly be welcomed by every electrical experimenter, whether he be young or old.

* *Electrical Toy Making for Amateurs*, by T. O'Conor Sloane, A.M., E.M., Ph. D. Published by The Norman W. Henley Publishing Co., 132 Nassau Street, New York City. Contains 210 pages and 77 illustrations. Cloth bound. Price, $1.00.

Electric Bells and Alarms

"Electric Bells and Alarms" * is a very practical little book devoted to bells, fire and burglar alarm systems, and annunciators. Not only are all forms of circuits included in the work, but all component requisites—such as battery cells, bells, push buttons, thermostats, annunciator drops and other parts of bell, burglar and fire alarm, and annunciator circuits—are described at length. The book contains much information on the latest practice in these branches of wiring, and even the well versed electrician will find considerable instruction in this little volume.

* *Electric Bells and Alarms*, by N. H. Schneider. Published by Spon & Chamberlain, 123-125 Liberty Street, New York City. Contains 83 pages and 70 illustrations. Cloth bound. Price, $0.50.

Fire and the Birth of Civilization

A delightful little essay has been written by C. H. Robinson under the title of "Longhead: The Story of the First Fire," * in which an absorbing story is woven about the first fire—caused by a thunderbolt striking a tree—and its discovery by one of our prehistoric ancestors. The work covers at length the mode of living as well as characteristics of the prehistoric man. It narrates, step by step, how the discovery and subsequent application of fire led to civilization; first, by the introduction of weapons whereby man became the master of the wild beasts whom he heretofore feared to face, followed by the advent of cooked food and the companionship of man and woman. Later, these savage men began to associate and co-operate together, thereby accomplishing many tasks that were not possible before. The final stage described by the author is the dawn of invention.

"Longhead: The Story of the First Fire" is a most interesting work, since it deals with a subject that cannot fail to interest everyone. Very little is known of our early ancestors who inhabited the earth long before the birth of history and any additional information relating to them is most valuable.

*-*Longhead: The Story of the First Fire*, by C. H. Robinson. Published by L. C. Page & Co., Boston, Mass. Illustrated with five full-page plates made from drawings by Charles Livingston Bull. Contains 127 pages. Cloth bound. Price, $1.00.

(*Continued from page* 503)

earth are to be removed and blasting is the quickest and easiest solution of the problem.

Occasional jobs of breaking up steel castings can be found.

The terracing of hilly land to prevent washing of topsoil is a practice in many farming communities where the land is rolling and the topsoil loose and easily washed. The terracing is expensive and laborious work. By blasting the subsoil, the land can be put in a condition to absorb most of the water and prevent the washing.

Gophers and burrowing animals are very troublesome to thousands of farmers in the west, but can be driven out by blasting.

Professional blasters usually charge about $5.00 a day for their time and in addition, make a profit on the sale of dynamite and blasting supplies. But little blasting work can be done in northern states in cold weather but in the South, work can be done nearly all the year round. A fairly industrious blaster should average 150 days' employment per year in the North and 250 days per year in the South. In the first instance, his earnings at $5.00 per day would amount to $750, and if he used an average of 50 pounds of dynamite per day and supplies for same, his profit on the goods would be about $1.00 per day, or $150 per year. He should also make 50 cents a day on his helper's time, or $75.00 per year. This would make a total of $975 for the year. He should do at least this much the first year in the North.

On the same daily basis, his net receipts in the South the first year should not be less than $1,600. In the second year, net receipts should be at least twice those of the first year, owing to greater ease in securing the work, better knowledge of costs, and the probable employment of assistant blasters at $2.50 to $3.00 a day, capable of handling jobs independently at a profit to the employing blaster of several dollars a day.

GOT HIS NUMBER

"I'm sorry to tell you, mum, that I'll be leaving you next week. I'm going to get married."

"That so, Emma? Who is the lucky man?"

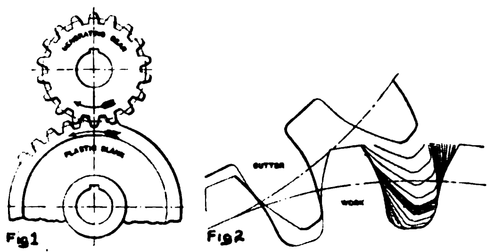
"He's a policeman, mum. On this beat, too."

"That's fine. I wish you joy. And what is his name?"

"I don't know yet, mum; but his number is 518."—*Chicago Ledger.*

CUTTING GEARS WITH GEARS

One of the most interesting operations which the casual visitor to a great automobile or machine shop observes is the cutting of spur gears. This job, which formerly meant the expenditure of considerable time and worry on a milling machine, is now a comparatively simple

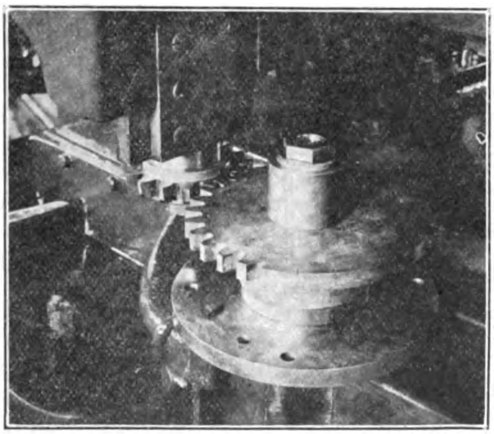


DIAGRAMMATIC REPRESENTATION OF THE GEAR CUTTING SYSTEM

proposition in the modern "generator."

Imagine a metal gear running in contact with a blank made of some plastic material as shown in Figure 1. It is plain that the generating gear will mould teeth in the plastic blank of the proper shape to engage with it.

Now imagine the generating gear to be made of hardened steel and to be reciprocated vertically while both it and a metal blank are rotated at the proper speed. If the edges of the cutter are properly ground and sharpened it is obvious that a perfect gear will be cut.



A GEAR CUTTING MACHINE IN OPERATION

Figure 2 shows some of the positions assumed by the cutter and the blank as they are revolved. A single revolution completes the gear. The principle is identical to that of Figure 1, except that the cutter is given a vertical reciprocating motion.

The photograph shows a gear shaper at work having completed about one-quarter of a revolution. The ram to which the cutter is attached must be built with great strength in order to stand up to the work which it has to do.

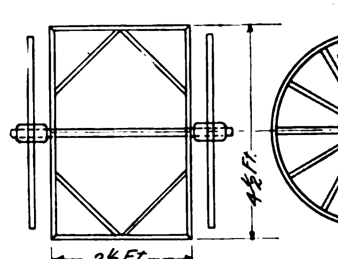
Contributed by

L. J. Lesh.

LADDER TRUCK

The accompanying drawing shows the main details of a home-made truck that will be found very useful for carrying ladders from place to place. This truck can be built at a very small cost, and with only a small amount of labor.

For the truck wheels, get a couple of old buggy wheels that are in a fair state of preservation. The axle is made



WORKING PLANS FOR LADDER TRUCK

from a round stick of hard wood of the right diameter to fit the hubs of the wheels. The wheels can be held in place by driving wire nails through the ends of the axle. The framework that carries the ladders is made from soft pine boards, 4 inches wide and 1 inch thick. The corners are mitered together, and the sides are braced with additional pieces of board, as shown. The side boards have holes drilled in their centers, to fit the axle, and thus allow the frame to pivot on the axle. These holes should form a snug fit for the axle, as otherwise the framework will tip too easily. Wire spike nails should be driven in the top edge of the frame, so that they will catch against the ladder rungs and thus hold the ladder from sliding off the truck when being transposed.

Contributed by

H. M. Nichols.

When You Need Anything Electrical

Save 1/3

LARGE ILLUSTRATED CATALOGUE No. 11G WITH 11,000 BARGAINS SENT FREE. ASK FOR IT.

Independent Electrical Supply Company

H. H. KABAT, President

59 Warren Street New York

NEW HOME STUDY BOOKS

HOUSE WIRING. By Thomas W. Poppe.

This work describes and illustrates the actual installation of Electric Light Wiring, the manner in which the work should be done, and the method of doing it. It is intended for the Electrician, Hepler and Apprentice. It solves all Wiring Problems, and contains nothing that conflicts with the rulings of the National Board of Fire Underwriters. It gives just the information essential to the Successful Wiring of a Building. Among the subjects treated are: Locating the Meter. Panel Boards. Switches. Plug Receptacles. Brackets. Ceiling Fixtures. The Meter Connections. The Feed Wires. The Steel Armored Cable System. The Flexible Steel Conduit System. The Ridig Conduit System. A digest of the National Board of Fire Underwriters' rules relating to metallic wiring systems. Various switching arrangements explained and diagrammed. The easiest method of testing the Three and Four-way circuits explained. The grounding of all metallic wiring systems and the reason for doing so shown and explained. The insulation of the metal parts of lamp fixtures and the reason for the same described and illustrated. 125 pages. Fully illustrated. Flexible cloth. Price........................50 cents

DYNAMO BUILDING FOR AMATEURS, OR HOW TO CONSTRUCT FIFTY-WATT DYNAMO.

By Arthur J. Weed, Member of N. Y. Electrical Society.

A practical treatise showing in detail the construction of a small dynamo or motor, the entire machine work of which can be done on a small foot lathe. Dimensioned working drawings are given for each piece of machine work and each operation is clearly described. This machine, when used as a dynamo, has an output of fifty watts; when used as a motor it will drive a small drill press or lathe. It can be used to drive a sewing machine on any and all ordinary work. The book is illustrated with more than sixty original engravings showing the actual construction of the different parts. Price, paper, 50 cents. Cloth..$1.00

TELEPHONE CONSTRUCTION, INSTALLATION, WIRING, OPERATION AND MAINTENANCE.

By W. H. Radcliffe and H. C. Cushing.

This book gives the principles of construction and operation of both the Bell and Independent instruments; approved methods of installing and wiring them; the means of protecting them from lightning and abnormal currents; their connection together for operation as series or bridging stations; and rules for their inspection and maintenance. Line wiring and the wiring and operation of special telephone systems are also treated.

Intricate mathematics are avoided, and all apparatus, circuits and systems are thoroughly described. The appendix contains definitions of units and terms used in the text. Selected wiring tables, which are very helpful, are also included. 100 pages, 125 illustrations.................................$1.00

Any of the above books sent postpaid on receipt of price.

MODERN PUBLISHING CO., 32 Union Square, NEW YORK

Proposed Aeroplane Flight Around the World.

THE offering of $300,000 in prize money by the Panama-Pacific International Exposition for a 90-day aircraft flight around the world has aroused considerable interest and discussion in aviation circles. Strange to state, although this undertaking is by far more difficult than anything yet attempted in aeronautics, it has been met with great enthusiasm on the part of aviators, most of whom believe the feat possible at present.

The proposed route for this flight lays eastward across the United States, starting from the Exposition Grounds at San Francisco. Arriving at New York City, the direction of flight is northward over land to Labrador and then across the Atlantic Ocean by way of Greenland, Iceland and Scotland. The route then lies through the large continental cities, including Paris, Berlin, Warsaw, St. Petersburg and Moscow, after which comes a long stretch across Siberia following the Trans-Siberian Railroad. The remainder of the flight is across the Bering Strait and thence via Alaska and the Pacific Coast back to the starting point.

The greatest difficulty presented in this flight is the journey across the Atlantic Ocean. This problem has been somewhat simplified by the proposed route via Greenland, Iceland and Scotland, which enables landing points to be made on the first two mentioned islands so as to allow the airmen to rest. Otherwise, a single flight of about 2,500 miles would be necessary without any opportunity for landing. Not only is the crossing of the Atlantic a serious obstacle to overcome, but the flight across Siberia presents many difficulties, since this country is remote from the centers of civilization, making it difficult for airmen to effect repairs and secure necessary supplies and fuel. Again, the distance itself, which will be at least 30,000 miles, presents quite a task. There are few aviation motors and aeroplanes manufactured to-day that could cover this distance without having many repairs. In fact, the life of most engines and aeroplanes is probably not greater than that mileage.

In view of these many obstacles it is surprising to note the optimistic opinion of many leading aviation experts, although there are of course other authorities who do not deem the feat possible at the present stage of aviation. However, the project is indeed a very ambitious one on the part of the promoters and it is to be hoped that 1915 will witness the encircling of the world via aeroplane.

Tuning for Long Wave Lengths.

By T. A. Fite

ALL radio operators are desirous of receiving messages from the Navy land stations or those of the Federal Company that employ the Poulsen system. To do the latter, a ticker must be installed. As this instrument has been fully described in previous issues of this magazine, no attempt to describe it again will be made.

The average receiving transformer, tight or loose coupled, does not contain enough inductance to tune stations using a wave-length above 1,500 meters. To remedy this, some methods are presented below which the experimenter may try out if he desires.

By the first method, a loading inductance is placed in series with the antenna circuit, and still better, another can be connected in series with the secondary or detector circuit. If these coils are placed so that they are mutually inductive, a large increase in efficiency will be noticed. It can be easily seen that the energy, which is induced from the antenna circuit to the detector circuit, would be totally lost otherwise. An ordinary tuner or loose coupler can be used to advantage if connected as shown in Figs. 1 and 2. The latter will be found to be the best, as the degree of coupling can easily be changed.

The author has also employed capacity instead of inductance to increase the

An Old Man at Fifty —A Young Man at Seventy

The Remarkable Story of Sanford Bennett, a San Francisco Business Man, Who Has Solved the Problem of Perpetual Youth

By C. E. PAGE, M. D.

Author of "Natural Cure for Consumption," "How to Feed the Baby," etc.

THERE is no longer any occasion to go hunting for the Spring of Eternal Youth. What Ponce de Leon failed to discover in his world famous mission, ages ago, has been brought to light right here in staid, prosaic America, by Sanford Bennett, a San Francisco business man. He can prove it too, right in his own person.

At 50 he was partially bald. To-day he has a thick head of hair, although it is white. At 50 his eyes were weak. To-day they are as strong as when he was a child. At 50 he was a worn-out, broken-down old man. To-day he is in perfect health, a good deal of an athlete and as young as the average man of 35.

Sanford Bennett at 50

Sanford Bennett at 72

All this he has accomplished by some very simple and gentle exercises which he practises for about ten minutes before arising in the morning. Yes, the exercises are taken in bed, peculiar as this may seem.

As Mr. Bennett explains, his case was not one of preserving good health, but one of rejuvenating a weak middle-aged body into a robust old one, and he says what he has accomplished, anyone can accomplish by the application of the same methods, and so it would seem. All of which puts the Dr. Osler theory to shame.

I haven't room in this article to go into a lengthy description of Mr. Bennett's methods for the restoration of youth and the prevention of old age. All of this he tells himself in a book which he has written, entitled "Old Age—Its Cause and Prevention." This book is a complete history of himself and his experiences, and contains complete instructions for those who wish to put his health and youth-building methods to their own use. It is a wonderful book. It is a book that every man and woman who is desirous of remaining young after passing the fiftieth, sixtieth, seventieth, and as Mr. Bennett firmly believes, the one hundredth milestone of life, should read.

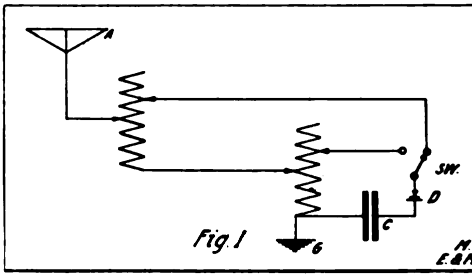
For the purpose of spreading broadcast the methods of promoting health and longevity developed by Mr. Bennett an interesting eight-page booklet which is, in effect, a summary of his system, has been prepared by the publishers of Mr. Bennett's interesting book—the Physical Culture Publishing Company, 2904 Flatiron Building, New York City.

This booklet they will send free to anyone sufficiently interested to write for it.

The grandest thing in the world is Youth, and it is one of the really great hardships of life that "its beauteous morn" should pass so swiftly and give place to old age.

For having solved the problem of prolonging youth during life, the world owes Sanford Bennett a vote of thanks. Of course there are those who will scoff at the idea, but the real wise men and women among those who hear of Sanford Bennett and his return to youth, will most certainly investigate further, and at least acquire a knowledge of his methods.

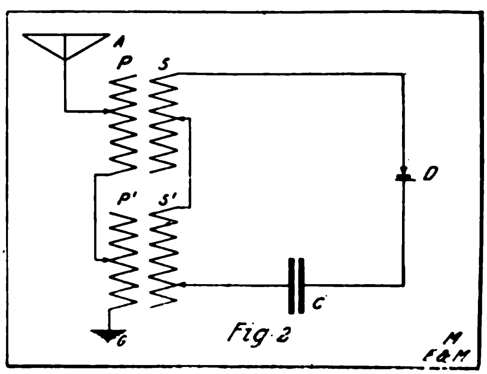
wave length. This method cannot be used to advantage on a tuning coil, but shows excellent results when using a receiving transformer. When a variable condenser of large capacity was shunted



across the antenna and ground connections, the wave length of the circuit was increased to 2,200 meters when an antenna having a natural period of 480 meters was used. A remarkable increase in signals was noted when another variable condenser was bridged across the secondary windings, but at no time was it so efficient as the connections shown in Figs. 1 and 2.

It was noted that when a small Murdock tuner was used, the antenna circuit could be tuned to 3,200 meters without additional inductance and capacity. The secondary circuit could be tuned to 1,750 meters.

As an experiment, a variable condenser was shunted across the secondary or detector circuit and was tuned with a wave meter to 2,200 meters; likewise the primary or antenna circuit. While a Navy station using the above wave-



length was sending a message, the variable condenser was removed and the full inductance of the tuner used in the secondary. A trifle more inductance was also used in the primary to make up for the removed condenser. The signals

were strengthened very perceptibly, but it will be noted that 2,200 meters wavelength was used in the antenna, and 1,750 meters in the detector circuit.

The best results were attained when one end of the Murdock tuner—any like tuner would do—was removed and a secondary with eight taps and wound with No. 32 S. S. C. wire was inserted. The taps were connected to two eight-point switches, as in Fig. 3. The coupling can be easily varied with these switches without necessitating the moving of this coil. A variable condenser was connected across the secondary winding. This gave a range of 3,200 meters with the above mentioned antenna. This was found to be ample for all purposes.

With this latter arrangement, a Navy station, 2,800 miles distant, could be

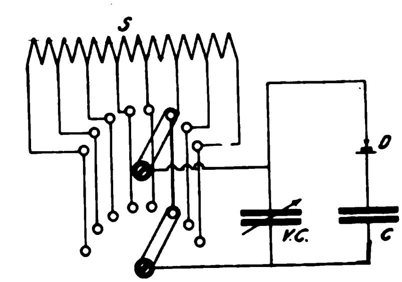


Fig 3

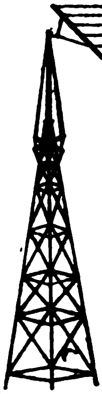
heard quite early in the evening. If the experimenter so desires, the condenser readings can be calibrated when using different taps on the secondary; the result being an efficient wave-meter. Distant stations, as well as one's own, can be tuned quite accurately with this instrument. The antenna and ground should be disconnected when tuning one's own station, but for other stations they should be left connected. Use as few turns as possible in the primary circuit.

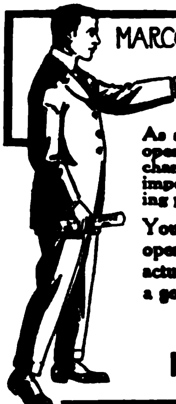
RENEWING WORN-OUT DRY CELLS

Worn-out dry cells can be renewed to almost their full strength by following the directions given below:

The materials required are four or more fruit jars or glass bottles, ten cents' worth of paraffin, ten cents' worth of rosin, and a little wood alcohol.

(*Continued on page 517*)





MARCONI OPERATORS SEE THE WORLD

See The World and Get Paid For Doing It

As a Marconi wireless operator you will have a chance to visit all the important and interesting places in South America, in Europe and elsewhere

You can readily train yourself to become a wireless operator at our school. Working every day with actual Marconi instruments, the course is fascinating and as soon as you have finished and obtained a government license we assure you of a good position.

Join the next class—beginning now. Write at once for full information and rates. Don't delay.

MARCONI WIRELESS TELEGRAPH SCHOOL OF INSTRUCTION, 1120 PROSPECT AVE. CLEVELAND, OHIO.

LEARN TELEGRAPHY

Morse or Wireless. Also superior station agency course. Splendid opportunities. Demand greater than supply. Graduates assisted. We own and exclusively occupy two large modern buildings equipped with R. R. and Western Union Wires and complete $3,000 Marconi Wireless Station. Oldest and largest school—est. 39 years. Investment $25,000. Endorsed by Railroad, Wireless and Western Union Officials. Expert practical teachers. Living expenses may be earned. Tuition low Easy payments. Catalogs Free.

Dodge's Telegraph Railway & Wireless Institute
7th Street Valparaiso, Ind.

LEARN TELEGRAPHY FREE

We teach you by mail, Wireless, Commercial and Railroad Telegraphy. Our course costs you nothing.
Write to-day for free booklet containing full details.

BROOKLYN TELEGRAPH SCHOOL
W. U. Telegraph B'ld'g. 313 Fulton St., Brooklyn, N. Y
Largest Telegraph School in the U. S.

THE BEST *EVENING* COURSE IN WIRELESS IN NEW YORK

If you live nearby and wish to hold your present position, while studying at night. Complete equipment—twelve instructors.

Prepare for a government license—under a Marconi Engineer
Day Courses in Operating and Construction
Evening Courses in Engineering, Operating, and Drafting
Spanish for Operators
New class in Engineering starts soon.

Y. M. C. A. TELEGRAPH SCHOOL, 148 East 86th St., New York

Learn Wireless, Railroad, and commercial telegraphy; classes day and evening; latest wireless apparatus used; pupils receive wireless messages from ships and stations many miles away. Write or call for descriptive matter, terms and bulletin giving positions held by our graduates.

The PAINE Uptown BUSINESS SCHOOL
Box A" 1931 Broadway, near 65th St., New York City

WIRELESS MANUAL AND CATALOG C OF ELECTRICAL SUPPLIES AND NOVELTIES **FREE**
DAVID KILLOCH CO. Dept. C 57 Murray St., N. Y.

TUNERS - - TUNERS

GET ONE WHILE THE GETTING IS GOOD

Bare wire wound—finely finished—a new and perfect slider on each instrument—short circuiting of turns impossible—the best tuner ever offered at exceptionally low prices.

A stamp brings you our leaflet illustrating these tuners and other good things in the wireless line.

THE WIRELESS MFG. CO., CANTON, OHIO

NEWARK ELECTRICAL SUPPLY CO.

We sell *EVERYTHING ELECTRICAL*

Our Wireless Manual and Electrical Material Catalog GRATIS
Write for it

281 MARKET ST. NEWARK, N. J.

If You Will Take Advantage of This Right Away

In addition to sending GAS ENERGY, which is the liveliest and newsiest for those interested in gas engines, for one year, we will send you free a copy of "How to Run and Install Gasoline Engines." GAS ENERGY covers the Stationary, Portable, Automobile, Marine, Aeronautic, and Producer fields in a way that no other paper does. Just send 50c. in postage or currency and we will enter your subscription for a year and mail you gratis copy of the above mentioned book.

GAS ENERGY CO., 22 Murray St., NEW YORK CITY

(*Continued from page* 514)

The first thing to do is to prepare the jars—quart fruit jars are the best for this purpose, but bottles will serve in the absence of the former. Since the jars and bottles have necks that are too small to permit of inserting the dry cells, it is necessary to cut them off. This is easily accomplished by following the various instructions that have been published from time to time in MODERN ELECTRICS AND MECHANICS. A simple procedure is to wrap a string several times around the portion of the bottle that is to be broken off and soak it with wood alcohol. The string is then ignited, and after it has been almost entirely consumed, the bottle is plunged into cold water. The bottle will be broken off at the point where the string was tied.

The next step is to slip off the covering from the dry cells and bore a number of holes in the zinc covering. If the holes are carefully punched, the results will be equally satisfactory, but it is essential that the zinc should not be driven into the holes so as to short circuit the inner sections of the cell. The holes should not be spaced more than ½ inch apart, and not too close to the top of the cell. A solution of sal-ammoniac is then prepared; special care being taken to break up the sal-ammoniac so that it will be thoroughly dissolved. A dry cell is then placed in a jar and melted rosin poured around it so that the cell will be firmly held to the bottom of the jar. The sal-ammoniac solution is then poured into the jar until it is within 1 inch of the top. The cell will at once begin to absorb the solution through the holes. It should be left soaking in the solution for at least 24 hours, and if the solution is then considerably absorbed, pour in enough more to fill it up to within 1 inch of the top. The final work consists of pouring melted paraffin on top of solution so as to form a solid coating which prevents the solution from being accidently spilled. This also enables the cells to be handled more readily.

At an expenditure of 35 cents for material, it is possible to renew eight dry cells. This method is quite economical and will be found very useful by experimenters using dry cells.

Contributed by

Harold Rice.

Wireless Telegraph Contest

The Wireless Station and Laboratory contest is a regular monthly feature. The best photograph submitted each month is awarded a first prize of Three Dollars; second best, Two Dollars; third best, One Dollar.

The description of a station should not exceed 250 words. Write on one side of the paper only, using as many separate sheets as are necessary. Descriptions should be written in ink—not pencil. Typewritten descriptions using double spacing are preferable to any. It is advisable to send two prints of the photograph whenever possible—one toned dark and the other light—in order to permit of choosing the one best adapted for reproduction. Prints should be sharp and distinct.

This competition is open to all, irrespective of whether they are subscribers or not.

FIRST PRIZE

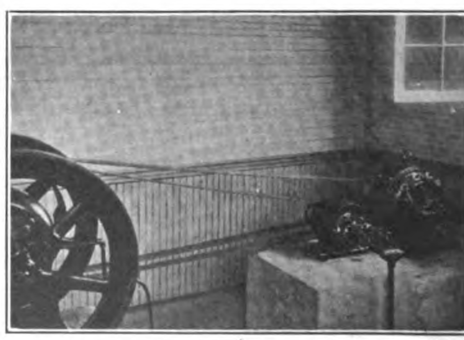
The following is a description of my wireless station used at the St. Charles College, Grand Coteau, La. The two

STATION BUILDING, POWER HOUSE AND BASE OF TOWER

neat looking buildings are the sending and receiving station, and the power house. The tower in the background is 115 feet high and supports the aerial on one side, while the other side is supported by an iron pole 40 feet above the main college building, making a total height of 125 feet. The aerial has a stretch of 250 feet and comprises four phosphor-bronze wires spaced 32 inches apart. Its natural wave length is between 480 and 515 meters. This, of course, is far above the amateur's allowance but this station is of the class known as "Special Amateur," so that I am only restricted to the 600 meter limit.

The power house contains a 2 kw. alternating current dynamo with a direct current ½ kw. exciter. The switchboard, which is not visible in the illustration, is provided with a Weston ammeter and voltmeter, as well as two rheostats that control the fields of both dynamos, together with three switches so arranged that the combination of any two will deliver A. C. or D. C. as desired. Each dynamo is belted to the same pulley of a 5½ horsepower gasoline engine for the purpose of throwing off the belt of the alternator when the direct current is only needed for scientific experiments.

The receiving set was bought from the Murdock firm and forms quite an effi-

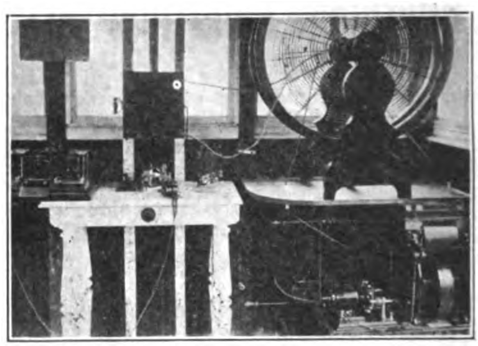


GASOLINE ENGINE, ALTERNATOR AND EXCITER

cient unit. It consists of a tuning transformer, variable condenser of the slide type, placed in series with the primary of the tuning transformer, and another variable condenser employed in connection with the secondary. A silicon de-

tector is used. The telephone receivers of 2,000 ohms complete the receiving set. I have received with this set for a period of three years with perfect satisfaction. Lately, I have added a loading coil and with it I find it quite easy to get stations of from 2,000 to 4,000 meters wave-length. I am somewhat skeptical as to the achievements of some of our amateurs with their home-made sets, covering, as they claim, thousands of miles—or imagining that they do. The best I can do under ordinary circumstances is to read NAR which is 720 miles distant.

The sending unit consists of a 2 kw. 110 volt A. C. generator, delivering 18 amperes into a Thordarson 2½ kw. transformer, especially made for my set. It steps up the voltage to 20,000 volts.



VIEW OF THE SENDING AND RECEIVING INSTRUMENTS

The current is broken by a Murdock rotary gap. The condenser is of the salt water type and is located in back of transformer. It consists of 36 quart bottles, adjustable in sets of three by means of sliding rods. A transformer of my own design is seen above the table. A six pole switch connects the secondary to the aerial, while the main current is broken by a 30-ampere Clapp-Eastham key. A kick-back preventer is used. It consists of three graphite resistance rods and two fuses. On the marble table can be seen a Murdock wave-meter combination. In actual operation the sending outfit registers a wave of 551 meters, but the oscillation transformer can bring this up to 600 by connecting to points marked on the copper strips.

This 2-kw. set is principally intended to establish communication between St. Charles College and the Seismological

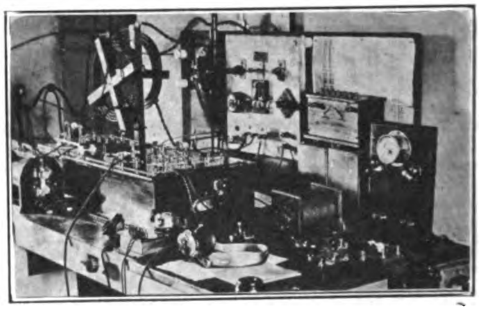
station at Loyola University, New Orleans, La.

Actual tests of the efficiency are going on now between the naval station at New Orleans (NAT). Although the writer has communicated with Galveston, (WGV), 275 miles away, he is not prepared to state the maximum possible range with the set.—*P. J. Philippe, S. J., St. Charles College, Grand Coteau, La.*

SECOND PRIZE

The accompanying view shows my experimental "radio" instruments, all of which are of my own construction with the exception of the spark-coil, 'phones, and primary switch.

The transmitter (at the far end of the table) consists of a 1-inch coil, condenser in oil, zinc gap and spiral coupling coils. The ebonite switch, to the left of the switchboard, throws into service a high



WIRELESS STATION OF RAYMOND EVANS

note buzzer, which is very handy for short distance work. The marble switchboard contains the change-over switch, aerial tuning lamp and the earthplate.

For receiving I use a box tuner which contains four variable inductances, 15 fixed condenser units and a variable rotary plate condenser; in conjunction with iron pyrites or galena and a pair of 1,000 ohm 'phones connected in series.

With the above set I get all the Commonwealth and New Zealand stations besides many others. I occasionally hear Macquarie Island (MQI). This is a low power station and is about 1,300 miles distant. I also hear MAL, which is Mawson's Base in Adelieland.

My sending range is up to about 20 miles. It might be of interest to the readers to know that the wireless amateur in Australia is very much in evidence. In Sydney alone, there are close on a hundred. All of these are licensed

The Grant Receiver

Has no equal for long distance work. Durable, sensitive and scientifically correct.

Head Band weighs only *3 ounces.* Connects to receiver by special non-conducting flexible tubing. Perfect insulation; no shocks to operator.

Magnets can be adjusted very close to diaphragm, insuring least magnetic leakage.

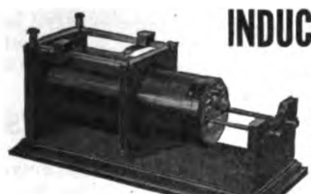
Buy No other Receiver until you get our booklet A, fully describing the "Grant."

Price, Complete Set as illustrated herewith $9.00

We make a full line of Wireless instruments. Description mailed on request.

The Grant Electric Co.
813 Prospect Ave.
Cleveland - - Ohio

INDUCTIVE TUNER



Want to do long-distance Receiving?

Why not begin right? Get one of our Prof. Type Tuners 7 x 7 x 15 in., has double slide, 8-point Switch wound with Enameled Wire, Price $7.00; a pair of our Superior Receivers, 2,000 ohms; have no equal, Price $5.25; a fixed Condenser, just the right capacity, price 80c, without case 40c; and an Audion Detector, nothing so good, will not jar out, price $15.00; storage battery for same, price $5.00. With the above list of instruments you will get results you never even looked for. Or, with the Tuner, Superior Receivers and Fixed Condenser, use any Mineral Detector, and the results will surprise you. Send 5c. in stamps for Illustrated Catalogue. None otherwise.

F. B. CHAMBERS & CO., 2046 Arch St., Philadelphia, Pa.

New High Grade Wireless Apparatus

Boston Variable Condenser, 25 Plates..........$3.75
" Mineral Detectors, composition base.... 1.75
" Combination Mineral Detector, white marble base 4.00
" Double Slide Tuner.................... 2.50
" Helix, fine finish...................... 3.50
" Junior Condenser, 50c; Large Condenser 1.00
" Small Spark Gap, 60c; Air-Cooled Gap. 1.00

Your money back on these goods if not satisfied.

Also Boston Agent for Elec. Imp. Co.

Manhattan Spark Coils   Electric Supplies and Flashlights

M. MUELLER
18 Devonshire Street, Boston

Noiseless Sliding Adjustment
Price $2.00

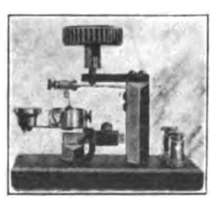
IMPERIAL DETECTOR

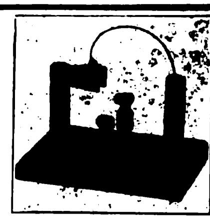
The best detector made for amateur use. Is mounted on a polished fibre base. Has the most sensitive adjustment of any detector made.

SUPPLIES

Buy the raw material and make your own instruments.
Send for Catalogue K 4.

Imperial Electric & Mfg. Co.
6855 So. Halsted St. CHICAGO, ILL.





Our DETECTORS are Guaranteed to give Full Satisfaction or Money Refunded

A1 Pacific Type, Yellow Lacquer, - - $4.00
A1 Pacific Type, Nickel Plate, - - - 4.50
C1 Catwhisker Type, Yellow Lacquer, 1.25
C1 Catwhisker Type, Nickel Plate, - 1.50
SEND FOR CIRCULARS

THE LINDELL ELECTRIC SHOP 1807 Boren Avenue Seattle, Wash.

by the Commonwealth Government and are allowed wavelengths up to 250 meters.

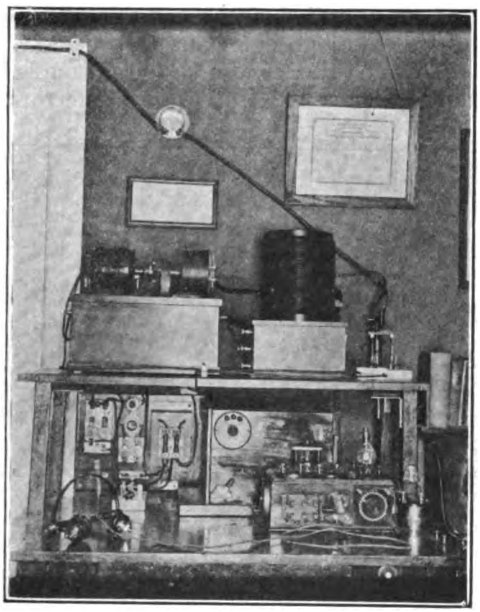
I obtain many useful hints from MODERN ELECTRICS AND MECHANICS and I never miss a copy.—*Raymond Evans, Sydney, N. S. W., Australia.*

— —

THIRD PRIZE

In the accompanying illustration are shown the instruments used in my station.

The transmitting end consists of a Clapp-Eastham rotary quenched spark set and, with the exception of the key, is all mounted on the upper section of the



WIRELESS STATION OF WM. H. ALLISON

table. The key is mounted on the left-hand side of the table near the switches and the protective condenser, making the A. C. wiring very compact and keeping it away from the receiving apparatus at the right.

The receiving set, which is contained in the small case, consists of a Blitzen receiving transformer, three rotary variable condensers, three fixed condensers, galena and audion detectors, a switch for connecting to either detector, and Pickard adjustable-magnet type receivers. The large case in the rear contains a loading coil as well as flashlight batteries for the audion.

My aerial is of the inverted "L" type and is 60 feet high and 60 feet long. It is composed of four wires spaced three feet apart.

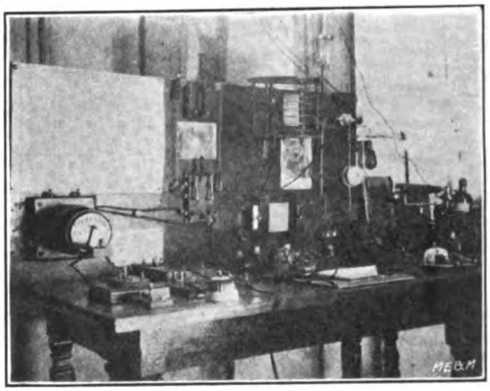
All wiring in both receiving and sending circuits is done with stranded wire of a suitable gauge.—*Wm. H. Allison, Worcester, Mass.*

HONORABLE MENTION

A photo of my wireless station is herewith submitted for entry in your wireless contest.

The transmitting instruments consist of a 1½-inch spark coil, helix wound with No. 10 copper wire; glass plate condenser, zinc spark gap, heavy key, and all necessary switches. The power used is supplied from two 6-volt 60-ampere-hour storage batteries.

For receiving I use a loose coupled tuner, silicon and iron pyrite detectors,



WIRELESS STATION OF F. W. BURGESS

two fixed condensers, and a 3,500-ohm headphone. The D. P. D. T. switch mounted on the board at the back of table is employed as a change-over. I also have a buzzer for testing the detectors.

My aerial is composed of two No. 14 copper wires, 150 feet long, on 12-foot spreaders, and is suspended between masts 55 feet high.

I have had excellent results from this set, having heard two New Zealand stations, both over 1,000 miles distant, as well as many others in Australia, and on board steamers. Nearly all of the above instruments are home made. Call letters, XDA.—*F. W. Burgess, Wagga Wagga, N. S. W., Australia.*

Questions and Answers

Questions and queries pertaining to electrical and mechanical subjects and of general interest to all readers, will be answered in this department. Name and full address of the sender should accompany all inquiries. Questions that are not deemed by the editor to be of general interest, will not be published and no answers will be given by mail.

DYNAMO.

(37) H. H., Monticello, Minn., writes:

Q. 1.—He has a 5 kw., 115-125 volt, 33 ampere direct current dynamo that is used for operating a moving picture arc lamp and some incandescent lamps. In spite of being driven at full speed the machine does not seem to be capable of carrying its expected load. How many 20-watt tungsten lamps should it light?

A. 1.—Five kilowatts at 125 volts means a current of 40 amperes, so if you have difficulty in getting 33 amperes, the machine is certainly not up to its rating. Unless the field magnets at present do not overheat, we would advise you to increase the speed. Perhaps the machine has a compound field magnet winding, but for some purpose, as for safety in storage battery charging, the series coils have been intentionally short-circuited. If so, remove the "jumper." If armature does not seriously heat, you may safely demand more current. We do not know how many amperes the arc lamp requires, but with the full 5000 watts available, the machine should operate 250 of the incandescent lamps.

Q. 2.—What is a good book to follow for wiring one's own house?

A. 2.—See the book entitled "House Wiring" by Poppe, advertised in this magazine.

AERIAL.

(38) J. W. H., New York, asks:

Q. 1.—I understand that the distance between wires in an aerial should not be less than one-fiftieth of their length in order to get the best results. Is this correct?

A. 1.—In order to get the separate effect of each wire the distance between wires should be as large as convenient, but in any case should not be less than one-fiftieth of the length of the span.

Q. 2.—If an aerial is constructed with three wires each fifteen feet long and the wires connected together at the end where the lead in is connected, will the wave-length be greater or less than one in which the wires are connected in series? That is, the open end of the antenna would come on the same spreader as the lead in. Would the wave-length of either of these be greater or less than a single wire forty-five feet long?

A. 2.—The single wire would have the greatest wave-length and the one where all of the wires are connected together at the end of the lead in would have the least wave-length.

BELT.

(39) J. K., New York City, asks:

Q. 1.—Why does a belt run off the pulley when the load is applied?

A. 1.—Apparently the pulley has a straight instead of a crowned face. Try a straight-edge on it to ascertain the truth. If it is crowned, perhaps the angles are not equal.

Q. 2.—What is the purpose of "Commutating poles" in direct current dynamos?

A. 2.—When current flows around the armature, the iron core is magnetized in a direction cross-wise to the regular field. This distorts the path of the lines of force, resulting in sparking at the brushes. By putting on these auxiliary poles, and energizing them by connecting their windings in series with the armature, a counter or corrective magnetism is set up.

Q. 3.—Is braking of printing press and elevator motors effected by short circuiting the armature through a resistance?

A. 3.—Yes, for this method can produce a much more gradual retardation than the mechanical friction type.

SERIES CONDENSER.

(40) H. T. Van Patten, Washington, asks:

Q. 1.—In the August issue of the *Electrician and Mechanic*, in the answer to question 2085 it is stated that a series condenser will not reduce the wave-length of the antenna. From the articles that have appeared from time to time I have always understood that a series condenser would reduce the wave-length. It certainly would appear so from the consideration of the formula for two condensers in series. Was this an error?

A. 1.—The question you quote does not say that the wave-length cannot be reduced by the addition of a series condenser. In this particular case it was preferable to change the antenna rather than put in a condenser to bring down the wave-length. A long antenna with a series condenser will not radiate effectively when it is necessary to make large changes in the wave-length. You are correct in the statement of the formula. Two condensers in series will have a smaller capacity than either alone.

Q. 2.—Is a tikker detector more sensitive than the perikon or electrolytic detectors?

A. 2.—It has been generally considered that the perikon was the most sensitive of the three named, but very long distance work has been done with a tikker detector which would indicate that it is very sensitive. Its method of operation is entirely different from the perikon.

Q. 3.—Would the gas furnace described in the July, 1913, *Electrician and Mechanic* produce heat enough to weld iron?

A. 3.—Only in small pieces.

BELL RINGING TRANSFORMER.

(41) G. M., La Salle, Ill., writes:

Q. 1.—In a high school building ten bells are commonly operated in series from batteries, and asks if they can be successfully run by use of a transformer on the regular lighting circuit.

A. 1.—Bell ringing transformers are now largely sold by electric lighting companies, and you will receive reliable information by inquiry of your local office. Of course, to show an economy over the use of primary batteries, they must be made with reference to well-known principles of design. One manufacturer is the Packard Electric Company of Warren, Ohio.

Q. 2.—In the ordinary formula for the numerical value for "L," the coefficient of self-induction, are the dimensions to be taken in metric units and what is the value of the permeability?

A. 2.—If no iron is used, the formula does not involve the permeability factor, for with air the value is unity. All you have to do is to measure the coil in centimeters, but the formula is true only for coils that are long as compared with their diameter. For iron cores and closed magnet circuits, the permeability may be taken as 1000, and only such a number of ampere turns employed as will keep the iron within this limit.

TYPE OF AERIAL.

(42) John K. Parker, Texas, asks:

Q. 1.—Which type of aerial is preferable, the horizontal or vertical, for amateur use?

A. 1.—If transmitting and receiving are both to be done the vertical will give the best results. This is because it has the shorter wave-length.

Q. 2—Will galvanized iron wire give satisfaction?

A. 2.—So long as it is well galvanized it will be satisfactory, but it is best to avoid the use of iron antenna wires.

Q. 3.—Which is the best for aerial construction, copper, aluminum, or phosphor bronze?

A. 3.—The phosphor bronze is the best because of its high tensile strength. For amateur use, copper is entirely satisfactory.

BERLIN CONVENTION.

(43) J. R. Tolmie, Washington, asks:

Q. 1.—Does the Marconi company still sell apparatus? If so, where can I purchase this apparatus?

A. 1.—The Marconi Company of America usually has apparatus which it sells. Write to them at their New York office.

If You Are Looking for Reliable and Well Made Apparatus or Parts

GET OUR CATALOGUE

It is the most complete up to date edition of its kind published. Here are some of the reasons why YOU should buy our apparatus.

Practically everything we use except raw materials is made in our own up-to-date plant.

We use only the best materials designs and workmanship. Every instrument is fully tested separately.

We fully guarantee each instrument for an UNLIMITED time.

Watch This Space Every Month for Something New

TRANSFORMERS

Highest efficiency closed core type. High silicon steel core and best copper windings. Primary layer wound. Secondary section wound and impregnated by special process. Empire cloth insulation throughout. Genuine mahogany cabinet. 5 variations of power ½ to 1 k.w.

PRICE $25.00
Shipping Weight 50 Lbs.

HEAD BANDS

Will never rust because they are made of genuine German silver throughout.

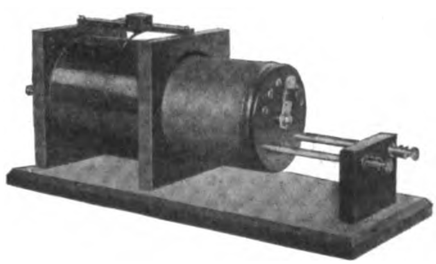
REGULAR PRICE EACH $1.50

Special This Month Only $1.00 Each
Postage 10c.

PROTECTIVE DEVICE

Do you have trouble from Kick-Backs? This protective device absolutely stops it all. Very effective and can be installed in 5 minutes. Order one now Shipping weight 1 lb. Price $2.50.

LOOSE COUPLED TUNER



Loose coupled tuner—$6.00. Enameled wire primary. Silk wire Secondary with 6 tap switch on end Woodwork dark mahogany. Metal work polished brass. Shipping weight 4 lbs.

We manufacture a complete line of sending and receiving apparatus and parts.
Live Dealers Write for Good Agency Proposition.
Did you send 10c. for our New Large Illustrated Catalogue?
The printers have it nearly finished. Ready for mailing about Feb. 15.
The 10c. will be credited on your first order for 25c. or over.

EDGCOMB-PYLE WIRELESS MANUFACTURING CO.

6029-6031 KIRKWOOD ST. **PITTSBURGH, PA.**

Q. 2.—In what book can I find a treatise on the valve or audion detector?

A. 2.—Consult Fleming's "Principles of Electric Wave Telegraphy and Telephony." Prof. G. W. Pierce's book also has something on the subject.

Q. 3.—Where can I procure a copy of the Berlin Convention?

A. 3.—If they are not all distributed you can get a copy from the Commissioner of Navigation, Dept. of Commerce, Washington, D. C. This is not the governing international treaty now. It has been replaced by the London Convention. You can obtain a copy of this new convention either from your local Radio Inspector or from the Commissioner of Navigation.

DYNAMO.

(44) L. S., Honesdale, Pa.:

Q. 1.—Has a 1-h.p., 500 volt Western Electric motor which he wishes to rewind for use as a 50-volt generator. Armature is $4\frac{1}{2}$ inches long, 4 inches in diameter and has 33 slots, with an available winding space in each of $\frac{1}{8}$" x $\frac{1}{2}$". Commutator has 66 segments. Field magnet is of iron-clad form, with two poles cast into a backing 10 inches wide and $\frac{3}{4}$ inches thick. He asks what scheme should be used for winding armature, and will No. 21 wire answer for shunt field.

A. 1.—About 4 lbs. of No. 15 d.c.c wire will be required for armature, and you will have to wind two coils per slot. Put four turns in slots 1 and 17, passing two wires on each side of shaft. Twist out a loop, wind four more turns in the same slots, and twist out a second loop. In order to prevent mistakes in the order of these and succeeding loops, it will be well to mark them, say by putting white shellac on the first and black on the second. Continue the winding in slots 2 and 18, getting two more loops, and so on, until 65 such loops are obtained, when by twisting the very end to the beginning, a 66th is obtained These loops are to be soldered into the 66 commutator segments, such a "lead" being given to their reach as will permit the brushes to come in the desired position. For field winding, the No. 21 wire now on hand will suffice. Wind just as much as possible in each coil, and for determining the best conditions of operation, you can try the two coils first in series, then in parallel, with each other. Six or seven pounds per coil should be the minimum, but with such a small quantity they should be operated in series only for 50 volts, but if you couple them in parallel and reduce the speed, you can operate at 25 volts.

GEISSLER TUBES.

(45) H. E. Beuket, Missouri, asks:

Q. 1.—Please advise me the name of the gases used in a geissler tube to cause a glow which conducts current readily and which gives a red or violet color.

A. 1.—Nitrogen gives a pinkish color, while hydrogen gives a reddish purple color. What you probably desire is the spectacular geissler tube which usually contains a mercury vapor and some such substance as potassium to give it the color.

TRANSFORMER.

(46) S. A. F., Norwood, Mass.:

Q. 1.—Sends a diagram showing the primaries of two transformers connected to three-phase supply mains, and asks if such an arrangement constitutes a balanced load? Previously a 30-kw. load was connected to only two of the mains, and admittedly unbalanced the system.

A. 1.—The connections you show are commonly known as the "V," or open delta method. It is largely used, as it calls for but two transformers, and these can be suspended on a single pole, whereas the closed delta would require three transformers, and would ordinarily demand double poles. In some cases the V connections are used in sizes of transformers amounting to 100 kw. The transformers cannot then be loaded beyond about 85 per cent. of their full rating, but even then some station managers figure that two at such a reduced rating cost less than three smaller ones at full rating. The open delta really gives nearly balanced conditions.

DYNAMO.

(47) S. G., Trinidad, Colo.:

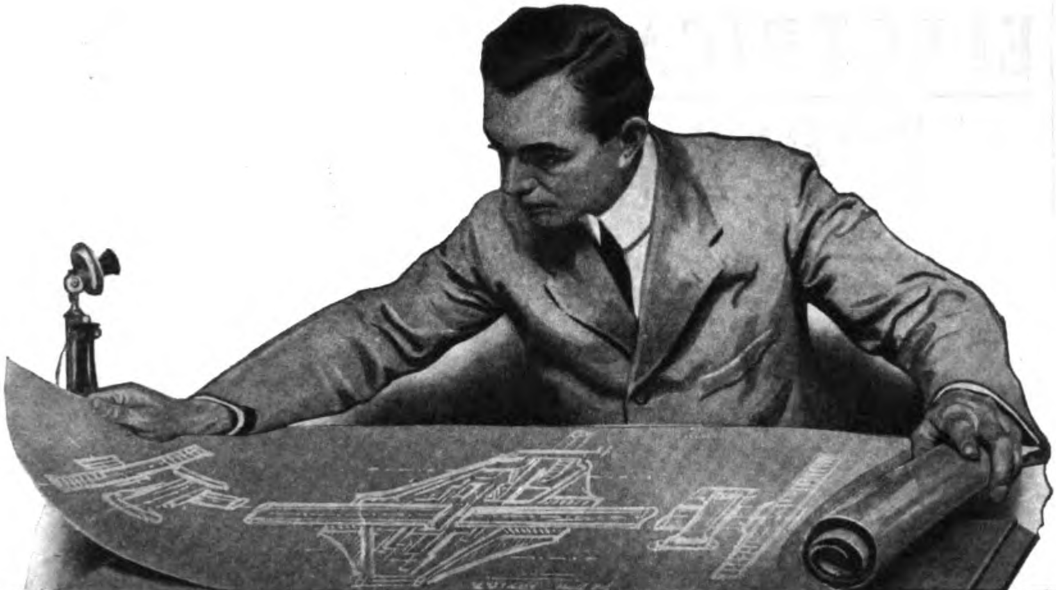
Q. 1.—Has made a dynamo from the directions given in the February and March numbers of the *Electrician and Mechanic*, but it fails to generate in the expected manner. Polarity appears correct, and as a motor the machine will run at a good speed when supplied at 6 volts. Various experiments have been tried, all to no purpose. What is likely to be the trouble?

A. 1.—By this sort of "absent treatment" it is hard to locate the exact fault, and you have apparently tried the regular methods. However, to reduce the air gap by winding iron wire on the outside of armature core is hardly effective, for this provides a leakage path from pole to pole outside the winding, and shields it from action. The separate excitation tests should be carried a little further. Put the two field coils in parallel with each other, excite them from the storage battery and drive the armature as fast and as long as you can. Observe how many volts will be generated Even with the brushes off some important tests can be made, for only small power should be required to drive the armature and practically no heat produced. If the opposite condition is found, there is evidence of faulty winding, and armature should be rewound. Perhaps your entire difficulty has been due to excess resistance in the field winding, and this will be remedied by putting the coils in parallel with each other, rather than in series, as already suggested. Let us know what further results you experience.

DYNAMO.

(48) H. H., San Francisco, Cal.:

Q. 1.—Sends a sketch of a dynamo having a laminated bipolar field magnet clamped between cast iron plates. Armature has 12 round holes each 3/8 inches in diameter. Core itself is 2 3/16 inches in diameter and 2½ inches long. He asks what winding to use for an output of 12 to 15 volts and two amperes, speed being 1500.



A. 1.—The machine is readily capable of a greater current than 2 amperes. You can wind 32 or more of No. 19 wires per slot, and get the desired voltage yet with 6 or more amperes. About 1 pound will be necessary, but since you have only six commutator segments, you will have to adopt a poor winding. Fill slots 1 and 6, and leave out a loop; then skip slots 2 and 7, and wind the second coil in slots 3 and 8, likewise completely filling them. Leave out a second loop, skip slots 4 and 9, but wind a coil in 5 and 10; leave out a third loop, and skipping slots 6 and 11 —6 being already filled—put a coil in 7 and 12, giving a fourth loop; a coil in 9 and 2 will give a fifth loop, while the last coil, in 11 and 4, will give an end to twist with the very beginning, and provide the sixth loop. A 12-segment commutator would be much more preferable. For field magnet you can put two pounds of No. 23 single cotton covered wire on each limb, and by coupling these in series or parallel with each other give some variation of voltage.

IMPEDANCE COIL.

(49) F. G., Pittsburg, Pa.:

Q. 1.—Asks for directions for making a coil to operate on a 110-volt, 60-cycle circuit, so as to permit the use of 4 amperes at 20 volts.

A. 1.—If your application demands continuous use at just this amount, we would advise the construction of an auto-transformer, with complete magnetic circuit of sheet iron. If only occasional use is desired, with considerable latitude of variation, we would advise you to make a straight coil with a bundle of sheet iron wires within. Such a device is of wonderful utility in its multitude of experimental applications. Bore a 1¾-inch diameter hole lengthwise in a piece of hard wood about 9 inches long and three inches square. Mount this on an arbor, and turn down the central portion to a diameter of 2 inches, leaving flanges at the ends ½ inch thick. Or a spool may be made from fibre washers and tubing, but no metal can be employed. Wind the spool full of No. 14 d.c.c. copper wire, attaching the ends to binding posts, a good method being to wrap and solder the wire around in the neck of the post. This securely prevents loosening. Get 6 or 7 pounds of tinsmith's annealed iron wire, of as small a size as possible, run it off the coil in long lengths, and straighten it by forcible stretching It can be cut into 10 inch lengths and bound in a bundle to fit the center of the coil. Use only string for this binding, as metal would provide a short-circuited secondary, and be wasteful of power. By varying the position of this iron core, a great variation of the current in the expermental circuit can be made

DYNAMO.

(50) R. R., Baltimore, Md., asks:

Q. 1.—Wishes to know how to change a dynamo now giving 14 volts and 3 amperes to 6 volts and 7 amperes.

A. 1.—Field winding need not be changed, except for putting the two coils in parallel with each other rather than in series as at present. Armature can be rewound, using

wire three numbers larger than at present. You can then get on but one-half as many turns, thereby giving but half the present voltage, but capable of twice as many amperes. If your machine has a goodly number of commutator segments, say 12 or more, you can utilize the existing winding, but so change the connections at the segments as to yield two independent windings in parallel. Remove all the top wires from the segments; examine the remaining connections, to see that they connect with similarly wound coils, say leading to the inner end of each coil. If there is disorder in this respect, correct it so that these leads to each segment will represent similar ends. Now regarding a certain segment as No. 1, test to see which of the protruding ends is the other terminal. This was previously soldered into segment No. 2, but instead solder it in No. 3. In similar order reconnect the remaining ends. The result will be a winding connecting with segments 1, 3, 5, etc., quite independent of the winding connected to the intervening segments. Use wide brushes, sufficient to cover about two and one-half segments.

TRANSMISSION LINE

(51) J. C. S., Kansas City, Mo., asks:

Q. 1.—What size of wire and spacing to use for delivering 35 kw. in single phase energy for incandescent lighting at a distance of 7 miles from the power station. The plan would be to step-up the voltage from 2300 to 6900 at the station, and at the receiving end to step it down again to about the original voltage for local distribution.

A. 1.—For such lines it is customary to consider the power factor as about .95. Possibly the line current at 6900 volts might be 7 amperes. With an allowable line loss of 5 per cent., No. 8 wire might answer, but this is ordinarily regarded as of insufficient tensile strength, so No. 6 is usually preferred. Using a spacing of 24 inches between wires, the inductive loss in the line would be, at full load, 70 volts, and the ohmic loss 207 volts; combining these at right angles would give the total drop as 220 volts. Therefore, if you put 2300 upon the step-up transformers, you ought to get nearly 2100 volts at the distant town.

IGNITION GENERATOR.

(52) F. N. O., Canova, S. D.:

Q. 1.—Is making a magneto machine, and asks certain questions as to the connections.

A. 1.—If you are making a direct current armature, various directions as to the method of winding will be found in answers to other correspondents. To energize the magnets you will need to place them in contact with the poles of a strong dynamo, or wind coils on them through which you can send current from a storage battery. This latter method will be expensive, but effective.

MAGNETS.

(53) C. C. S., San Diego, Cal.:

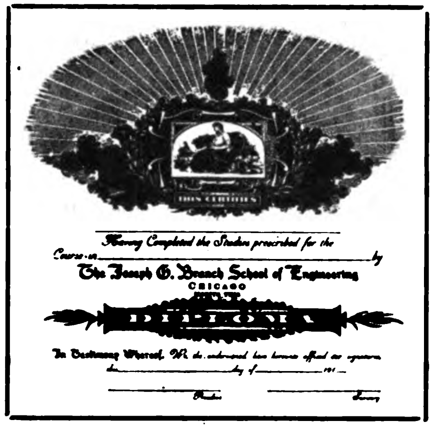
Q. 1.—Has taken great interest in reading the articles, "Permanent Magnets" by Prof. S. P. Thompson, and asks if we can give the

Electrical Engineering

If you wish to earn A BETTER SALARY, here is a chance to get your **diploma** at home during your spare time. **Men in constant demand everywhere. Big salaries** being paid for competent **Electrical Engineers.**

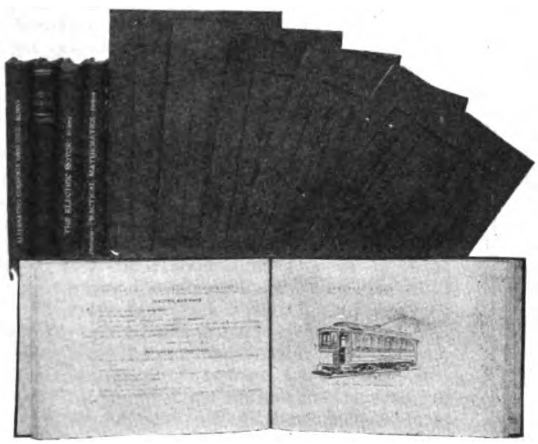
The men who get the **big jobs** are the men who understand the **principles** of electricity and their application.

Our Electrical Course teaches in plain, simple language and with easy lessons how to install and operate electrical machinery and appliances.



These lessons in Practical Electricity cover both Direct and Alternating Currents, high potential and high frequency currents and all that is necessary to become a proficient electrical engineer.

The course completely covers the field of practical electricity including power-plant work, and covers the following subjects, viz.: Practical Electricity, The Electric Motor, Practical Mathematics and Electric Wiring.



FREE

Ten text-books, handsomely bound, printed in large, clear type on fine quality of paper and profusely illustrated, are furnished free with this course.

The instruction is made so clear that any one can understand it, even though he has but a limited education.

The success of this school is due to the fact that we give the student only what he should know in order to become competent, and we do not waste his time and effort on useless matter.

Some of the students have been able to complete the course in three months. If you cannot devote much time to study, it will take a little longer.

THE PRICE IS LOW AND THE TERMS ARE EASY

Send the coupon and we will write you at once, giving you complete information and a special proposition.

FREE **Cut out and mail the coupon to-day, and we will send you FREE THE DYNAMO. Shows the consecutive steps in the development of the electric generator, with the construction of the modern generator. Fully illustrated in colors and all illustrations keyed, so that an explanation of each part of the same can be seen at a glance. Substantially bound in heavy paper.**

Please send me the "DYNAMO," and full information concerning your course in Electrical Engineering.

Name .... **Street and Number** ....

City or Town .... **State** .... **Present Position** ....

SERIES 6-P

THE JOSEPH G. BRANCH SCHOOL OF ENGINEERING
608 South Dearborn St. Chicago, Illinois

additional information as to the method of securing more permanent strength in the magnets used for ignition generators.

A. 1.—You are only one of a large number interested in this same search. There is little difference in the manner of energizing the steel, for its permanency is concerned in the quality of the material. When the magnets are removed from the rest of the structure and submitted to the action of the strong electromagnet, the steel is driven away beyond its capacity for retaining the energy. Stroking, rapping or coaxing will accomplish nothing further. You must be contented with the necessity of frequent re-energizing or else get magnets of better quality.

WAVE-LENGTH OF LOOSE COUPLER.

(54) Alex. Polson, Winnipeg, asks:

Q. 1.—If the primary of a loose coupler is placed in series with the antenna it is possible to tune to a wave-length of 500 meters when the coil is used as a single slide tuner. If the secondary is used in the same manner it is again possible to tune to 500 meters. What will be the wave-length to which it is possible to tune when the coils are used as a loose coupler?

A. 1.—It is not possible to give you the data asked for because you do not say anything about the size of the antenna. If used as a loose coupler on the same antenna you would be able to tune to about 500 meters more.

Q. 2.—If the natural wave-length of an antenna is 175 meters and I tune to an incoming wave by means of a wavemeter, do I get a reading of the true value of the received wave-length or do I get 175 meters additional?

A. 2.—Using your wavemeter as is ordinarily done you will get the true reading because you are tuning your wavemeter circuit to correspond to a secondary circuit which is in tune with the whole primary circuit of the receiver tuned to the incoming wave.

Q. 3.—If a wavemeter has a coil of inductance of 35 microhenries and then has this coil replaced by one of 52 microhenries, will the original maximum wave-length of 1500 meters be increased by the amount proportional to the square roots of the inductances?

A. 3.—Yes.

AN AGRICULTURAL EDUCATION

Proud Father—Welcome back to the old farm, my boy! So you got through college all right?

Farmer's Son—Yes, father.

Proud Father—Ye know I told ye to study up on chemistry and things, so you'd know best what to do with different kinds of land. What do you think of that medder there, for instance?

Farmer's Son (joyfully)—Jehoshaphat! What a place for cricket!—*Chicago Ledger.*

CORRESPONDENCE

Audion Experiments

The writers noted with some interest the results of Mr. Burglund's experiment in placing the Audion bulb in a strong magnetic field while receiving, as set forth in the January issue of MODERN ELECTRICS & MECHANICS, especially in view of the fact that the experiment was along a line upon which we have been working for some months—since the 28th of October, last, to be exact.

The results of our experiments thus far have been that the addition of the magnetic field improves the sensitiveness of all bulbs many fold, even in the extra sensitive bulbs offered by the lamp makers.

Our experiments at first involved the use of but one magnet, as later described by Mr. Burglund, but it was found, upon further investigation, that the addition of a similar magnet on the opposite side of the bulb produced still greater sensitiveness. By this addition to the magnetic field the magnetic lines of force are straightened out to a certain extent so that they pass through the wing and grid more nearly at right angles, and in consequence add to the efficiency of the rectification of the bulb.

It was found that by placing the south pole of the first magnet uppermost and facing the grid, then placing the second magnet with north pole uppermost at the opposite side of the bulb (on the wing side, of course), that the desired degrees of sensitiveness were obtained by varying the distance between the magnets and also the position of the magnets so as to place the bulb either near or away from the centre, but always keeping it directly in the lines of force, i. e., with the filaments and elements always cutting across these lines.

An inefficient aerial is being used in the tests which are conducted with long distance signals. In practically all cases the signals are absolutely inaudible unless the bulb is placed in the magnetic field, even though the bulb may be adjusted to its maximum sensitiveness in the ordinary manner Upon placing the bulb in the magnetic field the signals are brought in so that they are not only audible but thoroughly readable. And, too, magnets of the 3-bar telephone magneto are used instead of those of the 5-bar type

A diagram of the lines of force of the magnets shows that apparently the bulb has to be placed with the filaments directly in the path of the lines flowing between the south pole of the one magnet and the north pole of the other to attain the hypersensitive condition.

At times the various relative positions of the magnets seem to show even a certain selectivity in tuning as one station can frequently be tuned out and another brought in by simply varying these relative positions of the magnets, or the centering of the bulb between the two magnets, or by varying both. This is most frequently apparent in listening to Sayville and Arlington.

From these tests we find a new field opened for the improvement of detector sensitiveness, the most apparent conclusion to be drawn seems to be that the magnetic lines of force between the opposite poles of the magnets passing directly through the grid and wing amplify the rectification and consequently increase the loudness of the signals, even to a degree of bringing in otherwise thoroughly inaudible signals. And, of course, in addition to this, there is the advantage that Mr. Burglund points out of the elimination of the usual polarization of the bulb.—*R. R. Moore, and H. A. Fowler.*

A Misrepresentation.

My attention has been called to a wireless receiving set that won Third Prize in the present number of *Wireless Age*.

For the benefit of all concerned I wish to state that I constructed the outfit for Mr. Suchanek last May, 1913, and any statement other than the one herewith is untrue.

What Mr. Suchanek did was to buy an additional lamp stand, switches, batteries, etc., and add to the original outfit, somewhat changing its otherwise well-known appearance.

I would recommend that readers of *Wireless Age* consult the October, 1912, issue of MODERN ELECTRICS, page 730.

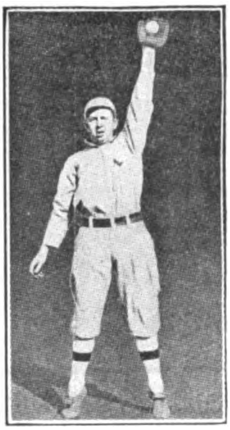
—*J. F. Arnold.*

Commercial Charges for Three-Phase Power

With reference to the question (No. 9) of Mr. T. A. Smith in the February issue, relative to the commercial charges for three-phase current and your reply to the effect that he will have to pay for only the actual watts used, regardless of whether his installation draws the same amount of current from each of the three phases or not, I think that this answer might be misleading to some readers and should therefore be modified.

In the case of regular contracts for the purchase of three-phase current for miscellaneous service, it is usual to insert a clause to this effect:

"The purchaser shall at all times take and use the three-phase power in such manner that the current will be taken equally from each of the three phases whenever possible, but whenever it is not possible to take the current equally from the three phases and the difference between any two phases is greater than ten per cent. of the lesser, then the



power to be charged and paid for shall be computed on the assumption that the current, and therefore the power, taken from each of the three phases is equal to the greatest amount actually taken from any one phase."

In drawing up contracts for large power service, it is also usual to insert a clause relative to power-factor, substantially as follows:

"The purchaser shall at all times take and use the three-phase power in such manner that the power factor will be as near one hundred per cent. as possible, but whenever it is not possible to take the current at one hundred per cent. power factor and the power factor is less than ninety per cent., then the actual power in watts taken and to be paid for shall be considered as ninety per cent of the volt-amperes supplied, and the watt-hour readings shall be corrected accordingly."

Of course, if there were not some regulations along these lines, some customers would be careless in regard to the proper balancing of their loads upon the several phases, and also in regard to the type and power factor of motors and other apparatus used. As regards regulation of voltage, it should be noted that the general regulation of a large distributing system would not be materially affected by the unbalanced load of any one small user, but the total unbalancing due to the combined unbalanced loads of a number of users might in some cases be so great as to make proper regulation of the system quite impracticable.—*V. C. Wynne.*

A SUGGESTION

Referring to the article on "A Handy Lighting Circuit" by H. P. Clausen in *Electrician and Mechanic* for June, 1912, page 366, the idea of saving current in that way is a good one, but it is possible to accomplish the same result by the use of a mortise-bolt in connection with an automatic door switch of the type that turns the light on when the door is closed, thus doing away with the primary cells necessary with Mr. Clausen's scheme.

We have had such a combination as outlined above in actual operation for several months, with very gratifying results.—*Edward A. Finch.*

Long Distance Receiving

Thinking that the readers of this magazine would be interested and also, as I believe it to be quite a record for an amateur station, I wish to state that with an umbrella type aerial 85 feet high and loose coupler, Deforest Audion and 2800 Brandes phones, I receive the signals from Sayville, Arlington and Key West stations so loud at night that they can be heard 35 ft. from phones, or by putting the phones close to a transmitter of an ordinary telephone they can be heard by another party many miles away. I also hear Key West working at different times of the day, as well as several other stations. Time signals come in very loud in the daytime. I have heard K. P. H., K. P. J. and N. P. L. during the winter months the last two years.—*Wm. Reinhardt.*

RADIO ATMOSPHERES

IF man knew as precisely the workings of the atmosphere as he knows his mathematics and his chemical combinations, wireless telegraphy would be even a greater Triton among the scientific and practical industrial minnows than it already is. The greatest difficulty in wireless telegraphy—and it needs not a Dr. John Perry to again say so—is due to the atmosphere.

Sudden atmospheric shocks or disturbances still continue to enter the receiving apparatus of important stations despite all of the new discoveries and improvements which come like mushrooms, every minute.

One gentleman, Mr. S. S. Brown, has wires stretched horizontally from his house to his stables at about forty feet from the ground. He receives all the every day commonplace messages and time signals with practically no sign of "atmospherics."

To be sure, lessening the height of high antenna lessens the energy received, but it seems that the diminution of the atmospheric disturbances is much greater than the diminution of the ordinary signals. One of Mr. Brown's latest relays magnifies the currents in the receiving station one hundred times and he expected that the signals would be well received, in spite of the lowness of the wires.

He was, however, surprised to find that the atmospheric disturbances had almost altogether disappeared. In fact, there were no static noises to magnify. The Salcombe Hill Observatory in London is also free from "atmospherics." Its antennae are very low like those of Mr. Brown.

Mr. Perry, a student of the wireless, explains his method of destroying this "butting-in" habit of the atmosphere. It seems to be practical because it is applicable to all antennae no matter how high they are. He states that an antenna is affected by rays of all frequencies, because its vibrations are damped by resistance, and it is, of course, most sensitive to rays of its own frequency. A static charge is of the nature of a sudden shock; it con-

sists of rays of all frequencies, and particularly of rays of all sorts of very high frequencies.

Suppose the frequency of the antennae to be anything from 50,000 to 300,000 per second, say about 100,000. Now, houses and trees are very imperfect antennae, the frequencies of which are probably much greater generally than one hundred thousand, although sometimes less.

When rays proceed horizontally the ether in the neighborhood of trees and houses is greatly robbed of all energies which accompany waves of high frequency.

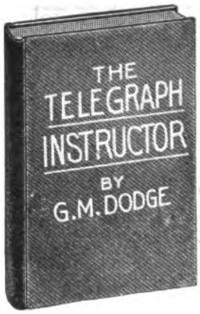
In fact, all rays of frequencies which correspond to the frequencies of trees and houses are absorbed, and a low antenna of 100,000 frequency receives but little energy of other frequencies than its own, and therefore little of the "atmospheric blow."

If this explanation is correct, it is only necessary to surround a receiving antenna by numerous others of all sorts of high frequency. If this is right, it is scarcely possible to receive atmospherics in the middle of a large city unless the ground is much higher than neighboring ground, just as is known that an ordinary house in the middle of the city is rarely struck by lightning.

Mr. Perry's explanation does not cover the whole situation, however, for the man in charge of a coast station states that he has great difficulty in receiving signals because disturbing "atmospherics" are so numerous. Ships in the neighborhood or even five miles away are undisturbed in their signaling. Such ships, of course, are not near houses or trees.

Local thunder storms, even twenty miles away, can be predicted from even these new sorts of stations. Mr. Perry says this is due to the fronts of the Maxwell waves not being vertical. He also supports his ideas by the fact that stations tuned low suffer more atmospheric disturbances than those tuned high.—*Dr. Leonard Keen Hirshberg.*

Makers of phonographs are aiming to use wood instead of metal in all parts of the instrument where this is possible, in order to increase the mellowness of the tone.



This Big 306 Page Book $1.00

THE TELEGRAPH INSTRUCTOR (fifth and revised edition) covers every branch of telegraphic work (railway and commercial) and is full of the most useful hints and suggestions that have ever been put into printers' ink. It contains complete instructions for setting up telegraph instruments, line construction, manipulation of switch boards, care of batteries, etc. It contains the Morse and Continental Codes in full and hundreds of abbreviations that are in general use. The duties of every railroad and telegraph employee, from the superintendent down to the engineer, conductor and switchman, are fully explained in this big book. It is not only intended for a telegraph student, but is a valuable reference book for the operator.

THE AUTHOR OF "THE TELEGRAPH INSTRUCTOR." Mr. G. M. Dodge, of Valparaiso, Indiana, is an old and expert telegraph operator with years of varied experience in both railway and commercial telegraph service. He is now holding a responsible position with the Western Union Telegraph Company and is President of a large and prominent telegraph school. He is a member of the Old Time Telegraph Association, and is also an associate member of the Association of Railway Telegraph Superintendents. Mr. Dodge is an authority on all matters pertaining to the telegraph.

YOU CAN BECOME THOROUGHLY QUALIFIED for the operating department of almost every railroad as soon as you have mastered the contents of **THE TELEGRAPH INSTRUCTOR.** Train rules, train signals, switch and interlocking signals devices are fully explained and descriptively illustrated in this book. A big lot of other valuable information, such as the block system of handling trains with descriptions and illustrations of modern devices used in railroading, are fully covered in this splendid book.

Sent Prepaid on receipt of price.

MODERN PUBLISHING CO. 32 UNION SQUARE, NEW YORK

Seriously Speaking

You may read everything published on wireless telegraphy, conduct the most painstaking experiments, only to discover that something is lacking. Very often that one thing will solve all your problems. Ask us. We know and will be mighty glad to answer you through the pages of

The Wireless Age

Past the elementary stages? Then you want to know something of the finer points in the wireless art. That's our mission; to tell you in special articles everything you can't find out elsewhere. Without question, the magazine is the brightest, snappiest, most instructive publication in the field—ask anyone.

Risk a quarter—stamps, money-order, check or cash will do, just as long as it's twenty-five cents—tell us it's for a 3 months' trial subscription. No subscriptions renewed at this rate; this is just a special offer to give you a chance to know what you have been missing.

The Wireless Age **450 Fourth Avenue** **New York City**

MODERN ELECTRICS AND MECHANICS

Classified Department

You will find it a good investment to use these columns.

Advertisements in this department 5 cents a word; no display of any kind. Payable in advance, by currency, check, money order or stamps. Count 7 words per line.

5% discount for 3 insertions
10% discount for 6 insertions
15% discount for 9 insertions
20% discount for 12 insertions within one year.

One of the most profitable high grade classified mediums in the United States. Try it out.

Advertisement for the May issue must be in our hands not later than March 31st.

BOOKS, ETC.

SEND 12c FOR "SEXUAL PHILOSOPHY," clearest, best, most instructive sex manual published. Actually teaches, not merely argues. Write to-day. "Health-Wealth" Publishing House, 82 Bennington St., Lawrence, Mass.

SECOND-HAND BOOKS—HALF PRICES ON every subject; new 25 per cent. discount; books bought; catalogue No. 818 free. Foyle, 121 Charing Cross Road, London, England. ★

GET VALUABLE MAIL WHOLE YEAR FOR 20 cents. Money returned if unsatisfactory. Cornish Electric Company, Schenectady, N. Y.

"FASCINATING BOOKS: SAMPLE AND catalogue 10c. Taylor Brothers, X2129 Clifton, Chicago.

BOOKS ABOUT ELEVATORS — BEST PUBlished. Morse, 19 Union Pl., Yonkers, N. Y. (2)

YOUR LIBRARY IS NOT COMPLETE WITHout a copy of Bound Bolume No. 4 of Modern Electrics containing 958 pages, with over 1,000 illustrations and 1,200 questions and answers on topics of vital importance to you. Elegantly bound in black cloth; gold stamped. Our supply is limited, so order today while you think of it and you will not be disappointed. Price, 2.00; 40c extra by mail in U. S.; 75c extra in Canada. Modern Publishing Co., 32 Union Square, New York, N. Y. (r)

PICTURES ANR POST CARDS

MUSICAL POSTCARDS. CAN BE PLAYED on any phonograph. Big assortment of Songs and Musical Numbers. 10c each. N. Nathan Company, 242 West 148th St., New York City.

"THREE ARTISTIC BEAUTIES 10c; 26 MINIAture photos 20c, six American Beauties 10c; Stage Beauty Catalogue 2c; all for 30c. Taylor Brothers, X2129 Clifton, Chicago.

24 ARTISTIC BEAUTY POSES, BEAUTIFUL woman, 10c. New 64-page book for gentlemen, 12c. Both 20c. Normal Specialty Co., M 7, Englewood, Chicago.

8 x 10 PHOTOGRAPH OF ARLINGTON RAdio Station and Towers (NAA), 25 cents. Hillers Photo Company, 238 First St., S. E., Washington, D. C.

44 LOVERS' CARDS AND BOOK OF TOASTS, 10c. A. Kraus, 409 M. Chestnut St., Milwaukee, Wis. ★

ART PHOTOS. FRENCH MODELS. IMPORTed. Three for 10 cents. Box 1514A, Paterson, N. J.

FEMALE BEAUTY CARDS. REAL PHOTOgraphs. 6 for 25c. Maple Co., 121, Napanoch, N. Y.

25 COMIC POST CARDS AND BOOK OF FLIRtations, 10c. A. Kraus, 409 L. Chestnut St., Milwaukee, Wis. ★

PHOTOGRAPHY, CAMERAS & SUPPLIES

FILMS DEVELOPED 6c, ALL SIZES. PRINTS 2¼ x 3¼, 2c; 2½ x 4¼, 3½ x 3½, 3¼ x 4¼, 4c; 40c dozen. Postcards, 50c dozen. Work guaranteed and returned 24 hours after receiving. Send negatives for samples. Girard's Commercial Photo Shop, 194 High St., Holyoke, Mass.

KODAKS, GRAFLEX CAMERAS, LENSES—Everything photographic; get bargain list. You can save money by sending your order to Willoughby, Broadway and 11th St., New York. (r)★

WE BUY, SELL AND EXCHANGE. BARGAINS in microscopes, telescopes, binoculars, cameras, etc. Bargain list sent. Kahn & Son, Opticians, 54 John St., New York. Established 62 years. (r)★

CYKO POSTCARDS FROM YOUR NEGATIVES, 2c; 100, $1.50. Amateurs send for complete price list and samples. The Fotokrafts Shop, Loveland, Ohio.

ELECTRICAL APPARATUS

LABORATORY DISCONTINUED MARCH 1ST; contents of electrical photo experimental dept. of an auto sales firm in N. Ill., consisting of condensers, coil tester, fuse blocks, high and low powered receivers, lamps, ammeter, sockets, insulators, automatic telegraph set, individual set, sending tape, insulators, instruction books, three telephones, camera, 7 in., extra lenses, unbroken pkgs. paper chemicals, flash lamp, powder, lantern slides, film holders, developing and printing outfit, instruction book. Fine outfit for school, club or student in physics. Will ship to first remittance of $100. Marvin, Maple Park, Ill.

DIAMOND TRANSFORMERS OPERATE BELLS, toys, signals, rectifiers for charging storage batteries and spark coils through stepdowns from 110 v. Most reliable on the market. Diamond Transformer Co., 315 Second Ave., Pittsburg, Pa. ★

SWTCHBOARD METERS FOR VOLTAGE AND amperage, 4¼ in. diameter, in aluminum case, for $1.25 and upwards. These instruments are thoroughly practical and will give years of service. Our prices are made possible only by a new design of great simplicity. Circular on request. Progressive Mfg. Co., Box 295C, Reading, Penna.

PUNCHED DISCS, NOTCHED OR PLAIN, castings and materials for building Prof. Watson's motor. Put in your order and get busy. Write for full information and prices. Wm. C. Houghton, 141 St. Jerome Ave., Holyoke, Mass.

DIAGRAMS — OUR MODERN BLUE PRINT Chart Method of Electrical Wiring. Write for information. Electrical Wiring Diagram Co., Box C-173, Altoona, Pa.

DETECTIVE PHONE—MAKE ONE YOURSELF. You can hear a whisper. Plans and information 25c. Lobe Mfg. Co., 167 West 102d St., New York City.

WORNOUT DRY BATTERIES MADE BETTER than new for 8 cents. Instructions 20 cents. Willamack, Grampian, Pa.

OLD DRY BATTERIES RENEWED, ABOUT 1c each. Instruction 25c. Crown Chemical Co., Hamilton, Ohio.

WIRELESS, FLASHLIGHTS, TELEGRAPHS, etc., at lowest prices. Write for circulars. J. W. Denton, Gregory, Mich.

25 FORMULAS FOR 50c. RENEWING DRY Batteries. List free. Charles A. Lutz, Dept. F, York, Pa. (1)

RENEW DRY BATTERIES; THREE GUARANteed processes, 10c. Formula Bureau, 3311-EM, Belleplaine Ave., Chicago.

STORAGE BATTERIES ARE VERY HARD TO master and understand, but if you read this book you will know all about them from beginning to end. "Storage Batteries, Stationary and Portable," by J. T. Niblett, M.I.E.E. 80 pages, 21 illustrations, pocket size, silk cloth binding. Price, 50c postpaid. Modern Publishing Co., 32 Union Square, New York. (r)

"CONSTRUCTION OF INDUCTION COILS AND Transformers" is a valuable book, containing 100 pages and 72 illustrations, by H. W. Secor. You cannot afford to be without this book, which is the latest work on construction of induction coils and transformers. $0.25 postpaid. Modern Publishing Co., 32 Union Square, New York. (r)

STAMPS, COINS, ETC.

$4.25 PAID FOR FLYING EAGLE CENT OF 1856. Hundreds of other coins bought. Send 10c for buying catalog. A. Kraus, 409 K. Chestnut St., Milwaukee, Wis. ★

STAMPS—105 CHINA, ETC., STAMP DICtionary and list, 2c. A. Bullard, Sta. A., Boston, Mass.

OLD STAMPS BOUGHT—$75.00 PAID FOR a certain old stamp; hundreds of other stamps bought. Send stamp for buying list. A. Kraus, 103 Kraus Bldg., Milwaukee, Wis. ★

HELP WANTED

LOCAL REPRESENTATIVE WANTED. SPLENdid income assured right man to act as our representative after learning our business thoroughly by mail. Former experience unnecessary. All we require is honesty, ability, ambition and willingness to learn a lucrative business. No soliciting or traveling. All or spare time only. This is an exceptional opportunity for a man in your section to get into a big paying business without capital and become independent for life. Write at once for full particulars. National Co-Operative Realty Company, L-599, Marden Building, Washington, D. C. ★

MEN AND WOMEN WANTED FOR GOVERNment jobs. $65 to $150 month. Vacations. Steady work. Parcel Post means many appointments. Common education sufficient. "Pull" unnecessary. Write immediately for free list of positions open to you. Franklin Institute, Dept. E203, Rochester, N. Y.

MECHANICAL DRAWING. THE WARNER system makes expert draftsmen. If you are earning less than $25.00 per week we can increase your salary. Free book. Colorado Correspondence College, Dept. 55, Denver, Col.

FREE ILLUSTRATED BOOK TELLS OF about 300,000 protected positions in U. S. service. Thousands of vacancies every year. There is a big chance here for you, sure and generous pay, lifetime employment. Just ask for booklet S-947. No obligation. Earl Hopkins, Washington, D. C. ★

$5 DAILY EASILY EARNED AT HOME SPARE time, silvering mirrors. No capital. Free instructing booklet tells you how to make $5 daily. Patterson & Co., Dept. N, Brookville, Ky. (11)★

LEARN AUTOMOBILE DRIVING. COMPLETE book, how to operate, repair, get license, position. Postpaid 10c. Holmes Novelty Co., Desk 6, Plymouth, Mass.

GOOD POSITIONS OPEN EVERYWHERE. Let us place you. State qualifications, salary, etc., first letter. "NISCO," Dept. MDF, Cincinnati. (9)★

I WILL START YOU EARNING $4 DAILY AT home in spare time silvering mirrors; no capital; free instructive booklet, giving plans of operation. G. F. Redmond, Dept. A. G., Boston, Mass. (5)★

WANTED—SEVERAL HONEST, INDUSTRIOUS people to distribute Patriotic Literature. Salary $60 per month. Prof. Nichols, Box F, Naperville, Ill. ★

MAKE FROM $100 TO $500 A MONTH WITH illuminating paint. Particulars for stamp. M., Box 35, Hagerman, Idaho.

REAL ESTATE

LET US SELL YOUR PROPERTY—ANYTHING. Bargains everywhere—inquiries daily. State particullars first letter. "NISCO," Dept. XDF, Cincinnati. (9)★

FOR SALE: 60 ACRES OF FINE LAND, ON Grand Island, N. Y., fronting on the beautiful Niagara River, right across from Buffalo; suitable for high grade development, bungalow plots, gentleman's estate or farming; nearly 600 feet shore front with riparian rights; price $300 per acre; worth $500; liberal terms will be made with responsible parties; house and barns near shore. Address W. H. Northrop, Grand Island, Erie County, New York. (r)

STORAGE BATTERIES ARE VERY HARD TO master and understand, but if you read this book you will know all about them from beginning to end. "Storage Batteries, Stationary and Portable," by J. T. Niblett, M.I.E.E. 80 pages, 21 illustrations, pocket size, silk cloth binding. Price, 50c postpaid. Modern Publishing Co., 32 Union Square, New York. (r)

THIS ELECTRICAL DICTIONARY WILL JUST fit in your vest pocket. Carry it around with you while you are at work. "Handy Vest Pocket Electrical Dictionary," by Wm. L. Weber, M.E., containing upwards of 4,800 words, terms and phrases employed in the electrical profession with their definitions given in the most comprehensive manner. Full leather cover 50c postpaid. Modern Publishing Co., 32 Union Square, New York. (r)

INSTRUCTION

GOOD BLACKSMITHS ARE SCARCE AND few learning the trade and the blacksmiths must make the tools for all—from surgeon to the safe blower. Buy Toy's Modern Methods Forging and Welding different kinds of steel solid, and doing all hard jobs easy, also hardening and tempering to a standard by colored charts. Any smith can be an expert that means good jobs and big money. All for one dollar. Send for valuable samples free. W. M. Toy, Sidney, Ohio. (r)★

EXPERIMENTERS WHO DESIRE COMPLETE instructions for making a step-down transformer for experimental purposes, at small expense (that can be connected with ordinary house circuits- to send 25c for the best book ever issued on the subject. Great demand; everybody wants it. Better than batteries. Address, Engineering Education Extension, Lock Box 41, Hanover, N. H.

ST—STU—T—T—ERING OR STAMMERING. Let me tell you, by mail, how I cured myself, after 30 years of misery and failure. Discovered a natural method which anyone can use, at home. Since then have won social and business success. Send me your address, in confidence. Walter McDonnell, Drawer F 667, Station F, Washington, D. C.

FREE TUITION BY MAIL—CIVIL SERVICE, mechanical drawing, stationary engineering, electric wiring, agriculture, poultry, normal, bookkeeping, shorthand and typewriting courses. For free tuition, apply Carnegie College, Rogers, Ohio. (r)★

FREE ILLUSTRATED BOOK ON HYPNOTISM and other occult sciences to all who send their address. Write to-day and learn how to influence and control others. M. D. Betts, Sta. 174. Jackson, Mich. (r)★

COLLEGE AND UNIVERSITY DEGREE courses; resident, non-resident. Address Vetus Academy, Incorporated 1904, New Jersey Branch, 120 Palisade Ave., West Hoboken.

"SPANISH-IN-A-WEEK," BY T. S. ROMERO, embodying a new method, scientific, exact, comprehensive, by an expert teacher of pure Castillian Spanish. This book contains the fundaments of the language, easily grasped and of sufficient vocabulary to enable anyone to obtain a working knowledge of Spanish. Every word phonetically pronounced. Appendix contains geographical information in Spanish and English of all Latin-America. Sent postpaid, cardboard 50c, cloth 75c. Modern Publishing Co., 32 Union Square, New York.

PRINTING AND ENGRAVING

DIGNIFY YOUR CORRESPONDENCE. 100 LETterheads and envelopes printed on excellent bond, $1, prepaid. 500 letterheads or envelopes, $1.50. 1,000 for $2.50. Samples free. Proper printing. Robison printery, Curwensville, Pa. (1)

ALL FOR $1.25 POSTPAID, 100 LETTERheads 8½x11, 100 Envelopes 6¾ 20 lb. Bond. Printed to your order. Samples free. Genuine Typewritten Letters our specialty. Carter Company, 62 State, Rochester, N. Y. ★

500 BOND LETTER HEADS AND ENVELOPES for $2.50 postpaid. Business Houses send for prices and samples. The Little Miami Letter Co., Loveland, Ohio.

GOOD ENVELOPES, GOOD PRINTING, 300 $1.00 postpaid. Business cards, 350 $1.00. 15 years serving customers by mail. Amity Specialty Press, Card Dept., Amityville, N. Y.

GUMMED LABELS, 3,000 $1.00. 1 x 2 INCHES. Catalogue Free. Helmus Company, Hoboken, N. J. (4)★

500 BUSINESS CARDS PRINTED TO YOUR order 75c. Geo. Birt, Russell Ave., Indianapolis, Ind. (5)

BOAT BUILDING FOR AMATEURS. BY Adrian Neilson, C.E. This book will tell you how to build all manner of small boats, such as punts, skiffs, canoes, row and sail boats; only $1.00, postpaid to any address in the U. S. Modern Publishing Co., 32 Union Square, New York City.

PATENTS

PATENTS SOLD ON COMMISSION, INVENTIONS perfected—Ideas developed. I guarantee utmost satisfaction or no pay. Expert in the development of patents. Legal and technical advice free. R. S. Shelmo-Jacobsen, Consulting Engineer, Dept. D., 452 Peoples Gas Bldg., Chicago, Ill. ★

PATENTS THAT PROTECT AND PAY—ADvice and books free. Highest references. Best results. Promptness assured. Send sketch or model for free search. Watson E. Coleman, Patent Lawyer, 624 F St., Washington, D. C. (r)★

PATENTS AND TRADEMARKS, ELECTRICAL and mechanical a specialty. Book free. Joshua R. H. Potts, Patent Lawyer, 8 Dearborn St., Chicago; 805 G St., Washington; 929 Chestnut St., Philadelphia. (7)★

INVENTORS WANTED—TO SUBMIT DEVICES for street railway transfer system; also other inventions. For particulars address Inventors' Mutual Development Association, 818 Potomac Bank Bldg., Washington, D. C.

BENJAMIN ROMAN, SOLICITOR OF AMERIcan and foreign patents; trade-marks registered. Patent treatise mailed upon request. 15 Park Row, New York. ★

IDEAS WANTED—MANUFACTURERS ARE writing for patents procured through me. 3 books with list 200 inventions wanted sent free. Advice Free. I get patent or no fee. R. B. Owen, 44 Owen Bldg., Washington, D. C.

PATENTS WITHOUT ADVANCE ATTORNEY fee. Payable when patent allowed. Send sketch for free report. Books free. Fuller & Fuller, Washington, D. C. ★

PATENT YOUR INVENTION—$20,000 OFFERED for inventions wanted. Booklet and opinion free. Milo B. Stevens & Co.., Established 1864, 625 F St., Washington, D. C. (r)★

FREE—LIST OF PERSONS WHO WANT TO buy patents, prizes offered by manufacturers and lists needed inventions. Randolph & Co., 647 F St., Washington, D. C. (r)★

OFFICIAL DRAWINGS FREE—PATENTS PROcured or fee returned. Expert services. Send sketch for free search. The Patent Exchange, Jerden Bldg., Washington, D. C.

C. L. PARKER, PATENT ATTORNEY, 8 McGill Bldg., Washington, D. C. Inventor's handbook, "Protecting, Exploiting and Selling Inventions," sent free upon request. (r)★

WRITE FOR MY "WORDS OF VALUE TO Inventors." John R. Woodworth, Registered Attorney, Worder Bldg., Washington, D. C.

PATENTS SOLD — FREE BOOKLET TELLS how we get cash for your patent. Buyers waiting for good inventions. Patent Sales Co., Frankford, Pa.

1868—MIATT—PATENTS—1914—i.e., 45 YEARS' personal, practical and successful experience in procuring U. S. and Foreign Patents, Registrations of Trade-Marks, Labels, Prints, Copyrights, etc. Also as Counsellor and Expert in Patent Causes. Personal attention given to all business assumed by mutual consent, but *only* on reasonable compensation for time and labor involved. Terms moderate, but not contingent. Information and advice freely given, but no circular literature. Branch Office, Washington, D. C., for transaction of business with Patent Office direct. Reliable and competent foreign representatives. Geo. W. Miatt, Attorney and Counsellor at Law and Patent Expert. Patent business exclusively. Offices, Temple Court, Cor. Nassau and Beekman Sts., New York City. (r)

THIS ELECTRICAL DICTIONARY WILL JUST fit in your vest pocket. Carry it around with you while you are at work. "Handy Vest Pocket Electrical Dictionary," by Wm. L. Weber, M.E., containing upwards of 4,800 words, terms and phrases employed in the electrical profession with their definitions given in the most comprehensive manner. Full leather cover; 50c, postpaid. Modern Publishing Co., 32 Union Square, New York. (tf)

MACHINERY

INVENTORS: WE MANUFACTURE METAL articles of all kinds, to order. Also, special machinery, tools and dies, punchings, lathe and screw machine work, metal spinnings, castings, plating, wood and metal patterns, etc. Send sample for estimate and expert advice, free. The Eagle Mfg. Co., Dept. D., Cincinnati, O. (r)★

MODELS MADE FOR INVENTORS; GENERAL machine work; designing and perfecting; developing automatic devices and machinery. In a position to do all kinds of light tool and machine work. Prices reasonable; estimates cheerfully given. Ideal Machine Works, 61 Ann St., New York City. (r)★

FREE CATALOGUE OF MODEL SUPPLIES. Castings, metal specialties on contract. North Chicago Tool Works, 2134 Grove Ave., North Chicago, Ill. (1)

FIRST STEPS IN ELECTRICITY, OR ELECtricity for the beginner! Doesn't that title sound interesting? It is just what it denotes, or maybe more, because it starts off with the development of electricity, explaining fully in a purely and descriptive manner how to perform simple experiments with as little expense as possible. 288 pages, 114 illustrations, pocket size, cloth cover. Price $1.00, postpaid. Modern Publishing Co., 32 Union Square, New York. (r)

FOR SALE

BUY MY BIG POWERFUL AERO VACUUM cleaning wagon, and start business yielding big profits; small competition. Roy Creamer, Jeffersonville, Ohio.

FOR SALE—MOVING PICTURE FILMS. ANY subject, 1c per foot. Davis Service, Watertown, Wis. (1)

NAMES FOR SALE—MAIL BUYERS, FARMers, school teachers, agents; original letters for rent. Big Mail Directory, 1124 Foster Ave., Chicago. (1)

MARCONI 2-INCH COIL AND D.P.D.T. aerial switch. Coil used about a month. $8.00. D. G. Jerauld, East Harwich, Mass.

MOTORS FOR SALE CHEAP, 1-12 H.P., 110 V., a.c. and d.c., standard make, in good condition. Harlan S. Webster, 2026 Borden Ave., Massillon, Ohio.

ONE COSMOS, E. CO., ½ KW. O. CORE transformer, two J. J. Duck 1-qt. leyden jars, one new Halcun rotary spark gap. First offer takes all. George A. French, 300 S. Hamilton St., Mobile, Ala.

TELEGRAPHY

TELEGRAPHY — MORSE AND WIRELESS — Railway accounting (station agency) taught quickly. Railroad and Western Union wires and complete Marconi wireless station in school. Oldest and largest school. Expenses low—can earn part. Positions secured. Catalogue free. Dodge's Institute, Sixth St., Valparaiso, Ind. (4)★

WIRELESS, COMMERCIAL AND RAILROAD Telegraphy taught free by mail. Send for details. Brooklyn Telegraph School. W. U. Telegraph Bldg., 313 Fulton St., Brooklyn, N. Y. (8)★

TELEGRAPHERS' WORKING CONDITIONS, wage schedule, explained free. Pelnar School of Telegraphy, Madison, Wis. (8)

OUR 80-PAGE BOOK, "THE WIRELESS TELEphone," will be found invaluable to those interested in this science. This book contains 57 illustrations and is considered a masterpiece. Send $.25 in stamps, coin or M. O. to Modern Publishing Co., 32 Union Square, New York City. (r)

MODERN ELECTRICAL CONSTRUCTION. BY Henry C. Horstmann and Victor H. Tousley. A new revised and enlarged edition, 16mo., 358 pages, 178 diagrams. Pocket size, full leather limp. Price, $1.50 postpaid. Modern Publishing Co., 32 Union Square, New York.

MISCELLANEOUS

TOBACCO, THE PURE LEAF, NOT MANUFACTURED. The best tobacco for chewing and smoking. Samples, one pound prepaid, 25c. Dolan & Co., 1185 Market, Louisville, Ky.

POULTRY — WHITE ORPINGTONS, CELEBRATED Cook strain; most popular breed in America. Eggs for hatching $2.50 per 15. Address J. E. Teal, 4918 Ravenswood Ave., Chicago. (1)

SAFETY BLADES SHARPENED—GILLETTE'S, Duplex, all makes 2c each. Keene-Edge Co., Oshkosh, Wis.

WE ANALYZE EVERYTHING. RELIABLE formulas furnished, by expert chemists. Economy Laboratories, 721 East 161st St., New York City.

GRIT HAND SOAP FORMULA FOR 10 CENTS. John Pick, 580 Milwaukee, E. Detroit, Mich.

PEARLS AND BAROQUES BOUGHT AND sold. Laverne Mapes, Indiana Harbor, Indiana.

HUNDRED WAYS OF KISSING GIRLS. SOMETHING exceptional. A novelty, entertaining instructive. Price, 25c postpaid. J. M. Sheridan Co., 417 East 151st St., New York. (5)

MARRY—MARRIAGE DIRECTORY WITH photos and description. Free. Pay when married. New system. Box 525 F. W., Kansas City, Mo. ★

MARRY—MANY WEALTHY MEMBERS. WILL marry. All ages. Descriptions and photos Free. Box 314 E Z, Kansas City, Mo. ★

WOULD YOU MARRY IF SUITED? BEST matrimonial paper published. Mailed free. The Correspondent, Toledo, Ohio.

WILL EXCHANGE ONE SMALL MOTOR, ONE typewriter, cost $5; one telegraph set, 20 ohms; 40 copies 15c magazines, four Buster Brown cameras (new), 60 doz. Argo developing paper, 25 M. O. developers and supplies, for U. S. stamps or coins. H. Jones Wallis, 432 10th St., Troy, N. Y.

FOR EXCHANGE—RUHMKORFF TYPE COIL secondary of No. 32, 13 in. long, 6 in. diameter, gives 7-in. spark; Tesla transformer for coil up to 12 in. spark. Holds six gallons of oil. I have the oil. One loose coupler, one rotary condenser aluminum plates, one detector, one circular potentiometer, high tension adjustable condenser with 23 plates 8 x 10 in., one Leyden jar, one voltmeter, switchboard type; one Geissler tube, a lot of No. 32 and No. 10 wire; also some binding posts. Everything is mounted and finished in oak, worth over $100. Would like something of equal value. Lewis Hoppenthaler, 276 Jamaica Ave., Flushing, N. Y.

WHAT AM I OFFERED FOR BRAND NEW modern receiving set, with audion detector, $15 loose coupler, 3000 ohm phones, condensers, all on cabinet, used only ten hours. Will trade for transformer wound for 25 cycle, balance in other goods. What have you? W. D. Woodcock, 496 W. Ferry St., Buffalo, N. Y.

WOULD LIKE TO GET A 2-IN. SPARK COIL of good make; also other wireless instruments for the following: D. c. motor, suitable for rotary spark gap; a battery motor, rotary spark gap, 8 points; a 10 v. 3½ a. dynamo and hand machine to run same. Geo. McCarthy, 1012 Sutter Ave., Brooklyn, N. Y.

WILL EXCHANGE ONE MAHOGANY LOOSE coupler, 12 taps on secondary and 2 slide primary, new; also one Slaby-Arco coherer and decoherer for typewriter. J. Gilligan, 243 Marion St., Brooklyn, N. Y.

HAVE AN OMNIGRAPH WITH 15 DIALS, ONE-inch spark coil, gap, key, helix, condenser, large Tesla coil (throws 16-in. spark), potentiometer, 50 amp., 220 volt single throw 3 pole switch, variometer, 50 ft. No. 6 copper and a quantity of No. 4; also a large fuse block for switch. Will consider any good receiving apparatus or a ¼ kw. closed core transformer. Address F. X. J. M., care W. F. Whitmarsh, 48 Main St., Gloucester, Mass.

WIRELESS

WIRELESS AND EXPERIMENTERS' SUPplies. Look over our large catalogue and new supplement of our latest instruments. Condensers $.50 to $2.75. Detectors $1.75 to 4.00. Sent for 2c stamp. A. W. Bowman & Co., 55½ Sudbury St., Boston, Mass.

CLEARANCE SALE, SHOP-WORN APPARATUS; $4 two-slide tuner, $2; $5 rotory condenser, $3; $15 rec. transformer, $12, and other bargains; send for list. Radio-Electric Supply Co., Dept. E, Waverly, Mass.

DETECTORS ARE OUR SPECIALTY. OUR $0.50 detector has received messages 1500 miles. Each detector tested. Send for one. Prices, $0.50, $1.00. Maximum Specialty Co., 306 College Ave., Ithaca, N. Y. ★

WONDERFUL LONG DISTANCE FERRON OR silicon detector. Extremely sensitive. Only $2.00. Send for particulars. Trans-Continental Wireless Co., 2110 Alabama, Indianapolis.

BRASS RIBBON $0.02 PER FT; IMPREGNATED paper pulp tubes, Wood's alloy, slider rod, etc. Send for price list. Schenectady Wireless Supply Co., Schenectady, N. Y.

ENAMELED WIRE — NO. 34 FOR SECONDARIES, $1.20 per lb. postpaid. Jas. Ferguson, 210 N. Hawey St., Oklahoma City.

MAKE YOUR OWN ROTARY VARIABLE CONDENSERS; 25 plates 5¼ inches in diameter, $2.00. Address Wireless, 510 College Ave., Elmira, N. Y.

WIRELESS EQUIPMENT, BOOKS, TOOLS, etc.—Two Thordarson transformers, special oil immersed condenser, General Electric hot wire ammeters, helix, gap, special break key, 1 kw. and 3 kw. compressed air gaps, switchboard, Murdock loose couplers, variable condensers; wireless specialty, Brandes and Western Electric phones, $85.00 radiolytic detector, condensers, spark coils, relays, keys, sounders, aerial wire, insulators, 12-inch fan, lighting fixtures, etc. Complete drill sets, screw plate, vise, breast drill, saws, micrometer, calipers, grinder, etc. Electrical handbooks, Fleming, Pierce, Erskine-Murray, etc. Complete file U. S. wireless patents, Modern Electrics, and others. Office desk, chairs, stand, adjustable drawing table, board, etc. Request particulars on articles interested in. Stanley McClatchie, 178 West 82d, New York.

"WIRELESS HOOK-UPS," CONTAINING 96 pages and 100 hook-ups, is full of diagrams fully illustrating every possible wireless connection. This book will enable wireless men to get excellent results. Sent postpaid for $.25. Modern Publishing Co., 32 Union Square, New York. (r)

WE CAN FURNISH ANY BOOK ON WIRELESS published. Write Book Dept., Modern Publishing Co., 32 Union Square, New York. (r)

TO EXCHANGE FOR GOOD SPARK COIL OR ½ kw. open core transformer, $8; 200 ohm nickel-plated relay, vibrator for 1-in. coil, and sheet brass 4 x 8 x 1¼ in. James L. Green, Wesley College, Winnipeg, Canada.

WILL EXCHANGE ONE LARGE LOOSE COUPLER, one 2000 meter double slide tuning coil; also one half-inch spark coil. Everything in good order. Prefer good rotary variable condensers and detectors. Chester Ulsh, 252 Summit St., Box 179, Marion, Ohio.

WILL EXCHANGE 1 LB. SPOOL OF NO. 30 green silk wire, a variable condenser, two wireless keys, detector, four-volt battery motor, telephone transmitter, potentiometer, two fixed condensers, 12-point hard-rubber switch and 100 switch points. Charles E. Preiss, 415 Central Ave., Brooklyn, N. Y.

WIREMANS TOOLS

USE OUR INSULATION REMOVING POCKET tool, no knife needed, postpaid $1.50. Wireman's Tool Works, 2152 West 103d St., Cleveland, O.

"HOW TO MAKE WIRELESS INSTRUMENTS," by 20 Wireless Experts, containing 96 pages and 75 illustrations, written expressly for wireless amateurs, and is a book that you cannot afford to be without. Price, 25c postpaid. Modern Publishing Co., 32 Union Square, New York City. (r)

MODERN ELECTRICS AND MECHANICS

Apparatus Exchange Department

This department is for the free use of our subscribers and readers, to enable them to exchange technical articles for which they have no need for other articles or apparatus which they prefer.

Advertisements under this heading containing more than fifty words cannot be accepted; the right is reserved to rewrite or reject any advertisement which will not be for the best interests of our readers. Advertisements under this heading will be inserted one time only, free of charge.

Advertisements of articles intended for sale cannot be accepted, as a regular classified department is conducted for advertising of this character at a cost of 5c per word.

Advertisements should be addresed to "Apparatus Exchange Department," care *Modern Electrics and Mechanics*, 32 Union Square, New York.

Advertisements for the May number should reach us on or before March 31st.

I HAVE A FIRST CLASS SENDING CONdenser for a 2 or 2½ inch coil, worth $2.50, and a ½ kilowatt transformer coil with vibrator. This coil is in good condition, but has no primary condenser. Wish to trade, so what have you to offer me? John Wm. Waite, 3938 N. Third St., Philadelphia, Pa.

WILL EXCHANGE A COURSE IN PHOTOplay writing, a book on moving-picture acting (cost $2), a new set of boxing gloves, 80 feet of western comedy moving-picture film, about 80 feet of a "Pilot" film, entitled, "Lincoln for the Defense"; have other films, including small painted ones; slides; heavy football cover, and two 1000 ohm single pole receivers. Want receivers with head band and cord; helix, spark gap, ½ kw. transformer and many other wireless instruments. Immediate reply to all inquiries assured. Alfred Stellman, Box 38, North Hackensack, N. J.

LEARN TO FLY—BIG TWO-FOOT BLERIOT Monoplane. Latest model, knocked down, packed, ready for mailing, with blue print and complete drawings for assembling, with wheels and propeller. This model is usually sold by dealers for $2.00. Boys all over the country are having barrels of fun with them. For good, wholesome amusement, there is probably no flying device more entertaining and that will afford more fun for the boys and grown-ups than this pleasing toy. Guaranteed to fly or money refunded. Sent prepaid on receipt of price, $1.00. Model Flying Machine Company, 820 Reliance Bldg., New York City.

HAVE LARGE LOOSE COUPLER. WILL trade for a set of 2000 ohm head receivers, any good make preferred. Don Hartley, R. D. No. 8, Athens, Ohio.

HAVE A MAGIC LANTERN WITH 2 DOZ. large slides (original cost $1.75 without slides) and a small spring wound motor boat 9½ inches long (cost $1.10); total value $2.85. Will exchange for some wireless apparatus. What have you? Box 711, Lynbrook, N. Y.

WILL EXCHANGE A 1 H.P. STEAM ENGINE and gauge, one 6 v., 8 a. dynamo, a two-inch coil and a pair of telephones. What have you? Edw. Simolin, Jr., 632 Shepard Ave., Brooklyn, N. Y.

WHAT HAVE YOU TO EXCHANGE FOR ROVers name plate machine, one high-grade 6½ x 8½ view camera outfit, cost $75; one new gong steam whistle, one small brass whistle, one .22 Winchester repeating rifle, one bass violin-cello, one banjo, graphophone and 60 records? D. F. Casey, Harrisonville, Meigs Co., Ohio.

OUR 80-PAGE BOOK, "THE WIRELESS TELEphone," will be found invaluable to those interested in this science. This book contains 57 illustrations and is considered a masterpiece. Send $0.25 in stamps, coin or M. O. to Modern Publishing Co., 32 Union Sq., East, New York City.

WILL EXCHANGE ONE DAISY 1000-SHOT AIR rifle, Brownie No. 2 camera, 16 vol. Alger's books, cloth bound; four condensers, one pair Spaulding's running shoes, size 6, value $5; one pair hockey skates, size 10; one book on National Electric Code. Total value, $20. Would like ¼ or ½ kw. transformer. Edw. F. Dennis, P. O. Box 702, Tenafly, N. J.

WILL EXCHANGE 100 FT. LIGHT WIRE IN 12 pieces, 12 sockets, battery voltmeter in fancy box, 1½ lb. all sizes of wood, screws, 120 ft. No. 14 aluminum wire, one receiving coil without rods and woodwork for loose coupler. I wish to exchange for a motor or dynamo. If your goods are worth more, let me know, as I have more articles to trade. Ed. Walerych, 349 Medbury Ave., Detroit, Mich.

FOR EXCHANGE — 1½-IN. SPARK COIL, spark gap, helix, frame, clips, flexible wire and binding posts, loose coupler, potentiometer, fixed condenser, electrolytic and peroxide detectors, switches, 2-point D.P.D.T., two D.P.S.T., one S.P.D.T., and two pounds antenium wire. Would like first-class bicycle equipped with mudguard, gas lamp, etc. Philip Hoehn, 312 Jefferson St., St. Charles, Mo.

THIS ELECTRICAL DICTIONARY WILL JUST fit in your vest pocket. Carry it around with you while you are at work. "Handy Vest Pocket Electrical Dictionary," by Wm. L. Weber, M.E., containing upwards of 4,800 words, terms and phrases employed in the electrical profession with their definitions given in the most comprehensive manner. Full leather cover; 50c postpaid. Modern Publishing Co., 32 Union Sq., East, New York.

HAVE SOME OF THE FIRST EDISON INCANdescent bulbs manufactured. Just the thing for the curiosity gatherer. Will exchange for Brandes 1000 ohm Superior receiver or long-distance transmitter. Must be in good condition. B. Moran, 6 Grand St., Natick, Mass.

I HAVE 35 BOYS' BOOKS, ALL IN GOOD condition, which I would like to exchange with any one for a good loose coupler or loading coil. The value of the books is about $9. Joe L. Penny, Middle St., Haverstraw, N. Y.

FOR TRADE — THE FOLLOWING SETS OF books: Gas Engines, Architectural Drawing, Surveying and Mapping, Mechanical Drawing, etc., B flat cornet, case, mute. Want set of I. C. S. Italian text-books, language phone, records, books or anything of equal value. Charles W. Hall, Supt. Town Farm, Kittery Depot, Me.

FOR EXCHANGE — ONE 2-INCH BOX TYPE spark coil, worth $8; one antenna switch, worth $2, and one telegraph key. Wanted: A motorcycle or motorcycle engine, suitable to attach to ordinary bicycle. Will pay difference. S. C. Porter, Hamilton, N. Y.

BOUND VOLUME NO. 3 OF "MODERN ELECtrics" is now ready, which contains 740 pages, over 1,000 illustrations and writings of 300 authors, 650 articles of unusual interest, with 1,173 questions and answers. Bound in handsome black cloth, gold stamped. $1.50; $0.30 extra by mail. Modern Publishing Co., 32 Union Sq., East, New York City. (tf)

WANTED—CLAPP-EASTHAM FERRON DETECtor, rotary variable condenser and electrose, 6-inch or 10-inch insulators. Have a 50-watt dynamo, single slide tuner, 1000 ohm receiver with split head band, 6 v. 10a. storage battery and a 2 v. 40 a. storage cell. E. P. Koulsol, 436 West 23d St., New York City.

TO EXCHANGE—A PROFESSIONAL STRIKing bag for anything in wireless line, or striking-bag, football and Indian clubs for a 1½-in. Bulldog spark coil. G. Bolton, 369 Dix Ave., Detroit, Mich.

YOUR LIBRARY IS NOT COMPLETE WITHout a copy of Bound Volume No. 4 of *Modern Electrics*, containing 958 pages, with over 1,600 illustrations and 1,200 questions and answers on topics of vital importance to you. Elegantly bound in black cloth; gold stamped. Our supply is limited, so order to-day while you think of it and you will not be disappointed. Price $2.00; 40c extra by mail in U. S.; 75c extra in Canada. Modern Publishing Co., 32 Union Sq., East, New York.

WILL EXCHANGE ONE 1913 MODEL COASTER brake bicycle and one new No. 16 gauge double barrel shotgun, used very little, in perfect condition. Both cost $50. Will exchange for wireless goods. Write to R. E. Wason, Box 6, Ellsworth, Ohio.

HAVE "THE MICROSCOPE," BY PROFS. Naegeli and Schwendener, translated from the German work, "Das Mikroskop"; cost $5.50. Will exchange for science books or chemical appliances, or what have you? Frank Earl, 388 Manhattan Ave., New York City.

HAVE FOR EXCHANGE A 7 x 9 SELF-INKING foot power job press with three chases and two sets of rollers, worth $20. Also have a 12 x 15 foot power self-inking jobber, worth $30. Will exchange either or both for high grade wireless receiving instruments. Leslie Jones, Charlestown, Ind.

YOU CAN TURN YOUR SPARE TIME INTO dollars by taking subscriptions from your friends and acquaintances. You as a regular reader of MODERN ELECTRICS AND MECHANICS know its good points and can present its attractive features in a way which will readily make subscribers of your friends and acquaintances. Convince me that you are in earnest and willing to push things; send me the endorsement of three responsible business men who are willing to vouch for your fitness and I'll gladly send you your official appointment papers, together with full particulars as to how to go about the work, and how much there is in it for you. Don't delay until some one else in your territory has secured the appointment. Write your application to-day. M. C. Cooney, Manager Local Agents Department, Modern Publishing Co., 32 Union Sq., East, New York City.

WILL EXCHANGE A 1/4 KW. SENDING AND receiving wireless outfit, in first-class condition, for a motorcycle or parts, machinist lathe or bench drill. Charles Brown, Jr., 125 Bergen St., Brooklyn, N. Y.

WHAT AM I OFFERED FOR THE FOLLOWING: One set of wireless receivers, 300 ohms, nickel-plated head band, 6 ft. silk cord, one potentiometer, two snap switches, one football and one basket-ball. Storage battery preferred; also variable condenser. Percy Provan, 446 Madison St., Brooklyn, N. Y.

WILL EXCHANGE COMPLETE 1/4 KW., 200 meter sending set, cabinet mounted, finished and stained in rosewood; also receiving set consisting of loose coupler, fixed condenser, galena detector and one pair of 2000 ohm phones; value $45 to $50, for a 1 kw. transformer, manufactured, or a 1 1/2 or 2 kw. home-made. Write to Harold Winningham, 515 Second Ave., West, Seattle, Wash.

HAVE FOR EXCHANGE TWO 1 1/2-IN. COIL secondaries, 1/4 kw. transformer secondaries, wireless fixtures, etc. I want a manufactured and well-known brand of loose coupler, in good condition, or variable condenser. Write to Harold Winningham, 515 Second Ave., West, Seattle, Wash.

"HOW TO MAKE WIRELESS INSTRUMENTS," by 20 Wireless Experts, containing 96 pages and 75 illustrations, written expressly for wireless amateurs, and is a book that you cannot afford to be without. Price, $0.25 postpaid. Modern Publishing Co., 32 Union Sq., East, New York City.

FOR EXCHANGE—ONE $15 LOOSE COUPLER, one pair 3000 ohm phones and head band, one-inch spark coil, one valve detector, one hot-wire meter, one $25 battery fan and one helix. Would like the following: X-ray tube and other electrical apparatus, good revolver, photographic chemicals, papers, plates, films and apparatus. A. Bergith, 313 Deer St., Dunkirk, N. Y.

FOR EXCHANGE — ONE PLUMMER SWITCH with 20 breaks, hard rubber top, can be put right on switchboard. Has automatic releases, worth $4.50; two telephone transmitters, and one magneto generator with small pulley attached. Would like good hot-wire meter or Blitzen variable condenser or Thordarson step-down transformer. George E. Jette, 161 Summer St., Central Falls, R. I.

BOOKS, AS A RULE, ARE FILLED UP WITH technicalities and are of very little use to the experimenter, but here is a book which is simple, plain and understandable. Send your order at once for your copy of "Electricity Made Simple," Clarke Caryl Haskins, 288 pages, 108 illustrations, 12mo., cloth binding. Price $1.00 postpaid. Modern Publishing Co., 32 Union Sq., East, New York.

HAVE FOR EXCHANGE WIRELESS AND electrical instruments. Also have a lot of other things, such as Book on Wireless Telegraphy and Telephony, post card projector, hockey skates, No. 1 Brownie camera, two step-down transformers and $4 worth of magic tricks. Write for complete list of goods and descriptions. Want a large and small capacity rotary variable condenser and cat whisker detector. Murdock preferred. However, write if you have any kind of variable condensers. Albert T. Huizinga, 11002 E. Crescent Ave., Morgan Park, Ill.

WILL EXCHANGE ONE DYNAMO-MOTOR, one hydro-electric direct connected dynamo of 1-6 h.p., one 1 1/2-in. wireless coil, and one 12-in. fan motor, for a pair of hockey skates, small gasoline engine, etc., or any fair offer will be accepted. Articles are in A1 condition. J. C. Pfister, 727 Factory St., Canal Dover, Ohio.

WANTED—HIGH GRADE SENDING AND receiving outfit, complete, value not less than $50. Will give in exchange $50 equity in Richmond building lot. A. B. Helminger, care Western Union Telegraph Company, Richmond, Va.

WHAT HAVE YOU IN EXCHANGE FOR A pair of Government phones, cost $28; 3,200 ohms resistance; two home made loose couplers, a Perikon detector, costing $17; and a variable plate condenser. Would like some good make of loose coupler, either Murdock or Blitzen. J. I. Bozensky, 1064 Blake Ave., Brooklyn, N. Y.

WANTED— A 1" OR 1 1/2" WIRELESS SPARK coil, key and gap for a large rotary press and a static machine, value about $10.00. Will exchange a post card projector, value $7.00, for a good variable condenser and detector (not home made). H. E. Smeltzer, 91 Nichols St., Norwood, Mass.

JUST OFF THE PRESS — BOUND VOLUME No. 5 of MODERN ELECTRICS; contains more real information than is found in $50.00 worth of electrical books; 1,344 pages; 2,100 illustrations; 1,650 questions and answers. A veritable encyclopedia on electricity. If you are a student of electricity or desire to keep in touch with the electrical progress of the world you can't afford to be without this wonderful collection of data on inventions, illustrations and writings of leading authors from every part of the world. Positively only 39 sets left. Orders will be filled as received and money returned when supply is exhausted. Price $3.00; 65c extra by mail in U. S.; 95c extra in Canada. Modern Publishing Co., 32 Union Sq., East, New York, N. Y.

WHAT HAVE YOU TO EXCHANGE FOR THE following articles? A 1/2-KW. transformer, a 1/2-KW. spark gap, an electrolytic interrupter, a 1/2-KW. condenser, a 1/2-KW. helix and one D. P. D. T. switch. Would like good manufactured receiving instruments. Those interested, write, William Jamison, 244 W. Wash. St., Sullivan, Ind.

HAVE FOR EXCHANGE A PAIR OF 2,000 ohm phones and nickel headband for 6-60 storage battery. James J. Kertz, 243 Marion St., Brooklyn, N. Y.

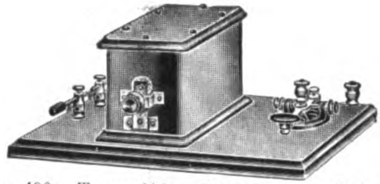
HAVE THE FOLLOWING ARTICLES TO EXchange for wireless instruments: Stamp album, with valuable collection; new 22 calibre revolver; a pair of skates size 11; Bleriot model aerophone; football, without bladder; 2 flash lights; 2 pair boxing gloves; 1 pitcher's mit; and a phone; and $3.00 set of drawing instruments. H. D. Copland, 42 Huron Ave., No. Cambridge, Mass.

WILL EXCHANGE A 35-50 WATT DYNAMO, a variable receiving condenser worth $3.50, and a loading coil worth $2.00, for a hot wire ammeter of good make or a potentiometer worth $2.00; a $2.50 loading coil and a wireless key with opal glass base worth $1.75. Other electrical goods for exchange on demand. James M. Shute, Uxbridge, Mass.

WANTED—A VARIABLE CONDENSER, PREferably a "Blitzen" rotary. I don't want a slide plate. I have for exchange a perikon detector with lathe action stand; 1-inch spark coil and key; also $3 battery motor. C. W. Jennings, 222 N. Grand St., Marshall, Mich.

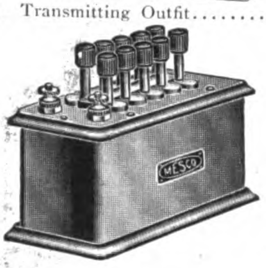
MODERN ELECTRICAL CONSTRUCTION, BY Henry C. Horstmann and Victor H. Tousley. A new revised and enlarged edition. 16mo., 368 pages, 178 diagrams. Pocket size, full leather limp. Price, $1.50 postpaid. Modern Publishing Co., 32 Union Sq., East, New York City. (tf)

No. 484. Transmitting Tuning Coil...........**$5.10**



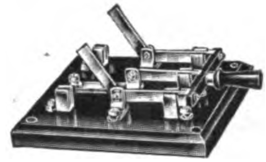
No. 490. Transmitting Outfit.........**$12.00**

No. 486. Leyden Jar, ½ pint **$1.05**



No. 439. Adjustable Primary Condenser **$5.00**

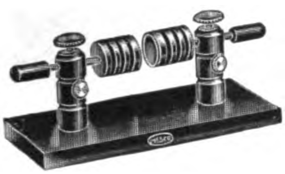
No. 452. Wireless Telegraph Key, Legless....**$1.95**



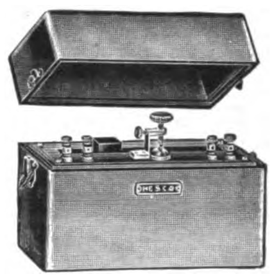
No. 416. Antenna Switch.**$2.00**

Send for Our New Manual of Wireless Telegraphy C1

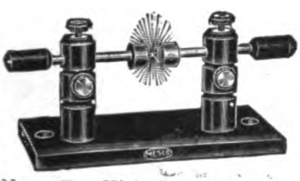
It contains 104 pages and tells how to erect and maintain wireless telegraph stations. Shows a number of diagrams. Has the Morse and Continental Telegraph Codes. Illustrates the best instruments to use; tells what they are for and how to use them. Do not wait until some other time, but sit down now and send your name and address, and get one. It costs you nothing.



No. 417. Flanged Spark Gap **$4.50**



No. 458. Receiving Set..**$7.80**



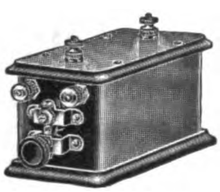
No. 465. High Efficiency Spark Gap............**$3.00**

Send for Our New Catalog C26

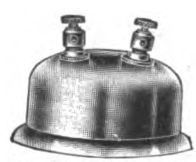
It is pocket size, contains 212 pages, with over 1,000 illustrations, and describes in plain, clear language all about Bells, Push Buttons, Batteries, Telephone and Telegraph Material, Electric Toys, Burglar and Fire Alarm Contrivances, Electric Call Bells, Electric Alarm Clocks, Medical Batteries, Motor Boat Horns, Electrically Heated Apparatus, Battery Connectors, Switches, Battery Gauges, Wireless Telegraph Instruments, Ignition Supplies, etc.

It Means Money Saved to You
to have our Manual and our Catalog when you want to buy

No. 480. Headband with two 1000 ohm receivers.**$6.06**



No. 462. Wireless Spark Coil, 1 in.............**$5.40**



No. 440. Fixed Receiving Condensers **$0.75**

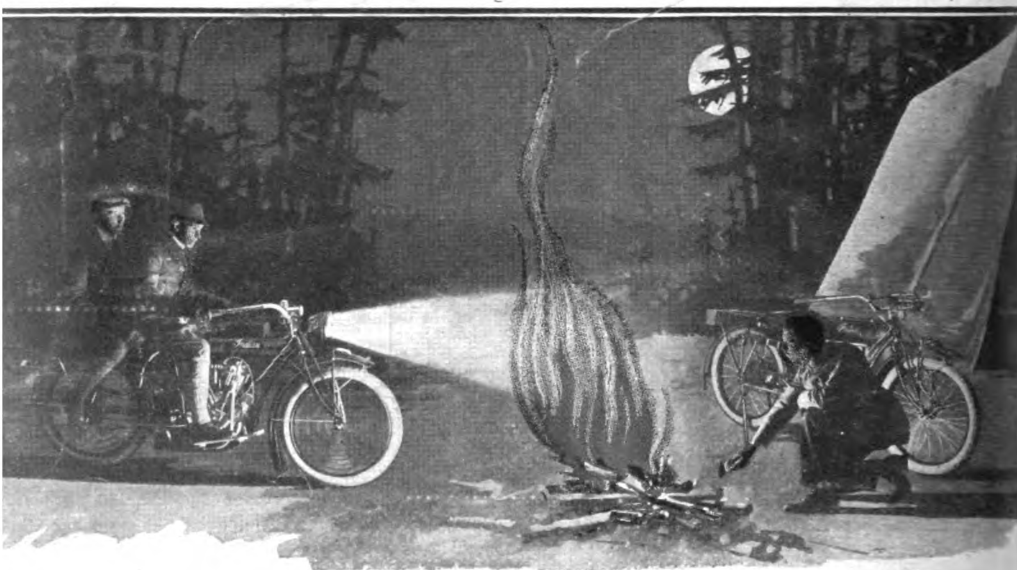
Two Books Every Wireless Operator Should Have

AMATEURS' WIRELESS HANDY BOOK . . . . . . Price $0.25
LESSONS IN WIRELESS TELEGRAPHY . . . . . . Price 0.25

Manhattan Electrical Supply Co.

NEW YORK 17 Park Place — **CHICAGO** 114 S. 5th Ave. — **ST. LOUIS** 1106 Pine St. — **SAN FRANCISCO** 604 Mission St.

FACTORIES—JERSEY CITY, CINCINNATI, RAVENNA, OHIO



The Out-of-door Life!

MOUNTED on a sturdy, fast Indian you are in command of everything that's going on, far and near. Shore and country—short trips or long trips—the whole out-of-doors is yours when you own a motorcycle. The zest of riding, with its rush of pure air—as you roll off mile after mile—gives a new exhilaration, just makes life hum with fresh delight!

What point of interest do you want to reach quickly? Throw a leg over an Indian—give a "twist of the wrist"—and off you go.

Indian MOTOCYCLES FOR 1914

are powerful and swift red beauties. All have Footboards, the famous comfort feature, the Cradle Spring Frame and 38 Betterments. Some have electric equipment, consisting of electric head light, electric tail light, electric signal, two sets of storage batteries. Also Corbin-Brown rear drive speedometer.

Prices have been revised downward—mechanical values increased—so that almost every young man can own an Indian with a little effort.

And remember this: All Indian riders have a world-wide service always on call, provided by 2,700 Indian Dealers and Service Stations.

The 1914 Line of Indian Motocycles

4 H. P. Single, Service Model	$200.00
7 H. P. Twin Two-Twenty-Five, Regular Model	225.00
7 H. P. Twin Two-Sixty, Standard Model	260.00
7 H. P. Twin Light Roadster Model	260.00
7 H. P. Twin Two-Speed, Regular Model	275.00
7 H. P. Twin Two-Speed, Tourist Standard Model	300.00
7 H. P. Twin Hendee Special Model (with Electric Starter)	325.00

Ask the nearest Indian dealer for a free demonstration. He'll be glad to talk the Indian over with you. Send for the new 32-page catalog.

HENDEE MANUFACTURING CO. (Largest Motorcycle Manufacturers in the World) **880 State St., Springfield, Ma**

Branches and Service Stations—Chicago, Dallas, Kansas City, Minneapolis, San Francisco, Atlanta, Denver, Toronto, Melbourne, Lon