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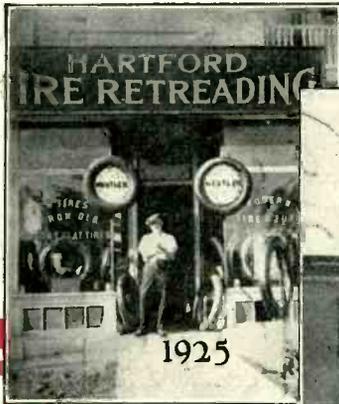
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THE EXPERIMENTER

THE DREAM RECORDER

See Page 398



40
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RADIO
ARTICLES



"Read the facts about the amazing growth of Nestler Licensees. Make this success your own!"



EMIL NESTLER, discoverer of the Nestler Rubber Fusing Process, is the recognized authority on tire retreading.

From \$780 year store to \$8200 year building in one year

Your community, too, needs Nestler Service

WHAT these two Hartford men have done, you too can do. Early in 1925, they secured a license to operate the patented Nestler Rubber Fusing Process in Hartford, Conn., and opened for business in a small \$65 a month store. In twelve months they built up the largest tire servicing business in the state with no previous tire experience. An \$8200 a year building has just been taken to give room to take care of a steadily increasing demand.

What is the Nestler Rubber Fusing Process and what does it do? Only a bare outline can be given here. It is a patented Process producing a de-vulcanization of rubber, by which a positive fusion or welding of new and old rubber can be produced at will. Nothing like it has ever been employed before. It makes possible the first practical and successful method of retreading pneumatic auto and truck tires, doubles the mileage at one-third the price of a new tire and saves car owners 50 per cent of their tire bills. It is creating a brand new industry.

An Enormous Market

A thousand miles of use takes but a few ounces of rubber from the tread of your tires. A tire considered worn out because of tread wear has actually lost only 15 per cent of its cost. Of the more than 34 million tires which are now annually junked, a large proportion could be made to do *double duty* with the Nestler Rubber Fusing Process. Since it was patented in 1920 the Nestler Rubber Fusing Process has been in practical use. Hundreds of

thousands of tires are now being successfully Nestlerized annually.

Be President of Your Own Company

Think of the opportunity for a Nestler Rubber Fusing Station in your community. Previous experience unnecessary. Only moderate capital required. Earnings of \$4,000 to \$15,000 and more annually are now being made by Nestler Operators. Records of growth similar to the one in Hartford are being made all over the country!

The Nestler Rubber Fusing Process is not only a better method of tire servicing, but is also more simple, cheaper and faster than any other method on earth.

Any man of average intelligence can master the Nestler Process in a few days time. Free instruction in the Nestler Rubber School or by mail is given all licensees. New plan makes it possible to *earn while you learn*.

The Nestler Plan

The Nestler Plan gives the full facts concerning the Nestler opportunity. It tells the methods used by the Hartford Tire Retreading Co., and hundreds of other successful Nestler Operators throughout the world in building prosperous businesses in their communities. Write for it today and we will also send you a copy of the Nestler catalog and a history of tire servicing methods which will show you the great advantages you will have. This is a proven, new and uncrowded field of business with an enormous demand and unlimited possibilities for growth. Present conditions are all favorable due to high tire prices. Write for the books today.



New Tires From Old. That is the Nestler Message in a nutshell.



NESTLER RUBBER FUSING CO., Inc.
Dept. J-9, 245 W. 55th Street, New York, N. Y.

WRITE FOR IT TODAY!

MAKE BIG MONEY IN ELECTRICITY!



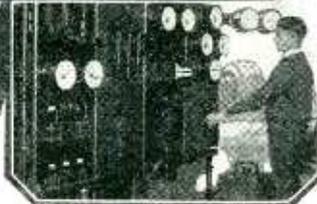
800% Pay Increase "I now make 8 times what I earned when I enrolled. I used to get \$50 a month—now it's \$400." Carroll Moeschler, Chaska, Minn.



\$9,000 a Year Auto Electricity pays W. E. Pence, Albany, Ore., over \$9,000 a year. 58 men enrolled for this training on his recommendation.



\$1,000 a Month John Jirinec, 336 Ditmars Ave., Astoria, L. I., now earning \$12,000 a year, says, "Cooke Training is responsible for my big income."



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\$700 in 24 Days "Thanks to you, I made \$700 in 24 days in radio," says F. G. McNabb, 7 W. 16th St., Atlanta, Ga. "I recommend your training everywhere."

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Send the Coupon below for full particulars of my great pay-raising training—the training that has fitted thousands of men for jobs paying \$3500 to \$10,000 a year in Electricity



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Don't you keep on working for \$25 or \$35 a week. Get into Electricity. Thousands of Cooke Trained Men who knew nothing about it a short time ago are now earning \$70 to \$200 a week as Electrical Experts—and they don't work half as hard as you do. Why stick to your small pay job? Why stick to a line of work that offers no chance—no promotion—no big pay? Get into the world's greatest business. Electricity needs you. I'll show you how to do it. Get ready for the big-pay job now.

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EDITORIAL & GENERAL OFFICES: 53 Park Place, New York City

GENERAL ADVERTISING DEPT.: 53 Park Place, New York City

Published by Experimenter Publishing Company, Inc.
(H. Gernsback, Pres.; S. Gernsback, Treas.; R. W. DeMott, Sec'y.)

Publishers of SCIENCE & INVENTION, RADIO NEWS,
RADIO INTERNACIONAL, RADIO REVIEW and AMAZING STORIES

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Could Noah's Ark Hold All the Animals?

The modern scientific viewpoint is illustrated and described in an interesting way. You will enjoy it.

How North Pole Airplane Flight Was Navigated

How Commander Byrd navigated his airplane to the North Pole and back, explained with simple diagrams by an aeronautical engineer.

Winter House Garden

An interesting and seasonal article by the well-known authority on flowers, Dr. Ernest Bade.

Pipe Contest

What can you do with iron or other pipe and fittings? New prize contest will appear in the next number.

How to Read Blueprints

A subject which is engaging the attention of more people than ever before. This article will be profusely illustrated with photos and diagrams, making the subject as plain as A B C.

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SCIENCE AND INVENTION is published on the 10th of each month. There are 12 numbers per year. Subscription price is \$2.50 a year in U. S. and possessions. Canada and foreign countries \$3.00 a year. U. S. coin as well as U. S. stamps accepted (no foreign coin or stamps). Single copies, 25 cents each. A sample copy will be sent gratis on request. All communications and contributions to this journal should be addressed to Editor, SCIENCE AND

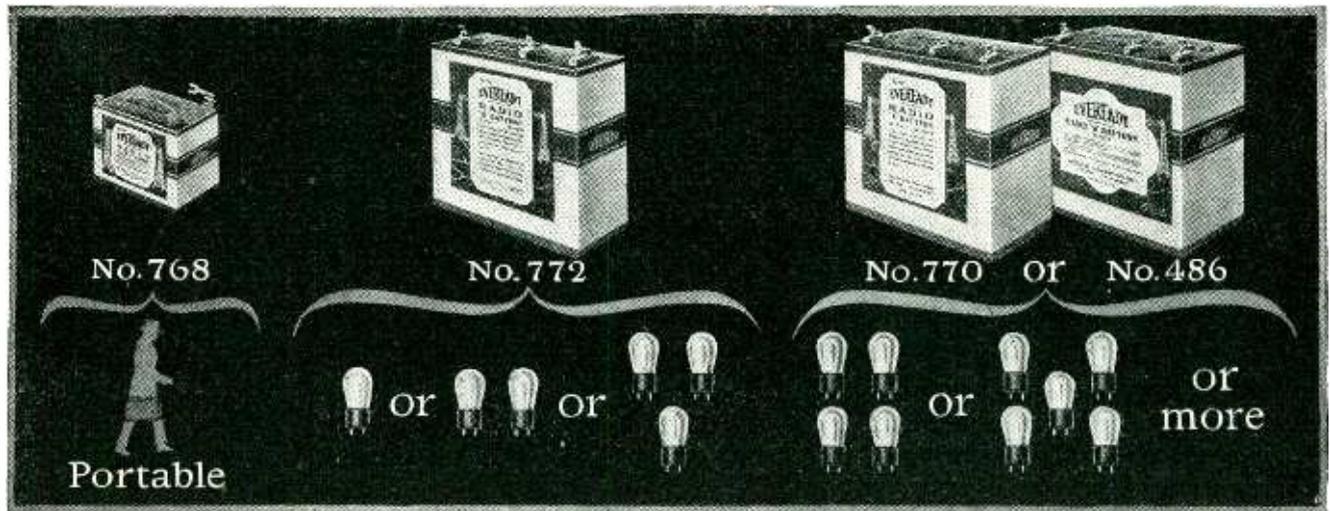
INVENTION, 53 Park Place, New York City, N. Y. Unaccepted contributions cannot be returned unless full postage has been included. ALL accepted contributions are paid for on publication.

SCIENCE AND INVENTION. Monthly. Entered as second class matter May 10, 1924, at the Post Office at New York, N. Y., under the act of March 3, 1879. Additional entry at Long Island City, N. Y., and

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T. F. Magrane Finucan & McClure A. J. Norris Hill Co. Davies & Dillon
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THOUSANDS of people have made the discovery that Eveready "B" Batteries, when used in the proper size, and on sets equipped with a "C" battery*, are a most economical, reliable and satisfactory source of radio current.

Here is the secret of "B" battery economy, reliability and satisfaction:

On all but single tube sets—Connect a "C" battery. The length of service given below is based on its use.*

On 1 to 3 tubes—Use Eveready No. 772. Listening in on the average of 2 hours daily, it will last a year or more.

On 4 or more tubes—

*NOTE: A "C" battery greatly increases the life of your "B" batteries and gives a quality of reception unobtainable without it. Radio sets may easily be changed by any competent radio service man to permit the use of a "C" battery.

Use the Heavy-Duty "B" Batteries, either No. 770 or the even longer-lived Eveready Layerbilt No. 486. Used on the average of 2 hours daily, these will last 8 months or longer.

These figures are based on the average use of receivers, which a country-wide survey has shown to be two hours daily throughout the year. If you listen longer, of course, your batteries will have a somewhat shorter life, and if you listen less, they will last longer.

Evereadys give you their remarkable service to the full only when they are correctly matched in capacity to the demands made upon them by your receiver. It is wasteful

to buy batteries that are too small. Follow the chart.

In addition to the batteries illustrated, which fit practically all the receivers in use, we also make a number of other types for special purposes. There is an Eveready Radio Battery for every radio use. To learn more about the entire Eveready line, write for the booklet, "Choosing and Using the Right Radio Batteries," which we will be glad to send you on request. There is an Eveready dealer nearby.

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| WCAE—Pittsburgh | St. Paul |
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HOW TO INVENT— WHAT TO INVENT

and What to Do About Protecting and Selling An Invention

ALTHOUGH the fact has been universally recognized that Invention is governed by a few simple, easily acquired, fundamental principles, no one ever thought of putting these principles in black and white so that everybody interested in invention could read them. In spite of the fact that Thomas A. Edison made his famous statement that invention should be taught as a science, thousands of people continued to work blindly, doggedly, haphazardly to perfect their ideas.

But now anyone can learn how to invent. Fifteen famous inventors have at last given to the world the laws and principles of Inventive Science. They have shown every ambitious man and woman how to invent. They are teaching Invention exactly as other people are teaching law, medicine, bookkeeping. Instead of spending years groping blindly, instead of wasting your time in useless, heartbreaking drudgery, you learn how to complete your ideas quickly *and what to do about them* when they are completed. You learn how to think so you are sure to succeed.

Everybody Invents

For a long time it was commonly believed that every invention was a matter of pure luck—the result of some happy inspiration that suddenly flashed through a man's brain, and which made him fabulously rich without the slightest effort or thought. But you can prove for yourself that this is not so. You can prove for yourself that invention is the result of thinking and action along definitely exact, scientific lines.

Suppose when you went home tonight you found a window rattling. Through your mind would flash, almost instinctively, a regular order of thoughts which characterize the conception and completion of every invention the world has ever known. First, you would recognize a problem to be solved—the rattling of the window. Then you would think of several principles of science or mechanics which would solve your problem. You might think of the scientific fact that if you poured water on the frame the wood would swell and tighten the window. You might think of using a nail. But what you most poobably would do would be to use the oldest mechanical principal known to man, the wedge.

What Invention is

Brought down to its simplest terms, that is exactly the way every invention has been made—combining two ideas; a problem

- How to develop your imagination
 - How to develop your ideas
 - How to get the facts you need for inventions
 - How to keep legal records of ideas
 - How to use scientific principles of mechanics
 - How to avoid wasting time on impractical inventions
 - How to apply for a patent
 - How to organize a company
 - How to protect your rights
 - How to market a patent
- and hundreds of other vitally important facts which EVERY successful inventor knows and uses.**

which must be solved and a fact of mechanics or science which solves the problem. So, although you may never have thought of it just this way, every time you solve a problem in your daily life—at home, traveling, or in business—you are an inventor; you use the principles of thought and action which govern the Science of Invention!



Raymond F. Yates, who with fourteen other famous inventors now makes it easy for you to learn how to invent in your spare time at home.

You can see, therefore, how easy it is for you to develop your natural instinct to "fix things." The same processes of thought that almost instinctively told you to fix a rattling window with a wedge can be so well developed that you can learn to invent other things almost as easily and quickly. You know, too, that every invention is made only by thinking inventively. And every inventor is agreed that the principles of Inventive Science are so simple, so

easy to learn that anyone, regardless of training or education, can develop himself to become a successful inventor!

With every new advance, with every new discovery that the world experiences, more problems are coming up—and more inventions are needed to solve these problems. Now, as never before, are new inventions wanted, and the world will pay a fortune to the man or woman who gives it just one of the inventions it needs.

Even little ideas can bring you a fortune. Eberhard, who invented the rubber on the end of a pencil, has been paid hundreds of thousands of dollars for his simple idea. The man who invented the metal tip for shoelaces, the man who conceived the idea of the "humped" hairpin, the man who developed the metal tape measure, all have achieved success and wealth as great or greater than the inventors of large machinery.

Learn How to Invent at Home

If you would like to develop your natural inventive ability along *money-making* lines, instead of trifling with ideas—if you would like to **DO** something about your ideas instead of letting someone else patent

and market them ahead of you, let this great Course in Inventive Science help you. Get the advice and help of the fifteen famous inventors who tell you the secrets of invention which you **MUST** know to be successful.

This is the first course in practical invention that has ever been devised. In simple, easy-to-understand language you are told how successful inventors work; you learn how to think along inventive lines, you learn the short-cuts to successful invention; you learn how to use the secrets of invention that convert a simple little idea into money.

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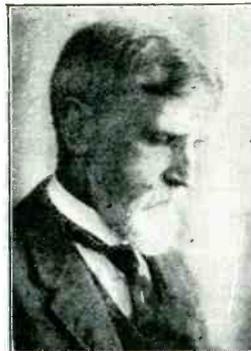
J. J. KELLY.

I am but half way through your course and am certain that I have saved my Company many times the cost of the course and raised myself in the Share Holders estimation. The knowledge obtained has its immediate practical application and I do not hesitate in saying your course and the personal attention you give is invaluable to the practical man in any business where chemistry plays a part. You may use this letter and my name and address to the furtherance of your good work.

JOHN WALTER.

I have not written since I received the big set. I can still say that it far exceeded my anticipations. Since I have been studying with your school I have been appointed chemist for the Scranton Coal Co., testing all the coal and ash by proximate analysis. The lessons are helping me wonderfully, and the interesting way in which they are written makes me wait patiently for each lesson.

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S. I. Sept.



Afraid of My Own Voice But I Learned to Dominate - Others Almost Overnight

SUDDENLY the boss turned to me and queried, "Well, Conroy, what's your opinion?" They all listened politely for me to speak and in the silence I heard my thin, wavering voice stammering and sputtering a few vague phrases. Like a flash Stoddard interrupted me and launched on a brilliant description of his plan. All sat spell-bound as he talked—my views were forgotten—and yet I have been studying the problem for months and I was prepared to suggest a sound, practical plan which I knew would solve all our difficulties.

And that was the way it always was—I was always being given opportunities to show my ability and always failing miserably. I was bashful, timid, and nervous—I never knew how to express myself, how to put my ideas across. In fact, I was actually afraid of my own voice! Constantly I saw others with less ability, less experience than I being promoted over my head—simply because they had the knack of forceful speech, self-confidence, and personality—the very qualities I lacked.

In social life, too, I was a total loss—I was always the "left-over"—the one who sat back and watched the others have a good time. I seemed doomed to be an all around failure unless I could conquer my timidity,

my bashfulness, my lack of poise and inability to express myself.

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And then suddenly I discovered a new easy method which made me a powerful speaker almost overnight. I learned how to bend others to my will, how to dominate one man or an audience of thousands. Soon I had won salary increases, promotion, popularity, power. Today I always have a ready flow of speech at my command. I am able to rise to any occasion, to meet any emergency with just the right words. And I accomplished all this by developing the natural power of speech possessed by everyone, but cultivated by so few—by simply spending 15 minutes a day in the privacy of my own home to this most fascinating subject.

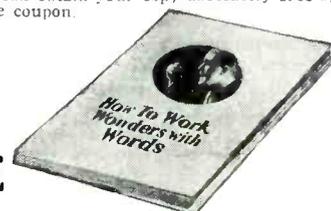
There is no magic, no trick, no mystery about becoming a powerful and convincing talker. You, too, can conquer timidity, stage fright, self-consciousness and bashfulness, winning advancement in salary, popularity, social standing and success. Today business demands for the big, important high-salaried jobs, men who can dominate others—men who can make others do as they wish. It is the power of forceful, convincing speech that causes one man to jump from obscurity to the presidency of a great corporation; another from a small, unimportant territory to a sales-manager's desk; another from the rank and file of political workers to a post of national importance; a timid,

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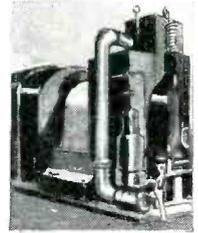
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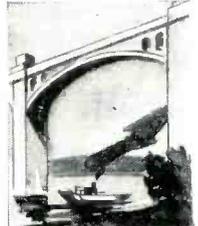
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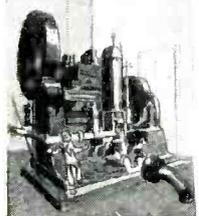
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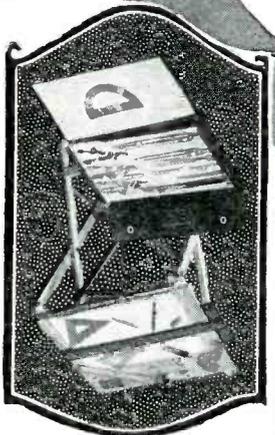
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"Those Who Refuse to Go Beyond Fact Rarely Get As Far As Fact" - - - HUXLEY

SCIENTIFIC WEATHER FORECASTING

By HUGO GERNSBACK

If any one had predicted, 500 years ago, the exact occurrence, to the second, of a solar or lunar eclipse for the coming year, or for ten years in advance, he would probably have been executed or burned at the stake, without much ado, for witchcraft. Astronomy, as we know today, is an exact science, and it is possible now to predict eclipses with certitude within a few seconds of their actual occurrence, not only for one year ahead but for centuries and thousands of years in the future, if necessary.

Weather predicting, particularly long-range weather predicting, has not been much of a success heretofore. The reason was that it was not founded upon an exact science. We do know, however, that the sun must of necessity be responsible for our weather in general. We know that it is the sun that, through its electromagnetic rays, transformed into heat in the outer layers of the air, has an important relation to the weather.

It is known to science that in the upper regions of our atmosphere the air currents are always about the same, while on certain parts of the earth, due to rotation of our planet and to solar activity combined, we have certain trade winds at almost exact times of the year. From such data it is not possible to make exact weather predictions because other variable data, up to this time, has been missing. This variable data has now been studied for a number of years by Dr. Charles G. Abbot of the Smithsonian Institute, who has recently discovered new proofs that the amount of heat given off by the sun from day to day, and from year to year varies. It is believed by Dr. Abbot that from such data that can be ascertained accurately, it will be possible in time to make long range weather predictions.

For some thirty years Dr. Abbot has been investigating sun phenomena and has measured the heat which it sends indirectly to the earth. In true scientific fashion, Dr. Abbot made measurements with exceedingly accurate instruments at various points of the earth, such as Mt. Wilson and Mt. Whitney, in California, at Bassour, Algeria, at Mt. Harqua Hala, in Arizona, and at Mt. Montezuma, in Chile, South America. He constructed wonderfully sensitive instruments, capable of measuring the millionth part of a degree change in temperature, with which to effect the intricate heat measurements.

Dr. Abbot plotted the measurements of the total quantity of heat received on the earth's surface. On the same paper he then plotted the solar constant-values over a number of years. These solar constant-values are the result of the measurements of the total quantity of heat received on the earth's surface, and then corrected measurements of the loss

of heat through the earth's atmosphere so as to indicate the values as found, for instance, on the moon. The two results were closely parallel.

Not content with this Dr. Abbot also plotted the average number of sun spots for July of the same years on the same paper, and the harmony was again apparent. With this accomplished, the next step was to make the daily measurements of solar radiation as accurately as was humanly possible. The National Geographic Society has already donated \$55,000 to establish a solar observatory at Mt. Brukkaros, in southwest Africa, in order to co-operate with Dr. Abbot's two existing stations in California and Chile. The outcome of all this will be that during the next few years it is hoped that by these methods it will be possible to accurately foretell weather conditions for any part of the world for weeks, and in some cases, months, ahead.

The problem is one of great complexity, because there are so many variable factors that enter into the calculation of such problems. For instance, the percentage of moisture in the air is most important and must be accurately known. This is easily ascertained by instruments which are already in use. Another and vital variable is contained in volcanic dust thrown out by volcanoes of the earth from time to time. Such volcanic dust is thrown up to great heights and the impalpable dust stays in the upper regions of the atmosphere for many months. The dust in this case acts as a sort of screen, and cuts off solar radiation, hence, during a volcanic outbreak, experience has shown that cooler weather may be expected, because less solar radiation reaches the earth.

Dr. Abbot in his selected measurements, made for the month of July for the years 1910 to 1920, was careful to omit the years 1912 and 1913, because the volcano of Mt. Katmai, in Alaska, filled the atmosphere of the whole northern hemisphere with volcanic dust during those years.

Then there is the matter of meteoric dust, which is thrown a number of times during the year, into the atmosphere. Every time a meteor strikes the upper regions of the atmosphere, the meteor becomes volatilized, acting in an analogous manner to volcanic dust. Swarms of meteors hit our atmosphere almost constantly, there being hardly an hour during the day when such bodies do not strike us, while at other times

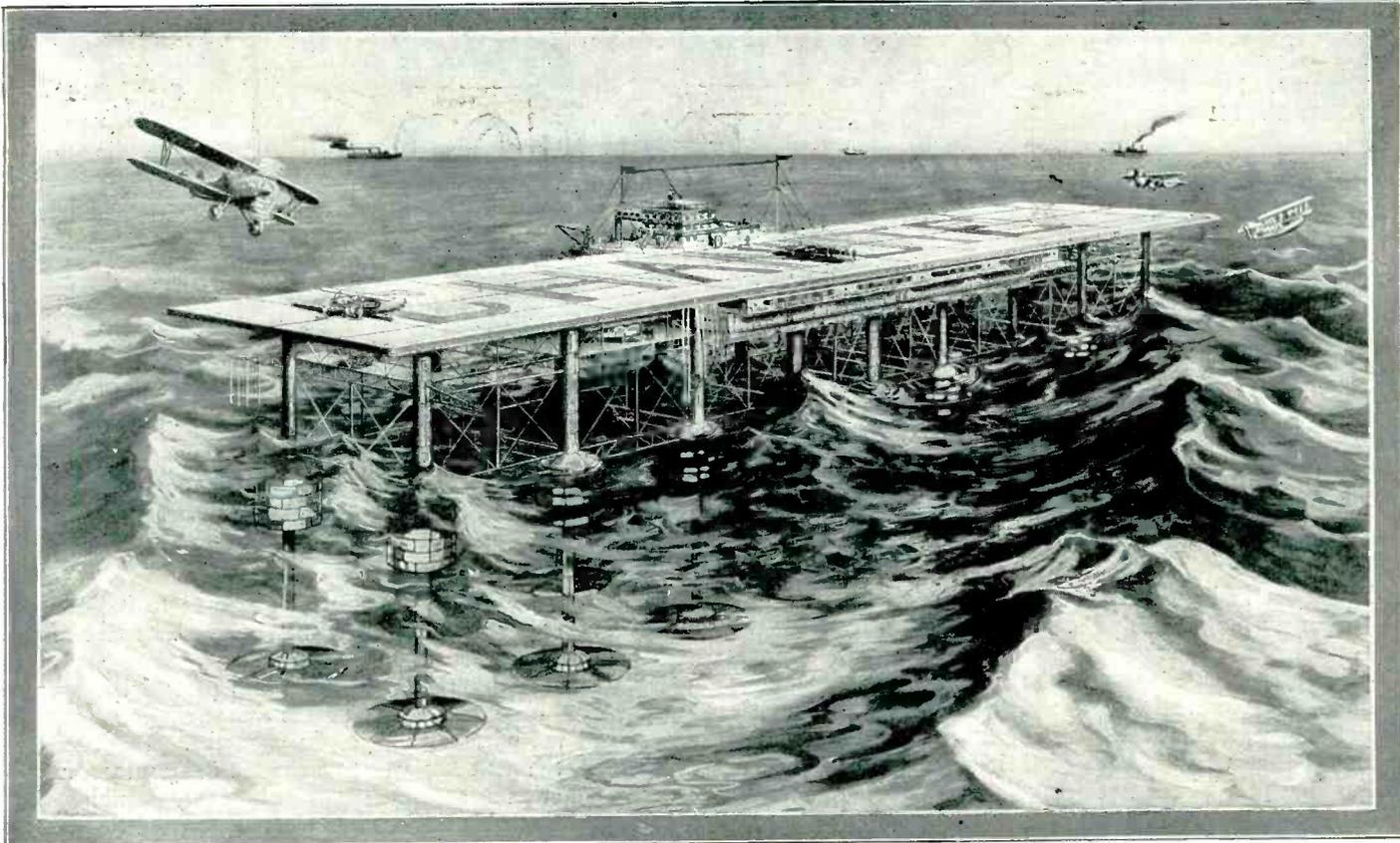
during the year, whole swarms pass through the upper air. It is very likely, however, that a mean value can be found for this meteoric dust, which will greatly facilitate long range weather forecast.

The far-reaching import of these researches can not be appraised too highly. From an economic standpoint alone their value is truly tremendous.

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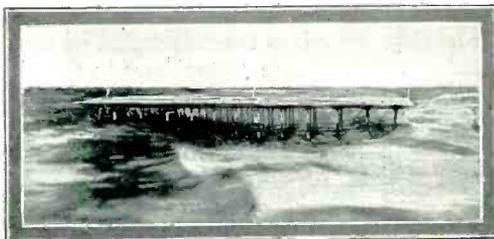
Mr. Hugo Gernsback speaks every Monday at 9 P. M. from Station WRNY on various scientific and radio subjects.



Above we behold one of the eight seadromes or airplane landing stations spaced 400 miles apart across the Atlantic Ocean, as proposed by a well-known American engineer, Mr. Edward R. Armstrong, of Wilmington,

Delaware. These huge landing stages would be about eleven acres in extent, measuring 200 ft. by 840 ft. They would have deep draught, as great as 150 ft., so as to have their buoyancy chambers and legs below the wave depth.

Ocean Stations for Airplanes



Photograph at left shows scale model of the Armstrong ocean landing stage under test in tank with waves 70 ft. high. Note that this remarkable design of platform preserves a practically level surface, while the waves break through it rather than against it.

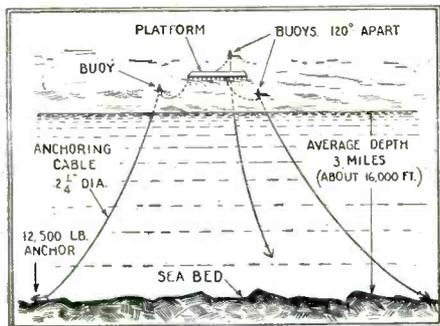


Photo at right shows model of seadrome and also model of steamship "Majestic" under test in tank with 50 to 60 ft. waves; note that platform is practically level, while steamship "Majestic" is diving downward, practically overcome by the huge waves. The average height of ocean waves is 50 ft.

STARTLING as it may seem, a prominent American engineer, has actually worked out the technical details for an ocean landing platform or seadrome, on which Trans-Atlantic airplanes can land. One of the most interesting questions that arise in connection with such a project is that of anchoring the seadromes along the route across the ocean. Mr. Edward R. Armstrong of Wilmington, Del., chief research engineer for the famous Du Pont Powder Company, is the man responsible for this latest development in trans-oceanic air travel, and as the accompanying drawings

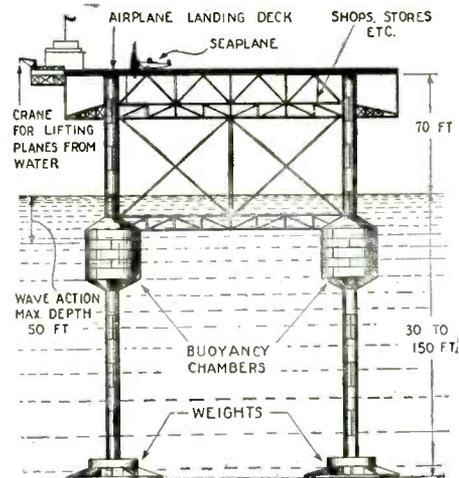
show the platforms are to be anchored by three steel cables, extending down through three miles of water in some cases to 12,500 pound anchors. The platform can shift back and forth as waves and storms may dictate, and plenty of latitude is permitted due to the long cables. If the platform should move half a mile or more, it would make no difference to the airplane pilots.

ing capacity being occupied by fuel; the same airplane using Mr. Armstrong's scheme can carry forty passengers. Based on 100,000 passengers per year, the annual difference in cost in favor of the sea station route is \$14,080,000. Mr. Armstrong's scheme calls for 24 planes total, while without sea stations 240 planes are required.



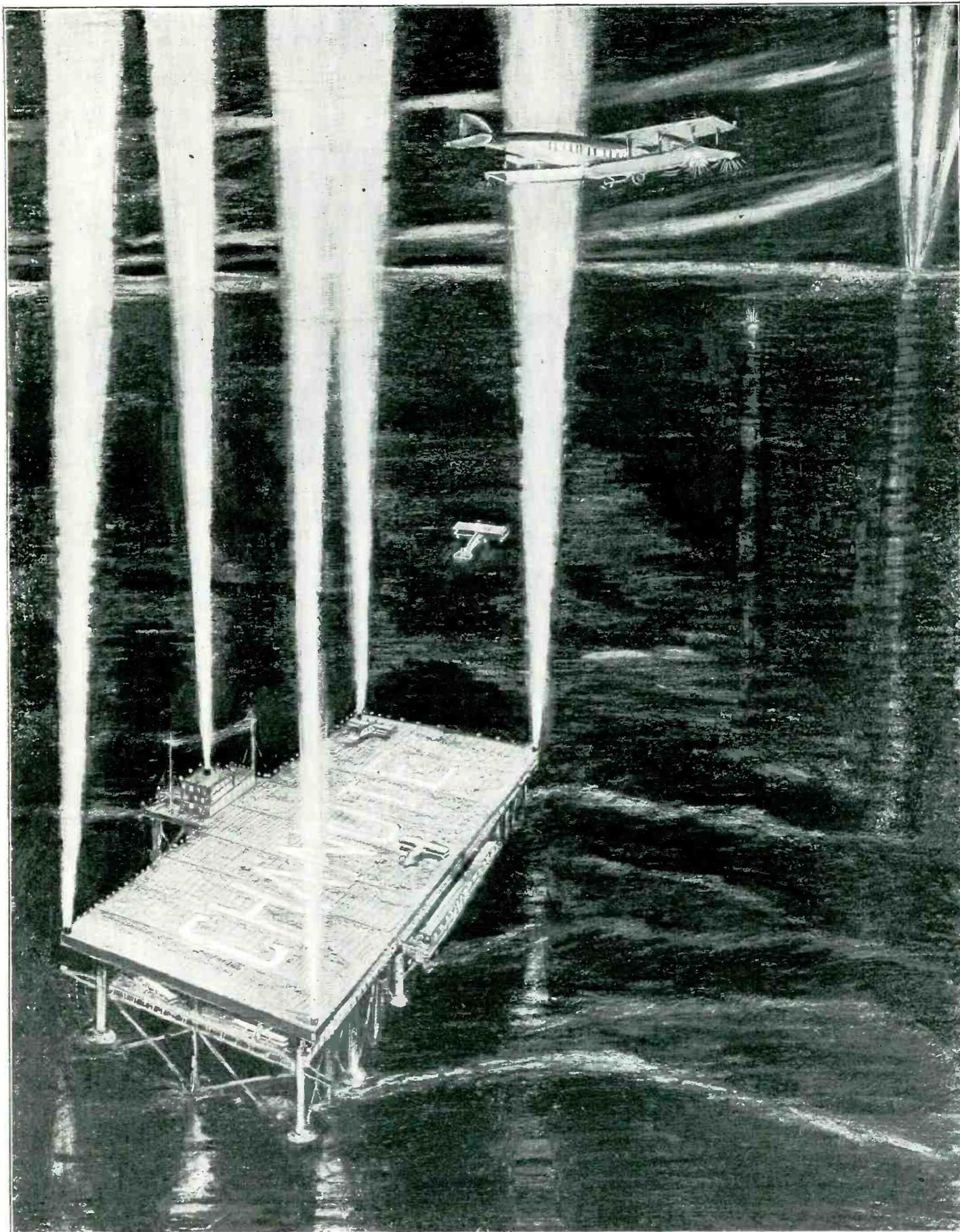
Method of anchoring seadrome, utilizing stranded steel cables 2 1/4 inches in diameter.

As the picture on the opposite page shows, the seadromes would be marked at night by powerful colored searchlight beams, each station having its own particular color. Located fifty miles apart along the airplane route would be marker buoys, each buoy being illuminated automatically as darkness approached. The eight large seadromes, each measuring 200 ft. by 840 ft. and covering 11 acres, would be veritable floating hotels. Repair shops and storage space are provided for in the present designs of Mr. Armstrong, and radio as well as other signalling means are arranged for. Each station has its own name which is illuminated at night. The inventor has prepared tabulated data proving that this is the only feasible method for transporting passengers across the ocean for the principal technical reason that if no such sea stations are utilized, then the planes can only carry about four passengers, the balance of their carry-



End view of seadrome. The buoyancy chambers can be placed below the wave action depth.

How Airplanes May Skip Across Ocean

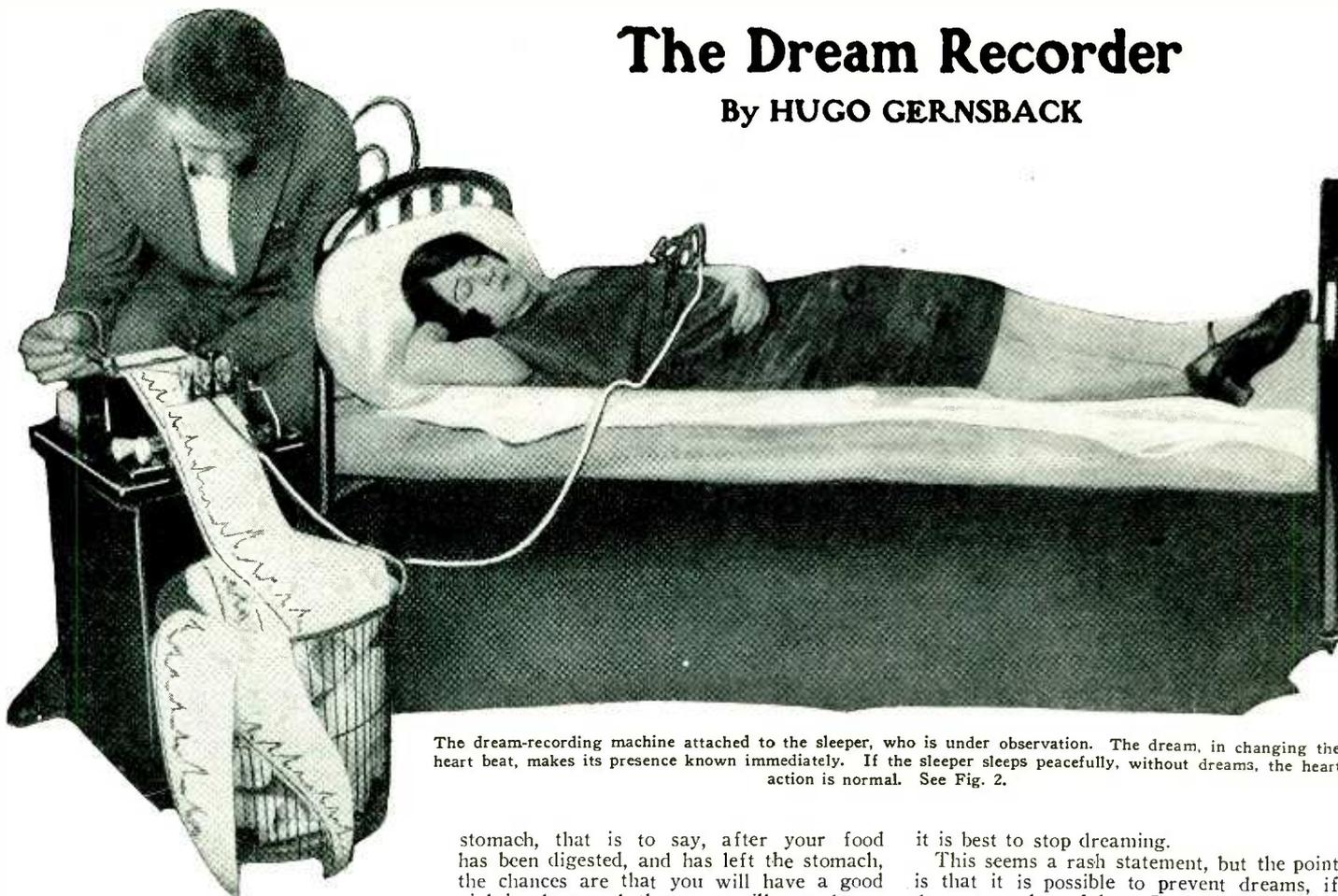


THE realistic night scene above shows two of the Armstrong seadromes or landing stations for airplanes, as they wing their way across the Atlantic from America to England. Each station would have its own colored searchlights, enabling the pilots to distinguish each station if necessary. Located 50 miles apart along the aerial route are illuminated buoys anchored in position by cables and anchors. The large plane shown above has a

capacity of 40 passengers and luggage and carries signal as well as landing lights. Hotel accommodations are provided on each platform for those desiring to stay over night. Owing to the clever design of these landing platforms, the waves break through them rather than against them. The buoyancy chambers supporting the platform are placed deep enough to escape the wave action, extending about fifty feet maximum.

The Dream Recorder

By HUGO GERNSBACK



The dream-recording machine attached to the sleeper, who is under observation. The dream, in changing the heart beat, makes its presence known immediately. If the sleeper sleeps peacefully, without dreams, the heart action is normal. See Fig. 2.

WELL, how did you sleep last night?" says your host, as he pats you on the back.

"Fairly well," you retort, "But that Welsh Rarebit gave me such a beastly nightmare I couldn't go to sleep again for a few hours."

This is the sort of conversation we hear very frequently, but we laugh it off, and the world moves on.

Few people, if any, ever give a thought to the reason for our dreaming. From ancient times on, dreams have been looked upon with great superstition, and even today

dream books are consulted for an interpretation of this or that dream. The mechanics of the dream itself, from the psychological viewpoint, have been studied by many philosophers and scientists, but few, if any, ever gave any thought to the primary cause of dreaming.

PRIMARY CAUSE OF DREAMS

It may be said that 90 per cent. of our dreams lead right back to our stomachs. That this has not been recognized more widely has always been a mystery to me. It is, therefore, not the brain that is primarily responsible for dreams, but, rather, the stomach. If you go to sleep with a comparatively empty

stomach, that is to say, after your food has been digested, and has left the stomach, the chances are that you will have a good night's sleep and that you will not dream at all. Of course there are exceptions to this, as to anything else, but in the great majority of cases you will find that this is the truth.

When you have slept "like a top," it simply means that you have not dreamt. The person who sleeps best, and is most refreshed by sleep, is that person who does not dream. The term "pleasant dreams" should be abolished, as soon as possible. There is no such thing, in my opinion, as a "pleasant" dream. *All dreams, whether pleasant or unpleasant, interfere with your rest, and if you do need the rest and do wish to wake up refreshed in the morning, then*

it is best to stop dreaming.

This seems a rash statement, but the point is that it is possible to prevent dreams, if dreams are harmful, as I shall show. Most foods take anywhere from two to six hours to digest. Some foods take even longer than this. The table reproduced herewith shows this clearly. Due to means not exactly understood today, there is an unusual nervous reaction between the stomach and the brain, while we are asleep, so that a full stomach with slow-digesting food causes constant dreaming, often of the nightmare kind.

My own theory is that the process is somewhat as follows: The minute you lie down and sleep, and the stomach is still working while digesting its food, the gases usually thus developed, press against the heart,

causing an oppressed feeling, which is then, by nervous reaction, reflected to the brain, thereby inducing harmful dreaming.

FATAL DREAMS

This kind of dream is distinctly dangerous, often even fatal. A great many people die in their sleep. For instance, Mr. William Jennings Bryan died in such a sleep. It is quite probable that sleepers of this kind meet their death directly due to nightmares, or other fear-inducing dreams. For example, if, during a nightmare, as happens to all of us, we fly through space, or fall down a precipice, we usually wake up all covered with perspiration, and the heart beating violently. If the heart is sound, no

DIGESTION OF DIFFERENT FOODS IN STOMACH

These foods leave the stomach in two to three hours:

Boiled Milk, Eggs, raw, poached, or omelet; Beef Sausage, Sweet-breads, Oysters, Whitefish, Shellfish, Asparagus, White Bread, Rusks, and Biscuit.

These foods leave the stomach in three to four hours:

Chicken, Lean Beef, Boiled Ham, Roast Veal, Beefsteak, Salted Caviar, Coarse Bread, Boiled Rice, Boiled Cabbage.

These foods leave the stomach in four to five hours:

Smoked Tongue, Smoked Beef, Roast Goose, Salt Herring, Lentil Porridge, Pease Porridge.

An ordinary dinner leaves the stomach in four to five hours. Foods are divided into four groups, according to the ease with which they are digested. The first group contains the most easily digested foods:

(1) Beef Tea, Milk, Soft or Raw Eggs, Biscuit.
(2) Boiled Calves' Brains, Sweetbread, Boiled Fowl, Pigeon, Calves' Feet.

(3) Scraped, underdone Steak, Potato Puree, Stale Bread.

(4) Roast Chicken or Pigeon, Roast Veal, Cold Roast Beef, underdone, Whitefish, Macaroni, Rice, Chopped Spinach.

NOTE: There are exceptions to all of these, because food is digested more quickly by working men who consume energy than by those who sit still or lie down.

damage results, but if the heart is defective, often a heart stroke or the bursting of blood vessels occurs, with the immediate death of the victim. *Any one with a weak heart, therefore, should never indulge in heavy food before going to sleep, whether it be an afternoon nap, or the night sleep. If he does, a fatality may result, directly due to a dream.*

Even the most pleasant dreams, which have nothing to do with the digestive organs, affect the heart action. You may sleep with a totally empty stomach and still have a dream. In that case it probably never is a fear-inspiring or nightmare type. It is of the variety termed a "pleasant dream." A dream may be induced in a sleeper by scent, or perfume, by a slight noise in the room, by touching the sleeper's body at any point, by a change of temperature, by a change of barometric pressure, by a nervous shock during the day, and a thousand and one other means. Such dreams are of a very short duration, as a rule, and do not greatly interfere with the sleep itself, although I maintain that it is best not to dream at all.

IF YOU DREAM—SEE YOUR DOCTOR

For that reason, if you are inclined to dream much, you should consult a physician and re-arrange your diet in such a manner that through the experience which you will shortly gain you will dream less and less. You will have to experiment on yourself, as no two individuals are the same. Some people find that they sleep much better by drinking a glass of hot water or milk before retiring, or some other harmless liquid. All of this will have to be experimented with until you find the correct formula.

The sleeper's position in bed is also most important. Some people dream excessively when sleeping on their left side. This is but natural, because the heart, under compression, gives rise, very often, to fear complexes, especially in nervous and excitable people. It becomes then a matter of training to sleep on the right side or in such a position that no dreaming is induced. This is a matter of experience also, and here a little self-hypnosis often does wonders. If you are inclined to sleep on your left side, and if you know this induces bad dreams, all you have to do, before retiring, is to keep on repeating, *with as much will and concentration as you can muster*, that you will positively not sleep on your left side that night, and keep on repeating this in the well-known Coué form, nightly for several weeks. You will find that by willing strongly enough, you can cure yourself from sleeping in any position that you do not wish to assume.

ACTUAL DREAM RECORDS

In order to test what has been said before, I decided to make actual tests upon

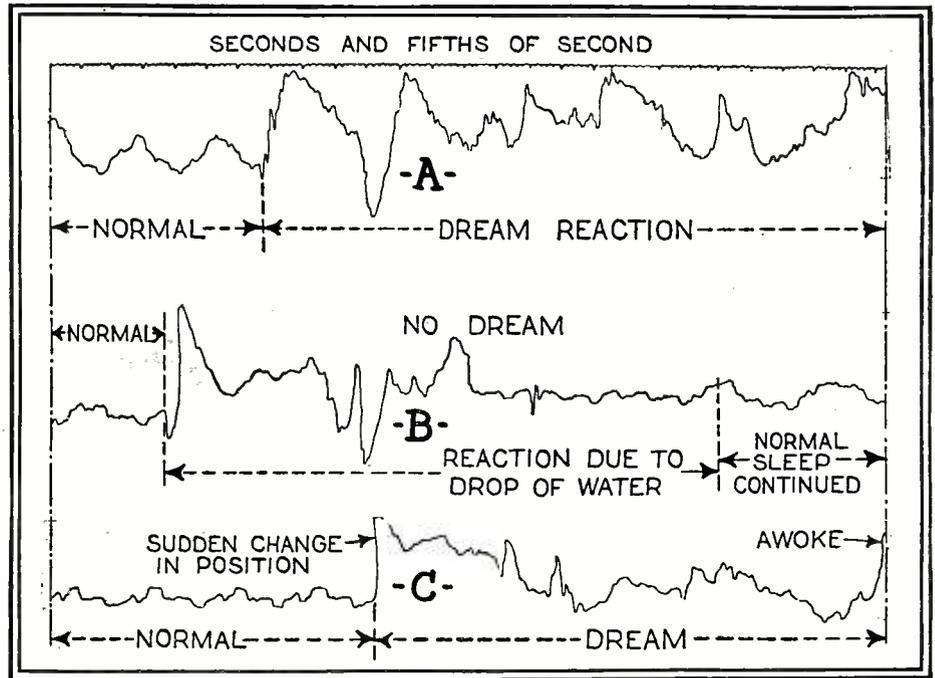


Fig. 2. Actual records of dreams taken with the Polygraph. Note the dream reactions, which increase heart fluctuations above the normal.

sleepers, and the illustrations here show the results of these tests. Recourse was had to a heart and pulse testing machine, known as the "Polygraph." The Polygraph is a very sensitive instrument, which, when strapped over the heart or on the wrist, will give an exact record of the heart beat. The instrument is exceedingly sensitive and records not only the breathing, but the heart action as well.

In order not to go into any great technicalities, it may be said here that a great number of records were made in our laboratories, and my theory that dreams could actually be recorded is now a fact. While the technique of dream recording has not been carried to a logical conclusion, I wish to state here that whatever results we had in the laboratories were very encouraging, and I hope that much good will come from the future recording of such dream actions. I believe that in due time physicians will find it necessary to record the dream actions of their patients if they dream too much, which consequently interferes with their health.

At this point I also wish to explode an old theory that dreams are of a very short duration. We actually found the reverse true, at least the polygraph recording the heart action, showed that a dream lasts at least a number of seconds, and not fractions.

It is obvious, from the records obtained in our laboratories, that during the process

of dreaming, the heart action is materially stimulated, and respiration is also accordingly increased. All of the cases which came under our observation produced the same effect, when a dream actually occurred.

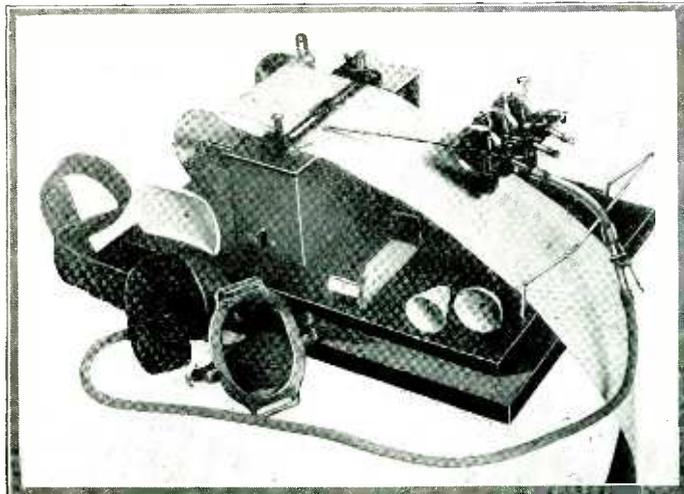
The tests not having been carried on over an extended period, we had no chance to observe a *nightmare* or startling dream, but it is quite apparent from our records that if there had been such the resulting action would have been greatly increased. In our illustration, Fig. 2, we show actual records taken by the polygraph.

In case "A" it will be observed that the apex beat increases almost instantly to four times the normal sleeping rate. In "B" and "C" on our graph it becomes difficult to actually note the apex beat because of the influence which breathing has upon the heart record.

The gradual undulations of the curves in the normal record are produced by the process of inhaling and exhaling. The inspiration in all of the cases is much greater under the excited reaction of a dream than in the normal sleeping state. Notice also that the respiration is changed when the subject changes his or her position during sleep, and you will also see that when dreaming, in case "C" the heart rate was stimulated immediately after the change of position.

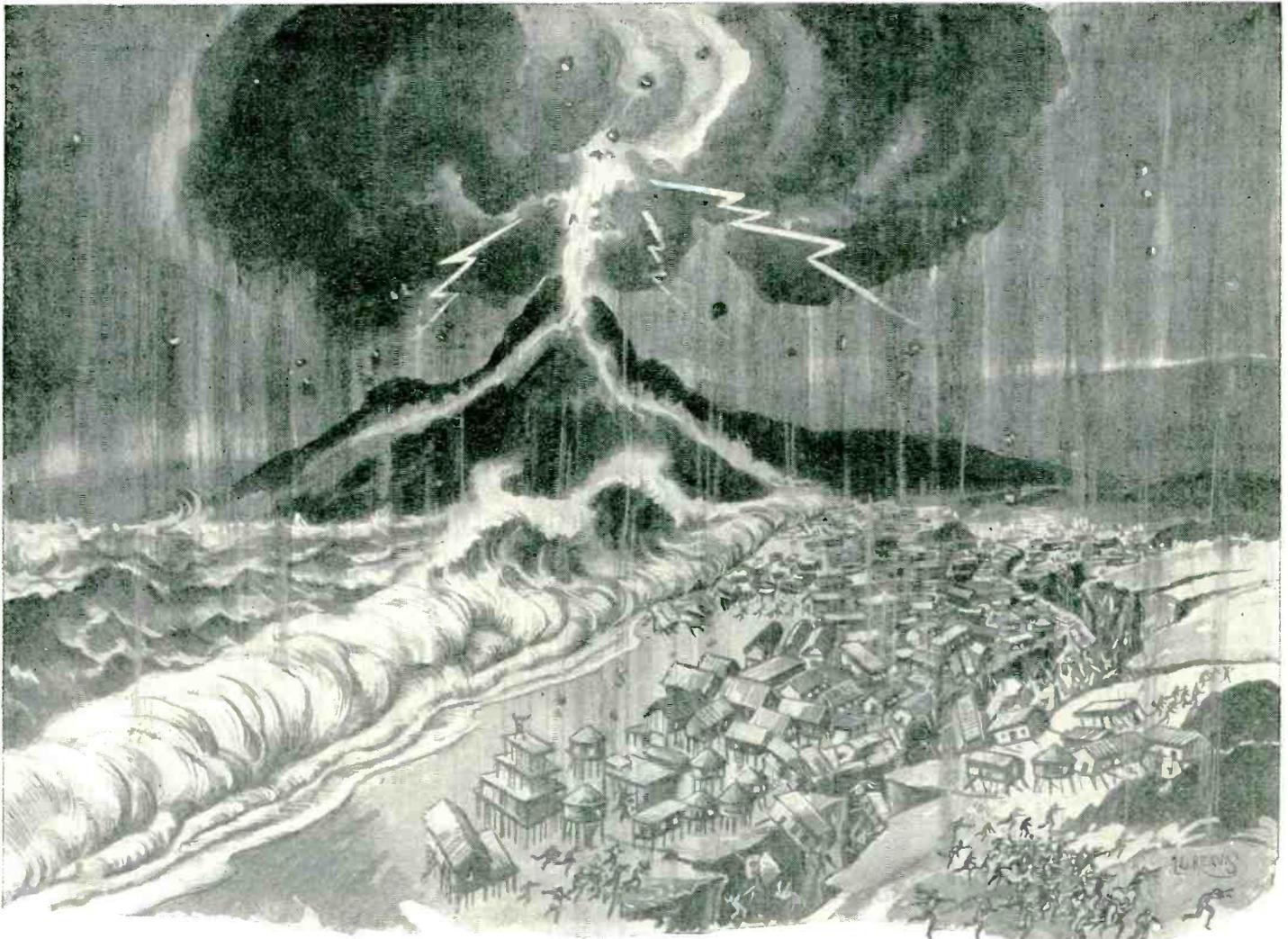
In "C" an electric bell was used to awaken the subject, being rung softly at first and then permitting the bell to remain quiet until the subject again assumed normal respiration and heart curves, and then the tone was increased until the subject eventually awoke. Although a slight disturbance took place every time, it was not as marked as just before awakening, at which time this patient recalled a dream of an alarm clock awakening her and summoning her to work.

It is obvious from records which have been obtained that dreams do affect not only respiration but also the heart beat, and that the dreams of some subjects stimulate the heart to a greater extent than those of another. It is believed that this is the first attempt made to record heart action during sleep, laying particular stress on the heart action of subjects who dream a lot. The experiments have not yet developed to a point where a record was taken during a nightmare or one taken of an individual who frequently walks in his sleep.



The Polygraph Recorder — primarily built to record the heart and pulse actions, and used here for the first time to record dreams.

Photo, courtesy of E. Leitz, Inc.



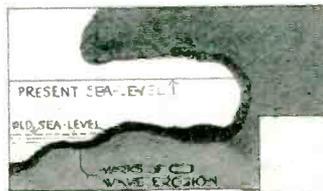
The most gigantic and terrifying cataclysm ever witnessed by man was probably that which took place when the Aegean Continent subsided so that water completely covered everything except the highest mountains. As the picture above shows, the onrushing tidal wave swept everything before

it. Earthquakes caused giant cracks to open in the face of the earth, while volcanoes belched forth smoke, rocks and boiling lava. Imagine such a catastrophe occurring today, especially in the vicinity of our larger sea-ports like New York City or San Francisco.

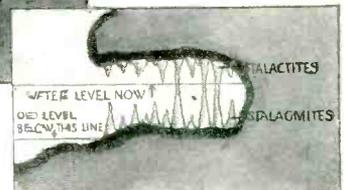
The World's Greatest Cataclysm

By PROF. DONALD H. MENZEL, PH. D.
(Department of Astronomy, Ohio State University)

THE most gigantic cataclysm ever witnessed by man doubtless occurred when the Aegean Continent subsided, as the picture above shows, and as the map drawing below and on the opposite page also illustrates. The time of this cataclysm is comparatively recent, contrasted to the millions of years that constitute every geological period. This subsidence occurred since the last glacial epoch. A flint knife discovered in deposits laid down before the catastrophe, proves that man was present. Cross in map below shows where flint knife was found. The contour in depth-map below shows what the general shape of the continent was.

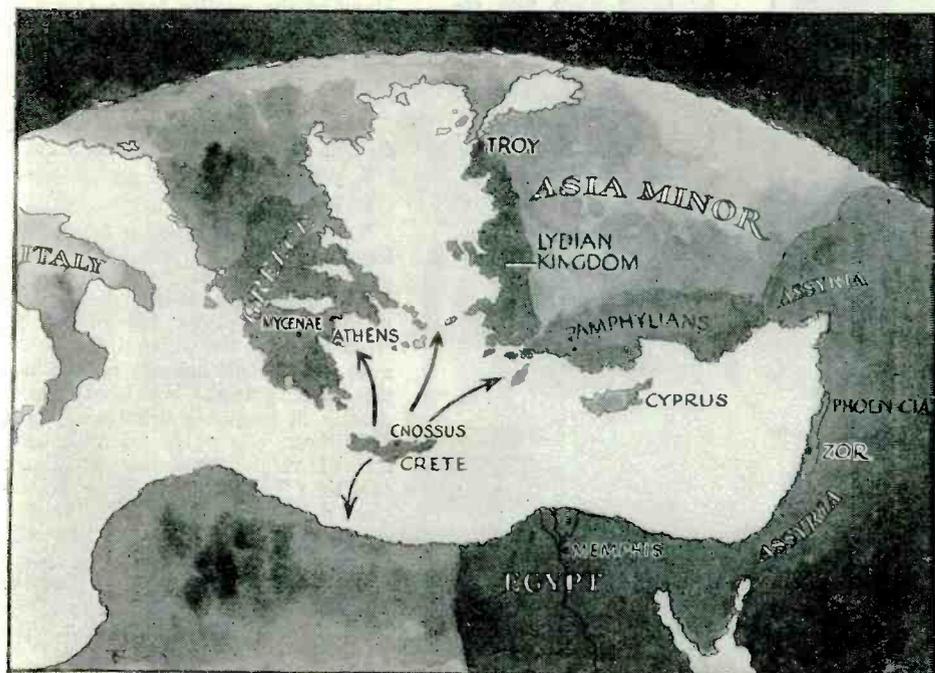
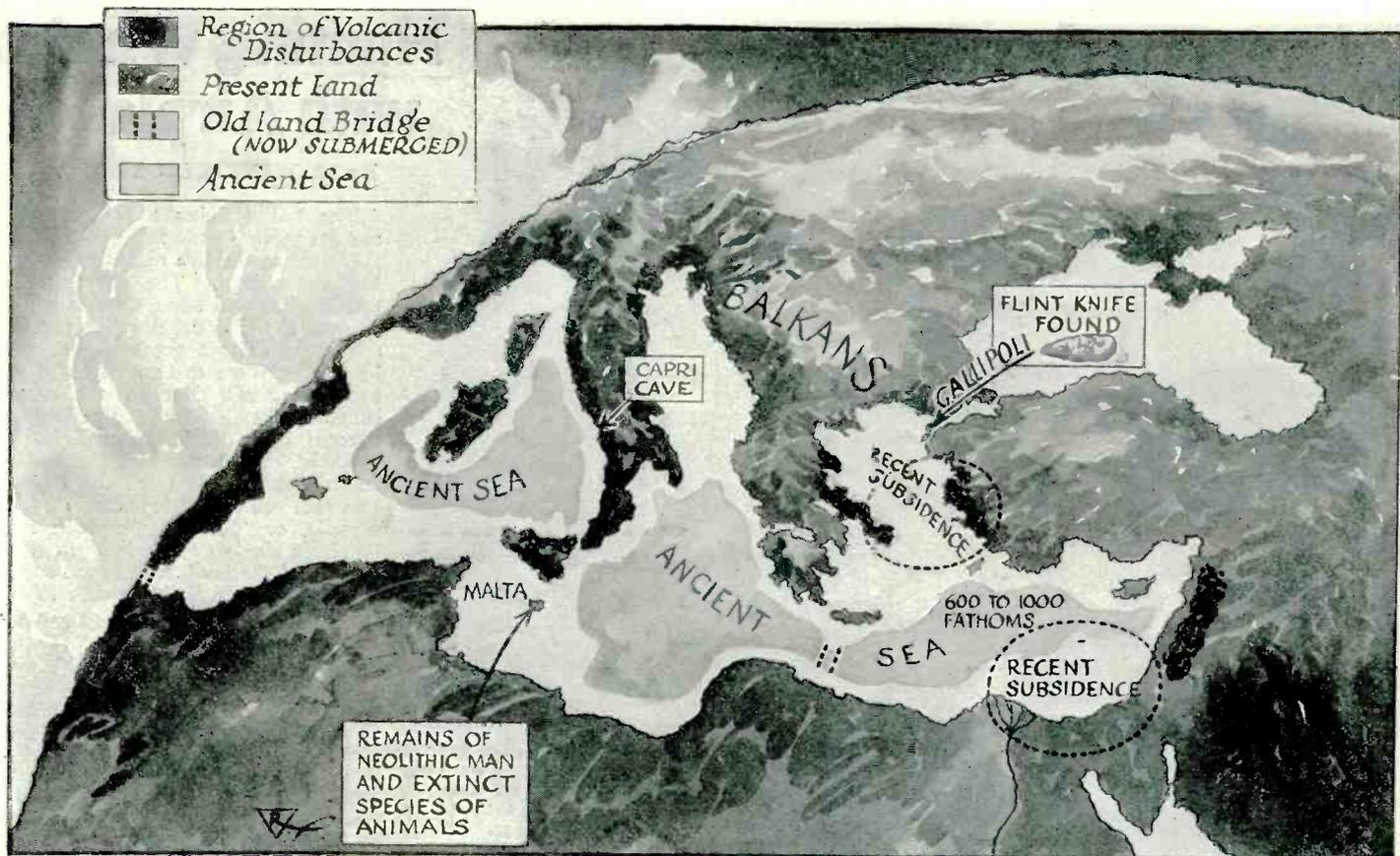


The two views herewith showing cross sections of the caves of Capri, Italy, give proof of the sinking of the coast.



While the original subsidence was probably quite rapid, accompanied by floods, earthquakes, and volcanic eruptions which would destroy all life in the basin, it is interesting that it is still slowly continuing in spots.

The two pictures above show the effect of the subsidence in the caves of Capri, Italy. The formations known as stalactites and stalagmites take place only in air. The fact that we find them submerged in caves proves that the water level has risen considerably since they were made. The unsettled condition of this region is further evidenced by the number of active and extinct volcanoes which surround the Aegean. It is not a coincidence that the three great prehistoric civilizations surround the vanished continent. From the similarity of their arts the parent race apparently was scattered in all directions.



The physical map above shows the positions of the centers of ancient civilization at the time of the great flood, caused by the subsidence of the Aegean Continent. It is thought, due to the similarity of their arts and legends, that the parent race was scattered as arrows show.

THE maps at left and above show centers of ancient civilization. It seems from a study of the subject that the parent race living in the center of the continent was scattered in all directions by the catastrophe. The origin of the flood-myth common to many peoples, the cradle of civilization and the source of language and art, by this theory, rest at the bottom of the sea. The location of the ancient seas and the land bridge to Africa are shown clearly on the map.

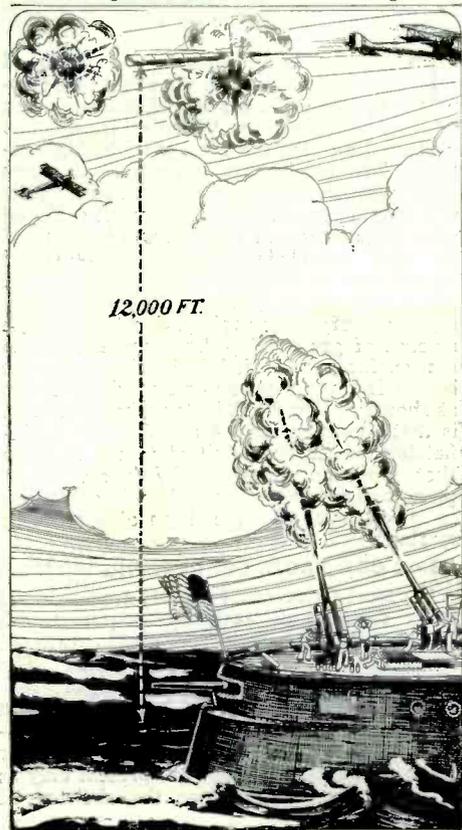
Grass-Growing By Electricity

EXPERIMENTS in the use of electric light at night for promoting the rapid growth of grass have been tried under outdoor conditions on the Jumping Brook Golf Club's course in New Jersey. A clay gravel site was dug, and the top soil from another portion of the land used to provide about fifteen inches of soil for the green, which was sown early in June, and over a portion of it were erected 24 special reflectors, each containing a 1,000-watt tungsten bulb. The reflectors were hung four feet from the ground and gave a continuous even light. The light was switched on on June 6th, and

for the next 21 nights. The weather was unfavorable to the rapid germination of grass seed, but the first seed came through under the electric light five days after planting. Nothing came through on the unlighted portion of the green until two days later. At the end of three weeks the grass under the electric light had attained a general growth of nearly four inches, while on the portion of the green outside the lamps there was a growth of about one inch. This system saves at least 40 per cent. in the time between planting and cutting the average green, and after cutting it, thickens the growth.

Air Bombers Beware

In recent aerial target practice sleeve targets were shot down from a height of 12,000 feet by five inch guns on the U. S. S. "West Virginia."



Hunting Whales with Airplanes

By H. WINFIELD SECOR

The tail ("flukes") is horizontal, and not vertical as in fishes; it is probably used as the sole means of propelling the animal. The dorsal fin is totally absent in some Cetaceans, but in others, the dreaded killer for example, grows to a great height. Unlike fishes there are no bones in the back fin or tail. Between the smooth skin and the flesh the entire body is covered by a thick layer of fat or "blubber," which prevents the loss of animal heat (it is from the blubber that the oil is "tried out.") The nostrils, or "blowholes," which may be either single or double, open from the top of the head, save in the sperm whale. When a whale comes to the surface to breathe, it at once expels the air from its lungs. This warm air is saturated with water-vapor, and, when it is discharged, condenses; thus a column of steam or spray is formed, which is forced to a considerable height (20 feet or more). It is this spray which gives rise to the common belief that the whale actually spouts water. Cetaceans are found in all the oceans from near the Antarctic regions to within the Arctic Circle. Many of the smaller forms (porpoises and dolphins) ascend rivers for a considerable distance, and all the members of one family are exclusively inhabitants of fresh water.

The whales of the world may be divided into two great classes, viz:

1. Whales without teeth.
2. Whales with teeth.

Those of the first group (the toothless whales) are all characterized by plates of so-called "whalebone," or baleen, hanging from the roof of the mouth. The plates are of use in straining from the water the often almost microscopic animals upon which these whales feed. Whalebone varies greatly in length in different species. Whalebone was of considerable commercial value, the better grades at one time being worth from six to eight dollars per pound. The blue or sulphur bottom whale, a life size model of which hangs from the ceiling of the museum, the Finback and the Right whale are representatives of the toothless or whalebone whales. The

(Continued on page 476)

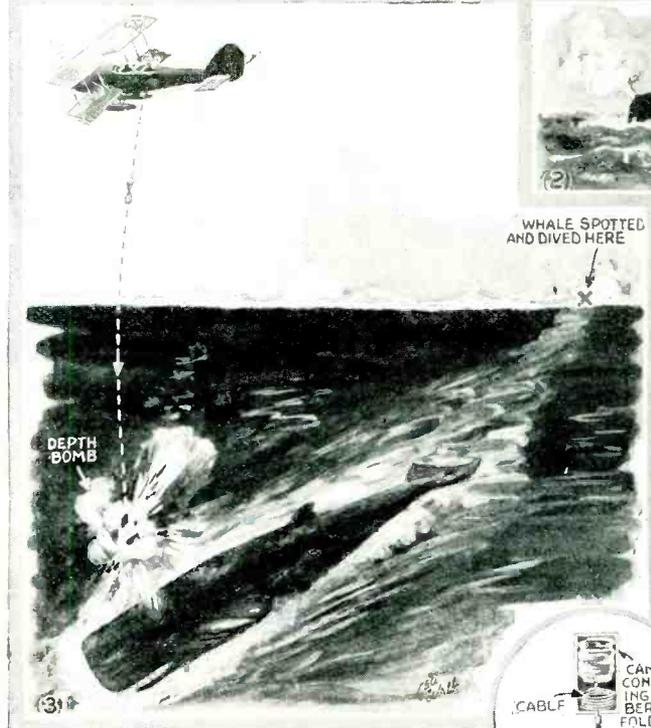
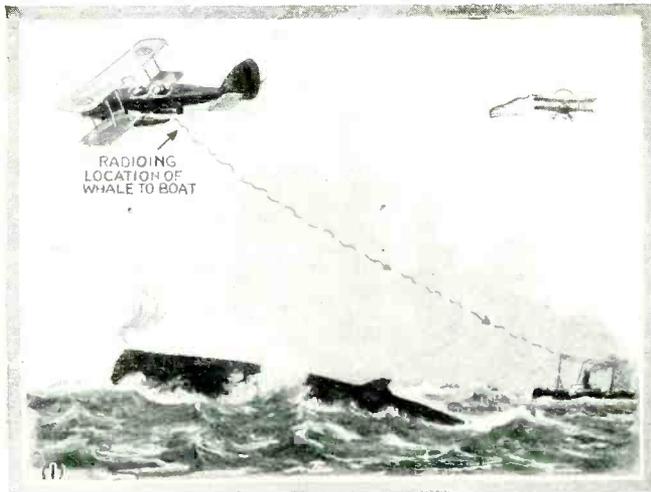


Fig. 1 shows latest method of hunting whales. Plane spots whales and radios the news back to mother boat equipped with harpoon gun.

Fig. 2 above shows scheme for killing whale with explosive bomb dropped from airplane. Whale floats shortly after being killed.

Fig. 3 at left shows how airplane can use depth bomb on whale, which is visible at considerable depth. Whale would rise to surface afterward.

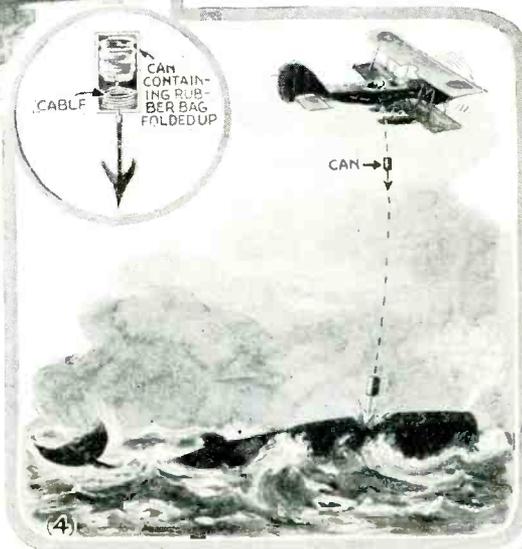


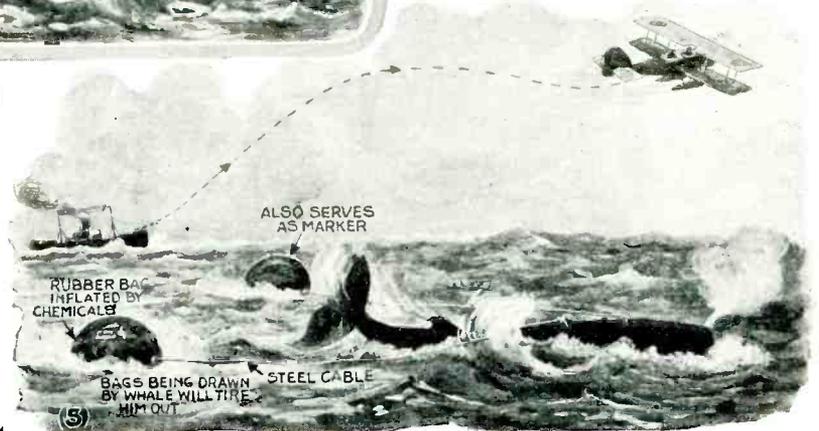
Fig. 4 shows scheme employing inflatable bag and harpoon dropped from airplane on whale.

Fig. 5 shows bags inflated to tire out whale and give vessel chance to capture him.

THE very latest news in the science of hunting whales is to the effect that Captain George L. Marquand, manager of a whaling company of Victoria, B. C., has chartered an airplane for each whaling venture. The airplanes will be used it seems mostly for spotting the whales, when the pilot will radio back to the whaling vessel equipped with harpoon guns as to the whereabouts of the whale or whales. Other possibilities of the airplane in hunting whales are shown in the accompanying pictures. As whales when killed putrefy very rapidly, due to the large amount of gas developed, they would rise to the surface even if killed with explosive bombs from an airplane or by a depth bomb, as shown in Fig. 3. A better scheme perhaps is that shown in Figs. 4 and 5 where an inflatable rubber bag is fitted to the harpoon shot from an airplane. With several of these fastened to the whale, he will eventually be tired out and the bags also serve as markers.

SOME ODD FACTS CONCERNING WHALES

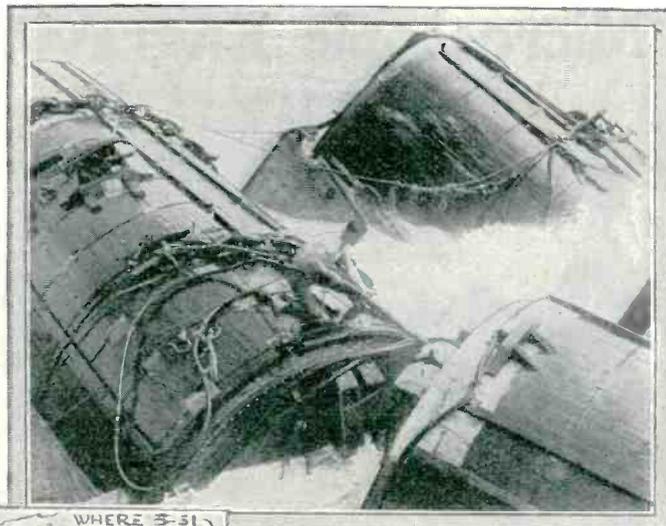
On most Cetaceans (whales) traces of the hairy covering of ordinary mammals are present, showing in a few short, scattered hairs on certain parts of the head. The forelimbs, (represented by the fins, or "flippers") are like those of other mammals in structural characters; they are used as balancing organs. The hind limbs are never to be seen externally, and are present only as small vestigial bones (see the skeleton of the Dolphin).



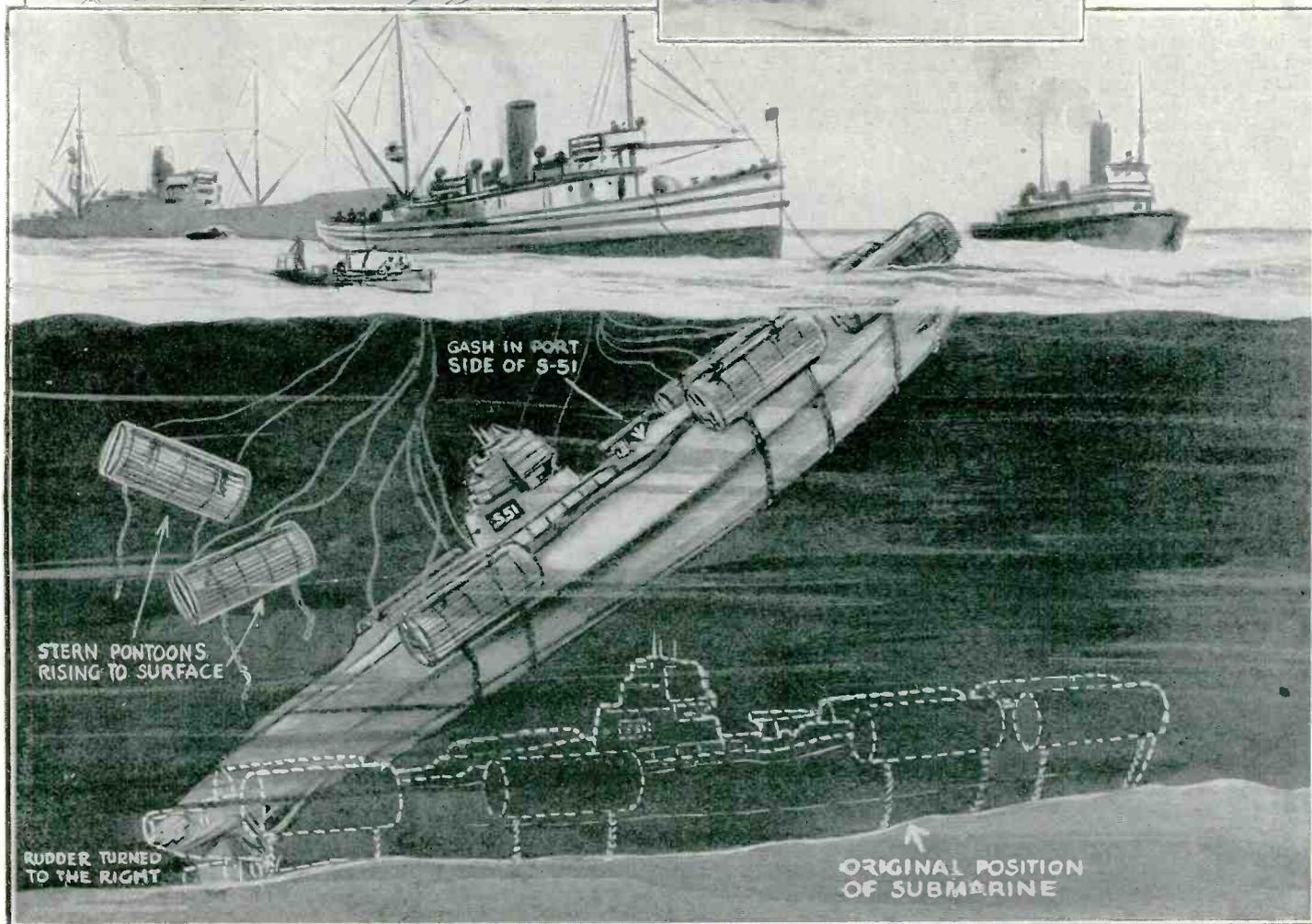
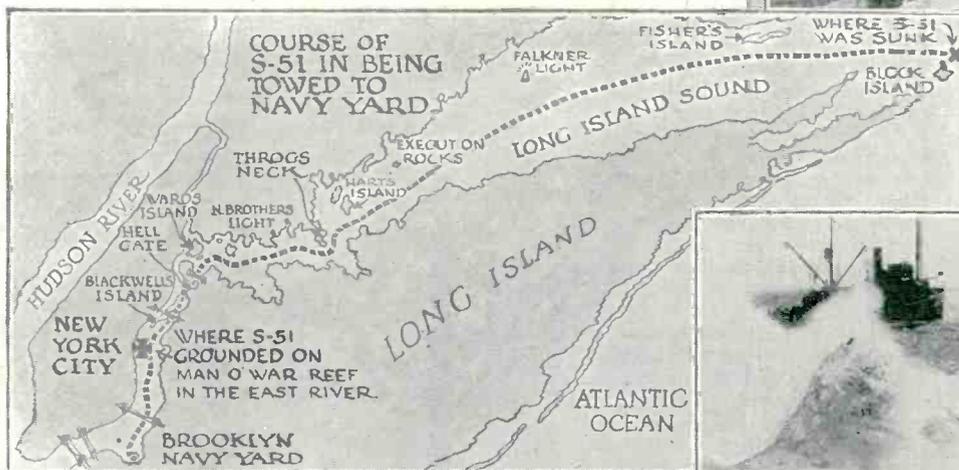
S-51 Finally Raised

Grounds on Way to Navy Yard

THE ill-fated submarine S-51, sunk after a collision with the S. S. "City of Rome," off Block Island, has at last returned to her home port after having appeared to be hopelessly fixxed. The first attempt to raise her from her resting-place 150 feet below the surface resulted in failure when the chains connecting the rear pontoons parted. Their breaking-away threw an additional load of 150 tons on the other pontoons, and it was found necessary to permit the S-51 to sink again so that a new "bite" might be taken. The specially-equipped "Falcon," under the command of Commander E. Ellsberg, recompressed air from the air-banks of the submarine S-50, which stood-by near at hand, and pumped it to the lifting pontoons which finally succeeded in raising the sub to the surface. In towing the S-51 to the Navy Yard she was grounded for a time on Man O' War Reef in the East River, but the next day she was placed in dry-dock.



The jaw of the S-51 can be seen between the forward pontoons in the above photo of the first salvage attempt. The figure on the rear pontoon is one of the courageous divers who risked their lives to keep the hose-lines from fouling. At the left is a chart of the route followed by the salvage party, showing where the S-51 grounded after having passed what were considered the most hazardous points. The photo at the left gives an idea of the risk entailed in the work of salvage. Here one of the rear pontoons is crashing upward after breaking away.

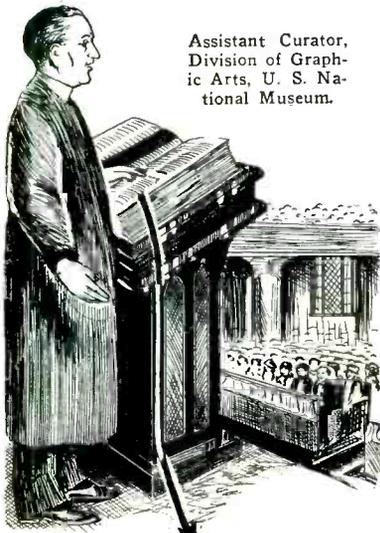


The drawing above illustrates the method of placing the pontoons so that they would exert the greatest possible lifting power on the wreck. Commander Ellsberg decided, after the rear pontoons had broken away and barely missed a surf-boat in rising, that the sub should be lowered again.

Microscopic Engraving

Lord's Prayer Engraved on Pin Head

By R. P. TOLMAN



Assistant Curator, Division of Graphic Arts, U. S. National Museum.

The micro-engraving shown at right was done in 1/100 inch circle.

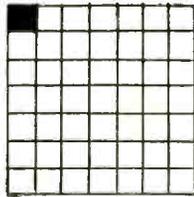
When we are confronted with statements like this we are all liable to use a little word of four letters. Before this article is finished you will probably want to use this little word several times, but every statement is fact.

Just one more illustration, before I tell you how these infinitesimal engravings are made. The Lord's Prayer is commonly used in things of this kind, for example, it has been engraved on the head of a large pin, and it has been cast on a typed body, one-sixth of an inch square and in micro-engraving it has been used extensively. Mr. McEwen sent one of his smallest engravings of the Lord's Prayer to the Bureau of Standards, Washington, D. C., to be measured. Their report gave the dimensions as 0.0016 of an inch by 0.0008 of an inch high.

Now if you will multiply these figures you will find that one Lord's Prayer of this size will cover only 1/781,250th of a square inch, in other words the 227 letters in this prayer would have to be engraved 781,250 times to completely cover one square inch.

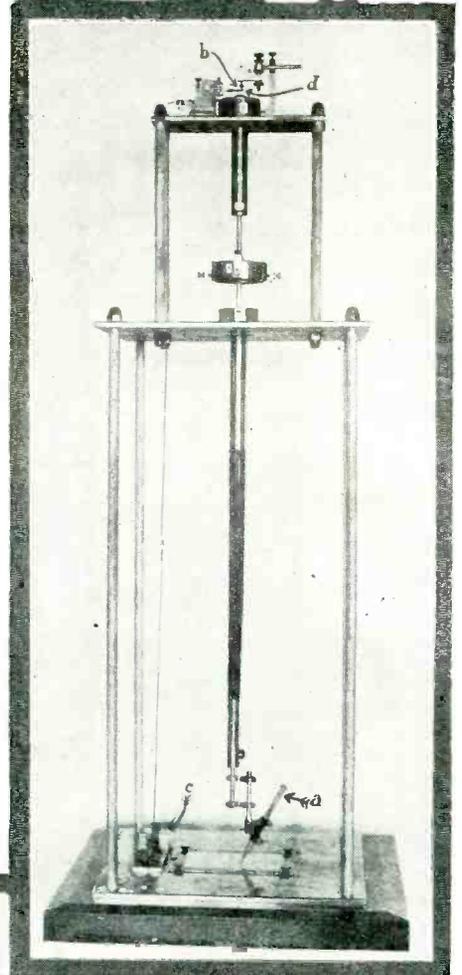
I don't blame you for shaking your head. Fig. 2 is a reproduction of this micro-en-

The micro-engraving of the Lord's prayer below was made in 1/781,250th square inch. The entire bible engraved on this scale would occupy but 1/49th square inch.

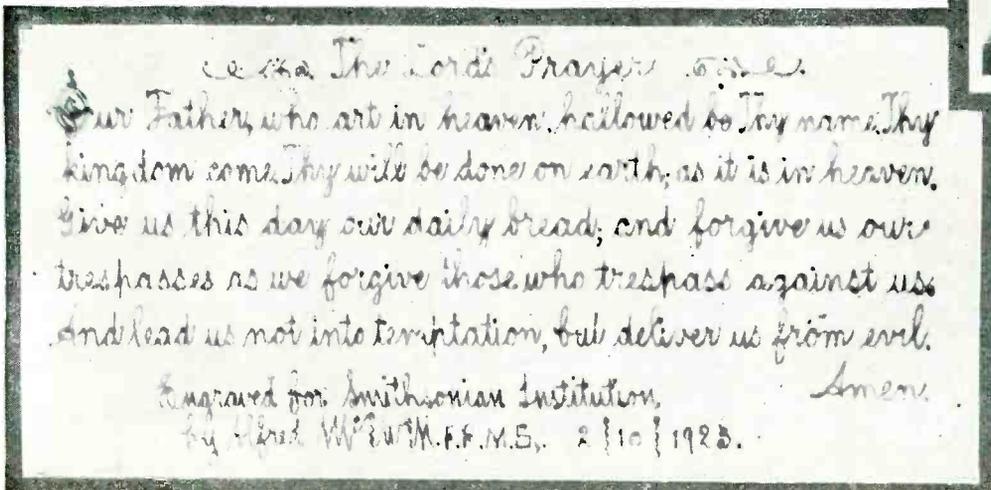


THE first micro-engraving that I ever read (I had seen others with the naked eye, but nothing but glass was visible) was one which was sent to me in the form of a letter, it was clearly seen through the eye of a needle. But before it could be read it was necessary to enlarge it 85 times by a high power microscope. This micro-engraving covered about 1/11250 of a square inch. The reproduction is enlarged about 70,000 times. This had been prepared by Alfred McEwen of New York City, for a Regents meeting of the Smithsonian Institution where it created much interest. It reads in part: "This is a crude, hurriedly prepared large sample of 'Micro-engraving.' The writing was done with pencil on a 4x7-inch tablet. One a little larger (Fig. 1), is one one-hundredth of an inch in diameter; the ruled lines are less than 1/1,000th of an inch apart; this illustration measures about 4 1/4 inches and if it was exactly 4 1/4 inches in diameter, it would contain 12,3518 square inches; and if it were possible to engrave all over a sheet of glass that big, this same letter with its illustration would have to be repeated 123,518 times to cover it.

The diagram at the right shows in simplified fashion how micro-engravings are made. The person doing the writing takes the pencil in hand and writes out in ordinary sized letters the sentence or other material to be engraved in a fraction of a square inch. As will be seen at once the short length of the upper arm with respect to the greater length of the lower arm, causes the handwriting to be markedly reduced in size. The micro-engraving is done by means of a highly polished diamond point made with the finest precision.

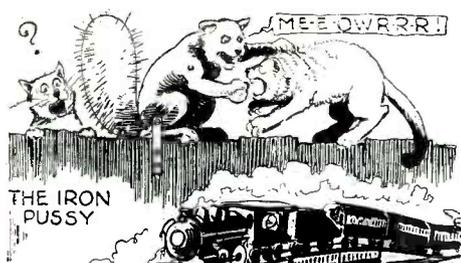


graving, it is not as clear as the larger ones, but it can be read. The distance between the top of the top line and the bottom of the last or seventh line is 1/1,250th of an inch. The paper on which this article is printed is about 1/400th of an inch thick, therefore the seven lines of this engraving could be repeated three times in a space equal to the thickness of one page of this magazine. It does not seem possible. To carry this comparison along a little farther. The fifty-six words of the Lord's Prayer contain 227 letters and on this scale 177,343,750 letters could (Continued on page 450)

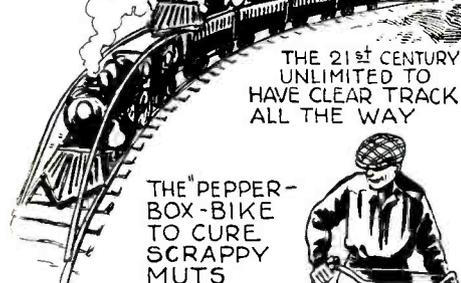


Odd and Unusual Patents

By STUART WALKER

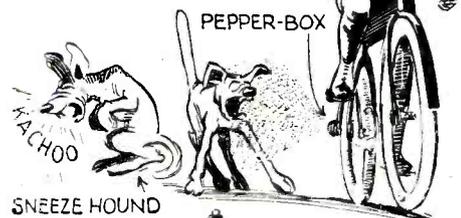


THE IRON PUSSY



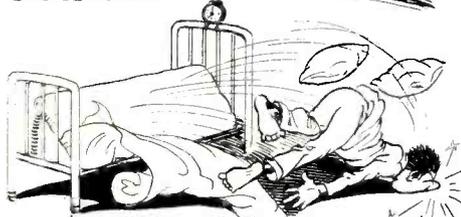
THE 21ST CENTURY UNLIMITED TO HAVE CLEAR TRACK ALL THE WAY

THE "PEPPER-BOX-BIKE TO CURE SCRAPPY MUTS



PEPPER-BOX

SNEEZE HOUND



The horse walking on a tread-mill operated the wheels of an early train.



THREE "ALARM-BEDS" GUARANTEED TO GET YOU OUT ON TIME, REFRESHED AND LIMBERED UP.

SOCK



OUR civilization rests heavily upon the shoulders of the inventor. But for the man of new ideas we should now be living in huts and caves, wearing skins for clothing, and stalking about with a club in search of food. Fortunately for the world inventors are very numerous. The records at the United States Patent Office at Washington bear out this fact. Since the issuance of the first patent to Samuel Hopkins on July 31, 1790, for a process of manufacturing potash and pearl-ash, the Patent Office has granted more than a million and a half Letters Patents. Among them are the inventions which have changed the course of history, which have brought about our civilization of today—the internal combustion engine, the cotton gin, the locomotive, the telegraph, the telephone, the airplane, the radio, and thousands of others.

However, the Patent Office records also reveal many utterly useless patents, all undoubtedly intended to be of great service to mankind, but some are actually worthless, some grotesque, some ridiculous, and many are merely huge jokes. The scope of these "ireak" patents extends far beyond the bounds of practical imagination.

No one who has been awakened from a sound sleep by the exasperating yowls of a cat can fail to recognize the fine intentions of the man who patented a "mechanical sheet-iron cat with cylindrical attachment and steel claws and teeth, worked by clock-work, having a bellows inside which inflated the tail at will to an astonishing size and, by a tremolo attachment, causes at the same time the sheet-iron cat to emit the noises of a living one." When you are bothered by felines, just put the sheet-iron pussie out on the back fence. Every cat that hears him will come out to fight. No sooner is the sheet-iron cat touched than his claws and teeth begin to work with startling rapidity. The other cats are torn and put to flight, but the mechanical cat remains uninjured. In this case the inventor had, at least, a commendable intention, and it is strange that his efficient kitty did not become more popular.

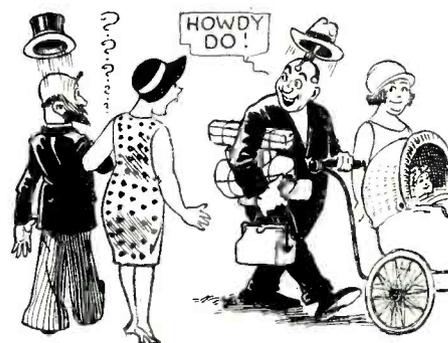
Those who spend time in worrying over the terrible congestion in all our large cities because of the great increase in motor vehicles may find suggestion of relief in the patent of a man from Wickes, Montana, which covers "a means for fast trains passing slow trains on the same track." This may sound highly imaginative, but the inventor proceeds to show what a simple and safe proposition it is. The patent provides for trains having rails along the tops of the cars and carriages, and inclined structures bearing rails at each end of the train. The fast train, upon overtaking the slow train, is merely supposed to run up the rear incline, along the top of the train, down the front incline, and on its way. It is a very simple matter indeed.

(Continued on page 469)



IT'S SO QUIET I CAN'T SLEEP.

IT TOOK YEARS OF SNORING TO PERFECT THE "NOTTA BITTA COMFORT ANTI-SNORING PAD"



ETIQUETTE DEMANDS THAT YOU SALUTE YOUR ACQUAINTANCES, YOU CANNOT CLAIM TO BE WELL BRED, UNLESS YOU WEAR ONE OF THESE "AUTOMATIC SELF-TIPPING HATS" ETC. ETC.



THAT SUPERB FEELING OF BEING DRESSED FOR THE OCCASION, AND AS DRY AS THE 18TH. AMENDMENT

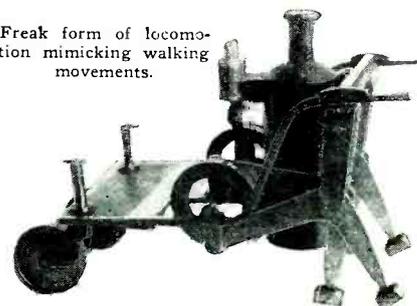


THE MOST CHICKEN-HEARTED PERSON CAN NOW PERFORM A MAJOR-OPERATION ON THE OLD RED ROOSTER.



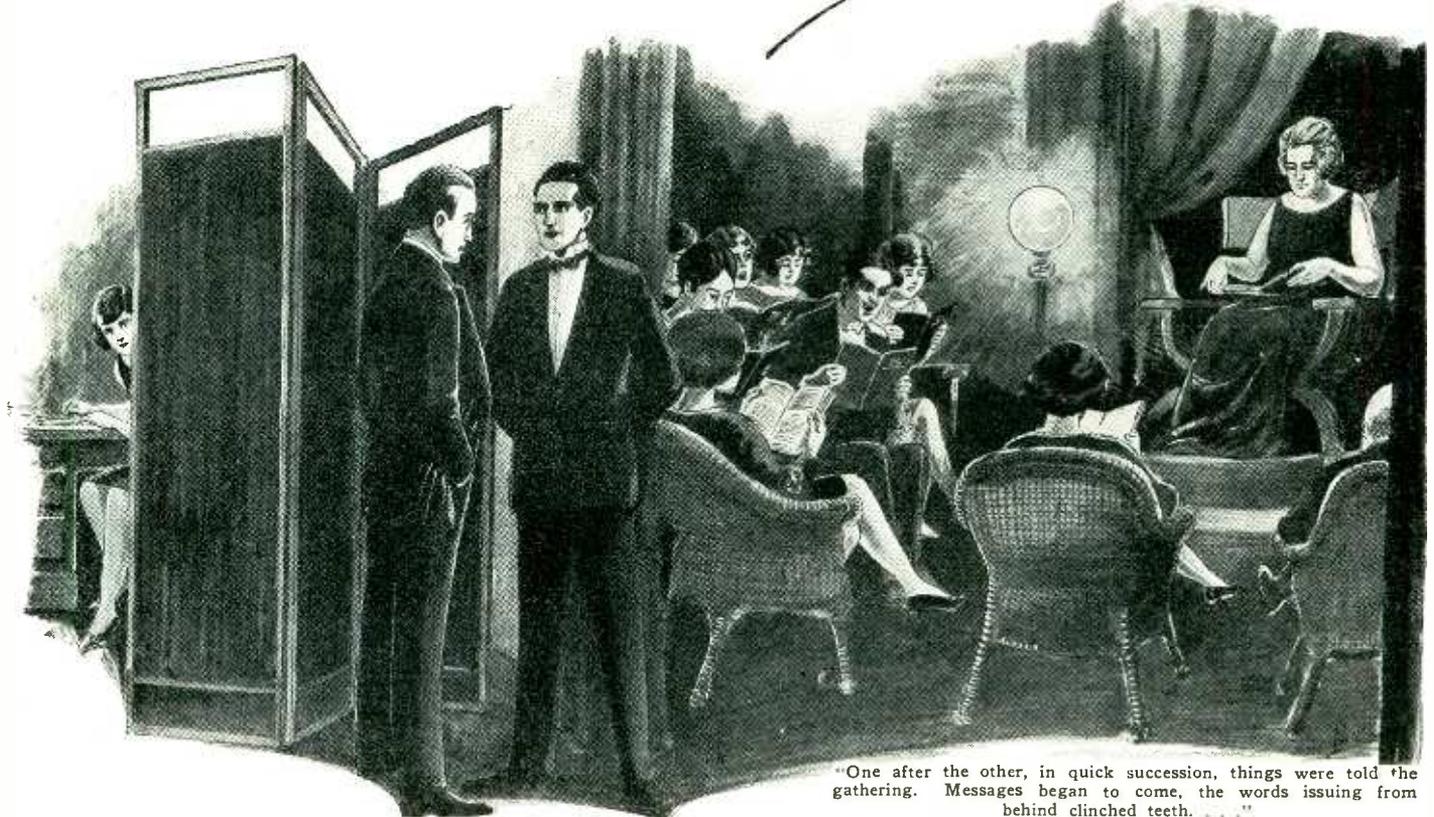
THE PLYMOUTH ROCK

Freak form of locomotion mimicking walking movements.



Our Spiritualistic Investigations

By *Dunninger*



"One after the other, in quick succession, things were told the gathering. Messages began to come, the words issuing from behind clinched teeth."

SEVERAL weeks ago during conversation with a very dear friend of mine, who by the way had been a fellow student of spiritualism and kindred subjects, he informed me that he had on two occasions witnessed a séance by an unknown medium whose offering was little short of miraculous.

"Yes, Dunninger, this woman is an enigma. Often I have witnessed similar things but never in my numerous experiences has anything impressed me as so unusual. Miss Thelma Mason is unusual in a way that would ordinarily be accepted as a standard of unusual intelligence."

"In what way unusual?" I asked. "Why this woman is no faker, I tell you Dunninger," said my friend Lustig. "She is uncanny; not alone does she bring apparent messages of those about her, but she actually described the likeness of my dead uncle Maxwell. Told me how long since he had departed and presented details of the illness that carried him off. Of course, I don't believe this stuff any more than you do, but I am frank to admit that she has me guessing. Would that you could hear those who were present with me speak of her seemingly marvelous readings . . . they are fully convinced that she is supernatural."

"She actually calls the departed by names and tells the sitters things that actually makes the color leave their faces . . . they sit astounded . . . amazed!"

"How does she do it? What is her method? I scoffed at what was told me of this woman. Finally I attended one of her séances and I too was amazed. Now, Dunninger, you must pay this woman a visit and see for yourself just what really transpires."

"Good," said I. "There is no time like the present," as I looked at my time-piece. "It is just five minutes past seven. Let us hail a cab and be on our way."

"Yes," said my friend, "that is all very

\$21,000.00 for Spirits

More than two years ago SCIENCE AND INVENTION Magazine offered a prize of \$11,000.00 to anyone who could demonstrate his or her ability to communicate with the spirits or to give some definite form of a psychical demonstration which in itself was not trickery.

The result has been that mediums and spiritual organizations have been afraid to place proofs before us. Those weak attempts which have been made to demonstrate psychical phenomena were almost instantly proven fraudulent, and no medium has dared to contradict our findings.

In view of these facts, should we not consider all mediums fraudulent? Should we not consider every psychical manifestation as being trickery pure and simple, intended primarily to fleece those who visit the circle and who find solace in the words from the worst forms of charlatans, namely those who are being permitted to practise upon the poor, seeking words from loved ones?

To the \$10,000.00 which has been offered by Joseph F. Rinn through this publication for Spiritual proofs and the \$1,000.00 in addition offered by SCIENCE AND INVENTION Magazine, we now add another \$10,000.00.

Dunninger, who writes exclusively for SCIENCE AND INVENTION Magazine and who is the Chairman of our PSYCHICAL INVESTIGATION Committee will personally pay \$10,000.00 to any medium or spiritualist who can present any psychical manifestation in so-called spiritualism, that he will not explain or that he cannot reproduce by natural means.

So now we have a total of \$21,000.00 offered for proofs of Psychical Manifestations. Spiritualists—get busy.

well, but these séances are not entirely public and arrangements must be made beforehand."

'Phone in hand my friend was soon informed that the next meeting would be held on the following evening. An appointment was made.

Arriving at the house, located in a side street east of Broadway, we were ushered into a reception room. The room was plainly furnished. The only pieces of furniture were several plain chairs and a small table. A quick examination proved that these articles were of the most ordinary type. No trickery there.

A number of pictures adorned the walls each of a religious character. These pictures were of the cheap lithographed type set in frames of the cheapest sort.

Here we were ready to witness the seemingly marvelous séances. Several "customers" were present. Several were of the aged type familiar at such séances. One old lady was there for the second time that week, she having attended the séances at least twice every week.

This old lady was in deep conversation with several others . . . unfolding the wonders accomplished by this medium.

Listening to that sort of talk tired us, but suddenly into the room walked a maid. She was partly Chinese and partly French. A clever talker and with ideas that seemed to end when we switched from the borderland to more prosaic chatter.

Unfolding a tale of a noted Chinese medium this little lady had me thinking what wonderful ideas she would have for unworkable illusions for stage work.

The maid next greeted several of the parties present; calling them by name and talking intimate bits of business.

"What is the charge for attending these séances?" I asked one of the bystanders.

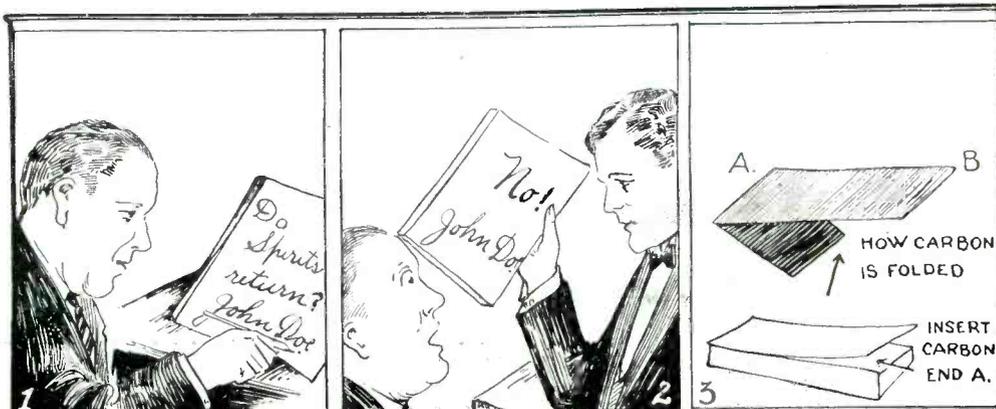
(Continued on page 463)

Spirit Tricks

By WALTER B. GIBSON

The Following Tricks are Duplicates of the Stunts Used by Fraudulent Mediums, and can be Performed Perfectly With Very Little Practice.

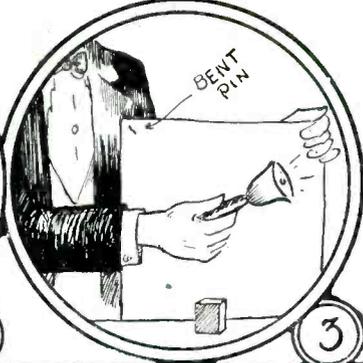
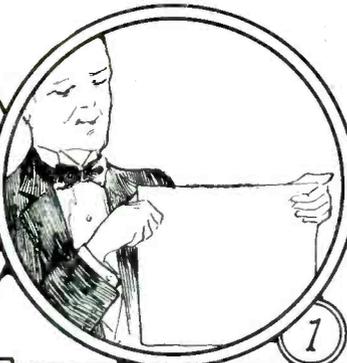
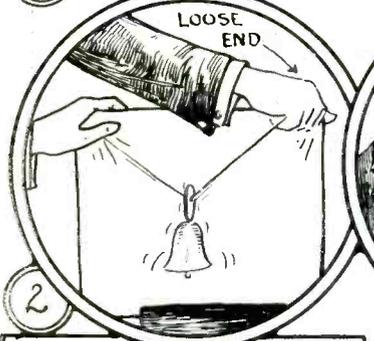
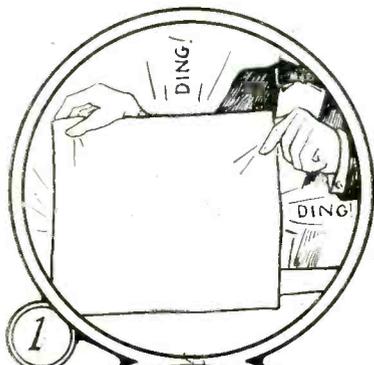
A handkerchief is held in front of a bell in the manner indicated in the diagram below. The bell rings almost immediately after the handkerchief is raised to the position shown. When the cloth is withdrawn the bell may be examined. The method is made clear in illustration 2, below.



A sheet of carbon paper is inserted under the top leaf of a pad. A question is written and the message is signed.

An answer is found on the second sheet over the signature in carbon. The question has not been reproduced.

The answer is previously written through carbon, the latter is doubled over as shown, preventing message being transcribed.

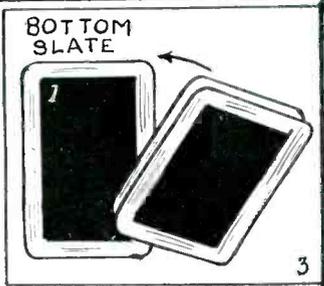
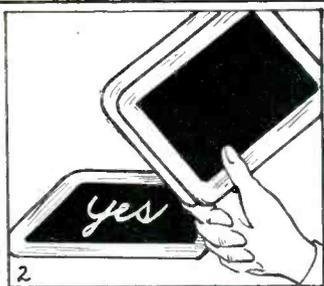
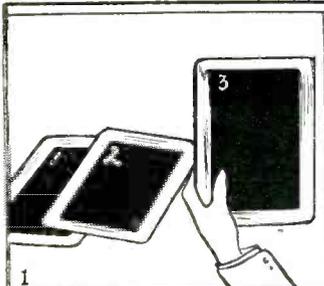


Note thread fastened to one end of handkerchief and other held in the hand. This passes through bell handle.

The medium holds a napkin in the manner illustrated in the drawing immediately above.

He turns body to the right, holding cloth in front of articles on table.

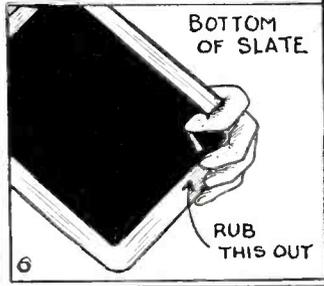
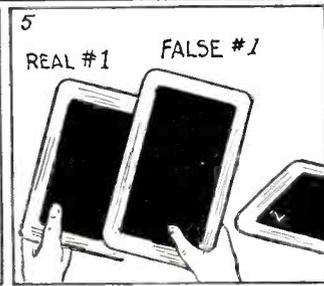
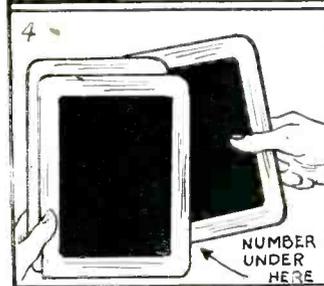
With one hand free, medium makes articles jump. Note attachment of napkin. Audience is on far side.



Three slates stacked together are examined and marked 1, 2 and 3 in upper corners.

On being stacked again and taken apart a message is found on one of them.

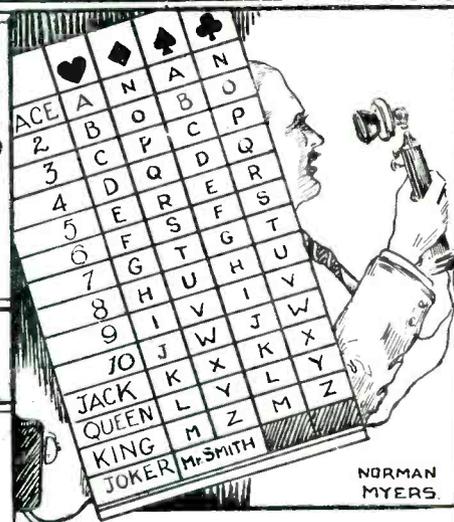
The bottom slate has a message on the under side. On top is figure 1.



When top slate marked 1 is returned to stack, it is placed underneath, number side down.

People see number 1 on top side of second slate and suppose it has been previously examined.

While marking remaining slate 3, fingers rub out 1 on the bottom. Accounting for third slate.



An improved version of the telephone trick is illustrated here. A person names a card in the pack and is told to call up Mr. Johnson, who tells him the name of the selected card over the telephone. No long list of names is required. Simply use the table shown, thus if the three of hearts is chosen tell the person to call Mr. Custer or Callahan. For the black cards use the title doctor or professor. For jack of clubs use Mr. X, the man of mystery and for King of Clubs or King of Diamonds use a name like Zeno.

The Month's Scientific News Illustrated

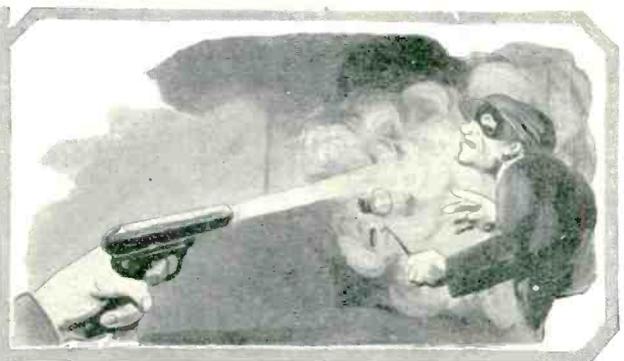
By GEORGE WALL



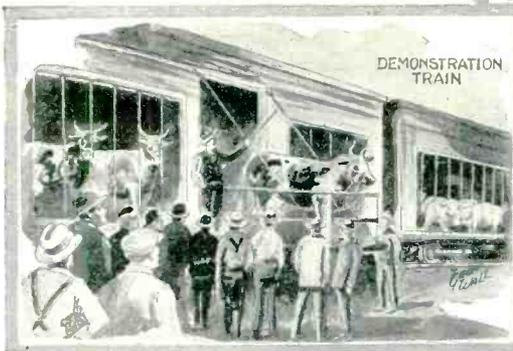
The Oregon State Department of Agriculture used flame thrower, a relic of the Great War, to destroy grasshoppers near Tule Lake. Casualties were estimated at 533,174,400.



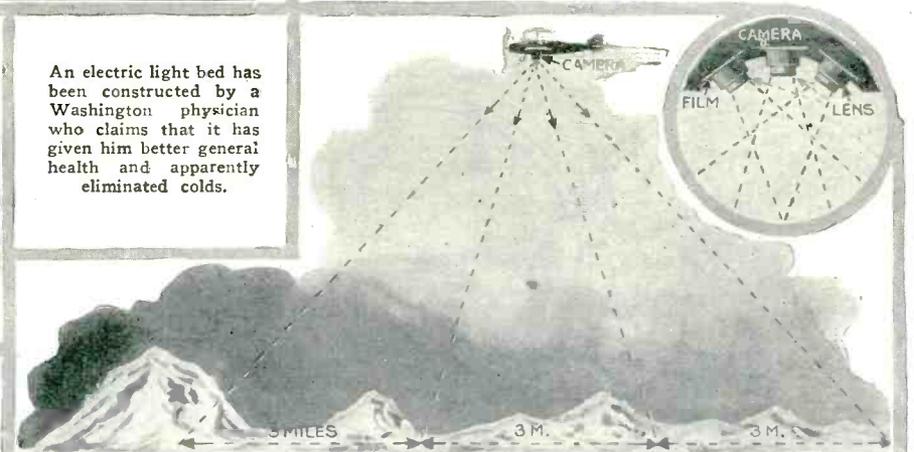
An electric light bed has been constructed by a Washington physician who claims that it has given him better general health and apparently eliminated colds.



The Army Chemical Warfare Service announces the perfection of a new gas pistol which will be used to combat crime. Unless they resort to gas masks in their raids, gunmen will be delivered gas-sick but uninjured into the hands of the law.



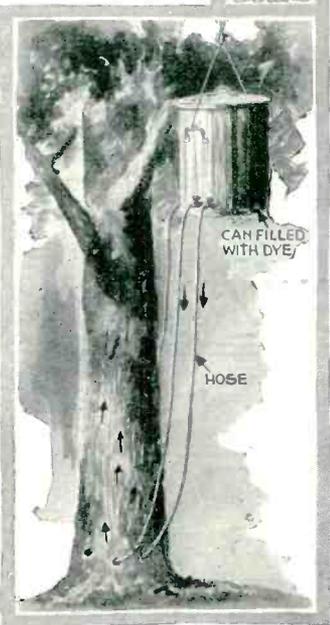
A special demonstration train carrying high-grade cattle, swine and poultry for demonstration to farmers and ranch owners, has been arranged for by the Department of Natural Resources of Nova Scotia. It will cover the territory of the Dominion Atlantic Railway.



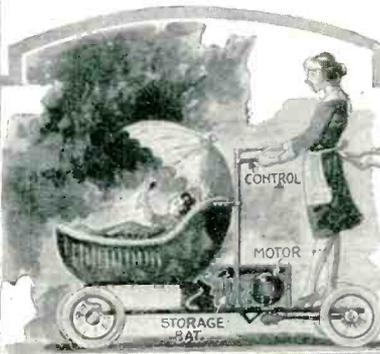
Three cameras of a new type have been assigned to the Alaskan Mapping Expedition for an extended aerial survey. From a height of 15,000 feet an area of 9 miles of territory may be mapped at one exposure.



The biggest explosion of dynamite ever set off within the Golden Gate wiped out a danger to navigation, the sunken hull of the oil tanker "Alden Anderson," on May 6. The explosion caused a water spout estimated at 800 feet high and 125 feet in diameter. The Anderson burned in 1924, causing the death of 7 members of her crew.

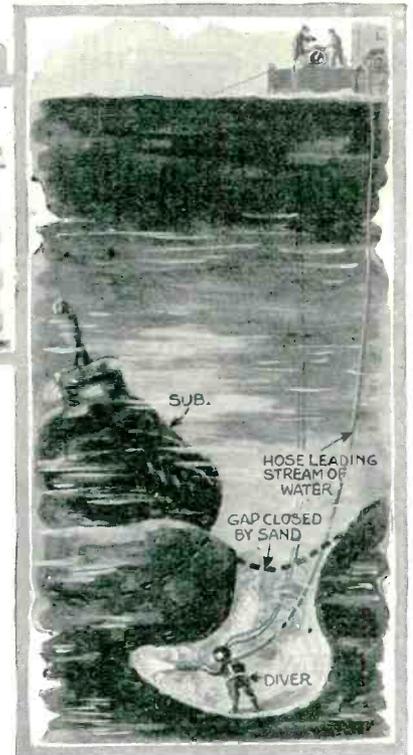


Two students of the University of Maine have succeeded in dyeing trees from their outer surfaces to the hearts of their trunks, using the process invented by a German scientist. The indelible dye is contained in garbage cans suspended at a height, and is introduced through holes bored at the base of the trees. The sap distributes the coloring matter in from two to four days.



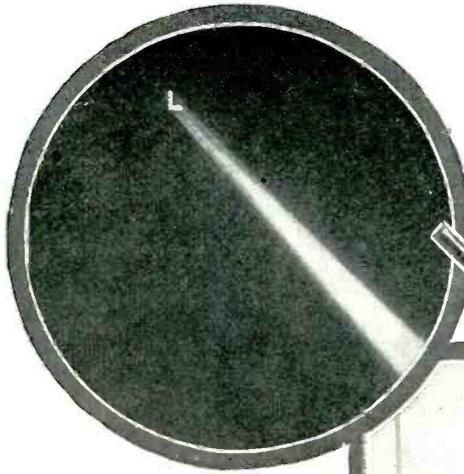
Above is shown the latest luxury for English infants. An automobile baby-carriage, run by a small storage battery electric motor, is geared to the wheels of the carriage platform. The nurse stands at the rear of the platform and governs the motor in the direction of travel by control levers.

During the raising of the S-51, one of the divers who was tunnelling under the wreck to pass a lifting chain around it, found himself trapped by a cave-in of the sand at the entrance of his tunnel. He succeeded in extricating himself by reversing the nozzle of the high-pressure hose used to wash away the sand.



A diver salvaging the S-51 found himself trapped by a cave-in.

SCIENCE STEPS AHEAD



A NEW advertising device called the projectograph, developed by Samuel E. W. Haines of Oakland, Calif., projects the image of a letter on a cloud bank by the use of a highly concentrated ray from a carbon arc projector. The positive or horizontal carbon is shaped in the cross section of the desired letter, and the reflector projects the image on it in a concentrated beam of light. The arc light is adjusted to focus on a distant cloud and is very efficient in cutting through fog as shown above. A battery of these lights may be used to write a sentence or slogan across the sky, or a series of letters may be projected from one projectograph by replacing the horizontal carbon by one cut to the outline of the letter to be projected.

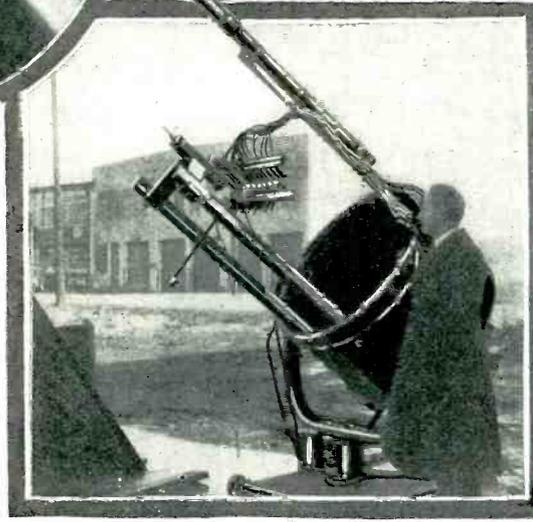
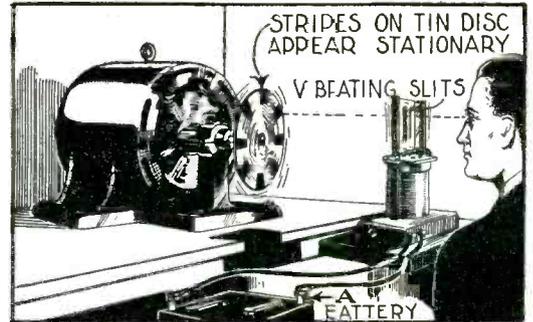
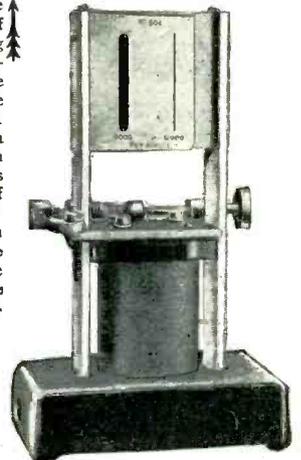


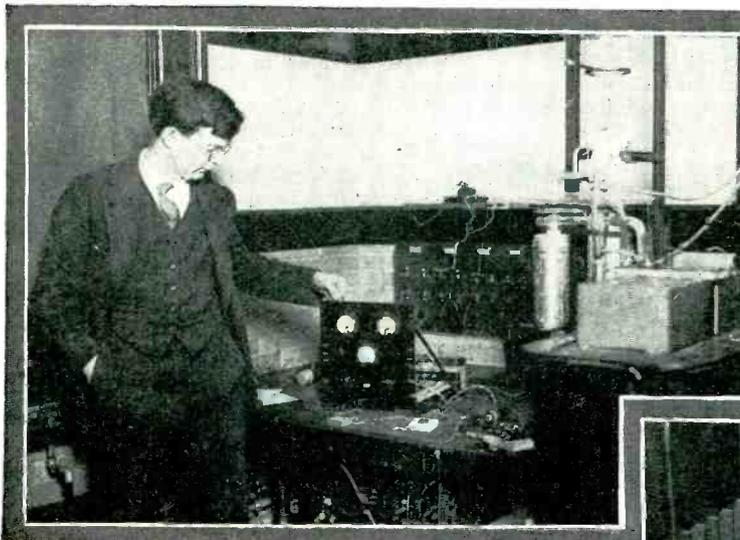
Photo above shows construction of projectograph arc light. The horizontal carbon made in the shape of the letter to be cast, may be seen at the end of the two focusing rods. A mechanism is provided which permits the horizontal carbon to be adjusted and removed for replacement. The reflector is rather flat, so that the light may be concentrated at a distance, and the distance of the arc from it is easily adjustable.



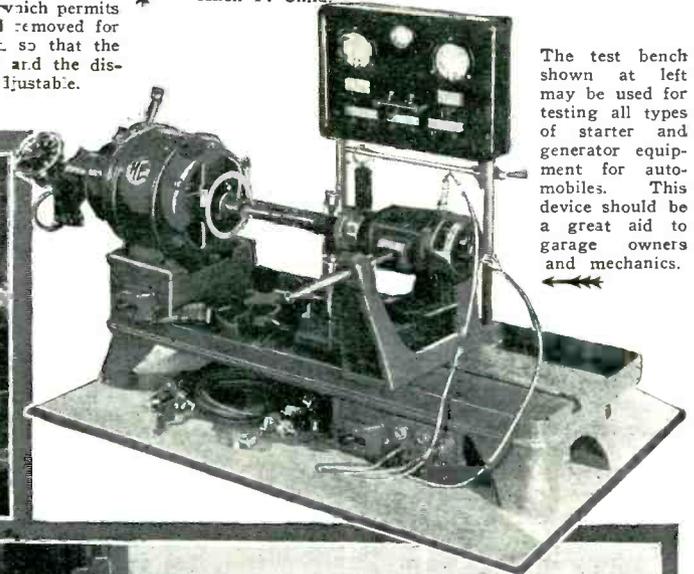
A new English device for the measurement of the speed of revolving shafts utilizes the principle of an aperture synchronized to the speed of the shaft. A disk bearing a pattern of strips as shown in the illustration above is fastened to the end of the shaft and the pattern is viewed through either of two slits in the mechanism. When the shaft speed is a little greater than synchronization, the pattern will appear to move in the direction of rotation; if less, it will seem to reverse. Aperture frequencies of 6,000 and 12,000 per minute are used, because these numbers have a large number of factors and are multiples of the standard A.C. frequencies. — Allen P. Child.



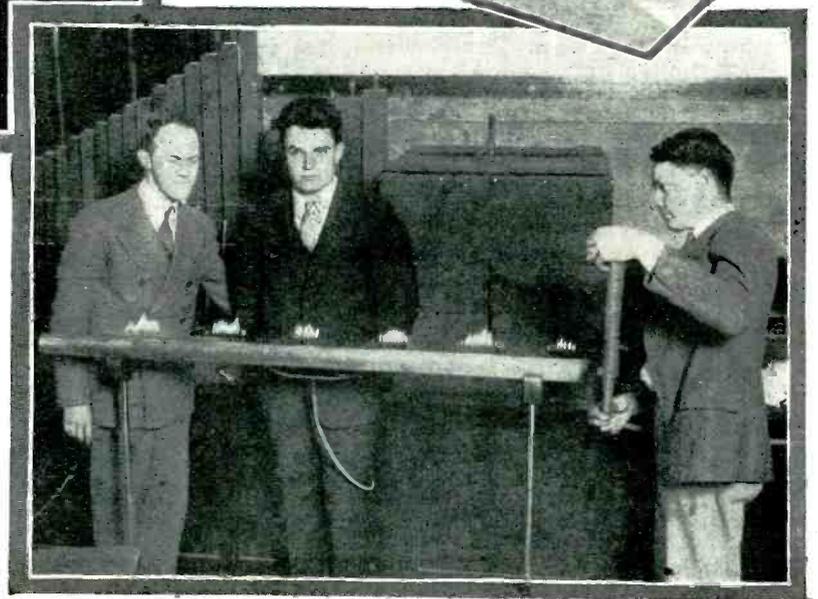
The vibrating apertures of the speed-counter may be easily seen in the above photo. The thumb screw at right is used to adjust vibrator armature.



HERE is the latest apparatus developed by the Bureau of Standards for counting electrons. The process utilizes high frequency apparatus similar to that familiar to radio fans. L. F. Cutiss, expert on gamma rays at the Bureau of Standards, is standing in front of the control board. Scientists have been experimenting for years with various theoretical methods of counting electrons, but until now the apparatus has been very complicated and the results all too uncertain.

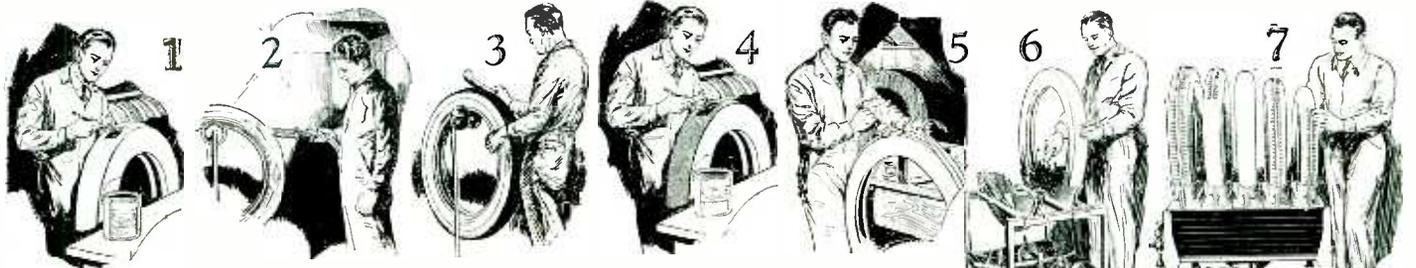


The test bench shown at left may be used for testing all types of starter and generator equipment for automobiles. This device should be a great aid to garage owners and mechanics.



Students of Pomona College, Claremont, Calif., used apparatus at right for demonstrating the action of sound waves. A musical note from a pitch pipe causes standing waves to appear in a row of closely spaced gas jet flames. By means of this process, called the Tyndall experiment, the wavelength and amplitude of sound waves may be demonstrated. Prof. Rowland R. Tileston is shown explaining the method to his pupils.

New Auto Tires from Old Ones



Successive stages in retreading tires: 1—Old tire painted with a special liquid and 2, heated with torch flame. 3—Charred rubber is scraped off, rubber being devulcanized. 4—Vulcanizing liquid applied, and at 5, new rubber is put on tire. Tire is put in mold, 6, and cured at 7.

IF you pay \$30.00 for a new tire for your automobile and drive this tire ten thousand miles for one year, at which time the tire probably looks all in; how would you like to have this tire successfully re-treaded at a cost of ten dollars or less, so that it would yield at least seventy-five per cent. of its original mileage over again. In other words you would obtain seventy-five hundred miles at least more life out of the tire at a very reasonable cost. It is a point not generally recognized by the average motorist that when an auto tire or shoe becomes worn down to or near the first fabric or cord, that only about fifteen per cent. of the rubber has been worn from the tire. So when we take off an old shoe in this condition and throw it on the scrap pile, or sell it for fifty cents to the junk man, we are throwing away approximately eighty-five per cent. of the rubber we originally bought.

Now there comes a new and very successful method of fusing a new rubber tread on the worn tire, after the system developed and patented by Mr. Emil Nestler of New York City. His method has proven so successful in the past few years that garage-men are rapidly installing his system all over the country. The accompanying illustrations show the successive stages through which a worn shoe or tire passes in the process of being re-treaded. Of course repair shops and garages have vulcanized auto tires for many years, but these jobs have not given the satisfaction that the motorist expected of them. It took a genius like Mr. Nestler to find out just what was wrong with the old vulcanizing system. There are seven simple steps in this new process for fusing a firm rubber tread onto the old worn shoe. These successive stages are as follows:

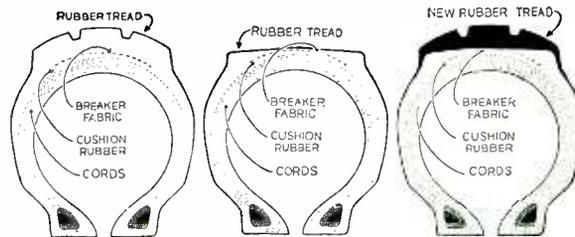
First the old tire is thoroughly cleaned and then the rubber on the worn tread is devulcanized. A non-inflammable and non-explosive liquid is painted on the tire over the old tread face; this is heated by the blue flame of a special torch or else by that from a gasoline blow torch. The compound disappears and then a char forms on the surface. This compound under the influence of heat penetrates the old rub-

ber rapidly and acts to de-sulphurize the rubber to a depth of about one-eighth of an inch. In the old vulcanizing process it was this sulphur content in the rubber that rendered the process impractical. When this first compound is heated it tends to hold the



Two photos above show same tire before (left) being treated and after (right) new tread has been fused on to old tire. At a cost of about one-third the original price, tire is renewed and good for at least 75% of its original mileage.

sulphur in suspension, but it does not remove it from the rubber; the rubber on the old



Sectional views above from left to right show original tire, worn tire, and retreaded tire respectively.

ber face becomes soft and tacky.

The third step is to scrape away the charred surface of the tire and the surface of the old rubber now resembles fresh uncured rubber. A second special compound invented by Mr. Nestler is now applied to the de-vulcanized rubber with a brush, and over this surface is placed a layer of thin

rubber known as "Camel Back." This tread rubber comes in various widths and thicknesses so that various size tires can be taken care of. It will be noted that no rubber is removed from the original tire, as in the old vulcanizing process, which greatly weakens the tire in many cases, besides making the process more costly. All of the original rubber on your old tire is preserved by this process and the editors have examined samples of Mr. Nestler's work and also have seen the process demonstrated. The new rubber cannot be separated from the old rubber of the tire, no matter how much it is twisted. It forms one homogeneous mass of rubber, and a non-skid tread is formed on the face of the new rubber, thanks to the clever moulds used.

The sixth step consists of placing a flexible sandbag inside the shoe and at the same time placing the tire into a special split mould by means of powerful clamps. The sandbag is expanded for forcing the soft uncured rubber into the non-skid design of the mould. This clamping is done away from the curing stove.

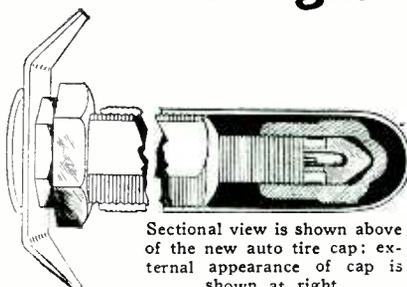
For ordinary installations the tire is covered completely with re-treading rubber and it can be cured in four sections, each one overlapping. The moulds are so designed that the curing is uniform around the tire.

No steam is used in curing and fusing the rubber together, simply dry heat from a gas burner, the heat warming the iron moulds in which the tires are clamped. Five tires can be cured at one time in the medium size stove. For the large shop there is available a full circle mould, whereby the entire shoe can be cured at one time. The time required for curing a section is forty-five minutes to one hour. Where the tire is cured in four sections this requires about five hours, including the preparation of the tire.

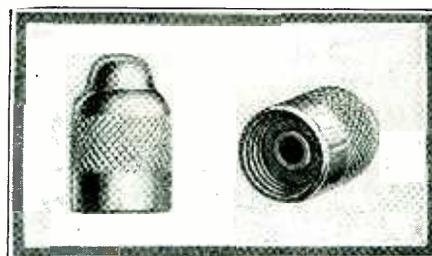
Where the full tread heating-furnace is used, the time is reduced to about two-thirds of this. This system has been developed also for renewing inner tubes and Mr. Nestler has also perfected a very clever (rubber) compound, which is pumped into the inner tube, rendering it puncture-proof for a period of about one year.

New Air-Tight Cap for Auto Tires

THE new principles embodied in this valve cap which gives it a tremendous advantage, are ball-bearing action and compression contact. This construction renders the cap absolutely air-tight, and the inventor claims that any tire equipped with this valve cap need never be touched again until punctured or



Sectional view is shown above of the new auto tire cap; external appearance of cap is shown at right.

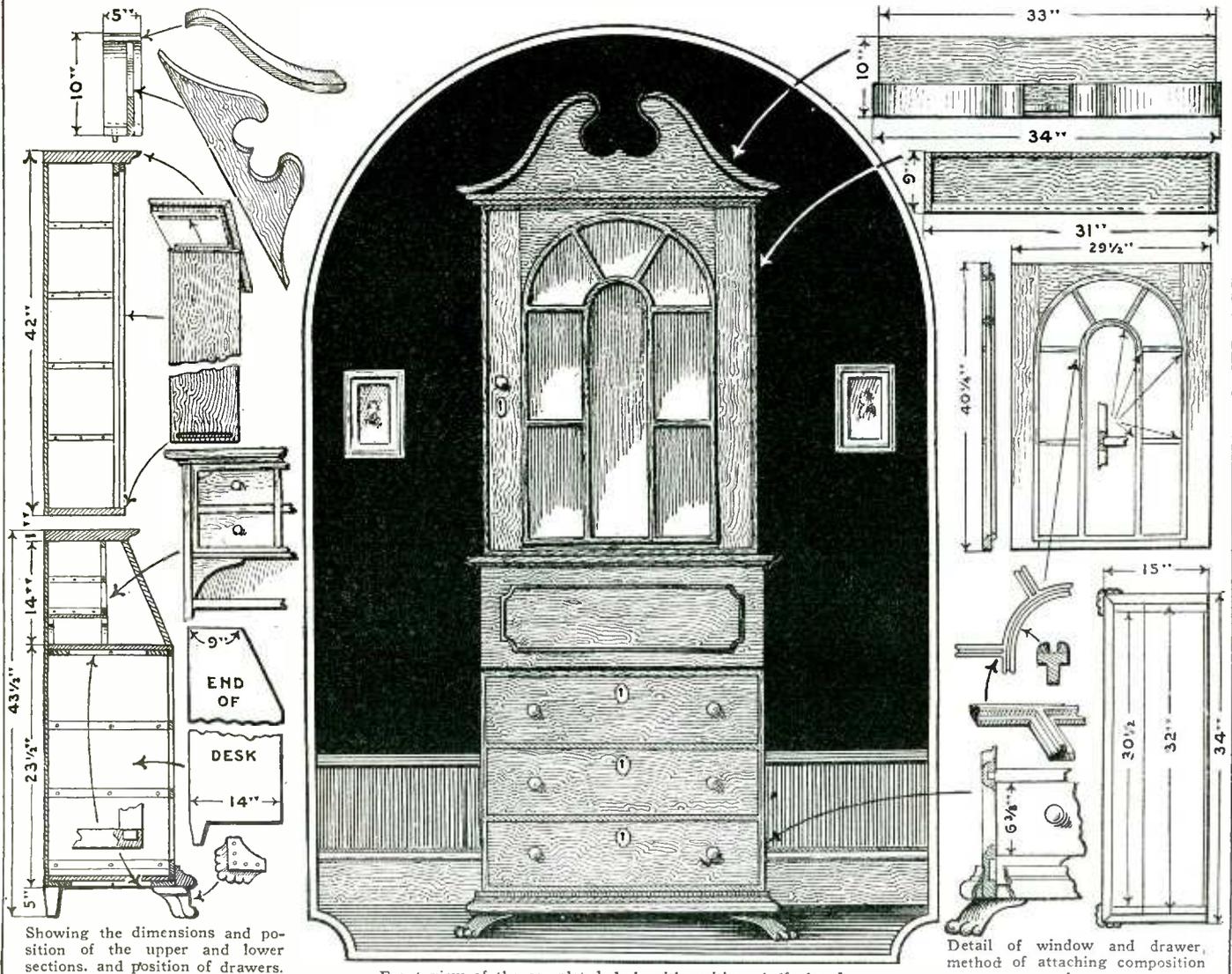


worn out. This cap is made up in three parts: An outer metal section, heavily nickel-plated; a special non-leaking packing disk, and a third or inner section which supports this disk, allowing it to contact solidly with the valve stem. Held thus firmly the packing disk cannot turn when the cap is screwed on.

Home Mechanics

How to Make a Maplewood Desk

By W. M. BUTTERFIELD



Showing the dimensions and position of the upper and lower sections, and position of drawers.

Front view of the completed desk with writing shelf closed.

Detail of window and drawer, method of attaching composition leg.



MAPLE desk in Early American Period is a beautiful piece of furniture. It can be made at home by following the illustrations on this page. Maple lumber is to be had at any first class lumber yard and the yard has the machinery to shape and cut it. Molding circular parts, mortises and tenons can all be better cut by machinery than at home or by hand.

If the home mechanic will cut accurate cardboard templates for his pieces, lumber can be shaped in the rough, ready to smooth and assemble. The mill work is done at slight cost in addition to that of the lumber.

The lower section of the desk should be assembled first. First there are two end or side pieces, each consisting of a single board 42½ inches long, 14 inches wide and ¾ inch thick. To prevent these from warping, tenons are engaged in mortises, cut one at each end of the top piece (see illustration for upper section). Each tenon is 7½ inches long, ½ inch high and ½ inch wide.

The sides are again secured by a shelf-like cross-piece forming the bottom of the desk inclosure. This piece is mortised and tenoned at each end and is 31 inches long, 13¾ inches wide and ¾ inch thick. They are further strengthened with a frame made of ½-inch by 3-inch plywood with mortise and tenon corner joints (as shown). This frame is glued and also screwed at each contact point.

A third support is given to the sides by a cross-piece with mortised and tenoned ends placed at the bottom of the drawer section. This piece is 31 inches long, 13¾ inches wide and ½ inch thick. It is of ½-inch plywood. A frame made and attached as described above is also used.

Ply-wood ¼ inch thick is used for the back. It is 37½ inches long and 30 inches wide.

The cross-pieces forming the openings for the drawers are mortised and tenoned. The bottom one is 31 inches long—including tenons, 2¼ inches wide and ¾ inch thick. The upper three are ¾ inch square and 31 inches long over tenons.

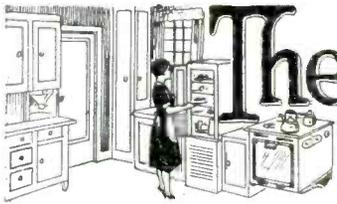
The frame holding the four drawers

and two pigeon holes placed in the desk inclosure is made in one piece. It has false joining marks (see drawing) and is 30 inches long, 14 inches wide, including brackets, and ½ inch thick. A bottom, back bracket, partitions and drawer slides are other parts used here. The wood used is ply-wood.

A single board 14¼ inches wide, 33 inches long and ¾ inch thick forms the drop lid for the desk. To prevent it from warping, channel grooves 2 inches deep and ¾ inch wide are cut through the center flatwise at each end, and pieces of the maple of the above size glued in the grooves with the two grains reversed or crossing each other. Molding (¼ inch quarter round) is used to form a false panel on the front of the lid. It is used as shown in gluing the sash door molding (see illustration).

The seven drawers all have ¾-inch maple fronts, with ½-inch ply-wood backs and ends and ⅜-inch ply-wood bottoms. They are made like any machine-made drawer, so by examining a drawer

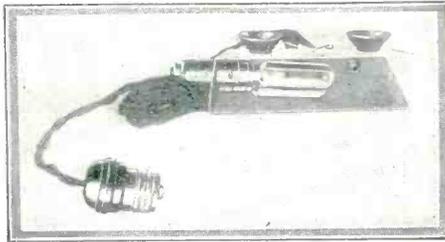
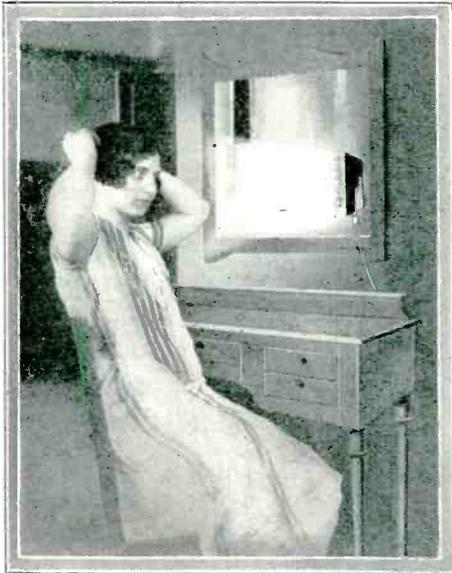
(Continued on page 473)



The Home Scientific



Light for Universal Purposes



These photographs show a new type of light fitted with two suction cups and a clip permitting of its attachment to any surface in any position. A ten-watt bulb is fitted in the highly nickel-plated reflector.—Dallmer Mfg. Co.

Marcel Waver



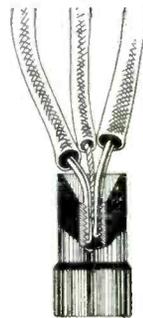
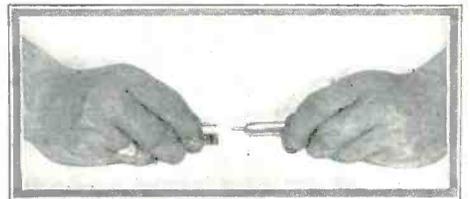
The marcel waver shown in photograph above produces a natural wave due to the curvature of the device. Even a novice can operate it.—S. M. Masse Co.

Can Opener

The can opener here, has a cutting knife, and a jointed right handle which grips the edge of the can and removes the top in one piece turning down the rim edges at the same time, thus preventing accidental injury from a sharp edge. It will cut square cans.—Truedell Mfg. Co.



Wire Nuts



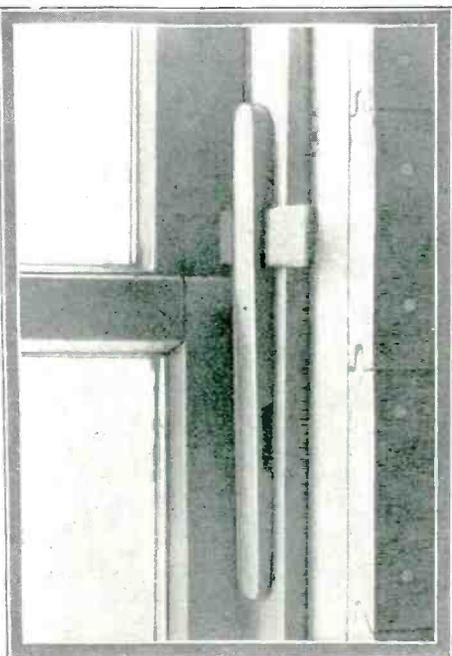
For joining two or more pieces of wire together without soldering the wires these nuts are very convenient. The ends of the wire are bared and pushed into the nut which cuts its own thread on the wire and makes a permanent connection. It is not necessary to tape the joint and four or more wires may be joined together with one nut.—Tork Company.

Fruit Corer

This tool is for the purpose of removing the core of grapes, fruit and similar fruits. The tool is pressed into the center of the fruit and then the jaws are brought together by spreading the handles of the corer. A cup-like depression results.—Boyle Products Co.

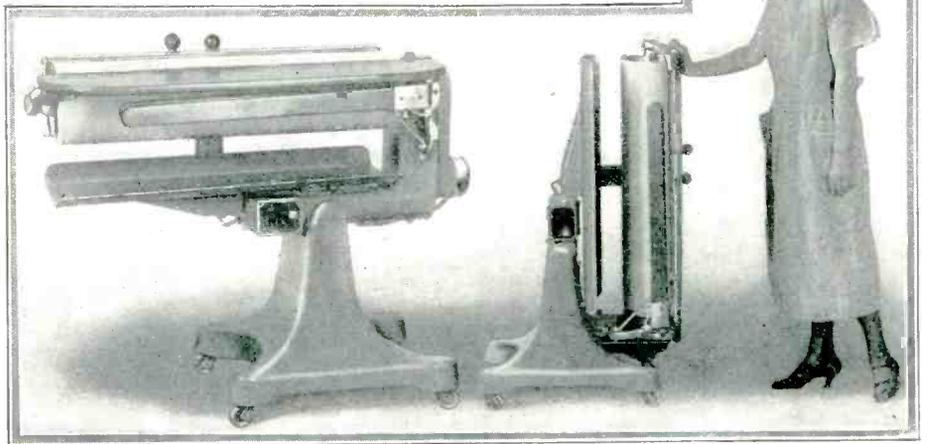


Window Fastener



Cut two notches in a strip of wood and screw to window frame. Wedge of wood holds window open or locks it.—P. B. Bacheller.

Ironing Machine



Cross section through a nut showing wires, is illustrated above.

With this device the housewife can sit and do a day's ironing in part of one morning. It is attachable to any outlet. Because the roll opens, cuffs, neckbands, collars, dresses and skirts can be ironed.—Electric Household Utilities Corp.

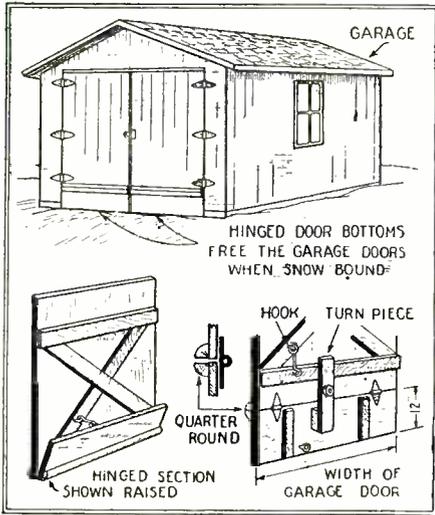
Addresses of the manufacturers of any of the above may be had upon request.

MOTOR HINTS

By GEORGE A. LUERS

A New Monthly Department Prepared by a Well-Known Automotive Engineer

GARAGE DOORS FOOL SNOW



Clever way to fit garage doors so as not to become snowbound.

SOME few years ago, not many car owners would concern themselves with the availability of the automobile in the winter. Conditions have changed, the car is an everyday necessity and the freedom with which it can be put in and removed from the garage is of especial interest.

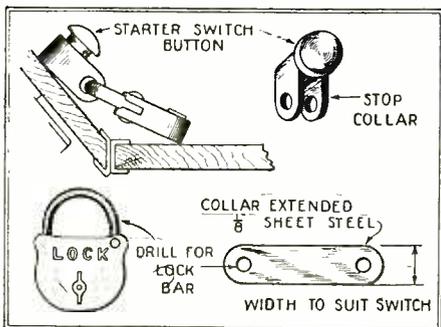
To avoid being snow bound, with the garage doors stuck fast, the car owner will save trouble and much hard labor later on, by preparing the doors of his garage, to swing freely, when the ground is covered in deep layers of snow.

The appended sketch shows one of the simplest and best ways to arrange the opening to the garage, which consists mainly of hinged bottoms to turn up and inside the doors.

The doors to be altered are cut off a distance of twelve inches at the bottoms. Pine or preferably cypress of a corresponding width is obtained, and by means of strap hinges, a piece is attached to the lower edge of each door. Battens are nailed on to re-enforce this extension, and a turn piece is arranged as shown to hold the extension down. One small hook to attach the extension when raised, completes the work of preparing the doors.

STOP COLLAR FOR THE STARTER BUTTON ON THE CAR

Repairs were being made to a building, and an automobile occupied a space where it was desired to load a truck in front of the building. The truck driver stepped into the parked and locked car, put it into gear, stepped on the starter and moved it up the block.



A simple scheme for locking the starter button.

To prevent the starter button being pressed down by children, garage attendants, thieves or unauthorized persons, thus discharging the car's battery, a simple stop collar of the type shown in the sketch can be attached to most makes.

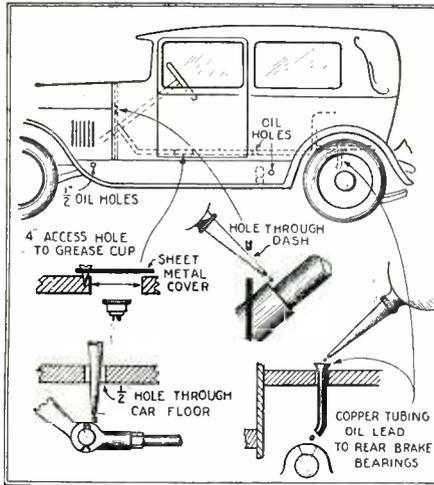
This is a U-shaped piece which clips around the stem of the starter button, bearing against the collar and seats against the body of the starter switch or floor board above.

Make the U collar from 1/2-inch sheet steel, drill two small holes in the projecting ears for the bar of a small padlock. The length of the U collar is easily determined from the starter switch, taking the measurement when the button is not pressed down.

Of course this stop collar may not appeal to the closed car owner, but the majority of car drivers, using open cars will appreciate the advantage that this stop has in avoiding discharged batteries. The protection is appreciable in contrast to the small cost in time to make it up.

HOW TO LUBRICATE HIDDEN PARTS

Under the car for oiling, is not only hard on the clothes, but also hard on the eyes. Of course you might get out the goggles and line the garage floor with rugs, but this does not necessarily remove the undesirable features of getting under to lubricate.



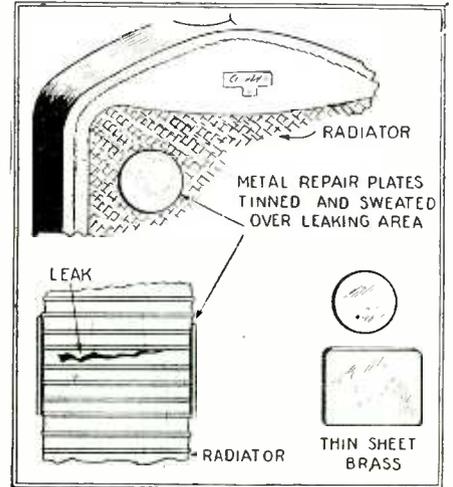
How to make accessible those out-of-sight bearings on your car.

A means which helps considerably to avoid the obstacles formed by disc wheels, low chassis, bumpers and aprons, and simplifies the oiling work is that of drilling access holes for the spout of the oil can or for oil ducts.

To illustrate this, the sketch shows the main places which require frequent lubrication and the necessary access holes for oiling from a convenient place above the car.

Small holes are drilled through the running board aprons, through the dash, through the car flooring and under the rear seat compartment directly above the part to be oiled. The size of the hole required depends on the accessibility of the part under it. If only the oil can spout is to be accommodated, a half-inch hole is sufficient, but if a grease cup is to be reached, a four-inch or five-inch hole with tin cover should be cut. Many leads can be reached with a piece of copper gasoline pipe, pushed into a small hole drilled into the floor board and the oil fed to a bearing by dropping it into the tube.

SHEET METAL DISCS MAKE SERVICEABLE AND NEAT RADIATOR REPAIRS



An effective way to repair a radiator leak. Monogram may be soldered over the patch.

On the honeycomb type of radiator leaks from a freeze or break caused by other reasons, can be neatly and serviceably repaired by means of a small metal disc on the outside and one inside.

To make this repair, cut out the two sections of metal, sheet brass for permanence, into a circular shape, or rectangular if this better meets the need. Tin one face of each piece of metal. Clean off the edges of the leaking area of the radiator and with a hot tinned soldering iron, apply a circular area of solder. Then with a hot soldering iron, press the tinned face of the repair patch to the radiator and sweat it into place.

This repair is made without removal of the radiator and does not endanger the solder in the tubes as will a blow torch which is brought against the radiator, when attempting to fill interstices with solder.

If you desire you can attach your motor club emblem right over the brass patch, polish it bright or touch it up with black enamel.

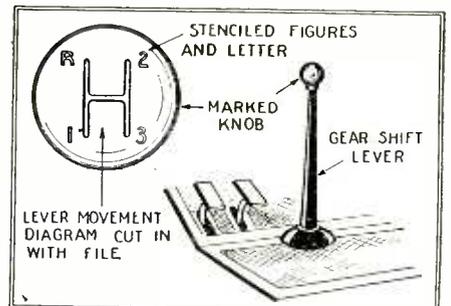
MARKED GEAR SHIFT KNOB TO AVOID WRONG SHIFT

To add this to the car, only a file and machinist's stencils are required.

Cut an H into the convex surface of the knob with a file and stamp the letter and figures at the extremities of the H.

After cutting in the index, it is made clear and distinct by filling the cuts with white paint or white wax.

The correctly cut index indicates to the garage attendant or temporary driver, the proper location of the shift lever for each of the four conditions of operation, thus preventing the stripping of a gear.



For green drivers this method of marking the gear shift knob will commend itself.

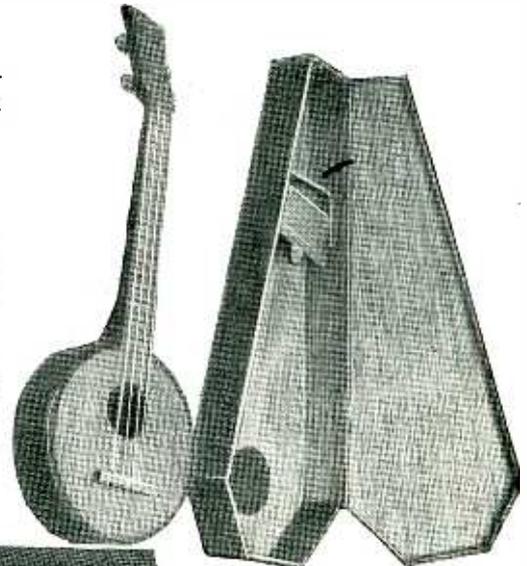
AWARDS IN \$5,000.00 MATCHCRAFT CONTEST



From the photograph of Miss Olsen, above, playing the ukelele, a fair idea of the size of the instrument may be obtained.

UKELELE AND CARRYING CASE OF UNUSUAL BEAUTY WINS FIRST PRIZE—\$100.00, IN THIS MONTH'S CONTEST. MODEL BUILT BY STANLEY PERRON OF SALEM, MASS.

Undoubtedly the finest model which has been entered in the Matchcraft Contest up to the present time and which won for its builder, Stanley Perron, of Salem, Mass., the coveted First Prize, appears in the photographs on this page. It was really remarkable to see what Mr. Perron had created with the matches. The ukelele and its accompanying carrying case received this month's \$100.00 prize.



The above photograph shows the carrying case of the ukelele open and also clearly indicates the presence of a receptacle for spare strings. The carrying case is made of matches laid on in three layers, the corners of the case being very carefully joined and glued. The builder took great pains in polishing up this very excellent Matchcraft model, so much so that the matches took on a glass-like finish and exhibited a lustre which it would take a poet to describe. The ukelele itself has a very mellow tone and surprising volume for its match-construction. Thousands of matches were required.

The photo at the right shows the carrying case closed and the back of the ukelele. Every part of the instrument, with the exception of the keys and strings, is made of matches. Notice the back of the instrument and observe the concentric layers of matches located in different planes giving rise to the artistic effect. The back was built up several layers thick and then carved down and polished.

\$5,000.00 Prize "Matchcraft" Contest

WATCH FOR PRIZES IN OCTOBER ISSUE

16 Monthly Prizes

First Prize	\$100.00
Second Prize	75.00
Third Prize	50.00
Fourth Prize	35.00
Fifth Prize	25.00
Sixth Prize	20.00
Seventh Prize	15.00
Eighth Prize	12.50
9th to 16th Prizes of \$10.00 each	\$80.00

FOR the present year, SCIENCE AND INVENTION magazine will award a total of \$5,000 in prizes, in a new contest. You are asked to make models, fashioning the same entirely from safety matches. Please observe the following simple rules:

- (1) Models submitted must contain at least 90 per cent. safety matches in their construction.
- (2) Models made of toothpicks, paper matches, or non-safety matches, are not eligible in this contest.
- (3) Models can not be built around boxes or other supporting articles. Walls, roofs, etc., must all be self-supporting and made of matches.
- (4) All liquid adhesives, such as glue, shellac, cements, etc., are permissible.
- (5) Models may be painted, gilded or silvered.
- (6) Models may be of any size.
- (7) In order to win a prize, it is necessary that either models be submitted, or, if this is not practical, owing to their size, a 5"x7" photograph of the model may be sent in lieu of the model itself. The best models submitted each month will be awarded the prizes scheduled here-with.

IMPORTANT

QUITE a few matchcraft models from contestants arrive broken every month, due to faulty packing, or weak construction. It should be remembered that boxes are often violently thrown around in transit before they reach us. Make sure first that your model is constructed strongly enough to withstand severe shocks. Then, before you send us the model, after you have it packed as well as you know how, throw it up almost to the ceiling and let it come down on the floor. Open up the box and see if the model is not damaged. Only after such a test can you know that the model will arrive safely.

All First Prize Awards will henceforth become the property of the Experimenter Publishing Company and will be used for exhibition purposes.

(8) All models submitted to SCIENCE AND INVENTION Magazine will be promptly returned to the builder, who will prepay all charges.

(9) Where SCIENCE AND INVENTION has any doubts as to the model (where photos only are submitted) complying with all the regulations, the judges may, at their discretion, request that the actual model be sent in for inspection, paying transportation charges both ways.

(10) This is a monthly contest, lasting for twelve months, each monthly contest closing on the first of the month following date of issue. Thus the contest for the month of September will close October 1, 1926, and prize winning announcements will be made in the December, 1926, issue. The October issue will contain July prize winning entries.

(11) Models must be shipped in a strong wooden box, never in a cardboard box, as SCIENCE AND INVENTION can not be held responsible for breakage in transit due to models having been improperly packed.

(12) When models are sent, be sure to affix tag, giving your name and address, to the model itself. In addition, put name and address on outside wrapper of package.

(13) Address all letters, packages, etc., to Editor, "Matchcraft" Contest, care SCIENCE AND INVENTION Magazine, 53 Park Place, New York.

Caution—Soak or cut heads from matches before building your model so that the models may be expressed or mailed. The strike-everywhere square cut Liberty matches can be used if the heads are cut off.

This contest started Dec. 1, 1925, and will terminate Dec. 1, 1926.

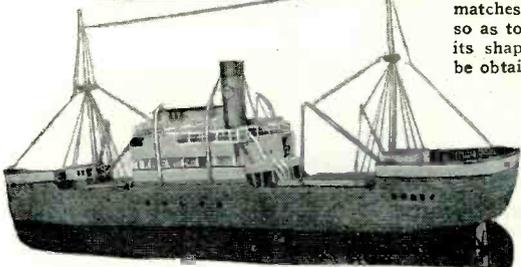
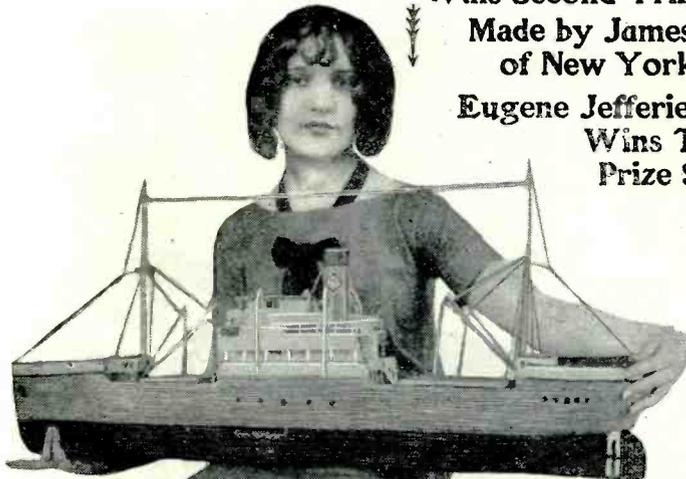
REMEMBER— This is a monthly contest offering sixteen prizes every month. Don't hesitate, send in your model now!

MATCHCRAFT

Model of Liner
Wins Second Prize \$75.00

Made by James Quinn
of New York City

Eugene Jefferies' Fan
Wins Third
Prize \$50.00



SECOND PRIZE—\$75.00 was won by James Quinn of New York City for the model ship shown in the photograph above and to the left. The ship has a hollow hull and the matches around the stern were bent so as to give this part of the vessel its shape. A comparative size may be obtained by examining the photo above. Miss Sadie Bernstein is holding the vessel.

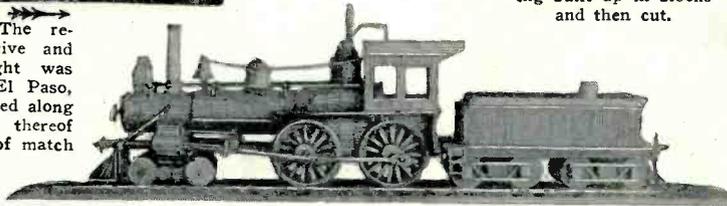


THIRD PRIZE — \$50.00 was awarded the fan, constructed by Eugene Jeffries, Anacortes, Washington. The fan is less than 1/16th of an inch in thickness at its edge, the matches being built up in blocks and then cut.

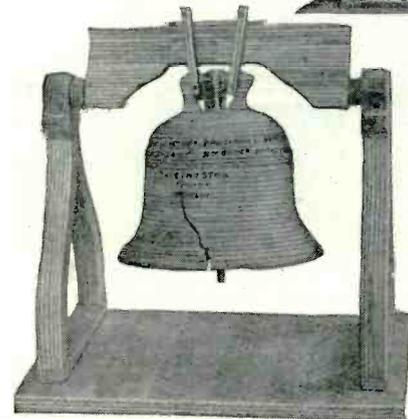
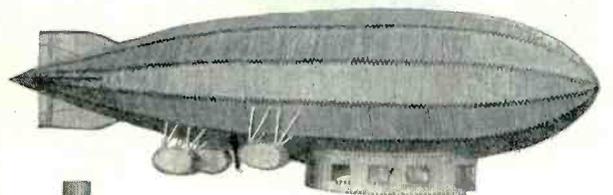
Miss Rose Bickman holding the fan which won Third Prize.



FOURTH PRIZE—\$35.00. The remarkable model of a locomotive and tender illustrated at the right was built by Louis A. Smith of El Paso, Texas. The model may be pushed along the rails and every portion thereof works. Even the bell cord is of match construction.

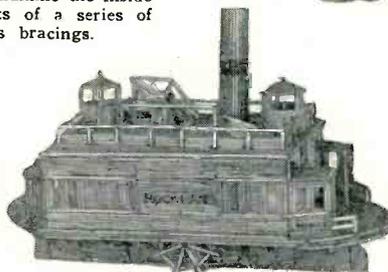
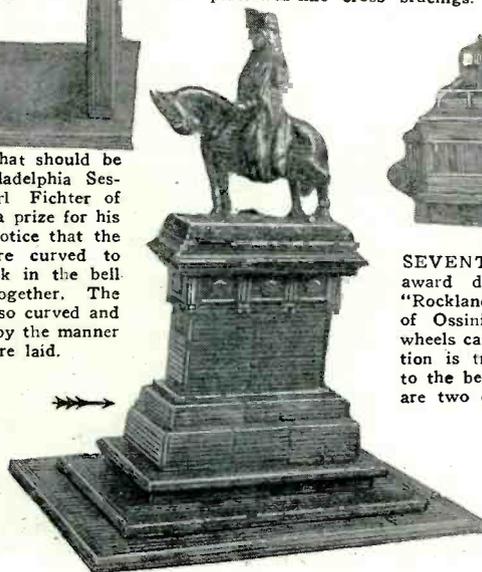


FIFTH PRIZE—\$25.00 was awarded Oliver E. Kaupang of Minneapolis, Minnesota for the model of a dirigible illustrated here. The model is two feet, ten inches long and ten inches in height overall from the top of the bag to the bottom of the caboose. At the nose of the bag a door is located which may be opened to examine the inside construction. This consists of a series of spider-web-like cross bracings.



SIXTH PRIZE—\$20.00. What should be more natural during the Philadelphia Sesquicentennial than that Karl Fichter of Philadelphia, Pa., should win a prize for his model of the Liberty Bell? Notice that the matches forming the bell are curved to shape. Also observe the crack in the bell and the bolts holding it together. The matches in the standard are also curved and the base artistically decorated by the manner in which the matches are laid.

EIGHTH PRIZE—\$12.50. This statue of George Washington at Valley Forge is almost fourteen inches high. Pedestal, Horse and Rider are of solid construction, the latter too being carved to shape. The model is 100% matches and was built by Irving Klein of Brooklyn, N. Y.



SEVENTH PRIZE—\$15.00 was the award decided on for the ferryboat "Rockland" built by Warren C. Brown of Ossining, New York. The paddle wheels can be made to rotate, which motion is transmitted by means of levers to the beam on top of the ferry. There are two drive ways, one on either side of the engine-room.

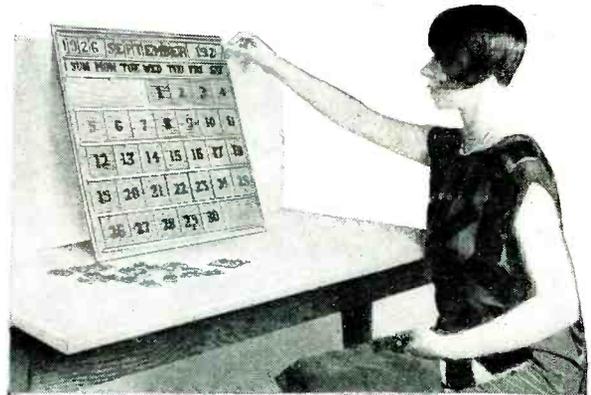


FOURTEENTH PRIZE—\$10.00 was awarded to Miss Beatrice M. Chase of Central Falls, Rhode Island, for her construction of a Toonerville Trolley illustrated in the photograph at the right.

Further Matchcraft Awards

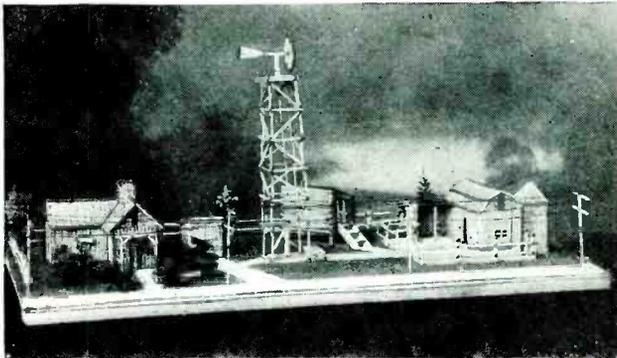
Continuing the List of Prize Winners for This Month.
Your Model May Also Win a Prize, so Send it in Now

NINTH PRIZE—\$10.00 was the award decided upon by the judges for the perpetual calendar illustrated in the two photographs at the right. The setting of the days of the week is permanent, but the dates may be shifted at will and the month and year may also be changed. Sufficient additional wooden slides fitting into grooves accompany the calendar and extra letters to form all of the months of the year are also included. The back is of three-ply match construction. The model was built by Chas. E. Parker of Claymont, Delaware.



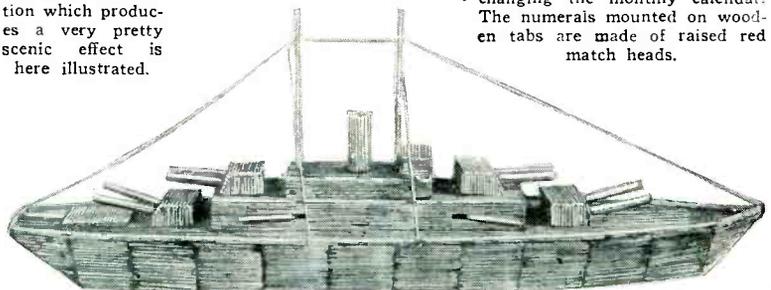
In the above photograph, Miss Shirley Hecht is engaged in changing the monthly calendar. The numerals mounted on wooden tabs are made of raised red match heads.

ELEVENTH PRIZE—\$10.00. The model of farm buildings built by John E. Hackett of Hornell, N. Y., is illustrated in the photograph below. The farmer's home, graincrib, windmill, stable and silo may be seen in the photograph.

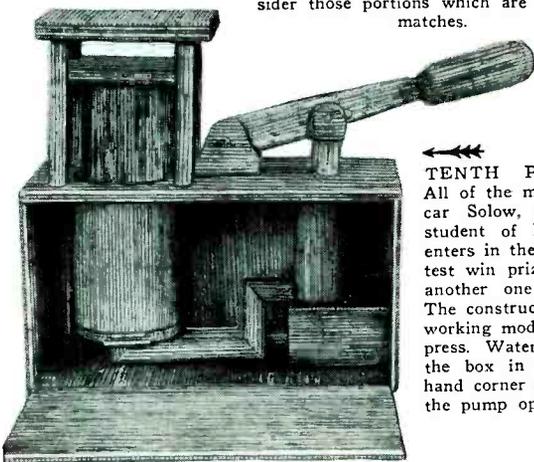


The model above is mounted on a baseboard. The judges, however, only consider those portions which are made of matches.

A match construction which produces a very pretty scenic effect is here illustrated.



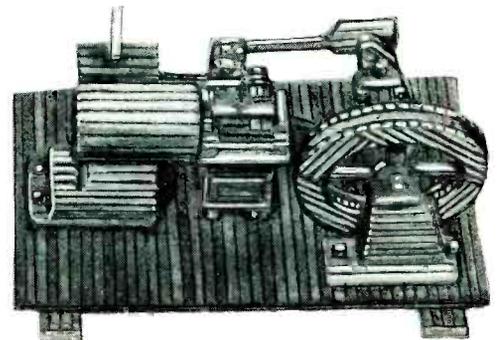
FIFTEENTH PRIZE—\$10.00. Henry Ludwig of Ridgewood, N. Y., who built the Matchcraft battleship shown above is only fourteen years old and although he submitted quite a few models in previous contests this is the first one which won an award. The gun turrets are mounted on swivels and the guns may be raised or lowered and the turrets may be rotated. The construction of the hull is hollow and the matches were laid on ribs made of the same material.



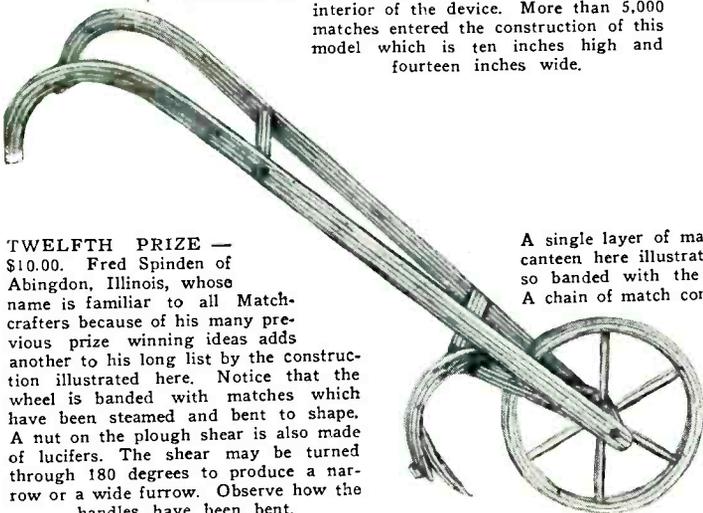
TENTH PRIZE—\$10.00. All of the models which Oscar Solow, a High School student of New York City enters in the Matchcraft contest win prizes and this is another one of his models. The construction represents a working model of a hydraulic press. Water is admitted to the box in the lower right hand corner and by means of the pump operates the press.

The pump and plunger and the pipes are made of matches. The piston of the pump is a solid block of matches. The table of the press is of four-ply match construction. The front has been removed to show interior of the device. More than 5,000 matches entered the construction of this model which is ten inches high and fourteen inches wide.

THIRTEENTH PRIZE—\$10.00. To the right we see a working model of a horizontal steam engine which was very cleverly constructed by Theodore Sterrett of Port Arthur, Ontario, Canada. This model is less than four inches long and two inches in width and approximately 2 inches high.



SIXTEENTH PRIZE—\$10.00. The last of the group of prizes for this month, was awarded to Dr. A. A. Hansen of Virginia, Minnesota for his model of a canteen illustrated in the photograph below. The top is provided with a ring for its removal and a clasp for holding it in place.



TWELFTH PRIZE—\$10.00. Fred Spinden of Abingdon, Illinois, whose name is familiar to all Matchcrafters because of his many previous prize winning ideas adds another to his long list by the construction illustrated here. Notice that the wheel is banded with matches which have been steamed and bent to shape. A nut on the plough shear is also made of lucifers. The shear may be turned through 180 degrees to produce a narrow or a wide furrow. Observe how the handles have been bent.

A single layer of matches forms the canteen here illustrated which is also banded with the same material. A chain of match construction serves as the handle. This chain is very unique.



Into the Fourth Dimension

FIRST INSTALLMENT

By RAY CUMMINGS



"A farmer's boy beside us had a handful of old horse-shoes. He began throwing them. One of them visibly went through the "ghost." Then a man

with a star on the lapel of his overcoat fired a shot. It spat yellow flame. Where the bullet went no one could have told. The specter was unchanged."

CHAPTER I The Ghosts of '46

THE first of the "ghosts" made its appearance in February of 1946. It was seen just after nightfall near the bank of a little stream known as Otter Creek, a few miles from Rutland, Vermont. There are willows along the creek-bank at this point. Heavy snow was on the ground. A farmer's wife saw the ghost standing beside the trunk of a tree. The evening was rather dark. Clouds obscured the stars and the moon. A shaft of yellow light from the farmhouse windows came out over the snow; but the ghost was in a patch of deep shadow. It seemed to be the figure of a man standing with folded arms, a shoulder against the tree-trunk. It was white and shimmering; it glowed; its outlines were wavy and blurred. The farmer's wife screamed and rushed back into the house.

Up to this point the incident was not unusual. It would have merited no more than the briefest and most local newspaper attention; reported perhaps to some organization interested in psychical research to be filed with countless others of its kind. But when the farmer's wife got back to the house and told her husband what she had seen, the farmer went out and saw it also; and with him, his two grown sons and his daughter. There was no doubt about it; they all saw the apparition still standing motionless exactly where the woman had said.

There was a telephone in the farmhouse. They telephoned their nearest neighbors. The telephone girl got the news. Soon it had spread to the village of Procter; and then to Rutland itself. The ghost did not move. By ten o'clock that evening the road before the farmer's house was crowded with cars; a hundred or more people were

FOREWORD

In this, my own conception of the phenomena we popularly call "ghosts," I have not intended to involve either spiritualism or religion. Rather have I determined to stand upon the middle ground of science. I am aware, of course, that many of you will declare that there is very little of our coldly precise science to support what I am so boldly setting forth. Call it then—Scientifiction.

My basic conception is elusive; my characters freely admit it. Like a dream, not lending itself readily to word depiction. Purposely I have made it so, for to reduce it to an over-bald reality would paradoxically destroy the very essence of its realness. If at times my word pictures seem inadequate, I beg you to lower the printed page for a moment and let your own imagination roam.

If I can do that—stimulate your imagination, drive your thoughts from the humdrum affairs of our own little lives out into uncharted seas; and most of all, if I can thus entertain you—my purpose will have been accomplished.—Ray Cummings.

trampling the snow of his corn-field cautiously, from a safe distance regarding that white motionless figure.

It chanced that I was also an eye-witness to this, the first of the ghosts of '46. My name is Robert Manser. I was twenty-six years old that winter—correspondent in the New York office of a Latin-American Export House. With Wilton Grant and his sister Beatrice—whom I counted the closest of my few real friends—I was in Rutland that Saturday evening. Will was a chemist; some business which he had not detailed to me had called him to Vermont from his home near New

York. In spite of the snowy roads he had wanted to drive up, and had invited me to go along. We were dining in the Rutland Hotel when people began talking of this ghost out toward Procter.

It was about ten-thirty when we arrived at the farm. Cars were lined along the road in both directions. Flashing headlights; chugging motors. People trampling the road, the fields, clustering about the farmhouse; talking, shouting to one another.

The field itself was jammed, but down by the willows along the creek there was a segment of snow as yet untrampled, for the crowd had dared approach so far but no further. Even at this distance we could see the vague white blot of the apparition. Will said, "Come on, let's get down nearer. You want to go, Bee?"

"Yes," she said.

We began elbowing and shoving our way through the crowd. It was snowing again now. Dark; but some of the people had flashlights which darted about; and occasionally a smoker's match would flare. The crowd was good-natured; with courage bolstered by its numbers, the awe of the supernatural was gone. But they all kept at a safe distance.

Somebody said, "Why don't they shoot at it? It won't move—can't they make it move?"

"It does move—I saw it move, it turned its head. They're going up to it pretty soon—see what it is."

I asked a man, "Has it made any sound?"

"No," he said. "They claim it moaned, but it didn't. The police are there now, I think—and they're going to shoot at it. I don't see what they're afraid of. If they wanted me to I'd walk right up to it." He began elbowing his way back toward the road.

We found ourselves presently at the front rank, where the people were struggling to keep themselves from being shoved forward by those behind them. Thirty feet across the empty snow was the ghost. It seemed, as they had said, the figure of a man, blurred and quivering as though moulded of a heavy white mist at every instant about to dissipate. I stared, intent upon remembering what I was seeing. Yet it was difficult. With a quick look the imagination seemed to picture the tall lean figure of a man with folded arms, meditatively leaning against the tree-trunk. But like a faint star which vanishes when one stares at it, I could not see a single detail. The clothes the face, the very outlines of the body itself seemed to quiver and elude my sight when I concentrated my attention upon them.

Yet the figure, motionless, was there. Half a thousand people were now watching it. Bee said, "See its shoulder, Rob! It isn't touching the tree—it's inside the tree! It's leaning against something else, inside the tree!"

The dark outline of the tree-trunk was steady reality; it did seem as though that shadowy shoulder were within the tree.

A farmer's boy beside us had a handful of horse-shoes. He began throwing them. One of them visibly went through the ghost. Then a man with a star on the lapel of his overcoat fired a shot. It spat yellow flame. Where the bullet went no one could have told, save that it hit the water of the creek. The spectre was unchanged.

The crowd was murmuring. A man near us said, "I'll walk up to it. Who wants to go along?"

"I'll go," said Will unexpectedly; but Bee held him back.

The volunteer demanded, "Officer, may I go?"

"I ain't stoppin' you," said the man with the star. He retreated a few steps, waving his weapon.

"Well then put that gun away. It might go off while I'm down there."

Somebody handed the man a broken chunk of plank. He started slowly off. Others cautiously followed behind him. One was waving a broom. A woman shouted shrilly, "That's right—sweep it away—we don't want it here." A laugh went up, but it was a high-pitched, nervous laugh.

The man with the plank continued to advance. He called belligerently, "Get out of there, you! We see you—get away from there!" Then abruptly he leaped forward. His waving plank swept through the ghost; as he lunged, his own body went within its glow. A panic seemed to descend upon him. He whirled, flailing his arms, kicking, striking at the empty air as one tries to fight off the attack of a vicious wasp. Panting, he stumbled backward over his plank, gathered himself and retreated.

The white apparition was unchanged. "It was just like a glow of white light," the attacker told us later. "I could see it—but you couldn't feel it. Not a thing—there wasn't anything there!"

The ghost had not moved, though some said that it turned its head a trifle. Then from the crowd came a man with a powerful light. He flooded it on the spectre. Its outlines dimmed, but we could still see it.

THIS NEW STORY
by
RAY CUMMINGS

will not only entertain you but will mystify you as well. Mr. Cummings possesses the unusual faculty of adroitly mixing science and fiction in a most attractive way. If you have read the last story by this author, "Tarrano the Conqueror"—you will look forward to an exciting tale.

A shout went up. "Turn that light off! It's moving! It's moving away!"

It was moving. Floating or walking? I could not have told. Bee said that distinctly she saw its legs moving as it walked. It seemed to turn; and slowly, hastelessly it retreated. Moving back from us. As though the willows, the creek-bank, the creek itself were not there, it moved backward. The crowd, emboldened, closed in. At the water's edge we stood. The figure apparently was now within or behind the water. It seemed stalking down some invisible slope. Occasionally it turned aside as though to avoid some obstruction. It grew smaller, dimmer by its greater distance from us until it might have been the mere

reflection of a star down there in the water of the creek; then it blinked, and vanished.

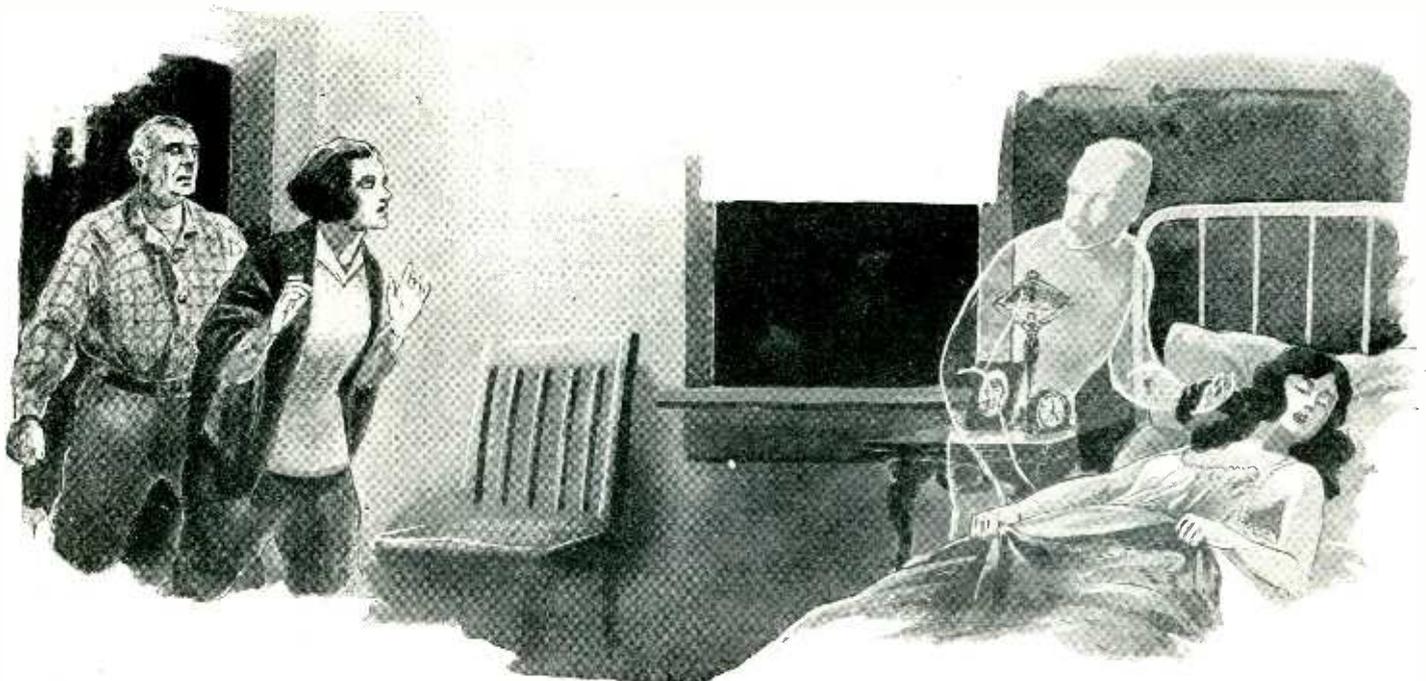
There were thousands who watched for that ghost the following night, but it did not appear. The affair naturally was the subject of widespread newspaper comment; but when after a few days no one else had seen the ghost, the newspapers began turning from the serious to the jocular angle.

Then, early in March, the second ghost was reported. In the Eastern Hemisphere this time. It was discovered in midair, near the Boro Badur, in Java. Thousands of people watched it for over an hour that evening. It was the figure of a man, seated on something invisible in the air nearly a hundred feet above the ground. It sat motionless as though contemplating the crowd of watchers beneath it. And then it was joined by other figures! Another man, and a woman. The reports naturally were confused, contradictory. But they agreed in general that the other figures came from the dimness of distance; came walking up some invisible slope until they met the seated figure. Like a soundless-motion-picture projected into the air, the crowd on the ground saw the three figures in movement; saw them—the reports said—conversing; saw them at last move slowly backward and downward within the solid outlines of the great temple, until finally in the distance they disappeared.

Another apparition was seen in Nome; another in Cape Town. From everywhere they were now reported. Some by daylight, but most at night. By May the newspapers featured nothing else. Psychical research societies sprang into unprecedented prominence and volubility. Learned men of spiritualistic tendencies wrote reams of ponderous essays which the newspapers eagerly printed.

Amid the reports now, the true from the false became increasingly difficult to distinguish. Notoriety seekers, cranks and quacks of every sort burst into print with weird tales of ghostly manifestations. Hysterical young girls, morbidly seeking publicity, told strange tales which in more sober days no newspaper would have dared to print. And in every country charlatans were doing a thriving business with the trappings of spiritualism.

(Continued on page 454)



"And the next night, in a Kansas farm-house, the farmer and his wife were awakened by the scream of their adolescent daughter. They rushed into her bedroom. She was in bed, and bending over her was the apparition of a

man. Its fingers were holding a lock of the girl's long black hair. At the farmer's shout, the ghost turned: its hand was raised—and the farmer and his wife both saw that the shadowy fingers had lifted the girl's tresses . . ."

Scientific Problems and Puzzles

By ERNEST K. CHAPIN

HYDROMETER LEVEL



Bucket containing floating hydrometer is whirled vertically.

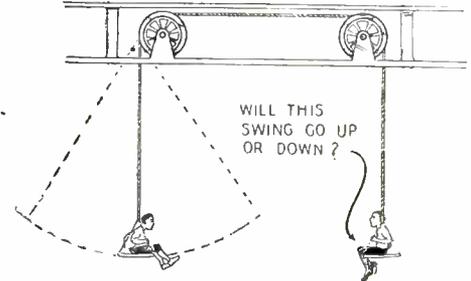
An hydrometer is floated in a pail of water. The pail is then whirled vertically at arm's length fast enough to prevent spilling water. When will it float highest, or will its level remain constant?

BALLOON ASCENSION



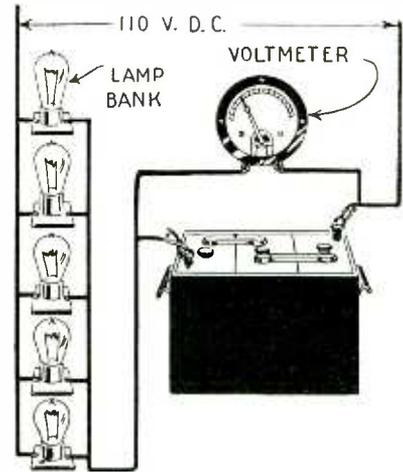
Does the length of the day have anything to do with the readiness or reluctance with which balloons ascend? If the speed of rotation of the earth should increase, would balloons be able to lift more or less than they can at present?

BALANCED SWINGS



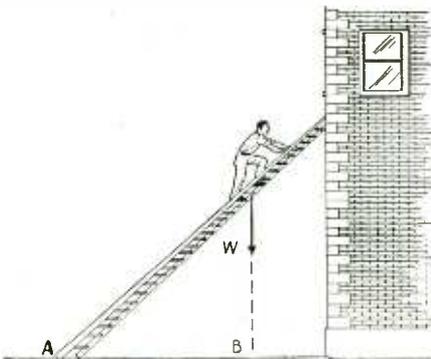
Two swings are supported at the opposite ends of a rope which passes over two freely rotating pulleys as indicated in the diagram. If two boys of equal weight are seated in the swings, what would be the effect on the positions of the swings, if one of the boys should set his swing in motion?

VOLTAGE OF BATTERY



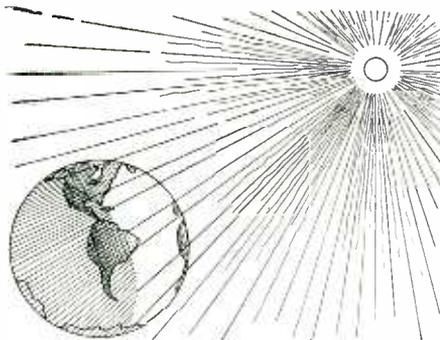
A voltmeter is shunted across a 6-volt storage battery which is connected to a 110-volt D.C. line. A lamp bank having 20 ohms resistance is connected in series with the battery. If the voltmeter will read only up to 7 volts, can it be used in this circuit? Could it be used on a 220-volt line?

WHEN WILL LADDER SLIP?



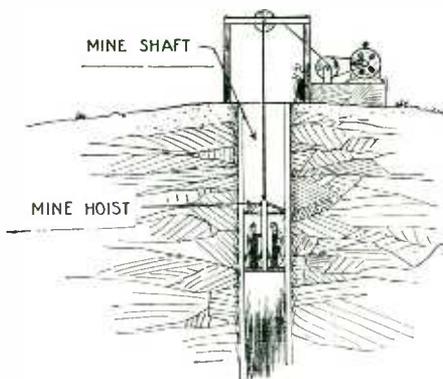
As a man climbs the ladder leaning against a wall, the ladder will have a decided tendency to slip when he reaches a certain point. Just what is the location of this point, and why is there a greater tendency to slip here?

SPEED OF LIGHT



Light is propagated in space at the rate of 186,500 miles per second. It takes light about 8 minutes to reach the earth from the sun. How does this fact affect the length of the day, the time of sunrise, and the time of sunset?

CHANGE IN WEIGHT



It is a well-known fact that at the poles, a person's weight is a little greater than elsewhere on the earth. It is also true that he is a little lighter at the equator than elsewhere. What effect do you think descent into a mine could have on the weight of your body?

Death!

Especially in cold weather, you may be tempted to start your engine with a rather rich mixture and let it "warm up" a few minutes before leaving the garage.

CARBON MONOXIDE, a deadly gas, immediately begins to discharge from the exhaust. It is heavier than air—if the doors are shut the garage begins to fill with gas.

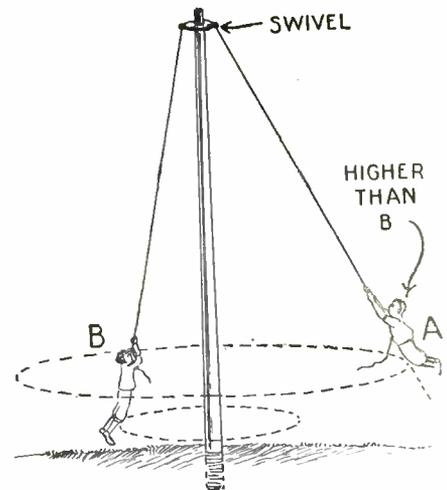
The level of the gas rises higher and higher; it creeps up until you begin to breathe it all unknowingly—for carbon monoxide is odorless and gives no warning of its insidious presence.

DEATH—quick, sudden, with no chance of escape—may come to you just as it has come to many others similarly trapped.

Keep the Garage Doors Open.

Courtesy Hartford Accident and Indemnity Company.

SPEED OF ROTATION



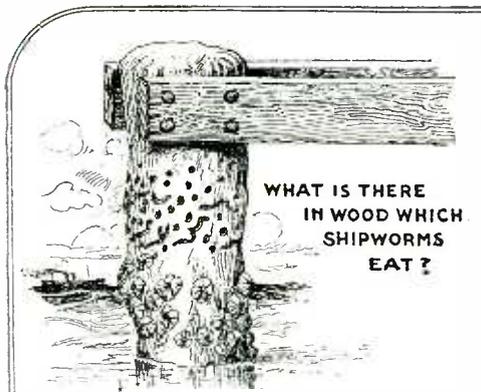
Two children swing around a pole on ropes of unequal lengths. A has a longer rope than B, but he is swinging higher. Will A make the trip around the pole in a shorter time than B?

(Answers to these problems appear on page 446)

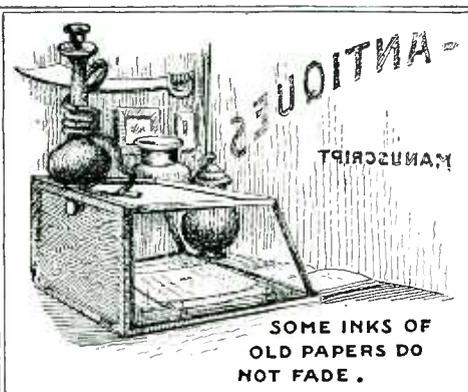
Everyday Chemistry

Some Practical Everyday Chemistry Wrinkles that We Seldom Think About

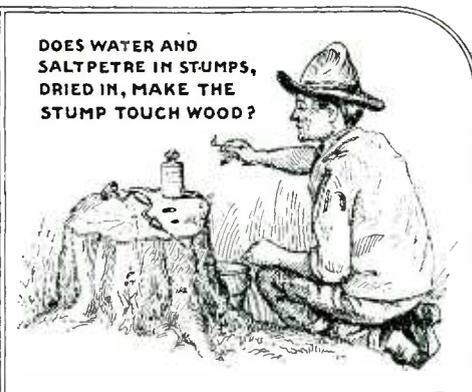
By RAYMOND B. WAILES



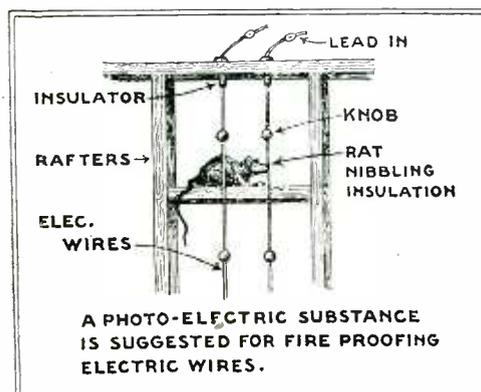
1. A chemical analysis of their stomach contents shows that they live by eating the carbohydrates present in the wood, of which sugars are a class.



2. Carbon inks have been found to outlive iron, dyes and other chemical inks. Ancient scripts usually contain carbon in a finely divided condition as the ink pigment.



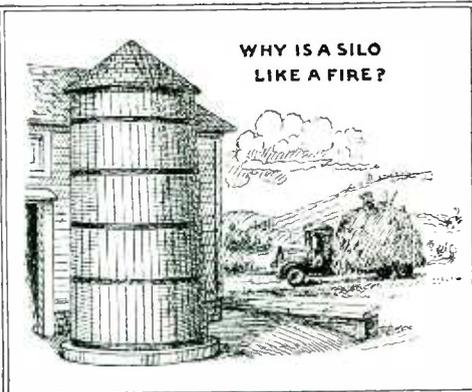
3. Stumps cannot be burned out in this manner. It would take as much saltpetre as the stump's weight to afford the fuse or touchwood properties.



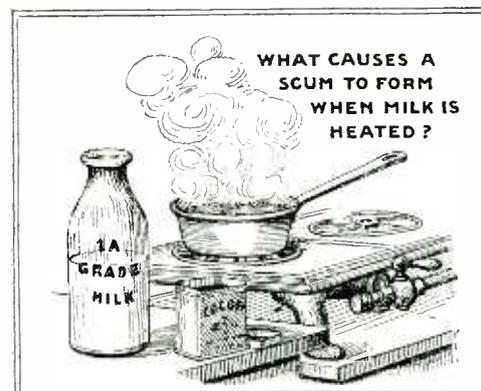
4. Selenium, used for coloring red glass and photo-electric cells, may be incorporated with wire insulation to make them fireproof.



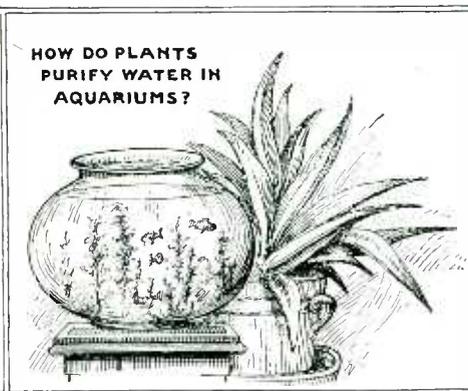
5. Soap is added to grease stock to give a body to the lubricant and as a supporting means for the grease. It is not an adulterant.



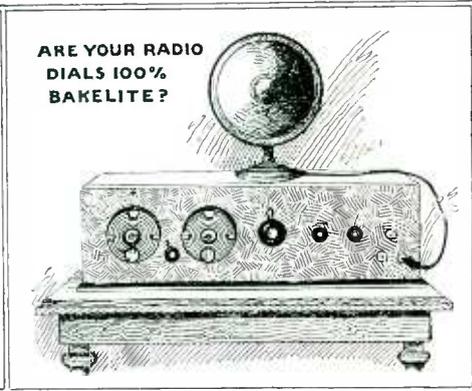
6. Oxidation, or uniting with oxygen occurs, same as wood of a fire consumes oxygen. Oxygen in a silo is used up in 5 hours, after stocking it.



7. This is due to a compound composed largely of casein. It is not the impurities arising by boiling.



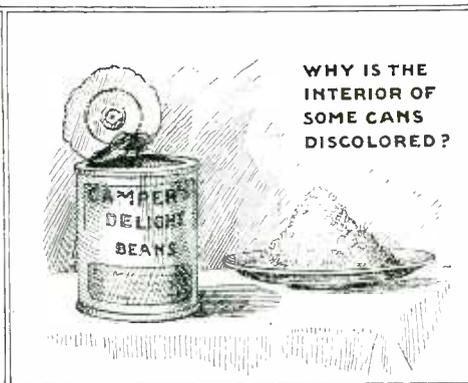
8. Green plants in aquariums give off oxygen to the water and it is this oxygen which the fishes breathe.



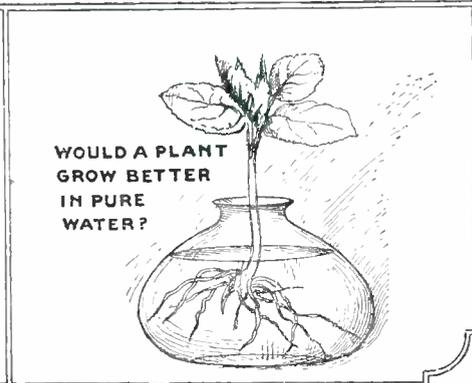
9. Finely pulverized wood, wood-flour, is used as a body in the manufacture of much of the moulded composition radio dials and knobs.



10. The (inflammable) liquid is composed of a carrier such as gasoline or kerosene and contains about 5% of dichlorobenzene, the active ingredient. An odoriferous substance is also added.

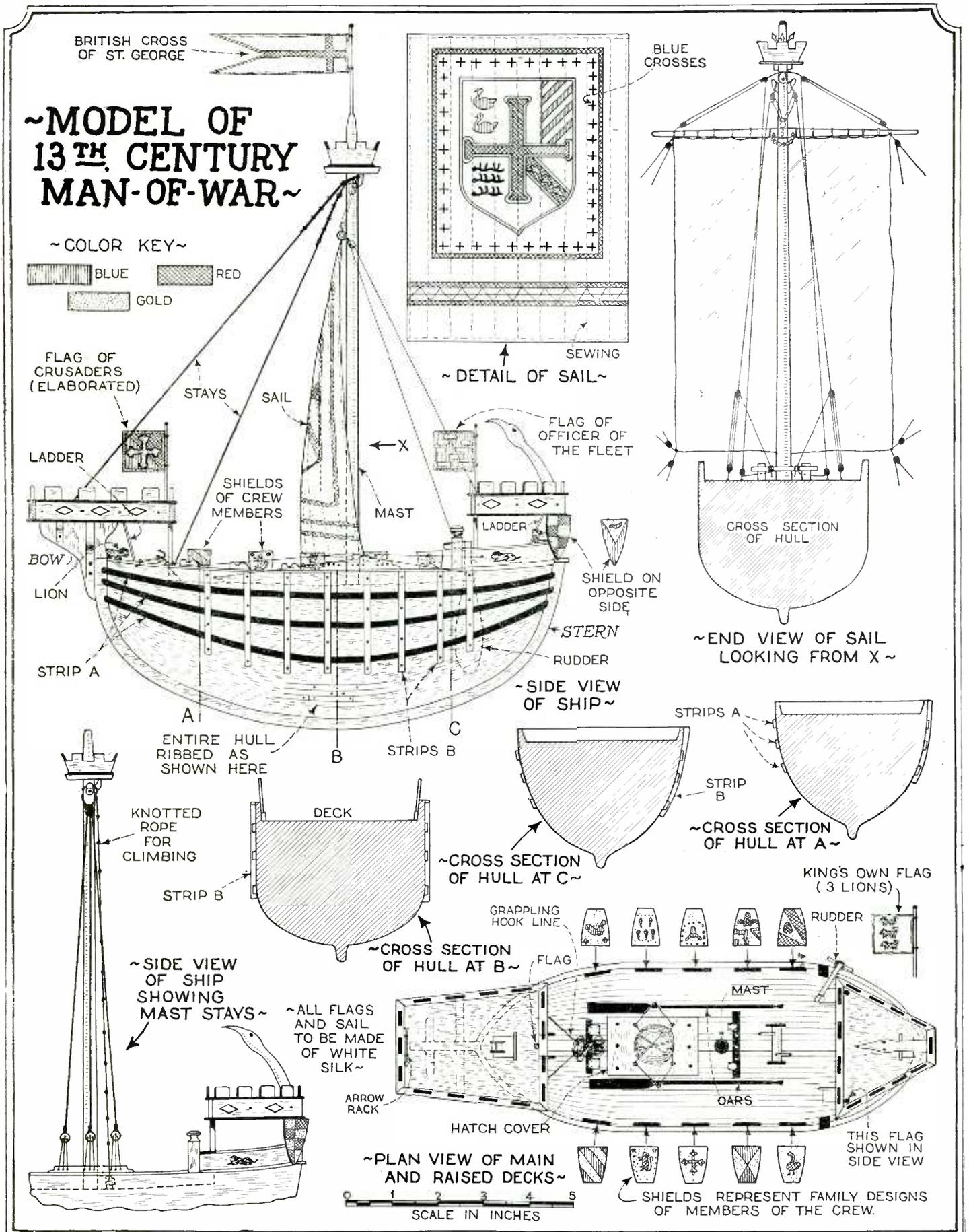


11. Imperfect tinning of the inside of the can causes some of the iron to combine with sulphur in the product, to form (black) iron sulphide, seen inside can. It is not dangerously poisonous.



12. Plants require chemical salts in solution to make them grow. Pure water such as distilled water does not contain these plant foods or appetizers. A few plants grow in water.

Model Man-of-War Wins Cup



Above we see the complete details of the very excellent model of a Thirteenth Century "Man of War" which was built by Henry O. Havemeyer, Jr., and for which the judges have awarded him this month's Cup and Certificate. The entire hull is ribbed as the specifications indicate and according to the builder is an exact replica, built to scale of ships similar to those which

were used in the fleet of Richard Coeur de Lion and the subsequent ruler. Notice that this vessel was steered by a rudder which is not secured to the back of the ship, but hangs down on the starboard side of the vessel. The Model Department will supply blueprints of the above vessel at 50c. See past issues for other ship models and blueprints available.

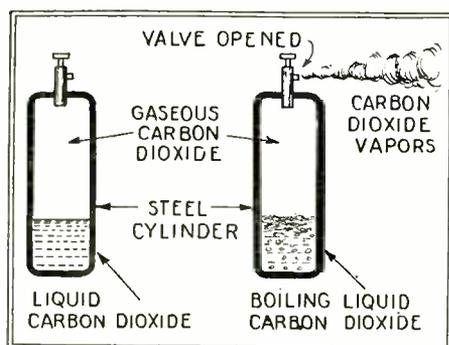


One Hundred and Sixty-Six Degrees Below Zero [Fahrenheit]

Fascinating Experiments With Carbon Dioxide Snow

By O. IVAN LEE, B.Sc., F.M.S.A.

LIQUID carbon dioxide can now be obtained cheaply and easily in small steel cylinders. Following is an illustrated description of how to make "carbon dioxide snow," and with its aid to perform many very wonderful experiments made possible by the intense cold obtained.

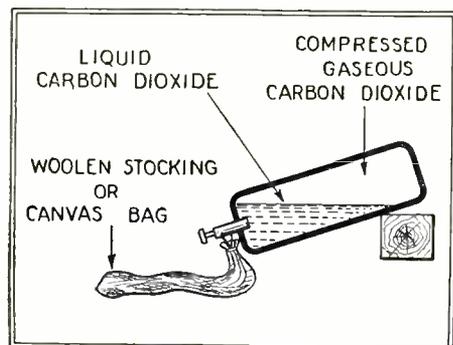


Liquid carbon dioxide in a steel cylinder. When tap is opened it starts to boil.

The cylinder as received is only *partly* filled with liquid carbon dioxide, the space above being filled with gaseous carbon dioxide under great pressure.

If the valve is opened while the cylinder is in an upright position, the compressed gas merely escapes as a colorless or white vapor, being replaced by more from the liquid carbon dioxide below which boils as the pressure is lowered. The gas coming out is cool, but not intensely cold, and is rapidly dissipated into the atmosphere.

The cylinder is laid down on the floor in an inclined position with the valve end con-



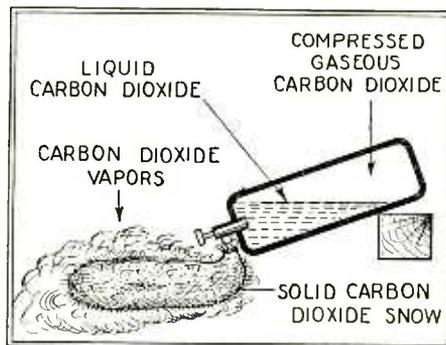
Getting ready to make carbon dioxide snow. Note bag into which gas is to flow.

siderably below the level of the other end. This permits *liquid* carbon dioxide to be forced out of the valve by the pressure of the compressed gas above it. Over the valve outlet is firmly tied a woolen stocking or canvas money bag. The operator may conveniently sit astride the cylinder during the next operation.

Everything being in readiness, the operator should firmly open the valve sufficiently wide to insure the liquid carbon dioxide

ample opportunity to escape, bearing in mind, too, that *there is absolutely no danger in conducting this experiment.* The escape of the gas is accompanied, however, by a rather terrifying loud hissing noise like that of a boiler blowing off steam, together with the production of voluminous clouds of white smoke which roll across the floor in a kind of billowy fog agreeably cool to the ankles to one walking therein. The bag or stocking becomes distended, white gas escapes at every pore, and a kind of hoar frost speedily covers it. In a moment, the bag will be found completely filled with *something firm and solid.* The valve is now shut off.

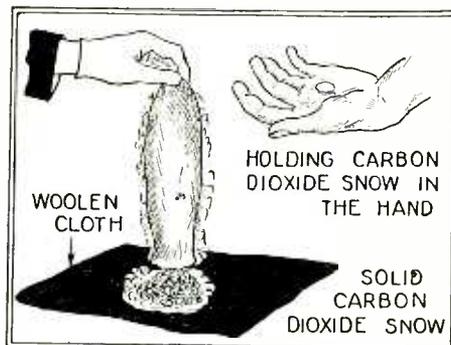
The contents of the bag are now shaken



The bag is filled with carbon dioxide snow and the gas is escaping through the pores of the cloth.

out on a woolen cloth, using a cotton gloved hand if necessary to detach any adhering lumps. The snow white solid material always surrounded by a halo of white vapor, is solid carbon dioxide having a temperature of -78.5 C. below 0 C. (109.3 below 0 F.)

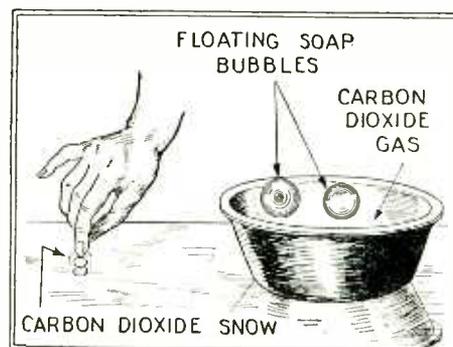
The snow is so intensely *cold* that by reason of the relatively high temperature of objects at ordinary or body temperatures, they are very *hot* compared to it. As a



Shaking snow out of the bag upon a non-conducting square of woolen cloth. Holding a lump of snow in the hand.

consequence, the solid snow never really is in contact with objects on which it apparently reposes. It behaves, in fact, exactly

like drops of water on a red hot stove, dancing around on a cushion of vapor until completely *sublimed*, since the carbon dioxide passes directly from the solid to the gaseous state. Lumps may be safely and comfortably held on the palm of the hand or between the fingers, *so long as they are not pinched.*

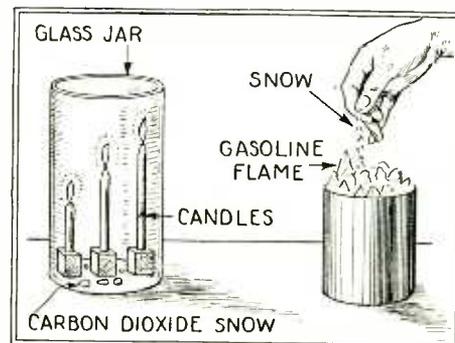


Left: Rolling a little ball of carbon dioxide snow about on a plate. Right: Floating soap bubbles on the gas.

pressed or squeezed. In this event, one will actually be "burned" (*i.e.*, frost-bitten), for the same reason that a blister is produced if one neglects to wet the finger before touching a hot flat-iron.

Solid carbon dioxide snow is now retailed in New York City at least, in chain candy stores, under the trade name of "Dry Pack." It is sold in paper cartons at 60c. per pint and will keep for 10 or 12 hours, and can be used directly for all the experiments described.

A piece of the solid snow placed on a polished surface and slightly touched by the



Extinguishing candles with the snow and putting out a gasoline flame with it.

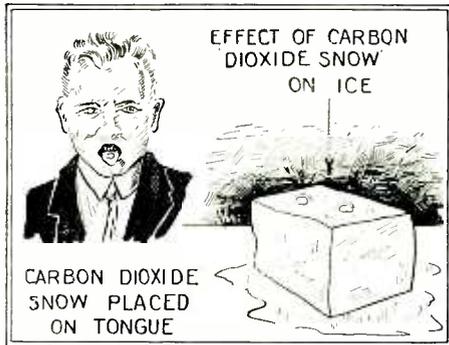
finger, glides rapidly over the surface as if it were supported on invisible wheels.

A few lumps of the snow are thrown into a basin and allowed to evaporate. If soap bubbles are then dropped into the basin, they will float around in it buoyed on an invisible surface of carbon dioxide gas which is heavier than air, like corks on water.

Several lighted candles are placed at different heights in a glass jar and some lumps

of the snow dropped in. One by one, the candles will be extinguished, beginning with the lowest.

A few drops of gasoline are placed in



Left: Carbon dioxide snow in mouth. Be careful not to press it. Right: Carbon dioxide pellets on a lump of ice.

a baking powder tin and ignited. If a lump of the carbon dioxide snow is then dropped in the flame will be almost immediately extinguished.

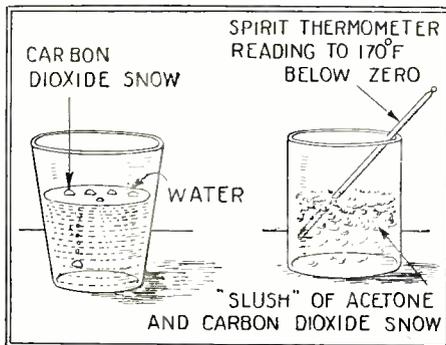
A lump of carbon dioxide snow may be safely placed in the mouth, rolling it around on the tongue so that the surface of the tongue does not get too cold in one place.

If placed on water, the lumps of carbon dioxide snow float around like little balls of cotton and slowly disappear. If a lump is pushed under the surface, a continuous train of bubbles of carbon dioxide gas arises. In no case, is any ice formed around the

lumps, nor is the water sensibly cooled to the touch.

Placed on ice, the lumps disappear somewhat more slowly, and melt holes in the ice.

A glass vessel is half filled with acetone, and lumps of carbon dioxide snow added. At first, the lumps melt and disappear, and the liquid foams and boils furiously, but as more snow is dropped in, the mixture becomes quiet and finally resembles a slush of snow and water. This "slush," however,



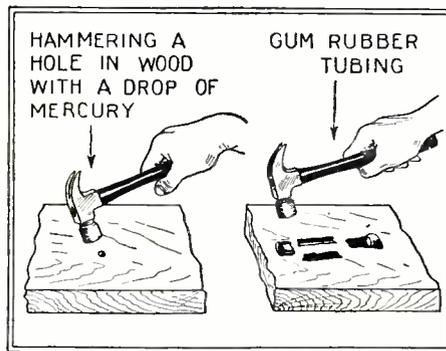
Left: Carbon dioxide snow floating on water. Right: Mixing acetone and carbon dioxide snow. This is so cold that you must use a spirit thermometer.

possesses a temperature of 166 degrees Fahrenheit below zero, or 198 degrees below the freezing point of water!

Since mercury solidifies at forty below zero (Fahrenheit and Centigrade) a mer-

curial thermometer is useless for measuring the true temperature and a special spirit thermometer is employed.

A drop of mercury is placed in a small



Left: Hammering mercury which has been frozen by carbon dioxide snow into a wooden board. Right: Rubber tubing is made so hard by the snow that it can be broken like glass.

paper spoon and plunged into the freezing mixture. Instantly, the mercury is frozen as hard as shot. When removed, placed on a board, and struck a violent blow with a hammer, it will be driven into the wood, where it will soon melt, leaving a hole.

A piece of pure gum rubber tubing or a rubber band immersed in the acetone solution is frozen so solid that when struck with a hammer it will be shattered into bits as if made of glass.

Experiments with Carbon Monoxide

By J. G. SCHUMAKER, A.B., M.S.

(Continued from page 330, August issue)

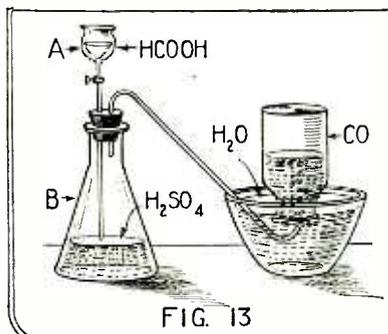


Fig. 13. Making carbon monoxide gas from oxalic acid and concentrated sulphuric acid.

CARBON MONOXIDE

Carbon monoxide was first made by F. de Lassone in 1776, by reducing zinc oxide with carbon.

In 1796 Joseph Priestley prepared the gas by heating iron oxide with charcoal. Though Lavoisier knew that the gas burned to carbon dioxide it was not until 1800 that Cruikshank showed that it was a gaseous oxide of carbon. Minute traces of the gas are found in the air, larger amounts in volcanic gases, meteorites, chimney gases and tobacco smoke.

The simplest way for the young experimenter to make carbon monoxide is to set up the apparatus as shown in Fig. 15. Pour about 50 c.c. of concentrated sulphuric acid into the flask A and about 10 c.c. of formic acid (HCOOH) into the tap funnel B. Heat the sulphuric acid to about 100° C. and then allow the formic acid to drop slowly into the hot acid. Each drop of formic acid produces some carbonic monoxide. The velocity of the gas flow can easily be regulated by the rate at which the formic acid is dropped into the sulphuric acid.

The same gas can also be prepared by warming gently a mixture of concentrated

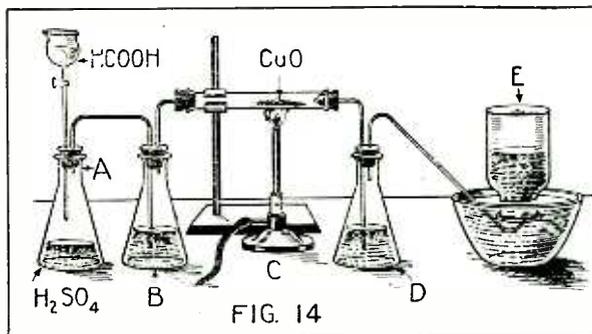


Fig. 14. Reducing copper oxide to metallic copper and collecting carbon dioxide produced.

sulphuric acid with sodium formate or with oxalic acid (H₂C₂O₄). In the latter case both carbon dioxide and carbon monoxide are formed. The two gases are separated by passing them through solutions of sodium hydroxide (NaOH) or caustic potash (KOH). These solutions will absorb the carbon dioxide.

Carbon monoxide is a colorless, odorless and highly poisonous gas. It will burn in air with a blue flame and form carbon dioxide. The gas is a very active poison and forms a cherry-red compound with the haemoglobin of the blood which is called carbonyl haemoglobin. This fact was discovered by Priestley in 1826. This prevents the blood from carrying the proper amount of oxygen to the tissues and therefore increases the rate of respiration. Whenever moist carbon monoxide is passed over cold palladium black formic acid can be detected as one of the products. The same acid can be detected when a jet of burning carbon monoxide is directed against a piece of ice.

Carbon monoxide is used as fuel and a reducing agent. The gas is generated in the flask A and passed through water. Then it is passed over hot copper oxide. The oxide

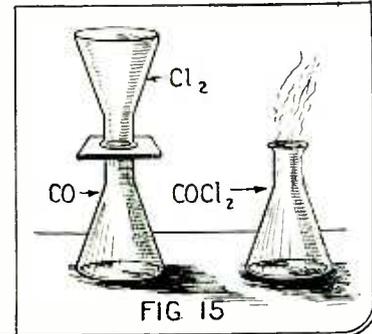


Fig. 15. Mixing chlorine and carbon dioxide gas. They ignite spontaneously.

is reduced to reddish metallic copper and the carbon monoxide is oxidized to carbon dioxide. The presence of the carbon dioxide is shown by the white precipitate in the flask D. Collect the rest of the carbon monoxide in E.

Metals like aluminum and magnesium when heated to a high temperature will reduce carbon monoxide to carbon and an oxide of the metal.

Nearly all of the poisonous gases employed during the World War were volatile liquids containing chlorine. Phosgene or carbonyl chloride (COCl₂) is typical of such liquids, it is a liquid which vaporizes at 8° C. Fill one cylinder with carbon monoxide and the other with chlorine. Place the cylinders mouth to mouth and allow the gases to mix. The color of chlorine gas permeates both cylinders. Then cover each with a glass plate and expose one of them to strong sunlight. The color of the chlorine will disappear rapidly. Phosgene has been formed.

If the glass plate is removed from this cylinder, the gas begins to fume strongly because the moisture in the air causes the phosgene to decompose into hydrochloric acid and carbonic dioxide.



A Practical High Frequency Coil

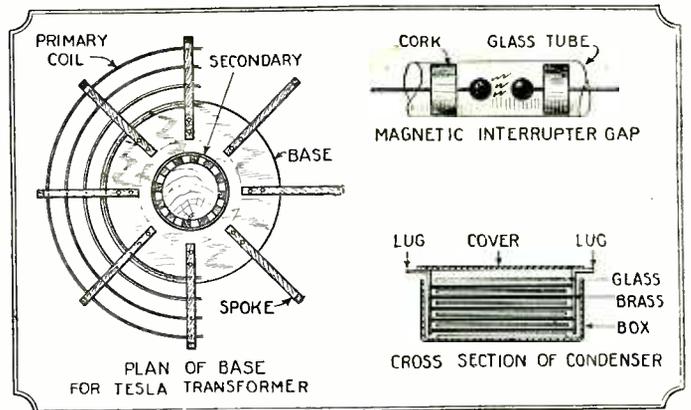
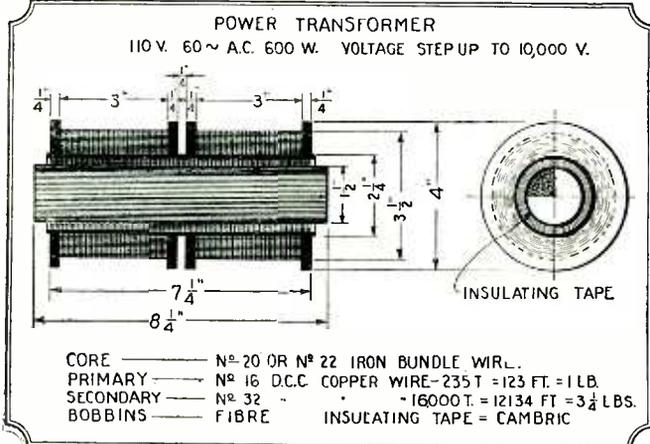
By WILLIS L. NYE

TO the experimenter who builds a Tesla-Oudin coil one of the finest uses is to test insulation of all sorts. This is quite useful and helpful, especially to the transmitting amateur who

is possible in this manner to arrive at the best type of insulation to use in our radio system and what materials.

One other interesting experiment is to test the actual breakdown tests of grid leaks,

sockets and some of the so-called low-loss condensers which claim good design. Of course the high-frequency current will travel on the surface in most cases but occasionally will not, which denotes poor insulation.

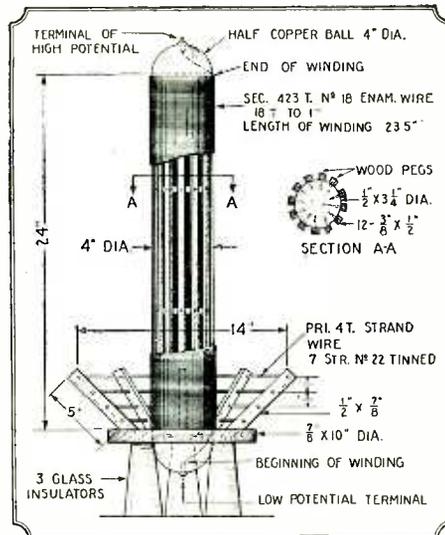


Here is shown a cross-section of the Tesla coil with the plan of the base. A magnetic interrupter gap is shown also and the cross-section of the very substantial condenser required for this apparatus.

has leaky insulation in his antenna system which would cause his antenna current to fall to a low value and cause a weak signal.

The Tesla coil is hooked on to the antenna and the power applied to the antenna. The coil will energize the antenna and if the insulation is at fault the flashover will be apparent at once if it is performed in the dark. The guys and fastenings of the pole should all be explored very carefully with a neon tube spark plug tester which will glow when it comes in the presence of a high-frequency current. If the insulator is leaky the brush discharge will be to the ground and can at once be found either by glow or exploring with the neon tube. With this method of inspection the leaks in the radiating system of a transmitter can be remedied. Of course it is to be expected that the antenna current will be small while the system is supplied by the Tesla coil and should not be expected to assume large proportions. It

The sockets of the vacuum tube may be tested along with the grid leak. Apply one terminal of each of the apparatus mentioned to the high potential terminal of the coil and apply the power. In this way one can see the actual comparison of the insulating quali-



This shows the construction of the Tesla coil, properly so called, with a cross-section and full dimensions, so that the cut acts as its own description.

ties of several materials. This is valuable to any one who is using high-frequency current and needs to know the proper insulation. It would be well to test ordinary porcelain insulators that are used for A.C. house current and make an actual comparison.

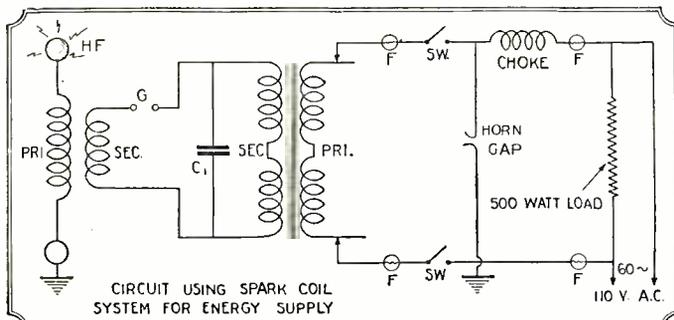
The Geissler Tube experiments are varied and the wonderful glow effects that can be obtained need not be detailed here.

A test of the breakdown capabilities and their resistance of high voltage condensers can be performed very nicely with this apparatus. The condensers are inserted in the line in the usual way and the high voltage applied. It would be well to test some of the fixed variety that now flood the market for radio use.

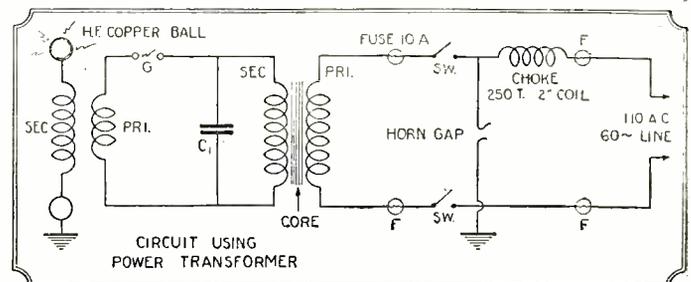
Bakelite, Celeron, and Formica used for panels for radio purposes should be given a good test for their breakdown to the current.

OTHER TESTS AND EFFECTS

Another test to perform is to fasten insulated wire, varying from No. 36 enameled to No. 16 enameled, and determine which will give the best discharges. The length should also be varied to find out which is the proper wire to use. Generally a wire



This is the layout of the circuit, using the spark coil system for the energy supplied. Note the protection afforded by the grounded horn gap.



Here the Tesla coil is supposed to be supplied from the standard lighting circuit, using the power transformer described above. Again the grounded horn gap is used to protect the system.

from one to two meters long will be found best with this particular coil. The wire should be thoroughly insulated at each end. In this manner the proper radiating system can be determined for radio use or for the coil only.

A wonderful electrical effect is to take thin wire and solder all the joints and make an electrical sign out of the wire by forming the letters and fastening all together and attaching to the output of the Tesla

transformer. This should be performed in a dark room as should all other experiments, that the proper glow may be visualized. Only in this way can many of the marvelous experiments be enjoyed. The letters on this sign will glow and the effect is startling to the uninitiated.

The Tesla coil will cause shock excitation in a near-by radio receiver because the wave is not really a tuned oscillating source. Consider this if you operate the coil in a con-

gested neighborhood with many radiocast listeners.

Another test may be made; wind a coil, mount it, and connect up a 1½-volt lamp in series to close the circuit. Considerable experimenting will be needed to determine the correct number of turns. When brought close to the coil the lamp will glow like a glow-type wavemeter. The actual power of the coil may be estimated at by how far away the lamp will glow.

How to Make a Spintharoscope

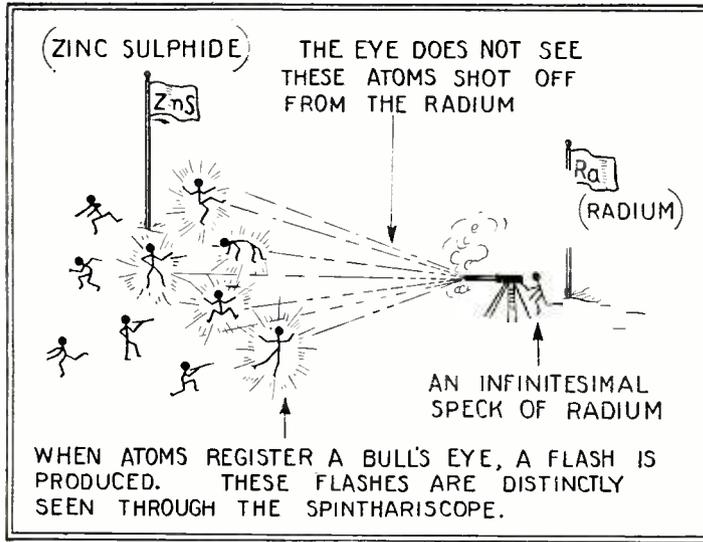
By RAYMOND B. WAILES

THIS little home-made instrument will enable one to see the effects which radium, that costly and mysterious element, produces throughout its life which is some thousands of years.

Radium is constantly emitting three kinds of invisible rays, all having various powers to penetrate supposedly opaque objects. One of these rays, the alpha, effects the illumination of the figures upon watch dials, clocks, faces, etc., and it is the effects which these rays produce which afford amusement in this little scientific toy.

The active material or luminous composition upon dials of clocks, watches, etc., is composed of a minute quantity of a real radium salt and a substance called zinc sulphide which is a chemical combination in a crystalline condition of metallic zinc, and sulphur. In its manufacture, the radium compound is thoroughly mixed with the zinc sulphide and applied to the clock dial by means of an adhesive.

Radium is constantly emitting rays, and when one of the rays called the alpha ray

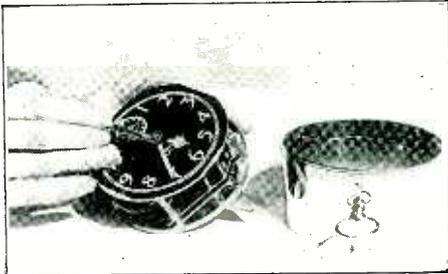


A picturesque presentation of the bombardment from radium. This action of radio activity lasts for many many years and if we had radium in quantity it would be a very uncomfortable substance because the bombardment or properly speaking radio activity, would have a bad effect analogous to burning upon anybody exposed thereto.

some jewelers and novelty dealers. These instruments have two lenses, one at each end, at one end is a cubic lens of extremely short focal length, in fact so short that objects have to be placed directly on the plane surface of the lens to be "in focus." To convert this type of magnifying glass into a spintharoscope, it is only necessary to apply the speck of radium-luminous composition mixed with the adhesive directly upon the face of the lens, so that it is "in focus." The effects are seen in a darkened room.

To get the best results from this little scientific apparatus, the eyes should be accustomed to the dark by having the observer remain in the darkened room several minutes before attempting to view the little explosions caused by the helium atoms which are constantly being shot off from the minute specks of radium mixed into the luminous composition.

The instrument will last for years if care is taken to prevent anything from coming into contact with the luminous surface.



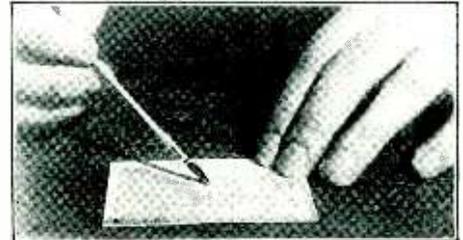
Removing a minute speck of radio active material from the hands of a luminous clock. It may be three times the bulk of the head of a pin.

strikes a small particle of the zinc sulphide, a miniature explosion results which can be clearly seen with the aid of a short focus, fairly strong, magnifying glass.

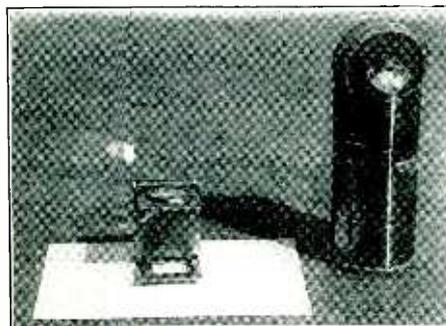
In making the spintharoscope, some of the luminous material from the hands of a luminous clock or watch should be carefully removed with a knife blade. The quantity taken should be about three times as large as the head of a pin, so it can be seen that the effective luminosity of the clock will not be impaired in the least. The bit of material should then be worked up with a tiny amount of glue, spar varnish, collodion, or even water if desired, and applied to a card such as an ordinary visiting card. To complete one form of spintharoscope, a small magnifying glass of the linen-tester type is placed over the luminous material applied to the card, to be viewed in the dark. The scintillations or miniature explosions which the alpha rays, or ionized atoms of helium as they should rightly be called,

Wanted!

The Editors of SCIENCE & INVENTION want interesting articles on electricity from the experimental standpoint to be accompanied by illustrations. The illustrations may be rough drawings, or sketches or photographs, and our readers can supply us with the best of materials that they have on hand. We pay our regular rates for these articles upon publication.



Transferring the luminous material mixed with varnish or glue to a card. Spar varnish is an excellent material for the purpose.



The so-called "floscope" sold by jewelers, and a linen tester are used for observing the spintharoscope effect.

make in their collision with the zinc sulphide, can be distinctly seen through the lens.

Another type of spintharoscope which operates somewhat better than the linen-tester type can be made from the "floscopes" or microscope-like magnifying glasses sold by

PURER IRON PRODUCED ELECTRICALLY

Pig iron is now the basic form from which all types of iron and steel are made but it may become obsolete and the direct manufacture of malleable iron and steel from ore may follow the invention of a special electric furnace of commercial size that has been built in the great Hagfors, Stockholm, Sweden, ironworks where iron ore and coal mixed and fused have been made to produce pure iron containing only two per cent. of carbon, and steel that can be worked in the usual manner.

The new process is continuous and fusion ceases only temporarily when the furnace is tapped, while the absence of gases and slag produces a superior product.

The United States leads the world in the number of electric steel furnaces in use, and with the discovery of a process of making iron and steel directly from ore would give a tremendous impetus to the use of the electrical smelting furnace.



JUNIOR ELECTRICIAN



Automatic Soldering Iron Holder

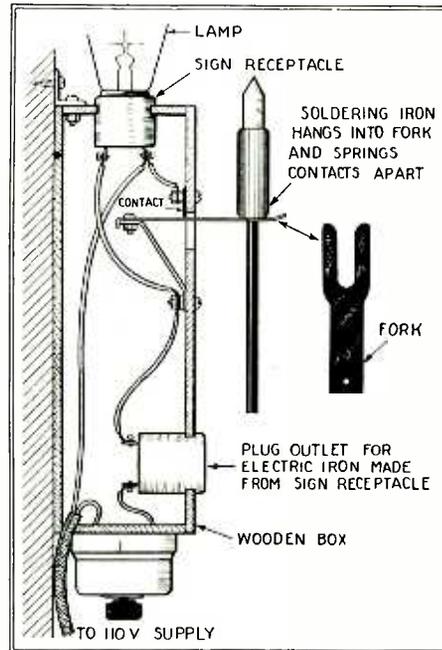
By THOS. W. BENSON

IT is very easy to forget that a soldering iron is plugged in and go away leaving it on overnight after a job of soldering is done. Having done this several times and burning out an iron the writer devised and built the holder illustrated herewith and the iron is now always remembered.

The base of the device was a small wooden box 12 inches long and 4 inches square to be secured to the wall as shown. A hole one inch square was cut in the front of the box three inches from the upper end and a support of spring brass for the soldering iron of the shape shown was supported in this hole by a bent brass bracket made from 1/16 inch brass strip 1/2 inch wide. This forms a spring support that is normally close to the top of the hole but when the iron is hung on it the spring is pulled away from the contact mounted inside the box as shown.

A porcelain socket is mounted on the top end of the box, and there is a snap switch on the bottom with a plug outlet on the front near the bottom. The wiring diagram and other details are given so that it should be easy for anyone to duplicate the device.

In operation the iron is left plugged in and hung on the forked hook. When a soldering job is to be done the current is switched on with the snap switch when the



light will light up. If the iron is wanted in a hurry it is removed from the hook, cutting off the light, and laid on some non-combustible object on the bench. As the work progresses the iron is hung on the hook when not actually in use which automatically connects the lamp in series with it. Thus while not in actual use the current through the iron is reduced to such a value as to just keep it hot without overheating

This is a very excellently devised soldering iron holder. As long as the soldering iron is hung up a slight current goes through it, just enough to keep it warm, but when in use the spring on which it hangs rises and gives it a strong current. The lamp acts as a perfect alarm so that there will be no danger of leaving the current turned on.

and full current is switched on when the iron is lifted from the hook. Should one attempt to leave the current turned on when the work is over the lamp being lighted will draw one's attention and ensure it being switched off. The proper size of lamp to use will vary with the size of iron. For the small irons used in radio work a 60-watt lamp is large enough but a 100-watt lamp of the carbon type should be used with the larger irons.

Part II.—Experiments With An Electroscope

By RAYMOND B. WAILES

(Continued from August SCIENCE AND INVENTION)

AMONG the earliest experiments in electricity, the electroscope was used a great deal in detecting the electrical charge upon bodies. Even today this instrument has not been shelved with the voltaic pile, the cumbersome Whimhurst machine, thermal batteries and the like. In fact it has been brought to the front in several fields, in one of which especially, that of radioactivity, it is of great importance. The instrument is very easily made and the experiments described here to be performed with it will afford one many interesting hours.

The writer's electroscope was encased in or built upon a small box five inches square, which formerly housed a crystal set. The interior of the box with the exception of the open end was lined with copper foil, such as sold for panel shielding. A binding post connects with this foil lining. A hole about an inch in diameter was bored through the right hand side of the box. This served to support a rubber stopper thrust through it, the stopper in turn carrying a three-inch machine screw which in turn carried a binding post at each end, one for external connection and the internal one for supporting a panel of brass. This inside brass panel has an "L" hook soldered to it, one arm of the hook engaging the double insert type of binding post upon the inside of the box. The brass panel supports the little strip of gold leaf which can be procured from a sign painter, or Christmas tree tinsel can be used. The foil strip should be about an inch and a quarter long and about a quarter of an inch wide. It is attached to the upper end of the brass panel by means of a minute drop of shellac.

The rubber stopper serves to insulate the internal workings from the wooden case and

from its inner copper lining. The external binding post serves to carry a little umbrella device made from a length of stout copper wire five inches long to the top of which is soldered a circle of copper three inches in diameter. This plate acts as a receiver for the charges in experiments, a sort of aerial as it were. A glass front completes the instrument, protecting the sensitive gold or tinsel leaf from stray air currents.

To show that friction produces a current of electricity, stroke a rubber comb through the hair, or some fur, touch it to the receiving plate, then still keeping the comb to the plate, touch the plate with the finger, remove the finger and then the comb. The leaf will be seen to diverge or stand away from the brass panel—it is now charged. Upon now touching the plate, the charge will escape through the hand and the leaf will fall against the brass panel. By quickly whipping the external binding post with a silk or cotton handkerchief, the leaf can be made to diverge, showing that a current has been made by the friction.

The leaf can be made to stand out when dry sand is allowed to fall upon the receiving plate through a funnel. The sand particles striking one another become electrified and impart their charge to the leaf. If flour be sifted upon the plate when the instrument is discharged, the leaf will diverge with tremendous force at the very first impingement of a tiny particle of flour; so it could be said that every kitchen is a miniature power plant.

If a metallic dish containing several drops of mercury is placed upon the receiving plate and the breath blown through the mercury to agitate the drops, the movement will cause a generation of electricity and the leaf

will diverge. If the mercury is pure, a negative charge will be imparted to the leaf, while if only a trace of an impurity such as zinc, cadmium or other metallic compounds are present in the mercury, a positive charge is formed.

It will be found that a charged electroscope will slowly become discharged if left untouched, the charge leaking through the air. A very rapid collapse of the leaf can be noted when a lighted candle is brought near the charged electroscope. The flame causes the air to become ionized, or conductive and the electrical charge leaks off with a greater rapidity.

25,000,000 C.P. USED NIGHTLY FOR "WHITE WAY" SIGNS

Flashing 25,000,000 candlepower of light against the sky each night, New York's "Great White Way" is literally "the brightest spot on earth," it is revealed in the report of an electric sign survey made public by Arthur Williams of the New York Edison Company in connection with the opening of the fourth annual electric sign show held in the company's building at Fifteenth Street and Irving Place. The Edison Company's survey shows that of the 17,000 electric signs on Manhattan Island below 135th Street more than 2,800 are restaurant signs, more than 1,300 are barber shop signs, more than 1,100 advertise tobacco, 867 are clothing advertisements, 763 advertise automobiles and their accessories. Theatres take 7th place with 706 electric signs.

Mr. Williams' report shows that approximately 5,000 electric signs were added to New York's night skyline in the last year.



THE CONSTRUCTOR



Constructing An Inlaid Checker Board

By H. L. WEATHERBY

Director of Manual Arts of Public Schools of Montgomery, Ala.

THE construction of an inlaid checker or chess board is not as difficult as might appear at a first glance. It is not really an inlaid board as we think of inlay ordinarily. The small pieces are built up rather than inserted and even the novice me-

knife and the remainder of the processes call for no particular tools or apparatus.

The materials called for are as follows:
1 piece of 1/16-in. sawed veneer, about 12 in. x 16 in. of black walnut, mahogany, or other naturally dark colored wood.

1 piece of the same size in a good grade of hard white wood, holly, maple, or even a good white hard poplar will do. The above mentioned pieces go to make up the squares.

Now we need a couple of yards of inlay line. This may be purchased in any design desirable from houses handling this type of material, at very small cost.

We will next need a piece of veneer about 6 in. x 16 in. which we will cut into four strips for the border. A piece of walnut or mahogany veneer for the back and a 1/4 in. 3-ply panel; each to be about 16 in. square completes our material list with the excep-

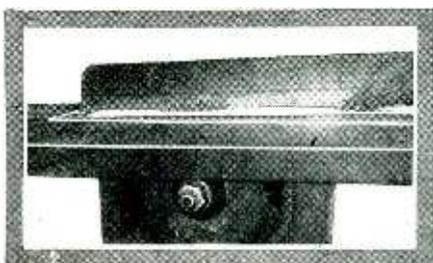


Figure 1. Saw both pieces of veneer for the squares into strips one and one-half inches wide with the grain, using a smooth-cutting saw. In case a machine saw is not available a sharp knife and a straight edge may be employed. In the real sense of the word, this is not an inlaid checker board, but really a built-up checker board which, when finished, will well repay the maker for the small amount of effort required in its construction.

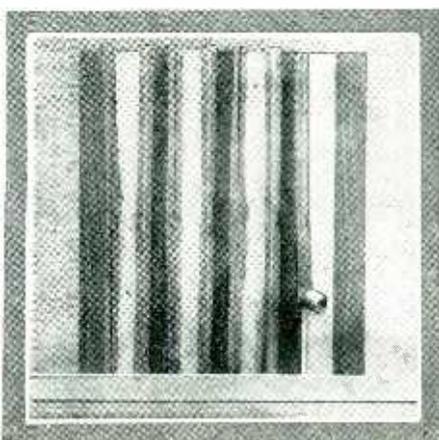


Figure 2. Tack these strips to a flat board using small brads, driven in only a short way, alternating white and black woods. Glue narrow strips of paper along the joints. Any good wrapping paper will do. Line the ends up against a thin strip of wood. Allow twenty-four hours for glue to set. Walnut, mahogany or other naturally dark-colored wood forms the dark squares and holly or maple makes the light-colored squares of the checker board.

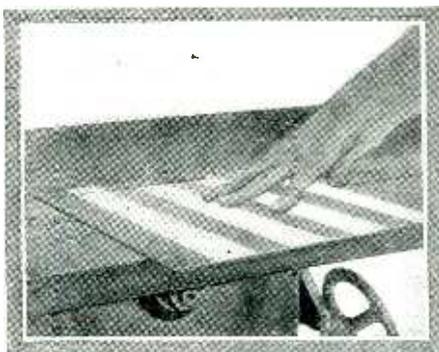


Figure 3. Saw the square thus formed into strips one and one-half inches in width across the grain. There will then result strips of wood one and one-half inches in width made of alternate black and white squares. By reversing each piece of wood, end for end, not upside down, the pattern is easily formed.

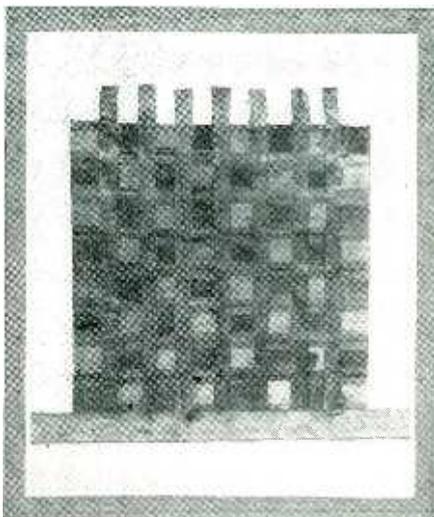


Figure 4. Tack and tape these strips as in step number 2, being careful to alternate the strips so that the squares come right—that is so that a white square comes next to a black square.

chanic, who is a lover of the game, need not be afraid to tackle the job of building a checker board such as the one illustrated.

A machine saw, although not absolutely essential, is desirable for cutting the pieces since more accurate work may be done in that way. However, the veneer from which our squares are made can be cut entirely by hand with a good straight edge and a sharp

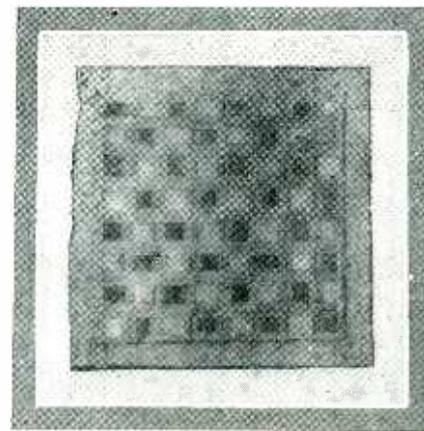
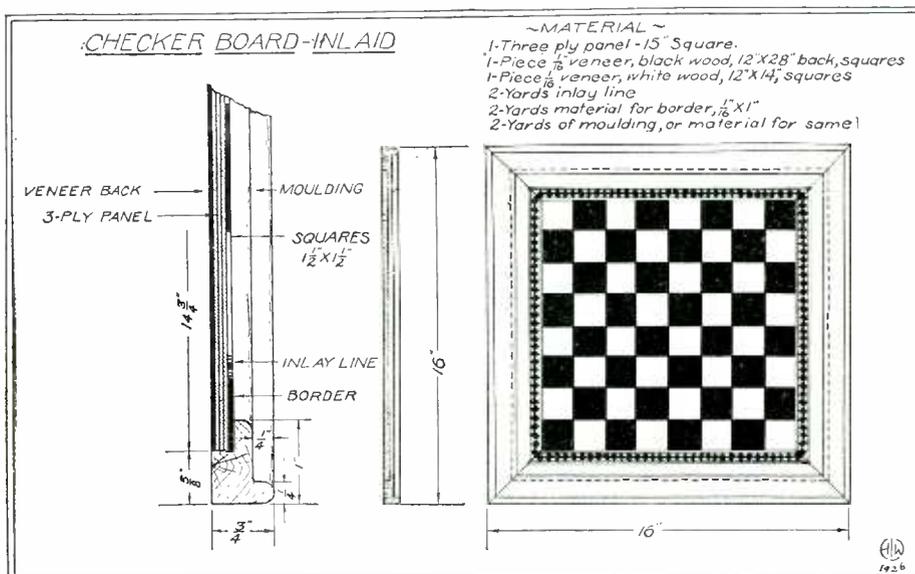


Figure 5. Mitre the inlay line and border, being careful to get good fitting corners. Tack these around the main part of the board in position and tape. This taping should all have been done on one side.



The above diagram illustrates in detail how the checker board is made. By following the stages illustrated in the photographs even the novice should have no difficulty in reproducing the same.

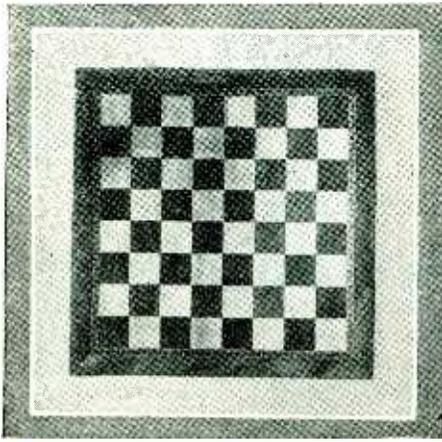


Figure 6. The above photograph shows the reverse side of Figure 5.

tion of four mahogany pieces $\frac{7}{8}$ in. x $1\frac{1}{4}$ in. x 14 in. for the frame. A piece of veneer must be glued to the bottom side of the board to correspond with the squared or top side in order to overcome a tendency toward warping.

The processes of construction are very clearly illustrated by the photographs. After the final assembly the whole board is given a coat of hot linseed oil as a protection and also to enrich the natural colors of the wood, then a couple of coats of white shellac, rubbing lightly with very fine sandpaper be-

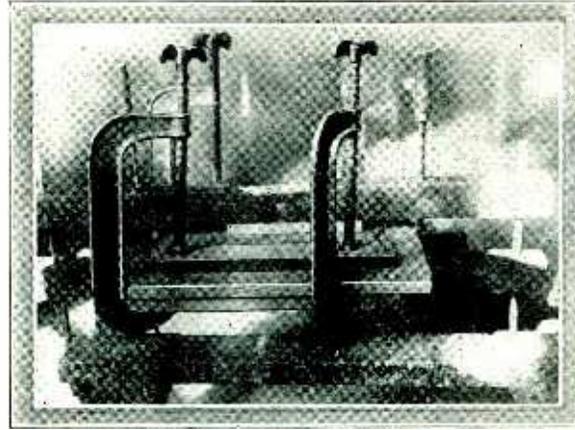
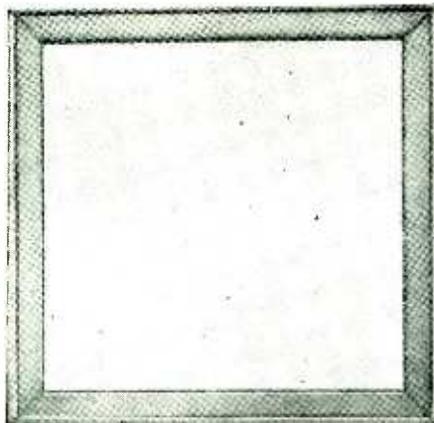


Figure 7. The parts are now clamped together for gluing.

Figure 10. The finished frame at the left.

Figure 11. The finished checker board, right.

Figure 9 below. Make up the frame either with a combination plane or with the circular saw. Nail and glue the mitre corners together, then fit the board into the rabbet and the frame and glue into place.

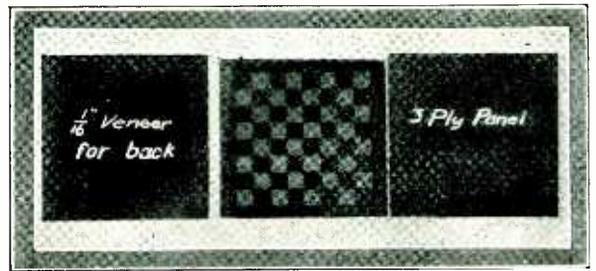
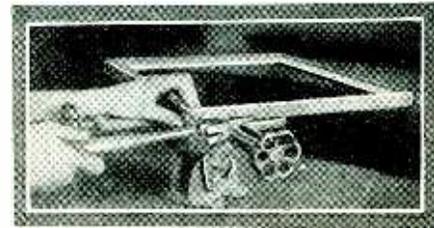


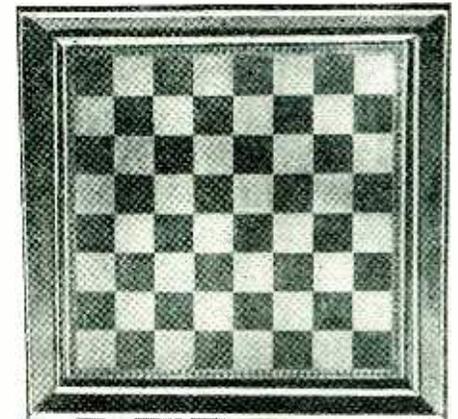
Fig. 8.—Now glue the parts together with the square of plain veneer on the bottom, the piece of 3-ply panel in the middle, and the squared veneer on top, exerting all possible pressure with the clamps. Be sure not to try gluing the taped side to the panel. Allow ample time for glue to thoroughly set, then scrape paper off and sandpaper.

tween coats, and then finally two coats of rubbing varnish, allowing a couple of days for drying between varnish coats and then rubbing with pumice stone and oil, or pumice stone and water.

The back side should be covered with a piece of felt which should be glued on, as a protection to the furniture on which the board is placed.

If directions are carefully followed the results will be very gratifying, and a checker board fit for a family heirloom will be the result.

The photograph below shows the finished checker-board, the construction of which is here described.

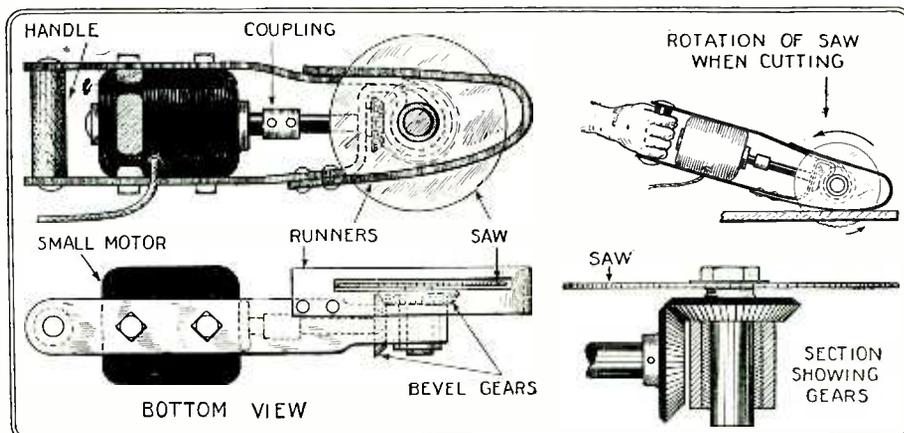


Rotary Hand Saw Made from Small Motor

WORKING somewhat along the lines of a swing saw, for operating a circular saw cutter by hand and pushing it across the wood to be cut, it is possible to make up from a small fan motor or sewing machine motor, a combined motor and saw that is portable and takes the place of the usual rip or cross cut hand tool. For this construction, having procured a light weight motor, only a small circular saw, two bevel gears, some strips of iron and some of cold rolled steel and bronze for the shafting and bearings are required. In the attached drawing, a construction is shown, without dimensions, which can be followed in making up one of these tools. Starting at the handle, a round wooden block, securely attached to the rear of the motor, is the hand grip for applying the cutting

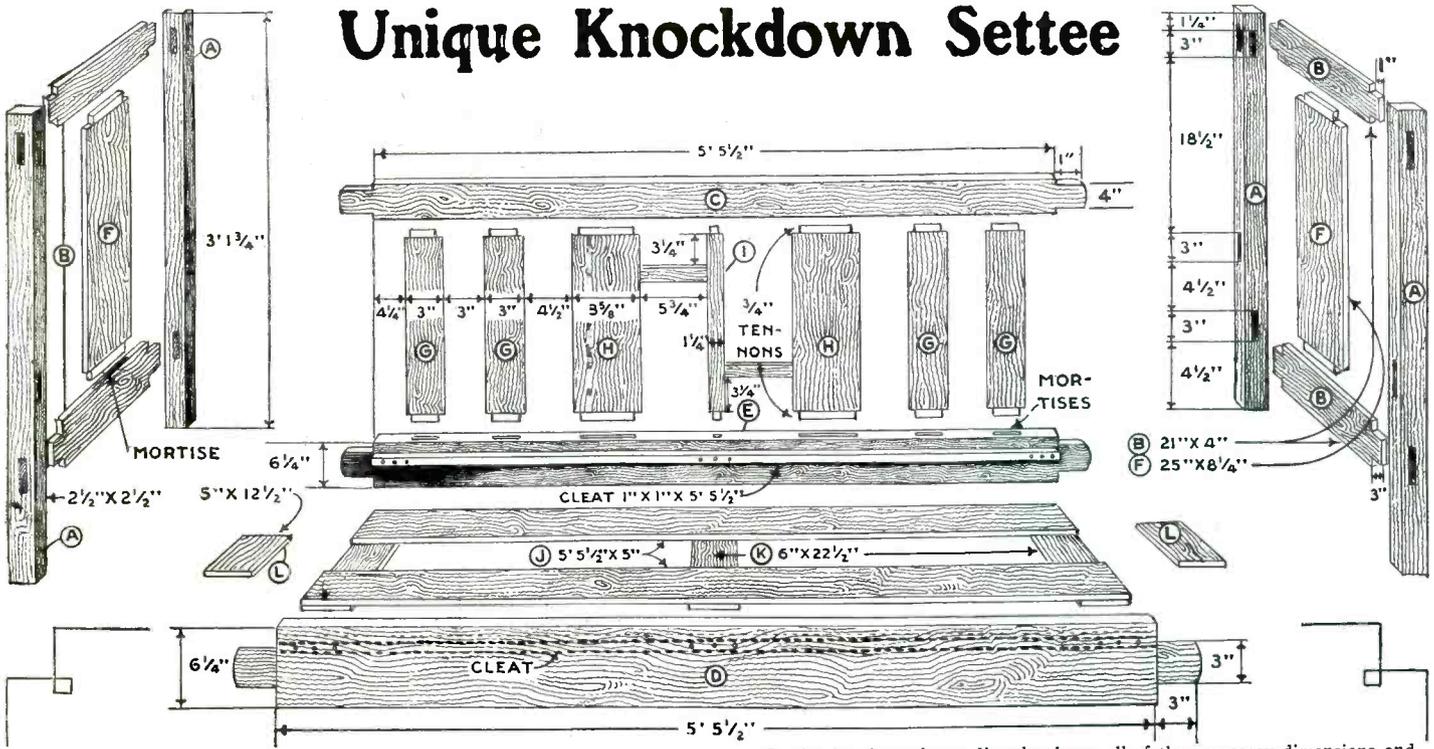
tool. Two iron or steel straps, parallel with the motor shaft, jointly secure the handle, motor and the gear and saw bearings. A short shaft coupled to the motor, carries one bevel gear on the other end. The second shaft forms the saw mandrel and carries the other bevel gear. It is necessary in making up this tool to drive the saw in the direction

indicated, and for that reason the location of the bevel gears and the rotation of the motor must be considered. It is possible also in working up the runners or guides to make these adjustable for depth of cut or for varying with the size of the saw to be used. The circular saw may be removed and another easily substituted.—G. A. LUVERS.

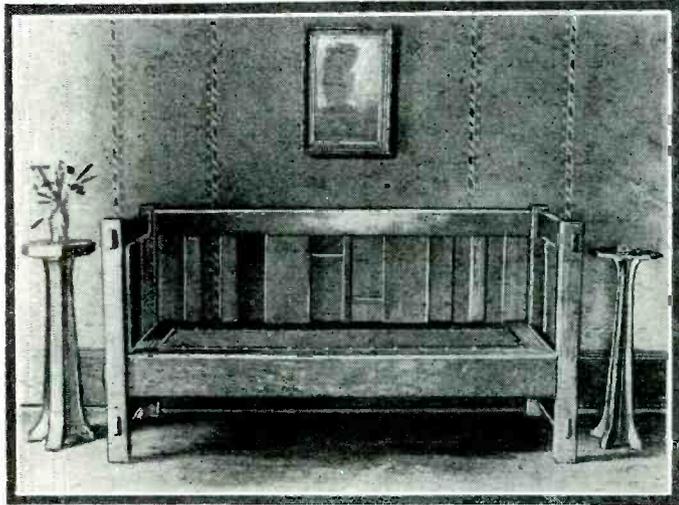


The diagram at the left shows how a motor-driven circular saw can be easily constructed. Great care should be taken to see to it that the saw runs in the direction of the arrows, because in this way it will cut down into the wood; whereas if it rotated in the opposite direction it might run away from the work.

Unique Knockdown Settee



In the drawings shown directly above, all of the necessary dimensions and details for the construction of this unusual and handsome settee are shown. The carpentry work required is very simple and can be performed by anyone who is at all handy with ordinary woodworking tools. There is no undesirable complication.



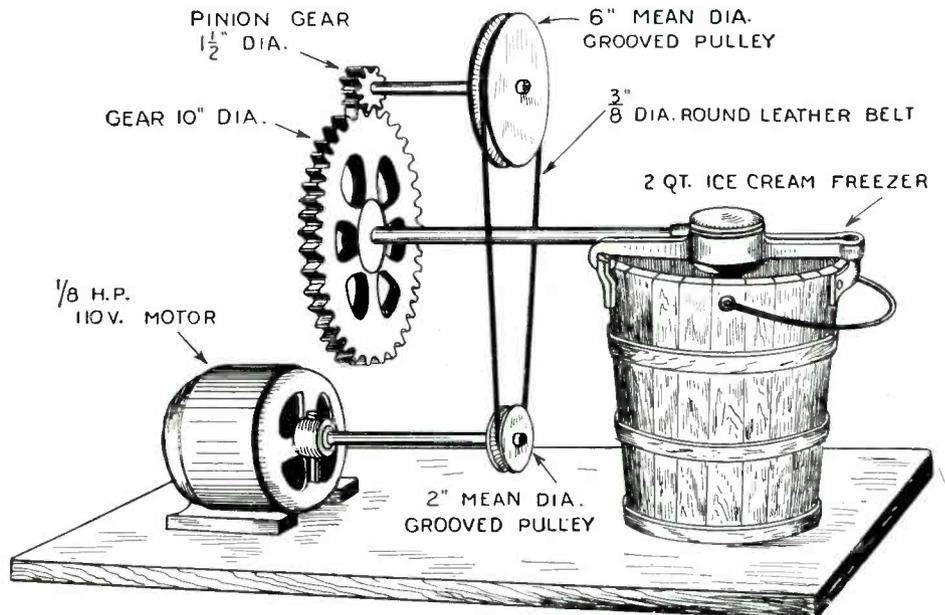
A VERY simple and dignified settee that can easily be used to grace any room in the house is illustrated in the photograph at the immediate left and is shown in detail in the reproduced drawings directly above. Note how simple each and every part is made. Plain mortise and tenon joints are used throughout and the parts are glued or pinned in place. The following material is required:

- 2 1/2 in. sq. by 15 ft. for 4 corner posts, A;
- 4 in. by 15 ft., for top and bottom end rails, B, and top rail, C;
- 6 1/4 in. by 12 ft., for front and back seat rails, D, and E;
- 8 1/4 in. by 5 ft., for two end pieces, F;
- 3 in. by 6 ft., for 4 back slats, G;
- 8 5/8 in. by 3 ft., for 2 back slats, H;
- 1 1/4 in. by 3 ft., for 3 back slats, I;
- 5 in. by 13 1/2 ft., for 2 bottom boards, J, and 2 end boards, L;
- 6 in. by 6 ft., for 3 cross boards, K;

(Excepting A the thickness of the above material is 3/4 in.)
 6 1/4 in. by 1/2 in., by 9 1/2 ft., for remaining 2 bottom filler boards;
 1 in. by 1 in. by 11 ft., for 2 seat cleats;
 Green drill-backed imitation leather, 14 in. wide by 58 in. long;
 Gimp; Tacks; and 2 doz. 1 1/2 in. screws. —Tud Garver.

Power Driven Ice Cream Freezer

THE tedious work of making ice cream with a hand type of freezer can be eliminated by converting the freezer into a power type, using the system suggested in the illustration at the right. To do this, a long shaft is coupled to the regular freezer shaft and a 10 inch gear is fastened to the free end of the new shaft. This is then meshed with a 1 1/2 inch gear, which is on a shaft driven by means of a 6 inch pulley; this is belted to a 2 inch pulley, driven by a 1/8-horsepower motor. By following these general details and providing suitable bearing and shaft supports, the results obtained will be most satisfactory. Of course, other methods of driving the freezer from an electric motor can be devised, but in any event, the gearing ratio must be such that the dasher in the freezer is turned at a comparatively low rate of speed. This is furthermore important in order that too great a load is not placed on the motor. Also, a chain drive can be substituted for the belt drive if desirable or more feasible. —H. W. Secor





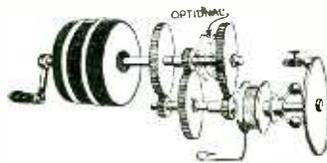
HOW TO MAKE IT



AUTOMATIC FISHING BOAT

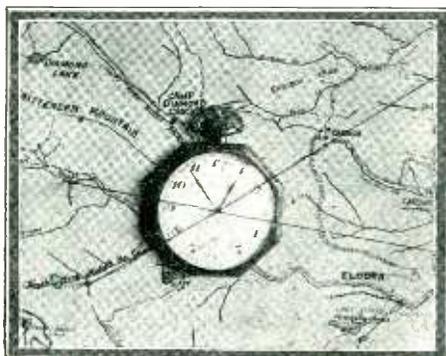


The model boat above carries a phonograph motor which automatically hauls in any fish which nibbles on the trigger line.

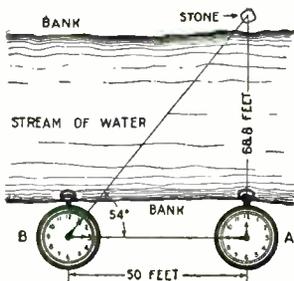


Motor is shown at left. Any sort of trigger release may be attached to the governor brake.—R. J. McHale.

TWO USES FOR YOUR WATCH



A number of practical uses can be found for your watch if you remember that each minute division on the dial represents an arc of 6 degrees. Its use as a protractor and direction indicator is shown by the photograph above. The arc between each two consecutive numbers equals 30°.—H. E. Benson.



With the aid of an elementary knowledge of trigonometry, the figures on a watch dial may be used to find out the distance across a stream. The Pythagorean hypothesis ($BC^2 = AC^2 + AB^2$) is used here.—Charles Rugler

NOVEL LAMP MOUNTING

If the lamp is suspended within the shade by means of a three-arm disk as shown at the right, it may be easily removed and carried about. The disk is held in place by its own weight, but it may be modified so that it clips to the top of the shade.—J. T. Hurley.

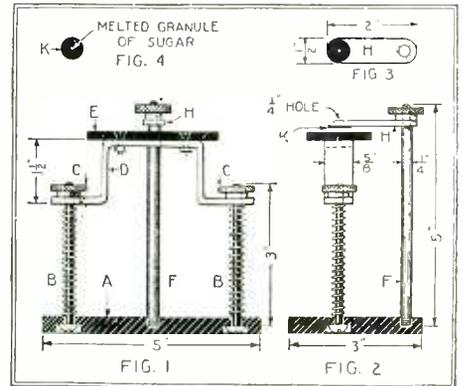


USE FOR OLD INSULATORS



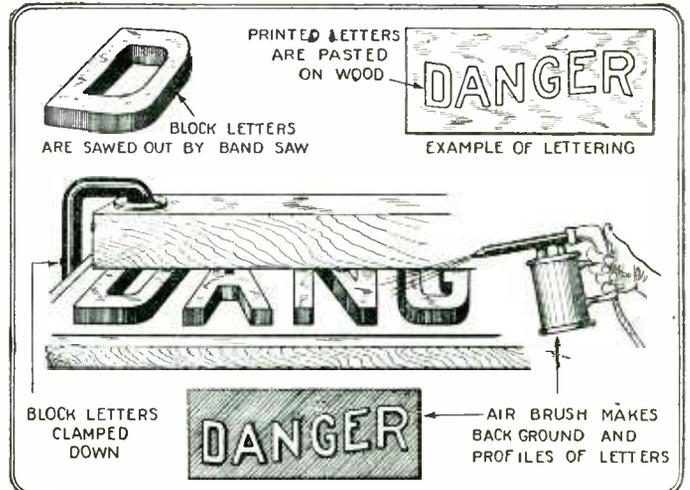
Telephone-wire glass insulator knobs pushed onto the legs of the kitchen chair will make it hard to tip over and more easily slid around. If the chair is made of soft wood, they may be screwed on.—J. R. Malloy, Rep. No. 12,257.

SMALL MICROSCOPE

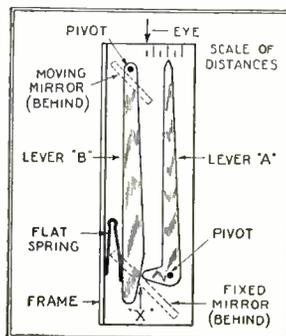


A magnification of 300 diameters may be obtained by the use of a melted sugar lens in the small microscope above. High illumination is necessary because of the very small size of the lens.—E. L. Richardson.

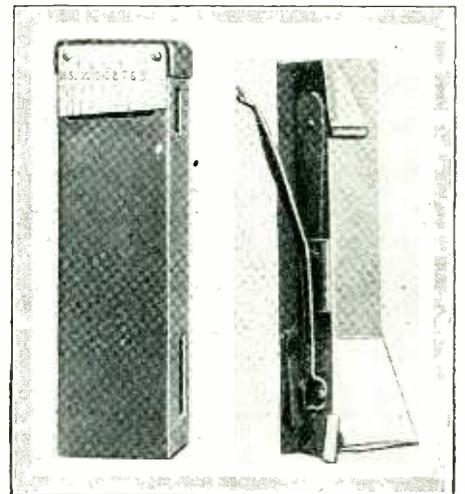
LETTERING AUTO BODIES



RANGE FINDER FOR SNAP-SHOT CAMERAS

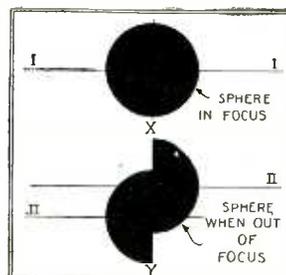


The drawing to the left shows the series of levers which operate the mirror in the range finding device. The scale of distances may be easily seen in the photograph to the right and the relative positions of the rest of the mechanism located.



On the left, the internal mechanism removed from the casing, showing the two mirrors; on the right, the complete instrument, with the scale and indicating lever at the top. The operator looks through an opening at the top and perceives the image in the two mirrors.—C. A. Oldroyd, Rep. 4433.

Using a new Kodak range finder, the observer focuses on a mirrored image. A circle seen out of focus appears bisected as at Y but when in focus, both halves register perfectly.



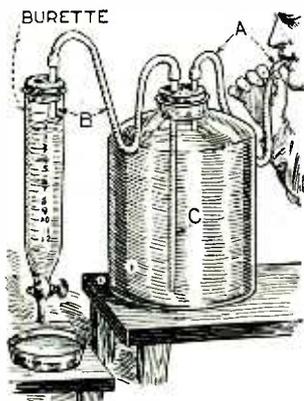


WRINKLES RECIPES & FORMULAS



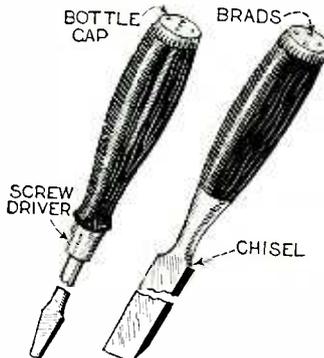
Edited by S. Gernsback

TO REFILL BURETTE



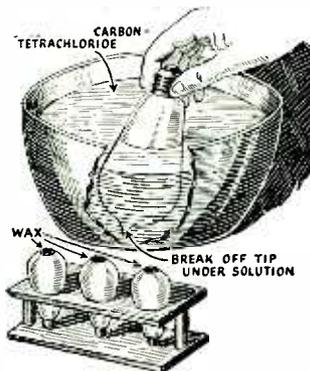
Blow in tube A until solution is above zero mark in the burette. Lower end of tube B is even with zero mark. Excess solution siphons back automatically into the stock jar. Tube C must always be partially submerged. — David N. Roush, Rep. No. 1017.

USE FOR BOTTLE TOPS



Old crown cap bottle tops may be braded to the handles of carpenter's tools to prevent the handle being split by hammering. Smooth down sharp edges to prevent cutting hands. — Wilson G. Walters, Rep. No. 6385.

FIRE EXTINGUISHERS



Old electric light bulbs filled by breaking off the tips in a bowl of carbon tetrachloride, make very effective fire extinguishers for home use. Breaking off bulb in flame releases chlorine which puts out the fire. — Dorothy J. Newbury.

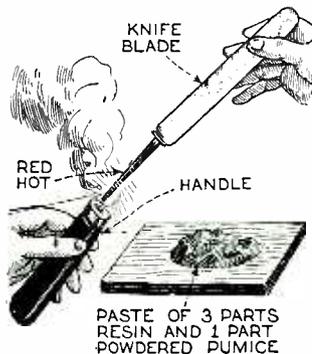
FORKED BOTTLE OPENER

By cutting off two tines of a kitchen fork as shown in illustration, a very good crown cap remover may be made. The fork may be used for its usual purpose as shown at the right. — Juan Estolas.



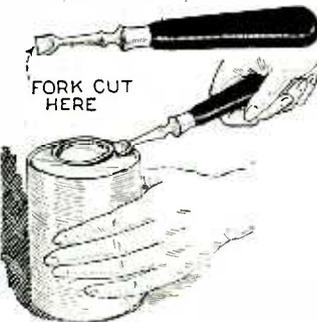
TO REPAIR KNIFE

Fill cavity in handle of kitchen knife with paste made of 3 parts resin and 1 part powdered pumice stone. Insert red hot prong of knife blade and it will stay put. — Nina Jeffers.



CAN COVER LIFTER

An old fork cut off at the base of the prongs makes an excellent tool for removing the covers from paint and varnish cans. — Wendell Rich.

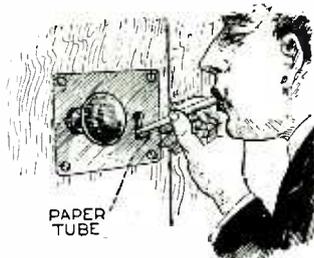


TO MELT STEEL



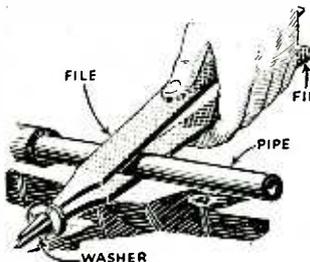
Touch a stick of sulphur to a red hot piece of steel and it will melt as easily as lead. Iron if heated white hot will act the same way. — Vernon Miller.

LUBRICATING LOCK



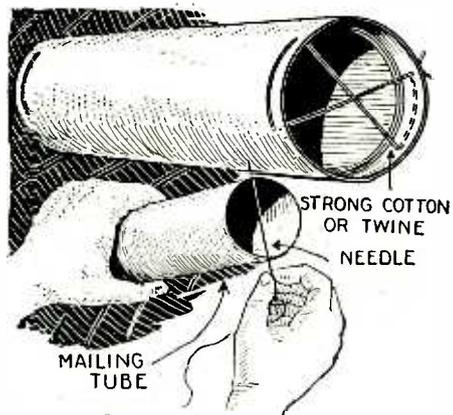
Graphite powder made from pencil leads if blown as shown, into a door lock, will lubricate it thoroughly. — Wendell Rich.

PIPE WRENCH



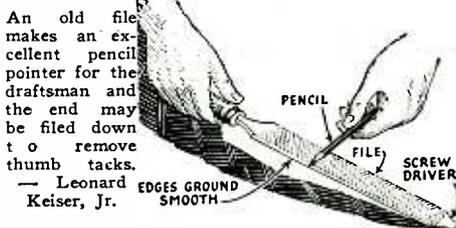
An efficient wrench for turning pipes may be improvised by fastening the handles of two flat files with a washer as shown. — H. W. Hepler.

KEEP THEM IN



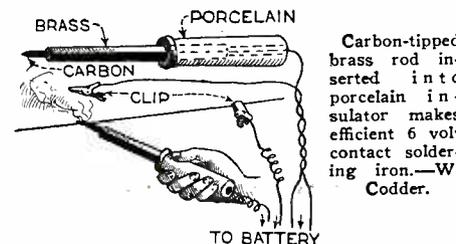
A good way to secure the contents of a mailing tube is to sew up the ends with two stitches as shown above. — Arthur A. Blumenfeld.

DRAFTSMAN'S TOOL



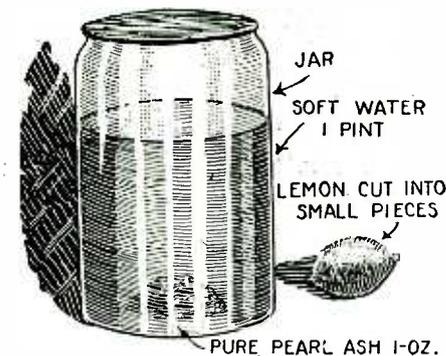
An old file makes an excellent pencil pointer for the draftsman and the end may be filed down to remove thumb tacks. — Leonard Keiser, Jr.

6-VOLT SOLDERING IRON



Carbon-tipped brass rod inserted into porcelain insulator makes efficient 6 volt contact soldering iron. — W. Codder.

GREASE REMOVER



Dissolve 1 oz. pure pearl ash in 1 pint salt water, add 1 lemon cut up small. Keep in warm place 2 days, strain and bottle. Saturate grease spots with liquid and wash out with clear water. — John H. Varley, Rep. No. 19629.

CAN THE DEAD BE RE UNITED?

The Editor's recent article in SCIENCE AND INVENTION entitled "Can the Dead be Re-United" has been read and after mature reflection I am reluctant to take the writer seriously nor can I look upon it as a mere jest put forth for the purpose of bringing on controversy. He stated in substance that during the last 250,000 years ten trillions of human beings have lived and died on this earth, and the chance for one of that number to meet a particular friend in the hereafter was so remote that it would be just as easy as finding a lost needle in a haystack nine hundred feet high. In this same article, many other similes of a like nature were put forth, to show the absurdity of even thinking of a future union.

We go back to the front page of this same interesting Journal and we find advertised thereon a contrivance purporting to convey the human voice through the air across the United States without wires or speaking tubes. "Ye gods and little fishes"; can you expect us human beings up in this Northwest country to believe such fairy superstitious stuff? Eight years ago one of my professional friends from Minneapolis sneered and told me such was only "small town talk."

In view of the able article referred to in the Journal and judging by all the known rules of science, isn't that advertisement on the front page some huge joke the Journal is endeavoring to pandering off on us in the name of truth? Pardon the satire; but do you for a moment Mr. Editor, think that I will believe you when you state that you can stand in New York within a closed building and speak to me while I am here eighteen hundred miles away? Why man, just think of the millions of human beings between us, think of the ten thousands of humming dynamos, millions of cattle, dogs, chickens, birds, wild beasts, existing between us making more or less noises. There are the noises of the ear splitting street car, the good, bad, and indifferent musicians by the thousands are grinding out noises. Yes, the listing winds, the growing plants, and the noise of the revolving earth itself is there to prevent you from throwing your voice eighteen hundred miles. Without considering the call of the crickets and the "bub" "dub" sounds of our own heart throbs there are existing right now—not only ten trillions of noises but quintillions of noises to interfere with your voice ever reaching my auricular appendages from that distance. It is preposterous, it is astounding. No gross superstition of the dark ages can equal that preposterous advertisement of the voice throwing. I write not so much in refutation of the editor's arguments, but to throw light on what some consider a dead subject but nevertheless which is a live wire.

Here for instance, is a man before us weighing 160 pounds, one who is insane with delirium. Multiply the 160 pounds by sixteen ounces and it gives us 2,560 ounces which we multiply by 480 minims or grains which we find in an ounce and it gives us, 1,228,800 grains. Divide each grain into 500 parts and we have 614,400,000 parts. We take from our satchel one grain of Hyoscine and divide it into five hundred parts and we take only one of these five hundred parts, dissolve it in water and inject it under the skin of our delirious patient and wait a few minutes for results, when behold, the stormy wildness disappears and he becomes as quiet as a subdued virgin. To personify, one man was thrown into a crowd of 614,400,000 and almost instantly he put a quietus on all. This is an every day phenomenon. (Your calculation is wrong.—Ed.)

The great trouble with us when looking upon our own kind is to think of the form as the man, while the real man is an invisible being manifesting through the physical form. Without life and without the soul (Ego) the human form is nothing more than dead matter. There is underlying all things a formless primordial stuff which for convenience we call chaos, and which is moulded into shape by mind. Nothing can exist without first an idea, and as the idea (imagination) comes into existence it crystallizes the primordial substance into form. Some claim that this primordial substance is the negative side of Deity. Seeds of any kind are prepared forms waiting for the proper environment before life enters with the soul of the thing. A form can be living or dormant without being ensouled; but the moment the entity of soul enters it becomes animated, be it plant, animal, or man. Being of different vibration they interpenetrate each other as light may be said to interpenetrate air. Our philosophy may be as old as Democritus but it will stand all present tests.

For instance, here is a room dark and filled with air. Flood it with light and the air is still present. They interpenetrate. Another illustration, a new born baby-form comes upon the threshold lifeless. We instantly apply heat and cold and start artificial respiration chasing the fluids of that infant from one extremity to the other, drawing the air into its lungs and expelling it therefrom, but it remains a dead form all the while until the real Ego enters therein. At that very moment the soul becomes the light of the body and the baby begins to live, and cries out for air. (Rather because of the air.—Ed.) The form must first be properly attuned before the Ego can enter.

Physical light is the Word (vibration) and it is no less than a direct manifestation of spiritual light



SCIENCE AND INVENTION desires to hear from its readers. It solicits comments of general scientific interest, and will appreciate opinions on science subjects. The arguments pro and con will be aired on this page. This magazine also relishes criticisms, and will present them in both palatable and unpalatable forms. So if you have anything to say, this is the place to say it. Please limit your letters to 500 words and address your letters to Editor—The Readers Forum, c/o Science and Invention Magazine, 53 Park Place, New York City.

be it from metal, man, or sun. Sunlight is the highest physical manifestation of the great Spiritual Light back of the sun. The spoken word coming from man is not man yet it cannot exist apart from him. It can be bottled up, so can the sun light as we find it in wood and coal. A ray of light coming from the sun is not the sun and yet we are unable to say that it is separated from the sun. Man, the entity is nothing apart from the great Spiritual Fire

AMAZING STORIES

THE new scientific fiction magazine, **AMAZING STORIES**, will be on the newsstands August 10th. Here is a magazine after your own heart. Readers of this magazine who have read the scientific fiction stories for years will welcome **AMAZING STORIES** with open arms.

The next issue of **AMAZING STORIES** contains, among others, the conclusion of the great radio novel "Station X"; the "Moon Hoax" the greatest scientific hoax ever published (1838) by a daily newspaper, an impressive story by H. G. Wells. A novel by Jules Verne commences in this issue, and also one by Garrett P. Serviss.

AMAZING STORIES has secured the sole rights to all of Jules Verne's stories, written by this, the greatest of all scientific fiction writers.

Be sure to get your copy today. The magazine is edited by Hugo Gernsback.

PRICE 25c PER COPY.

back of the physical fire. If the Ego withdraws from the body it is night within the body. If he withdraws with the mind and with the light and chemical ethers there enters death in the form.

The great Light or Spiritual Fire produces the idea and physical light comes, known to us as vibration and it exists in all things being much closer to us than our hands and feet, for it interpenetrates. The physical light cannot be present without the or its Spiritual Father for it emanates the idea producing the vibration.

The complexity of noises that can be produced on our musical keyboard of eight or nine octaves is beyond a life time's calculation—yet we can draw those numbers down to nine, then to four, and even down to one octave; which is as simple as the seven colors of the rainbow being drawn down to the three primary colors; red, yellow, and blue; and then narrowing these three down to the one great white light. (White light is a combination of colors.—Ed.) Nothing can exist without sound, for even the Ego of man individually has a sound peculiar to itself. By the laws governing sound we observe that it becomes a simple matter for the Individual (Ego) to reach any other soul in the solar universe by becoming attuned or in rapport with

H. G. WELLS

the greatest living author of scientific fiction, will be found every month, with one of his thrilling tales, in **AMAZING STORIES**. Be sure to get a copy of this amazing magazine.

AT ALL NEWSSTANDS

that soul. The re-union of discarnate souls is then one of the simplest things in nature.

W. STUART LEECH, M. D.,
Roseau, N. Mex.

(You may be absolutely correct in your statement to the effect that the union of discarnate souls is one of the simplest things in nature. On the other hand, you may be just as incorrect. The fact remains that we cannot prove that discarnate souls actually do unite. The theory that they do is not new and has been advanced by many illustrious writers, among whom we find Ella Wheeler Wilcox and many others. The possibility of the soul or any one in the spirit world communicating with terrestrial life may be sincerely questioned, and if we are to judge from the results which our Psychological Prize Contest has brought, we would add that the theory is absolutely untenable. For three years now, SCIENCE AND INVENTION Magazine has offered \$11,000 for proof of spiritual manifestation, and for three years every medium who has been investigated has been proven fraudulent and has admitted his or her deceit. It will be remembered that the article by Mr. Gernsback was not intended to conflict with any form of religious teaching or worship. He, himself, gave arguments which, if they were held by the reader, completely negate other parts of the theory which he advanced.

Your statement to the effect that the three primary colors, red, blue and yellow can be narrowed down to one great white light is incorrect, inasmuch as a white light is composed of all the colors and is not a single color.

Were we to enter upon the metaphysical to an even greater extent, we could say that there is no such thing as color, because red is not red in a perfectly dark room; neither is that quality of pigment which we know as red of a reddish hue when illuminated with a blue-green light.

Your letter is very interesting from more than one standpoint, and we are glad to give it space in this department. We only wish we had room enough to publish more of the exceedingly interesting communications which are brought to us in the daily mail.—EDITOR.)

LIFE BOATS FOR SUBMARINES

Editor, SCIENCE AND INVENTION:

In your recent edition of SCIENCE AND INVENTION you wrote an article on "Safety on Submarines" on pages 1082 and 1083. On the latter page you have a number of diagrams illustrating a theory advanced by an inventor E. R. Kimball. He has invented life-boats sealed and screwed tightly on the deck of submarines. In case the submarine should get out of commission and not be able to rise to the surface the sailors could get into these lifeboats, loosen them and be carried to the surface by the contained air. On the surface they could remove the top, start the motor and the crew would proceed in the boat to find assistance. However, if you will take the trouble to look in Jules Verne's "Twenty Thousand Leagues Under the Sea" you will find that Captain Nemo has just such a contrivance on his Nautilus, the only difference between Kimball's and Verne's idea being: 1. Kimball's boat was inverted; Verne's was not. Kimball's boat had a gasoline engine; Verne's had a collapsible mast and sails.

S. MELTZ,
Brooklyn, N. Y.

(And as the old adage goes, "There is nothing new under the sun.") Nevertheless, there is a great difference between a theoretical idea of a fiction story-writer and the practical working of the same idea as designed by an engineer. Years ago, flying was advocated; today we think nothing of an airplane. We are now talking of television, of firing rockets to the moon, of tunneling the Atlantic Ocean or building a bridge across it, of being able to fly straight up into the air, hover over any point and land in an area not more than six feet in diameter, of leaving London after breakfast and having dinner in New York and various other impossibilities today, probabilities tomorrow and old things a few years hence. The idea of life boats for submarines was not original with Verne. Generally, ideas are developments. Few inventors take a rapid stride forward, breaking away from conventionalities and developing something absolutely new and fundamental.—EDITOR.)

DISLIKES TORTURE METHODS

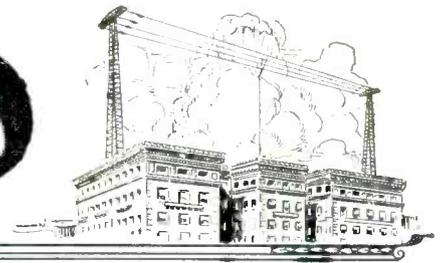
Editor SCIENCE AND INVENTION:

Being a scientific enthusiast, I have read nearly every scientific and mechanical magazine, also library books treating of scientific works, and how to make them, but I've found that there is no book equal to Science and Invention. One of your chapters is entitled "Ancient Torture Methods." Don't you think it would be rather morbid for a person to read such an article? But the worst of it is that a magazine containing such healthy and interesting articles as yours should dwell on that theme. Would it not be better to substitute for "Ancient Torture Methods" such wholesome articles as the rest of your book contains—David B. Levine, New York, N. Y.

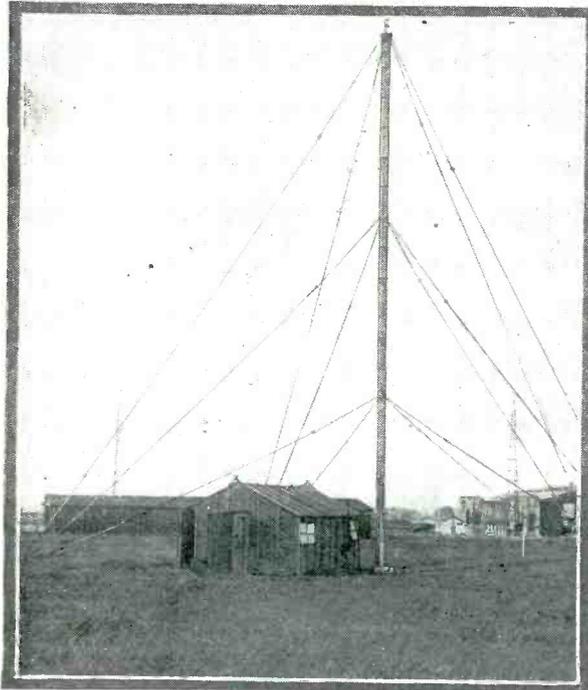
(The last of the series of "Ancient Torture Methods" has been published and for the present there will be no more of these articles.—Editor.)



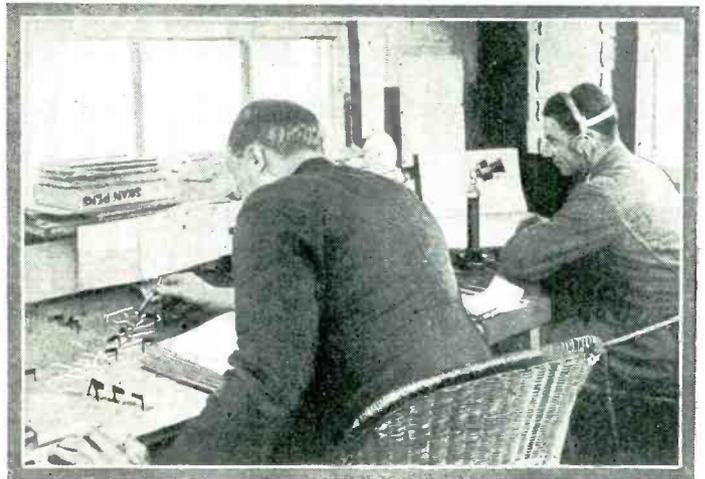
RADIO



Radio Control of Passenger Planes



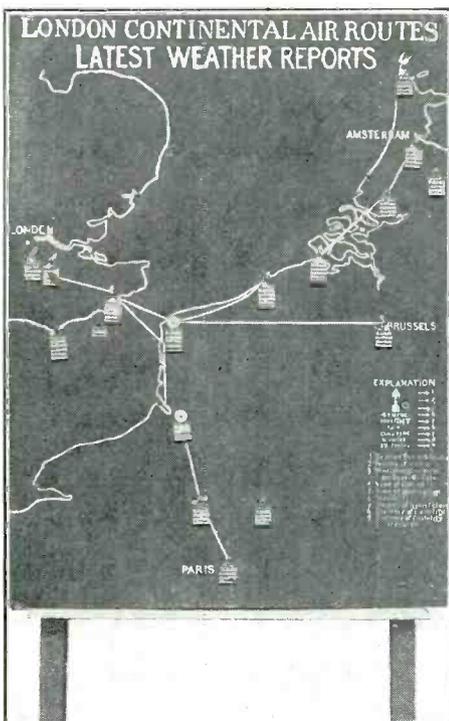
←←←
The photo on the left shows the aerials and radio cabins at Croyden, England, Airdrome of the Imperial Airways. This is the home port of the cross-channel planes.
At right, the radio telephone in use in the control tower at Croyden.
→→→



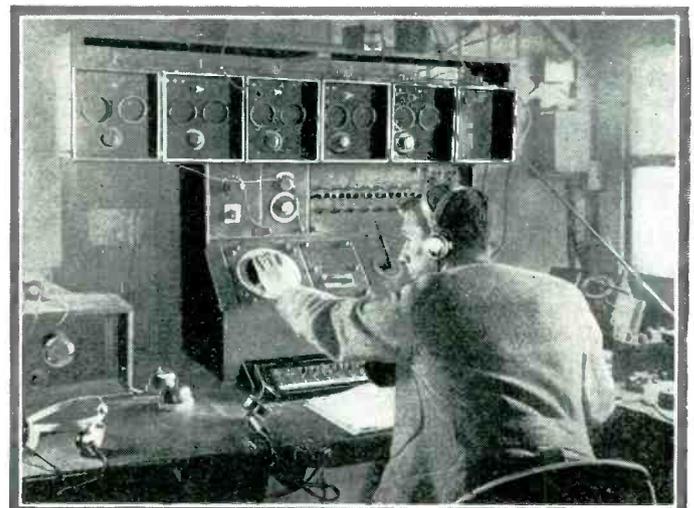
CONSIDERING the recent activity in commercial aviation and the realization of its possibilities shown by the American experts in the past year, it should be interesting to the reader to describe the methods of

communication between planes used by one of the largest foreign companies, The Imperial Airways, Ltd., with headquarters at Croyden, a suburb of London, operates Continental air routes between Paris, Brussels, Amsterdam and other important cities, carrying passengers and freight at a very moderate rate. This company very soon found it necessary to provide some means of warning its pilots of bad weather conditions which they might unexpectedly run into with disastrous consequences. On the advice of the Air Ministry, they decided to equip each plane with a complete radiophone receiving and transmitting installation, and to provide means at the home field for keeping in constant communication with every plane. The weather reports are received at the control tower of the Croyden Airdrome by radio from the pilots of the planes, and from various observation posts throughout the continent. Here they are bulletined (see photo) for the benefit of outgoing pilots and passengers and are

phoned to the planes in flight once every half hour. In the upper right-hand photograph the airdrome manager is shown reading a chart which has just been checked. He is giving the pilots instructions through his assistant whose microphone is connected direct to the broadcast transmitter shown in the lower right. Above the operator of the transmitting unit may be seen six separate panel units. Each one of these is a receiving set which is permanently tuned to the wavelength of one of the flying stations. The operator on duty at the central station is constantly on the watch for signals from the planes, which he relays through telephone lines to the control tower. In connection with this, it is interesting to note that a similar system of communication has been experimented with to some extent in this country for communication between moving railroad trains. While the system has never been developed to the point of great utility, we may soon expect to equal our English friends in communication efficiency, as laboratory tests have proven the idea quite feasible.



←←←
Transmitting apparatus used at the Airdrome for communication with planes in flight is shown at right. The pilots of the planes are in constant communication with the home field and with each other and receive reports from headquarters in exchange for hourly bulletins as to flying conditions in their area.
→→→



←←←
The Weather Report Board at the Croyden Airdrome is shown at left. Here British aviators before starting flight get detailed information on weather conditions in their path. Reports are also transmitted to the pilots in flight from the control tower every half hour using the apparatus shown in the photo at right

WRNY Celebrates Its First Birthday

By CHARLES D. ISAACSON

YES, thank you, WRNY is one year old and doing very nicely. WRNY had its birthday party and there were gay doings; you should have been there. In all probability you were—over the radio. I wonder if any of my readers stayed all through it. I myself was exhausted when it was over, but I danced to the last lingering dance, about two in the morning.

It was a great day: June the 12th, and WRNY just one year old. Grant Mitchell made the cleverest speech of the day. He came over from his successful play, "One of the Family," in which he is starring, to join the theatrical unit; there being units from every walk of life to pay respect to the station. Grant brought a present: it was a small child in a bathtub, and with it was a birthday card. Grant said he had a hard time procuring the right kind of card, because the card-seller did not know what sex a radio station is supposed to be. Grant declared that WRNY is a lusty baby in any event, and that probably the reason is that it is out in the air all the time!

Dr. Lee de Forest made the most complimentary speech. The father of radio broadcasting was present at the very birth of WRNY and has watched it through these trying months of its infancy. So he spoke with a great deal of godfatherly pride.

We began with a group of smart youngsters from the National Stage Children's Association, who had previously entertained the President at the White House. Then some of our leading authorities in the women's hour: Ruth Conne on Fashion, Mrs. Mary Fanton Roberts on Arts and Decoration, Mrs. Rose V. S. Berry on Painting and Sculpture, and so on down the long list—each took two or three minutes to administer just a capsule of thought and entertainment.

By noon we felt sufficiently educated, and a whole hour of the wildest, maddest, merriest, bluest and reddest popular and jazz music rent the air. Dr. de Forest was listening and I am wondering what he thought of his responsibility as the father of broadcasting. In any event the young folks, who adore this phase of WRNY's entertainment, sent in dozens of added requests. After luncheon, we returned for a matinee, in which a dozen of WRNY's finest ensembles came in for a fifteen-minute show. Talk about your continuous performances! Now it was grand opera; now it was an instrumental trio; now it was a real concert imported right from Carnegie Hall; now a little army of violinists playing in unison.

At twilight, the members of the Radio Theatre Players, having finished their own Saturday matinees, dashed over to WRNY with a lift in the form of a play "The Surprise." Olive Wyndham was the guest star, and James Durkin, a well-known director, was another guest. Well, from then on, it was a case of one celebrity after another.

(Continued on page 462)



MARIE TIFFANY
of the Metropolitan Opera Company, who sang for us lately over WRNY.



MICHEL BARROY
Russian baritone, who has appeared with the Follies, is a frequent feature at WRNY.



VIRGINIA HOWELL
Of "Alias the Deacon," whose charming Southern readings at WRNY are always welcome.



John Henry Titus
The nonagenarian author of "The Face on the Bar-room Floor," recited it for us at WRNY.



OLIVE WYNDHAM
Now starring in South Africa, paid WRNY a visit the night before she sailed.



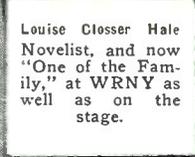
Wellington Cross
Of "No, No, Nanette," is now almost a permanent member of WRNY's staff of announcers.



Helen Wasserman
Of the Geon ensemble—not Irene Bordoni, as you may have thought from her vivacity.



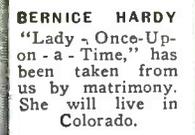
David Putterman
Youngest of the cantors. You may have heard his fine voice in records, as well as over WRNY.



Louise Closser Hale
Novelist, and now "One of the Family," at WRNY as well as on the stage.



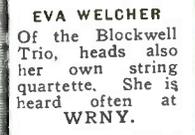
Sir Gilbert Parker
Canada's greatest novelist, was one of WRNY'S many celebrated visitors of late.



BERNICE HARDY
"Lady - Once-Upon-a-Time," has been taken from us by matrimony. She will live in Colorado.



Beniamino Riccio
Baritone, is one of the popular soloists who make so delightful the Edison Hour at WRNY.



EVA WELCHER
Of the Blockwell Trio, heads also her own string quartette. She is heard often at WRNY.



ISABELLE AUSTIN
Used to be of "Roxy's Gang," but has now one of her own at WRNY.

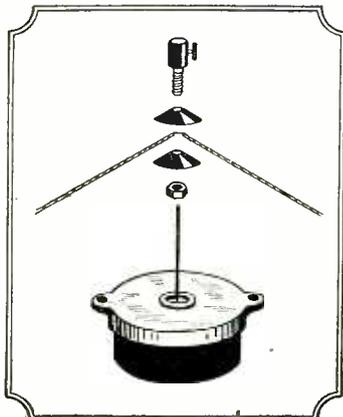


HARRY HERSHFIELD
Cartoonist, is shown here with his famous creation, Abie Kabibble. They entertained you recently from WRNY.

Home-Made Cone Speaker

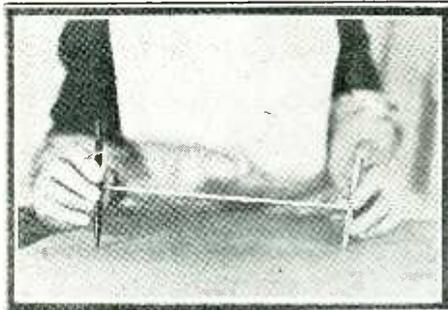
By HERBERT E. HAYDEN

THOSE who "roll their own" when it comes to radio sets surely will not stop at building their own cone type loud speaker, especially now since very excellent parts are available upon the market. The



An exploded view of the most essential parts of the cone type loud speaker is shown in the above diagram.

unit proper, of course, cannot readily be made by the average experimenter since it requires a great deal of mechanical skill and the use of precision machinery, to say nothing of engineering ability for the electrical and mechanical design of the instrument.



If a regular draftsman's compass with an extension beam is not available, the circle for the cone may be laid out by means of two pencils and a piece of string.

Cutting out the cone, however, and assembling the parts may be successfully done by the layman and affords an evening of genuine fun and real satisfaction as well as effecting a substantial saving in the price of the speaker.

The first step in the assembly is to describe



The unit is carefully mounted in place and should be accurately centered for the best results.



When completed, the speaker may be hung up on the wall in an inconspicuous place where it will be out of the way.

a circle of the proper diameter upon the parchment paper. The average man probably does not possess a draftsman's compass with an extension beam, and will therefore have to resort to some other means for making an accurate circle. Two pencils and a piece of string make a very good substitute for a compass. This scheme is shown in one of the photographs on this page. After the circle has been described, a sector is laid out, the exact size depending upon the size of the cone. After cutting away the sector the cone is formed and glued together along the edges formed by the removal of the sector.

The next step is to solder the connecting rod onto the diaphragm. In order to accomplish this the diaphragm is either scraped or sandpapered clean at the center. Great care must be taken not to bend the diaphragm at any point. The exact center of the dia-



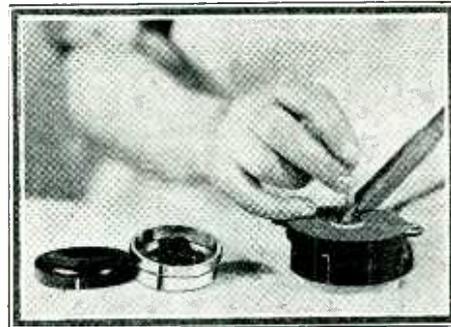
A sector is cut out of the parchment sheet and the edges are then glued together preparatory to the formation of the cone. Only a good grade of glue should be employed.

phragm is determined either by means of a combination square or by trial with a compass. The connecting rod is then placed in position and soldered on, care being taken that the rod is as nearly as possible perpendicular to the diaphragm. Only sufficient solder should be put on to firmly hold the rod in place. Too much solder loads the diaphragm unnecessarily and causes the speaker to reproduce poorly. The solder should be equally distributed around the connecting rod in order to avoid unbalancing the diaphragm.

The connecting rod bushing, the cone-shaped washers and the tightening nut are now mounted on the front cone and the supports for the unit on the rear cone. The

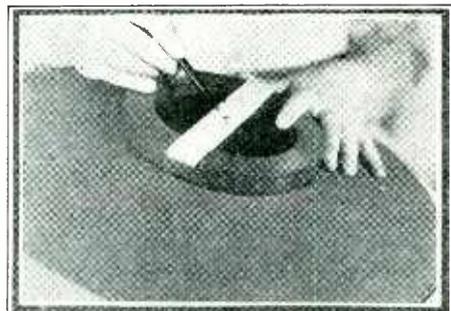
two cones are accurately matched together and a strip of ornamental tape is put around the edges.

After the speaker has been completely assembled and the glue thoroughly dried, it is connected to the set for a test. The connecting rod is adjusted by means of the thumb screw on the sleeve until the best volume and quality are obtained.



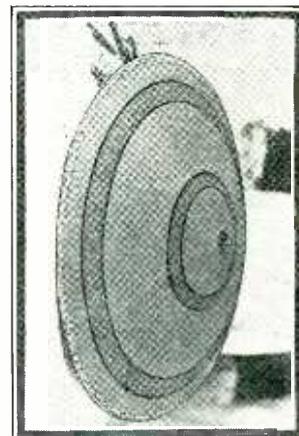
The diaphragm of the speaker unit is scraped or sandpapered clean in the center and the connecting rod carefully soldered.

The horn type of speaker in its usual form must have a place to stand upon, and is, as a rule, placed on top of the receiving set. This often gives rise to a loud humming sound, caused by the mechanical vibration of the tubes. The remedy is to place



The hole in the cross bar through which the connecting rod passes should be accurately centered to avoid friction.

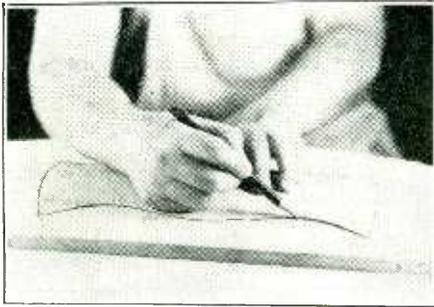
the speaker at some distance from the set. This practice generally makes necessary the addition of an extra table or stand for the horn. The cone speaker described in this article requires no place to stand upon. In fact, it may be conveniently suspended from a nail or hook in an inconspicuous spot on the wall. A design may be painted on the cone to add to its attractiveness.



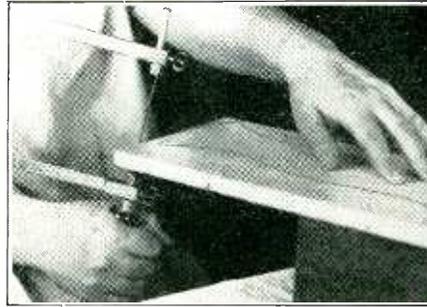
The completed cone is shown here suspended from a nail located in a convenient spot on the wall.

Building a Good Box Loop

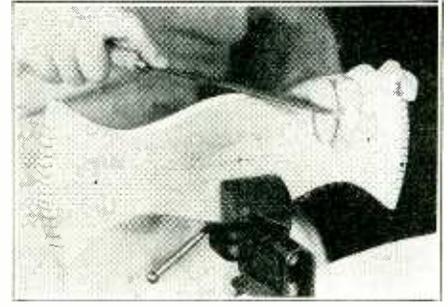
By HERBERT E. HAYDEN



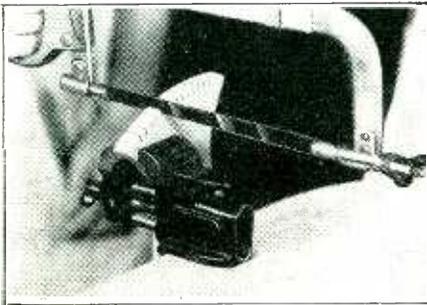
The outline of the loop end is laid out on a smooth piece of $\frac{1}{2}$ " whitewood by marking around the edge of a template accurately cut to size from cardboard.



The end pieces are then cut out with a fret-saw. Be very careful to hold the blade of the saw vertical, and to follow the outline marking very accurately.



After the end pieces have been cut out, their edges may be trued up by the use of a flat wood-file. The markings for the notches and mounting holes are seen.



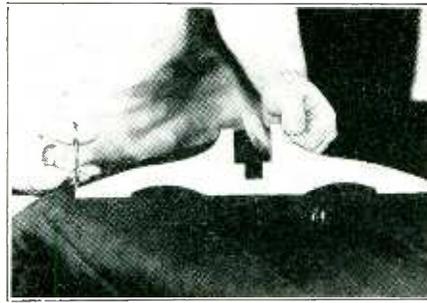
Place the end piece in a vise, being very careful not to dent the wood by too much pressure, and carefully cut out the notches.



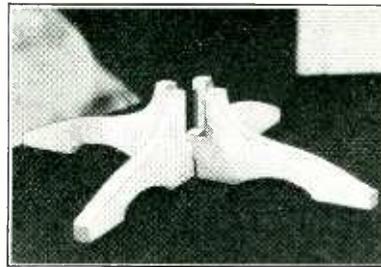
Use a sharp knife to even up the notches so that the loop wire will not be damaged when threaded through them.



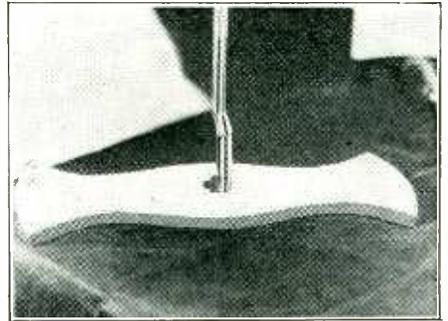
Three small holes are then drilled in the upper end piece to pass screws fastening it to the dowel sticks.



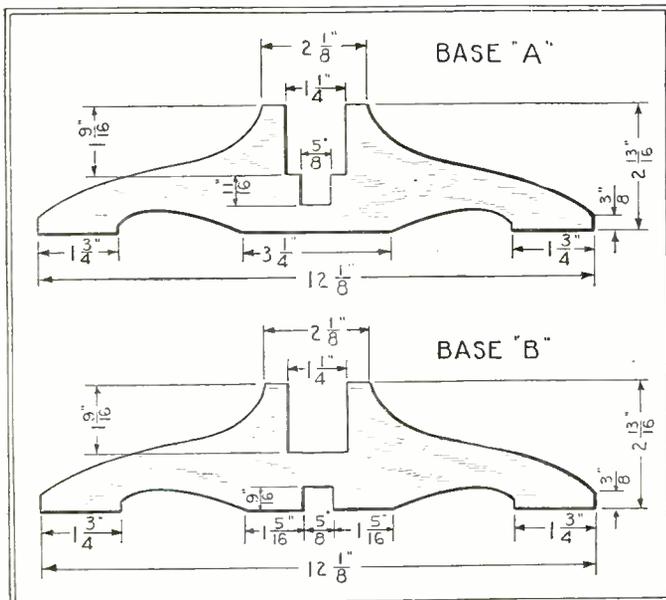
Templates are accurately drawn from the dimension sheet for the base members, their outline transferred to another piece of $\frac{1}{2}$ " whitewood and cut out as before.



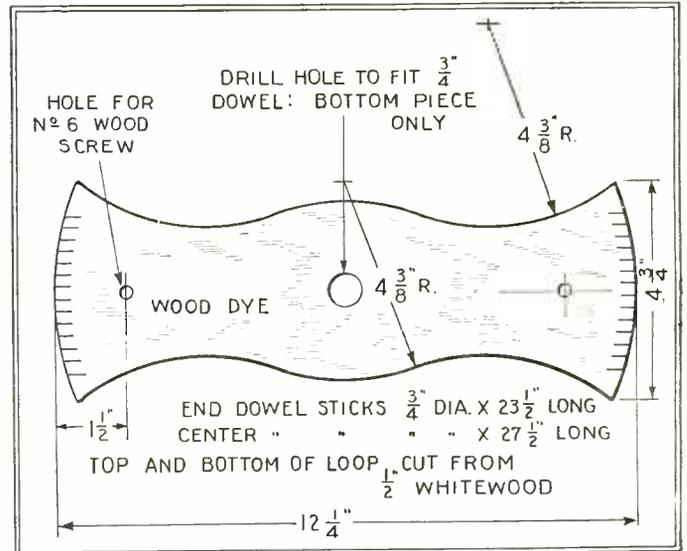
When both base members have been cut out and smoothed, it will be found that they fit together as shown above. It may be necessary to retrim the edges to obtain an accurate fit.



The two small screw holes and one $\frac{3}{4}$ " hole to pass the center dowel stick are next drilled in the lower end piece. The center hole should be only slightly larger than the dowel.

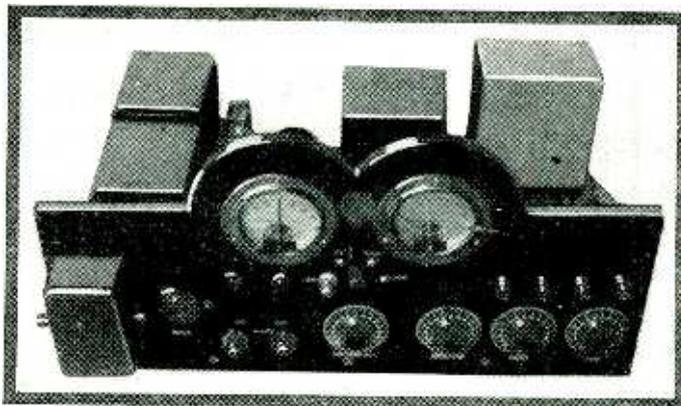
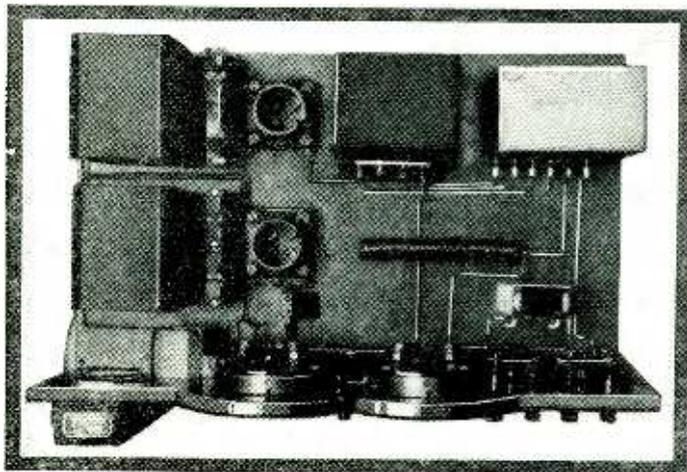


The drawings above should be very carefully followed, with the exact dimensions given. Lay out the cardboard templates full size.



Both end pieces are constructed as shown above, the only difference being in the fact that the center hole of the upper is drilled just large enough to pass a No. 6 wood screw. Note that the radii of all curves used are given. The notches should be $\frac{1}{4}$ " deep.

(Continued on page 477)



At left is a top view of the "B" eliminator which shows the positions on the condenser bank, transformer, chokes, and Raytheon tube sockets. Above may be seen the panel arrangement with meters and controls.

160 and 320 Volt "B" Eliminator

By A. P. PECK

THE "B" eliminator illustrated in these columns and constructed by Mr. L. A. Brams of Brooklyn, N. Y., proved to be such a success that it was greatly sought after by exhibitors at one of the recent radio shows for demonstration in their booths. This eliminator is one that is so versatile in character and is of such neat construction that the underlying ideas should appeal to everyone interested in radio from any angle whatsoever.

A few facts as to what this eliminator will do will not be amiss here. First, as will be noted from the photograph and diagram two Raytheon tubes (R) are used so that an extremely high voltage can be rectified. Then, variable resistances are available for controlling the out-put to the detector, the radio-frequency amplifiers, the audio-frequency amplifiers and for calibrating the voltmeter. Switches are incorporated so that high or low voltage outputs can be obtained. The milliammeter can be cut in or out of the circuit and the output voltage can be changed quickly and easily. Signal lamps are connected in the circuit to show whether high or low voltage is being supplied.

The power supply part of this "B" eliminator consists of two standard center tap transformers (T) of the type designed for use with the Raytheon tube. There are several of these on the market today, but those illustrated combine every desirable feature. They are small and compact and are completely encased in a metal box, which not only shields the coils but protects them

from physical damage. Also very convenient soldering lugs are placed near the base of the instruments so that all wiring can be kept low and out of danger. These transformers are easily mounted, and are especially neat in appearance. Each one supplies current to a single Raytheon tube. Of course, .1 mf. fixed condensers (C) to take care of line surges must be shunted across the secondary. This is standard practice.

The outputs are wired to a particularly interesting multiple switch, which was specially constructed by Mr. Brams from standard practice. Probably by shopping around, a manufactured switch can be found that will do the work. It must, however, give the effect of three different switches. Two are to be of the single-pole, double-throw type, and the other of the single-pole, single-throw type. The single-pole, double-throw switches are so connected in the circuit as to enable the operator to change from high to low voltage output instantaneously. It will be noted that what this does is to place only one Raytheon tube in the circuit, or to connect both tubes in series so as to give a double output. It also controls the input. By using this system, voltage outputs of approximately 160 and 320 volts can be obtained.

When switch S is in the low voltage position, switch S1 must be arranged so that its contacts will be open and S2 must be on contact A. When S is in the high voltage position, S1 must be closed and S2 on contact B. In front of the lamps controlled by S2 are green and red bulb's eyes. When the green light shows, low voltage is being

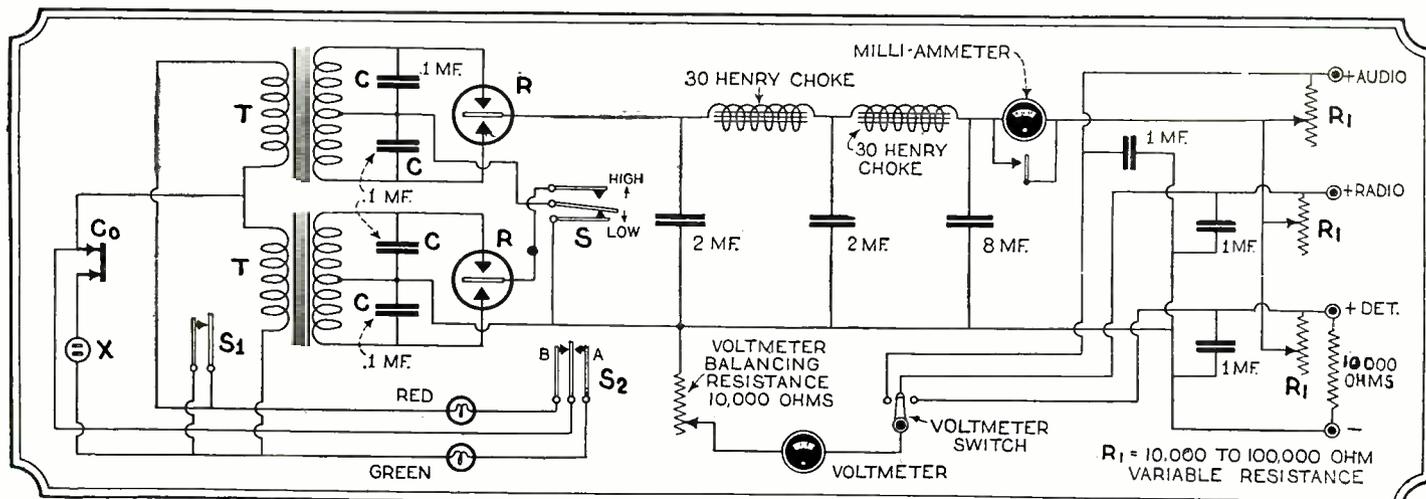
used, but when the red light shows, the power supply is being used for high voltage.

In building "B" eliminators it must be realized that high power is being dealt with, therefore, certain precautions must be taken, and one of the most important is in connection with the input circuit. It is a very good idea to use a circuit breaker in series with the 110-A.C. line and this is indicated by "CO" in the diagram. This instrument is now available on the market and is of a type that opens when a load of over 3 amperes acts upon it. Thus, if a short-circuit takes place anywhere in the eliminator, this circuit breaker will immediately open and prevent any damage being done to the "B" eliminator apparatus or to the house fuses. This circuit breaker is a decided advance in safety for "B" eliminators. It also acts as a line switch to turn the eliminator on and off.

On the front panel of the eliminator is mounted a standard electric light plug-receptacle. This is for easy and convenient connection to the house lighting circuit, and can be of any type ranging from the crude porcelain to the elaborate flush type plug receptacle. See X in diagram.

In order to determine just what current is being drawn by the complete receiver, Mr. Brams inserted a milliammeter in series with the high voltage amplifier lead. This milliammeter can be left in the circuit at all times if so desired. A voltmeter has also been incorporated, but this is rather a superfluous accessory for the average amateur, and need not be used. It is shown in the

(Continued on page 465)



In the diagram above, notice the compound switch, S, S1, S2, for change-over from low to high voltage. The voltage control resistances, R1, are an interesting feature and permit fine variation of output. Although 30

henry chokes are specified, it was found that 90 henry chokes improved the output quality. With the Raytheon tubes no hum is noticeable and better quality is obtained.

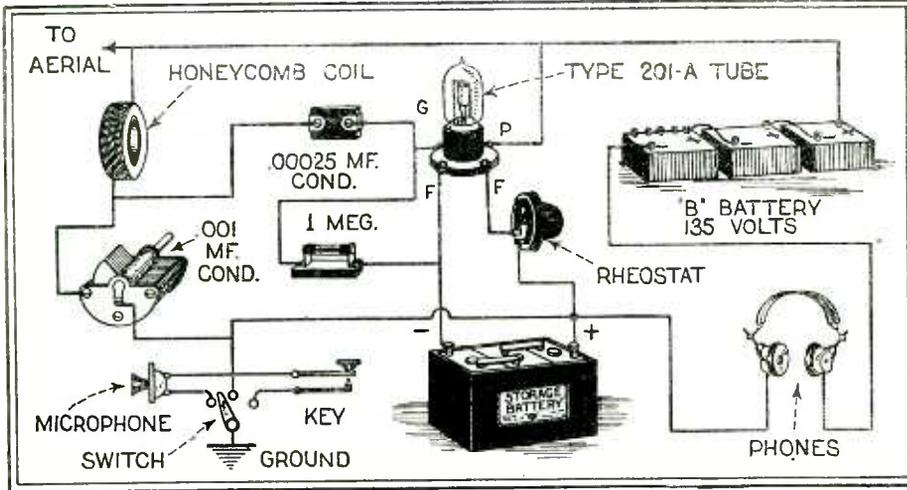
RADIO ORACLE

In this Department we publish questions and answers which we feel are of interest to the novice and amateur. Letters addressed to this department cannot be answered free. A charge of 50c. is made for all questions where a personal answer is desired.

COMBINATION RECEIVER AND TRANSMITTER

(495) Q. 1. Joseph S. Reed, High Point, N. C., desires a diagram of a simple low power combination receiver and transmitter.

A. 1. The circuit requested is given in these columns. A three-point switch is connected in the ground circuit to throw the set in position for receiving, transmitting by voice or transmitting by k.y. The tube used may be a 201A with 120 volts on the plate. The diagram shown is known as the Colpitts circuit.



Q. 495. Picture diagram of a combination low power transmitter and receiver with three-way change-over switch for receiving, phone transmission and key. The circuit used in this set is the well known Colpitts.

"B" BATTERY SUPPLY

(496) Q. 1. Miss Eleanor Brown, Lancaster, Pa., asks advice as to the best method of supplying "B" battery current to her receiving set.

A. 1. The choice of the source of current supply for your set necessitates consideration of the efficiency of the several methods commonly used. First and most popular is the standard dry cell type of "B" battery. This type of current supply is the most efficient known, provided that the batteries used are of high quality. You must be sure that you are purchasing new batteries, because cells which have been standing on the dealer's shelves for any length of time are sources of much objectionable noise in the set due to chemical depreciation. Storage "B" batteries come next in order of efficiency, their only drawback lying in the fact that sulphated plates and poor inter-cell connections are liable to cause trouble. If you have direct current in your home it is comparatively simple to obtain a reliable and fairly quiet source of current. All that is necessary is some sort of approved protective device to protect the set in case of shorts and a well constructed filter system. It is quite possible to draw your supply from an A. C. line, too, but a transformer and rectifier are necessary to make the current usable for radio purposes.

OSCILLATION

(497) Q. 1. Richard Langley, Hooker, Oklahoma, asks: In a three circuit tuner; what are the most obvious causes of too much oscillation? In other words, what causes a receiver to oscillate continually, it not being possible to stop the oscillations and use the receiver for broadcast reception?

A. 1. One of the most common causes of this effect, particularly in home-made receivers, is the employment of too many turns on the tickler coil. The remedy is obvious; remove sufficient turns to cause the receiver to operate correctly as a regenerative set but not to squeal. This should be done with the receiver tuned to the highest wavelength, which it is desired to receive. Ten turns on the tickler is often found sufficient for a coupler covering the broadcast wave-length.

Another cause of self-oscillation over the entire range is long grid leads and plate leads that are run parallel to each other. Remedy: separate the leads or run them at angles to each other. Also have grid and plate leads as short as possible.

Sometimes the addition of a by-pass condenser across the output of the detector circuit will aid considerably in controlling a continuously oscillating receiver. Also try adjusting the grid leak, the detector tube rheostat and varying the plate voltage applied to the detector tube. Changing tubes may be of further assistance.

A. F. TRANSFORMER RATIO

(498) Q. 1. Richard Wayne, Rochester, N. Y.: asks: In an audio-frequency amplifier, is it better to use a transformer having a 3 to 1 ratio in the first step and one having a 6 to 1 or 10 to 1 ratio in the second step or should both transformers have the same ratio?

A. 1. It is advisable to use the smaller ratio transformer in the second step rather than in the first stage. In order to avoid distortion, the ratios of both transformers should be as low as possible, consistent with good volume.

this would result in interference when the set is detuned from the resonance point.

Another method sometimes employed is to vary the filament current of the tube by means of the rheostats. The volume of the set may be controlled successfully in this manner, but the depreciation in quality is very marked when the filament current falls below a certain value. An efficient way to control the output of a set is to connect a variable resistance having a range of approximately from 10,000 to 100,000 ohms across the secondary of the first audio frequency transformer. This resistance absorbs power from the circuit and allows the output to be regulated to the desired value without causing distortion.

PUSH-PULL AMPLIFIER

(501) Q. 1. Willie Robert Jones, Shreveport, La., asks: Will the UV-199 type of tube work with push-pull transformers?

A. 1. UV-199s may be used quite successfully with push-pull transformers, although the same volume of sound should not be expected as with 201A tubes.

Q. 2. Do push-pull transformers amplify signals without distortion?

A. 2. The push-pull transformers go a long way toward eliminating distortion, especially in cases where the grids of the tubes are liable to become overloaded, if used with ordinary amplifying transformers.

Q. 3. Will a resistance coupled amplifier work satisfactorily with 90 volts on the plate?

A. 3. Owing to the high voltage drop across the coupling resistance, it is necessary to employ a higher "B" battery voltage with a resistance coupled amplifier than with one using transformer coupling. At least 135 volts of "B" battery should be used with a resistance coupled amplifier.

RAILROAD INTERFERENCE

(502) Q. 1. Alfred Martin, Akron, Ohio, states that whenever a train passes within the vicinity of his home, the signals which he is receiving on his radio set fade out and return after the train has gone by. He has observed that only signals coming from stations located in the same direction as the train fade out, while all other signals are practically constant in intensity. He wishes to know the reason for this.

A. 1. When a train or other large metallic object is situated between a broadcast station and a receiving set, the train absorbs a good deal of the energy which the radio set would otherwise pick up. If the train is sufficiently close to the receiving set, it may absorb so much of the radio energy, that practically none reaches the receiver. Signals coming from any other direction will not be affected to the same extent, since the receiver antennae intercepts the transmitted radio waves before they reach the train or other metallic body located in the vicinity of the set.

INCREASING TUNING RANGE

(503) Q. 1. J. W. Benson, Indianapolis, Ind., says: My tuned radio frequency receiver does not tune high enough. I believe the trouble lies in the fact that the variable condensers are too small. How can I increase the range without going to the expense of replacing the variable condensers?

A. 1. If a small fixed condenser is connected in each of the three tuning circuits as shown in the diagram, and so arranged that the three fixed condensers may be thrown into the circuit simultaneously by means of a switch, then you should experience no trouble in reaching the higher wavelengths. The capacity of each of the small fixed condensers should be about .001 mf.

"B" BATTERY TRANSMITTER

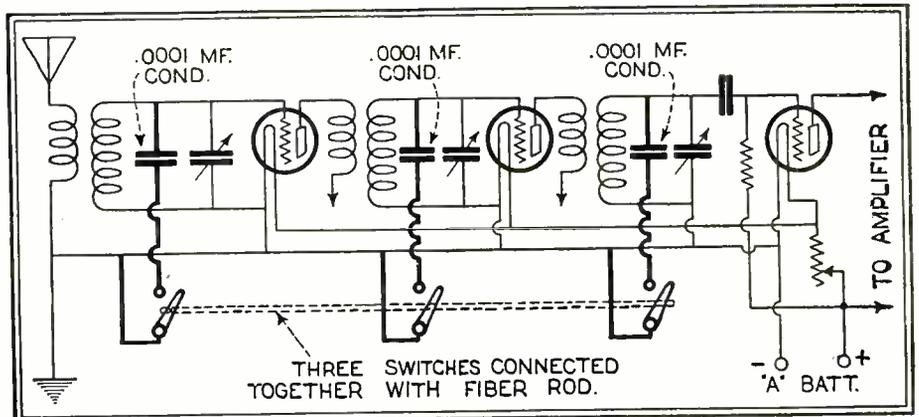
(499) Q. 1. James McGrath, Chicago, Ill., inquires: Are "B" battery transmitters such as that described in the October, 1925, issue of SCIENCE AND INVENTION Magazine practical for use on short waves?

A. 1. These transmitters are found to be entirely practical, particularly on the short waves, where almost incredible distances are covered with very low power input. For instance, one of our readers in South Africa built the transmitter described in the issue mentioned above and with it, he carries on constant communication with another transmitting amateur located 800 miles away! All of this is done with an ordinary receiving tube and 150 volts of "B" battery applied to the plate. Of course, there is not much QRM in this particular locality and where traffic is heavy, "B" battery operated transmitters cannot be expected to "push through." However, during periods when traffic is light, some exceptional results may be expected with this type of set.

VOLUME CONTROL

(500) Q. 1. Fred J. Simpson, Lincoln, Nebraska, wants to know: What are some of the methods for controlling the volume of a radio receiving set?

A. 1. One way to control the volume of a set is by detuning the set. This method is not very satisfactory in cases where several stations are broadcasting on approximately the same wave-length, since



Q. 503. A method of increasing tuning range of radio frequency receiver by shunting small fixed condensers across secondary variable condensers of radio frequency stages.

Scientific Humor

DON'T KNOW—100% CORRECT

An extremely valuable football player had been conditioned for poor grades and was told that he would have to get a passing grade of 50 in chemistry in order to play in an important game. The Professor of Chemistry, who was an ardent fan, said that he would give the student an oral examination and later, announced that he had passed with a grade of 50. When asked what the questions were, the Professor said: "I asked him what color Venetian Red was and he said 'Blue' and he was wrong. I asked him what color Yellow Ochre was and he said he didn't know, and he was right, so I gave him 50 for the exam.—Miss Mabel Overholt.

STEPPING ON IT



Girl: "Father, look, there is a bug on the ceiling!"

ABSENT-MINDED PROFESSOR: "Well, step on it and don't bother me any more.—Harry Davis, Rep. No. 24447.

NO GRASS ON A BILLIARD BALL

Little Anna asked her father why he didn't have any hair on top of his head. He answered, "For the same reason that grass won't grow on a busy street. You know why now, don't you?" "Sure," she replied, "it can't get up through the concrete."—Mrs. C. A. Hardesty.

HE CALLED IT A RUBYIAT

PROFESSOR OF LITERATURE (who is handling a radio set): "I want a rheostat, thirty Khayyams resistance." CLERK: "You mean thirty ohms, don't you?" PROFESSOR: "That's right. I knew it was either ohm or Khayyam.—W. W. Hatfield.

SPIDER WEB COILS



"Bridget, what did you leave those cobwebs around the radio for?"

"Sure and I thought they was a part of it, Sor."—Alfred Bogan.

FITS ANYTHING

FIRST MUSICIAN: "What key are you playing in?" SECOND DITTO: "Skeleton key." FIRST MUSICIAN: "Skeleton Key?" SECOND DITTO: "Sure. Fits anything."—Edward Niczkowski.

ETHER MORE OR LESS

"You know, Tom, I think there's only one song appropriate for Radio Broadcasting." "Which song is that, Fred?" "Over the Waves."—Ernest Rinn, Reporter No. 11908.

SOME ARE JUST AS GOOD

RADIO FAN: "Give me a wave trap, quick, I want to catch a street car." CLERK: "Sorry, sir, you can't use them for that."—Ernest Rinn, Reporter No. 11908.

First Prize \$3.00
MANY A ONE WE'VE BLOWN OUT!



To Radio Editor:
 How can I put out the lights in my radio? I've heard of people blowing out their tubes, but I don't see how it's possible.
 (Signed) Anxious.
 —Herbert Krause.

ROUGH STUFF ON TOUGH

There was a young chemistry tough Who insisted on mixing some stuff, Then heated the vial And after a while They found his front teeth and a cuff.
 —H. S. Postgate, Reporter No. 26469.

WE receive daily from one to two hundred contributions to this department. Of these only one or two are available. We desire to publish only scientific humor and all contributions should be original if possible. Do not copy jokes from old books or other publications as they have little or no chance here. By scientific humor we mean only such jokes as contain something of a scientific nature. Note our prize winners. Write each joke on a separate sheet and sign your name and address to it. Write only on one side of sheet. We cannot return unaccepted jokes. Please do not enclose return postage. All jokes published here are paid for at the rate of one dollar each, besides the first prize of three dollars for the best joke submitted each month. In the event that two people send in the same joke so as to tie for the prize, then the sum of three dollars in cash will be paid to each one.

AND ROSE AGAIN

PROF. TO PHYSIC STUDENTS: "Now, who broke the barometer?" No response from students. PROF.: "I want to know how this barometer was broken." FEEBLE-MINDED STUDENT: "Didn't you say the barometer fell this morning?"—Raymond C. Johnson.

A DIRTY DIG

WIFE: "Come, let's get down to brass tacks and thrash this thing out." HUBBY: "No, we'll use ten penny nails. It's easier to see the point with them!"—Henry A. Courtney.

ON EARTH OR IN HEAVEN?

OLD LADY: "Are you sure that this century plant will bloom in 100 years?" FLORIST: "Certainly, ma'am. If it doesn't, bring it back and your money will be returned."
 —R. Smith.



ANOTHER TWINKLE, TWINKLE, LITTLE STAR

Scintillate, scintillate, luminous constellation! Interrogatively and inquiringly do I question your constituent elements In your prodigious altitude above the terrestrial sphere, Similar to crystalline carbon suspended in the celestial firmament.
 —A. Leventhal.

ANTE MORTEM

"Fancy old Bill, of all people, going into the gunpowder shed with a lighted candle!" remarked the proprietor of the explosive factory to his foreman. "I should have tho't that would have been the last thing he'd do."
 "Which, properly speaking, it was, Sir!" replied the foreman.—H. S. Postgate, Reporter No. 26469.



THE TRUE ORIGIN

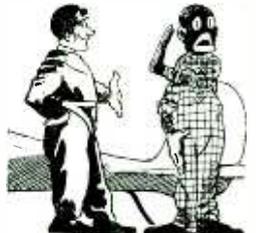
PROFESSOR: "Smith, what is the composition of water?" SMITH: "Water is composed of two gins, oxygen and hydrogen. Oxygen is pure gin; hydrogen is gin and water."—J. Richardson, Reporter No. 26535.

WAS TRUSSED UP

"Arthur, I don't think you understand the word engineer," said the teacher. "So try and give a sentence using it." Arthur replied, "Was the engineer the bridge when the accident happened?"—Irving Callahan.

FIRM TERROR

AVIATOR (to colored man): "How would you like to have a ride?" COLORED MAN: "No, sah; I stays on terrah firmah and the more firmah the less terrah."—Wilbur Holland.



VERY PRACTICAL

PROFESSOR: "Give me a practical application of the 'right hand rule.'" STUDE: "To find the direction of the current in the third rail grasp it with your right hand so that the fingers are curved in the direction of the lines of force, and your thumb will point in the direction the current is flowing."—Frank Schmulowitz.

ANOTHER USE FOR THEM

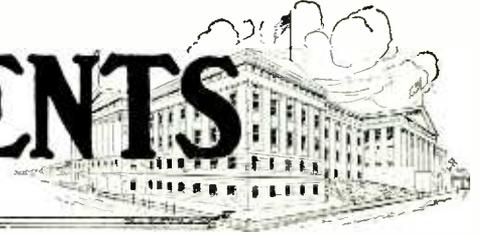
Grandma greeting grandpa as he enters the house with a loud speaker under his arm. "Why Pa, I won't let you go around the streets with that thing sticking in your ear even though you are deaf."—F. Ebel.

TEN THOUSAND TIMES MORE

"Pop," inquired little Clarence Lilywhite, "what am a millenium?" "Sho!" said the parent, "doan' yo' know what a millenium am, chile? It's jes' about the same as a centennial, on'y it's got mo' legs."—Alma Seccoid.



LATEST PATENTS

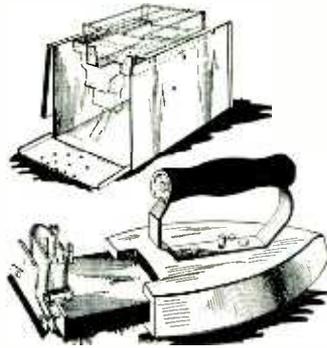


ROACH TRAP



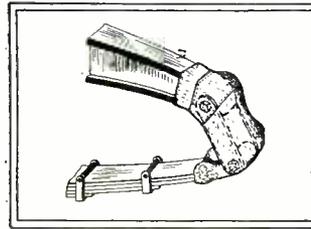
No. 1,578,061 issued to Jacques Abadie. This trap utilizes the knowledge that a roach prefers an opening only slightly larger than his body to one much larger. The bait is placed in a screened, covered box which is entered through a wedge-shaped passageway containing slots of various widths. The roach, attracted by the bait, chooses the slot most suitable to its size, enters the box and is unable to find the way out.

HEATER-COOKER-IRONER



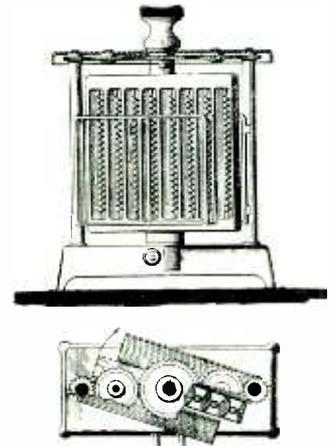
No. 1,580,909 issued to Joseph Lavoie. This invention relates to a self-contained electric radiant heating unit which is usable in a variety of ways. A rack is contained in the carrying case, shown in the upper half of the illustration, which permits the heating unit to be used for toasting bread or as a small electric stove. A sadiron is provided which contains a receptacle for the heating unit, forming a very efficient electric iron. The apparatus is so arranged that it may be telescoped and packed within the limits of a light metal packing case which is provided. The device is very compact when packed, and should make a handy unit for the traveler.

SHACKLE COVER



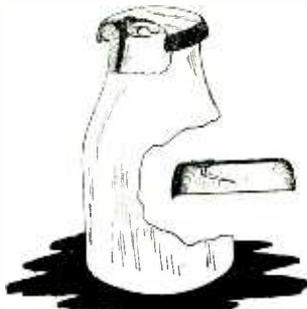
No. 1,574,898 issued to Jason A. H. Johnson. This invention relates to a cover for spring shackles on automobiles. It consists of a boot of leather or similar material, which is laced about the spring ends and shackle bolts and protects the moving parts of the spring assembly from the intrusion of injurious dust and grit. A cover applied in this fashion also functions to prevent the leakage of grease from the spring leaves.

ELECTRIC TOASTER



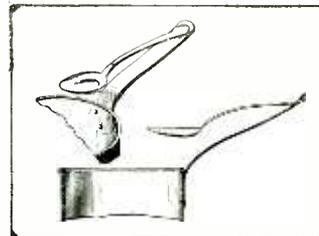
No. 1,580,244 issued to Albert Guissart and Edgar H. Barge. The toaster illustrated below incorporates two novelties in design: first, the method of automatically turning the toast without removing it from the holder; second, a self-operated switch which cuts off the current when the holder arms are not in a position for toasting. Turning the knob at the top of the toaster rotates the holder arms so that they change positions and also disconnects the apparatus from the power line when the arms are half rotated.

MILK BOTTLE OPENER AND CAP



No. 1,575,319 issued to Ryk Cruyff. This invention consists of a cap of aluminum or other light metal which, when fitted over the top of an unopened milk bottle, bears a cutting blade which punctures the paper cap and on being turned, cuts it away. The aluminum cap may be used as a cover for the contents after the bottle has been opened.

SPOON-SUPPORTING MEANS



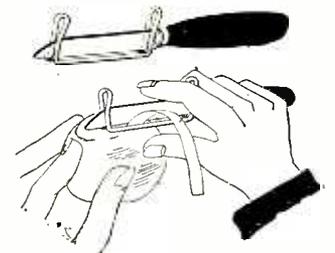
No. 1,580,582 issued to Alvin E. Carman. A simple slot cut in the end of the handle of a kitchen utensil acts as a receptacle for the handle of a mixing spoon and keeps the spoon out of the way of the utensil cover and prevents its becoming overheated.

VANITY CASE



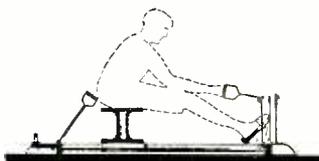
No. 1,580,369 issued to George T. Bates. The latest thing in the way of portable beauty shops is shown above. The metal case contains in one of its halves a firmly cemented glass mirror, the other half containing receptacles for loose powder, rouge compact, two puffs and lipstick. As may be seen above, the cover of the pocket containing the rouge compact is so arranged that, when closed, it holds the lipstick in place. The loose powder is covered by an adjustable sifter-top, which in one position is sealed and will not permit the escape of powder.

KNIFE GUARD



No. 1,578,295 issued to Virgil D. Swihart. Here is a device which will make it possible to assign hubby to K. P. duty as official potato-parer without fear of his using up all the potatoes in paring. The wire clip which is made of spring steel fits over the blade of the paring knife and may be adjusted so that strips of any thickness desired may be cut from the vegetable or fruit. The principle on which this operates is practically identical to that incorporated in the design of Gillette and other types of safety razors, but we do not by any means recommend that this apparatus be used to remove hirsute adornment. Try it if you must, but remember that we have no First Aid column.

EXERCISING APPARATUS



No. 1,577,809 issued to Edward T. Randall. This apparatus incorporates many of the features found in expensive gymnasium equipment. A sliding seat permits its use as a rowing machine, and means are provided for the use of coil spring exercisers and Whitley cable exercisers.

SANITARY CONTAINER

No. 1,584,261 issued to Alphonso Vuolo. A novel sanitary holder for tooth brushes, nail brushes, tooth-paste tubes, etc., has been invented in the form shown at the right. The container is so arranged that each article is kept in a separate compartment and is prevented from falling out by a flange at the bottom of the receptacle, which forces the article to take the position shown in the drawing. Evaporation is permitted through ventilating holes in the sides of the container, and the top is so constructed that dust is prevented from settling upon the contents. A ring is provided attached to the cap for suspension from a hook.



NOTICE TO READERS. The above illustrated and described devices have recently been issued patent protection but are not as yet to our knowledge available on the market. We regret to advise that it is impossible to supply the names and addresses of inventors of the above devices to any of our readers. The only records available, and they are at

the Patent Office at Washington, D. C., give only the addresses of the inventors at the time of application for a patent. Many months have elapsed since that time, and those records are necessarily inaccurate. Therefore, kindly do not request such information. —EDITOR.



THE ORACLE



The "Oracle" is for the sole benefit of all scientific students. Questions will be answered here for the benefit of all but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink; no penciled matter considered.

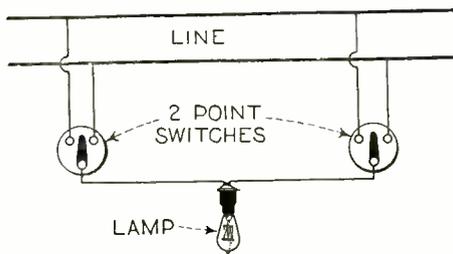
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 50 cents is made for each question. If the questions entail considerable research work or intricate calculations, a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

TWO-WAY LIGHT CONTROL

(2104) Q. 1. James A. Broadston, Cincinnati, Ohio, says: In many halls there is a light controlled by two push-buttons so that it is possible to turn the light on or off from either button, regardless of the position of the other. Please publish the wiring diagram of such an arrangement.

A. 1. The diagram you request is given in these columns.

Q. 2. When a friction clutch begins to take hold, there is a certain amount of friction. When the



Q. 2104. This method of connection permits a light to be operated from two points.

clutch is fully engaged, there is no friction and also when it is disengaged, there is none. Please explain how the friction varies when the clutch is thrown in.

A. 2. When the clutch is in the disengaged position, the slippage may be regarded as infinite and the friction between the two parts of the clutch is zero. As the clutch engages, the friction increases from zero as the pressure and difference of rotary speed increases up to a maximum. As the difference of speed grows less the latter condition occurs practically when the two parts of the clutch are rotating at the same speed and there is no slippage between them. When the clutch begins to disengage, the friction between the two parts decreases, and slipping increases and friction decreases until the clutch is entirely disengaged.

RAPIDITY OF FREEZING

(2105) Q. 1. F. L. Stetzer, Weehauken, N. J., wants to know: If two pans of water of the same size are put into a room at freezing temperature, the water in one pan being at the boiling point and the water in the other pan at a temperature of 80° Fahrenheit, which pan of water will be the first to freeze?

A. 1. The water at the boiling point contains the greater amount of heat and it will therefore take longer for the heat to diffuse itself into the air of the room. Consequently the water at the higher temperature will not freeze as quickly as the water at the lower temperature.

WATCH DEMAGNETIZER

(2106) Q. 1. Russell F. Waterman, Columbus, Ohio, writes that his watch has become accidentally magnetized due to the fact that it has been within the magnetic field of a large generator and no longer keeps good time. He desires to know how the watch may be demagnetized and brought back to its normal state.

A. 1. A watch demagnetizer can be made by winding 50 turns of No. 22 D.C.C. wire on a cardboard tube 4 inches in diameter. This winding is connected in series with an ordinary 60 watt lamp on the 110 A.C. line.

By inserting the watch and pulling it out a few times, you will be able to completely demagnetize it.

THERMIT PROCESS

(2107) Q. 1. Vinogradoff, Scotia, Calif., wishes to know the proportions of the chemicals used in the Thermit process of welding and the chemical reaction which takes place.

A. 1. The Thermit process is based upon the heat produced by the oxidation of aluminum by a metallic oxide. In welding iron the proportions used for the Thermit mixture are 3 parts of iron oxide, Fe₂O₃, and 1 part of aluminum powder. When the mixture is ignited, the aluminum combines with the oxygen in the iron oxide, liberating free iron in a molten state, the temperature of the reaction often reaching as high as 5400° Fahrenheit.

RENEWING OLD FILES

(2108) Q. 1. Richard Dietrich, Rochester, N. Y., states that he has several old files which are almost worn out and would like to know how they can be treated to restore their cutting surface.

A. 1. Old files may be rendered useful again by the following process: Boil them in a potash bath, brush with a hard brush and wipe off. Plunge for half a minute into nitric acid, and pass over a cloth stretched tightly on a flat piece of wood. The effect will be that the acid remains in the grooves, and will take away the steel without attacking the top, which has been wiped dry. The operation may be repeated according to the depth to be obtained. Before using the files thus treated, they should be rinsed in water and dried.

Q. 2. How can cloth be treated to make it fire-proof?

A. 2. The cloth should be dipped in a solution consisting of 10 to 20 parts of potassium carbonate and 4 to 8 parts of ammonium borate in 100 parts of water. When thus applied the liquid covers the material with a glassy mass and if it should come in contact with fire, carbon dioxide gas is given off, preventing burning.

Q. 3. How is decalcomania paper made?

A. 3. Smooth unsized paper, not too thick, is coated with the following solutions:

I. Gelatin, 10 parts, dissolved in 300 parts warm water. This solution is applied with a sponge. The paper should be dried flat.
 II. Starch, 50 parts; gum tragacanth, dissolved in 600 parts of water. (The gum tragacanth is soaked in 300 parts of water; in the other 300 parts the starch is boiled to a paste; the two are then poured together and boiled.) The dried paper is brushed with this paste uniformly, a fairly thick coat being applied. The paper is then allowed to dry again.

III. One part blood albumen is soaked in 3 parts water for 24 hours. A small quantity of sal ammoniac is added.

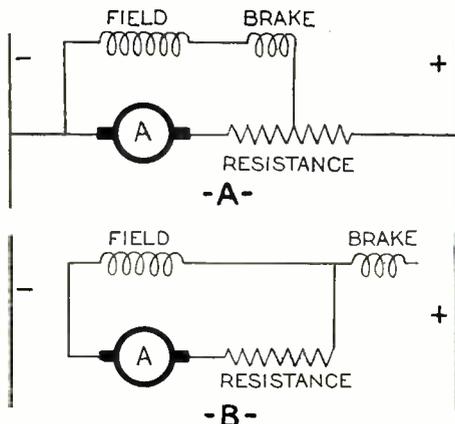
The paper, after having been coated with these three solutions and dried, is run through the printing press, the picture, however, being printed reversed so that it may appear in its true position when transferred. Any colored inks may be used.

DYNAMIC BRAKING

(2109) Q. 1. Raymond V. Hatton, St. Louis, Mo., asks: What is meant by dynamic braking of an electric motor and how is this accomplished?

A. 1. When it is desired to bring motors to rest quickly, or in the case of crane or hoist motors to hold the load after having raised it, they are supplied with brakes. Braking may be accomplished in two ways, namely, mechanical braking and dynamic braking.

Dynamic braking is accomplished by connecting the motor to operate as a generator for delivering energy to some local circuit or returning it to the supply circuit, which action retards the motor. When it is necessary for the machine to hold its load, dynamic braking is supplemented by friction brakes which become operative when the motor comes to rest and the dynamic braking ceases. In applying dynamic braking to series-wound motors the field winding is usually first connected in series with a resistance across the line wires to

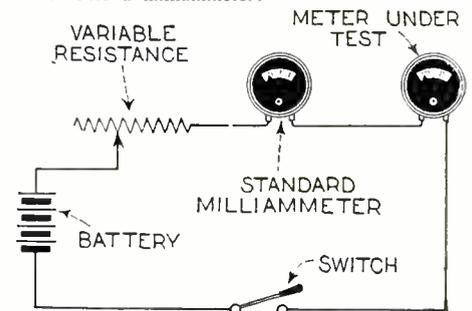


Q. 2109. Circuit diagram for dynamic braking system for electric motors.

insure the motor building up as a series generator, and thereafter the motor is disconnected from the line, leaving the motor armature and field in circuit with the resistance in the diagram. These connections are shown respectively at a and b.

CALIBRATING MILLIAMMETER

(2110) Q. 1. Murray Farmer, Norwood, New York, asks: How can an ordinary ammeter be converted into a milliammeter?



Q. 2110. Milliammeter calibrating circuit.

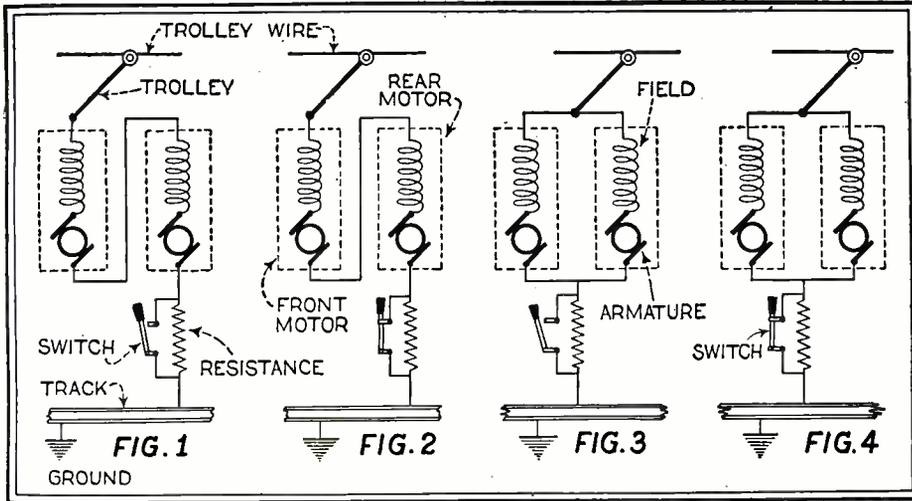
A. 1. An ammeter, if it is of the type having a shunt across the movable coil may be converted into a milliammeter by removing the shunt and recalibrating the instrument in comparison with a standard milliammeter. The connections for the recalibration test are shown in these columns.

DEFINITION OF SHORT CIRCUIT

(2111) Q. 1. James B. Larson, Indianapolis, Ind., asks: What is a short circuit?

A. 1. The term "short circuit" is a broad one and it usually refers to the case where an electric conductor of practically zero resistance is connected across the opposite sides of an electric circuit, causing the current in that circuit to rise to 10 or possibly 100 times its normal value, the result being that the fuse or other protective devices open the circuit. If no protective devices are provided in the circuit, the storage battery or dynamo feeding the circuit will be damaged, due to the heavy current surging through this circuit caused by the low resistance "shorting" conductor. If you have 10-ampere fuses in a house lighting circuit and you suddenly short-circuit a fuse or switch block with a screw driver, a current of possibly 50 to 100 amperes passes for the fraction of a second and the fuses melt. If this did not happen, the conductors would get hot and possibly set fire to the house. A.C. transformers and alternators can stand momentary overloads approximating a short circuit, where D.C. dynamos or storage batteries would be ruined. Cases are on record where a heavy short circuit current has caused a dynamo or storage battery to actually "blow-up" or burst.

Another way of describing a short circuit is to adapt Ohm's law to the conditions on hand. The current which flows in a circuit is equal to the electro-motive force divided by the resistance of the circuit. The smaller the resistance becomes, the greater the current will be. Theoretically when the resistance of the circuit becomes zero, the flow of current will be indefinitely large. It is quite possible in the case of a battery or generator to short circuit the terminals with a conductor whose resistance is practically zero. Under this condition, the current would rise to infinite proportions if it were not for the fact that the battery or generator has what is called an internal resistance. It is this internal resistance which keeps the value of the current down under the short circuit conditions. The short circuit current is different for different types of batteries. In the case of the Daniel or gravity battery, a short circuit for a period of a few hours is not only harmless but also necessary to the battery being "polarized." The gravity battery has a very high internal resistance and this keeps the short circuit current down to a low value. Most other types of batteries are usually exhausted and waste zinc and battery solution by short-circuiting. If a large A.C. or D.C. generator is short-circuited, the current rises to enormous proportions and serious damage often results, due to windings burning out or being so strongly attracted to each other by virtue of their enormous magnetic field that they are actually drawn out of the armature slots and twisted out of shape.



Q. 2112. The four drawings above show the connections made by trolley car controller to vary the current supplied to the motors.

TROLLEY CAR CONTROLLER

(2112) Q. I. B. Brown, Indianapolis, Ind., desires to have explained the action that takes place when the handle of a trolley car motor controller is set on the various notches.

A. 1. Referring to Fig. 1 we see that both the motors, which are of the series type, are connected in series with a resistance across the line, one side of which is the trolley wire, the track and ground acting as the return. This corresponds to the condition when the controller is on the first notch. Moving the controller handle to the second notch cuts out the series resistance, leaving the two motors connected in series across the line. This is shown in Fig. 2. Fig. 3 shows what happens when the handle is placed on the third notch. The two motors are now connected in parallel with the resistance in series with both motors. In the fourth or full speed position indicated in Fig. 4 the series resistance is cut out, leaving both motors connected in parallel directly across the line.

GAMMA RAYS

(2113) Q. I. W. Brown, Toronto, Canada, would like to have explained the method by which gamma rays are generated and the uses of the gamma ray.

A. 1. Gamma rays are produced by the disintegration of radium, you will find some valuable information on this point in the very interesting book, "The Interpretation of Radium," by Soddy. A stamped self-addressed envelope will bring you the name and address of the publishers of this book.

BLUEPRINT PAPER

(2114) Q. I. Victor D. Clark, Chicago, Ill., asks how blueprint paper is prepared.

A. 1. The ordinary blue photographic print in which white lines appear on a blue ground may be made on paper prepared as follows:

- A. Potassium ferricyanide 10 drachms
- Distilled water 4 ounces
- B. Iron ammonia citrate 15 drachms
- Distilled water 4 ounces

Mix when wanted for use, filter, and apply to the surface of the paper.

With this mixture no developer is required.

The paper after exposure is simply washed in water to remove the unaltered iron salts. The print is improved by immersion in dilute hydrochloric acid, after which it must be again well washed in water.

PREPARATION OF CONCRETE

(2115) Q. I. Maurice Putnam, Rochester, N. Y., asks: What is concrete and how is it prepared?

A. 1. Concrete as used by engineers in construction is generally formed of an artificial mixture of Portland cement and an "aggregate" consisting of sand and gravel or broken stone. These ingredients are mixed with water either by hand or by machine mixers. When in a semi-liquid form the material can be shoveled or poured into molds, and will gradually harden in either air or water, forming an artificial stone of high strength. The compressive strength of concrete varies with the quality and proportion of the materials; the compressive and tensile strength are both tested.

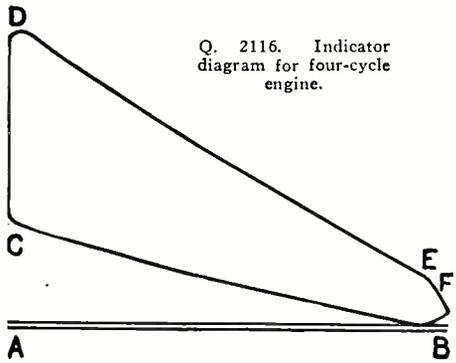
The ingredients are usually measured by volume, the actual percentage of each being determined by measuring the percentage of voids or air spaces contained in the sand and in the gravel or broken stone. The principle in mixing concrete is based upon completely filling the voids or air spaces in the sand with cement and the voids in the gravel with sand. In order to obtain as nearly as possible a perfectly homogeneous and solid mass free from air spaces, the percentage of voids in the sand is determined by filling a pail whose volume is known full of sand and pouring in water until the pail just begins to overflow. The water is then drained off and its volume measured. This gives the percentage of air spaces contained in the sand. The same process is followed in deter-

mining the percentage of voids in the gravel or broken stone. The concrete most generally used in the average type of structure is proportioned of 1 part of cement, 2 parts of sand and 4 parts of gravel or broken stone. The ratio is modified slightly for different class of work.

ACTION OF FOUR-CYCLE ENGINE

(2116) Q. I. James Powell, Atlanta, Ga., asks: Please explain by means of an indicator diagram the action of the four-cycle gas engine.

A. 1. In the four-cycle engine, the ignition of gas takes place in one end of the cylinder every two revolutions of the flywheel or every two double strokes. The following sequence of operations takes place during four consecutive strokes: (a) intake of a mixture of gas and air during an entire stroke; (b) compression during the second



Q. 2116. Indicator diagram for four-cycle engine.

(return) stroke; (c) ignition at or near the dead-point and expansion during the third stroke; (d) expulsion of the burned gas during the fourth (return) stroke.

The figure shows an indicator diagram of a four-cycle engine. AB, the lower line shows the admission of the mixture, at a pressure slightly below the atmosphere on account of the resistance of the inlet valve. BC is the compression into the clearance space, ignition taking place near C and combustion with increase of pressure continuing from C to D. The gradual termination of the combustion is shown by the rounded corner at D. DE is the expansion line, EF the line of pressure drop as the exhaust valve opens, and FA the line of expulsion of the burned gases. The pressure being slightly above the atmosphere on account of the resistance of the exhaust valve.

X-RAY HAIR REMOVER

(2117) Q. I. J. L. Phillips, Detroit, Mich., asks: Can X-rays be used for the removal of superfluous hair?

A. 1. It is possible to employ X-rays for this purpose but the operation must be performed by an expert, since, if the treatment is not properly administered, very severe X-ray burns may result. The apparatus must be so adjusted that it affects the hair roots only and not the skin.

SYMPATHETIC INKS

(2118) Q. I. Victor H. Russell, Chicago, Ill., desires to have described the methods of preparing invisible ink.

A. 1. Invisible ink, or sympathetic ink, as it is sometimes called, may be made of lemon juice, sulphuric acid or cobalt chloride. Other substances may also be used. If the writing is done with a solution of sulphuric acid it is invisible until heated, whereupon it turns brown. The action is similar if lemon juice is used as the writing fluid. In the case of cobalt chloride, the writing is at first invisible and turns pink when heated. After a while, the cobalt chloride absorbs moisture from the air and disappears again, reappearing upon being heated.

WIRING CIRCUITS

(2119) Q. I. Clifford Harveson, Spring Grove, Minnesota writes: I have noticed in wiring houses for electric lights that No. 12 B. & S. Gauge is used for the main wires. For the branch circuits No. 14 is used. Is this the correct way of doing it? I should think a short circuit on the No. 14 wires would cause the latter to burn out before the fuses on the main line would blow.

A. 1. In an electric wiring system, the mains are, as a rule, made heavier than the branch circuits because they have to carry the sum total of the currents flowing in all of the branch circuits. Each branch circuit must be individually fused, according to the National Electric Code. A short circuit on any of the branch circuits would cause the fuses in that circuit to blow. If, for some reason, these fuses do not blow, then the main fuses will in all probability blow before the branch wires become sufficiently heated to burn out.

TESTING OF GASOLINE

(2120) Q. I. A. Donovan, Seneterre, Quebec, Canada desires to know what methods may be used for testing the quality of gasoline, how to detect the presence of kerosene and water in gasoline and to determine the percentage of each.

A. 1. To test for the presence of impurities in gasoline, it is only necessary to pour a few drops in a saucer and to allow it to evaporate in the open air. The residue, whether it be in solid or liquid form is the impurity. This test will also indicate the presence of kerosene, the latter remaining as a liquid in the saucer. In order to determine the proportion of kerosene, a measured amount of gasoline is evaporated at a temperature of from 80 to 100 degrees Fahrenheit, the liquid remaining behind being kerosene, and if the amount is measured it will give an idea of the proportion of kerosene to gasoline in the original sample. The presence of water in gasoline is easy to detect by pouring some of the gasoline in a test tube and allowing the tube to stand undisturbed for a few minutes. The water, being heavier than gasoline, will settle to the bottom in a separate layer, if there is any water present in the sample.

MAKING HAIR STAND UPRIGHT

(2121) Q. I. Walter Gehring, Detroit, Mich., asks: How is it possible to make the hair rise by means of radio or electricity?

A. 1. This may be accomplished by means of a high frequency coil such as a Tesla or Oudin coil. Another method is to stand directly underneath a rapidly moving leather belt. The static electricity generated will attract the hair and make it stand upright. The second method is only practical if performed in cold dry weather.

Q. 2. Is it injurious to the hair or skin?

A. 2. The hair or skin is not injured in any way in the performing of experiments of this nature. The only thing felt is a sharp tickling sensation.

Q. 3. Where can I obtain details and complete instructions for building an apparatus for carrying out the experiment?

A. 3. A large Tesla coil was described in the March, 1925 issue of THE EXPERIMENTER. Another article of this nature appears in this issue of SCIENCE AND INVENTION Magazine.

(2122) Q. I. George E. Stevens, Athens, Ga., asks for data regarding the earth.

- A. 1. Equatorial radius, 6,378,388m., 3,963,399 mi.
- Polar radius, 6,365,909 m., 3,949,992 miles.
- 1° latitude at the equator = 68.70 miles.
- 1° latitude at the pole = 69.41 miles.
- Mean density of the earth, 5.52 g. per cu. cm.
- Mean distance from the earth to the sun 149,500,000 kilometers, 92,900,000 miles.
- Mean distance from the earth to the moon 384,393 kilometers, 238,854 miles.

Science and Invention

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NO. 1000

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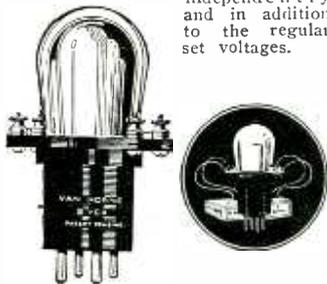
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Answers to Scientific Problems

(Continued from page 420)

THE HYDROMETER IN THE PAIL

AS the pail is whirled around in a vertical circle the pressure within the water is increased when the pail is at the bottom of its orbit on account of the centrifugal force which is then added to the natural weight of the water. At the top of its orbit the internal pressure becomes zero because the weight of the water is just balanced by the centrifugal force of the rotating liquid. With an increased internal pressure at the bottom of the orbit the buoyancy of the liquid will increase and make the hydrometer float higher whereas at the top of its path the decreased internal pressure will allow the hydrometer to sink indefinitely into the liquid.

THE BALLOON PROBLEM

A balloon will rise provided its own weight, including that of its contents, is less than the weight of the air which it displaces. If the speed of the earth's rotation should increase, the centrifugal action would decrease the weight of the atmosphere and hence the buoyant force on the balloon. Thus the lifting power would be decreased everywhere except, of course, at the poles. If the earth should rotate about seventeen times as fast as at present, the weight of the atmosphere would become zero and hence the buoyant force would also be zero. It would then be an easy matter to project even very massive objects from the earth, but the buoyancy of the atmosphere would not cause any object to rise.

THE SWINGS

If one of the boys should set his swing in motion he would by that action produce a centrifugal force on his swing which would gradually raise his comrade up. The motion would be somewhat jerky because the maximum pull would be exerted when the swing was passing the lowest point in its arc, that is when it was moving the fastest.

THE SLIPPING LADDER

Consider the ladder as a lever system with its pivot at point A on the ground. As the man ascends the ladder the moment due to his weight ($W \times AB$) increases and this increases the tendency for the ladder to turn about the pivot A. This means the nearer the man is to the top of the ladder the harder the ladder will push against the wall and the greater will be its thrust horizontally against the ground.

VELOCITY OF LIGHT AND THE LENGTH OF THE DAY

Since it takes a little over eight minutes for the light from the sun to reach the earth, we can see that the light which we see at any moment must have started from the sun some eight minutes ago. The apparent direction in which the sun lies is the direction which it had about eight minutes ago. At sunrise we see the sun eight minutes after it was actually on our horizon, while at sunset we see it for eight minutes after it has actually set. Thus the day begins eight minutes later and ends eight minutes later than it would if light had an infinite velocity.

THE BATTERY AND THE VOLTMETER

The voltage across a storage battery while on charge is exactly the E.M.F. of the battery plus the fall of potential due to internal resistance. This fall of potential is equal to

(Continued on page 448)

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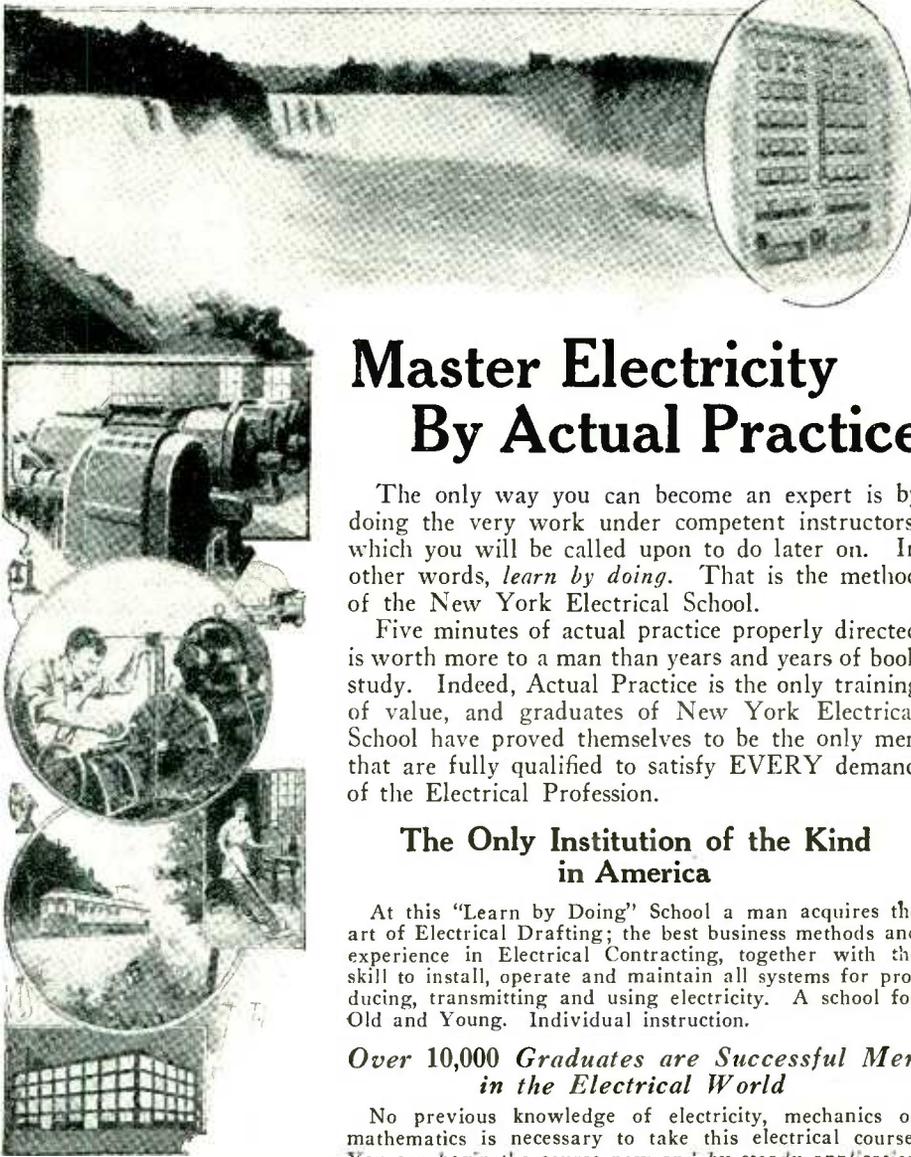
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Answers to Scientific Problems

(Continued from page 446)

the product of the charging current and internal resistance. If for example, a battery had an E.M.F. of 6 volts and no internal resistance a voltmeter connected to its terminals would read just 6 volts no matter what current were used to charge the battery. In a good storage battery the resistance is not zero but is so slight that the product of the charging current times this resistance is negligible in comparison with the E.M.F. of the battery itself. Hence the reading of a voltmeter connected to such a battery on charge remains practically equal to the voltage of the battery regardless of the voltage of the charging circuit. Certainly it would be a pretty poor six-volt battery if its resistance were so great that a 0 — 7-volt voltmeter could not be used with it.

CHANGE OF WEIGHT

As a person descends a mine his weight is reduced by the attraction for his body of that portion of the earth which lies above him. If he continued down to the center of the earth his weight would, of course, become zero since the gravitative pull of the earth would be equal in all directions.

THE POLE-SWING PROBLEM

The child that is farthest from the ground will not only move with greater speed in the circular orbit which he describes around the pole, but he will also make a complete trip around the pole in shorter time. This comes from the fact that it takes a higher circular velocity to give the child sufficient centrifugal force to carry him farther out and higher up in his orbit. If the children were at the same distance above the ground they would be moving around the pole in the same time although the child on the longer rope would be moving more rapidly with respect to the ground.

CORRECTION NOTICE

In the "Experimental Electrics" Department in the July issue in the "Puzzle Lamp Circuit," by W. B. Taylor, four four-way switches should be employed, instead of four three-way switches.

RUN CARS WITH ACETYLENE

The Automobile Club of France announced recently that the tests for the substitution of acetylene for gasoline in automobile motors have given complete satisfaction.

An enthusiastic report states that the economy amounts to about 50 per cent., with no increase in the consumption of lubricants and no bad effects on the valves, cylinders or pistons.

Why Wear Glasses? Thousands Are Throwing Them Away

Upon startling revolutionary facts has been based a remarkable new scientific system of eye-training, which quickly enables you to train the muscles of the eye so you can make them work properly at all times, and without effort or strain. This new system has been prepared by Bernarr Macfadden, in collaboration with the eminent ophthalmologist who discovered the real truth about eyes.

Remarkable tests were made in the N. Y. City Public Schools from 1903 to 1911. 2,000 children who had defective eyesight were instructed in a few of the simple exercises and in a short time their vision was radically improved. In one school, several children who had been compelled to wear glasses were enabled to discard them altogether.

No claim is made that this course is a cure-all.

In many cases glasses are essential. But if you are wearing glasses because of faulty refraction—far or near sightedness—astigmatism—cross eyes—squint eyes—weak, watering eyes—eye headaches or strain—you owe it to yourself to try this course without delay.

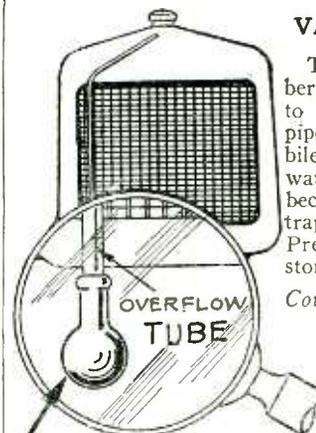
Cross section drawings show plainly the whole mechanism of the eye—muscles and nerves. Photographs of defective eyes make clear the real reasons for poor sight. Your own trouble is clearly illustrated. With this knowledge in mind, it becomes easy for you to correct your defective muscles and gain strong sight.

We are willing to send the entire course on approval giving you the privilege of returning it within five days after receipt if not satisfactory. The price of the course is only \$3.00, plus delivery charges.

MACFADDEN PUBLICATIONS, Inc.,

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The small rubber bulb attached to the overflow pipe of an automobile radiator saves water and alcohol because it forms a trap for the vapor. Pressure does not store up.

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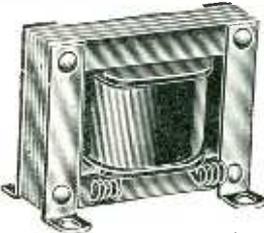
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RASCO "B" BATTERY ELIMINATOR SUPPLIES

SEND FOR FREE BOOKLET: "HOW TO BUILD AN EFFICIENT "B" ELIMINATOR"

CHOKES

\$1.55
POSTPAID



This excellent choke, especially manufactured for "B" battery eliminators, and used in the standard eliminators, has about 40-millihenry capacity, (10,000 turns of No. 32 wire) and is warranted to do the work right. Will not heat or burn out under normal load.

No. S4002, Choke\$1.55

RASCO FILTER BLOCK

\$3.65
POSTPAID



This is the high capacity 500-volt tested condenser system used in the standard "B" Battery Eliminators. Contains 4 condensers, all in one housing, as follows: 4 mfd., 2-mfd., 1/2-mfd., 1/2-mfd., total 7 1/2-mfd. Complete as illustrated, with 5 terminals; in enameled tin shell.

No. S4001 Block\$3.65

RECTIFIER CELLS

\$0.60
POSTPAID



These rectifier cells, of which four must be used for the complete full-wave rectification, are standard with us, having been specially designed for "B" eliminator work. These 4-oz. jars, with acid- and heat-proof rubber screw covers, are furnished with two electrodes, namely pure aluminum and lead. A vent cap is also provided. The special connectors listed below should be used for connecting the cells together. Size 4 1/2" x 2 1/4".

No. S4003, Rectifier Cell (but no connectors nor salts) complete with cover and electrodes each \$0.60

HIGH CAPACITY CONDENSERS

\$0.60
POSTPAID



These are standard condensers and are of the best vacuum impregnated paraffin type. The insulation is specially-prepared paper, and the units are compressed hydraulically before they are sealed in their metal casings.

All of our condensers are tested for 500 volts breakdown; each condenser comes in an enameled black tin casing.

There are two metal terminals to which wires or bus bar can be readily soldered. We have developed these condensers especially for "B" eliminator work, and we believe our prices are the lowest in the country.

Try connecting a number of these condensers together. You can make any capacity "Filter Block" for any style "B" or "A" eliminator.

No. S4007, 4-Mf. Condenser, each	.....\$2.00
No. S4008, 3-Mf. Condenser, each	.....1.65
No. S4009, 2-Mf. Condenser, each	.....1.30
No. S4010, 1-Mf. Condenser, each	.....0.75
No. S4011, 1/2-Mf. Condenser, each	.....0.60
No. S4012, 1/4-Mf. Condenser, each	.....0.50

RESISTANCES

\$0.50
POSTPAID



These resistances are standard for eliminators and will carry about half a Watt on continuous load. Glass enclosed, cartridge type. Two of these must be used in standard eliminators. The resistance is 10,000 Ohms per unit. Resistances come complete with two spring clip mountings.

No. S4005, "B" Eliminator Resistance, 10,000 Ohms Each. \$0.50

CONNECTORS

\$0.25
POSTPAID



These special connectors are used in order to connect four of the rectifier cells together. Set of 4 special connectors sold as one unit. These connectors snap over the round electrodes, giving it positive binding contact at all times that stays put. No loose connection possible. Illustration shows how connector clamps over 1/4" rod. Center Hole is used for screw and nut binding post. Made for 1/4" rod only.

No. S4004, Set of 4 electrode connectors\$0.25

RECTIFIER SALTS

\$0.20 POSTPAID

Only long experience can produce the correct "B" eliminator rectifier salts. Borax and similar salts "creep" over the electrodes and usually short circuit them. Our patent salt combination is guaranteed to keep electrodes clean and will not "creep." Sold only in units for our No. 4003 rectifier cell. One filling charges one cell.

No. S4006, Rectifier Salts, per box (one complete charge) each \$0.20

ELECTRODES

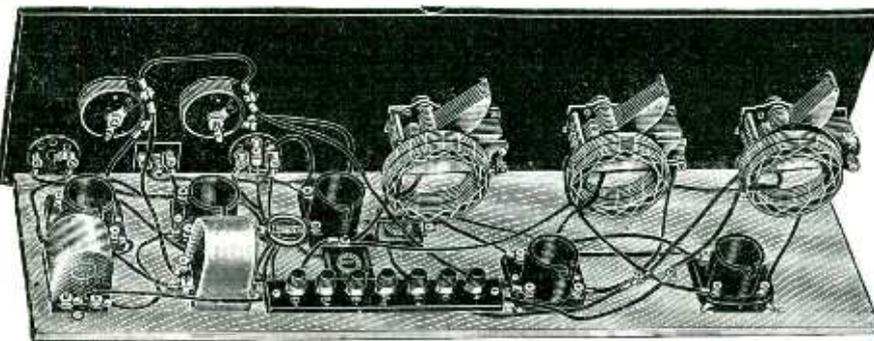
For those who wish to make their own rectifiers, we supply electrodes. The success or failure of a rectifier lies in the purity of the aluminum used. We use only 99.5 per cent pure Aluminum in connection with our rectifiers.

The small electrodes measure 3/4" long by 1/4" diameter. The large electrodes are 5" long by 1/2" diameter, and are equipped with one threaded end and square composition nuts. The large electrodes are intended for pint jars.

No. S4015, Small Aluminum Electrode	.....\$0.10
No. S4016, Small Lead Electrode	.....0.08
No. S4017, Large Aluminum Electrode0.35
No. S4018, Large Lead Electrode0.30

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S9216A

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Connections Always Perfect

PARTS INCLUDED IN THIS RECEIVER

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Panel, drilled and engraved, Bakelite-Dilecto, 7x263.50	Fixed grid condenser and mounting, Micamold 9002535
Baseboard, laminated	......40	Grid leak, 2 megohm, Patent	......32
Coils, tuned transformers, our No. 2029	.....1.05	Fixed condenser, .002 mfd Micamold	......31
3 Variable condensers, .00033 Capacigrad @ \$1.70	.....5.10	Fixed condenser, .005 Micamold	......41
3 1-Inch Pilot Dials	......75	Binding post strip, Rasco (with binding posts)	......35
2 Transformers, audio frequency, Patent @ \$3.75	.....7.50	No-Sod-er connecting wires, full set	.....1.75
2 Rheostats, 20-ohm, Pilot	......92	Necessary hardware, screws, angles, etc.	......25
Snockets, low loss, Bakelite, Pilot @ 25c	.....1.25	Blueprint and instruction sheet	.....1.00
Jack, single circuit improved	......40		
Jack, double circuit improved	......70		
		Total Price of Set.....	\$32.24
		Our price, Catalog No. S9216.....	\$22.95
		No. S9210A, same kit, but without cabinet.....	\$17.95

BIGGEST VALUE IN AMERICA

If you wish the finest 5-tube set to be had, you have it in this model. No better set made in popular-priced receivers. Low cost compared with results obtained.

This is not a small set thrown together with questionable parts that no one knows and made only to sell. All our parts are listed by name and are standard merchandise—nothing else.

This is a BIG SET, measuring 7 x 26 inches, and there is no one in the country today who can compete with us in this particular outfit.

Note particularly that the condensers which we use are brass plate condensers of the new straightline frequency type, not obsolete straight wave-length type, which are so hard to tune on the lower waves.

NEW ADJUSTABLE COILS (Patents Pending)

In this set we use adjustable coils, which can be moved up and down, away from the condenser, until the right balance is found. This makes for an unheard of and really incredible degree of sensitivity which has not been realized heretofore in sets of this kind.

Note also that the panel comes to you all drilled, with all holes drilled in position, and that any child can put together this wonderful receiver in less than an hour.

This set is highly efficient for bringing in the greatly-desired long range reception. 3,000 miles has been covered repeatedly. This has been accomplished by using two stages of tuned radio frequency with detector and two stages of audio frequency.

The tuning is done by three large dials; the first dial controls the antenna tuning, the center dial the first radio transformer, and the last dial the second radio transformer.

Make Big Money by assembling and selling them complete to friends and business houses who need a First Class Radio. Many of our customers sell these completed sets from \$30.00 upwards.

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Sharpens
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AUTOSTROP SAFETY RAZOR CO., 656 First Avenue, New York City

Microscopic Engraving

By R. P. TOLMAN

(Continued from page 404)

be easily engraved in one square inch; there are 3,566,480 letters in the Bible. If you will solve this problem in division, you will find that the entire Bible could be engraved more than 49 times in one square inch. Fig. 4 represents a square inch divided into 49 equal parts, and the entire Bible could be engraved in any one of them. Engravings smaller than this have been made.

HOW MICRO-PHOTOGRAPHS ARE MADE

This kind of work is done, not by hand, but with the aid of a micro-pantograph. The first machine of this character was invented and used by W. Peters, a London banker, in 1852. The machine to make the micro- engravings shown was constructed after the Peters machine, with improvements by Mr. McEwen and by Rev. J. G. Crawford of Saunderstown, R. I.

Whatever is to be engraved is written with the pencil (a) the movement, in its greatly reduced form, is carried to the top of the machine, to the diamond point (b), but before the operator starts to write, he holds down the key (c) which is connected with a lever at the top, this brings the cover glass (d), on which the engraving is to be made, in contact with the diamond point, so that every movement of the pencil is cut in the glass, at whatever scale the machine may be set. Between each word, the crossing of a "t" or the dotting of an "i", or for punctuation marks, the pressure on the key is released, but when engraving is wanted the key is pressed.

Now just what is this diamond point and how is it prepared?

The usual reply has been, "it's a secret," but as a matter of fact, nature in fashioning the diamond has taken care of the entire work and at intervals along the planes of cleavage, ultimate crystals, as Rogers called them or, exquisite gravers for these fine lines may be found, and when carefully handled, they may be used for years. Their exact location and adjustment for this miniature engraving, however, is somewhat of a secret and for some time to come must remain an irksome series of patient trials, for I know of no royal road to finding and adjusting a crystal suitable for work of this character.

The letter first described in lead pencil was made 4 by 7 inches in size. The lead pencil letter contains 28 square inches, this was reduced to 1/11,250 of a square inch and then the reduction was enlarged by photography to about seven square inches, and yet they are alike as can be.

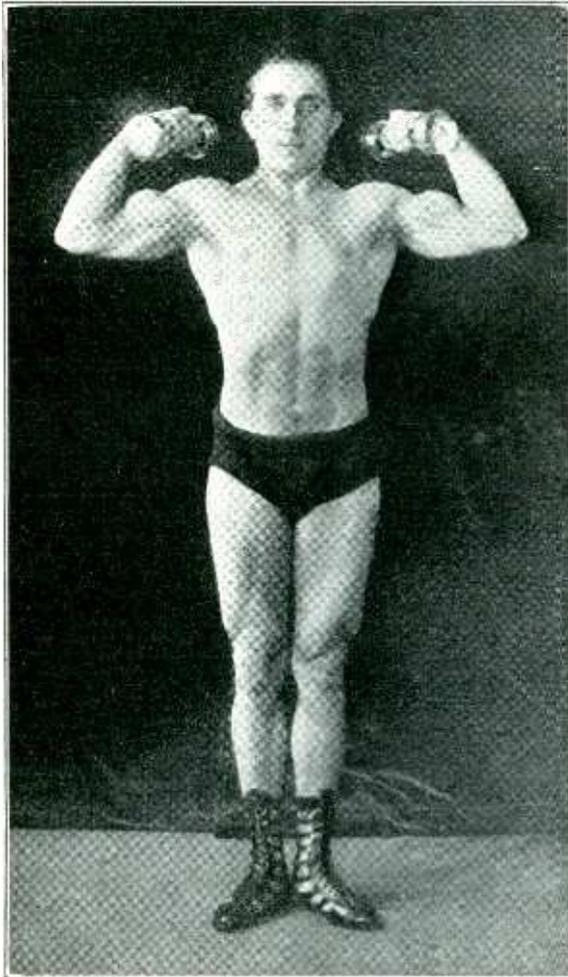
When you consider what this micro-pantograph will do, you marvel more and more that any human being could make a machine, which apparently has no lost motion, that can duplicate the movement of a pencil on so small a scale that the eye cannot see it and yet when enlarged it is identical. The machine itself is as wonderful as the work it does.

Fifty to sixty years ago micro- engravings were quite common, but at the present time they are very rare. The early workers were W. Peters, William Webb and R. J. Farrants. Mr. Alfred McEwen of New York City is the only worker today.

About the only use devised for these small engravings would be the sending of secret messages in time of war. They could be engraved on a stick pin, a collar button, eye-glasses or many other things and it would be impossible for anybody to detect them except the person who knew where and how to look for the messages.

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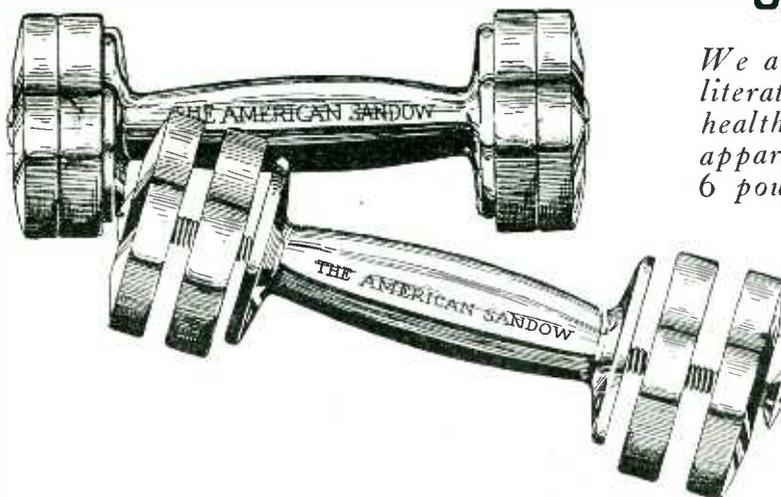
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Patent Advice

Edited By
Joseph H. Kraus

In this Department we publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain patent phases. Regular inquiries addressed to "Patent Advice" cannot be answered by mail free of charge. Such inquiries are published here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge all details, in order to protect the inventor as far as it is possible to do so.

Should advice be desired by mail a nominal charge of \$1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

NOTE:—Before mailing your letter to this department, see to it that your name and address are upon the letter and envelope as well. Many letters are returned to us because either the name of the inquirer or his address is incorrectly given.

RESILIENT WHEEL

(956) Q. I. J. Floyd Miller, Cincinnati, Ohio, has obtained a patent upon a type of resilient wheel and asks our opinion as to its marketability.

A. 1. There have been many resilient wheels for automobiles and other vehicles patented and brought to our attention within the past year. Most of them are not practical. The buying public does not seem to take to a device of this nature because most of the resilient wheels so far offered are clumsy and weird in appearance as well as inefficient in operation. We do not believe that there is much of a field for a wheel of this nature until something is produced that will stand up under hard usage and that will present an appearance equal to or better than that of the present day wooden spoke or metal disk wheel.

PATENT APPLIED FOR

(957) Jerry G. Cormicke, Corapolis, Penna., says that he has applied for a patent and wants to know in what way he is protected. He also wants to know how long it will take to get his patent issued.

A. The mere fact that you have applied for a patent does not allow you any protection in the eyes of the law and the patent application is of no value, except in so far as it may be a means of establishing a claim of priority, which of course, necessitates court litigation. The length of time for the issuance of a patent depends on the particular department to which the action is assigned. Most of the departments have quite a few ideas on hand which demand prior action. The nature of the claims also affect the time of issuance.

R. R. CROSSING GATE

(958) Lloyd T. Deibert, Leighton, Penna., writes that he has been working on a railroad crossing gate for a long time and asks us how he can dispose of his idea.

A. It seems almost impossible to induce railroads to install automatic crossing gates. Furthermore, these devices are usually inoperative under certain weather conditions and therefore not infallible. The only way in which you can proceed with your device is to take up the subject with various railroad companies and explain the advantage of your device. There is a possibility that they might be willing to view a working model and comment thereupon. Further than that, there is nothing that you can do with a device of this nature. Of course, you can apply for a patent and undoubtedly obtain one, but such a procedure would be costly and undoubtedly the patent would be of no value after it was issued.

RADIO ANTENNA PLUG

(959) Gilbert Doty, Detroit, Michigan has designed an antenna plug which is to enable the use of house wiring as an antenna for a radio set.

A. The system you described in your letter of recent date has been published in various past issues of different radio periodicals. Owing to this fact, it will be quite impossible for you to patent your system and we would not advise you to proceed further with it.

ELECTRICAL TIRE GAUGE

(960) Hal. Frederichsen, Los Angeles, California has designed an electrical air pressure tire gauge to be placed on the dashboard of a car and requests our opinion of same.

A. There are many reasons why we do not believe that your proposed type of electrical pressure gauge for tires would be at all advisable for general use. In the first place, it would undoubtedly be extremely complicated in construction and would be subject to many troubles that would naturally follow. Without any further description of the device we would certainly not advise you to proceed with attempting to patent it as we do not believe such a patent would be worthwhile. If, however, you wish us to comment specifically upon it, it will be necessary for you to submit details showing how the device operates. Unless it is something radically new and entirely different from any other devices which have been designed to accomplish the same purpose, we would not advise you to even bother to submit details.

COMBINATION RULER AND BLOTTER

(961) J. J. Bermida, Jersey City, N. J., asks us whether we think a combination ruler and blotter would be a good idea.

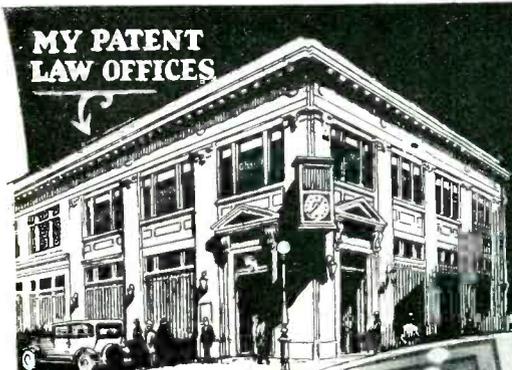
A. We noted the plans and specifications for your proposed combination blotter and ruler and would advise that the idea is essentially very old. In a contest which was conducted by this magazine many months ago, several designs of a similar nature were entered. This contest was for collecting together designs for combinations of various useful appliance and the idea occurred to many that a blotter and ruler combined would be useful. In view of the fact that so many prior claims to a combination of this type exist, we do not believe that it would be practical for you to proceed with your particular type and would not advise you to proceed towards attempting to obtain a patent upon it.

ELECTROLYTIC AUTO

(962) G. A. Edelman, Manhattan Beach, N. Y. asks if a system for operating an automobile consisting of electrolyzing water, mixing the gases, exploding them in a combustion engine and using the force to drive a generator and the auto, would be of value.

A. We would advise that your system is not practicable and cannot be made to operate with any degree of economy. An attempt was made some twelve years ago by an inventor in Ohio to construct an automobile identical with the principle illustrated in your drawing and specifications. His automobile was to run by the explosion of oxygen and hydrogen gas; the water formed by the explosion was to be returned to the storage tank and the running motor was to furnish the power for not only running the automobile, but also charging up the storage batteries, which latter supplied the current for the electrolysis of water. The amount of energy required to decompose water is so great that it will be necessary to install a whole group of storage batteries in the car and charge them up every day before an attempt is made to run the car for that day. The system will not replenish itself. It cannot be made to develop perpetual motion, which is what the device would do were it to operate as described. This inventor of the water automobile sold stock in his company and then absconded with nearly all the money entered into the firm. His associates were still working upon the idea when we last heard from them.

We would advise that you forget the system entirely as it is apparently impractical.



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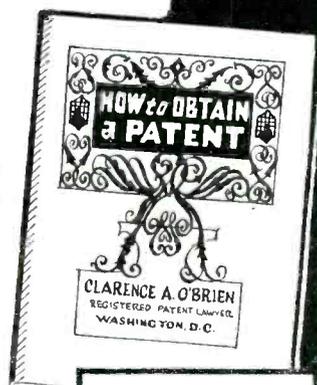
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Into the Fourth Dimension

By RAY CUMMINGS

(Continued from page 419)

In late July the thing took another turn. A new era began—a sinister era which showed the necessity for something more than all this aimless talk. Four men were walking one night along a quiet country road near a small English village. They were men of maturity, reputable, sober, middle-aged citizens. Upon the road level they observed the spectres of four or five male figures, which instead of remaining motionless rushed forward to the attack. These ghosts were ponderable! The men distinctly felt them; a vague feeling, indescribable, perhaps as though something soft had brushed them. The fight, if such it could be called, amounted to nothing. The men flailed their arms in sudden fear; and the apparitions sped away. Greenish, more solid-looking than those heretofore seen.

This was more than mere visibility—an actual encounter. These four men were of the type who could be believed. The report was reliable. And the next night, in a Kansas farm-house, the farmer and his wife were awakened by the scream of their adolescent daughter. They rushed into her bedroom. She was in bed, and bending over her was the apparition of a man. Its fingers were holding a lock of the girl's long black hair. At the farmer's shout, the ghost turned; its hand was raised—and the farmer and his wife both saw that the shadowy fingers had lifted the girl's tresses which they were clutching. Then it dropped them and moved away, not through the walls of the room, but out through the open window.

The girl was dead. She had suffered from heart trouble; was dead of fright, undoubtedly. It was the beginning of the era of menace. And that next afternoon Wilton Grant telephoned me. His voice had a strange tenseness to it, though it was grave and melodious as always.

"Come out and see us this evening, will you Rob?"

"Why yes," I said. I had not seen them for over a month—an estrangement which I had not understood and which hurt me terribly, had fallen between us. "Of course I will," I added. "How's Bec?"

"She's been quite ill . . . No, not dangerous, she's better now. Don't fail us, Rob.



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About eight o'clock? . . . That's fine. We—I need you. You've been a mighty good friend, letting us treat you the way we have—"

He hung up. With an ominous sense of danger hanging over me, I went out to see them at the hour he had named.

CHAPTER II

Groping at the Unknown

Wilton Grant was at that time just under forty. He was a tall spare man of muscular build, lean but powerful. His smooth-shaven face was large-featured, rough-hewn, with a shock of brown hair above it—hair turning grey at the temples. Beneath heavy brows his grey eyes were deep-set, somber. His ruddy-brown complexion, the obvious strength of his frame at a quick glance gave him an out-of-doors look; a woodsman cast in the mould of a gentleman. Yet there was something poetic about him as well; that wavy, unruly hair, the brooding quality of his eyes. When he spoke, those eyes frequently twinkled with the good-nature characteristic of him. But in repose, the somberness was there unmistakable; an unvoiced, brooding melancholy.

**Articles in Radio News
for September**

Television, an Accomplished Fact, by A. Dinsdale.

Audio Amplification For the Beginner, by A. P. Peck.

Radio-Operated Furnace Melts Precious Metals, by S. R. Winters.

Alleviation of Static, by L. W. Hatry.

Newest Discoveries In the Range of Ultra-Shortest Waves, by Prof. Boris Weinberg.

Overloading the Audio Amplifier, by Sylvan Harris.

A New Idea In Set Construction, by Joseph Riley.

Yet there was nothing morbid about Wilton Grant. A wholesomeness, mental and physical, radiated from him. He was a jolly companion, a man of intellectuality and culture. His deep voice had a pleasing resonance suggestive of the public speaker. Normally rather silent, chary of speech, he could upon occasion draw fluently from a vocabulary of which many an orator would be proud.

He was a bachelor. I often wondered why, for he seemed of a type that would be immensely attractive to women. He did not avoid them; the pose of a woman-hater would have been abhorrent to him. Yet no woman to my knowledge had ever interested him, even mildly. Except his sister. They were orphans and she was his constant companion. They were both in fact, rather chary of friends; absorbed in their work, in which she took an active part. Their home and laboratory was an unpretentious frame cottage in a Westchester village of suburban New York. They lived quietly, modestly, with only one automobile, and no 'plane.

Will opened the door for me himself, smiling as he extended his big, hearty hand. "Well! You came, Rob? You're very forgiving—that's the mark of a true friend." He led me into the old-fashioned sitting room. "I'm not going to apologize—"

"Don't." I said. "I knew of course you had some reason—"

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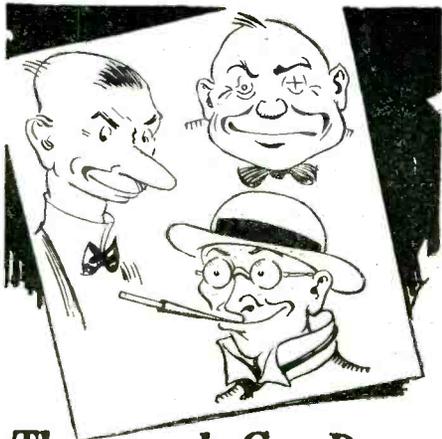
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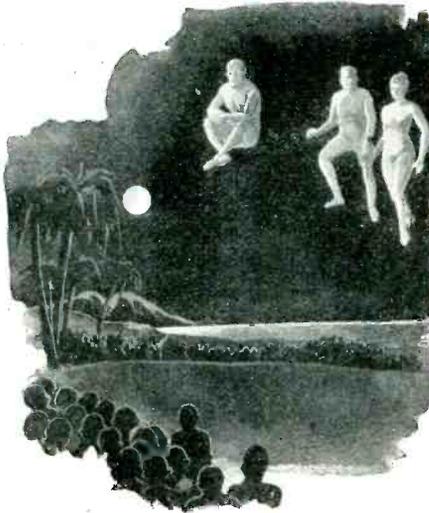
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"Then, early in March, the second ghost was reported. In the Eastern Hemisphere this time. It was discovered in midair, near the Boro Badue, in Java. Thousands of people watched it for over an hour that evening. It was the figure of a man, seated on something invisible in the air nearly a hundred feet above ground. It sat motionless as though contemplating the crowd of watchers beneath it. And then it was joined by other figures! Another man, and a woman."

We were seated. He said with a nod, "Yes. A reason—you'll hear it now—tonight—"

His voice trailed away. It made my heart beat faster. He had changed. I saw him suddenly older.

"Where's Bee?" I asked out of the silence.

He jerked himself back from his reverie. "Upstairs. She'll be down in a moment. She's been ill, Rob."

"But you said not seriously."
"No. She's better now. It's been largely mental—she's been frightened, Rob. A terrible strain—that's why I thought it better for us to isolate ourselves for a while—"

"Oh, then that's why—"
He was deprecating, apologetic. "That's why I wrote you so peremptorily not to come to see us any more. I was upset myself, I needn't have been so crude—"

"Please don't apologize, Will. I—I didn't understand, but—"

"I'm not. I'm just telling you. But now Bee thought we should have you with us. Our best friend, you understand? And it will make things easier for her—naturally she's frightened—"

My hand went to his arm. What I had meant to say I do not know, for Bee at that moment entered the room. A girl of twenty-four. Tall, slim and graceful. Her long chestnut hair, which usually she wore in the prevailing mode coiled upon her head, now hung in braids. She was a beautiful girl.

She was dressed now in a clinging negligee which seemed to accentuate the slim grace of her. But the marks of illness were plain upon her face; a pallor; her eyes, though they smiled at me with the smile of greeting upon her lips, had the light of fear in them; her hand as I took it was chill, and its fingers felt thin and wan.

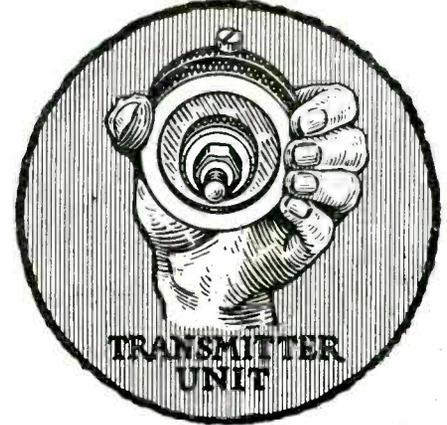
"Bee!"

"It's good to see you, Rob. Will has been apologizing for us, I suppose—"

These friends of mine calling me to them in their hour of need. I had been annoyed, hurt; I had not realized how deep was my affection for them . . . for Bee . . . Vaguely I wondered now if their trouble—this fear that lay so obviously upon them both—concerned the coming of the ghosts.

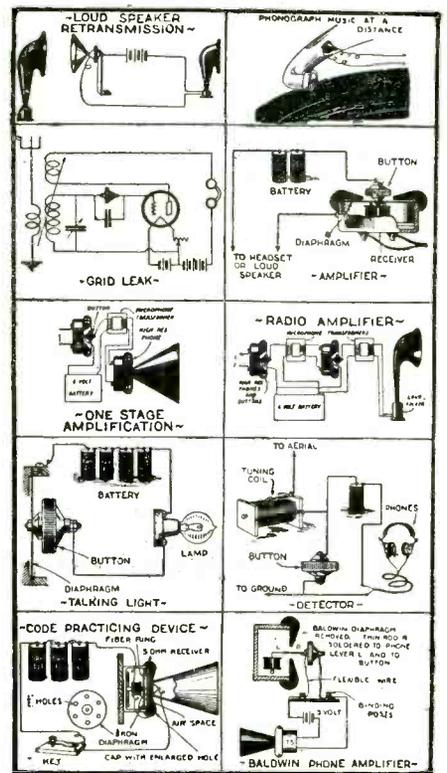
Bee sat close beside me, as though by my nearness she felt a measure of protection.

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Will faced us. For a moment he was silent. Then he began, "I have a good deal to say, Rob—I want to be brief—"

I interrupted impulsively, "Just tell me this. It is—does it, this thing whatever it is—does it concern the ghosts?"

I was aware of a shudder that ran over Bee. Will did not move. "Yes," he said. "It does. And these ghosts have changed. We knew they would—we've been expecting it."

"That poor girl," Bee said softly. "Dead—dead in her bed of fright. You read about it, Rob?"

"A menace," Will went on. "The world is just realizing it now. Ghosts, changing from shadow to substance—" He stopped, then added abruptly, "We've never told you much about our work—our business—have we? Reticent, peculiar friends—"

They had in truth always been reticent. I had never been in their laboratory. They were engaged I understood, chiefly with soil analysis; sometimes people would come out to consult them. Beyond such a meager idea I knew nothing about it.

Will said abruptly, "Our real work we have never told anyone. It concerns—well, a research into realms of chemistry and physics unknown. I have been delving into it for nearly ten years, and then Bee grew old enough to help me. We've made progress—" His smile was very queer. "Tonight—I'm ready to show you something that I can do."

They seemed to torture Bee, these words of her brother's. I heard the sharp intake of her breath, saw her white fingers locked tensely in her lap.

"Not—not tonight, Will."

"Tonight—as good a night as any other . . . Rob, would it surprise you to know we anticipated the coming of the ghosts years ago? Not that they would come, but the possibility of it. Ghosts! What do you think they are, Rob?"

"Why ghosts—ghosts are—"

"Spirits of the dead made visible?" His manner was suddenly vehement; his tone contemptuous. "Earth-bound spirits! Astral bodies housing souls whose human bodies are in their graves! Rubbish! These are not that sort of ghosts."

I stammered, "But then—what are they?"

"Call them ghosts, the word is as good as any other." His voice grew calmer; he went on earnestly, "I want you to understand me—it's necessary—and yet I must not be too technical with you, too abstruse. Let me ask you this—you'll see in a moment that none of this is irrelevant. How many dimensions has a point?"

At my puzzled look he smiled. "I'd better not question you, Rob, but you won't find me hard to understand. A point—an infinitesi-



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mal point in space—has no dimension. It has only *location*. That's clear, isn't it? A line has one dimension—length. A plane surface has length and breadth; a cube, length, breadth and thickness. The world of the cube, Rob, is the world we think we live in—the world of three dimensions. You've heard of that intangible something they call the fourth dimension? We think it does not concern us—but it does. We ourselves have four dimensions. *We are the world of the fourth dimension.* But the fourth is not so readily understood as the other three."

He paused for an instant, then added, "The fourth dimension is time, Rob. Not a new conception to scientists—think a moment—how would you define time?"

"Time," I said, "Well, I read somewhere that time is what keeps everything from happening at once."

He did not smile. "Quite so. It is something in the universe of our consciousness along which we progress in measured rate from birth to death—from the beginning to the end."

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Bee murmured, "And beyond death there is no time."

He ignored her. "We are living in a four-dimensional world—a world of length, breadth, thickness and time. The first three, to our human perceptions, have always been linked together. Time—I do not know why—seems to our minds something essentially different. Yet it is not. Our universe is a blending of all four.

"Let me give you an example. That book there on the table—it exists because it has length, breadth and thickness. But Rob, it also has *duration*. It is matter, persisting both in space and in time. You see how the element time, is involved? I'll go further. We know that two material bodies cannot occupy the same space *at the same time*. With three of the dimensions only—that is, if theoretically we remove the identical time-factor—they do *not* conflict. You're confused, Rob?"

"I'm not quite sure what you're aiming at," I said.

"You'll understand in a moment. Matter, as we know it, is merely a question of vibration. It is, isn't it?"

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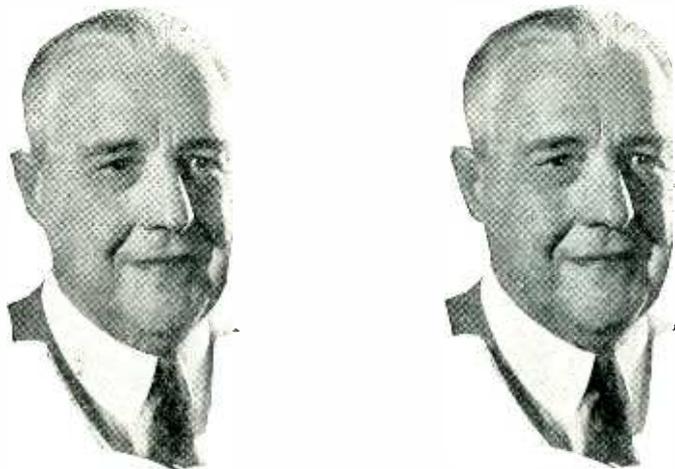
"I know light is vibration," I responded. "And sound. And heat, and—"

He interrupted me. "The very essence of matter is vibration. Do you know of what matter is composed? What is the fundamental substance? Let us see. First, we find matter is composed only of molecules. They are substances, vibrating in space. But of what are molecules composed? Atoms, vibrating in space. Atoms are substance. Of what are they composed?"

"Electrons?" I said dubiously.

"Protons and rings of electrons. Let us cling to substance, Rob. These electrons are merely negative, disembodied electricity—not matter, but mere vibration. They—these electrons—revolve around a central, positive nucleus. This then, is all the substance that matter has. But when you penetrate this inner nucleus, what do you find? Substance? Not at all. This proton, as they sometimes term it, this last inner stronghold of substance, is itself a mere vortex—a whirlpool in space!"

I groped at the thought. Matter, substance, everything tangible in my whole conscious universe, robbed of its entity, re-



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The editors know that if they receive these letters, there are thousands of others in this country who get similar letters and who fall for the claims made in the numerous prospectuses giving the earning capacities of the various machines.

Most of the shares of stock for these perpetual motion machines are being sold at a rate of \$1.00 per share, although some inventors are trying to sell shares of stock at \$100.00 per share.

Therefore the editors of this publication say, "Just come in and show us—merely SHOW us—a working model of a perpetual motion machine and we will give you \$5,000.00. But the machine must not be made to operate by tides, winds, waterpower, natural evaporation or humidity. It must be perpetual motion."

duced to mere vibration in empty space. Vibration of what? I knew that there was no human mind to give the answer.

"It's appalling, Rob, the unreality of everything. Metaphysicians say that nothing exists save in the perception of it by our human senses. . . I was talking of the dimension, time. It is the indispensable factor of vibration. That's obvious. Motion is nothing but the simultaneous change of matter in space and time. You see how blended all the factors are? You cannot deal with one without the others. And mark you this, Rob—you can subdivide matter until it becomes a mere vortex in empty space. Can you wonder then—"

I had noticed Bee gazing intently across the room. "Will!" she said suddenly; her voice was hardly more than a whisper of repulsion. "It's there now, Will!"

The room was brightly illumined by a cluster of globes near the ceiling. Will left his seat, calmly, unhurried, and switched them off. There was only the small table electrolifer left lighted. It cast a yellow circle of light downward; most of the room was in shadow. And over in a corner I



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saw the glowing apparition of a recumbent man no more than ten feet from us.

Will said, "Come here, Rob—let me show you this." His voice was grave and unburied. As I crossed the room hesitatingly, Bee was with me, forcing herself to calmness. She said, "It's here most of the time. Watching us! It seems to be on guard—watching—always—"

Will drew me beside him. Together we stood within a foot of the spectre. It took my courage, but after a moment the gruesome element seemed to leave me for Will stood as though the thing were a museum specimen, explaining it.

I saw, so far as I can put the sight into words, the vibrating white shape of a man reclining on one elbow. It was slightly below the level of the floor, most of it within or behind the floor, the outlines of which were plainer than the apparition mingled with them. The head and shoulders were raised about to the level of our ankles.

A man? I could not call it that. Yet there was a face which after a moment I could have sworn was human-featured; I could almost think I saw its eyes, staring at me intently.

Will stooped down and passed his hand slowly through the face. "You can feel nothing. It has visibility—that property only in common with us. Try it."

I forced my hand down to the thing, held it there. It was like putting one's fingers into a dim area of light.

"Is it—it is alive?" I asked.

"Alive?" Will's tone was grim. "That

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depends on what you mean by alive. It can reason, if that answers you."

"I mean—can it move?"

"It moves," said Bee. "It watches us—follows us—" She shuddered.

The details of the figure? I stepped back to see it better. It seemed now a man clothed in normal garments... a malevolent face, with eyes watching me... Was that face my imagination, or did I really see it?

I must have stammered my thoughts aloud, for Will said, "What we see, and what really exists, has puzzled metaphysicians for centuries. Who knows what this thing really looks like? You do not, nor do I. Our minds are capable of visualizing things only within the limits of an accustomed mould. You see that thing as a man of fairly human aspect, and so do I. The details are elusive; but stare at them for a day and your imagination will supply them all. That's what you do in infancy with the whole material world about you—mould it to fit our human perceptions. But what everything really looks like—what this thing here might appear in actuality to a mind omniscient—who can tell?"

"Can it—hear us?" I demanded.

"No—I do not think so. It can see us, no more. And it has no fear." With a belligerent gesture he added humorously, "Get up, you, or I'll wring your neck!"

"Will, don't joke like that!" Bee protested.

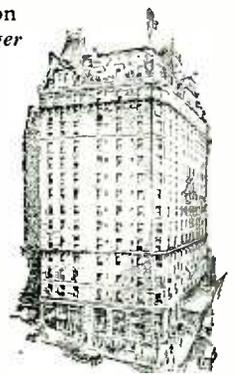
He turned away and switched on the main lights. I could still see the thing there, but now it was paler—wan like starlight before the coming dawn. Will turned his back on it and sat down. His face had gone solemn again.

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"These things are materializing, Rob. They have become a menace. That's why what I'm planning to do should be done at once. . . Bee! Will you please not interrupt me!" It was the first time I had ever heard his tone turn sharp with her, and I realized then the strain he was under. "Rob, listen to me. Science has given me the power to do what I'm planning, but we won't discuss that now. Call this anything you like. What I want you to know is—there is another realm about us into which—under given conditions—our consciousness can penetrate. Call it the Unknown. The realm of Unthought Things. A material world? I've shown you, Rob, that nothing is substance if you go to the inside of it."

Dimly I was groping at a hundred will-o'-the-wisps, my mind trembling upon the verge of his meaning, my imagination winging into distant caverns of unthought things that hid in the elusive dark. Could this be science?

He was saying, "My mind cannot fathom such another realm, nor can yours. You think of land, water, trees, houses, people. Those are only words for what we think we see and feel. But there are beings—sentient beings—in this other state of consciousness we can now be sure. For Rob, they are coming out! Don't you understand? They have already come into the borderland between the consciousness of their realm and ours."

He would not let me interrupt him. "Wait, Rob! Let us say their realm is inferior. Or they have a lust for adventure—or a lust for something else—they are coming out nevertheless. A menace to us—that girl in Kansas is dead." He swept his hand in gesture at the apparition behind him. "That thing is watching me. As Bee says, it is on guard here. Because, Rob, I found a way of transmuting my identity out of this conscious realm of ours into that same borderland where these things we call ghosts are roaming. And they know it—and so they're on guard—watching me."

He paused for the space of a breath. Bee, white-faced, tremulous, turned to me. "Don't let him do it, Rob!"

"I must," he declared vehemently. "Rob, that's why we needed you here—to wait here with Bee. I'm going in there tonight—into the shadows, the borderland, whatever it is. These—nameless things are striving to come out—but I'm going to turn them back if I can!"

(To be continued)

LEAD TETRAETHYL FOR AUTOMOBILES

It will be remembered that some weeks ago that much excitement was occasioned by the idea that tetra-lead-ethyl, which was recommended as an addition to gasoline for use in automobiles, was liable to occasion cases of lead poisoning. A most extensive investigation was made under the auspices of the United States Public Health Service and two hundred and fifty-two subjects were exposed to different conditions, some to the lead ethyl conditions, others to ordinary conditions in garages, and it was found that no harm whatever resulted from the proposed addition to the gasoline. Curiously enough, lead poisoning symptoms were detected in garages in which none of the compound was used. This was supposed to be due to the presence of lead in the dust of the shops. The investigation is so thorough and so well checked by comparative tests that there is no doubt that the alarm was absolutely needless, at least in degree. The committee believes that the investigation should be continued but the conclusion so far as evolved is substantially that stated above.



The Telephone and the Farm

THERE was not a farmer in the world fifty years ago who could talk even to his nearest neighbor by telephone. Not one who could telephone to the doctor in case of sickness or accident. Not one who could telephone for the weather report or call the city for the latest quotations on his crops. Not one who could sell what he raised or buy what he needed by telephone. A neighborly chat over the wire was an impossibility for the farmer's wife or children.

In this country the telephone has transformed the life of the farm.

It has banished the loneliness which in the past so discouraged

the rural population and drove many from the large and solitary areas of farms and ranches.

It is a farm hand who stays on the job and is ready to work twenty-four hours every day.

The telephone has become the farmer's watchman in times of emergency.

It outruns the fastest forest or prairie fires and warns of their approach. It has saved rural communities from untold loss of lives and property by giving ample notice of devastating floods. Three million telephones are now in service on the farms, ranches and plantations of the United States.

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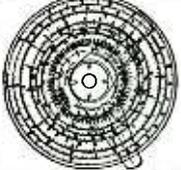


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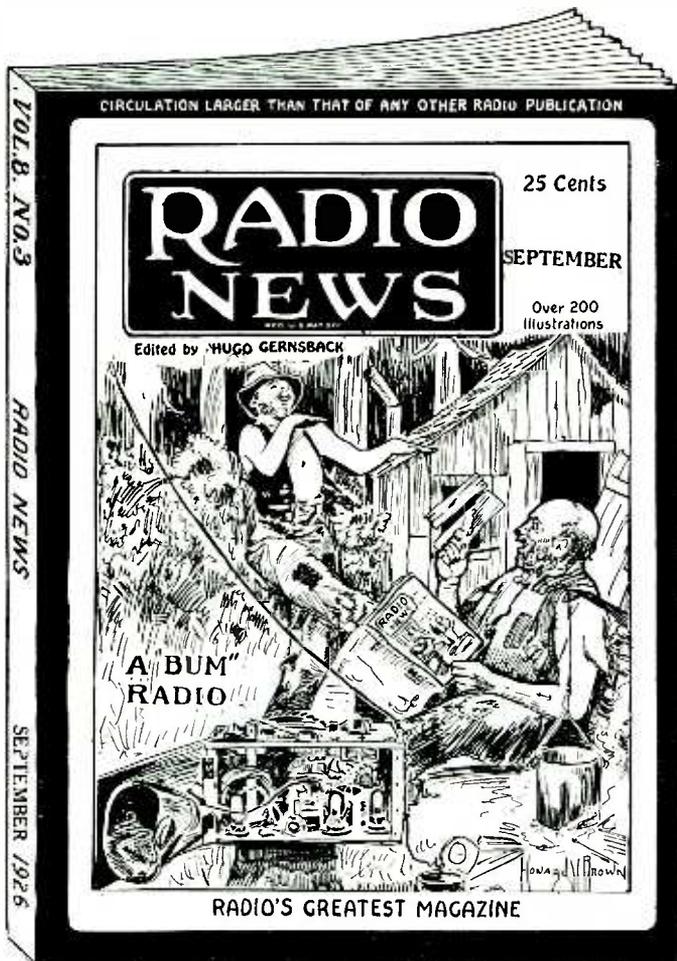
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WRNY Celebrates the First Birthday

By CHARLES D. ISAACSON
(Continued from page 436)

The Corporation Counsel of New York City, Arthur Hilly, poured forth some of his inimitable jokes. If you ever want a speaker to keep any crowd in stitches, engage Arthur Hilly.

I'm not going to attempt to repeat the list of folks who were there. But Dr. Miller, spokesman of the Protestant churches of the city; Dr. Goldstein of the orthodox synagogues; Dr. Landman of the Jewish Circle, and Dr. Reisner were the religious leaders. Arthur Guiterman, the literary, and Wolf Gilbert, the popular song leader, were also present.

And at 9 o'clock there came the demonstration of the Pianorad, the latest radio musical instrument, invented by Mr. Hugo Gernsback, Editor of RADIO NEWS. The Pianorad uses a keyboard like a piano, 25 vacuum tubes, and 25 loud speakers. The instrument gave beautiful flute-like tones that could be changed to the quality of an organ when desired. It is a development of the well-known Staccatone. It will be described in the October issue of RADIO NEWS.

THE EDISON MUSIC BOOK

The Edison Hour goes merrily along. Harry T. Burleigh, the negro singer, came back, and Beniamino Riccio, the operatic baritone, made his debut with the Edison Ensemble, while the Ukrainian Chorus gave a colorful program. Speaking of the Edison Hour reminds me to offer you their new wonderful book, "A World Tour of Music," which is very important, in that it tells you about the music of nine nations, their composers and important compositions, and is handsomely illustrated. Write me and I will see that you get a complimentary copy.

And talking of things complimentary, I am also empowered to offer a free pass to the wonderful amusement park, Starlight Park, to anyone who writes me here. To New York visitors this assures one solid evening's pleasure (bathing, opera, shoot the chutes, etc.) And one further offer: Madame Helena Rubinstein, famous beauty expert, who is now speaking over WRNY, is giving a free beauty reading to the ladies. Her fee is ordinarily a high one (she has been adviser to empresses, queens, leaders of society and the stage), but if you who read these words will write Madame Rubinstein, care of WRNY, and ask her for advice, she will be glad to help you.

NOVELTY PROGRAMS

I am particularly proud of the novelties, which have crowded WRNY's famous Friday night 10:15 hour. There was the epic of June Brides which apostrophised life, love and marriage. Then came the group which were transported from Hawaii and other points distant by Wally Gluck. Did you join us the night we had the "Campfire in the Woods," or did you travel to Czechoslovakia when we had a "Night in Prague?" The Czech Consul, Mr. Broz, was there to guide us on the last mentioned affair.

Far from the fields of novelties, came the heralded debate of Norman Thomas and Hugo Gernsback. The Socialist leader, former minister of the conservative Brick Presbyterian Church, a some-time candidate for the Governorship, attacked with sincerity the radio "interests." Mr. Gernsback defended, not the "interests," but the intentions of the radio industry and broadcast operators.

That was the night when Alice Brady appeared in the Edison prize play, "The Return of Mary Ellen," following Grant Mitchell and preceding Louise Closser Hale and Olive Wyndham.

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By DUNNINGER

(Continued from page 406)

"Oh, Miss Mason has no set charges. She conducts her spiritual gatherings without charge but donations to carry on her wonderful work are gratefully received."

"What are the usual donations?" I asked, not to be outdone in generosity.

"Two dollars seems to be the amount that is ordinarily placed upon the plate," I was informed, "although some pay as high as five and ten dollars."

The little maid, who had left the reception room now reappeared, and told us that the medium would soon be with us.

More conversation followed among those present and notes and data were exchanged about the past, present and concerning future hopes and dreams that they hoped would some day materialize.

"I am going to ask about some copper stock I have had in my trunk for several years. I want to know if it will ever be of any value," remarked one believer. "That stock has never been of value and if it ever will be my name isn't Mary B. Maguire! But I have hopes, because it will be just as Madam Thelma says. I do have to raise money because my rooming house at—51st Street has a mortgage falling due soon."

I smiled to myself. Glancing at my friend I saw that he too was interested. Ha, ha, thought I, talk is the cheapest thing there is.

"My doctor says that in a week or two I shall be well again. My operation has been such a troublesome thing! exclaimed a bright young lady.

"What was the trouble?" asked another.

"Acute appendix," came the quick reply.

"Too bad . . ." said another, "my sister had the same trouble and died several weeks after she was pronounced cured."

What price glory thought I. And settled down to listen to the talk of these women.

Time seemed to drag. It usually does when one thinks of the marvels one is about to see! Several others compared notes and told of the things the medium had predicted as well as the things they were going to ask. A buzzer in the room, which we had not seen, buzzed merrily. As if knowing just what they were supposed to do the gathering filed into another room. We followed.

Seating ourselves in available straight-backed chairs all conversation ceased.

Enter the medium.

She was a tall, middle-aged woman, with large features and a firm jaw. Here was a woman who was able to cope with any emergency or circumstance.

In a firm, medium-pitched voice she began to speak.

"Any questions you care to ask my controls . . . for I am but a machine speaking the thoughts of the hovering spirits . . . must be concentrated upon. Through me they will communicate with you.

"We will open the séance with a few brief hymns. I will have my assistant distribute books among you."

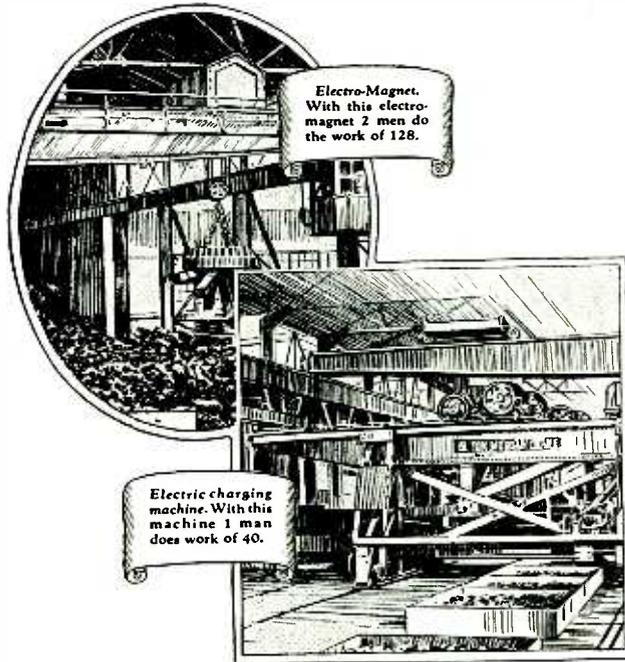
This was done.

"We all turned to the proper page and the song was rendered. Several more hymns were sung and the books collected and stacked upon the table in front of the medium.

More talk on the Great Beyond and spirit controls.

Gazing dreamily into space . . . the medium began to get seeming messages. At first she did not speak. Impressions must have been arriving.

One after the other, in quick succession, things were told the gathering. Messages



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MIAMI, FLORIDA



began to come, the words issuing from behind clinched teeth. One woman was told about her recuperating from the appendix operation. Another about the copper bonds and the mortgage.

I was given a message from my dead sister. (I never had a sister). But I had spoken in the reception room of a sister and her name.

This is perhaps the key to the solution of the entire mystery.

The thing was out. The elderly lady who had been there on several occasions was truly the spirit, but not a departed one. The astral force was that which was emphasized through the lips of the medium.

She of course gathered all the conversation she heard in the ante-room and what little more she needed was supplied by general conversation while we were waiting for the medium's entrance into the den of mysticism.

The elderly lady must, at one time, have been a stenographer of some sorts, inasmuch as she took down our conversation which seemed to be transmitted by the medium practically verbatim.

This information was written in short hand in the hymn book handed her, which the assistant took pains to keep on the top of the stack, when the books were later on collected.

This book containing the necessary information about those who had departed across the threshold . . . about my sister that never was . . . and the rest of the collected talk . . . was opened directly in front of the medium; an action apparently careless, but strictly necessary, as this so-called ghost woman must have also been a student of Isaac Pitman and could read stenographic notes very well.

The information she imparted to me and likewise to my associate did not seem to upset our spirits to any marked degree, inasmuch as a short while later, we were seated in a restaurant enjoying the food products of the living, rather than feasting upon the psychic thoughts of the dead.

One fact, however, was quite apparent . . . my friend did not seem to be over anxious to discuss the happenings of the evening.

Later, comfortably ensconced in a cab, we lighted weeds and, looking at one another . . . we indulged in a hearty laugh.

(No. 3 will appear in the next issue.)

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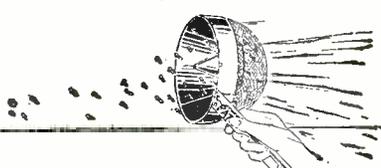
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160 and 320 Volt "B" Eliminator

By A. P. PECK

(Continued from page 439)

photograph, however, and the wiring for it is also indicated in the diagram. A three-point switch serves to throw the voltmeter from one to another output circuit, so that each one can be measured separately. It must be realized that an extremely high resistance instrument has to be used in connection with such "B" eliminators, to obtain results of any accuracy at all.

Since we are dealing with high voltages it is necessary to have resistances of rather high load capacity to control the various outputs. There are several reliable resistances on the market today that are especially adapted to this work. One should be chosen that will not heat up under an ordinary load. A fixed resistor of this type or three well-made variable resistors and a fixed resistor can be used at the discretion of the builder.

In order to further simplify the wiring for the amateur, Mr. Brams employs a block type of filter condenser, wherein all the condensers are in one casing and handy terminals are provided. The various photographs will show clearly how such a procedure simplifies the wiring as compared with some of the original "B" eliminators using a maze of separate condensers. Although the condensers are used in block formation, they are shown separated in the diagram so their respective positions in the complete circuit can be more clearly seen.

An eliminator of this type will be a decided addition to any radio receiving set. With it a power amplifier using a UX-120 tube can be employed and thus great volume will be obtained. When less volume is desired the power amplifier can be cut out of the circuit and the low voltage output of the "B" eliminator employed. Of course, as can be seen in the photographs Mr. Brams "dolled up" his eliminator to a very great degree, but only because of pride in his workmanship.

SAYS GAS WILL OUST COAL

That gas as fuel will in a few years take the place of anthracite and all coals is the prediction of Dr. Julian C. Smallwood, Associate Professor of Mechanical Engineering at Johns Hopkins University.

"The days of anthracite are numbered," he said recently. "There is too little anthracite and it is too expensive. Many persons have told me that they have no intention of resuming its use after the interruption this winter. Under present conditions this means increased use of soft coal, with a consequently greater smoke nuisance."

Dr. Smallwood expressed himself as opposed to ordinances regulating the evil.

"The enforcement of such ordinances in other cities is not encouraging," he said. "They require the formation of still another bureau with a chief and a corps of investigators. We are already overburdened with them and their usefulness is, to say the least, problematical."

"In a few years gas will be far less expensive than at present, and gas, I believe, offers the most probable solution of the heat and smoke question. Oil is used in some cases, but there is not enough of it and it is impracticable. Coke is another serious possibility and awaits only improvements in methods of consumption.

"Railroads for some time to come will be obliged to use coal. The abatement of the smoke nuisance from railroads will come through electrification."

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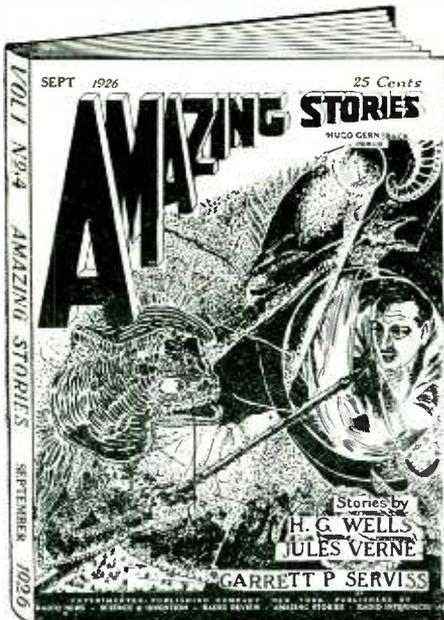
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**Other big features in
September issue**

THE PURCHASE OF THE NORTH POLE, by Jules Verne, in which some enterprising mathematicians and scientists attempt to bring the North Pole to a temperate zone—or bring the temperate zone to the North Pole. A stroke of lightning sets things flying in the mathematician's room and an error gets into the calculation. Of course, that upsets their plans considerably.

A COLUMBUS OF SPACE, by Garrett P. Serviss (2nd instalment) in which our adventurers continue their marvelous experiences with the Venusians on the light side of the planet Venus.

STATION X, by G. McLeod Winsor (Conclusion) in which the Venerian aids in a terrific battle against the Martians and Professor Rudge, at least, returns to tell the tale.

THE MOON HOAX, by Richard Adams Locke, is a classic sciencefiction story containing excellent science along with some obvious mistakes, which were not detected even by a scientific audience. It is probably the greatest scientific hoax that was ever perpetrated upon a credulous public.

BLASPHEMERS' PLATEAU, by Alexander Snyder, wherein some eminent scientists successfully experiment with infinite secrets, until they become drunk with their power. Then another scientist arrives on a friendly visit. It is a powerful and gripping story which is sure to hold your interest.

A spherical steel shell fitted with a glass window and containing an intrepid explorer descends five miles to the floor of the ocean.

A number of human-like, terrible monsters surround the shell and carry it away—what happens to the explorer and his steel house will keep you in breathless suspense.

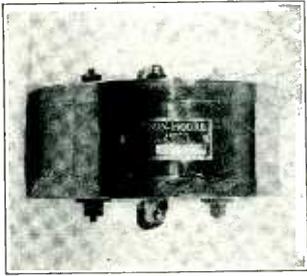
Incredible things occur, yet, as the author himself explains, there is today no knowledge to refute the amazing sights the explorer sees.

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Don't miss it—Featured in "Amazing Stories" for September.

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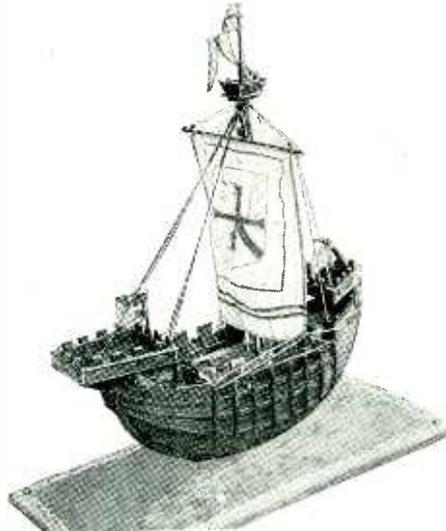
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Model Department

(Continued from page 422)



Another View of the Prize Winning Model.

Rules for Model Contest

1. A handsome trophy cup engraved with your name, will be awarded as the prize for the best model submitted during the month. The decision of the judges will be final and will be based upon: A—novelty of construction; B—workmanship; C—operating efficiency of the model as related to the efficiency of the device which the model simulates, and D—the care exercised in design and in submitting to us sketches and other details covering the model.
2. Models of all kinds may be entered. They may be working models or not, according to the subject that is being handled.
3. Models may be made of any available material, preferably something that is cheap and easily obtainable. Models made of matches should not be submitted to this department but should go to our Matchcraft Contest Editor.
4. Models must be submitted in all cases. Good photographs are also highly desirable and where the maker does not desire the model to be taken apart, legible drawings with all dimensions covering parts that are not accessible must be submitted.
5. Models should be securely crated and protected against damage in shipment and sent to us by parcel post, express or freight, prepaid. Models will be returned when requested.
6. Models for entry in any particular contest must reach this office on or before the 25th of the third month preceding date of publication. For instance, models for the October contest must reach us on or before the 25th of July.
7. Address all entries to Editor Model Department, c/o Science and Invention Magazine, 53 Park Place, New York City.

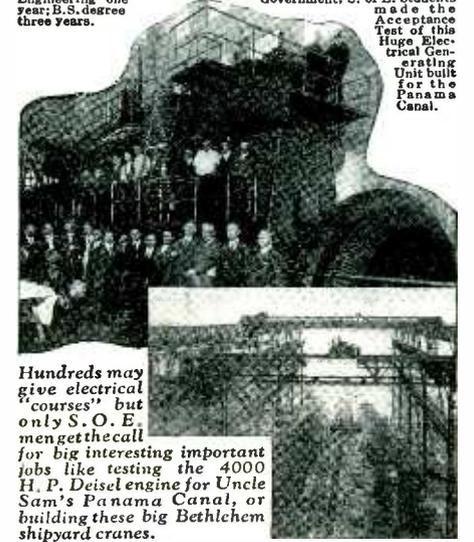
LIGHTNING RODS

The Wisconsin Industrial Commission in urging property owners to install lightning rods stated that 500 people are killed and 1,200 injured annually by lightning in the United States and Canada. In Wisconsin alone the property loss caused by lightning in 1924 amounted to \$923,210. The U. S. Bureau of Standards asserts that lightning rods reduce the fire hazard as much as 80% to 90% in the case of homes and by as much as 99% in the case of isolated farm barns. In spite of this simple and inexpensive means of protection, fires started by lightning in the United States in the year 1923 caused losses amounting to \$10,922,669, according to the National Board of Fire Underwriters.

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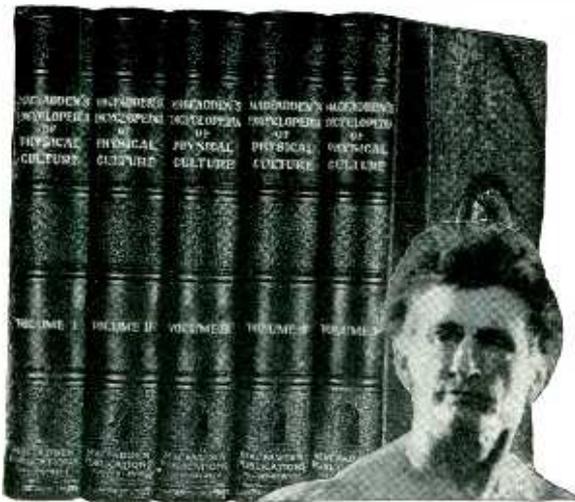
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Will you be one of the 800,000 who will die this year of preventable disease?

OF the hundreds of thousands who die from respiratory diseases, bronchitis, pneumonia, kidney diseases, tuberculosis, influenza, and intestinal disorders, a large proportion would not have died if they had been able to recognize early symptoms and had known how to treat themselves.

Nature always warns of impending sickness. The occasional headache, that tired, exhausted feeling, loss of appetite, a casual cold and other slight disarrangements are Nature's warnings to you that your body isn't functioning properly or that you are not living and eating correctly.

You can rule your health just as surely as you can rule your actions. If you are not enjoying perfect health today it is because you haven't employed the method provided by Nature to keep you well. If you don't know what her requirements are, you are sure to blunder into some kind of sickness—perhaps fatal disease.

ENCYCLOPEDIA of PHYSICAL CULTURE New 6th Edition ~ Completely Revised

EVERY year more than ten thousand people die of bronchitis, sixty-four thousand die of pneumonia, seventy-five thousand die of kidney trouble, fifty thousand die of respiratory disease, one hundred and six thousand die of tuberculosis, approximately eighty-five thousand die of influenza, and more than ten thousand die of intestinal trouble.

Barring accidents and suicides, only a small percentage of these thousands should die.

It is a fact that only about one person out of three enjoys good health. And those who are physically a little "off" right now will more than likely be the ones to succumb to preventable diseases this year. And they are the ones who should not die.

Nature is constantly warning you of impending sickness. Seemingly trivial symptoms tell of serious trouble taking root in your body. And yet, ninety-nine people out of every hundred will absolutely ignore these danger signals. As long as they are not flat on their backs, they will fool themselves into believing that they are all right.

Nature is merciless. If you do not understand her laws and her methods of preventing and curing sickness, you suffer. She knows no excuse—she accepts no apologies.

The Average Person Pays Thousands of Dollars in Doctor's Bills

Those who do not know Nature's methods of preventing and curing sickness are ill an average of 21½ days each year. In fact, it is estimated that the average person in a lifetime spends \$4,100 on doctor and hospital bills, loss of time from business, medicine and other expenses due to illness. Thousands of people are living half-powered lives because they are ignorant of the laws of Nature. Many of these people will fill an early grave, when they might easily have lived to enjoy a ripe old age.

What would it be worth to you to be able to in-

stantly identify in its earliest stages any sickness or disease that might overtake you or any member of your family? To enjoy perfect health, almost complete freedom from sickness, doctor and hospital bills, and no days of suffering and worry, or salary lost through sickness?

How to —

- possess exhilarating health every day in the year
 - know your own body
 - eat for health
 - diet for the cure of disease
 - know the art of food preparation
 - build a powerful physique
 - correct physical imperfections
 - become a physical director
 - avoid unhappy marriages
 - avoid disease
 - fast as a curative measure
 - cure by hydropathy (heal by the use of water)
 - apply all methods of drugless healing
 - give first aid in emergencies
 - apply home treatment for disease
 - recognize diseases by manifestations
 - build nervous energy
 - treat the common form of disease
 - understand the process of reproduction
 - benefit by laws of sex and marriage
 - treat diseases of women
 - diagnose diseases
 - have healthy and vigorous children
 - treat female disorders
 - treat male disorders
 - obtain virility and manhood
 - care for the complexion
 - manicure: care for the hair and feet
 - cultivate the mind
- These are only a few of the matters explained in the Encyclopedia.

is given of the laws of sex, the attainment of virile manhood and womanhood, and happy, successful parenthood, together with details for diagnosis and treatment of all sexual diseases. Handsomely illustrated charts on anatomy and physiology are scattered throughout the book.

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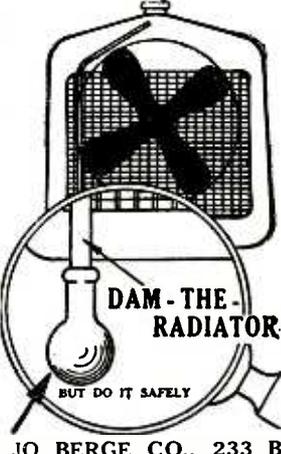
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Odd and Unusual Patents
(Continued from page 405)

Any cyclist who has had his heels nipped by a dog will appreciate the value of the "dog chaser" patented by a young lady. This invention proposes to fix two perforated boxes to the forks of the bicycle. The boxes were to be filled with snuff, pepper, or other pulverized material calculated to repel vicious canines who annoy cyclists, and were connected with tubes to a bulb fastened to the handlebars. The bulb need only be compressed and the pepper is sprayed upon the dog. The inventor claimed that the dog ceased to annoy after having a pepper spray.

There is no disputing the statement that a vast amount of thought and consideration has been given to the subject of awaking from sleep. The patent records show that at least three men wanted to rid mankind of its most distressing foible—oversleeping. The first secured a patent on a combined alarm clock and bedstead. The inventor provides for "the dropping of a bolt, as the hour hand of the alarm clock reaches the appointed hour, lets loose a set of bars which holds up the mattress which in turn swings upon central pivots dropping the sleeper upon the floor." The second covers an alarm clock connected with a container and a tube. The tube has a perforated end to be fastened about the neck of the sleeper. Before retiring the user fills the container with water, and at the hour set a spring actuated by the clock releases the water from the container into the tube and the sleeper is given a cold shower. The inventor speaks of this device as "an easy awakener." The third patent is called "an alarm and waking bed." This contraption consists of a clock which, upon striking the hour set, releases a bar and the head portion of the bed collapses, thereby giving the upper part of the sleeper's body a severe jolt.

The realm of courtesy is brought into contact with the field of invention by a gentleman from Seattle who patented a self-tipping hat. This ingenious man constructed a hat which would tip itself without the aid of the hands. The hat contained a curious mechanism which was held in a case clamped to the head of the wearer. In the words of the inventor this remarkable headpiece "automatically effects polite salutations by elevation and rotation of the hat on the head of the saluting party when said person bows to the person or persons saluted."

A patent which is quaintly reminiscent of Percy, the famous mechanical man of the comic sheets, was granted on the invention of a man named Praul, covering a steam tractor engine which was propelled by a very unusual means. Instead of having wheels at the rear of the carriage, the inventor provided two pair of vibrating levers or walking legs which operated forward and backward in an elliptical movement, one metal foot being placed forward and then drawn backward thereby pushing the engine forward. The inventor described the legs of his contraption as "moving like the hind legs of a cow." This device was intended for farm use, being especially adapted for running over rough ground.

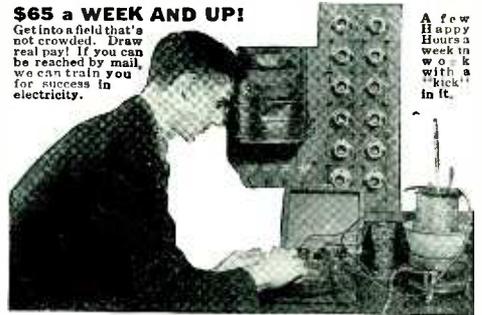
In the early days of railroading, experiments were made on many unusual devices before the locomotive engine successfully solved the problem which confronted the railway builders. An early nineteenth century patent covers a car driven by means of a horse on a treadmill inside the car, which, by means of connection with a set of gears, drove the wheels forward. Actual experiment proved this odd means of propulsion unsatisfactory for railroad use. When the

(Continued on page 471)

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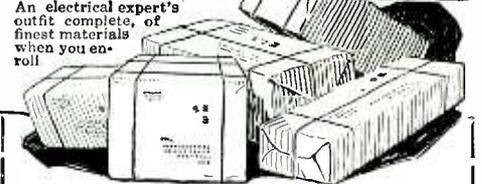
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Odd and Unusual Patents

(Continued from page 469)

feelings of the horse are considered, it is fortunate that the treadmill-car was not a success.

Ingenuity knows no bounds or rules. Some clever chap secured a patent on a raincoat with a gutter and a spout. The lower hem of the coat is turned up to form a gutter and is inclined so that the water will run to one side where a tubular spout several inches long shoots the water away from the wearer, the idea being, of course, to keep the legs dry.

Snoring is still a great menace to society although in 1872 a humorous patent issued on an Anti-Snoring Device. The patentee alleged that "a person cannot snore while lying on his side," and to prevent lying any other way he provides us with "an arch of hard material secured between the back of the shoulders by means of straps about the waist and neck, thereby preventing the person from sleeping on the back." Snoring is thus easily eliminated by a removal of the cause. We also find among the patents a guillotine for decapitating poultry.

(To be continued next month.)

Book Review

FREEHAND DRAFTING, by Anthony E. Zipprich. Hard covers, 6" x 9", illustrated, 131 pages. Published by D. Van Nostrand Co., New York City. \$1.60.

This is a very suggestive book. It tells about drawing without a ruler, tee square or triangle, and teaches or endeavors to teach dependence on the human hand. The book work is so very practical with so many illustrations giving examples of free hand practice, that it is most interesting. The position of the hand for drawing straight lines and curves is given in such detail that the work and manipulation of a left handed draftsman is considered. All kinds of elementary shapes and lines open the book, and then we come to geometrical definitions with numerous illustrations in perspective of solids. The idea is of course that free-hand work leads to the production of perspective views, while the servant of the tee square and triangle always tries to do everything in the boldest projection. One chapter is given to isometric sketching, which may be termed in a sense, the lazy man's perspective. It is, however, perspective with the observer so far away that the vanishing point ceases to exist. No better practice could be found for one who has occasion to make these quick sketches than to follow right through the book and copy the many very characteristics and instructive examples given.

FARM ENGINEERING, by Byron Burnett Robb, M.S.A., and Frederick Gardner Behrends, B.S. Hard covers, 5¼" x 8¼", illustrated, 454 pages. Published by John Wiley & Sons, Inc., New York City. \$2.50.

The old house of John Wiley & Sons long known to the scientific world are issuing a series of books called the "Wiley Farm Series." They are edited by Professor A. K. Getman, Supervisor of Agricultural Education at the University of the State of New York. This book is the first of the series and the only one so far published. About everything imaginable about the farm is included, such as harness repairing, (Henry Ford has not yet driven away all the horses), soldering, rope work and belt lacing. These we may place at the foot. So fully is all this given and in such detail, and with such numerous illustrations, that it will interest anyone, even if it were only on account of the wide application of much that is described. A section on knots is such as to give points to almost anyone, and even the yachtsman will find instruction here. Then as we go on the installation of a power plant, leveling up for foundations, the engineering of drainage and the installation of concrete work, and coming into the house the subject of plumbing is very fully given. The number of illustrations is in excess of the pages, and a very good index is given. We warmly commend the work to our readers.

(Continued on page 474)



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Home Mechanics

By WILLIAM BUTTERFIELD
 (Continued from page 411)

a good idea of their construction may be had. The three large ones are 30 inches long, 13 3/4 inches wide and 6 3/8 inches deep. The four smaller 9 inches long, 6 3/4 inches wide and 4 inches deep.

An ogee molding 1 inch wide and 1 1/2 inches high is used at the bottom of the desk as shown. The back legs are formed by a part of each side piece, the front legs are of composition in the style of claw feet. They are screwed to the bottom frame.

The brass locks, hinges, glass knobs and sliding drop lid supports can be had at any furniture maker's supply house. The composition legs can be obtained there also.

The upper section or bookcase part of the desk is assembled first with two sides, each is 41 inches long, 9 inches wide and 3/4 inch thick. A top 1 inch thick, 33 inches long and 10 inches wide is put on just as the top of the lower section is mortised and tenoned. Both tops are the same size and thickness. A molding is cut on three sides of these two tops. It may be "stuck" on by machinery. The back is 3/8-inch ply-wood and is 41 inches long and 29 1/2 inches wide. A 1/2-inch ply-wood bottom is used with mortise and tenon ends; it is 30 1/2 inches long, including the tenons, and 8 3/4 inches wide.

The door frame for this section is formed of the sides, bottom and a 3/4-inch square maple cross-piece at the top (as shown). A 1/2-inch ply-wood door stop is made using two 1/2-inch square uprights and a cross-piece 1 1/4 inches wide and 1/2 inch thick (see illustration). Four 1/2-inch square ply-wood cleats are used to support the shelves. The shelves are maple and 29 1/2 inches long, 7 1/2 inches wide and 3/4 inch thick.

Before working on the door, it may be best to study the construction of a door and window sash by observing these two articles in their finished state. The outer upright pieces are called stiles, the cross-pieces are called rails and the thin pieces, forming the wooden divisions to the glass, are called bars. The stiles are grooved at the joints and the rails have tongues to fit the grooves. When glass is used, the opening made by joining these pieces together is rabbeted or cut out for the glass. The bars are made to fit into the rabbeted portion, and into their own rabbeted parts (see illustrations). They are held in the door part and to each other by mortise and tenon joints. For furniture all joints are glued.

The door is 3/4 inch thick, 29 1/2 inches wide and 40 1/4 inches long. The bars are 3/4 inch square, the stiles 5 inches wide, and 40 1/4 inches long, the bottom rail 1 1/2 inches wide and 20 1/2 inches long, including tongues, and the top rail 13 3/8 inches wide and 20 1/2 inches long, with tongues. The center upright bars are 26 3/8 inches long, with tenons, the half circle 7 inches in diameter and each of the cross bars 7 1/4 inches long, with 1/2-inch tenons at each end. Molding is put on as shown and before described.

Maple is usually stained some dark shade and finished with little or no gloss.

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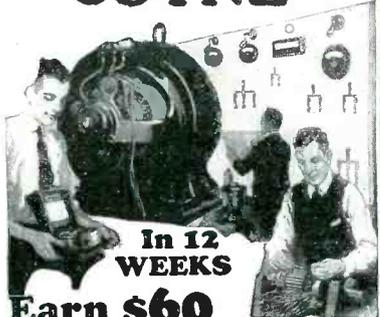
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Book Review

ELEMENTS OF RADIO COMMUNICATION, by Ellery W. Stone. Hard covers, 7 3/4"x5 3/4", 433 pages. Published by the D. Van Nostrand Publishing Co., New York City. Price, \$2.50.

This book takes up, in a very fundamental and systematic way, the elementary principles of radiotelegraphy. The subject is treated in a general manner for the most part, mathematics being resorted to only where necessary to make explanations more complete. Every phase of radio is given proportionate consideration, the author not delving very deeply into the mathematical aspects of any one particular angle of the subject. Transmitters and receivers, from the earliest Marconi types to the present-day high-powered developments are covered in a very comprehensive manner. Break or fad circuits are purposely not discussed, strict preference being given to the recognized standard ones.

This volume should prove interesting and instructive as a semi-technical general reference on modern radio.

MODEL MAKING, by Cyril Hall. Stiff cloth covers 5"x7 3/4", profusely illustrated, 139 pages. Published by R. F. Fenno & Co., New York City. Price 75 cents.

One is often impressed with the idea that it is a waste of time to make a model for after all what can a little steam locomotive, perhaps only ten inches long, do in the way of any service, and what is the object of constructing boats that are only twelve inches long, but there is a great deal to it in reality. It gives an admirable training in mechanical construction. It necessitates the study of engineering products, so that at once skill in the use of tools, the study of mechanical and naval constructions, the mechanical drawing and laying out of work, all applies, so that the time is far from wasted. The English model makers probably do the most in this line, and throughout the book we feel that we can discern the English influence to say no more. The book is profusely illustrated; it ranges from the steam locomotive, steamboat and similar things to electricity and to various other models, including, if we may term it a mechanical model, a sailing yacht of the English cutter type. The book contains an adequate index.

LABORATORY EXPERIMENTS IN PHYSICS by Elmer Reginald Drew, Ph.D. and Hermon W. Farwell, A.M. Stiff cloth covers 5" x 7 1/2", 143 pages. Published by The Century Co., New York City. Price \$1.50.

Harvard University some years ago issued a synopsis of experiments in physics required for entrance examinations. While they were quite clever, they did seem a little bit elementary. In this book we have detailed a number of much more advanced experiments in use in Stamford University and in Columbia University, the authors being connected, one with a western university, the other with an eastern one. The idea is to give the full directions for experiments in physics and mechanics to be done by the student in the laboratory, not merely for entrance qualifications. The illustrations are decidedly few, but we must picture to ourselves that the student has the apparatus itself in front of him, works with the apparatus itself and that very few illustrations are needed. We do find a diagram of a potentiometer set-up which should be interesting to our radio friends who apply the term potentiometer somewhat too loosely. There is an appendix containing notes on apparatus, and an interesting part of this section describes methods of doing calculations, because there are always liable to be inevitable errors not due to the figures but to what we may call the circumstances of the case.

THE TEXTILE FIBERS, by J. Merritt Matthews, Ph.D. Fourth Edition. Hard covers 5 3/4" x 9 1/4", 1053 pages, illustrated. Published by John Wiley & Sons, Inc., New York City. \$10.00.

This book is of special interest to the present reviewer, whose recreation happens to involve dealing with the very subject of its pages. A number of very patient souls are now taking up foot-power weaving in an amateur way, and the reviewer is one of those. It therefore follows that this book rather reaches one's heart. It has over one thousand pages and over four hundred illustrations. A most interesting portion treats of artificial silk, which is now coming into such extensive use, although it must be conceded that the durability of its effects is not satisfactory, and the filament of the silk worm surpasses it in quality. Microscopic views of the fibres are found throughout the pages. Mercerized cotton, another modern development, is described in considerable detail with illustrations of the machinery used in making and lustering it.

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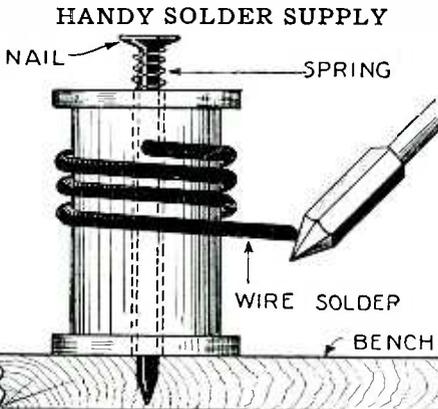
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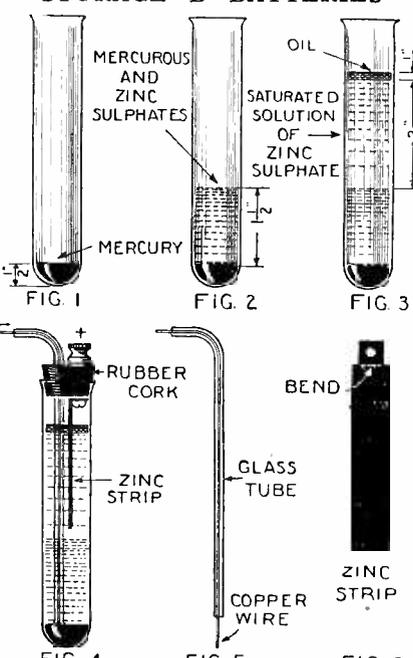


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—Clair W. Hudlow.

STORAGE "B" BATTERIES

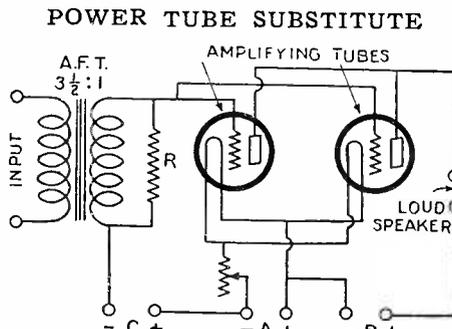


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FIG. 1 FIG. 2 FIG. 3
FIG. 4 FIG. 5 FIG. 6

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Hunting Whales With Airplanes

(Continued from page 402)

second group (the toothed whales) which includes the Sperm whales, Dolphins and Porpoises, all have teeth, varying in number from a single pair to sixty or more. They feed on fish, squids and cuttlefish.

As will be seen from the foregoing, the whale is just like a human being swimming in water. A man can swim under water for a few minutes holding his breath, and the whale simply goes him one better, having a tremendous pair of lungs, by means of which he can hold sufficient air to oxygenate his blood while submerged for a period of twenty to thirty minutes. But he may swim under water for five miles in a period of thirty minutes while submerged, and thus it is while hunting whales, the fishermen often are surprised to see a whale dive and then not see him again until he reappears and blows several miles away from the ship.

Those interested in whales, one of the most fascinating subjects the writer has ever met with, should certainly read the most remarkable new book entitled, "Whale Hunting With Gun and Camera," by Roy Chapman Andrews.

Some people when they first see a whale or his skeleton, such as those exhibited at the museums, frequently compare the whale with a submarine. They are more correct than they think, for imagine what power a whale has when, after being harpooned, he has fought courageously for ten hours and pulled a 90-foot steam-driven whaling boat after him at a speed of ten miles an hour, when the engines and screws of the whaling boat were set in full reverse or astern. Many a man has lost his life on whaling expeditions, simply by the swish of a whale's tail at close quarters, this powerful tail crushing him as flat as a flounder. Remember, one swat of his tail represents tons of meat and blubber crashing down upon you. If a whale charges an average small whaling steamer and hits it at right angles, he is quite likely to buckle in the plates and sink the boat. Sixty to seventy tons of solid meat and bones are not to be conjured with when it comes tearing down upon you at a speed of ten to fifteen miles an hour, the average speed of the whale when swimming. In Mr. Andrews' book you will find many instances where whales after having been harpooned have towed the whaling boat for hours, with the boat's engines and screws in half or full reverse. If you live anywhere near a museum where you can see a whale on exhibition, you should by all means go and have a good look at it. They are one of the most awe-inspiring sights you can imagine.

The question is often asked how big is a whale baby at birth, and the common impression seems to be that they are the size of a shark, or 7 to 12 feet in length. The baby whales at birth are most astonishing "little fellows" and would scare you right out of your boots if you ever met one in the water while swimming. The "babies" measure 12 to 25 feet in length, or from 1/4 to 1/2 the length of the mother whale when she gives birth to it. Many offspring have been born just at the point where the mother whale is hauled on the pier at land whaling stations; but if the mother expired shortly before, the baby whale is either born dead or is found in the womb of the mother, as the blubber is cut away.

The outer skin of the whale is very interesting, being of a tough, hairless nature about one-half inch thick. The heavy layers of blubber or fat underneath this skin vary from 8 to 12 inches in thickness, and serve to keep the blood of the whale warm.

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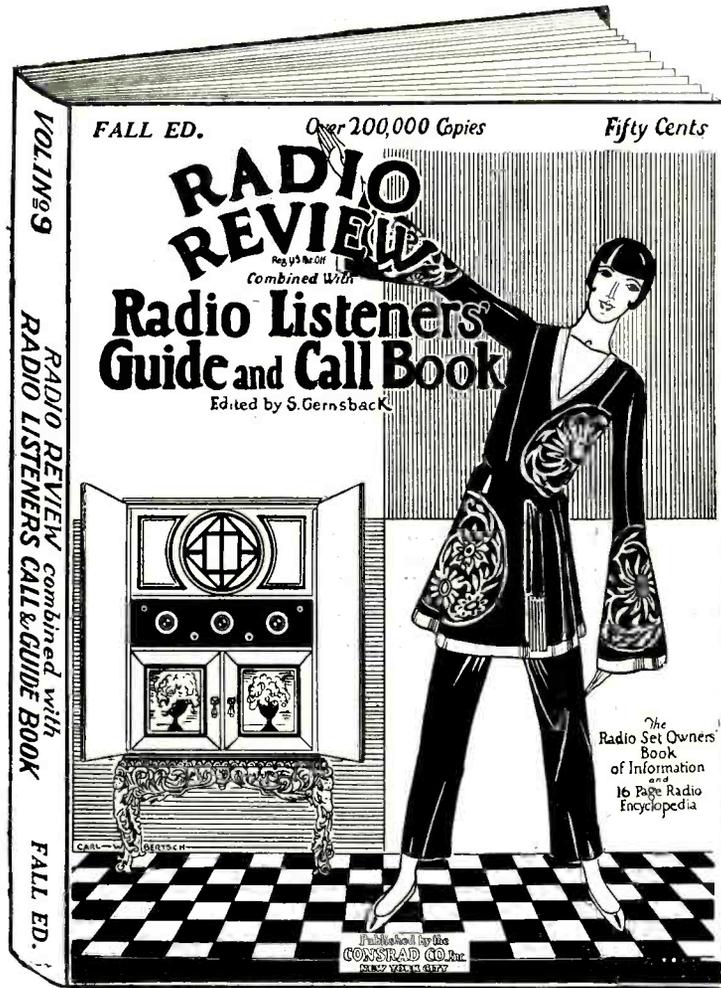
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Contents

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(Alphabetically by call letters)
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BROADCAST STATIONS OF THE U. S.

(By Wavelength & Frequencies)
This is a complete list of Broadcast Stations of the U. S. same as above, but listed numerically by Wavelength for added convenience.

BROADCAST STATIONS OF THE U. S.

(By States & Cities)
Another way of listing all U. S. Broadcast Stations. Especially valuable when location of a given station is known but the call letters indistinguishable by Radio.

CANADIAN RADIO BROADCAST STATIONS

(By Provinces & Cities) (By Call Letters)
This section contains the finest revised list of all Canadian broadcast stations obtainable. Listed two ways.

FOREIGN RADIO BROADCAST STATIONS

(By Countries & Cities)
A section containing the latest, most complete list of Foreign Broadcast Stations ever published.

Contents

RADIO SET OWNERS' BOOK OF INFORMATION

In this portion of Radio Review are a large number of selected articles each of great value to every Radio Listener whether he be a beginner, Amateur, Professional.

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A guide to Radio Exercises containing helpful charts of actual exercises and similar information.

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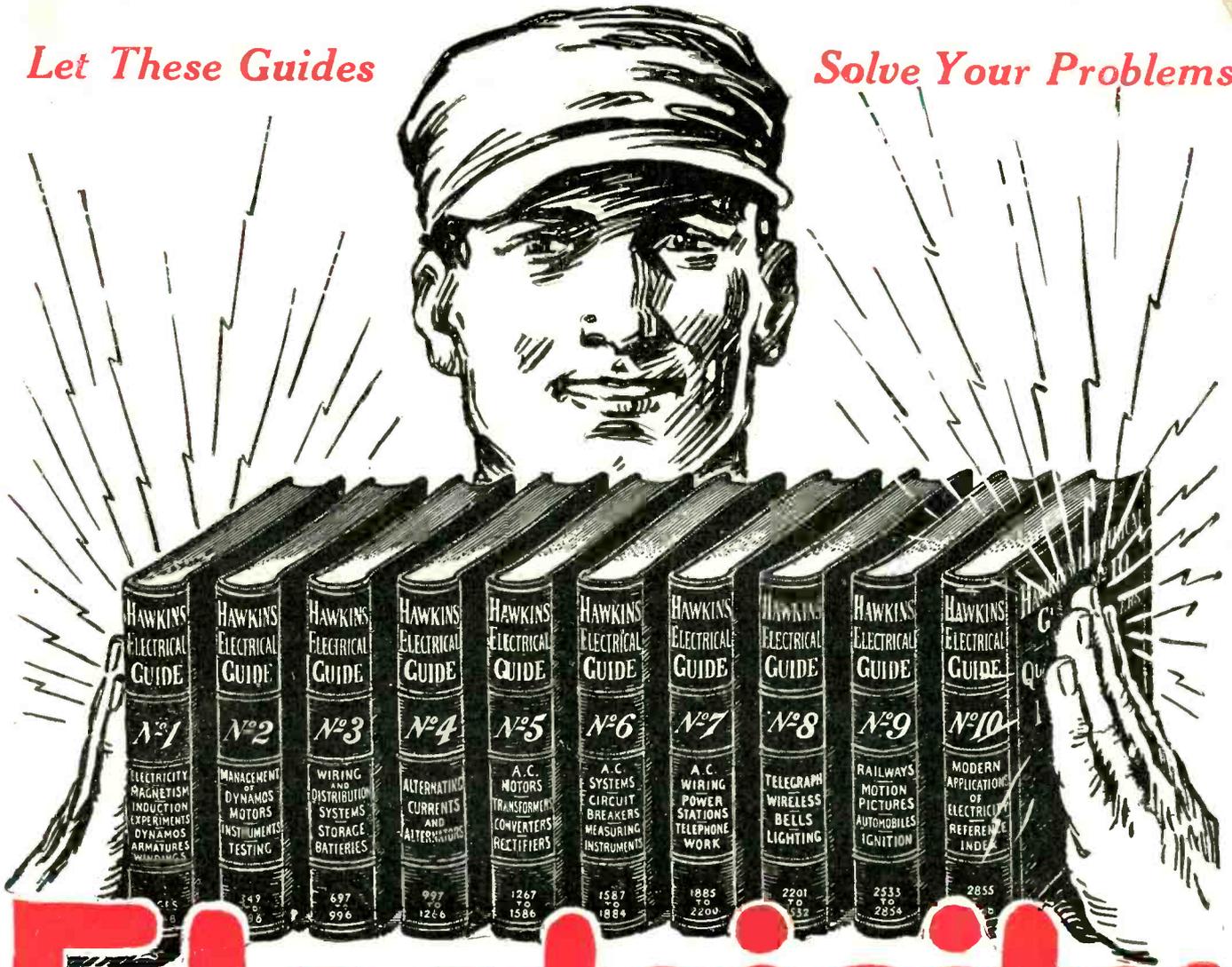
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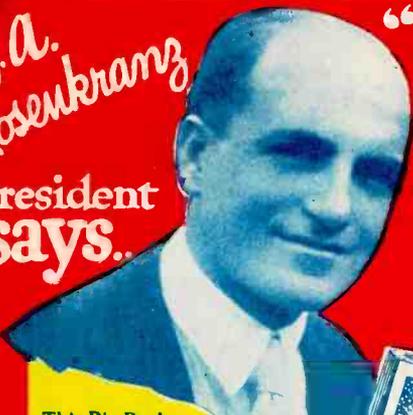
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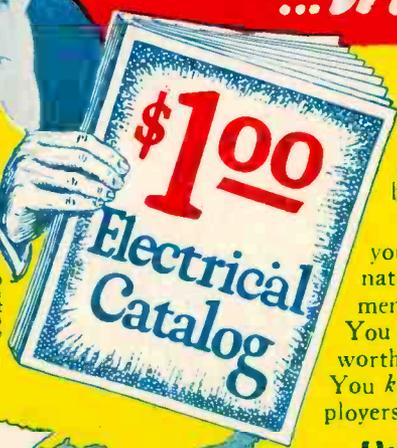
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In this book I've written exactly what you will do and learn at National. A photographic trip through this 3-acre school of shops and laboratories. The Truth about your opportunities. To keep the book from curiosity seekers I charge Easterners \$1 a copy—which is deposited to your account at 5% interest until you come to school. If you live in the West and can come to National NOW—I'll send you this \$1 book Free!



There are hundreds of high-paid electrical jobs begging here in California! Employers are asking me to supply them with trained men. So I offer you the opportunity to come to Los Angeles, get practical training in my big shops and fill one of these jobs before 1927!

If you're ambitious to make money I'll guarantee to make you a *real* Electrical Expert. My training method is internationally famous for its thoroughness. I've trained 16,000 men—from all parts of the world—to hold fine jobs at big pay. You perform all kinds of electrical work here on \$1,000,000.00 worth of new equipment, with expert instructors helping you. You *know how*—when you leave National. That's why big employers are anxious to hire my graduates.

FREE to men west of the Mississippi

\$100 to Easterners
The \$100 will be deposited to your account at 5% interest

Unless You Pass This Test You Can't Come to National

I'm sincere about this Big-Pay-Job Offer—and so I must limit this opportunity to ambitious men who are willing to spend enough time to learn electricity *right*. I don't want any half-trained men to represent National. You must pay your fare to Los Angeles—pay living expenses or work at part time jobs while learning—and pay a reasonable training fee when you enter school. These obstacles will not daunt the man who is determined to be a success—and I have special jobs and savings plans to help earnest men who lack funds.

so I must limit this opportunity

The Most Unusual Electrical Training in America

You get absolutely thorough, complete training at National. You are not rushed through. You master every job. Lifetime scholarship entitles you to stay as long as you like and come back after graduation for extra training free. This school's success is based on the highest-quality training possible. No expense spared to train you right. Endorsed by leading educators, electrical associations and employers, who say, "National produces the best trained men."

Los Angeles Is Magic City of Opportunity

World's largest hydro-electrical projects surround Los Angeles. Constant demand for Electrical Experts. National graduates supply this demand. Ideal climate—beaches—mountains—sports—amusements year 'round. Your Big Opportunity awaits in California. Grab a train and come—NOW!

FREE Employment Service—Earn While Training

You can earn board and room while at National by new cooperative plan of practical work in leading electrical and auto shops in spare time. We help you land big-pay job after graduation and find new openings for you as you advance. Send for catalog with full details of how National helps you to succeed.

Established 1904



NATIONAL ELECTRICAL SCHOOL

Dept. A 326

Santa Barbara and Figueroa Sts. LOS ANGELES, CALIFORNIA



Tours World as Radio Operator

"Passed Commercial Radio Operator's Examination with highest marks. Am starting at once for India, the Orient and Africa as 1st Class Comm'l Radio Oper. And only a few months ago I was an Iowa farm hand. I investigated three schools and traveled 2000 miles to get to National. Because of your thorough training I can also qualify as Chief Ship's Electrician." C. R. Cunningham



"Six Months at National Saved Me SIX Tedious Years as Apprentice."



"I passed Electrical Inspector's Examination and Electrical Repairmen's Examination for Civil Service with high grades. Only 27 men out of 311 passed the Inspector's Examination. I was eighth highest in Repairmen's Examination out of 126 men.

"Now I have several splendid positions open with big pay and advancement. Yet I trained for only six months at National and can fill these jobs better than other men who have worked for years as apprentices. I saved six years' work by going to National and I am certainly thankful I decided to take your short cut to success." Alex Johnson.

"My Civil Service Exams. Made Easy by National Training"



"My grade of 95% was fourth highest among 140 men who took the Electrical Mechanic's Civil Service Examination. As this examination was supposed to be for men with at least two years practical experience, my marks created a sensation at the Commissioner's Office.

"I found the questions easy because of my National training. The best move I ever made was entering your school. Because of my thorough training I am going to take the Junior Engineer's Exam, too. I find that my few months at National saved me at least five years as an apprentice doing tedious jobs." E. C. Small.

NATIONAL ELECTRICAL SCHOOL
Dept. A 326, Santa Barbara & Figueroa Sts., Los Angeles
Send me your free 64-page Electrical Catalog describing National quality training methods. (If you live east of the Mississippi, enclose \$1.00 which will be deposited to your credit at 5% interest.)
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