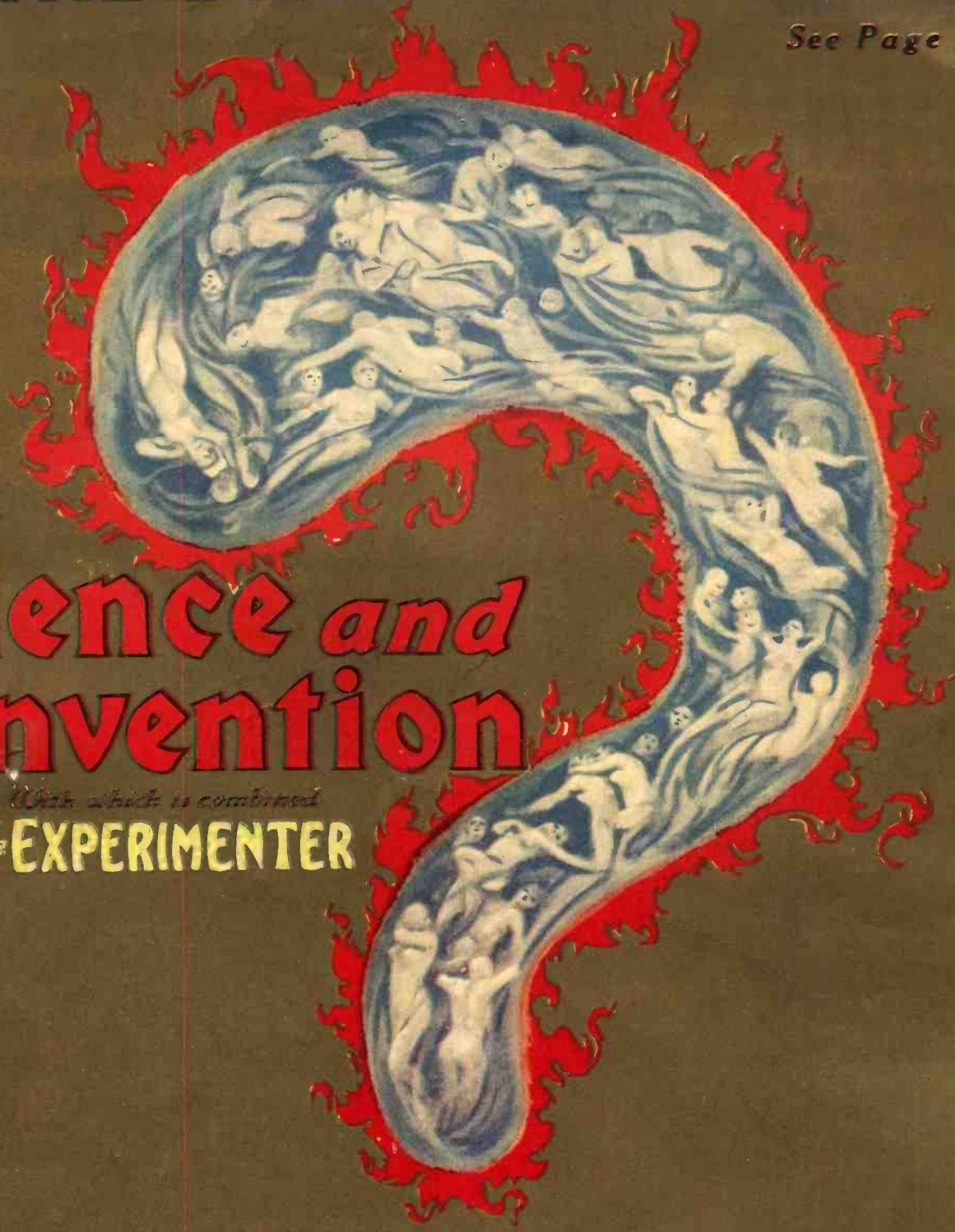


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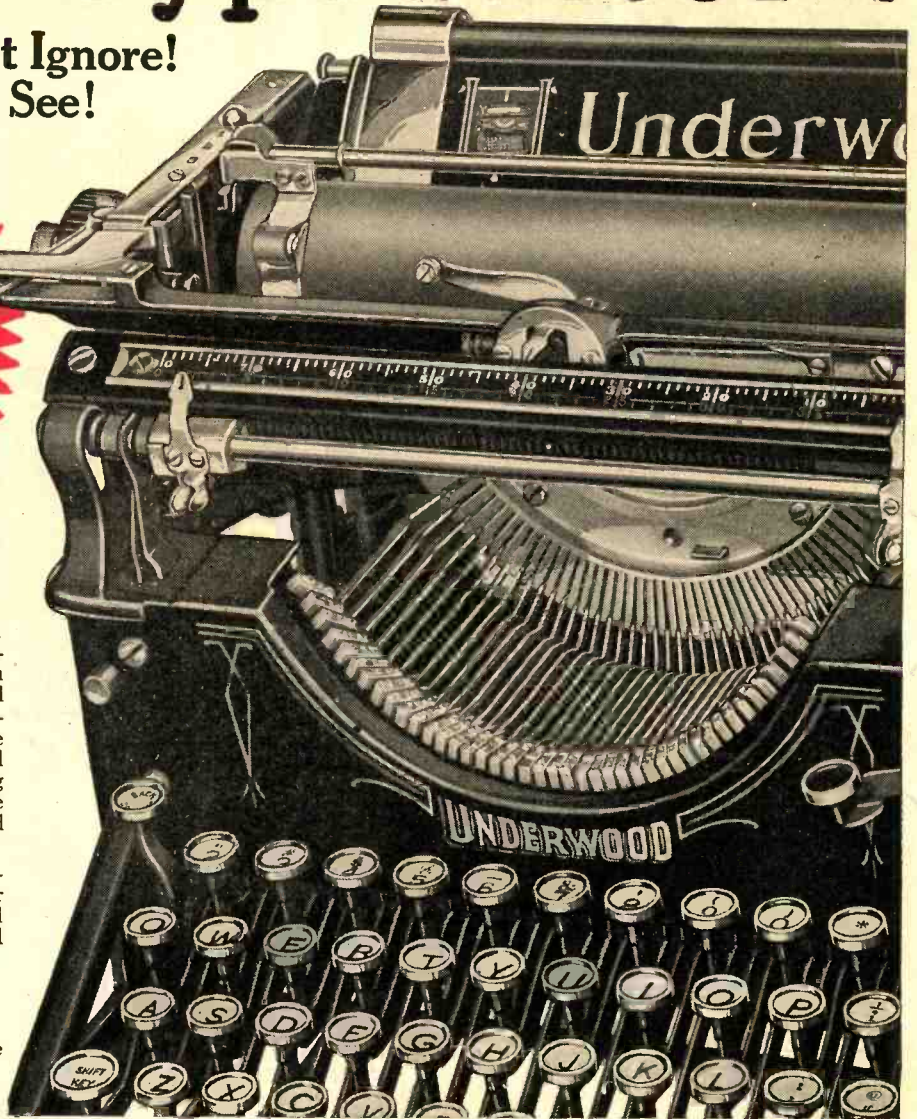


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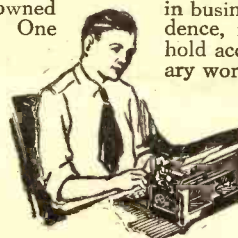
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IN OUR NEXT ISSUE

Hot Gas for Dirigibles.

The new art of heating gas for dirigibles is a most interesting one and an aeronautical engineer will describe in detail the methods and apparatus used.

Are Ants Organized?

They are indeed and a description of their home life will be found, together with various interesting and instructive illustrations.

Safety on the Railroads.

Did you know that a train, when properly equipped, can be automatically stopped even though traveling at a speed of 60 miles an hour, in case the engineer should thoughtlessly pass a stop signal?

Can Stars be Seen in Daytime From a Deep Well?

This is an old superstition and reasons for its existence as well as its fallacy will be given by an astronomer.

How are Movie Sub-Titles Made?

This is a most interesting phase of motion picture work that is not very well known. In an interesting article, you will find many details of this work.

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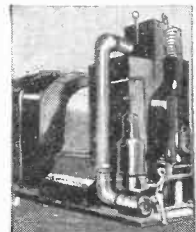
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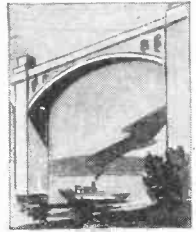
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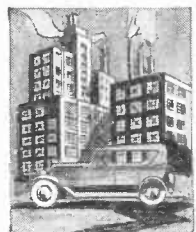
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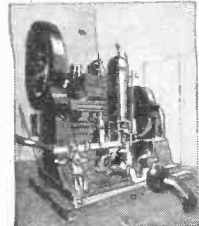
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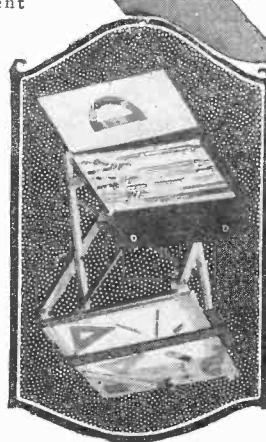
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HOW TO INVENT— WHAT TO INVENT

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.

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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 probably 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.



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.

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!

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,

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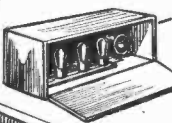
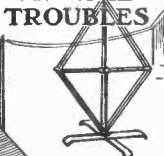
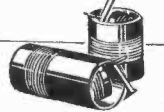
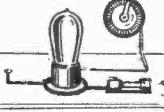
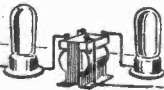
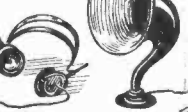
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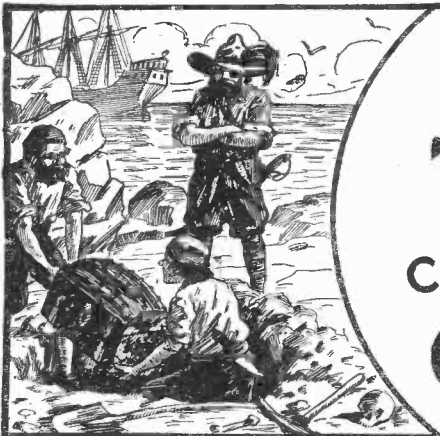
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Do you remember how the tales of pirate gold used to fire your imagination and make you want to sail the uncharted seas in search of treasure and adventure? And then you would regret that such things were no longer done. But that is a mistake. They are done—today and everyday—not on desert islands, but in the chemical laboratories throughout your own country. Quietly, systematically, the chemist works. His work is difficult, but more adventurous than the blood-curdling deeds of the Spanish Main. Instead of meeting an early and violent death on some forgotten shore, he gathers wealth and honor through his invaluable contributions to humanity. Alfred Nobel, the Swedish chemist who invented dynamite, made so many millions that the income alone from his bequests provides five \$40,000 prizes every year for the advancement of science and peace. C. M. Hall, the chemist who discovered how to manufacture aluminum made millions through this discovery. F. G. Cottrell, who devised a valuable process for recovering the waste from flue gases, James Gayley, who showed how to save enormous losses in steel manufacture, L. H. Baekeland, who invented Bakelite—these are only a few of the men to whom fortunes have come through their chemical achievements.

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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.—MORLAIS COUZENS.

I wish to express my appreciation of your prompt reply to my letter and to the recommendation to the General Electric Co. I intend to start the student engineering course at the works. This is somewhat along electrical lines, but the fact that I had a recommendation from a reliable school no doubt had considerable influence in helping me to secure the job.—H. VAN BENTHUYSEN.

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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 set 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.

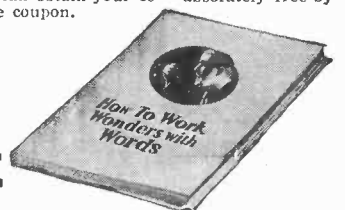
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SUPERSTITION

By HUGO GERNSBACK

ONE of the oldest and perhaps crassest of all human emotions is that described by the term of "superstition."

In this enlightened age it might be thought that this savage instinct—because that is all that it is—would have been entirely eradicated. But not so. I assert that superstition today is as great, or perhaps greater, than it was in the days of the Pharaohs and of the Caesars. In some cases, it is perhaps worse.

When we watch the savages go through their—to us so barbarous—performances, most of which are based upon superstition, we are moved, perhaps, to laughter or to pity, without stopping to think that many of us are as bad as, or worse, than the savages themselves.

There, is for instance, the *Taboo*, which, to the savage, means that a thing or object must not be touched under penalty of death. This is one of the most common of superstitions. To the savage it would probably appear equally ludicrous to see some of our enlightened citizens walking around a ladder instead of passing underneath it, or refraining from opening an umbrella indoors, or from sitting at a table with thirteen people, or yielding to many other equally foolish limitations imposed upon themselves by our so-called enlightened folk.

Most superstitions can probably be traced back to an instinct either inherited or experienced by ourselves. For instance, the fear of walking under a ladder was probably caused by a ladder falling upon some one, thereby hurting or even killing him. This information was then pandered about until people came to believe that it was actually harmful, or as we say, "unlucky," to walk under a ladder. We might as well be superstitious about walking in a street because a brick fell down at some time in the past and killed or hurt one or more of the passersby. The same logic is used in both cases.

By a curious coincidence, many great people have been affected by their various superstitions, and the greater they are the greater are their superstitions, and their stout belief in them. History, both ancient and modern, teaches that many of our greatest men were and are afflicted by this "disease", if so it may be called. A man sees a black cat walking in front of him perhaps twice during the entire course of his life, a thing purely accidental. Now perchance in these two cases something disagreeable happened to him, which, to be sure, would have happened without the passing of the black cat. But the belief becomes firmly rooted in his mind, that of course it is the cat that is to be blamed. Consequently, thereafter, if a black cat crosses his path, he knows that something unlucky *will* happen to him; whether immediately or six years later seems to make little difference in his warped logic.

While some assert that women are more superstitious than men, the male sex is just as deeply afflicted, and if the superstitions of the men are not so great in number they are as deeply rooted as in the fair sex. The woman being about the house a great deal naturally encounters more elements of the superstitious that abound in the house, as, for instance, the superstition of the broken mirror, salt spilled on the table, falling knives and forks, the cricket on the hearth, *ad lib, ad nauseum*. That these beliefs are deeply rooted in even the most modern and enlightened people is difficult to comprehend, but, unfortunately, it is true.

In enlightened America, thousands of men and women, the latter predominating, are flocking in ever-increasing number to Astrologers, Hindu Soothsayers, Gypsies, Palmists, Spiritualists, and many other fakers. The answer that you will usually get when asking one of these people why they pay out good money for such hokum is usually a laughing reply that they know that there is no foundation for the belief, and that it is done "just in fun." I personally have never been deluded by such talk, because people do not spend anywhere from 50c to \$5.00 for one of these sittings "just for fun." Unconsciously, they

do believe most of what is pandered about by these so-called "mystics", and as a rule swallow most of the findings, hook, line and sinker.

The careful investigator will always be surprised at the large number of people who believe in the ancient pseudo-science of Astrology. Before we knew anything of the movements of the planets and the stars, there perhaps was some excuse for such beliefs, but people today, just as well as those of old Egypt, still believe that it is lucky to be born on a certain day, with the stars or planets in a certain configuration; and what is more, they can usually find what they consider good proofs to back up their claims. But when they are made to understand that in each second of the day hundreds of different people are born whose destiny varies for each individual, no explanation is forthcoming. However, there is a sufficient number of people born on any single day to bring up the average figures on any common characteristics of their future that they wish to establish, if only you believe in this crass nonsense.

Palmistry, as practised by most fakers, is on the same level. I, for one, believe in palmistry just as I believe in physiognomy, or other character indications. I believe, for instance, that it is possible to tell certain things about characters, and occupation, by looking at one's hands. I need not be a palmist to identify the profession of the village smith from his hands, nor is it difficult to read the occupation of a violin virtuoso from his hands either. However, that is as far as I can conscientiously go. The faking palmist, though, insists that the lines of the hand will show your future and everything that will happen to you in the future. These things, of course, are utterly impossible and there are no authenticated cases on record, save a few coincidences. To be sure, once in a while a palmist will strike the bull's eye, by the simple "law of averages", but the hundreds and thousands that do not materialize are kept quiet and are not advertised.

In order to amuse the populace, one of the latest superstitions is to be found in the so-called "Numerology." This is the pseudo-science, wherein numbers are linked with the letters of your name, and, as is asserted by some of the exponents of this newest nonsense, if you are unlucky and if your career is not what it should be, the mere changing of your name, which, of course, results in the change of your numerals, will immediately spell "success" and "fame" for you.

As in all of the superstitions, there is a grain of truth concealed here somewhere. I can understand, for instance, that where a man has an unpronounceable name he will encounter a certain difficulty and resistance in getting on in life, but it can not count for a very great deal; because, after all, practically any family name that you can think of has some lucky or successful members, whose numerology is identical.

A great many of our superstitions are coupled with auto-suggestion and when everything is said, are in most cases harmless and do not hurt humanity as a whole, except to show us that we are still savages underneath our "modern civilization" veneer. In some cases it may even be said that some of our superstitions make us more careful and more cautious in some of our actions, so they may be considered as harmless in most cases.

Autosuggestion is a most powerful instrument of the mind. In many of our superstitions autosuggestion plays an important role. For instance, a young woman is told that she will marry a tall, dark-haired man. This makes a great impression upon her, and the chances are that when she meets a man of this type, who is at all acceptable she will be drawn strongly to him, and in many cases she will marry that type of man.

Of course she would not believe you if you were to tell her that it was autosuggestion that made her choose this mate, but she will be sure that her marriage was correctly predicted.

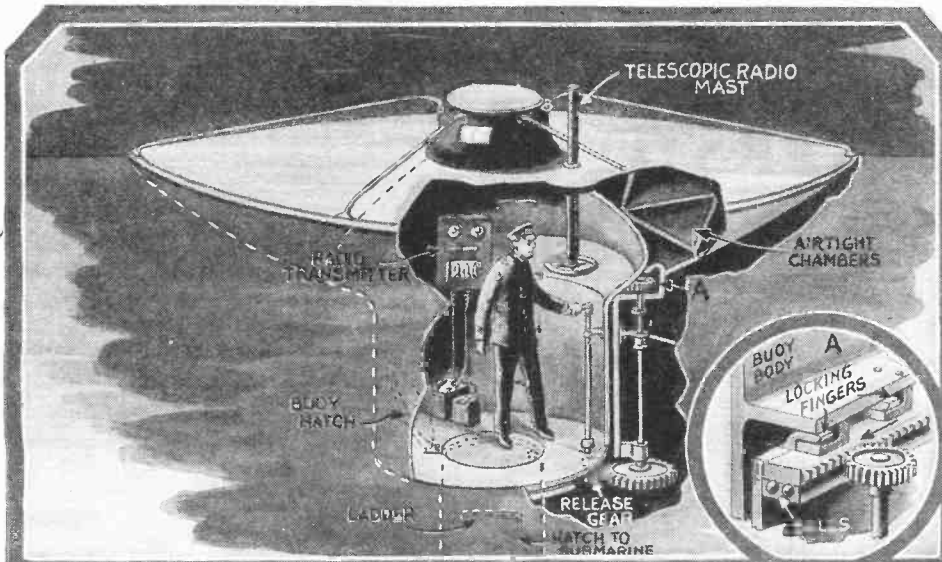
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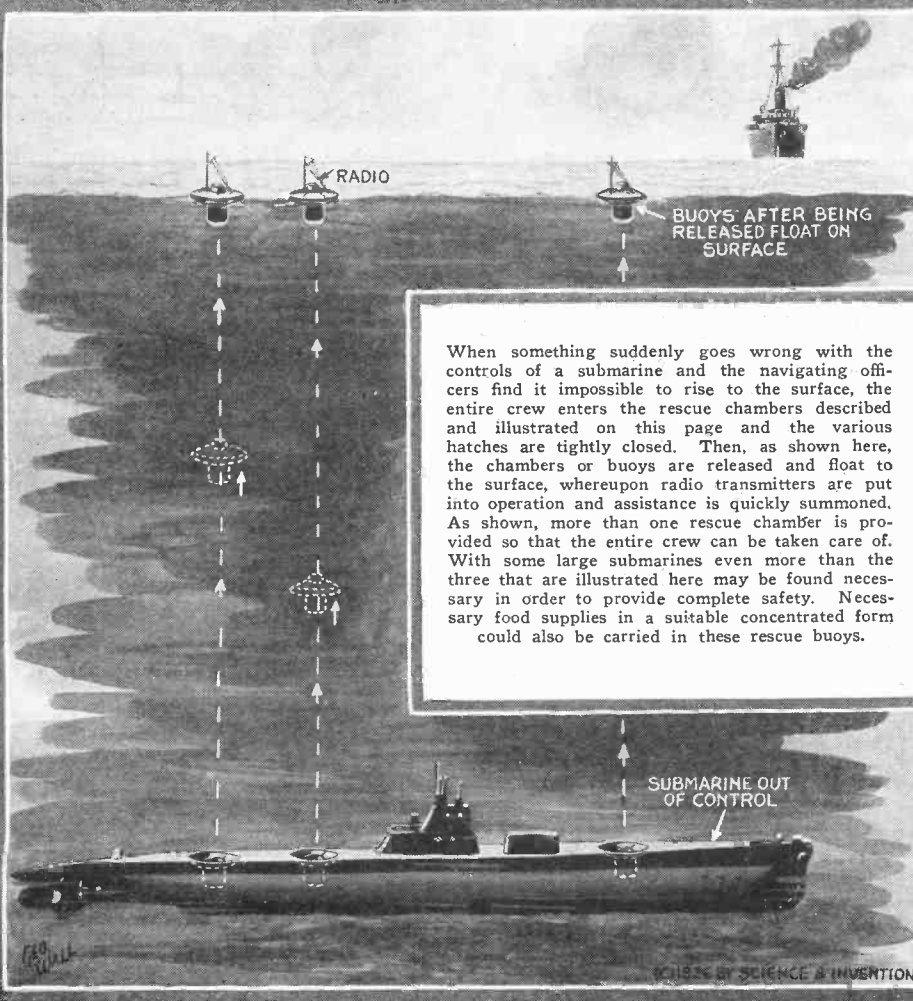
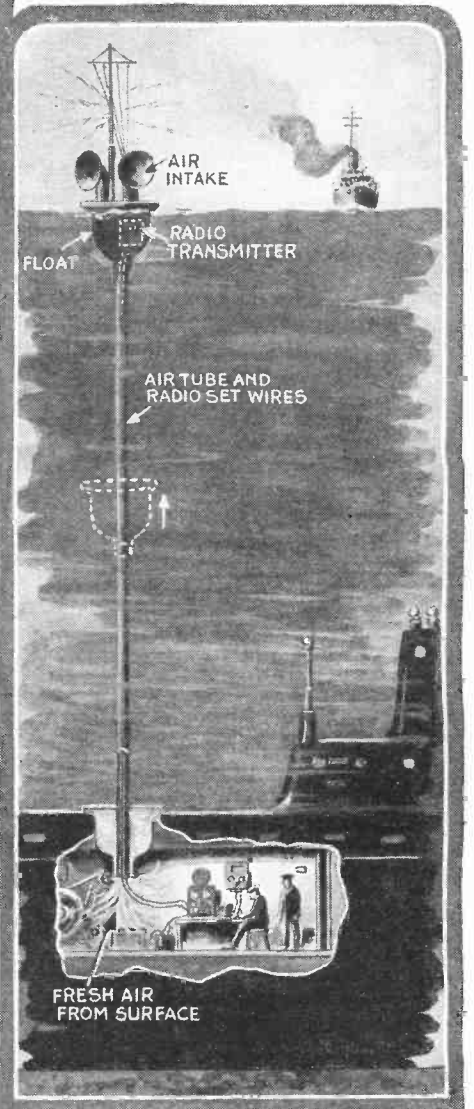
Safety on Submarines

Various Devices Described and Illustrated by Means of Which Submariners Can Escape From Disabled Submerged Vessels



AT the left are shown complete details of a patented type of submarine escape device that has been very cleverly worked out by its inventor and in which practically every emergency is provided for. This chamber, which in itself is so constructed that it will float, is designed to be one of several located at strategic points on the deck of a submarine. The chamber is so constructed that when it is entered from below and the hatch is tightly closed, one of the men within it can manipulate certain levers and release the entire chamber from the submarine whereupon it will immediately rise to the surface. The principal details of this system are shown in the illustrations at the immediate left. This device was invented and patented by A. J. Griffin.—Patent No. 1,103,958.

The device illustrated above is so designed and constructed that when fitted on the deck of a submarine it will not interfere with the maneuvering of that vessel in any way. It is firmly locked in place by means of the system shown in the insert A, and when part of the crew of a disabled submarine has entered it, a lever is turned and the escape chamber is released. The lever operates gears which in turn act on a rack and rotate the chamber slightly, thus unlocking the fingers illustrated and releasing the chamber so that it can readily rise. The mechanism is designed to operate on ball bearings so that even if a very tight fit is effected between the chamber and the submarine hull, still the release can be effected quickly and easily.

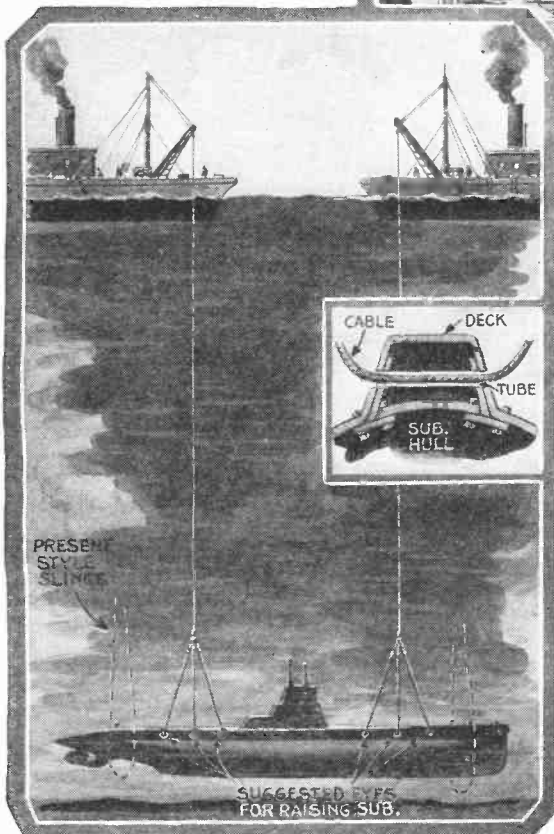
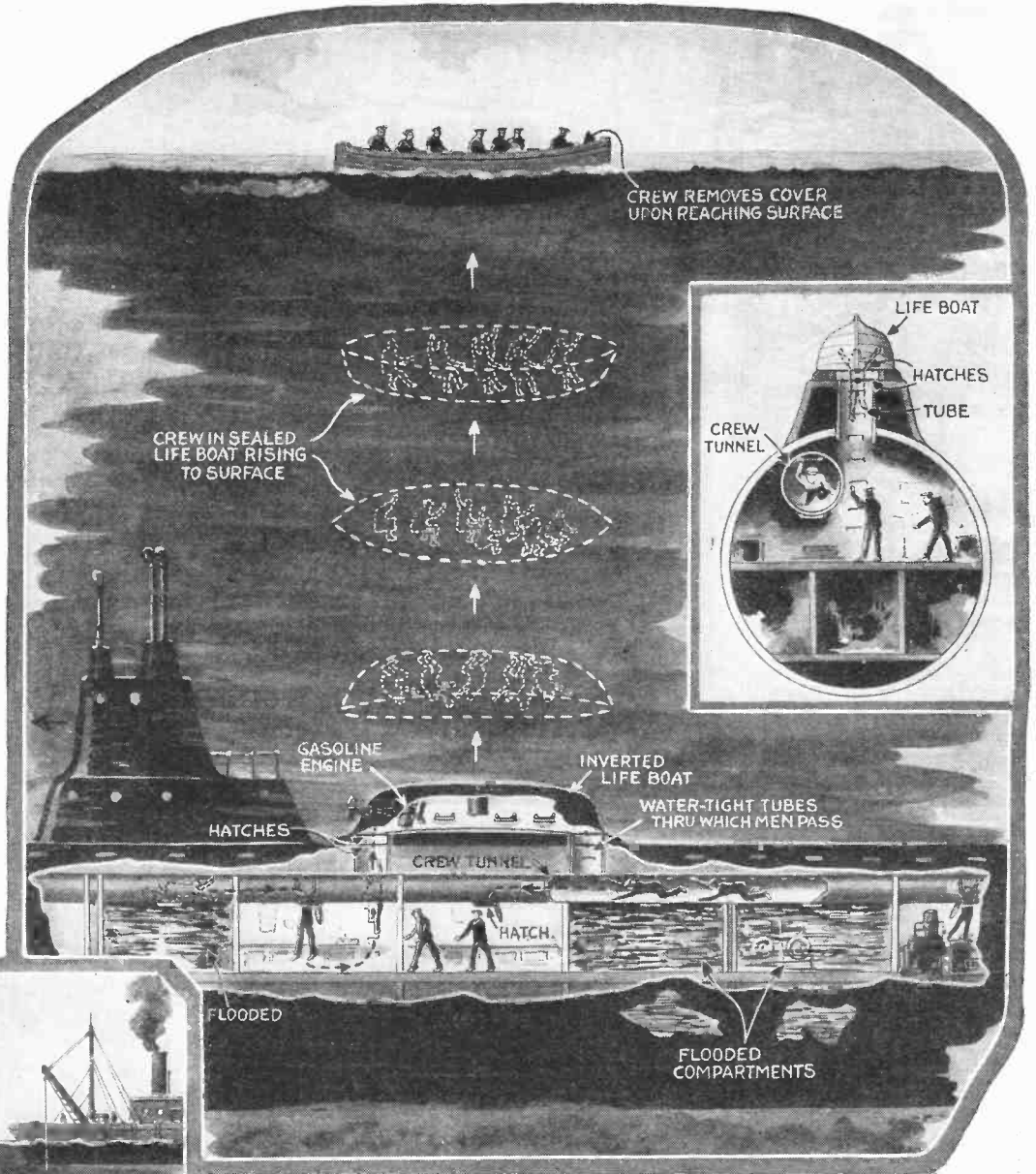


When something suddenly goes wrong with the controls of a submarine and the navigating officers find it impossible to rise to the surface, the entire crew enters the rescue chambers described and illustrated on this page and the various hatches are tightly closed. Then, as shown here, the chambers or buoys are released and float to the surface, whereupon radio transmitters are put into operation and assistance is quickly summoned. As shown, more than one rescue chamber is provided so that the entire crew can be taken care of. With some large submarines even more than the three that are illustrated here may be found necessary in order to provide complete safety. Necessary food supplies in a suitable concentrated form could also be carried in these rescue buoys.

Above: Another type of rescue device for submarines wherein the occupants do not actually escape but are provided with air and with means of radio communication by means of a float that is released and allowed to rise to the surface, carrying a flexible air tube and control wires for a small yet powerful radio transmitter built into the float. When the buoy reaches the surface, collapsible radio masts and air intake funnels can be erected and the navigators of the submarine can summon assistance. —Lyman Mason.

Due to Several Recent Submarine Disasters, These Rescue Methods Should Be of Timely Interest

WHEN attempting to raise submarines to the surface after they have been wrecked or damaged and have descended to the bottom, the usual method of placing slings around the vessel is often found to be inadequate for the work at hand. Other methods have been suggested and tried but as often as not have been found totally unsatisfactory. We only have to refer to the recent attempts to raise the S 51 to realize that the present-day methods of combating the ever-present menace of submarine disaster are not capable of producing the desired results. Therefore, we suggest in the illustration below, a method of constructing submarines so that they could be readily raised to the surface when it is impossible to bring them up under their own power. In dotted lines, the present style of sling are indicated. Our method is to equip the hull with specially designed protuberances through the sides of which holes are drilled and through which holes, strong flexible cables are to be passed. Using this system, it is impossible for the cables to slip and the chances of eventually salvaging damaged submarines would be greatly increased. The suggested constructional work would of course be done when the submarine is originally made and the cable holes would be an integral part of the submarine framework.



ANOTHER inventor, E. R. Kimball, has advanced the theory of submarine rescue illustrated in detail above. Mr. Kimball's idea covers two important phases of the subject. First, he would connect all of the separate watertight compartments of the submarine by means of a tunnel of sufficient size to allow a man to crawl through. In each compartment there would be a watertight entrance into this tunnel which would be kept locked at all times except when it was to be used as an emergency exit. The second part of the scheme is to place at intervals along the deck of the submarine, inverted boats with sealed covers and with watertight tubes communicating with different compartments of the submarine and with the inverted life boat. In time of an emergency, let us assume that, as illustrated above, three of the submarine compartments are flooded. Those of the crew who are alive and are stationed in the other compartments would immediately pass into the communicating tunnel and proceed into one of the compartments with which one of the tubes to the life boat communicates. They would then pass up through the tubes into the life boat and when all were assembled, they would close the hatches and release the life boat from the surface of the submarine. The inverted boat would then be released from the deck of the submarine whereupon it would immediately start to rise to the surface and by the crew shifting their weights as shown, the boat would be in an upright position when it arrived at the surface. Then, of course, the watertight cover would be immediately removed, the gasoline engine would be started and the crew would proceed in their life boat to find assistance.

There are many other refinements possible for this idea than those that we have shown in our simplified diagram. For instance, provision could be made for forcing water out of flooded portions of the tunnel and out of flooded life boats in case such an emergency should arise. Of course, more than one life boat could be placed on each submarine and in this case the chances for rescue increase.

MEDICAL FRAUDS

By JOSEPH H. KRAUS

Beware of the Cures Claimed Here. They Are Fraudulent

An ancient "quack" at work.



How a popular and expensive "medicine" used by the old Egyptians was imitated by treating meat with melted pitch.

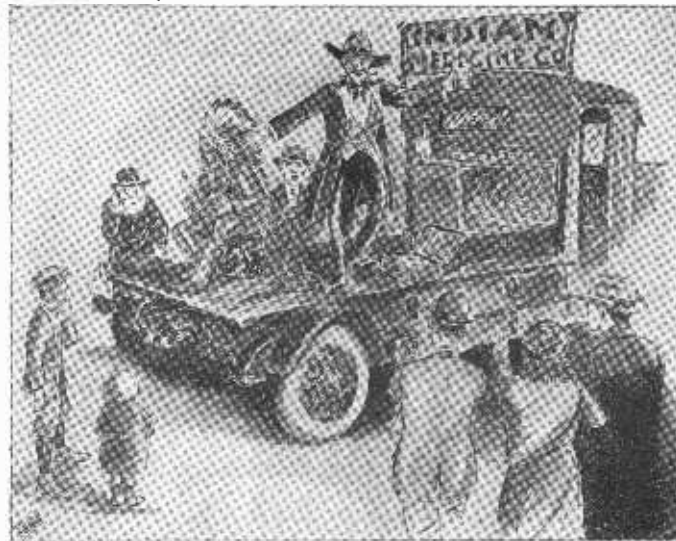
THROUGHOUT all ages of the world people have suffered from diseases, imaginary or real, and they have usually recovered, either spontaneously or with the aid of proper remedies. It is not always possible to decide in any given case whether the natural power of recovery which the body possesses has brought about a cure, or whether the treatment alone, or whether both together have been effective. But in most cases the influence of the imagination and belief is easily seen. Every physician of experience has had cases in which his treatment has benefited his patients much more than he had reason to expect. On the other hand, a patient may suffer for many years and receive treatment from the best doctors in vain, and then suddenly recover after using some patent medicine, which he then recommends to all of his friends. The little pink pills he has been using then become a panacea.

GOVERNMENT CHECK ON FRAUDS

Eventually, however, the Government chemist or the medical societies analyze the pills, only to find that they contain a little sugar and some pink coloring matter, together with a small amount of purgative drug. The pink pill cannot possibly do what is claimed for it, and the preparation is removed from the market.

The statements just made no doubt sound absurd, but our treatment of various ailments today is far less peculiar than the treatment employed when the United States

were first founded. As a matter of fact, I have in my possession a book bearing the copyright date of 1900, which describes the treatment of warts in the following terms: "When there is a full moon in the sky, go to a graveyard and find a hollow trunk of an oak tree, or the hollow stump of an oak tree, in which a small quantity of rain from a previous downpour has remained. Dip the hand in the water in the stump of the tree, then walk around the tree stump three times, being sure that you walk to the left. When your own shadow crosses the hollow in the stump, after you have walked around the tree stump three times, dip your hand in the water again. Then go home, but do not speak a single word to anyone until the



The vender of rattlesnake oil is a rare sight today, but it was not so many years ago that he did a thriving business in even the large communities. The oil is still sold by an occasional medicine man, but his numbers are few, and steadily decreasing.

following morning. If one treatment does not cure, another attempt should be made."

DECEPTIVE CLAIMS OF CURES

Such a method of treatment is as absurd as it is worthless, but a drowning man grasps at a straw, and most of us, when we are ill, try those cures which others claim they have found to be so wonderful. Not infrequently, testimonials of cures which have been effected, when carefully checked up, will be found to be inaccurate. In many cases, the sufferer will have died of the very disease which his testimonial indicates was cured by one or the other of the various preparations.

Fully two thousand, five hundred years ago there were *faith healers* that were making the same pretenses that Emile Coué is making today with his "getting better and better every day." Is there any hope that mankind will ever be any different?



Signs in drug store windows are often very deceptive. Be guided only by the claims made on the packages containing medicines, as such statements are under government control.

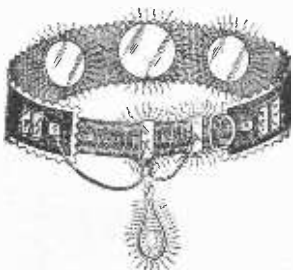
VARIOUS REMEDIES

There are, of course, some but not a great many, substances that are absolute remedies. Quinine, known for three hundred years, is a specific for malaria. Mercury is seven hundred years old, and arsenic two thousand, five hundred years old; both are agents of known value. There are a great many others which help, even if they do not cure.

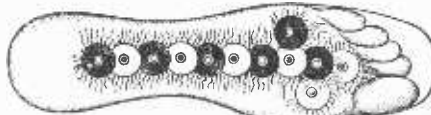
ANCIENT MEDICINES

Let us for a moment drop back into the olden times when medicine was not as far advanced as it is today. Some four thousand years ago, the Egyptians had a whole series of what they thought to be remedies for nearly every disease that flesh was heir to. There were more than seven hundred drugs employed in Egypt. Not a single one which the Egyptians employed is now in use, but the Egyptians were deceived, as we are being deceived today into believing that each and every one of the drugs was capable of bringing diseased individuals back to health. During the Crusades, preserved portions of the bodies of old Egyptians were considered to be powerful medicines, and "mummy" was frequently prescribed as a cure-all for any disease. "Mummy" was expensive, so "patent medicine sharks" in those days, if they may be called that, took ordinary meat and impregnated the meat with pitch. Then they palmed this off as the genuine article. Testimonials declared this remedy to be marvelous. Then there was another substance called "Usnea" in pharmaceutical language. This was moss which was scraped from the skulls of persons

(Continued on page 1144)

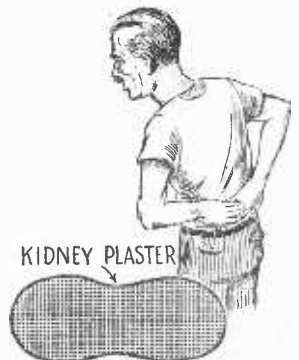


Did you ever wear an "electric belt" such as illustrated at the left, in hopes of curing a disease? If so, you undoubtedly found that it gave no relief and was a fake.



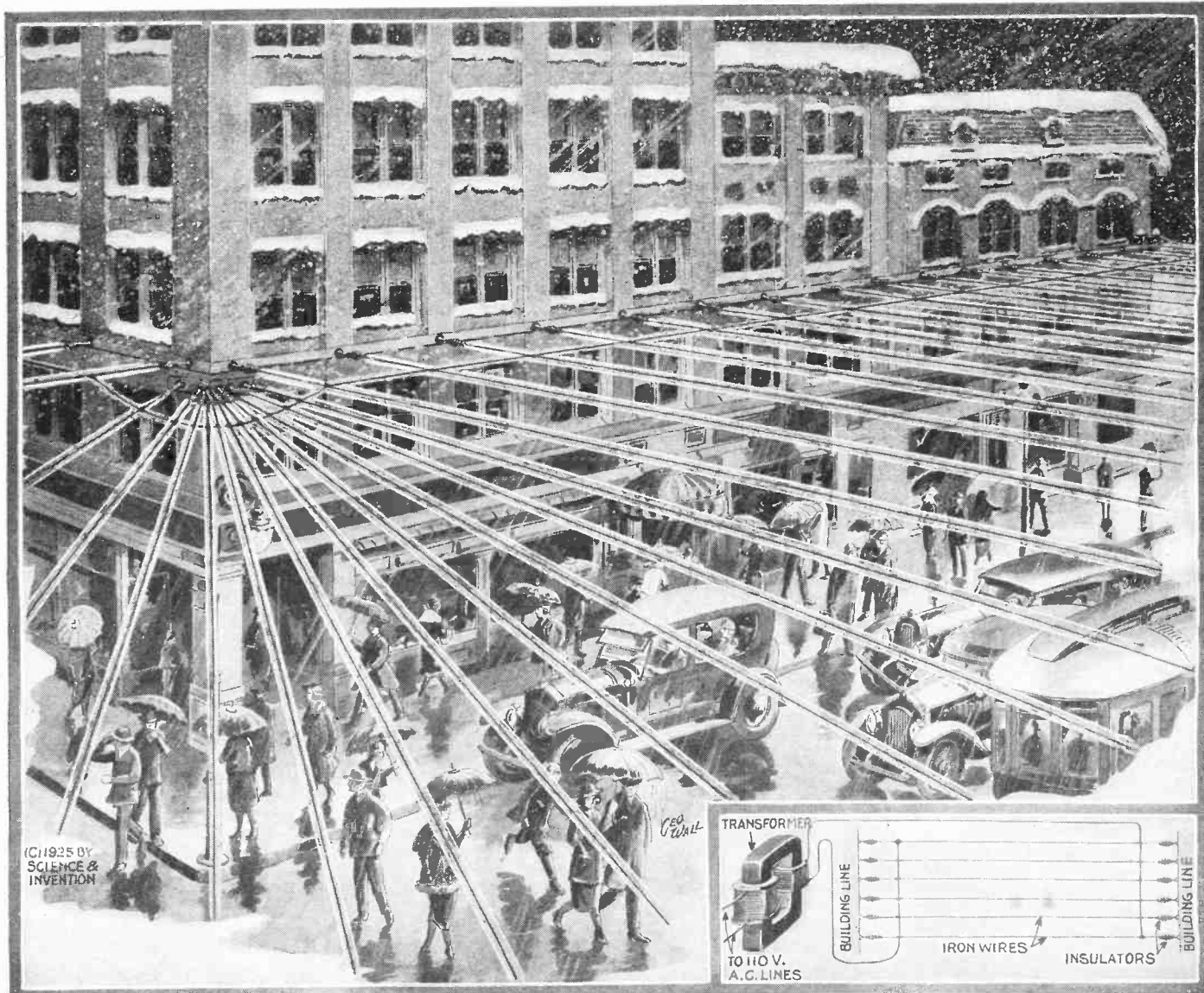
So-called electric insoles for shoes are illustrated above. They contain disks of dissimilar metals but there is no beneficial electrical action that takes place in them.

Kidney plasters and liver pads, designed to relieve all ailments of the back and cure many diseases are useless. Money spent in purchasing them is money thrown away. Usually the pains that are so treated are merely of muscular origin, and not of the kidneys.



Electric Snow Eliminator

By J. KAY LONDON



Above is shown an artist's conception of how the proposed electric snow eliminator would work. The system consists of a fanlike arrangement of wires stretched across the streets and thoroughfare. The wires are preferably made of iron or some other electrically resistant material, which

will develop heat when current is passed through it. As a safety precaution current at low pressure is used, so that should a wire break, there will be little danger to pedestrians, even though the current were not turned off immediately after the break. The small insert shows the circuit to be employed.

WHEN winter comes and the snow lays heavy on the ground great sums of money are lost because of traffic tie-ups and many tons of perishable merchandise go to waste. This condition affects the greater cities more vitally, than it does the outlying districts, because the latter generally provide within their homes for weather conditions, whereas the former are dependent on a daily purchase of commodities for their welfare. For this reason the large cities go to a great expense in removing snow as rapidly as it is possible, but even the highly efficient departments in these cities could not cope with a situation similar to the snowfall in New York City in 1888, when the snow was banked more than ten feet high in many places. Naturally such a snowfall closes all shops and interferes with the use of elevated trains and street cars, as well as other means of surface transportation.

If, however, we had all the main thoroughfares wired with a net-work of iron wires located approximately twenty feet above the street level, and if these wires were connected to sources of current supply at as low a potential as twenty volts, it would be possible to heat the wires sufficiently to melt any snow falling upon or near them.

Such a system is illustrated above and the diagram is likewise given. It will be seen that the device could easily prove satisfactory. The falling snow reaching the vicinity of the wires stretched across the streets is melted by the hot wires and falls in the form of raindrops to the sidewalk below. Now unless the outside temperature is exceptionally low, this partially warmed water will melt any snow which should happen to fall through the wires outside of the heated area. Thus the walks and thoroughfares are kept clear of snow and pedestrians use their umbrellas as they would on any rainy day. Such a system would likewise keep the streets a little warmer than they are on some of the wintry days.

The installation itself would not be very expensive. Insulators would have to be attached to the walls of buildings about twenty feet above the street level and iron wires would then have to be stretched from one side of the street to the other. Iron wires, of course, are quite cheap, but any other resistant material might be used in place of the iron wires. These wires are then connected together at one end with a bare copper wire, and this lead terminates at one of the poles of a step-down transformer. The

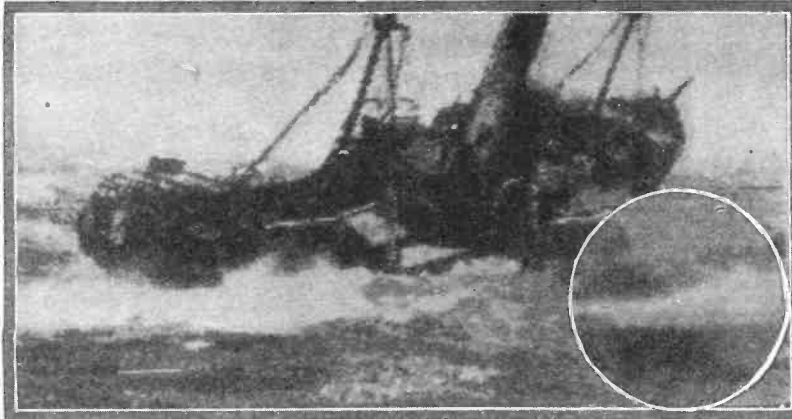
other output side of the step-down transformer connects with the iron wires near the buildings on the opposite side of the street.

The question of current supply is now important. In those cities where hydro-electric power development has been organized by either the city itself or by some large company, the electric power supply is quite cheap and the cost of operating such an installation would be very low. In fact the expense for operating a system of this nature would be cheaper than attempting to remove the snow by any of the snow removal methods which we now employ.

It remains to be seen whether this method would cope with very heavy snowfalls when the surrounding temperature is considerably below freezing. It might even be advisable to place ordinary switches in the circuit so that when the outside temperature falls to let us say ten degrees below freezing, the device would be shut off and in this way slippery streets would be prevented. Should one or more of the wires break, the possibility is that the cooling effect of the air would prevent a burn if the wire dropped upon the pedestrian. At a potential of twenty volts, accidental electrocution would be impossible.

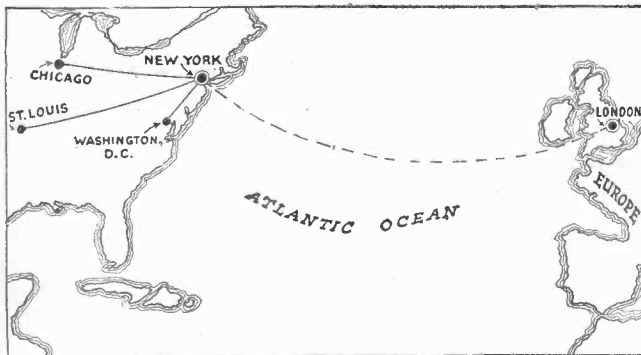
"Antinoe" Sinking Cabled Across the Atlantic

By H. WINFIELD SECOR, E. E.



At the left appears a picture of the foundering "Antinoe" as cabled from London to New York over the regular cable system. As shown on the right hand page the perforated tape containing the proper sequence of signals was made in London from the original snapshot of the "Antinoe." As the enlargement in the small circle shows, every part of the picture is composed of square dots similar to those of a half tone. These dots are of varying degrees of light and shade, and owing to their small size a faithful picture is built up as becomes evident by viewing the accompanying reproduction at arm's length.

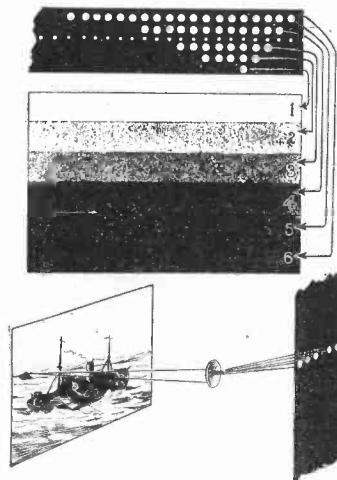
Photo at right shows machine for reproducing photo as well as preparing transmission tape in New York office of photo syndicate service. Man in center is Captain M. D. McFarlane, who in collaboration with H. G. Bartholomew of the "London Daily Mirror," evolved the Bartlane system of transmitting photos by radio or cable. The pictures may also be transmitted over telegraph lines if desired. The man at the extreme left of the picture is C. F. Willis, Bartlane expert, and man at right is F. S. Millar of the Western Union Cable Company. The photo shows first picture being received from London, September, 1925.



Map at left shows present facilities in actual operation for transmitting pictures such as "Antinoe" across ocean and to all parts of U. S.



The diagram at the immediate right shows the tone scheme employed in this process. It should be remembered to begin with, that no special cable transmitting or receiving apparatus is necessary. The snapshot received in London by airplane from the S. S. "President Roosevelt," was hurried into the Laboratory, and five prints on zinc were made from the negative, each of a different exposure, giving the five principal tones of light and shadow. There are really six tones obtained in the complete process, as the diagram at right shows. The five prints on zinc leave certain parts of metal exposed and an electric circuit is established through these portions, corresponding to lights and shadows, each registering on certain perforators as shown on opposite page. The cable company receives the perforated tape, transmits its readings across the ocean, the new tape being delivered to the New York laboratory, and reproduced as a picture in the manner shown. A marvelous concentrating lens combines the light rays in the reproducer to make square dots of varying tone values.

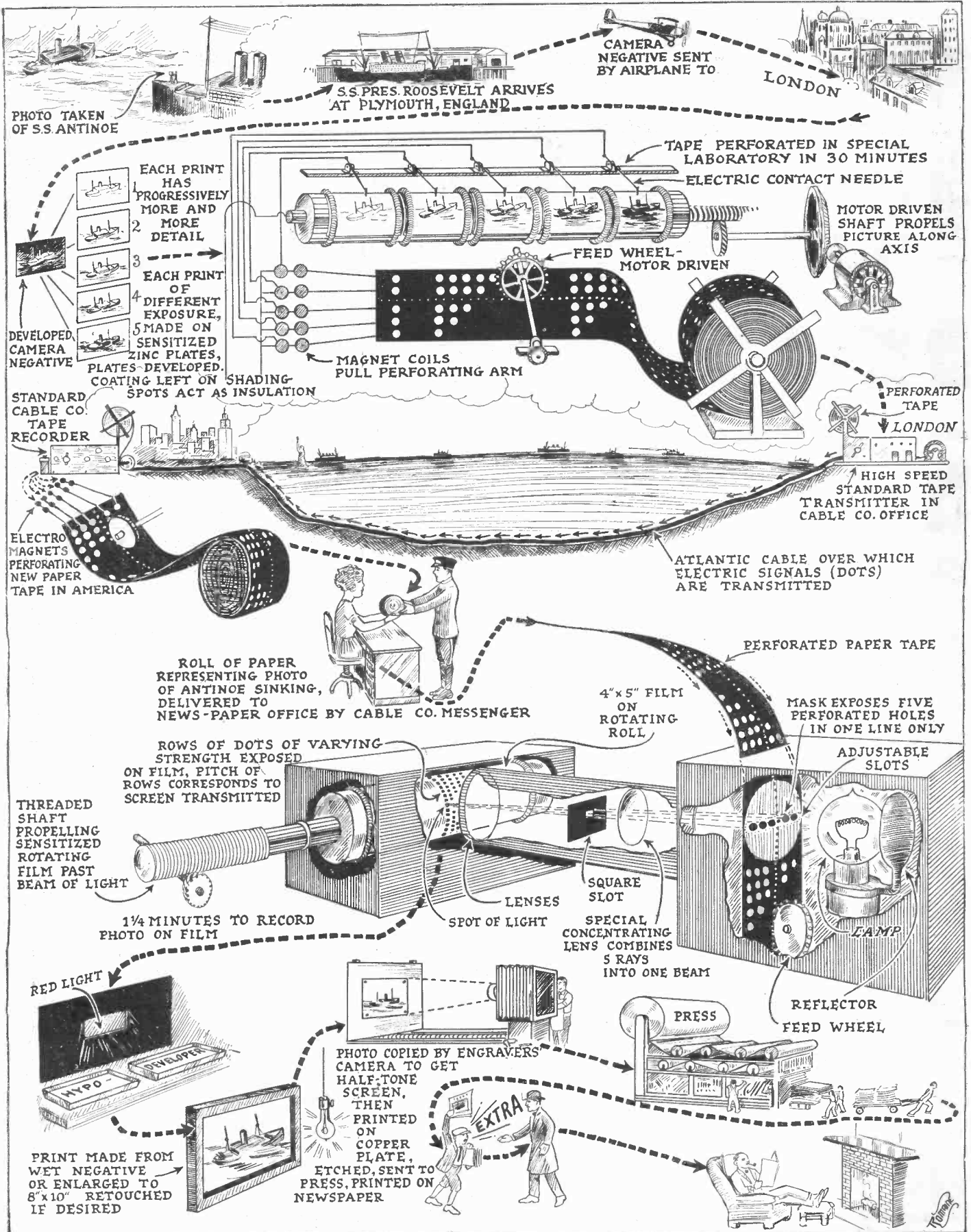


Above we see the smiling face of New York City's new mayor the Honorable James J. Walker, as reproduced in London papers from a picture cabled across the Atlantic from New York. Did you notice the art border around this page? It is composed of five feet of the perforated paper tape, a small part of the two hundred and seventy feet of tape required to transmit Mayor Walker's picture across the Atlantic.

The tape forming the border of this page and comprising a part of Mayor Walker's photo shown above, is just one-half the width of the actual tape used. It takes a relatively short time to prepare the five tone negatives from the original picture in the transmission laboratory, and the tape sig-

nals for photo are transmitted across the ocean in a few minutes. Once the tape is placed in the reproducing machine it requires but one and one-fourth minutes to record the picture on the film, develop and fix it, and obtain a print from the wet negative.

How Photos Are Cabled Across Atlantic



When the crew of the S. S. "President Roosevelt" was rescuing those on board the S.S. "Antinoe," a photograph was taken of the latter vessel. This photograph was subsequently sent by cable to the United States for publication. The above illustrations shows the various steps in the transmission. Five prints were made from the negative on zinc sheets. These were then developed and by the process used, the shaded parts were insul-

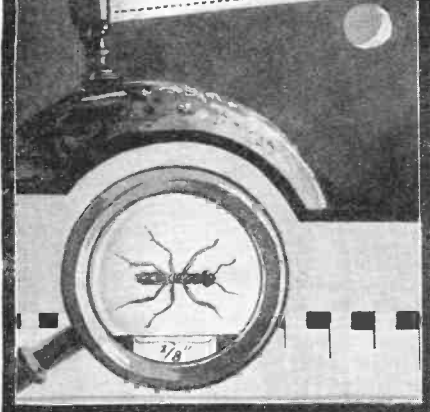
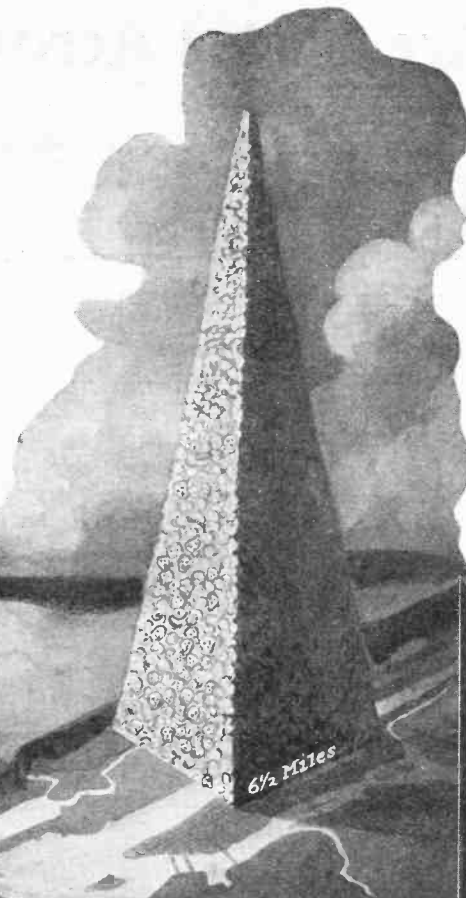
ated from the metal and the light parts were not. Then, as contact needles were passed over the surfaces as shown, circuits were made and broken and the tape was perforated. These perforations were transmitted in the usual manner, received and recorded. The recorded tape was then photographically impressed on a sensitized film in the special manner illustrated. From then on, the process is plain.

Can the Dead

By HUGO

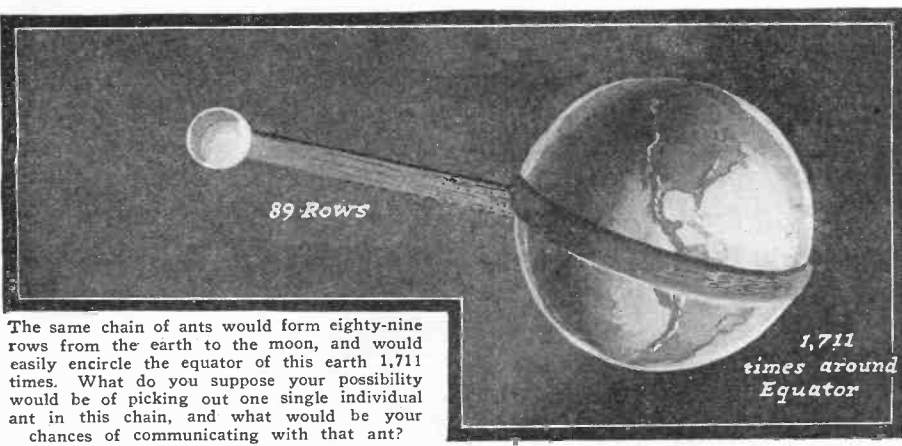
Member American

In this very interesting and comprehensive article by Mr. Hugo Gernsback, the subject of communicating with those who have passed over the borderland from this into a future life is taken up, particularly as it appertains to the possibility of communicating with others in the spirit world, who may have passed along the road to that mysterious land, sometime before you yourself take the journey. Assuming that only a quarter of a million years have elapsed since man first trod the ground of this planet, and assuming that all of these shells which we call bodies and which house that indescribable something called the soul, were piled up in the form of a pyramid, that pyramid would reach a height of nineteen and one-half miles, and would have a base six and one-half miles square. This pyramid would eclipse the world's highest mountain, Mt. Everest, which by the way has never been scaled by man.



Let us assume that the souls of men are only as large as an ant, one-eighth of an inch long, and that these are placed end to end. This chain of ants would reach out into space for a distance of 21,390,769 1/2 miles. It would take a beam of light one minute and fifty-four seconds to reach the end of the chain.

The question of the possibility of communicating with a spirit, while you yourself are in the spirit world, is taken up in the accompanying article from a purely scientific viewpoint. No attempt is made to dispute religious beliefs and there is no desire to attack any religious doctrine or teaching. The question of the hereafter is not discussed and is accepted on its face value. The main subject under discussion is the possibility of communicating with some single individual in the spirit world. The particular form of communication is also not given in this particular article. It is assumed that communication may take place in any of a variety of ways known and unknown to us today. The questions are looked upon purely from the standpoint of chance possibilities and your chances of effecting those communications have been calculated the same as Hoyle calculates your chances of getting a straight or a royal flush in a game of cards. If the doctor told you that you had one chance in ten trillion of living another twenty-four hours, the outlook would be quite hopeless. Well, you have less chance than that of communicating with a departed spirit!



The same chain of ants would form eighty-nine rows from the earth to the moon, and would easily encircle the equator of this earth 1,711 times. What do you suppose your possibility would be of picking out one single individual ant in this chain, and what would be your chances of communicating with that ant?

BEFORE I go further, I wish to make it plain here that nowhere in this article do I attack any religious belief, or take issue with any religious doctrines. I wish to show here merely my own impressions on the subject, approaching the problem from a scientific and mathematical viewpoint. I believe that whatever new ideas can be brought forward in an all-absorbing topic of this kind should be welcomed by all.

I shall not question the hereafter nor discuss the question of the existence of the soul in any way; but I do believe that consideration of certain angles of the subject will do no one harm, and perhaps give rise to some interesting discussion of this problem.

As far as science knows, the human race has been on this planet some 500,000 years or more. When I say "human race" I do so advisedly. For instance, the human being who existed 500,000 years ago is known to science as Pithecanthropus Erectus. This first, so-called "ape man," of Java, gives science its first idea of what our remote ancestors were. If he was a being who could speak, orally, he must be called a human being. But we need not look back quite so far; and for the purposes of this discussion I shall go back for only 250,000 years; at which period we are certain that there were human beings on this planet imbued with a fair degree of intelligence, and possessed of what we are pleased to term today "soul". This is in contradistinction to our closest relation, the ape, who, in popular belief, is thought of as not being possessed of a soul.

It is upon this platform that the present arguments are being reared. It can be shown that for 250,000 years or more the population of the earth has not varied very greatly. While, perhaps, the population at that time was not 1,748,000,000,—which is the population of the world today,—it probably was well over 1,000,000,000 (one billion) for the following reasons:

It is well known that the fecundity of aborigines was much greater than that of civilized man. For instance, at present it is to be doubted that the average family has more than three or four offspring. Hundreds and thousands of years ago this was not the case, the number of children being very much greater.

It is also true that even as recently as 2,000 years ago, people did not live as long as they do now, and died comparatively young. Diseases had not been conquered, and people died like flies, due to plagues and infantile diseases, as recorded in history. Counteracting this, there were many more births than there are today. Modern man, who is beginning to conquer diseases, does not have as many children as were customary at that time; so while it would seem that we should have a vastly larger population today, it remains fairly constant. In China and India, even today, there are still a great many more births than in the western civilizations; but these are immediately offset by devastating diseases, famines, etc., which kill off so many more people. The balance is therefore adjusted very nicely by Nature.

Careful computation shows that the yearly deaths for the entire planet take 43,369,813 lives out of the 1,748,000,000 inhabitants. If we take this yearly figure and base our calculations upon 250,000 years, as already mentioned, we shall get the figure of 10,842,553,250,000. This is a tremendous number, far greater than is possible for

Be Re-United?

GERNSBACK, F.R.S.

Physical Society

the human mind to comprehend. The figure, nevertheless, must be fairly approximate, but even if it should vary from the exact number by a few billions this would make very little difference for the purposes of this discussion.

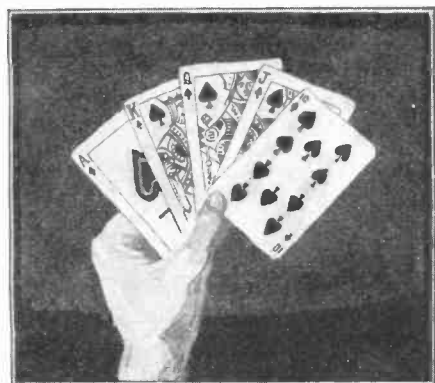
We are now confronted by the fact that if, during the past quarter of a million years, ten trillions of souls have passed into the Great Beyond, these ten trillions must still be floating around somewhere in space, if there is such a thing as a Hereafter.

Life insurance figures, carefully calculated, show us that the difference between the "expectancies" of man and woman averages a little more than two and a half years. By this we mean that the average chances are that when you die, your wife, if of the same age, will die two and a half years later. These, of course, are only average figures.

Let us now take an average case: Tom Jones, a man of very religious nature, believing in the soul and the Hereafter, dies today. His spirit, according to his belief, will therefore pass immediately into the Great Beyond. In all probability, his beloved wife, whom he sincerely hopes and prays to meet in the Beyond, will follow him not much less than two and a half years later. The problem then becomes "What are the chances that she will meet him in the Hereafter and again be united with him?" If we assume that Tom Jones, after he passes into the Great Beyond, retains his perceptive and reasoning powers and can remove himself to any point on this globe, the discussion must stop right here; because the probability then would be that he would certainly be near the locality where his wife lived but recently, and the minute she died and passed into the Hereafter, he would meet her instantly. That, of course, would end the problem to the satisfaction of every one. There would then be no discussion.

But let us go a little further. Some ecclesiastical writers and theologians believe that the soul has some shape, and for that reason must assume some dimension. Whether these dimensions are absolutely fixed or not need not enter into this discussion at all; but with ten trillion souls abounding somewhere above the planet, it must be assumed that there would be practically no standing room,—if we may use such an irreverent term,—for any of the souls.

While the earth is inhabited to a great extent, yet there are still not so many places where people actually live. There are, of course, isolated farms, and mountain tops, where the number of people who have actually died has not been very great. But take any of our crowded regions, as, for instance,



A "royal flush" comes once in 649,739 times (Hoyle). Your chances of getting one are 16,686,166 times better than your chance of communicating with a single soul.



Somewhere in the Atlantic Ocean a ship is sailing the high seas. Someone on board that ship throws a bottle into the ocean. Anywhere else in the world a person goes down to the shore to look for that bottle. What do you suppose your chances of finding that bottle would be? Remember it does not make any difference where the ship was or where you were when you looked for the bottle which measures $4 \frac{5}{16}$ " in diameter.

in Europe; and if you go back for some 250,000 years it will be found that there is not one spot, that has not been at various times inhabited by thousands upon thousands of people, who have long since died. Do their souls stay in any particular spot, or do they roam around, after reuniting, or not?

This question should not trouble us a great deal, because it can be answered to the satisfaction of all by any one who has religious beliefs. But I wish to point out here that it can not be denied that there must be a great deal of crowding in the Beyond, unless the reunited ones float on to the outer space, never to return. This, of course, would make it much simpler for those who also pass away, if we assume such a condition. It would seem more rational, however, that, having passed from this life, the departed souls would stay or hover around the planet.

If we assume this, we immediately become conscious that somewhere around the planet there are continually floating some ten trillion souls.

If the departed ones mingle with those who have already gone into the Great Beyond, what are the chances of the ones who die two or more years later to be reunited with their beloved ones? Again I shall be told at this juncture that souls, by means not known to us, are able to communicate with each other instantaneously, no matter where they are. If we ascribe this supernatural power to the departed souls we have no problem; because if even one lone soul arriving among ten trillion others scattered anywhere in space, were endowed with telepathic powers, the reunion would be very prompt. But of course we are not positive that the departed ones have such power; and without wishing again to deny this, let us assume that they have no such power. What, then, are the chances of one soul finding another one?

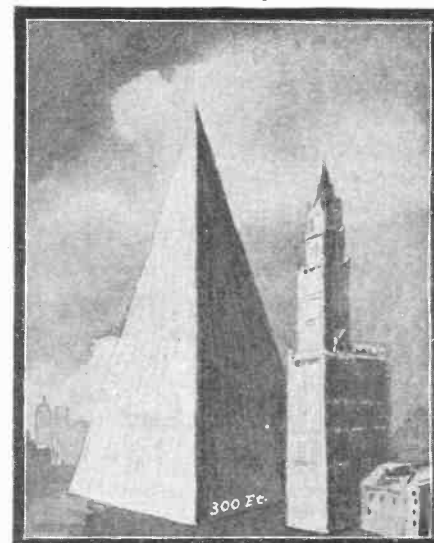
This becomes a simple problem of mathematics, and may be stated as follows: In a poker game, a royal flush comes once in 649,739 times, according to Hoyle. Your chances of getting a royal flush, are 16,686,166 times better than your chances of communicating with a particular soul.

If the departed soul has any dimensions, it may be as big as a planet or bigger, or as small as an electron, or smaller. If it had the size of an ant, or, let us say, was one-eighth of an inch long, and if all the ten trillions of souls were placed end to end, this distance would be 112,943,263.020 feet, or 21,390,769½ miles, almost 90 times the distance from the earth to the moon, or about 1,711 times around the Earth's equator.

(Continued on page 1151)



Now we see a man down at the shore looking for a bottle which may have been thrown overboard off the coast of Africa. This man approaches the nearest shore line to his home, and with a pair of spy glasses which restrict his vision to a circle $4 \frac{5}{16}$ " in diameter, he looks in eleven places and has just as much chance of finding it as he has of communicating with a spirit.



A needle is concealed in the haystack here shown 900 feet high. Do you suppose that you would be able to find a 2½-inch needle in this pile of hay? If not, do not expect to be able to communicate with a departed spirit.

Electro-Chemistry Restores Ancient Bronzes

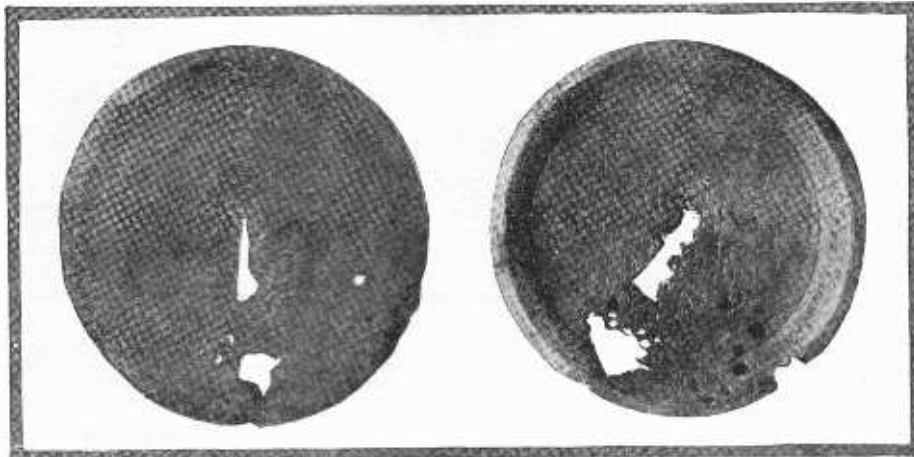
Crumbling Statues From Ruins Of Bygone Centuries Can Now Be Restored To Their Original Grandeur



Above: Corroded statue before it was treated to restore it to its original appearance and form.



Above: A fully restored bronze statue reclaimed by the electro-chemical method described here.

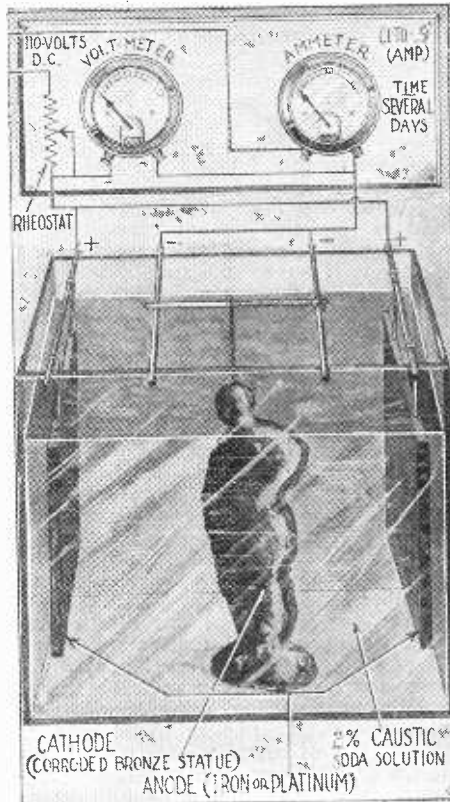


On the bronze plate shown at the left above, it is almost impossible to see any of the hieroglyphics. However, after it has been restored, as shown on the right, by the electrolysis method, practically all of the inscriptions are visible and can easily be deciphered.

THE cleaning, repair and restoration of ancient art objects has always been a most interesting subject, but up to the present time the methods that have been followed have been rather haphazard and as often as not have resulted in failure or complete destruction of valuable material. It is obvious, upon consideration of the subject that a good method of restoring bronze objects will be of great interest to antiquarians and museum directors throughout the world, inasmuch as not only statues and other bronzes that have been found in excavations in ancient cities have suffered, but more modern bronze objects are often badly corroded due to exposure to the atmosphere and the elements. The application of acid and other similar corrosive agents to such works of art often is disastrous in results. Mechanical methods of removing incrustations are so crude that parts of the objects are frequently damaged beyond repair.

A study of this subject has been undertaken by Prof. Colin G. Fink and Charles H. Eldridge of Columbia University and the results of their findings have been published in a pamphlet issued by the Metropolitan Museum of Art, in New York City. In essence, the new method that has been discovered utilizes reverse electrolysis. It has been found that in practically all cases, the corrosion on the surface of metal objects is a metallic salt and by an electrolytic method, these salts have been reduced to give their original basic element, that is the metal, and as a result it has been possible to restore corroded metal objects to their original contours, even in the original metal. It has been found that the details of design or workmanship have been preserved and followed exactly by the layer of metallic oxides covering the objects. Over this is usually found a crust formed by electrolytic decomposition and by reversing the process of electrolysis, this crust can be removed, and the oxide reduced to metal.

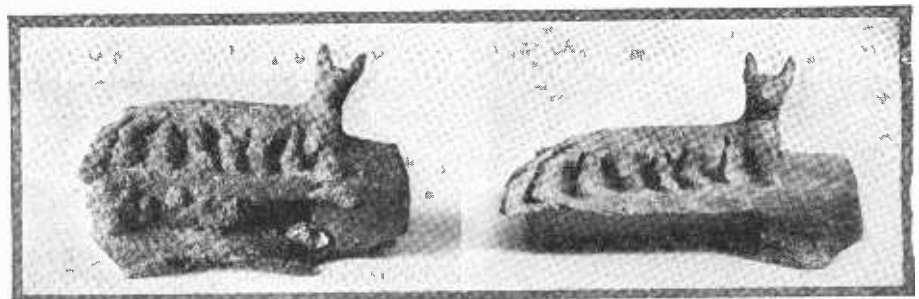
By following the method described below, it has been found possible, not only to restore partially corroded metallic objects but also to bring those back to their original form that have been wholly oxidized. In other words, even though there is no metal present, the oxide can be changed so as to present the original form. The first step in this process is to hang the bronze object



This diagram shows the details of the electro-chemical method employed in restoring ancient bronzes of various types.

in a 2% caustic soda solution as the cathode of an electrolytic couple, and pass a low amperage direct current through the solution. Two anodes are used, iron duriron or platinum, and they are hung on opposite sides of the object. For small parts 0.1 to 0.5 amperes are employed. By the action of the electrolysis, the crust is reduced to spongy copper. The object is then removed from the solution and carefully washed in warm water. If now there is a metallic base to the object, the reduced spongy copper layer may be removed by gentle brushing. If, however, there is no metallic core, the object is dipped into a solution of 1 part of nitric acid to 4 parts of water, and into water alternately over and over again, until the reduced outer layer of copper is dissolved. Soon the hard copper oxide surface in which is found the detail of the design is exposed and this surface is found to be almost as hard and smooth to the touch as was the original metallic surface of the bronze itself.

The various photographs shown on this page illustrate the wonderful results that can be obtained by expert manipulation of the process described above. For instance, note the bronze plate in the illustration at the top center of this page. When originally discovered, this relic was practically valueless because the inscriptions upon it could not be deciphered. When restored by electro-chemistry, there was no trouble whatsoever in determining the exact history of the antique plate.



Another example of a restored bronze art object is shown in the above photographs. At the left, the destructive corrosion can readily be seen. No details can be discerned. At the right, the photograph shows the same statue after restoration showing the complete detail that has become visible throughout the entire structure. —Photos Metropolitan Museum of Art.

New Steel Resists Great Heat

Oxy-Acetylene Torches Fail To Affect Donsteel

IN a recent demonstration of a new alloy steel christened donsteel, in honor of its inventor, J. G. Donaldson, vice-president of the Mosler Safe Co., that material was proven to be far superior to any other alleged torch-resisting materials. The demonstration was given in order to show just how burglar-proof the door of a new safe to be installed in a Dayton, O., bank has been made. Constructed of a sheet of donsteel and a core of the same metal, 6 inches thick, this safe door will foil the attempts of the most up-to-date and scientific safe breaker.

In the demonstration given, sheets of ordinary iron such as used in some cheap makes of safes were attacked with an oxy-acetylene torch. The material readily yielded and a 1-inch plate was cut through in less than two seconds. Then other types of safe metals were tested including such supposedly burglar-proof metals as chrome steel, compositions of steel and copper and mixtures of steel and carborundum. Each and every one of them yielded to the intense heat of the blow torches, proving that many of the so-called burglar-proof safes in use today can be readily rifled by means of an acetylene torch in the hands of an expert. With some of these materials, it was necessary to use what is known as the "fluxing iron" process, invented by Francis J. Napolitan, which consists of burning an iron rod against the sheet of metal to be cut with the torch. Doing this facilitates the work enormously and it is said that a process similar to this is used by many professional cracksmen. In any event, everyone of the metals tested, with the exception of donsteel, yielded quickly and easily.

After these tests were completed, they were all applied to donsteel and with this metal, even the usually effective fluxing-iron process failed. First, the sheath of donsteel was heated with an oxy-acetylene torch for five minutes and the surface remained unchanged. Then, a disinterested party of oxy-acetylene torch users attacked the same sheet and after two hours work had still failed to make any impression.

Then the 6-inch thick core of the safe door was tested. It could not be affected in any way by means of either an oxy-acetylene torch or a drill. The reason why both a sheath of donsteel and a thick core of the same metal is employed is because it is believed that the thinner sheath can be burned through if sufficient time is employed and that it can eventually be penetrated by a drill. However, the thick core is absolutely im-

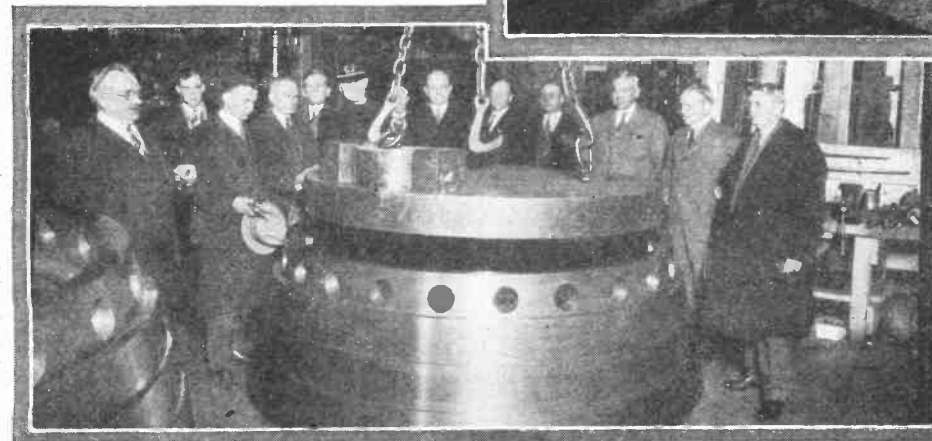
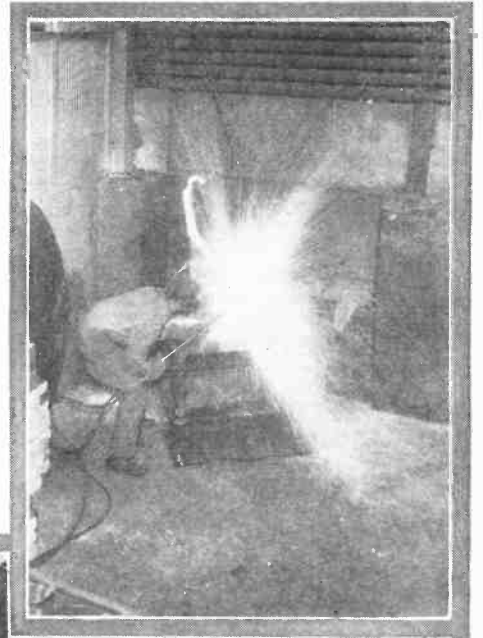
penetrable by any known means and therefore, perfect protection is achieved by the combination employed.

The vault in which this door is to be placed will be 60x20 feet and the walls will be constructed of reinforced concrete several feet thick. The entire installation is so made as to be absolutely burglar-proof.

Our various photographs on this page show metals undergoing the test of enormous heat and the one at the bottom of the page shows the donsteel core being inserted in the sheath.

It is obvious from these tests that the most scientific cracksmen with high speed drills and cutting torches would be foiled when encountering a safe door composed of donsteel. Even hours of work could not penetrate it, or even make an impression.

Right: Attacking a sheet of ordinary steel with an oxy-acetylene torch and cutting through it immediately. This demonstrates the lack of protection of an ordinary steel safe. →→→



Above: When a sheet of the new donsteel was acted upon by the hottest possible flame, the results were absolutely nil. It was found impossible to penetrate the sheath and in fact, no noticeable impression could be made upon the material at all. Successive attempts extending over periods of hours were fruitless. The material was thus proven ideal for use in the construction of absolutely burglar-proof safes. ↑

Left: Lowering the 6-inch thick core of donsteel into the outer sheath that comprises a vault door. The combination is thus made virtually burglar-proof and in fact could not be penetrated by any means that is at the command of the present day safe breaker. In combination with a reinforced concrete vault, perfect protection is achieved. ←←←

The New Cosmic Ray

The Existence of a New "Cosmic" Ray With a Wave-Length of But One Ten Millionth That of Ordinary Light, Has Been Shown in a Recent Series of Interesting Experiments Described Here

By PROF. DONALD H. MENZEL, Ph.D.

PROBABLY what will prove to be one of the most startling and far-reaching discoveries of the year has just been announced by Dr. R. A. Millikan, director of the Norman Bridge Laboratory of Physics of the California Institute of Technology, Pasadena, California. In brief, it might be said that he has proved the existence of a super-X-ray, for it has many of the properties of that now well-known ray. Perhaps a short review of X-rays will not be amiss here.

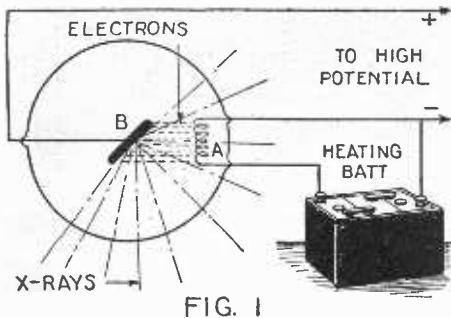


Fig. 1 shows how X-rays can be generated which, up to a short time ago were thought to have the shortest wave-length of any existing rays.

X-rays, or Roentgen Rays as they are sometimes called, are produced when atoms are bombarded by very high speed electrons—electrons which have fallen through a potential drop of thousands of volts. (See Fig. 1). A is a hot filament, similar to the filament in a vacuum tube, for producing a stream of electrons which are drawn over to the anode B, a piece of metal, by the source of high potential.

WAVE-LENGTHS OF NEW RAYS

Ordinary light is known to be a sort of wave-motion, the distance between wave crests being only about one-fifty thousandth of an inch. Small as this may appear, it is a large distance compared to the length of X-rays, which are shown in Fig. 2. The shortest rays yet investigated are the so-called gamma-rays emitted from radium, yet the new cosmic rays are fifty times shorter.

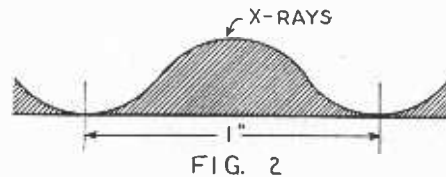
Imagine a wave of ordinary light magnified 500 billion times (Fig. 3). It would then be two hundred miles long and would stretch from New York to Boston. If the new cosmic ray, however, were similarly treated its magnified length would be but one inch.

EARLY EXPERIMENTS

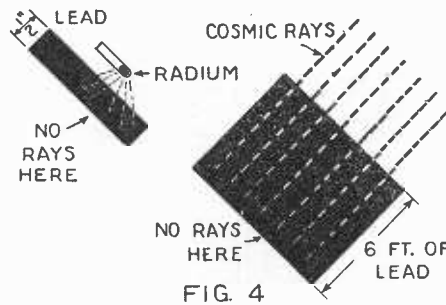
Professor Millikan's experiment was the culmination of an investigation covering a period extending over a number of years. The effects of these rays were first felt as early as 1903, when the British physicists, Rutherford and McLennan, studying an electroscope, found that the rate of discharge could be lessened by enclosing it inside a box of thick metal. Fig. 5 shows an electroscope. A is a metal rod from which are suspended two gold leaves B. The jar C is often of glass. When an electric charge is brought near the ball on the top of the rod A, some of it is conducted down the

rod, thus charging the two gold leaves similarly. It is an elementary law of electricity that unlike charges attract while like charges repel, therefore the two leaves take the position (a) when the electroscope is charged and (b) when discharged. The discharge is always due to the conduction of the original charge outward or of a neutralizing charge inwards.

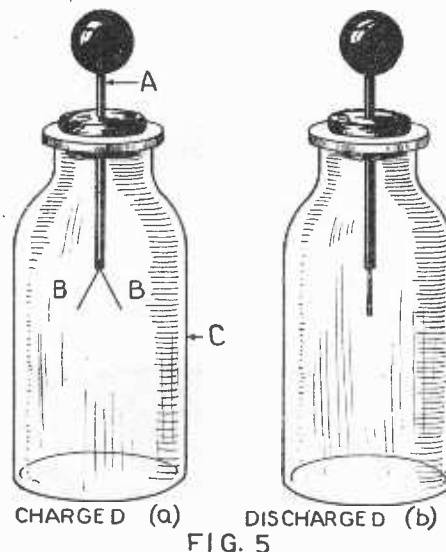
Suppose the electroscope charged and perfectly insulated from all stray sources of electrons. It would be reasonable to suppose that it would remain charged indefinitely. The British physicists found that the rate of discharge could be lessened by increasing the thickness of the sides of the box, nevertheless it could not be reduced to zero, as might be expected from the above reasoning. In fact,



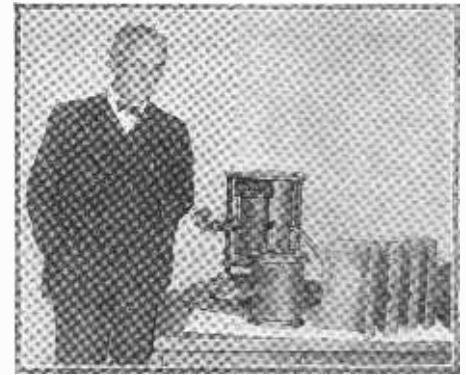
If X-rays were magnified to the wave-length shown above, the length of the waves of ordinary length would be one-fifth of a mile.



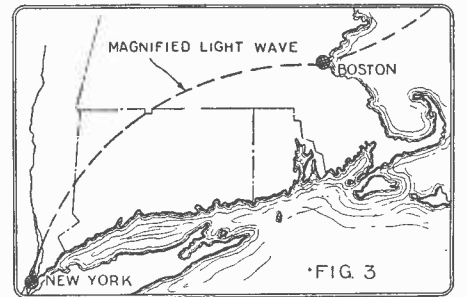
Radium rays will penetrate less than one-half inch of lead, but cosmic rays, of much shorter wave-length will penetrate nearly six feet of the same material.



A standard type of electroscope in a charged and discharged condition is shown in the illustrations A and B respectively. The text tells how this instrument aided in detecting cosmic rays.



The discoverer of the new cosmic ray, Dr. R. A. Millikan, is shown above with a device of his own design which made possible the discovery of these rays.



If one wave-length of ordinary light were magnified to the size shown above, a cosmic ray enlarged to the same size would have a wave-length of only one inch.

Millikan's experiments prove that the walls would have to be six feet thick in order to exclude the cosmic ray. But what effect does this have?

We have already seen from Fig. 1 how X-rays may be produced. If the collision of an electron with an atom results in the emission of light, it is easy to see how the collision of an atom with an X-ray beam may produce electrons. It is a simple reversible process. Thus, as long as X-rays or cosmic rays are present, electrons will be found which will discharge the electroscope.

COSMIC RAYS COME FROM BEYOND

At first it was thought that this new radiation had its origin in the earth's atmosphere. However, when balloons were sent up to a height of ten miles (see Fig. 7) at which altitude nine-tenths of the earth's atmosphere was below and only one tenth above, the radiation was discovered to be more than twice as intense as at the surface of the earth—proving definitely that it came from without.

Professor Millikan's next step was to find out, if possible, how penetrating was the new radiation. To accomplish this he sank his electroscopes and recording apparatus into Muir Lake, a body of water located on Mt. Whitney, the highest peak in the United States. It is almost unnecessary to state that his instruments were far more accurate than the simpler one drawn here, being equipped with an ingenious arrangement of moving film to photograph the rate of discharge. Though hundreds of feet deep, the main source of its water was from the melting snows—a necessary condition, for if its water had come long distances underground it probably would contain large quantities of dissolved radioactive salts which would produce the same effects and detract from the value of the measurements. It was found that the electroscopes did not stop discharging until at a depth of 45 feet below the surface of the lake. The air above the lake was equivalent to 23 feet of water and the total, 68 feet, was equivalent to six feet of lead, proving the remarkable penetrating power just mentioned.

(Continued on page 1147)

GREATEST NUMBER
WE CAN WRITE
WITH THREE 9'S
IS 9^{9^9}

9^9 IS
 $9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9$
9 TIMES
OR
387,420,489

9^{9^9} IS
 $9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9$
387,420,489 TIMES

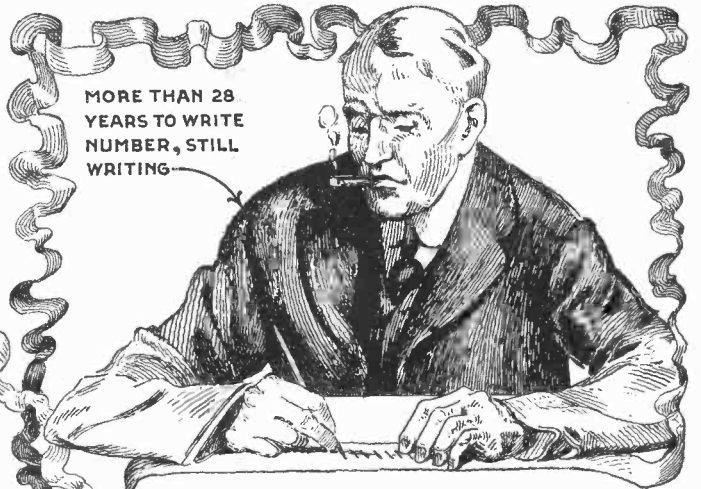
Greatest Three Figure Number

THE RESULT IS A NUMBER WITH 369,693,100 FIGURES—THE FIRST IS 4, THE LAST FIGURE OF IT IS 9

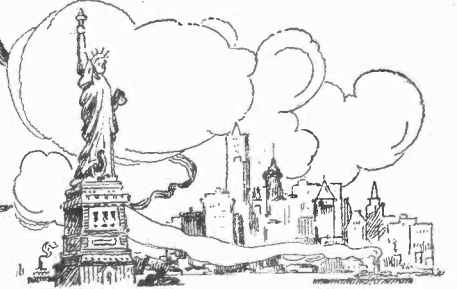
THE greatest number that can possibly be written with three figures is that indicated above. It was calculated by M. Laisant in Paris in the Ecole Polytechnique that the result is a number with 369,693,100 figures. The first figure of this tremendous group is a 4, and the last one is a 9.

Nine to the ninth power indicates that nine is to be multiplied by itself nine times. Nine to the ninth, to the ninth power, indicates that the first exponent is to be multiplied by itself nine times, giving a figure of 387,420,489. Then the first nine is to be raised to this power or in other words is to be multiplied by itself 387,420,489 times. Were one man to start writing this tremendous number, he would require a length of paper about 919 miles long, assuming that he spaces each figure a distance of one-sixth of an inch from its adjacent figure. The paper tape would very nearly stretch from New York to Chicago. The necessary time to write this number would be twenty-eight years and forty-eight days, assuming that the individual wrote one figure a second, ten hours a day every day in the year.

In all mathematical practice it is the custom to remove the outermost conditions first. Consequently the first exponent of the nine is raised to its power first. HUBERT SLOUKA, Rep. No. 7110.



PAPER ON WHICH FIGURES ARE WRITTEN WOULD STRETCH FROM NEW YORK TO CHICAGO



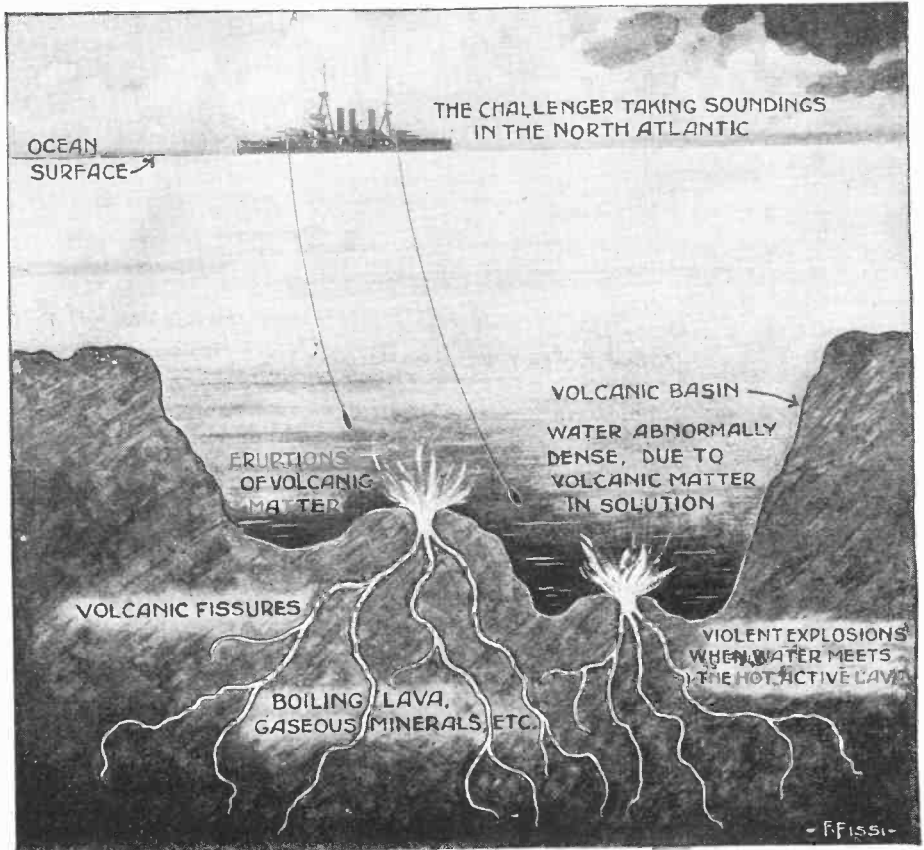
It will take more than twenty-eight years to write the result of the calculation indicated in the upper left-hand corner of the article.

Undersea Volcanoes

ETERNAL infernos in submarine abysses, where titanic masses of water meet the unquenchable fires of the earth's interior, have recently been discovered and described by M. J. Thoulet of the Paris Academy of Sciences. Vast explosions, billows of steam under the ocean floor, miles deep, roaring and bursting of natural furnaces—these fiendish activities liberate huge quantities of volcanic matter and distribute it along the lower reaches of the watery depths. This happens especially in regions of the North Atlantic where it has often been suspected that the sea bottom contains volcanoes.

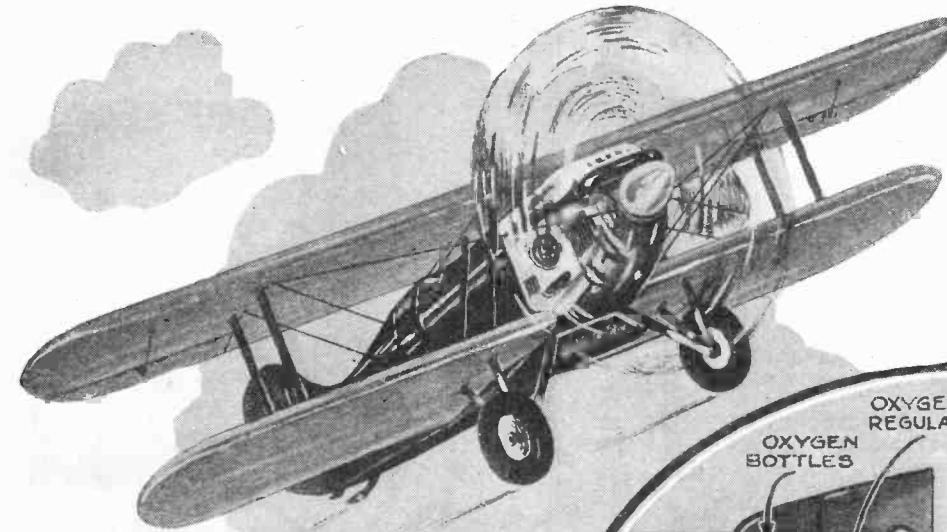
M. Thoulet arrived at these conclusions through his study of the soundings taken aboard H.M.S. "Challenger" on its recent oceanographic expedition around the world. He found that certain materials in solution in the sea-water at great depths became denser in some regions than in others. This unusual density, he concluded, can be explained only by the existence of submarine volcanoes, which give out materials which dissolve in the water.

Thoulet now hopes to be able by his methods to locate the exact position of some of these submarine volcanoes, and perhaps to measure accurately the degree of their activity. At any rate, it is a quaint and startling notion for travelers to Europe to entertain—seething battles of fire and water far in the depths beneath them. Perhaps also this volcanic power will be harnessed some day—for submarine power stations for trans-atlantic liners—who knows?—ERNEST BRENECKE.

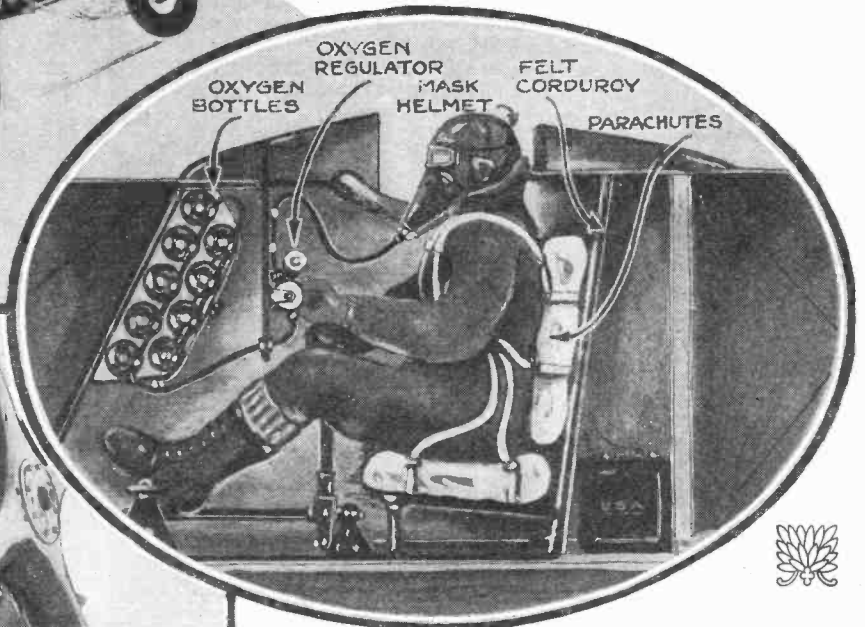


Reaching Great Altitudes

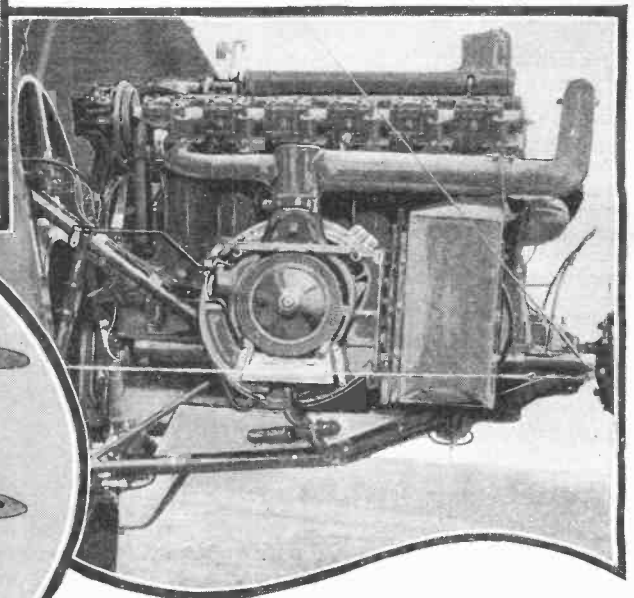
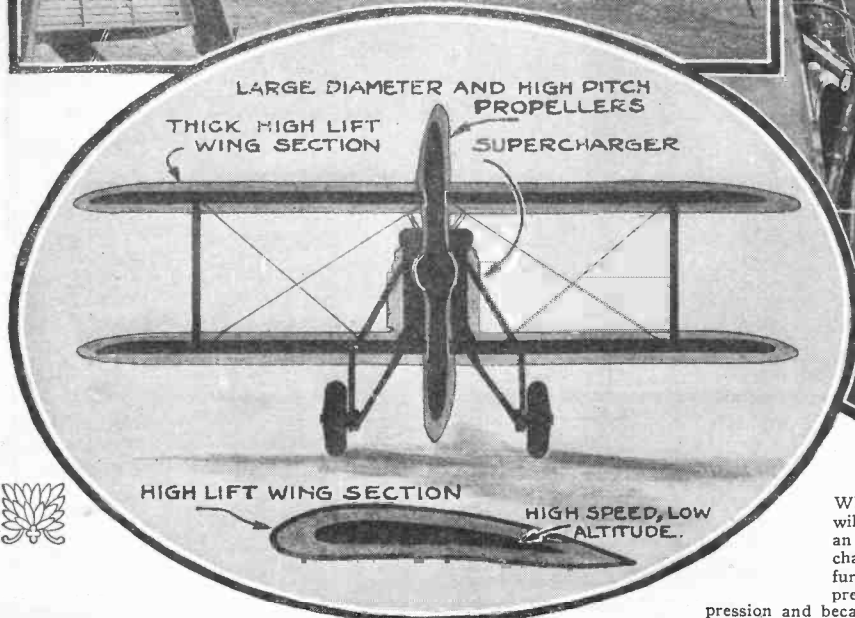
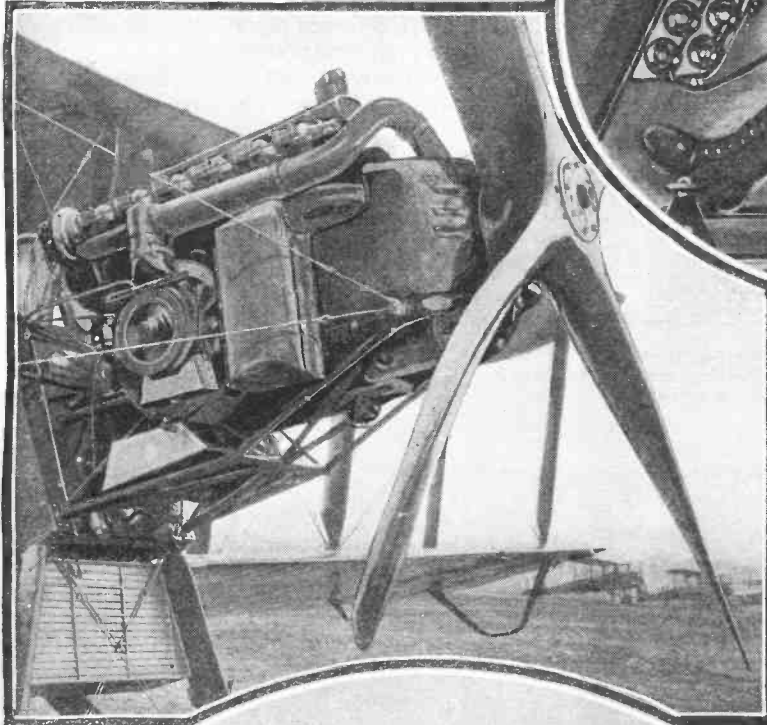
Many Precautions Must Be Taken and the Special Apparatus Used Is Illustrated



Above: The appearance of a plane especially equipped and designed for high altitude work. Note thickness of wings, and large propeller.



Above: A cross-sectional view of the cockpit of a high altitude plane. The pilot is supplied with oxygen from tanks in order to sustain life, while the cockpit is electrically heated and insulated with felt corduroy. Left: New type of geared Liberty motor equipped with supercharger and air cooling system for flying at the absolute ceiling, where the air is very rare and makes flying difficult.



When traveling at great altitudes, an ordinary gasoline engine will not function properly. Due to the rarefied atmosphere, such an engine will not obtain sufficient oxygen. Therefore, a supercharger or rotary air turbine is employed to compress the air and furnish it to the motor in the same quantities and at the same pressure as is obtained at sea level. During the process of compression and because of the fact that the supercharger is driven by the exhaust gases, the compressed air becomes very hot. It must be cooled before it enters the intake manifold, and this is done by means of the cooler located directly in front of the supercharger in the above photo. The pressure delivered by the supercharger is controlled by the operator of the airplane.

Black portions above show approximate proportions of standard airplane, whereas the shaded parts show where dimensions must be enlarged for high altitude flights.

New Plane Seeks Altitude Record

By WILLIAM P. SULLIVAN, Aeronautical Engineer

THE latest design in high altitude airplanes, using a special supercharged Liberty motor, is being tested by the United States Army at McCook Field, Dayton, Ohio, in hopes of bringing back to the United States the world's altitude record, now held by M. Callizo, a Frenchman, who attained an altitude of 39,586 feet in a specially constructed airplane, designed to meet conditions at high altitudes. This new design has many new features, including a specially constructed cockpit with its interior completely lined with plywood, covered with a quilted felt corduroy and electrically heated to withstand the terrific cold. The propeller is of large diameter, constructed from aluminum alloy and having variable pitch blades, which are adjustable from the pilot's cockpit. The wings are very large and of a special, thick, high-lift section, having an area of 600 square feet, with an aspect ratio of ten.

The heart of a machine of this sort lies in the ability and efficiency of the motor to function properly in the rarefied atmosphere at high altitudes. To bring this about, the motor is equipped with a special supercharger, which maintains a constant sea-level pressure of the atmosphere at all altitudes, enabling the motor to operate the same at altitudes of 30,000 feet or more, as it would at sea level.

This supercharger consists of a turbine-driven blower connected directly to the exhaust and intake manifolds of the motor. The turbine derives its power from the exhaust gases of the motor, which, in turn, rotates a blower pump. The entire supercharger itself becomes very hot, because of the use of the exhaust gases, and this heat is radiated out by air-cooled fins about the turbine. The compressed air from the blower, in turn, becomes hot, due to both its rise in pressure and to its passage through the

hot supercharger, and has to be cooled before it enters the intake manifold. This is done by passing it through a cooler, which is similar to a water radiator, and the cooled air, under the desired pressure, enters the carburetors. This pressure is controlled from the pilot's cockpit by operating a relief butterfly valve situated at the rear of the supercharger. As the plane continues to climb in rarefied atmosphere, this valve is gradually closed so that finally all the air sucked in by the blower goes directly to the carburetors. As the altitude increases, the pilot adjusts the valve, keeping the motor running efficiently, as one might adjust a carburetor on an automobile. Finally, a limit is reached by the supercharger, and from this point up, the power of the motor begins to decrease, until the power delivered by the motor does not produce thrust enough to drive the plane at a speed sufficient to lift. This point is called the *absolute ceiling* of the airplane.

The propeller, which is designed for the power-plant of high-altitude planes, is next to be considered. A propeller adapted to work efficiently at high altitudes must be of large diameter, large wing area and high pitch, which would be useless at sea level. This is due to the fact that, being designed for rarefied air, the air at sea level offers too great a resistance, so that the revolutions per minute would not be enough to furnish the thrust necessary for flight. Up to the present time, a sacrifice of high altitude efficiency has had to be made in order to enable the plane to leave the ground.

The propeller of the new design has what is known as variable pitch blades, that is, the blades rotate in sockets at the hub, in order to change their pitch while in flight, and are controlled by the pilot from the cockpit. This enables the pilot to set the blades at any desired pitch angle, where the

thrust is most efficient for the altitude in which the plane is flying. This pitch of the blades can be continually adjusted until it also reaches a limiting point of efficiency.

The next important feature is the wing design. The limiting factors of this portion of the plane are flexible enough to allow a design of high efficiency in rarefied air, while at sea level the loss of speed would be most noticeable, due to the greater resistance or drag, caused by the greater atmospheric pressure and a loss of lift, due to loss of speed, but not enough to be of paramount importance. As the plane acquires altitude, the lift-over-drag ratio would increase until it reached its most efficient working point, equal to that of the power plant.

The pilot must be considered as to his comfort and equipment. The cockpit must be enclosed as much as possible and lined with a warm covering of heat-retaining material and supplied with sufficient oxygen to facilitate breathing in the rarefied air throughout the climb. This oxygen is carried in a number of small metal bottles, coupled together and connected through a regulator valve, to a specially heated helmet and mask fastened to the pilot's head. The flow of the oxygen is controlled by the pilot by adjusting the regulator valve.

In climbing to the high altitudes, the pilot is kept busy adjusting all these instruments, due to a steady changing atmospheric pressure; especially, he must keep the oxygen system adjusted according to the height, which is absolutely essential to sustain life; also, the heating appliances that supply heat to the pilot's body in the extreme cold are to be under control. Hence, to establish a new altitude record means a man-size job, both on the part of the pilot and of the engineers, who all join in accomplishing it.

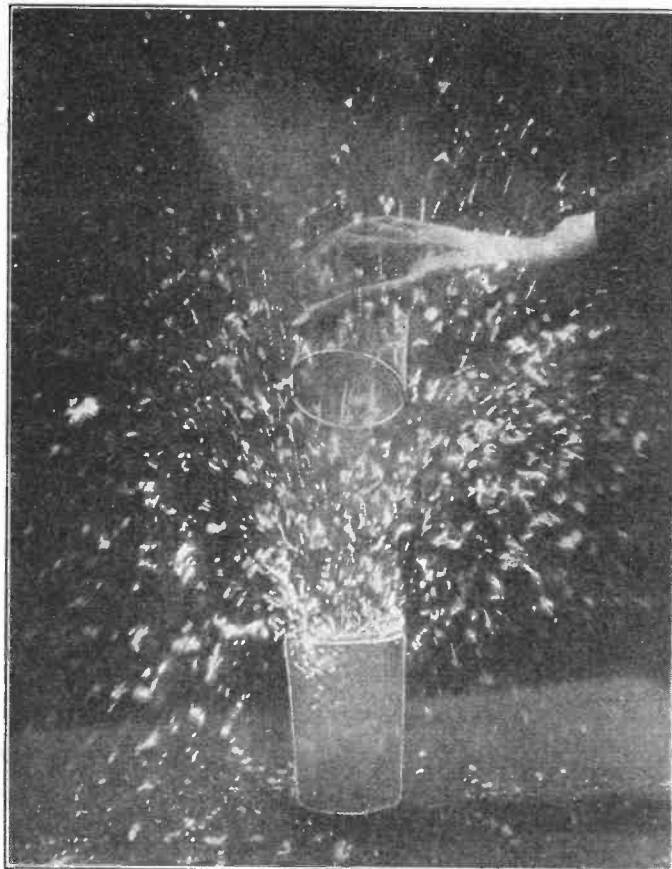
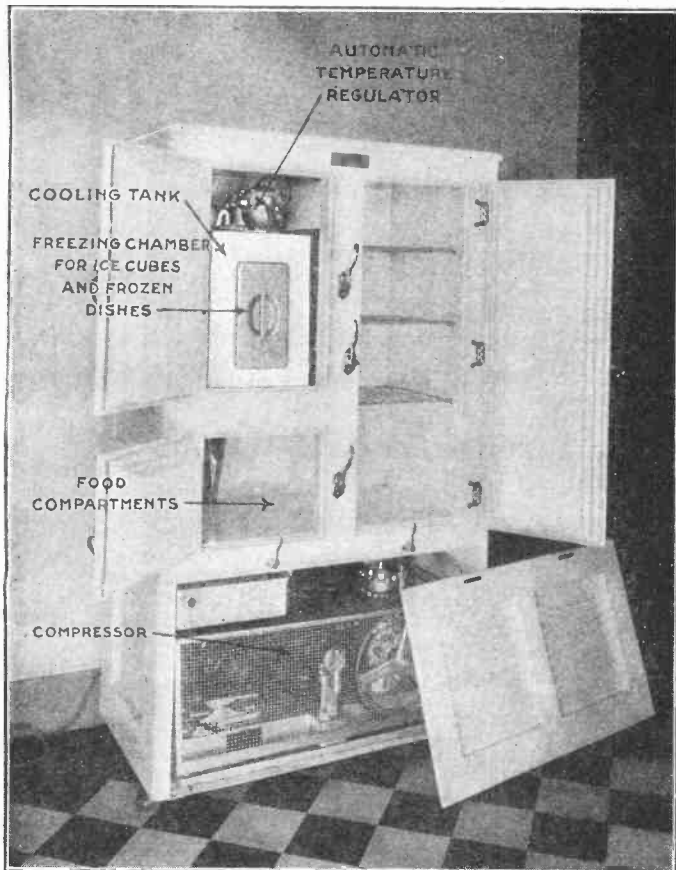
Distribution of Electricity



The average person will undoubtedly be surprised to learn that the largest consumer of electrical current in this country is the home user. Out of 17,000,000 customers, 14,000,000 of them are in homes throughout the country. Today, the average electric light bill is approximately \$25 per

year. If electrically operated refrigerators are installed in all homes, the yearly electric light bill will be practically doubled, but at the same time, the cost of refrigeration by electricity as compared to that by ice will be substantially less.

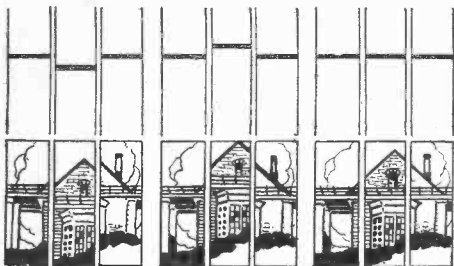
New Electric Refrigerator



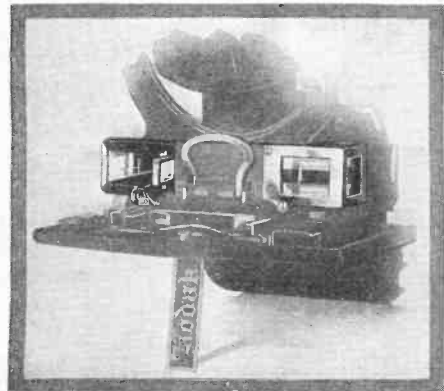
A new electrically operated refrigerator that is entirely self-contained is illustrated above. A small compressor located in the base compresses the refrigerating gas to a liquid which, expanding subsequently and at a very low temperatures, circulates through pipes around the food compartments and the freezing chamber. An automatic temperature regulator keeps the temperature constant.

The refrigerating substance that is used in this modern "ice box" is used over and over again and lasts for many years. The photograph above shows an interesting experiment performed with the liquid substance when it is at a temperature of 10° below zero. When poured into water, an "ice explosion" takes place. This photo was taken at a speed of 1-1500th of a second and the explosion took place in just that time.

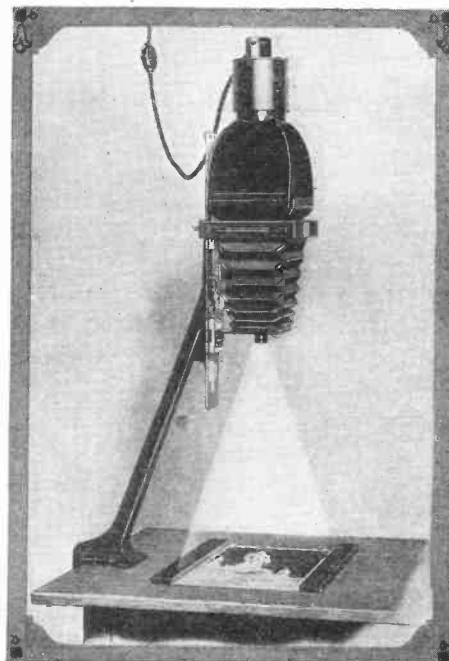
New Photograph Accessories



A NEW instantaneous range finder that is designed for use on small hand cameras is illustrated in the photograph in the lower left-hand corner of this page. By looking through the top of this instrument with the eyes quite close to it, the object upon which the photographer is focusing will be seen broken up into three distinct parts. If the camera is not focused properly, these three parts will be out of line as shown at the left, but when the lens is brought into proper focus the three sections line up as in the extreme right-hand diagram at the left. The range finder must be designed for the lens in use.

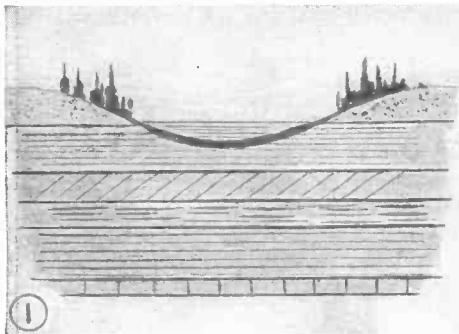


A SELF-FOCUSING enlarging device designed especially for the amateur photographer is illustrated in the photograph at the right. The light necessary for enlargement is supplied by an ordinary incandescent bulb connected to the house lighting circuit. The film or plate to be enlarged is slipped into a convenient and readily adjustable holder and placed in the camera directly above the bellows. By pulling the device up or down on a specially designed rack, the picture can be made as large or as small as desired within the limits of the apparatus. An ingenious cam arrangement keeps the focus constant, and no adjustment of it is necessary.

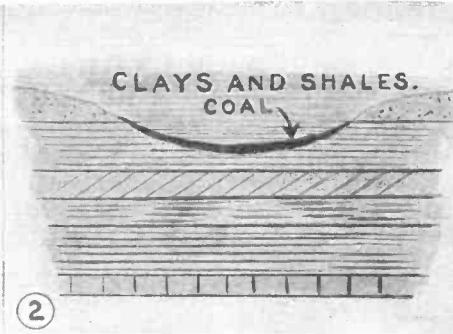


The Story of Coal

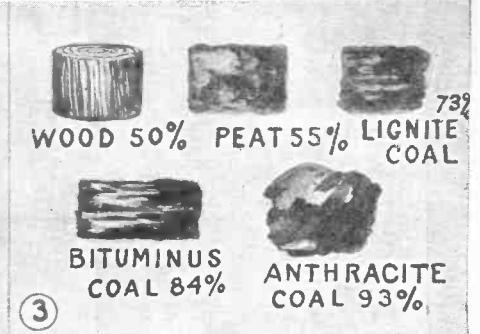
By J. E. BYRON, Mining Engineer



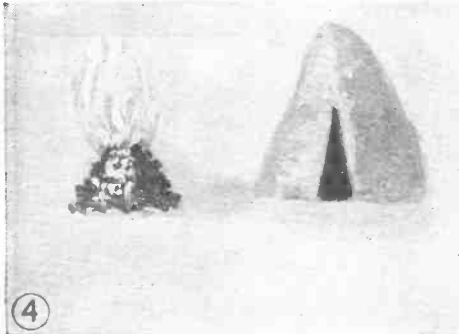
① Forests and plant life of the coal period were deposited in water, and formed a constituent of bogs like peat bogs of today.



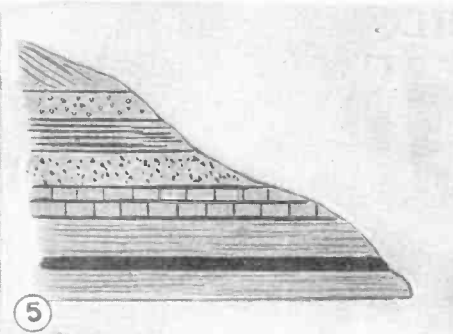
② The depression was filled by clay which gives shale, and the covered vegetation formed coal. Amount of covering pressure and heat determined the kind of coal.



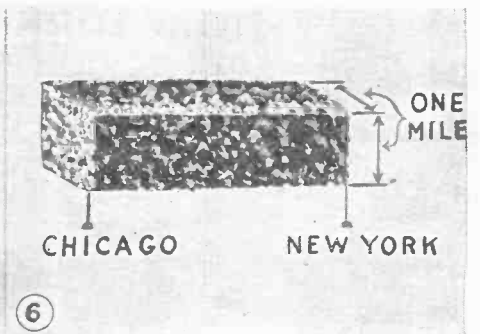
③ The amount of carbon that is found in wood, in peat and in various kinds of coal can be seen above. Anthracite is richest in carbon.



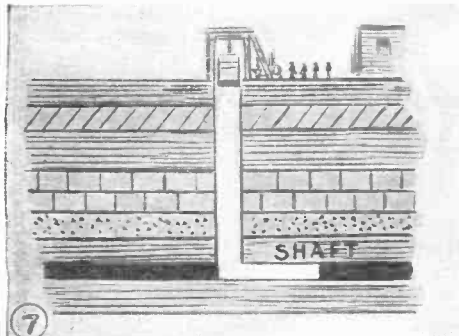
④ The first use of coal that historical records show was by the ancients living in about the year 300 B. C. It was used in open fires.



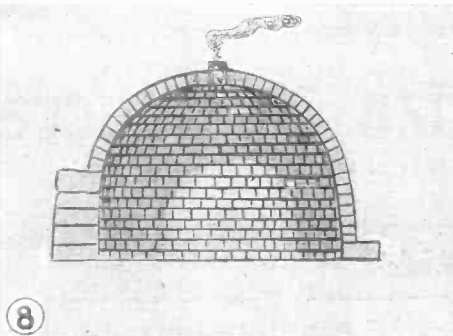
⑤ Bituminous coal was first discovered in the United States in an out-cropping near Richmond, Va., in 1750. The vein ran about as shown above.



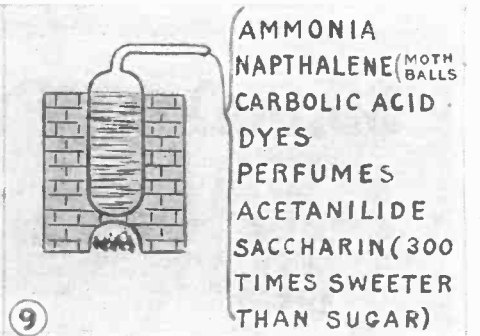
⑥ The available coal in the United States would form a wall one mile square in cross-section reaching from Chicago to New York.



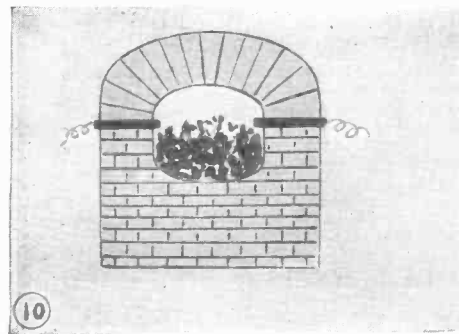
⑦ There are at the present time 600,000 men employed in the coal mines of the United States. They supply us with most of our fuel.



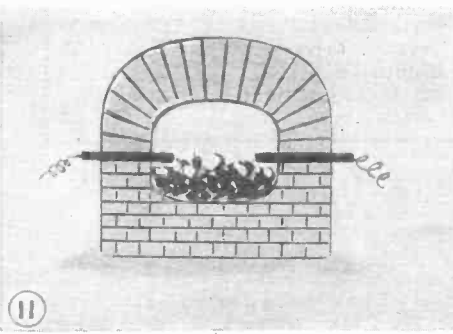
⑧ When coal is treated in coke ovens, it produces coke and also gives forth coal tar, many products of which are useful.



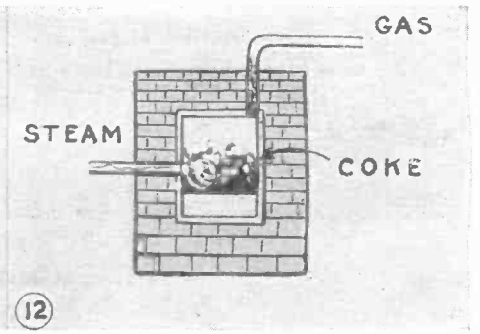
⑨ When coal tar is properly distilled and treated, it produces many valuable products, a few of the most important of which are listed above.



⑩ When coke and sand are melted together in an electric furnace, carborundum that is used for grinding purposes is produced.

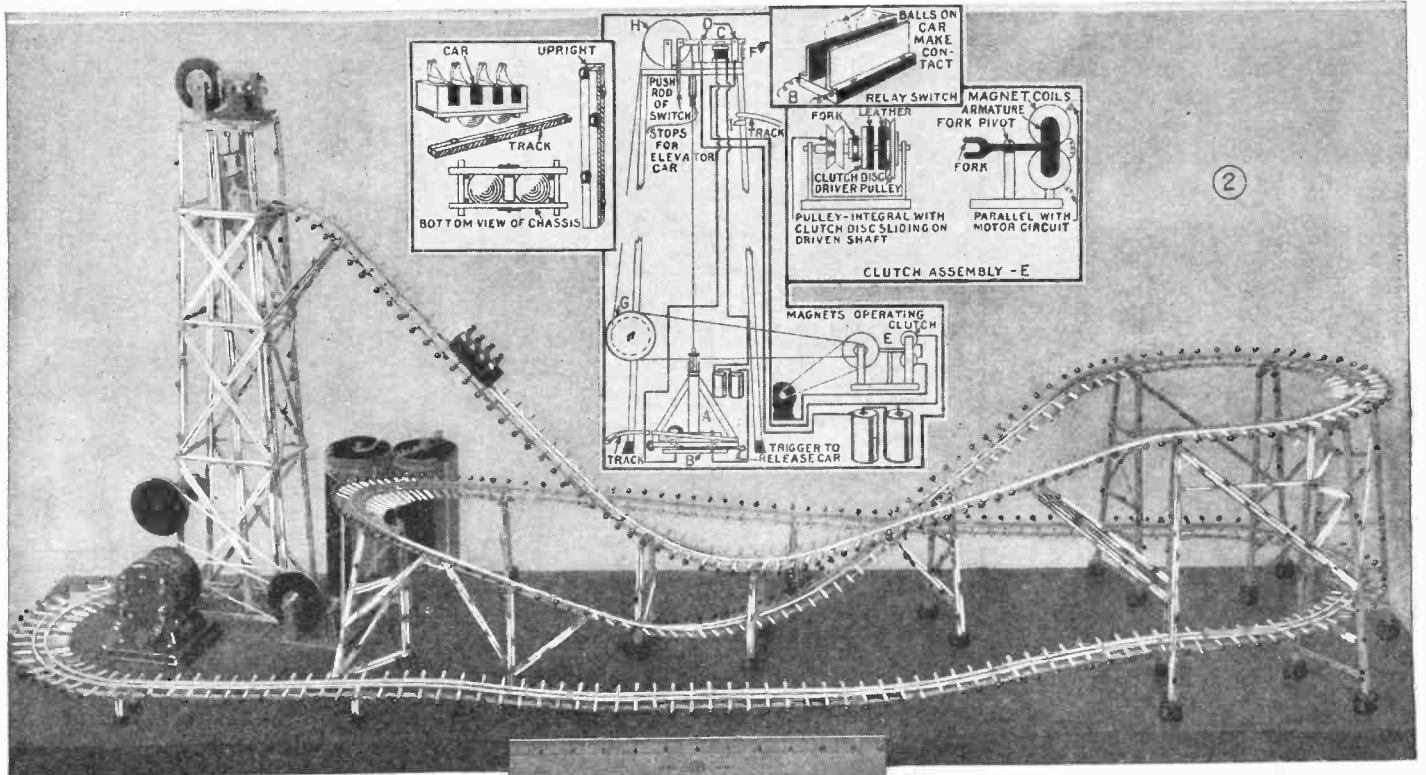


⑪ If, on the other hand, coke and limestone are ignited together, calcium carbide is produced from which acetylene gas is obtained.



⑫ Artificial gas is produced by heating together coke, steam and oil vapor in a furnace as is shown diagrammatically above.

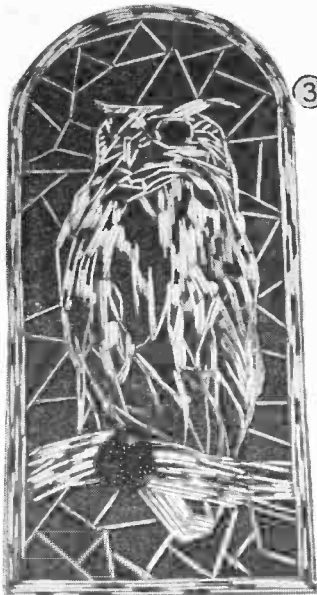
Prize Winners in the February Contest



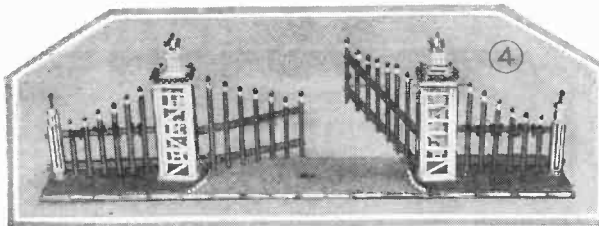
Second prize \$75.00 was awarded to J. S. Buynitsky of Washington, D. C., for the scenic railway above. It took six weeks to make this model.

The roller coaster, winner of the second prize award in this month's contest consists of a tower from which the car starts at a height of fifteen inches. There are sixteen feet of track and an automatic elevator which raises the car from the bottom of the tower to the starting point. The entire device is automatic: The matches were boiled and bent on phonograph needle forms to produce the curves and were then trimmed with sandpaper. The model is fifty inches long, thir-

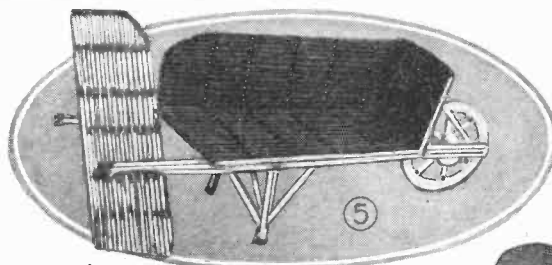
teen and a half inches wide. The car rolls on two ball bearings which also serve to make the contact for the relay and the motor operating the hoist. Car entering elevator car A, causes steel balls to make contact across B, closing relay circuit operating magnet C, which pulls down knife switch D, completing circuit through clutch assembly E, and motor. The drum winds up lifting car to top, by gravity when clutch opens, due to circuit being opened.



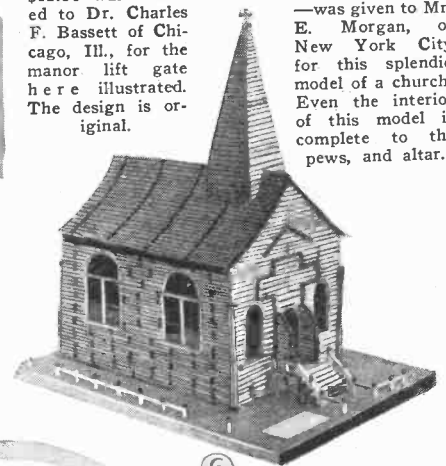
Sixth Prize \$20.00—The owl wall plaque shown in the photograph above was made by Dr. Ernest Bade of Glen Head, L. I. Dr. Bade employed unique construction.



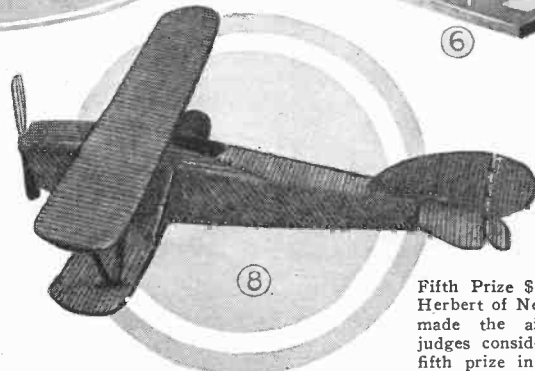
Eighth Prize \$12.50—was awarded to Dr. Charles F. Bassett of Chicago, Ill., for the manor lift gate here illustrated. The design is original.



Ninth Prize—\$10.00 — was won by the wheelbarrow construction illustrated in photo 5 above. This award goes to Mr. Fred Spinden of Abingdon, Illinois. It will be remembered that Mr. Spinden won the third prize for his wagon construction in the March issue.

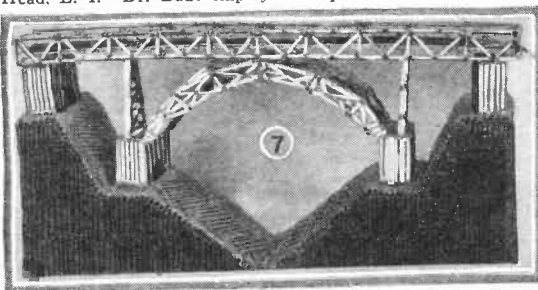


Third Prize \$50.00 —was given to Mr. E. Morgan, of New York City for this splendid model of a church. Even the interior of this model is complete to the pews, and altar.



Fifth Prize \$25.00—Mr. Eugene Herbert of New Rochelle, N. Y., made the airplane which the judges considered worthy of the fifth prize in this month's contest. Note with what care the

matches were laid in place. Most of the heads were cut from the matches and the entire model was carefully sandpapered so as to make it smooth.

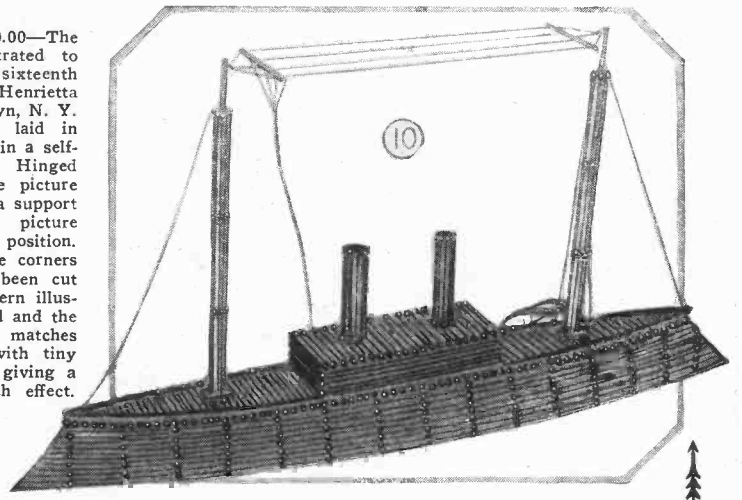


Twelfth Prize \$10.00—was won by John Benedette of New York City for the model of the Garabit Viaduct bridge. Cross section of the earth is made of matches.

More "MATCHCRAFT" Prize Winners



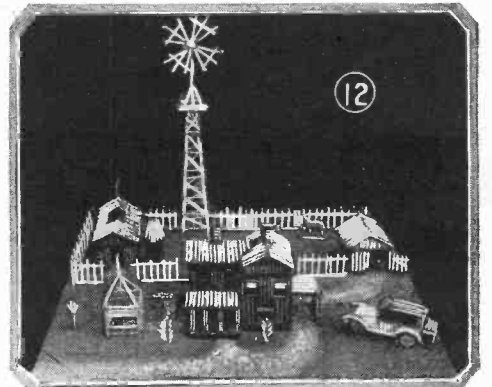
Sixteenth Prize \$10.00—The picture frame illustrated to the left won the sixteenth prize for Miss Henrietta Abramson of Brooklyn, N. Y. The matches were laid in place very carefully in a self-supporting frame. Hinged to the back of the picture frame one will find a support which holds this picture frame in an upright position. The matches for the corners of the frame have been cut up, so that the pattern illustrated can be formed and the back ends of the matches have been tipped with tiny drops of red paint, giving a double headed match effect.



Fifteenth Prize \$10.00—The battleship illustrated in the photograph above won this award and the lad who built the same is only fourteen years old. He is Master E. Don Bailey of Columbus, Indiana. Although the model is not complete in every detail, great care was taken to make the ship smooth and present a more or less professional appearance.

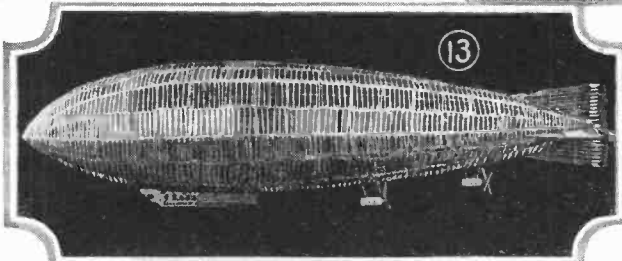


Tenth prize \$10.00—Mr. W. S. Hendren of Nicholasville, Kentucky, sends us the model village illustrated in photo 12. In this village everything is constructed of matches; even the trees in the foreground are made by shaving into the sides of a match producing leaflike growths. The automobile, wind mill, garage, houses and fence are all constructed entirely of matches.

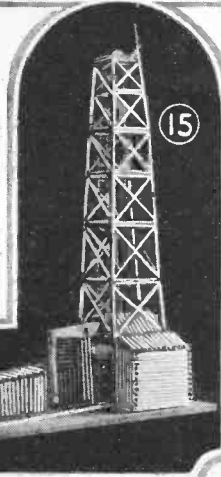


A model village is illustrated above and a lamp stand below.

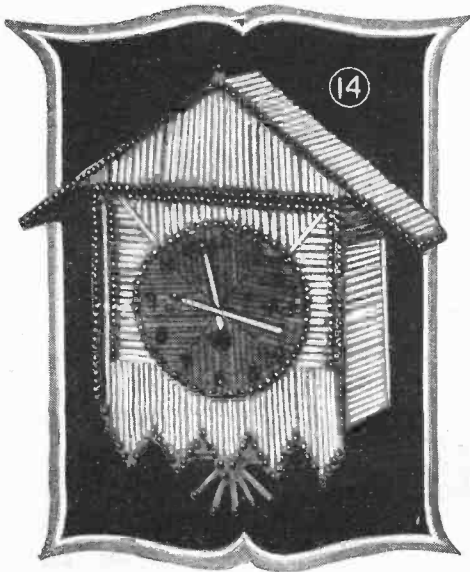
Fourteenth prize \$10.00—Mr. Harvey Bixby of Laporte, Indiana, took a lot of time to build the log cabin illustrated above. At first glance it would not seem as if this model is difficult to construct, but every match has been so cut that it dove-tails with the match crossing it.



Seventh Prize \$15.00—In the construction of the Zeppelin frame work illustrated in photo 13 above, Mr. F. E. Wilson of Covington, Ky., used up two thousand five hundred matches in building this three foot model showing only the skeleton framework. The small cars suspended from model are also composed of matches as are the propellers. Nothing but matches re-enforces the model.

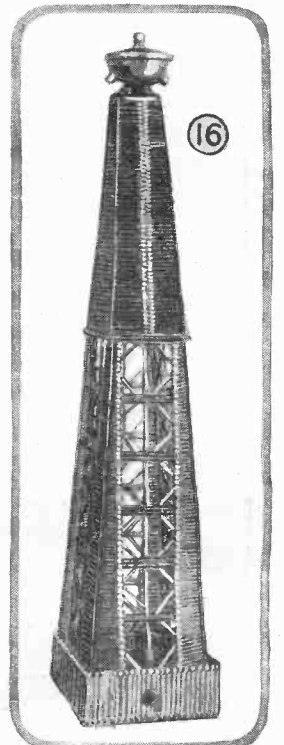


Eleventh prize \$10.00—In photo 15 above we see a model of an Oklahoma pumping station which should be fairly accurate, inasmuch as it was made by Mrs. W. S. Greenlie of Homony, Oklahoma.



Thirteenth prize \$10.00—The model of a wall clock illustrated above was made by Charles Komunicki of New York City. In the last issue his automobile won one of the awards.

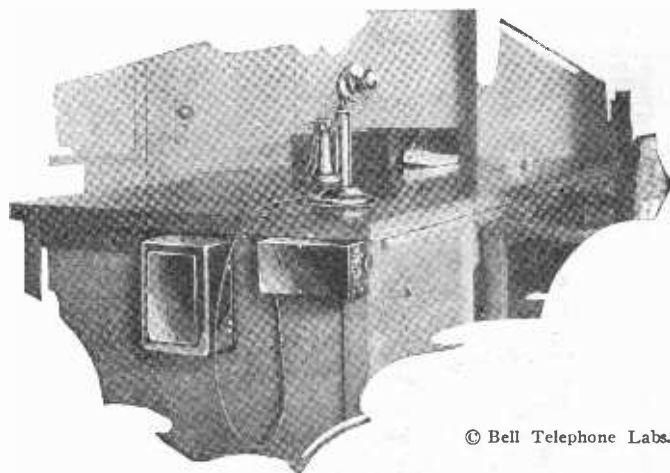
Fourth prize \$35—It is really surprising to note how strong a well constructed lamp stand can be even though it is made entirely of matches. Mr. A. W. Kingman of Hammond, Ind., showed us how this should be done and thereby won the fourth prize in the national matchcraft contest. A little time, a few matches, a pot of glue and you can also win some of these prizes. Try it.



Telephone Amplifier for the Deaf

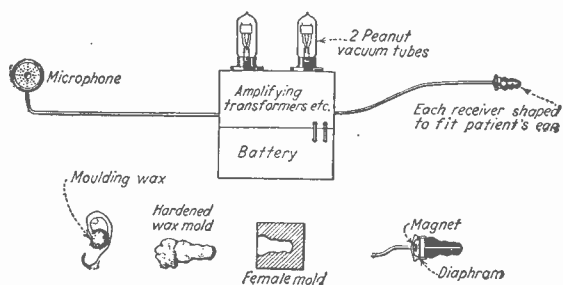


The latest aid to the deaf has recently been developed by the Bell Telephone Laboratories and has been designed in two different forms. Not only is the system adaptable to assist the deaf in ordinary conversation, but it can also be employed in connection with a standard telephone, so that the patient can hear more plainly. The device, in connection with a microphone is shown in use above.

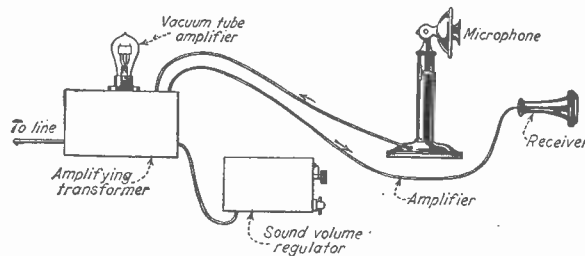


© Bell Telephone Labs.

Here the new system is connected with an ordinary telephone. Amplification is obtained by using vacuum tubes in a standard circuit.

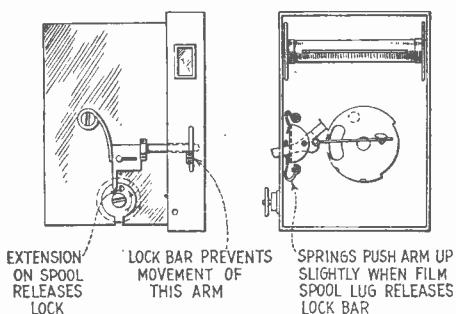


The instruments used in this new deaf phone are shown above and the method of making the small ear pieces is also illustrated.



Here the vacuum tube amplifier is connected in the receiver circuit of an ordinary telephone so as to render reproduced conversation louder.

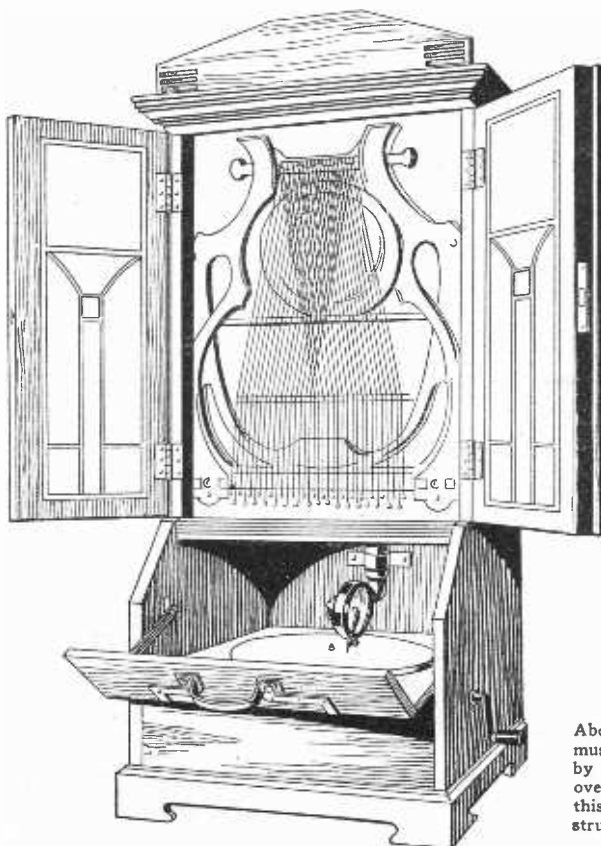
Camera Aid



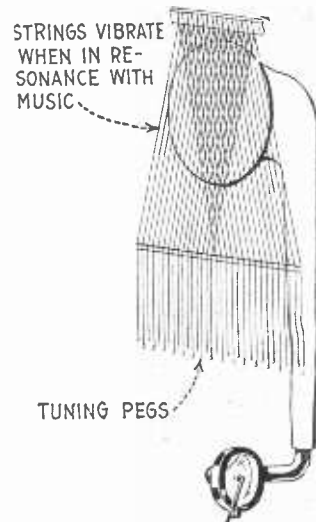
Very often the amateur photographer fails to wind the film after having taken a picture and consequently makes a second exposure on the same frame. This is prevented if the device shown above is employed. The lock bar, which is retracted by a projection on the winding spool, prevents another exposure after one has been taken, until the take-up spool is turned. The secret lies in the springs shown in the right-hand drawing above.
—A. C. Fischer.

In a novel type of talking machine that has recently been placed on a foreign market, the sound waves set up by the action of the record on the reproducer needle are given forth through the strings on the sounding board shown clearly at the right. The waves vibrate these strings and lend an unusual tone to the consequent reproductions. The strings are kept in tune in the same way as a piano and those in resonance with the sound waves are set in vibration.

A Musical Talking Machine



Left: The newly developed musical talking machine opened, showing record table, reproducer and strings.



Above: A diagrammatical view of this new musical instrument. Note the form taken by the strings so that all of them will pass over the mouth of the horn. Aside from this string attachment, the rest of the instrument is designed along conventional phonograph lines.

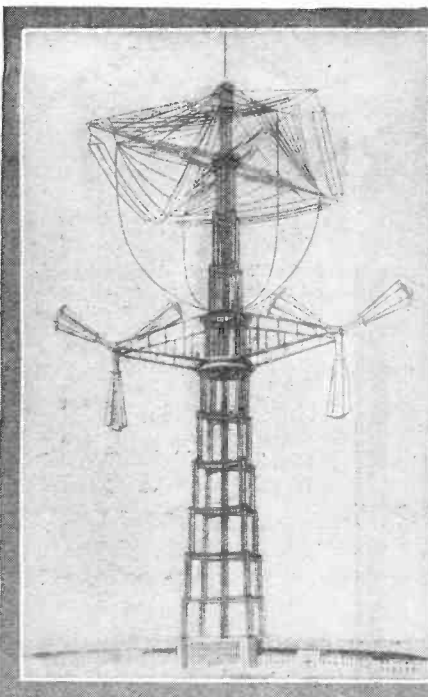
Photos from the Scientific World

What Scientists Are Accomplishing and Discovering

← Concrete cross ties for railroads have been adopted by the Bangor and Aroostook Railroad, replacing the ordinary wooden ties which in that locality are scarce and very expensive. The new ties are very satisfactory.

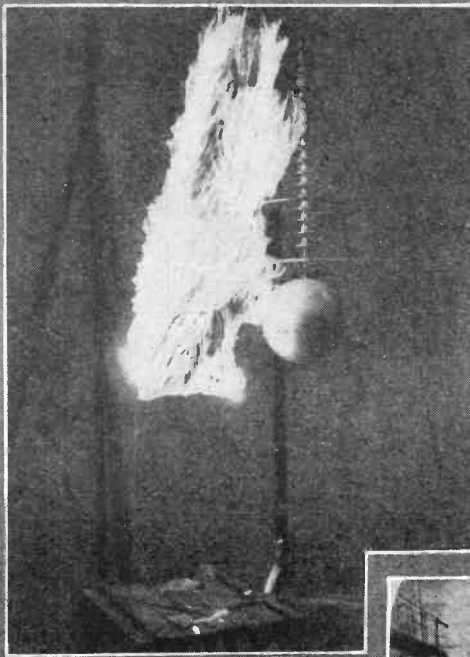


Below: A new system for obtaining electrical energy from the air has been devised by German scientists and the tower illustrated will be erected at Leipzig. It will be the highest structure in the world, towering to 1,800 feet above the surface of the earth, or 300 feet higher than the Eiffel Tower. The rotating wings it is said will generate power steadily, regardless of how little wind is blowing.

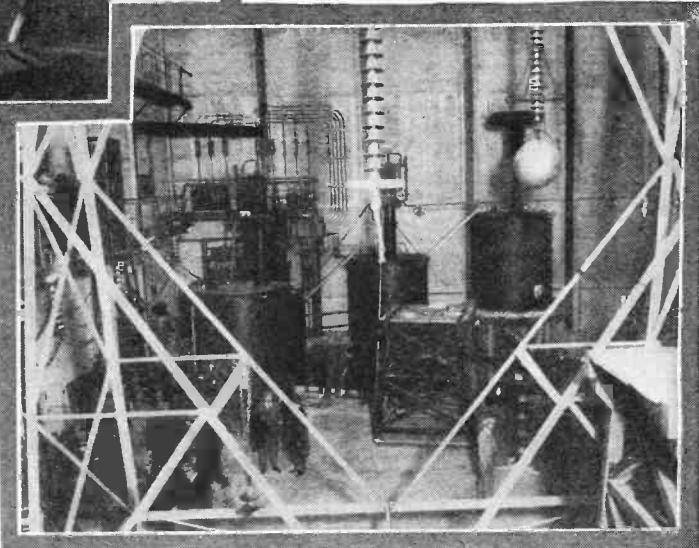


The illustration at the right shows how the natives of Mongolia build their homes. A framework of sticks is first constructed and then covered with a thick felt made from sheep's wool. The door is especially unique in construction as it does not open outward or inward but folds together after the fashion of an ordinary elevator door. In fact, the entire hut is made in a similar manner so that the walls can be folded up and the home transported to any place desired. The construction is plainly shown.

©Amer. Museum of Nat. History.



A specially designed transformer shown in the photograph at the right has recently been installed in the California Institute of Technology. It delivers one million volts and is capable of producing sparks of enormous length. One of these sparks, produced between a point and a ball is shown above. Note the flaming effect produced. The purpose of this installation is to test insulation values, to produce artificial lightning for demonstration and to conduct experiments with radio transmission of power.



↑ Above: A view of the electrical laboratory of the California Institute of Technology.



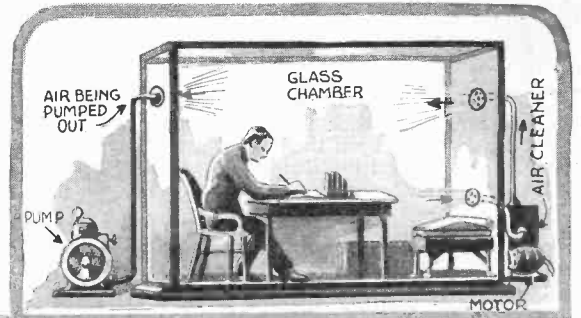
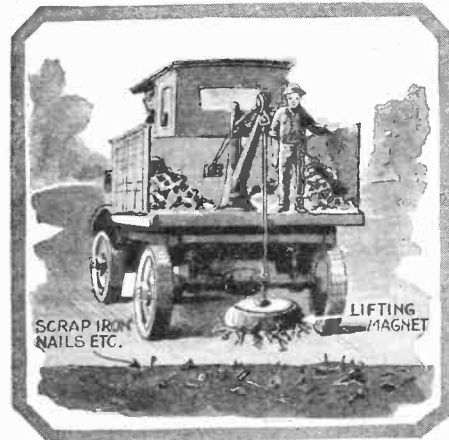
↑ Another triumph of German ingenuity is depicted in the photograph reproduced above. Gigantic halls, constructed entirely of concrete, have been constructed and are in use for the preservation of crude sulphur. All of the supporting beams as well as the cross pieces and other girders are of reinforced concrete. The total length of these halls is in excess of 300 feet, the width is somewhat greater than 60 feet and the height is about 50 feet.

The Month's Science News Illustrated

By GEORGE WALL

Left: A 36-inch lifting magnet was recently carried back and forth over a 7-mile stretch of road and it picked up 603 pounds of nails, tacks and scrap iron in that distance.

Below: For a long time, people near a certain power house were greatly annoyed by a mysterious hum. Numerous scientific investigations failed to locate the cause, but finally a workman placed a sheet of tin in the ash pit of a boiler and the hum stopped.



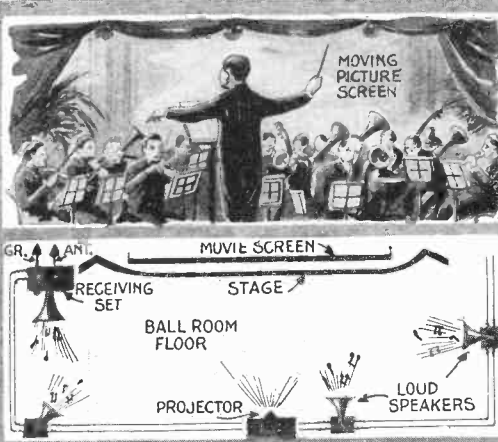
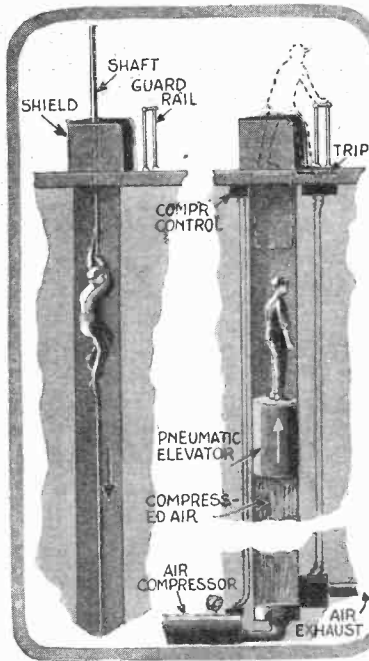
Above: After living for a week in a sealed room and breathing the same air continually, the experimenter's blood turned blue.



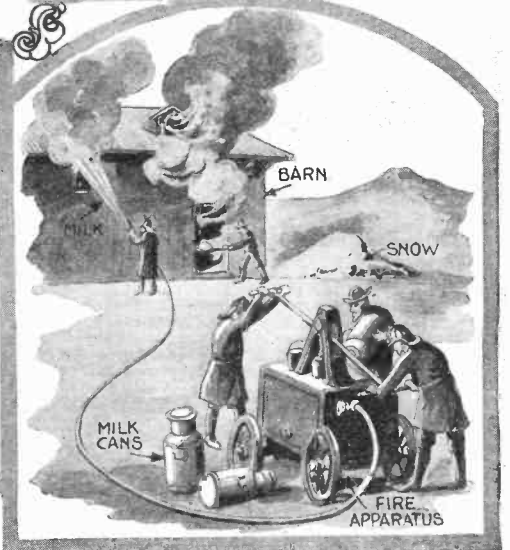
A new type of thermostatic alarm device to be used for protecting safes has recently been developed and it is so sensitive that it will respond to imperceptible changes of temperature. When a person enters the room in which it is concealed, the alarm sounds. It would certainly take a cold-blooded burglar to rob a safe protected with this device and even then, if he used a blow torch, the heat of that instrument would immediately sound the alarm.



The original principles of cooking are still in use among certain savage tribes and one of the most important of them is illustrated above.



A combination of radio and motion picture has recently been perfected and a demonstration given in New York City. Motion pictures of a well known orchestra in action were shown and the accompaniment was supplied by radio.



When fighting a fire in a small town, the water supply gave out and inasmuch as other buildings were threatened with destruction if something drastic was not done, the firemen poured cans of milk into their pumps and forced the lacteal fluid through the hose and directed the stream against the fire. Loads of snow were also pressed into service and shoveled into the fire in an attempt to prevent its spread.



An explosion in a mine recently claimed numerous miners, but one of the miners owes his existence today to his presence of mind when he grabbed the tail of a mule and was dragged to safety.

In a large newspaper office, stairways have been eliminated and communication between various departments on adjoining floors is effected by means of an installation such as that shown above. A man enters the shaft on the lower floor and immediately is raised to the next floor by means of the pneumatic elevator shown. The entire installation is automatic. Return is made by sliding down a brass tube such as used by firemen.

In the accident illustrated at the left, one of the miners relied upon an animal instinct which is equivalent to that prevalent in human beings, wherein self-preservation is supposedly the first law of nature. This miner, knowing that one of the mules employed for pulling the cars of ore would get out of the mine if there was any possible chance of doing so, grabbed the animal's tail and was saved.

Tarrano the Conqueror

TENTH INSTALLMENT

By RAY CUMMINGS

First American and Canadian Serial Rights

CHAPTER XXIII THE FIRST RETREAT

I MUST recount now what Elza later told me, going back to those moments when Elza sat upon the balcony watching Tarrano and the Red Woman. The significance of what had been transpiring

at the Water Festival was not clear to Elza; she did not know what was impending, but as she sat there with Tarrano beside her, a sense of danger oppressed her. Danger which lay like a weight upon her heart. Yet several times she found herself laughing—hilarious; and from Maida's

warning glance, and the steady odor which Maida wafted to her, she knew that Tarrano was using the alcholate fumes to intoxicate her.

The Red Woman and Tarrano were upon the dais. There came a flash; then darkness. Elza went cold with terror. She sat stiff and silent, while around her surged that turmoil of confusion. The smell of chemicals was in the air; her skin prickled as with a million tiny needles where sparks now began to snap against it.

How long she crouched there, or what was happening, Elza did not know. But presently she heard Tarrano's voice in her ear.

"Come, Lady Elza, I must get you out of this." In the darkness his face glowed wraith-like. Then she felt his hand upon her arm.

"Come, we must leave here. I would not have you endangered."

With a haste and roughness that belied the calm solicitude of his words, he pulled her to her feet. There was light in the pavilion now. Elza saw dimly the turmoil of struggling figures; and then she saw the scene duplicated—saw it shift and sway in crazy fashion. Though she did not know it, she was looking out along the curved rays which Tarrano was sending from them. Sparks were snapping everywhere. A second image of Tarrano appeared to the left of her—she saw it in a mirror nearby—yet he was at her right, gripping her arm.

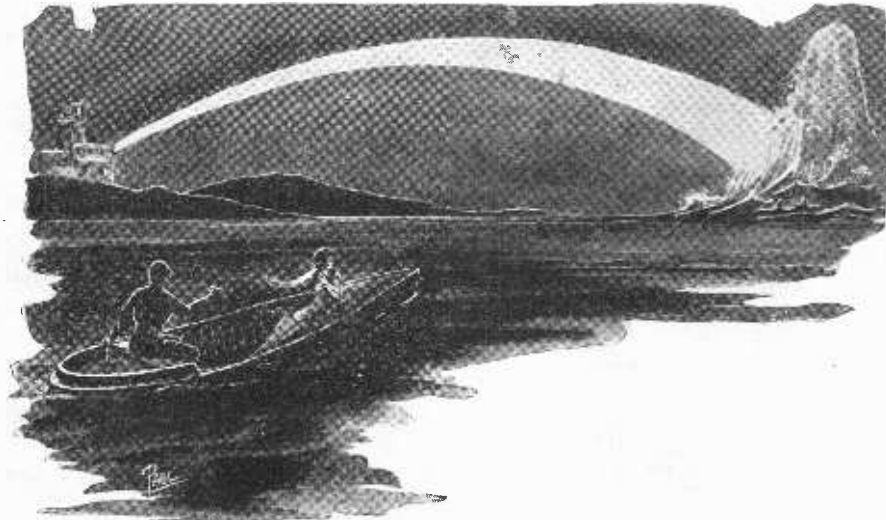
"Hurry, Lady Elza."

She found herself being dragged along the balcony; stumbling over a body lying there; feeling a surge of heat and electric disturbance beat against her face. Then Tarrano had her in his arms, carrying her. She heard him curse as a sudden wave of fire seemed to strike them—hostile rays bringing a numbness to muscles and brain. Tarrano was fumbling at his belt; and through a shower of sparks he stumbled onward with his burden.

Elza's senses were fading. Vaguely she was conscious that Tarrano was carrying her down an incline to the ground. Grateful, cool air. Stars overhead. Trees; foliage; shimmering water. . . The screams



Then abruptly, upon a table a huge Slaan leaped—his garments blood-stained from his victims, a blade of dripping steel in his hands.



It swung into the air in a slow, lazy parabola, came down and dropped into the lake. But it fell where the marksman saw the boat, a safe distance to one side. A ball of fire dropping into the water, exploding the water all around it for a distance of a dozen feet.

SYNOPSIS

In the spring of the year 2325, all of the rulers of the various countries of the earth are mysteriously murdered. Jac and Grayson, employees of a large news organization, find that the murders are the result of a plot on the part of the inhabitants of Venus. Tarrano, an erstwhile lower official of the Cold Country of Venus is found to be at the head of a plot to rule the universe.

Dr. Brende, a friend of Jac's has discovered a medical method whereby human beings may be kept from growing old. The Doctor is killed by a group of "Venus-Men" and Jac, Elza, the Doctor's daughter and Georg, the Doctor's son, are captured and taken to Venia, a city on the earth inhabited by people of Venus. Here they are imprisoned and Wolfgar, a Venus-man, friendly to the people of the earth, surrounds them by an electrical isolation barrage in an attempt to rescue them. The barrage is broken down and in the resulting confusion, Georg escapes to Washington in company with Princess Maida of Venus.

The next day, Tarrano offers to return the papers and models of the invention made by Georg's father, which he has confiscated and brands young Brende as an impostor. To offset this accusation, Georg is to tell his story to the earth as well as to Venus and Mars by radio and helio. He and Princess Maida go to the station but there they disappear.

Jac, Wolfgar and Elza, still captives, are removed from their prison and taken to the top of an enormous tower. Here, in the instrument room, where communication with the various planets is held, they view the disappearance of the Princess Maida and Georg by television. The abduction has been done by Tarrano's agents. On Mars, Tarrano's followers are attacking the ruling class and Tarrano offers Dr. Brende's secret to the public if they will surrender to his cohorts. They agree. Tarrano then announces to the earth people, that he will not give them the Brende secret and declares war upon them, challenging them to attempt to conquer him.

The air war vessels of the earth government start to attack Venia, but Tarrano sends up a bomb of surrender and then, with Elza, Jac and Wolfgar, he escapes through an underground passageway to a space-flyer. They go on board and are taken

to Venus to where Georg and the Princess Maida have previously been transported. They are royally welcomed and go to the palace of the Princess Maida. Here they are attacked by Argo, one of Tarrano's men, who shoots a violet-colored beam of light across the room, separating Maida from the rest of the party. He threatens to kill her, when suddenly Wolfgar throws himself into and through the violet beam of death.

Wolfgar dies soon after he confesses to Maida that he loves her and Maida has made a similar declaration. With great pomp and ceremony, the body of Wolfgar is laid to rest in the WATERS OF ETERNAL PEACE.

The evening after the burial of Wolfgar, Jac chances to be alone in a small boat near the palace and he is warned by a "slaan," a Venus man, to guard himself well. He also sees below the surface of the water and encased in a diver's cap, the face of an Earth man. Later that evening, preparations are rushed through for the great Water Carnival of Venus and to it proceed Georg and Maida; Elza and Tarrano; and Jac without a partner. They disguise themselves with long robes and masks and soon reach the scene of the festival.

At the carnival all of the inhabitants of the planet are seemingly given over to the pursuit of pleasure and love. However, there is a vicious undercurrent of events noticeable to Jac but which does not seem to claim the attention of Tarrano. At one place there is a swimming pool in which girls are constantly sporting themselves. Watching them, Jac sees one of them drag a Tarrano guard to the edge and with him grasped in her arms, plunge into the pool. A few seconds later the girl comes to the surface but the man is never seen again.

Toward the climax of the celebration, a notorious Venus character, the Red Woman, performs a dance particularly for the benefit of Tarrano. In the midst of it, the large hall in which it is being held, suddenly is darkened and rays of death shoot out over the place. Jac, forewarned, drops to the floor out of their range and throughout the entire assembly, "slaans" in the employ of Princess Maida wreak havoc with their long knives. The cry goes up, "Down with Tarrano. Loyalty, everyone, to your Princess Maida." The Venus people, followers of Maida, have revolted; the Red Woman is dead, but Tarrano—?

and confusion of the pavilion growing fainter. . . .

When Elza regained consciousness, she was lying in the bottom of a little boat, and Tarrano was sitting beside her.

"So? You have awakened? We are quite safe, Lady Elza."

She and Tarrano were alone in the boat. It was long and very narrow, with its sides no more than a foot above the water. Tarrano sat at its chemical mechanism. A boat familiar to us of Earth. A small chemical-electric generator. The explosion of water in a little tank, with the resultant gases ejected through a small pipe projecting under the surface at its stern. The boat swept forward smoothly, rapidly and almost silently, with a stream of the gas bubbles coming to the surface in its wake.

"Quite safe, Lady Elza."

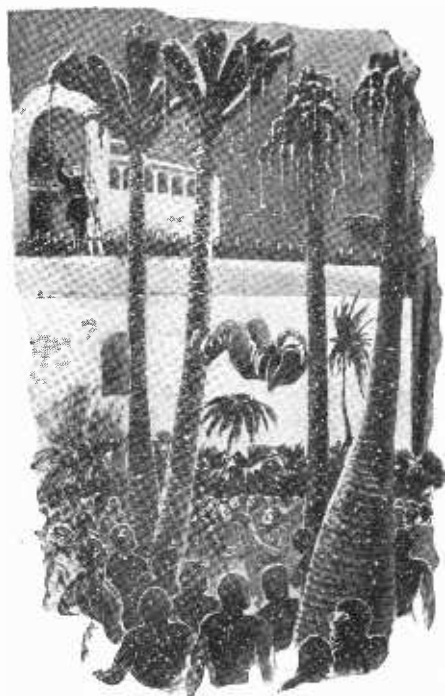
She saw that Tarrano's face was blackened with grime. His garments were burned, and hers were also. He was disheveled, but his manner was as imperturbable as ever. He made her comfortable on the cushions in the boat; drew a robe closer around her against the rush of the night air.

Elza was unhurt. She saw now, with clarifying senses, that they were plying along a narrow river. Banks of foliage on each side; the auroral lights in the sky; occasionally on the hillsides along the river, the dim outlines of a house.

It was all a trifle unreal—like looking through a sunglass that was darkened—for around the boat hung always a vague pall of gloom. Tarrano spoke of it.

"Our isolation barrage. It is very weak, but the best I can contrive. From these hills the naked eye, now at night could hardly penetrate it. . . . A precaution, for they will be searching for us perhaps. . . . Ah! . . ."

A white search-ray sprang from a house at the top of a hill nearby. It leaped across the dark countryside, swept the water—which at that point had broadened into a lagoon—and landed upon the boat. It was a light strong enough to penetrate the barrage—the boat was disclosed to observers in the house. But Tarrano raised a small metal projector. A dull-red beam sprang from it and mingled with the other. A



And then the sudden condensation brought snow—a thick white fall of it sifting down . . .

surge of sparks; then Tarrano's red beam conquered. It absorbed the white light. And Tarrano's beam was curved. It lay over the lake in a huge bow, bending far out to one side. Yet its other end fell upon the hostile house. The white search-ray

this flying with nothing above one, nothing to the side, or underneath save that transparent substance. To her it was like floating, and at times falling headlong through the air.

They rose no more than a thousand feet



The arctic! It was nothing like the Polar regions of Earth. Stark desolation. A naked land seemingly upheaved by some gigantic cataclysm of nature, lying tumbled and broken where it had fallen in convulsive agony; and then congealed forever in a grip of ice.

from the house was submerged, bent outward with Tarrano's beam. From the house, the observer could only gaze along this curved light. He saw the image of the boat—not where the boat really was—but as though the ray were straight.

Elza, staring with her heart in her throat, saw a ball of yellow fire mount from the house. It swung into the air in a slow, lazy parabola, came down and dropped into the lake. But it fell where the marksman saw the boat, a safe distance to one side. A ball of fire dropping into the water, exploding the water all around it for a distance of a dozen feet. Like a cascade, the water mounted.

Tarrano chuckled. "A very bad marksman."

Other bombs came. It turns me cold when I think how orders like this could have come from the Great City—these bombs which had they found their mark would have killed Tarrano, but at the expense of the life of Elza. They did not find their mark. Tarrano continually changed the curve of his beam. The image of the boat shifted. A few moments only; and riding the waves of the bomb-tossed water, they rounded a bend, back into the narrow river and were beyond range.

Tarrano snapped off his ray. "Quite safe, Lady Elza. Do not be alarmed. I doubt if they will locate us again. They should be very busy now in the Great City. I'm surprised they could even think to notify this Station we have just passed."

We were indeed very busy in the Great City during those hours, as you shall presently hear.

Tarrano and Elza were not again disturbed. How far they went in the boat she does not know, but at last they landed in a sheltered cove. An air vehicle was there. Tarrano transferred Elza to it, and in a moment more they were aloft.

The vehicle was little more than an oblong platform, with a low railing. A platform of a substance resembling *glascite-transparent*; and with a *glascite* shield V-shaped in front to break the rush of wind and yet give vision. A mechanism, not of radio-power, but of gravity like the Space-flyers. Such platforms had been, but were no longer in use on Earth. Elza had never seen one. It was a new experience for her,

at first, and then swept parallel with the ground. At a tremendous speed; even at this height the forests seemed moving backward as the ground moves beneath a surface vehicle.

Dark, somber forests of luxuriant tropical vegetation. It was now nearing dawn; the auroral lights were dropping low in the sky; the great Venus Cross of Dawn was rising, its first two stars already above the line of hills to one side.

Then the sky out there flushed red; a limb of the glorious Sun of Venus came up. A new day. And even though the air was warm, within Elza was a shiver.

"It is very wonderful to me, my Elza, this being alone with you."

He sat beside her, gazing at her with his calm, impenetrable eyes. It was near noon of that day following their escape from the Water Festival. They had flown possibly two thousand miles. The Sun had risen, but after a time—since their enormous speed and change of latitude had affected the angle at which they viewed it—the Sun now was hanging almost level, not far above the horizon. Hanging level, and turning visually cold.

Beneath the platform—a mile below now—lay a tumbled waste of naked crags. The borders of the Cold Country! Tarrano's stronghold! The birthplace of his dreams of Universal conquest.

Elza was staring downward. A barren waste. Rocks bare of verdure. Grey, with red ore staining them. A desolation of empty rock, with grey flat shadows. And far ahead, the broken, serrated ranks of mountains with rocky peaks, white-hooded with the snow upon their summits. The Cold Country. Bleak; forbidding.

This brittle air was cold; yet Elza and Tarrano were warm. Before the platform, a ray darted—a low-powered ray of a type that was to be so great a factor in the warfare into which we were all so soon to be plunged. It heated the air, so that the platform rushed always through a wind that was balmy.

"What did you say?" Elza looked up to meet Tarrano's steady gaze.

"I said it is wonderful to be thus alone with you, my Elza."

"Oh." She looked away.

(Continued on page 1136)



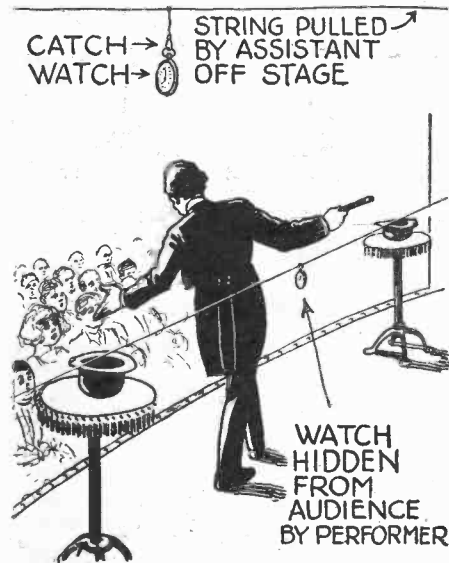
MAGIC "DUNNINGER" By

THE MAN WHO MYSTIFIED
Pres. Coolidge
Prince of Wales, Ex-President
Harding, Tatt, Roosevelt,
and other celebrities
Writes Exclusively for
SCIENCE AND INVENTION



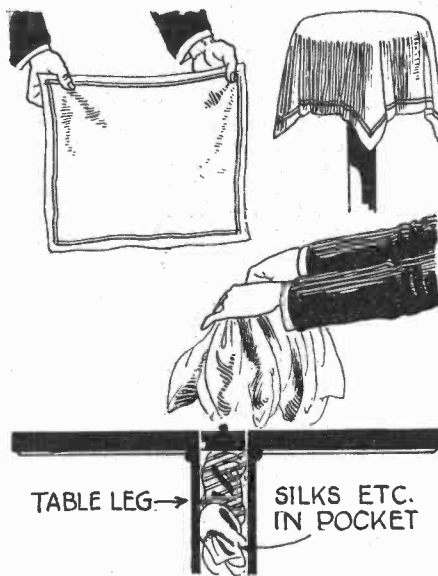
NO. 37 OF A SERIES

Invisible Transportation: In the diagram below the method of making an object pass from one hat on one side of the stage, to another hat on the opposite side of the stage, is clearly illustrated. The magician drops a watch or other object into one hat, taking care that it is hooked to the thread. Under cover of his body the watch is then transported to the other hat.



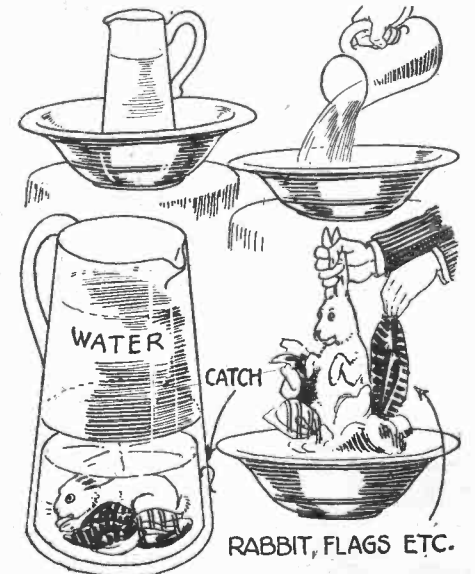
When the assistants behind the stage pull the string, the watch may be made to pass from one hat to the other under cover of performer's body.

Handkerchief Production: In the diagram illustrated below the magician employs a unique end table, which contains a pocket in its single supporting leg. Silks are pushed down into this pocket after having been securely fastened to the small cap covering the hole. Then he places one silk kerchief over the table and grasps it in the center, he pulls the load away with him and produces it.



Above is illustrated a clever method of securing a load from an end table.

The Water Pitcher Load: A pitcher of water is seen standing in a wash basin as illustrated below. Water is poured from the pitcher and immediately thereafter a rabbit, flags and silks are produced from the basin. No table traps are used. Notice that the pitcher contains a compartment in the bottom which houses the load. The water is poured outside of the compartment.



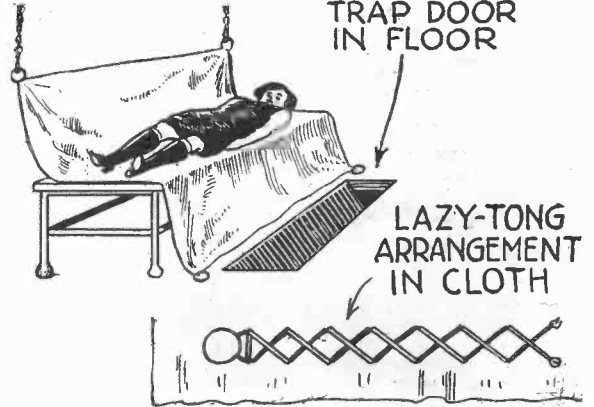
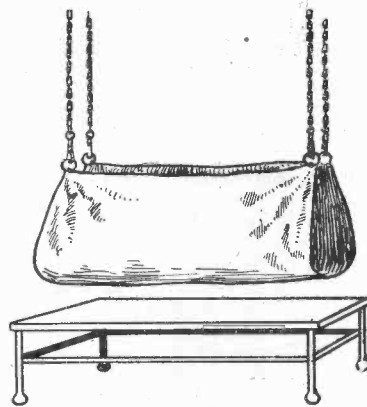
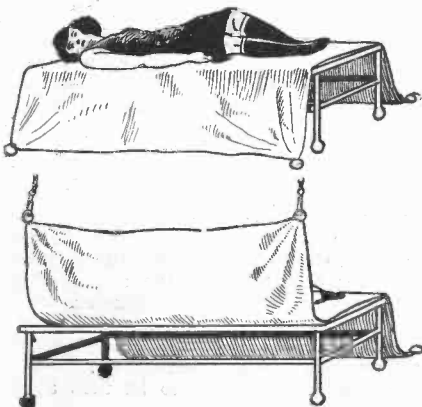
With the above illustrated device it is a simple matter to produce a variety of things from a pitcher and basin of water.

The Disappearing Lady

Below we see a very interesting method of making your female assistant disappear. The effect is as follows. A cloth is laid over an undraped table and the lady lies down

upon the same. The front and back ends of the cloth are then raised clear of the stage and the outline of the girl's body can still be seen through the cloth. A shot is fired

and the cloth collapses and drops to the stage floor, the girl having completely disappeared from mid-air. The girl rolls into a trap as the front fold of cloth is raised.



The girl lies down on an undraped couch which has been covered with a cloth provided with rings as shown. The front is raised and then the back follows. Apparently the girl is still within the cloth. As a matter

of fact she disappeared into the trap. The lazy tong arrangement in the cloth makes the audience believe that the girl is still concealed within the suspended sack. This tong is collapsed when the cloth is permitted to fall.

Rat Contest Awards



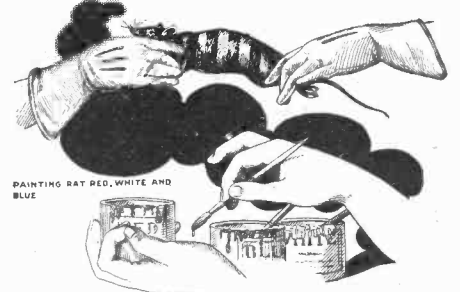
The above photograph shows how rats are being exterminated in some of the foreign countries. This particular picture shows a professional rat catcher. The tank on his back contains poison gas, a hose connecting from the tank is pushed down into the rubbish and then the bellows on top of the tank is actuated by means of a lever in the user's right hand. This gas means instant death to the rat pest.

The photo at the right shows four professional rat catchers and some of the victims. The gas acts upon the rats instantaneously halting them in their paths and immediately killing them.



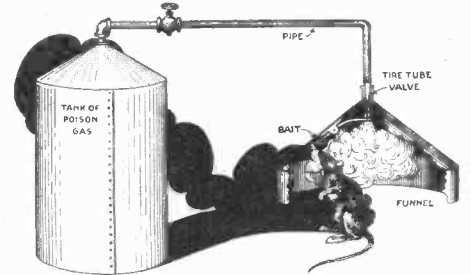
In the original announcement of the rat exterminating contest, the editors made specific mention that they desired new systems for killing rats. No consideration, therefore, was given to those old chestnut methods, as for instance, sprinkling grain of any kind on water and the rats in attempting to get at the grain will naturally fall through the layer and drown. Feeding the rats plaster of Paris or cement in any food mixture is also very old. Let us see how the judges assigned the \$250.00 in awards.

Fourth Prize, \$25.00—was awarded to R. D. Rabenold of Hillsboro, Iowa, for the method with which he was able to rid his farm of these pests. He merely painted stripes across the rats, as illustrated, and released the rats again. Such painted rats are not welcomed by their brothers and the other rats will soon disappear from the premises.



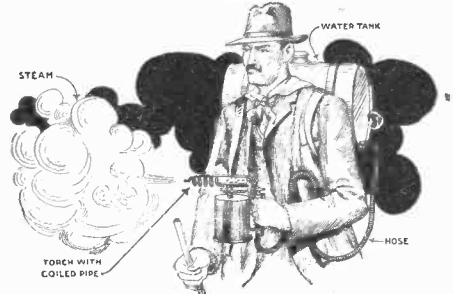
Catching the rat alive, painting stripes upon its body and releasing it wins fourth prize.

Fifth Prize, \$20.00—was won by John G. Dengler, of Pittsburgh, Pa., for the poison gas system here illustrated. When the rat pulls down on the bait, the valve is opened and the rat is killed.



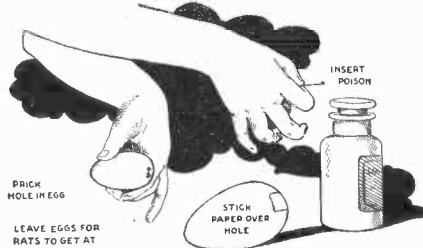
A tank of poisonous gas fitted with a valve and released as indicated got fifth prize.

Sixth Prize, \$15.00—was won by Juan P. Stoddart of Arica, Chile, for this idea. There is no danger to any merchandise nor any fear of starting a fire. Four men starting from four corners of a plot work to a common center spraying live steam on the ground.



The sixth prize winner suggested the use of live steam for ridding premises of rats.

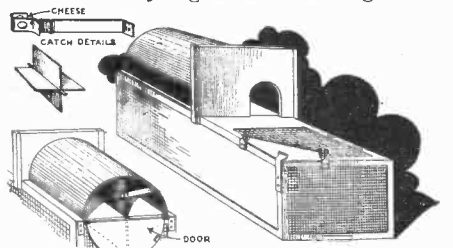
Second Prize, \$50.00—was won by Gregory Bowden of San Luis Obispo, Calif., for the suggestion for poisoning rats using an egg as bait. It is a well known fact that rats like eggs and they will carry those eggs down into their nests to feed their young upon the contents. A tiny hole is pricked in the egg and poison is pushed into the hole. The hole is then sealed with a piece of tissue paper. The egg is placed where rats will easily get at it. The poison does the rest.



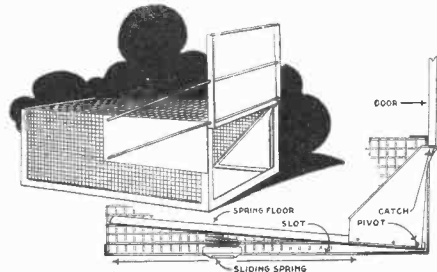
Pricking a tiny hole in an egg and then inserting poison and again resealing the hole is the second prize winning suggestion.

Third Prize, \$30.00—was won by Frederick C. Jones, of Woollahra, N. S. Wales. He takes an ordinary round bottle, mounts it on the end of a stick nailed to a box, and then greases the bottle well. A piece of cheese or other bait is then fastened to the bottle by means of wire. A runway is then fitted to the box and a pail of water placed under the bottle as shown. The rats in attempting to get at the bait lose their footing on the bottle and fall into the water to drown.

Seventh Prize, \$10.00—was won by T. Sheley of Indianapolis, Indiana, for the rat trap illustrated below. This is a self-setting trap which catches the rats alive. When the rat nibbles at the bait he releases the floor beneath him which precipitates him into the lower compartment, turning the door through an arc of ninety degrees and resetting it.

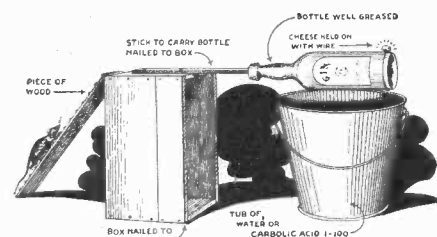


A self-setting rat trap, the construction of which is clearly shown, won seventh prize.



The first prize was won by the rat trap illustrated above. It may be set for any number of rats by changing spring position.

First Prize \$100.00—was awarded to J. Albin Hedberg of Chicago, Ill., for the construction of the trap illustrated above. By changing the position of the sliding spring beneath the floor the tension for the release of the door may be varied, so that the weight of one or seven rats closes the door.



A greased bottle suspended over a pail of water and fitted with bait, as illustrated above won the third prize.



MODEL DEPARTMENT



Win a Silver Trophy Cup

Take up "Model Making" as a Hobby. It is Interesting, Instructing and Profitable.
Submit Your Results to Us and Compete for the Handsome Engraved Cup Illustrated Below.

THE Model Department is here at last! Due to popular request, we have decided to incorporate a Model Department in this magazine and as a further inducement to our readers to build models and to submit them for publication, we are offering a prize of a handsome silver loving cup for the best model submitted each



Here is shown a photographic reproduction of the cup that will be awarded each month for the best model submitted. Isn't it worth working for? It is 17½" high and weighs five pounds.

month. Once you have won this cup, it is yours to keep. There is no necessity for you to win it two or three times in succession as is often the case in contests where cups are awarded as prizes.

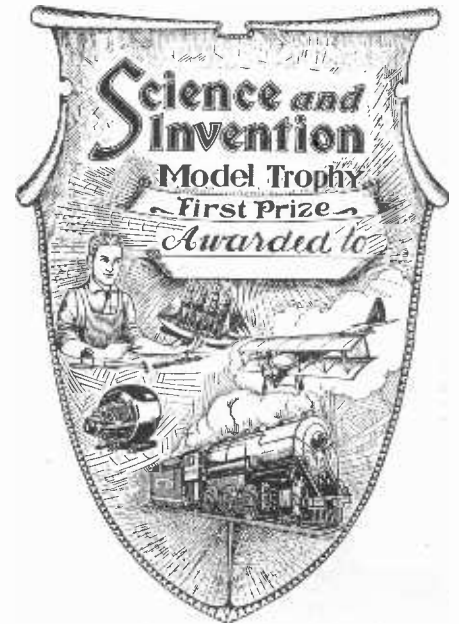
On the two following pages of this issue you will find complete details covering the construction of one of the finest working models of a steam engine and boiler we have seen in some time. This is an example of the kind of work that we want to encourage among our readers. The building of models is a hobby that is wide spread and you will find followers of it in every class and creed throughout the world. You need not have an elaborate machine shop in order to compete in our contest as some excellent models have been made with the very simplest of tools.

After you have viewed the drawings accompanying the following article, do not presume that you have to make similar drawings in order to enter your model. On the contrary, the simplest of detailed sketches will

Rules for Model Contest

1. A handsome silver loving 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 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 June contest must reach us on or before the 25th of March.
7. Address all entries to Editor Model Department, c/o Science and Invention Magazine, 53 Park Place, New York City.

suffice. However, your model must be submitted and from it and from the sketches that you send, our artist will make up drawings that can easily be followed by anyone. So, the work that you do, will benefit the other readers of SCIENCE AND INVENTION as well, providing that your design is published. By working hard and turning out the best



This illustration shows in detail the appearance of the shield that will be engraved on each cup awarded. The winner's name will be engraved in the blank space shown.



The comparative size of this beautiful trophy cup can be seen in the above photograph. This is a prize that you will be only too proud to show to your friends as proof of your ability as a model maker.

possible model, you will accomplish many things. First, you will be instructing yourself in some certain lines of endeavor. Secondly, you will be acquiring a knowledge of tools and how to handle them to the best advantage. Third, you may be helping others to enter this most fascinating of all pastimes. Fourth, and last but by no means least, you will be paving the way for competition in a contest that may net you a handsome silver trophy cup as a reward for your labors.

In the center column of this page, you will find complete rules for entering our Model Contest. Study them carefully and follow each and every one of them. If you abide by the rules, your entry can be handled quicker when it reaches this office and if it is awarded the prize, we can present it to our readers in the best possible form. Do not forget the main thing and that is that the model itself must be submitted. Remember the Model Engineers of today are the fullfledged engineers of tomorrow. Model building is the stepping stone to engineering if you elect to make it worth your study and thought.

Model Boiler

Details of The Construction of the Boiler For the Complete Stationary Steam Engine. Illustrated in the March Issue. This Is the Second and Final Installment

IN the last issue of SCIENCE & INVENTION Magazine we showed the complete details of a model steam engine developing 1/30th of a horsepower with steam at a pressure of only fifteen pounds per square inch. The remaining details for the construction of the boiler are listed on this and the following page. The diagrams are explanatory in themselves and every detail can be seen in the illustrations in this issue as well as those in the previous issue. The pipe connecting with the boiler to the cylinder of the steam engine should preferably run along the side of the boiler and as near to the fire box as possible, as the photograph in the previous issue showed. In this way additional heat is made to act upon the steam and a sort of a super-heated effect is produced. A small oil cup is preferably inserted into this pipe line so that the moving parts of the valve can be lubricated by merely permitting the oil to pass down into the pipe line. It may also be seen in the photograph published in the March issue that the pipe line slants downward toward the cylinder of the engine. In this way pockets that catch condensed water vapor are eliminated. The pump for the steam engine is unique in construction and not only serves the purpose of pumping cold water into the boiler, but may be used to supply water pressure for a small table

fountain or for a small fire hose. In the front end of the boiler a valve will be noticed, the lever of which when turned up permits the water from the pump to be injected directly into the boiler. When the lever is turned forward water from the boiler flows out, thus partly draining the boiler, and when the lever is turned down, water from the pump passes out of the pet cock near the

boiler. In this way either hot or cold water can be supplied at will and the boiler of course can be automatically filled up while the engine is running.

Throughout the model, leather, rubber or cardboard packing is used, except in the cylinder valve and pump. Here the pieces are made to fit accurately and a little oil prevents the escape of steam, and water in the case of the pump.

Several methods of operating the boiler are shown on the following page and in addition to those outlined, there are other systems which could be employed but which were not here illustrated because the most efficient forms and the neatest looking jobs are explained. For instance, an immersion heater can be inserted into the boiler and the leads can be taken out from the top of the boiler, but it is obvious that if this type of heater is used, the presence of the leads would be objectionable, and in addition it would be quite impossible to effect a replacement in the event that the immersion heater was burned out.

A slightly better form of using electricity for heating would be to employ a standard heating coil and place this directly under the boiler. An ordinary six hundred watt unit

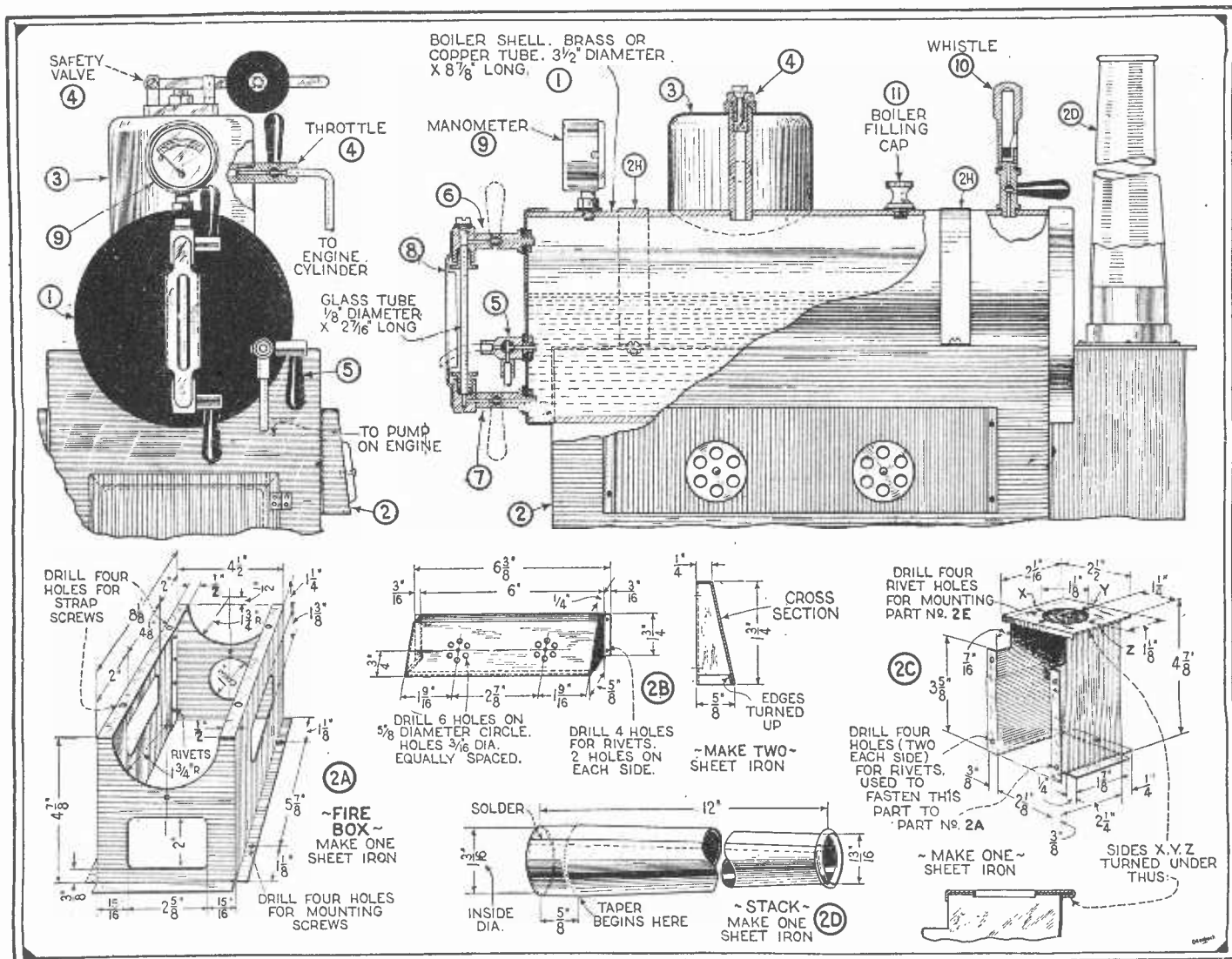
(Continued on page 1142)

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Who?

Will win the first Science and Invention Model Trophy Cup
See next issue.

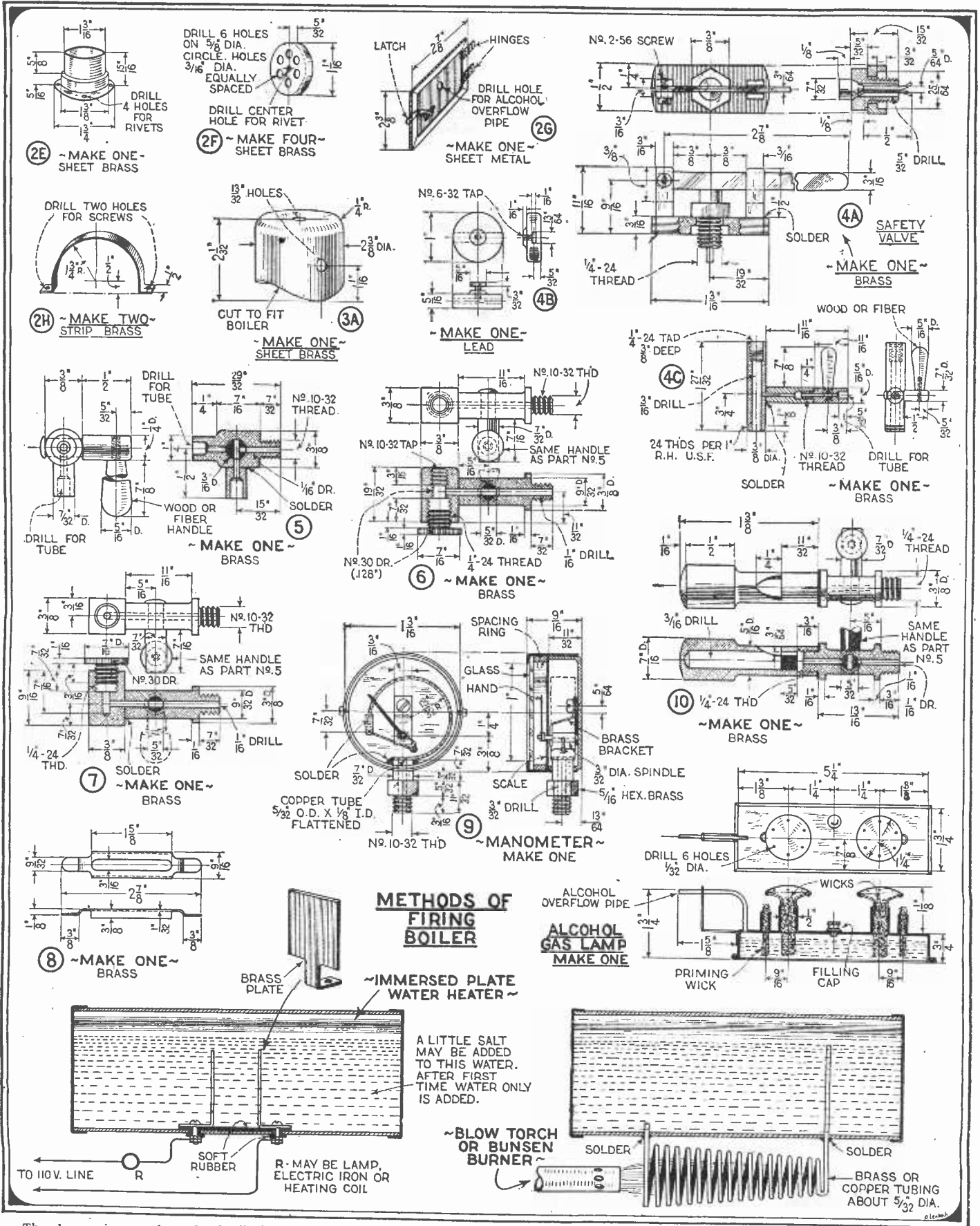
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The above set of diagrams further illustrate the construction of the steam engine and give specifically the construction design of the model boiler. Further details of this model boiler are shown on the following page. It will be noted that the numbers correspond with those on the detail drawings.

Stationary Steam Engine Details

Unique Methods of Firing the Boiler




The above print completes the detail diagrams for the model stationary steam engine developing one-third of a horsepower with only fifteen pounds of steam pressure in the boiler. This model may be made to drive a small dynamo or may be made to operate a small model pumping station or in fact it can be employed wherever one desires to use a miniature steam engine to operate a display of any nature. At the bottom of this page two optional methods of firing the boiler are illustrated. In the electrical system

when the water in the boiler gets low, current no longer passes across the plates, and consequently there is no danger of ever overheating the boiler. In the method using the blow torch, heat and high pressure steam are rapidly obtained. As a matter of fact in this particular form of firing, the model can be started, a minute or so after the torch has been ignited. Blueprints for the complete construction of this model steam engine may be had from the Blueprint Division of the Model Department.

Everyday Chemistry

By RAYMOND B. WAILES

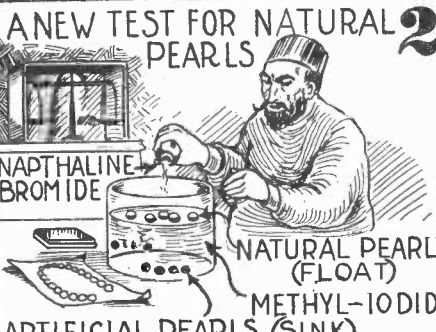
1 **POTASSIUM PERMANGANATE**



KEEP THE THERMOS BOTTLE SWEET AND CLEAN WITH PERMANGANATE OF POTASH

If a pinch of potassium permanganate crystals are placed in a thermos bottle and a few ounces of water are added, the mixture will thoroughly clean the interior of the bottle.

2 **A NEW TEST FOR NATURAL PEARLS**



NAPHTHALINE-BROMIDE

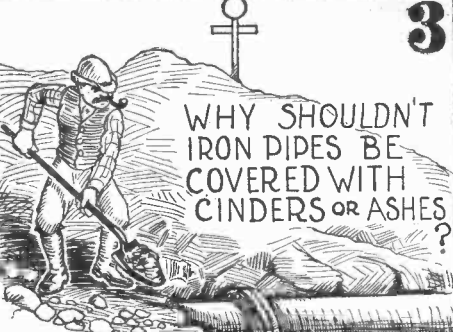
NATURAL PEARLS (FLOAT)

METHYL-IODIDE

ARTIFICIAL PEARLS (SINK)

If suspected pearls are placed in a methyl iodide solution and naphthalene bromide added, the natural pearls will float, whereas cultivated ones will fall to the bottom.

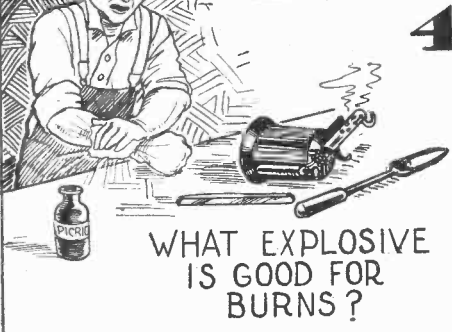
3



WHY SHOULDN'T IRON PIPES BE COVERED WITH CINDERS OR ASHES?

Cinders contain various forms of sulphur which probably form sulphuric acid and cause a rapid corrosion of the iron pipes. Do not use cinders for the purpose shown above.

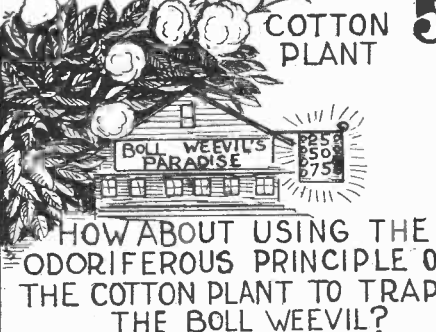
4



WHAT EXPLOSIVE IS GOOD FOR BURNS?

Picric acid, used as an explosive and as a yellow dye is a very good application for burns and scalds. Made into solution with water, it is applied with bandages.

5 **COTTON PLANT**



HOW ABOUT USING THE ODORIFEROUS PRINCIPLE OF THE COTTON PLANT TO TRAP THE BOLL WEEVIL?

Boll weevils are attracted to the cotton plant by the trimethylene, an odoriferous part of the plant. This substance could be used as a lure for boll weevil traps in the fields.

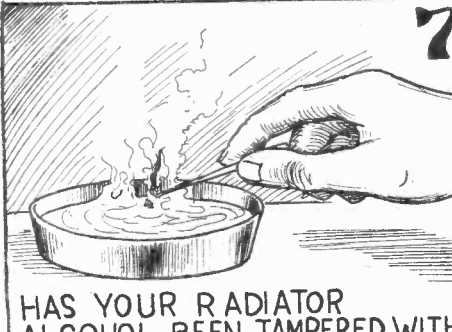
6



WHY DID SHAVING STICKS GET THE "BLUES"?

Nickel brass cases formerly used for shaving sticks and the alkaline soap combined with the copper and formed blue copper compounds. Now, aluminum cases are employed.

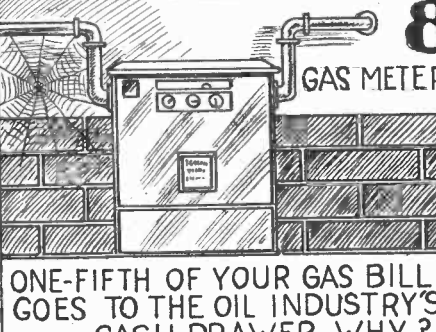
7



HAS YOUR RADIATOR ALCOHOL BEEN TAMPERED WITH?

To test this, pour a little of the alcohol into a flat tin pan as above and ignite it. If much liquid residue remains, the alcohol has been diluted maliciously with water.

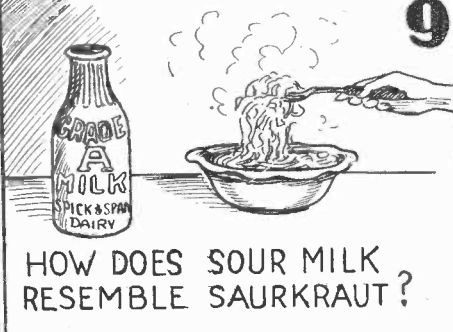
8 **GAS METER**



ONE-FIFTH OF YOUR GAS BILL GOES TO THE OIL INDUSTRY'S CASH DRAWER. WHY?

Because a petroleum distillate, gas oil, is used in making the majority of this country's illuminating gas. Therefore, you have to pay for the oil from which your gas is produced.

9



HOW DOES SOUR MILK RESEMBLE SAURKRAUT?

Both materials contain the same acid—lactic acid. The medicinal value of sauerkraut and the liquid in which it is cooked is beginning to come into its own.

10

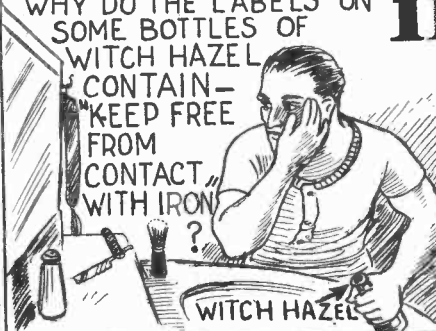
DO YOU KNOW THAT THE NICE SOFT BATH SPONGE IS CHEMICALLY ALMOST THE SAME AS SAND?



In part, bath sponges and sand are chemically the same. They are both composed partially of silica although they are entirely different in formation.

11

WHY DO THE LABELS ON SOME BOTTLES OF WITCH HAZEL CONTAIN—"KEEP FREE FROM CONTACT WITH IRON"?

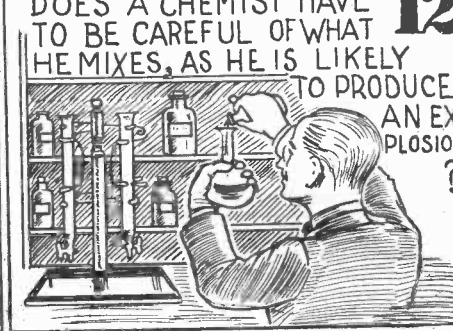


WITCH HAZEL

Because witch hazel contains a trace of tannic acid, which in the presence of iron forms iron tannates which are, in reality, the base of many writing inks.

12

DOES A CHEMIST HAVE TO BE CAREFUL OF WHAT HE MIXES, AS HE IS LIKELY TO PRODUCE AN EXPLOSION?



Under usual conditions, there is not much likelihood of an explosion. When handling unfamiliar materials, it is wise however to exercise ordinary safety precautions.

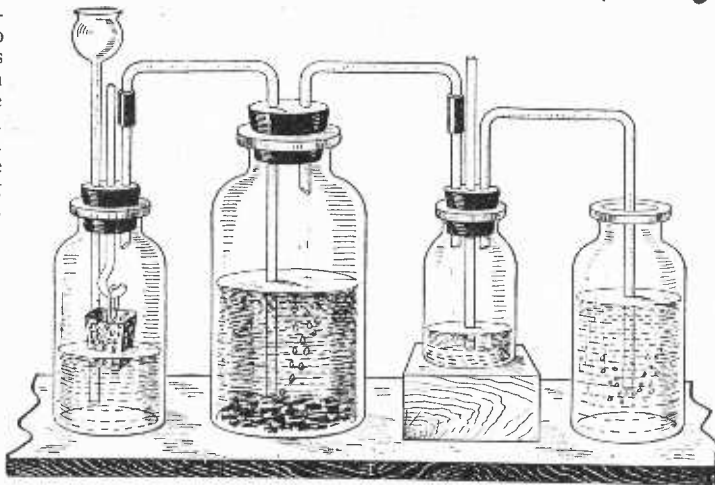


Recovering Silver From Hypo

A LARGE number of amateur photographers develop and fix their own negatives and prints. In the fixing solution of both negatives and prints quite a little silver is dissolved which is almost invariably thrown away.

The old hypo solutions are poured into a quart or gallon jug and retained until the bottle is practically full. The amount of silver obtained from even a quart of old exhausted fixing baths will surprise the photographer and the resulting silver nitrate can be used for quite a number of photographic experiments, or can be disposed of in other ways. That it does pay to save this solution has been strikingly illustrated in the moving picture industry, where enterprising men went out and collected old hypo baths in order to extract the silver from them. A fortune has been made by this means and now the old hypo baths are not given away, but sold at a good profit.

The easiest method to extract the silver from hypo by the home worker is to precipitate it as silver sulphide by means of hydrogen sulphide gas which can readily be produced in a special flask; the disagreeable odor given off by this gas can be "caught" in a dilute solution of caustic soda so that



A great quantity of silver is lost by photographers, who throw their hypo-solutions away after use. It can be readily recovered and saved by precipitation with sulphuretted hydrogen as shown above.

no odor is connected with the process.

The hydrogen sulphide is generated with iron sulphide acted on by dilute sulphuric acid in a bottle which is stoppered with a rubber stopper having three holes. One hole carries a safety tube, another a gas outlet tube, and the third carries a solid glass rod holding a leaden basket which contains the iron sulphide which may be raised from

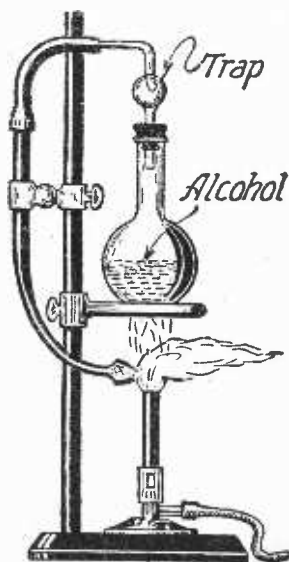
or lowered into the acid as desired.

When the basket is lowered into the acid, the gas is generated and is passed into the bottle containing the old hypo solution. This bottle is stoppered with a cork having two holes, one containing the tube which leads the gas into the solution, and one which leads out of the bottle and into a little glass containing a dilute solution of a caustic such as lye or in simpler fashion out of the window. This last tumbler absorbs the gas as it passes out and prevents the odor of the hydrogen sulphide generated from entering the room.

After running about an hour the flask containing the hypo will smell of the hydrogen. Then filter the solution, which is now black, through paper; take the paper with its black mud and place it in a beaker containing a strong solution of nitric acid. Boil the paper and the black silver sulphide until the entire mass has a straw color. Then filter again to remove the fibres of the filter paper and evaporate. This resulting silver nitrate is collected, and when a small bottleful has been obtained, it can be purified by fractional crystallization and you will have a nice quantity of silver nitrate.

Extemporized Blast Lamp

The illustration shows an extemporized blow-torch for use in the laboratory, but it should not be used except by a competent



A simple blow-torch where the fuel or rather part of it supplies the blast. It should only be used by the practised chemist.

chemist, one who is sure of himself. The illustration tells the story. A Pyrex flask, preferably a round bottom one, is placed on a sand bath over a Bunsen burner. From its neck a glass tube leads down to the top of

Bunsen burner, perhaps half an inch above it and a little to one side. The clamp which holds the tube will steady the flask. To secure pure gas, vaporized alcohol free from liquid, a trap of simple construction is used immediately above the cork; the illustration shows its simple construction.

Now on heating the alcohol with the burner placed as shown it soon begins to boil and gives off vapor at a slight pressure to start with, which may become considerable, for a few inches is high pressure in a gas lamp. The blast from the end of the tube deflects the flame and by shifting the burner about various jets can be readily produced. Enough of the heat is supposed to rise against the flask to maintain its temperature high enough to volatilize the alcohol.

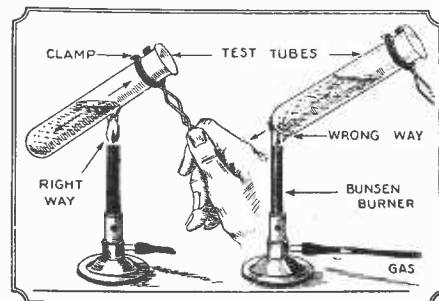
It is the reverse of the ordinary blast lamp, as the fuel or part of it produces the jet.

No doubt, the experimenter has often been alarmed at the very large number of test tubes which have been broken in his laboratory. An inquiry will reveal that a large proportion of them are broken when being used to heat a liquid or substance over the Bunsen burner.

Referring to the "wrong way" in the two sketches herewith, it will be seen that the extreme closed end of the test tube is being heated. This will cause steam bubbles to form, which will push the overlying liquid in the direction of the arrows, to L and also to B. It will be seen that B is the end of the tube and the bubbles bring the unprotected glass into the flame, heat becomes so great that the end of the tube by the heat and the return of the water is broken.

Test Tube Breakages

Referring to the "right way" as illustrated, it will be seen that the tube is heated near the surface of the liquid or well above the bottom of the tube. Any steam formed here will easily bubble up through the small amount of liquid overlying it and escape into



The right and wrong way of boiling a solution in a test tube. Even if you do it the right way do not turn up your gas flame too high.

the air of the test tube, the downward pressure being very slight and no breakage occurs. But even at this do not use too large a flame. Now, as the liquid becomes heated to boiling, the tube should be raised in the flame so that the central portion of the liquid is heated and then by another slight elevation the lower contents are heated. It will be found by employing this method of heating, with gentle shaking or swirling of the tube and its contents with a rotating motion of the hand, test tubes will rarely become broken over the flame.

—By Raymond B. Wailes.

Easy Experiments

By EARLE R. CA

ONE of the most interesting fields of modern chemistry is that of colloids. The field is especially interesting for the experimenter since many of the experiments in colloid chemistry are exceptionally striking, and are generally capable of being carried out with simple chemicals and apparatus. The most unusual experiments are those involving the so-called gels. These substance, in a sense, are the opposite of the colloid solutions. Colloid solutions consist of extremely finely-divided solid matter suspended in a liquid, while the gel consists of finely-divided liquid distributed through a solid. In carrying out the experiments below, little difficulty will be experienced if the directions are carefully

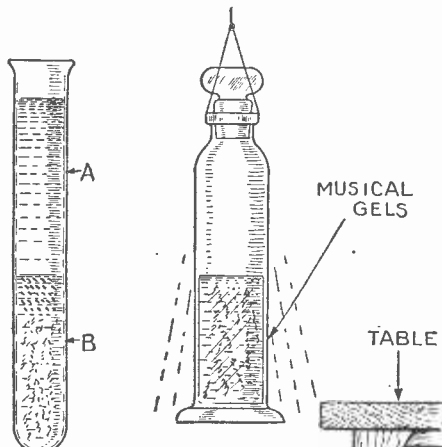


FIG. 1
FIG. 2
Interesting experiments with colloids. Fig. 1 shows overlying gels which may be given different colors. Fig. 2 is a gel whose receptacle gives a musical sound when struck against a table.

followed. The gels as a class are usually sensitive and unstable so that variations in their preparations often result in failure. This very fact, however, makes the field interesting for the real experimenter for lots of room is left for an enormous amount of experimenting in this field.

EXPERIMENT I A MUSICAL OR RINGING GEL

This particular gel is very readily prepared. Commercial water glass is diluted with about an equal volume of water and the solution is then poured into a small bottle or a test tube. With constant stirring concentrated sulphuric acid is then added to the above solution, the number of drops added being equal to the volume of the water glass solution in cubic centimeters. Sometimes the gel forms at once and sometimes the solution will have to be set aside for a day or two. The more dilute the water glass solution, the longer it takes to set. It is much better if several hours are needed to set the gel. The proper point is found by using different dilutions of the water glass solution although with the ordinary product the above dilution is satisfactory. The test tube or bottle containing the preparation when tapped against a wooden bench or similar surface will be found to give forth a clear ringing or musical sound. Successful ringing gels can also be formed with hydrochloric acid and water glass solution. The proper proportions can best be found by experiment. These gels can be kept a long time before they break down or undergo the process known technically as *syneresis*.

EXPERIMENT II BLUE AND RED COLORED GELS

By adding a few drops of phenolphthalein indicator solution to a gel of the kind de-

scribed in the first experiment the entire gel and a red or pink color by the use of the indicator. This, however, is a colored gel but only one made so by such means. A gel may be made by other salts in which the entire body of the gel is of a delicate blue color. An essential point in making this gel is that the solutions must be kept at a low temperature, preferably, under 15° C. (59° F.) which is a little below ordinary room temperature. A simple ice cooling bath will help in carrying out this detail. Three c.c. of a saturated solution of copper sulphate are mixed with forty-seven c.c. of a saturated solution of copper acetate. To this mixture are then added with constant stirring four c.c. of ammonia solution, made by diluting the ordinary strong concentrated laboratory reagent with an equal volume of water. The mixture sets to a light blue gel which will not break down from the gel form for nearly a week, if the temperature is kept low. A brown gel from manganese salts may be made by adding three drops of glycerine to twenty c.c. of a six per cent. solution of potassium permanganate. This gel rapidly sets but as a rule only remains in the gel form several hours.

EXPERIMENT III BANDED GELS (LIESEGANG'S RINGS)

A most peculiar phenomena sometimes occurs when ordinary chemical precipitates are formed in gels. Instead of forming in an even mass throughout the solution, as when a precipitate is formed in a water solution in a beaker or test tube, the precipitate in the gel forms in bands, leaving clear spaces between them. These alternate bands are called Liesegang's rings after their discoverer. A simple way of showing them with ordinary materials is to first make up a gel by dissolving two grams of ordinary gelatine in sixty c.c. of boiling water at the same time adding one-twentieth of a gram (one pea-size crystal) of potassium bichromate. The hot solution is poured into a small beaker and allowed to set. When the gel has set it is removed from the beaker and placed in a solution made by dissolving twelve grams of silver nitrate in one hundred and fifty c.c. of water. The cooling and placing in the solution had best be done in an ice box. The gel should be allowed to remain in the silver solution two days. When this has been done the gel is removed with a pair of forceps rinsed with water and sliced thru the middle with a sharp knife. The bands of the precipitated silver chromate can then be readily seen.

EXPERIMENT IV. CRYSTALS GROWING IN GELS

Many substances such as gold, copper and certain salts when slowly formed in gels take the form of beautiful crystals. One of the

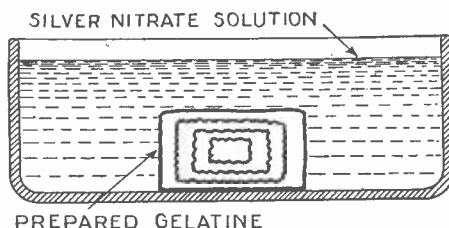


FIG. 3

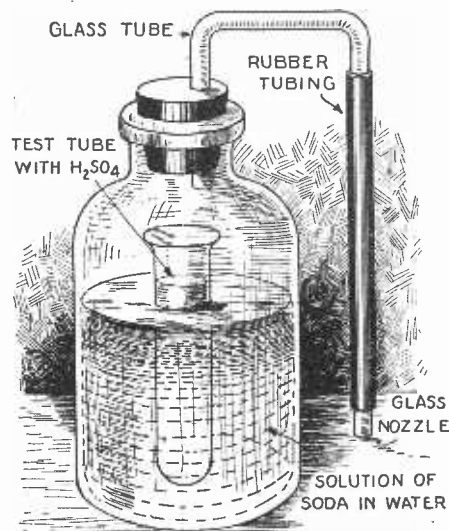
The illustration shows the method of producing Liesegang's rings. Silver chromate is precipitated in parallel bands, seen by cutting across the gel with a sharp knife.

easiest ways to show this phenomena is by forming golden crystals of lead iodide in silica gel, an experiment that was first performed by Holmes in 1917. This particular growth is strikingly beautiful. Dilute twenty c.c. of commercial water glass to about one hundred c.c. and add an equal volume of acetic acid solution made by diluting six

c.c. of the glacial acetic acid to a volume of one hundred c.c. Then add fifteen c.c. of a lead acetate solution, made by dissolving three grams of the dry salt in that volume of water. The mixed solutions are then poured into test-tubes to set. Each test-tube should be about half full. When the gel has set the remainder of each test-tube is filled with a solution made by dissolving thirty grams of potassium iodide in one hundred c.c. of water. The tubes are then observed from time to time. Various fern-like forms appear and the golden-yellow scales sparkle in the light. The proportions of the reagents can be varied within certain limits and variations of the phenomena can be thus observed.

A Home-Made Fire Extinguisher for the Laboratory

By FRANK H. MOORE



A chemical fire extinguisher, based on the action of sulphuric acid on sodium bicarbonate. The acid is contained in the test tube.

A FIRE is a thing that we are unable to foretell when one takes a notion to break out. Of course, if care is exercised in the use of it there is little or no danger. However, a fire extinguisher is an invaluable asset to have in the home, and will repay its owner many time, in the feeling of security which it imparts, particularly the experimenter who has a home laboratory and does considerable chemical and electrical work. The one here described is made after the pattern of the well known "Pyrene Extinguisher." As shown in the sketch the requisites are a wide mouthed bottle capable of holding at least a pint of liquid. A saturated solution of sodium bicarbonate (baking-soda), is prepared by dissolving about three ounces of the "soda" in the pint of water. When this has dissolved pour the mixture into the bottle. Now take a test tube long enough to reach almost to the top of the bottle, or so that the top of same will just clear the soda solution when it has been placed in it. Dilute sulphuric acid is now made (1 to 5), and poured into the tube, leaving about one-half inch clearance of the top. A one-hole rubber stopper is fitted with a fairly large bore glass tube bent at right angles, this having a three foot length of rubber tubing connected to it. Assemble the extinguisher by inserting the stopper in neck of bottle, and to use, simply invert the bottle and point the hose at the fire.

The principle of the extinguisher is this—The dilute acid comes in contact with the "soda" solution, which vigorously react chemically, causing a rapid evolution of carbon dioxide gas which forces the liquid out through the tube at quite a high pressure.

Patent Attorney
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1917



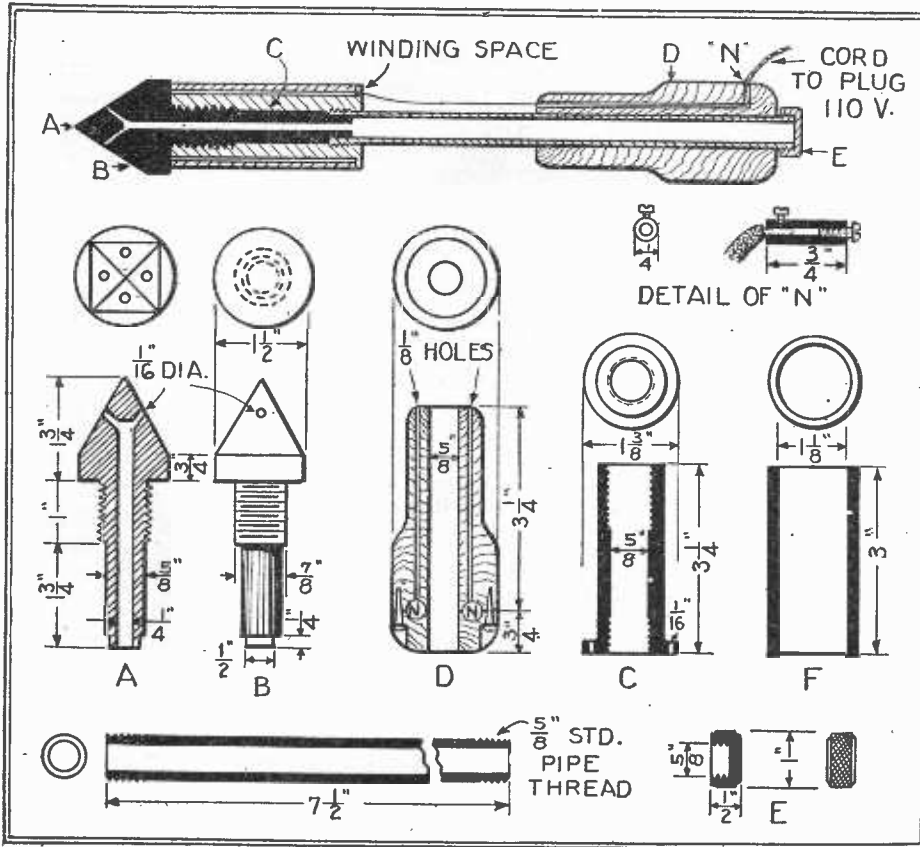
Magazine Electric Soldering Iron

By A. N. CAPRON

THE electric soldering iron here described and illustrated will at first glance seem to be the ordinary iron, but there are several improvements incorporated in its design. The tubular stem of the iron carrying at one end the heating element and at the other, the wooden handle is used as a magazine for a small stick of solder which is introduced at part E and secured with the knurled cap seen there also. The lower end of the stick of solder comes in contact with the central portion of the copper tip, and when the iron is heated a small quantity is melted and runs out through the fine capillary tubes in the faces of the copper tip, and thereby flows directly upon the work.

It can easily be understood that with such an iron, a larger amount of work can be performed in a given time, as the operator does not have to be continually applying solder to the tip. All dimensions are marked on the sketches.

The heating element consists of two layers of No. 26 nichrome wire wound with 1/32 inch space between turns, an asbestos thread makes a good separator. The form, C, is given a layer of micanite with 1/4 inch lap of 25 mils micanite or the equivalent in layers of thinner material, then the nichrome is fastened to the No. 16 enamel wire. The two holes 1/16 inch at base of form, C, are lined with a mica tube and the copper wire is pulled through leaving 10 inches extending outwards, the junction being on the inner end of the former. One layer is wound to 1/8 inch of the end; a layer of micanite 10 mils thick is put over the wire and the winding is continued to the other end (return). A piece of the same wire is fastened to the other end and pulled through the other 1/16



A very complete electric soldering iron is shown above whose interesting feature is that there is a cavity or reservoir in the bit which holds solder and in which the solder remains melted, coming out as required through a very small aperture communicating with the reservoir.

inch hole in the base of C, this hole being previously lined with a small mica tube. The other parts having been made, cover the wound portion with a layer of micanite and try the brass tube, F, on it, if this tube fits too loosely wind a layer of asbestos thread on the micanite to hold it in place and push the tube, F, into position tightly up to the collar on C.

The wrought iron pipe is next threaded and screwed into the lower end of form, C. The copper tip is placed at the other end and screwed tightly. It will be observed that the tube F is held tightly between the flanged ends of part, C, and tip, B. The wood handle is made in two pieces which are to be fastened together with screws or rivets and washers as shown. The lower part 2 is bored with a slight taper at the lower end, so as to grip the pipe, there are also 2 holes in

part 1 for the leads from the heating circuit. The ends of leads are fastened to the clip shown at N, a groove being cut on both parts to accommodate this clip. The 110 volt leads are fastened in such a manner, that no live wire emerges from the wooden handle. This is easily accomplished by cutting just sufficient rubber from the wire; the lower part of D when screwed home holds clip and wire leads securely. The addition of the knurled cap, E, completes the iron. But the enamel leads could be better protected by means of a serving of asbestos thread or cord and this asbestos serving protected by winding tightly one layer of No. 10 bare copper wire the end turns of which are to be brazed together with a blow-pipe.

The whole assembly is easily repaired and easily taken apart. The size of solder bar recommended is about 1/4 inch diameter or wire solder if obtainable will be excellent, this could be cut in pieces 4 to 6 inches long, one filling being sufficient for any ordinary job. If the cap is made a very tight fit it might be necessary to drill a very small hole in cap E to admit air, as if everything is air-tight, no solder could flow out at the tip. The size of the almost capillary tube at the tip is given in the sketch as 1/16th inch, but this size is suitable only for tinsmiths. The regular run on soldering work will be better done with a 1/25th inch hole. But this is an easy matter as a few blows around the outer end of the capillary hole will reduce it sufficiently for any special purpose.

Such an iron can be made for \$1.25 if the lathe work is done at home. Scrap can be used, the only part which it is absolutely necessary to make out of copper, being the tip or part AB.

Loud Speaker in Fish Head

By CLYDE E. VOLKERS

SEeking something new and unique in loud speaker design, the following experiment may be performed successfully:

The open mouth of a mounted bass head, the fighting grin of a muscalonge, or any mounted animal head offers opportunities for something new in loud speakers.

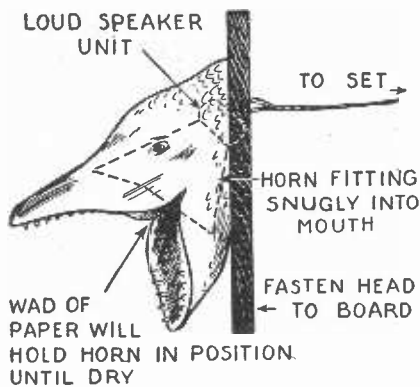
If you have no mounted fish head at the time, experiment a little and try to mount one (catch it first). A fish head may be

mounted easily. The important points to remember are: to remove excess flesh from the freshly removed head of the fish; to dust the inside of the skull with a mixture of alum and arsenic, 1 part arsenic to 2 of alum; after the eyes have been removed to fill the cavities with artificial eyes of wood, clay or glass, which are made in the natural colors; to prop the mouth open with a stick until the jaws have dried or set; to tack

the head to a suitable board by bending the gill flaps at right angles and driving the small tacks through them; to varnish the head after it has completely dried. A trial or two will yield satisfactory results.

The phone rests in a slot cut in the board on which the head is mounted. The cardboard horn is thoroughly soaked in water clamped to the phone, and then while it is soft, and plastic, is pushed against the inner

walls of the head, so as to be invisible. A wad of crumpled newspaper will hold the horn in place until dry, when it will retain its position.



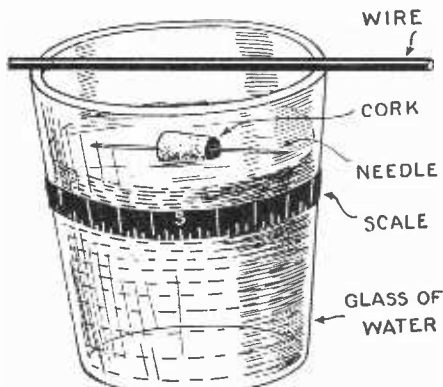
A fish's head nicely mounted on a board serves as the horn, ostensibly at least, of a loud speaker.

The cord should be led to the set in as inconspicuous a manner as possible, the mounted head being hung from the wall.

With the signals coming from the cavernous mouth of the trophy, the program may truly be called—"The voice of the Great Lakes."

AN EXPERIMENT IN THE ELECTRO-MAGNETIC EFFECTS OF A CURRENT

A common sewing needle is magnetized by stroking with a magnet or otherwise and is then thrust through a cork as shown so that it will float in water. In this case a tumbler is used to hold the water. Around the tumbler is pasted a scale marked off upon a strip of paper. A certain amount of niceness will be required in putting the scale upon the sloping side of the vessel. The

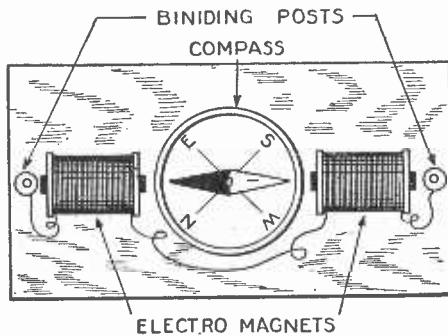


A rough and ready way of rapidly constructing an extremely delicate polarity tester and an apparatus also adapted for demonstrations.

simplest way is to wrap a sheet of paper tightly around the tumbler, and to spring a rubber band around it, using the rubber band for a guide to draw a horizontal pencil line. On removing the paper it can be cut accurately to this line, and parallel thereto or rather concentric with it is a second cut; this gives a band of paper corresponding to area of two circles of large radius. Putting water into the tumbler and floating a needle upon it, the magnetized needle will point, of course, to the magnetic north. The tumbler is now turned to bring the zero of the scale opposite to the point of the needle. On laying a wire across the top of the tumbler parallel to the needle a slight current through the wire will affect the needle, causing it to turn to right or left, according to the direction of the current. As the needle is frictionless as regards its support, except for the viscosity of the water, which is very slight, we have a most delicate current tester made from the simplest possible appliances.

CURRENT DIRECTION INDICATOR

A magnetic polarity indicator is illustrated here. This indicates directly the direction of a current or its polarity. The terminals



A current direction indicator. This instrument is of quite novel construction, and is a very delicate indicator of current direction as the magnets act so intensely on the needle.

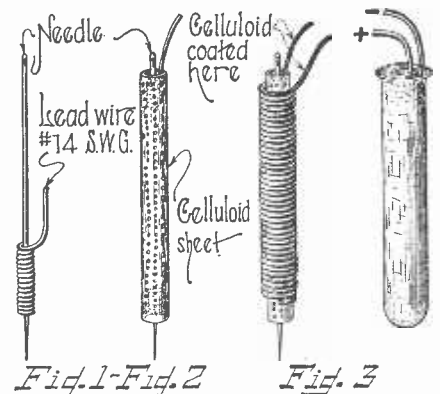
are connected to the binding posts, and the magnetized needle shows instantly the polarity. The instrument is best placed so that the magnetized needle will lie in the magnetic meridian. The magnet windings must be such as to give the direction of current, according to whether the needle points in one direction or the other. There is no half-way variation.

The active portion includes a small compass; there are two electromagnets, facing each other and two binding posts. The pivot of the magnetic needle and magnet cores lie in one line. The needle of the compass must be marked with a + on the proper end to indicate the north pole and with - on the other end. It is inexpensive in construction, and when the poles of the battery, which is to be tested are connected with the bind-

ing posts the needle will show the polarity or direction of the current. The constructor must wind the magnets so that opposite poles will face each other when a current passes.

MINIATURE STORAGE BATTERY

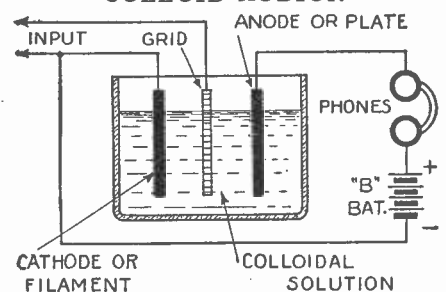
A lead wire No. 14 gauge is coiled around a needle. A piece of celluloid is softened by hot water and wrapped very neatly around



An oddly constructed B battery whose cells are glass test tubes or specimen tubes, and which can be made to give a high voltage by packing a number of the tubes snugly in a box.

the leaden wire. A second leaden wire is wound around the celluloid, this binding everything fast. The needle is then to be removed and it will be seen that here is the element for a storage battery cell ready for the solution. The elements are placed in a test tube or better yet what is known as a specimen tube, which is of heavier glass and acid added. The two terminals are then connected to the charging circuit, charged and discharged over and over again so as to form them on the Planté system. The small box can be packed with a large number of these tubes so as to give a sufficient voltage for a B battery.

COLLOID AUDION



The above shows the idea of the colloid audion. The colloid rectifier is practical, but so far no success has been had with the audion and the above diagram is given as a suggestion for further experimentation.

The Spencer Thermostat Disc



IN Sept. *The Experimenter* described the Spencer invention, a thermostat which operates to produce so sudden an opening and

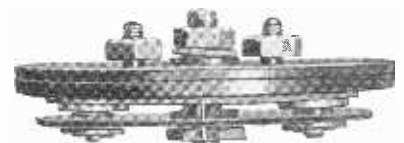
closing of a circuit that the danger of an arc is eliminated, and not only this, but it produces so great a pressure that a very perfect contact results.

Referring to the illustrations which we give here, front or face view of the disc is shown, with its three contacts spaced symmetrically around its periphery. As the disc closes the circuit, it is supposed to make three contacts and will do so infallibly if in good condition and in adjustment. Means are provided of course for insuring this result.

In the elevation and partial section the disc will be seen a little above the base plate, and this disc it is which snaps back and forth, and from this action with its clicking sound is derived a trade name, Klixon,

which is sometimes applied to this device.

Two views are given of the thermostatic disc used in the Spencer flatiron, for preventing it from attaining too high a temperature. The disc snaps back and forth like the bottom of a machinists' oil can, opening and closing the circuit.



Front view and elevation partly in section of the Spencer disc thermostat carried on its base. The three contacts are in parallel giving very low resistance.



JUNIOR ELECTRICIAN



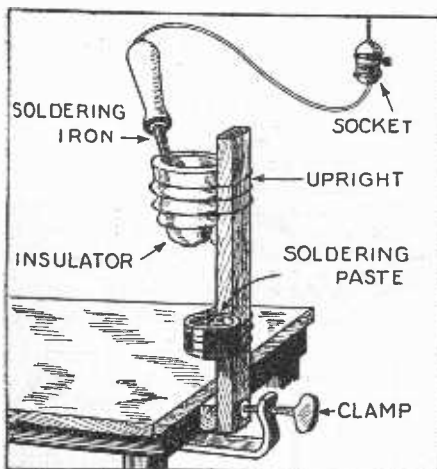
High Speed Soldering Outfit

By J. G. VILLEPIGUE

Here's the trouble saver supreme, for the experimenter. You don't have to fool with solder and acid, or watch the hot end of the iron with this outfit.

Just get a board about 1"x2"x8" (an inch or so either way won't ruin the works), then a ten cent clamp with which to fasten it to the bench. Take a flexible piece of wire, (No. 18 or bell wire) and fasten the can of paste to the upright at about table height. Next a (green) glass telegraph line insulator, like those used on telephone poles, is to be fastened to the top of the upright with a piece of the bell wire.

Now pick up those little drops of solder that fell off the iron when you wired that last radio set, and put them in the insulator. The iron can be left in this holder without any danger of starting a fire, and being shielded from air currents, it will take less time to get hot. When using it, touch it to



A telegraph line insulator is used to hold the electric soldering iron along with some bits of solder and some soldering paste.

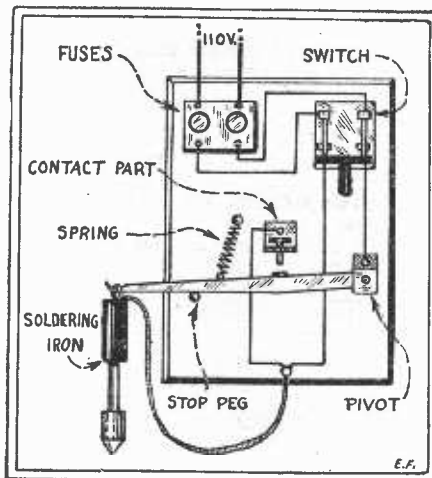
the soldering paste and put back in holder. Some of the drops of solder will melt on to it and the iron is ready to go. If you are afraid of the hot iron cracking the glass, put a plug of pumice stone hollowed out for the point of the iron inside the insulator.

The only caution to go with this outfit is to beware of poles carrying high tension wires when getting your glass insulator, if you want to get it that way.

Switch Mounting for Electric Soldering Iron

We have heard of soldering irons left upon the bench with current turned on overnight. Not only does this involve a waste of electric power but there is a certain element of danger in it, as the iron may get so hot as to cause a fire or perhaps only a charring of the bench.

The illustration shows a switch mounting suggested by the telephone switch. The illustration is self-explanatory. There is a line switch and when this is open no current passes. But when closed current will pass through the soldering iron, connected as shown, when it is removed from the hooked



Another arrangement for an electric soldering iron. A hook-switch automatically cuts off the current when the iron is lying upon it.

end of the lower spring switch. A spring draws the bar up so as to close the circuit when the iron is removed as it must be when in use.

If not in use the iron is to be hinged upon the switch-bar drawing it down and breaking the circuit and opening the circuit even if the main switch seen in the upper part of the box is closed.

Damping a Galvanometer

In a laboratory in which many galvanometer deflections had to be read in rapid succession, a novel method was used to bring the underdamped and overdamped galvanometers back to zero. A Faraday's disk was built and placed across the galvanometer terminals and was left in open circuit. After the deflection was read, the disk was put into the circuit and by a slight rotation the galvanometer is brought to zero.

The Faraday's disk consists of a copper disk mounted on an axis so that it rotates between the poles of a horse-shoe magnet. The edge of the disk dips into a mercury trough. Rotating the disk sets up an induced voltage and by closing the circuit, a small current is obtained.

By Reporter 22813.

The Invisible Cartoonist

By ARTHUR FLINNER

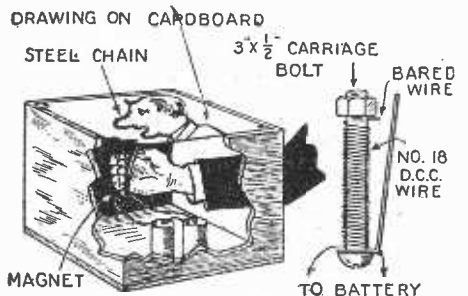
Drawing with electricity, that's what this is. A box of old boards is made large enough to hold two dry cells and with plenty of room for one's hand to travel about inside. The size depends on the kind of boards used. There is no top, but in one side a hole is cut large enough for one's hand to enter easily.

On a piece of thick paper or cardboard draw part of a profile of a head as shown but leave off the nose, mouth, and chin. A steel chain is laid to form these and is cut off at what seems to be the proper length. Then ends are put through holes in the paper and several drops of glue are dropped on them from the other side to hold them. A screw in each corner of the top keeps this from slipping about.

An electromagnet is made of a bolt, some wire—nearly any size will do just so it isn't

too large and clumsy—a brass or copper spring about three inches long and a short piece of tape. The wire is wound on the bolt until it is covered with about five layers. One end goes to the battery and the other end is curled around under the end of the spring opposite the end that is tapped to the magnet. This end of the spring is connected to the battery, and represents the switch. When one wants the circuit to be closed making the electricity flow through the magnet, this spring is pressed and it touches the curled piece of wire, thus closing the circuit.

The cells and magnet are placed in the box where they are completely out of sight. One's hand is put inside and moves the magnet about under the chain while pressing and releasing the switch alternately. The chain follows the magnet. With some practice one learns when to press the switch and when to release it and many funny faces can be made. It is wise to make several of the part-profiles



An iron chain is made to form all sorts of queer profiles by the action of a concealed magnet moved by the performer.

so they can be changed—old maids, fat men, bald men, scowling men, bobbed headed girls, crying babies, are a few possibilities. One caution—practice considerably before exhibiting your skill before your friends and you will have more fun. The faces will be made quicker and will be funnier.

Another point to be remembered is to use a chain of soft iron or if of steel to draw the temper. An extemporized chain can be made out of paper clips springing them together.

Simple Battery Charger

A 10-volt bell transformer is connected to a supply line (AC) and one of the leads is connected to a buzzer which is also connected to a rheostat through an ammeter to the battery. The other end of the transformer is connected to the opposite end of the electro-magnet and the vibrator. The current is then taken from a contact on a set screw to the vibrator and is then sent to the storage battery.

If D.C. current alone is available, the preceding arrangement will not work. For this purpose a simpler charger can be constructed.

Connect battery to one of the 110-volt lines. The other line is connected to ten 60-watt lamps in multiple to the battery.

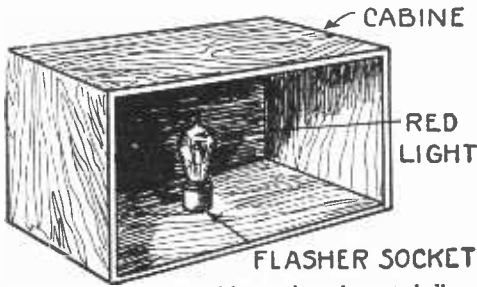
To determine the polarity, force the leads going to the battery into a potato. Around one lead the potato will become pinkish. This wire is connected to the positive end of the battery. The leads to the battery must not be more than three feet long.

Contributed by Wilfrid Thelen.

Picture Display Apparatus

WE have had occasion to speak of the two separate ways of lighting clock faces, advertisements and the like, by lamps placed behind transparent screens or by light from lamps in front.

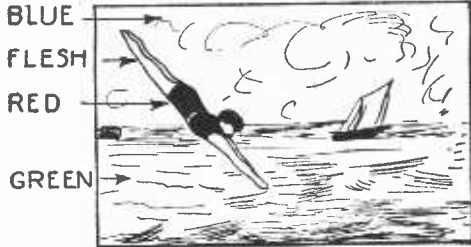
In the apparatus we illustrate, which has been recently patented, both systems of lighting are employed. There are two power-



A box provided with an incandescent bulb within, serves as the cabinet displaying two pictures alternately.

ful incandescent lamps contained at the bottom or rear of a sheet metal casing, open at the front. A composite picture is to be used.

First comes a sheet of glass, then a piece of translucent paper painted in thin transparent colors. This is to be exhibited by reflected light or by flood lighting. Back of this is a second sheet of paper on which there is another picture, and this is to be shown by transmitted light. A flasher is



Both pictures are painted on the same screen. One, shown above is seen when the inside lamp is dark.

provided to turn the lights on and off as required.

For flood lighting the lights may be arranged all around the frame or front of the box, or may be simply distributed along its upper edge. They are contained in a little trough to mask them from direct observation. Back of all the pictures is a second sheet of glass.

Thus when flood lighting is used the front picture is seen. When this ceases, the lights within the box are turned on, and the second picture being of more vivid tints, overpowers the design of the first picture so that it is virtually invisible.



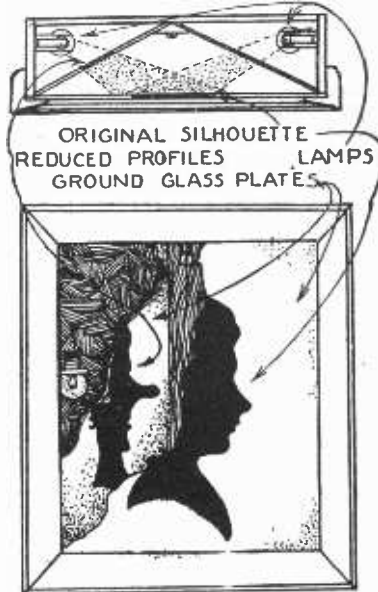
The other picture is a silhouette painted on the reverse side of the screen and can be seen only when the inside lamp lights. In this condition the other picture is invisible.

Magic Silhouette

By PHILIPPE A. JUDD

YOU have, no doubt, heard of the D. T.'s—maybe you've had 'em, but—when a perfectly lovely silhouette of a Follies belle

changes before your very eyes into a likeness of your landlady—and then to something even worse—well, you begin to wonder just what was in that last drink your friend mixed you. And when the thing reverses, and does it all over again, you feel like tearing the rather thick frame apart



Figs. 1 and 2. This device will enable you to mysteriously flash on its screen two different silhouettes. The display-box being very small it is difficult to see how the change is accomplished.

to see what makes it go. Well—here's what you'll find.

The frame isn't an ordinary frame, by any manner or means. The fact is—it holds quite a bit of junk behind its deceptive front. You will find two small electric bulbs, their sockets, and two ground glass plates arranged in the shallow compartment behind

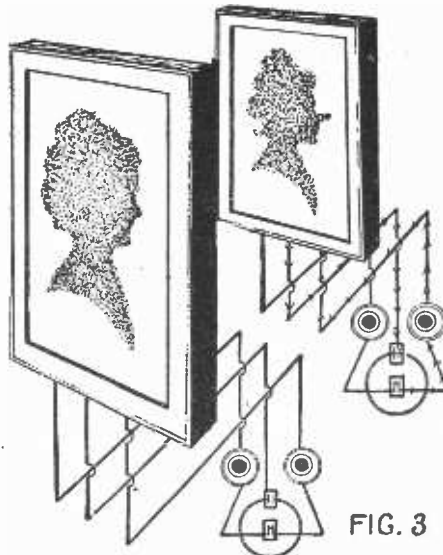


Fig. 3. Each of the pictures is controlled by two different electrical circuits from the same source. Two switches are provided.

the harmless looking chorus beauty. Figs. 1 and 2 show the constructional details.

The lamps are placed in the rear corners of the compartment, and are wired as in Fig. 3, the wires, battery and buttons being concealed. Each lamp has a ground glass partition between it and the front glass which carries the original silhouette. Each of these partitions has, directly in line between its lamp and the front figure, a reduced copy of the front silhouette, of such dimensions as to throw an exact duplication

of the figure on the front glass. When these have been adjusted, so that the original silhouette remains the same, whether unlighted, or lighted by either or both lamps, the features of the small profiles are ready for the exaggerating process.

This consists of adding to the various features so as to alter their appearance, as

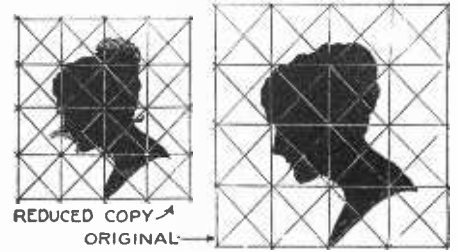
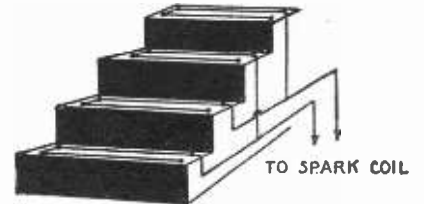


Fig. 4. The picture on the glass slide from which the silhouettes are projected must, on account of its inclination to the screen, be reduced. The illustration shows this reduced copy and the silhouette projected from it.

shown by the shaded portions of Fig. 4. It must be done very carefully as each alteration is magnified by projection. The silhouettes are all done in black Indian ink, or an opaque black paint, upon ground glass or parchmented paper. Fig. 4 shows the method of reducing the original profile. The operation is obvious. Hook it up and press the buttons. Fig. 3 shows what will happen.

Shocking Experiments

By CONSTANTINE TROY



THE ELECTRIC STAIRCASE

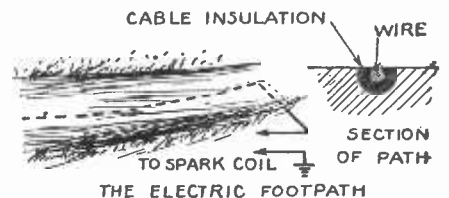
Your staircase can be easily electrified by the method illustrated above. This method will delight the heart of any practical joker.

DO you belong to that much loved (?) class of experimenters who delight in shocking their fellow creatures? Shake! I do, myself. Well, now that we have something in common, I'll let you in on a few tricks in our profession that'll make 'em sit up and take notice.

For the first one, a wooden stairway is needed (it may run up or down), some tacks, bare copper wire and the good old spark coil. To fix 'er up is just as easy as laying a carpet. String a wire back and forth across each step as shown and connect alternate steps to the two wires running to the coil.

When you hear "Pa" coming home from work, turn on your old coil and let 'er run!

Well, the next one shows how to "juice up" that footpath that runs through the back garden. An insulated wire when the ground in wet will give a satisfactory shock, satisfactory at least to the proprietor of the installation and will give plenty of juice.

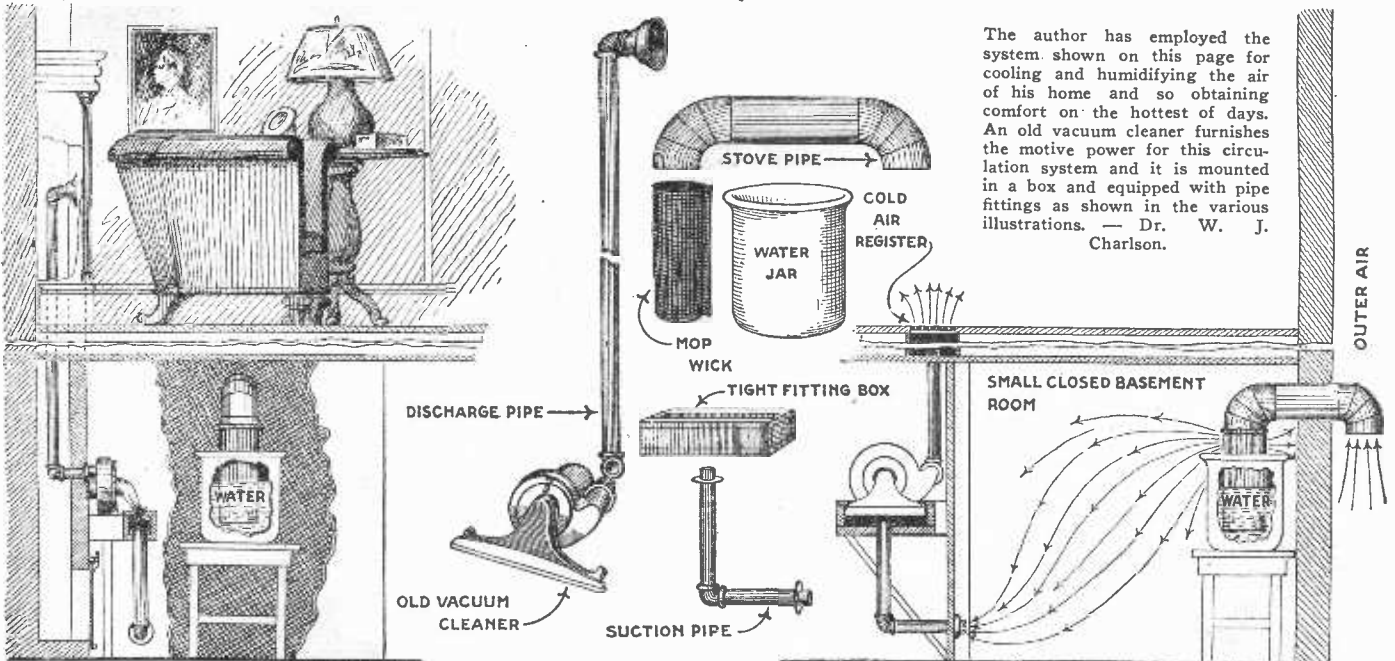


THE ELECTRIC FOOTPATH
One terminal of the coil is connected to an insulated cable under a path, a bare portion is exposed at the surface. The outer terminal is grounded.



THE CONSTRUCTOR

Cooling and Humidifying System

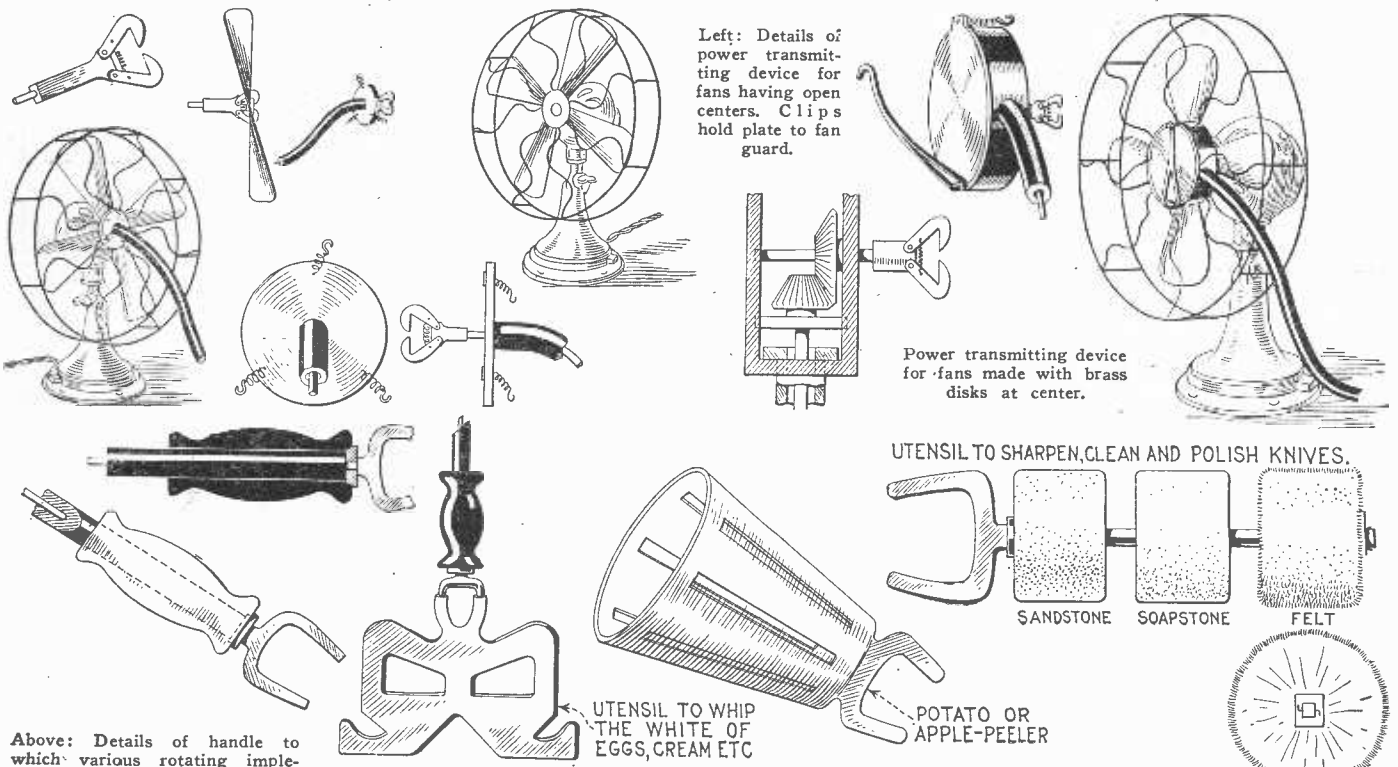


The author has employed the system shown on this page for cooling and humidifying the air of his home and so obtaining comfort on the hottest of days. An old vacuum cleaner furnishes the motive power for this circulation system and it is mounted in a box and equipped with pipe fittings as shown in the various illustrations. — Dr. W. J. Charlson.

At the extreme left above is shown one method of applying this system and delivering the cooled humidified air through a fireplace opening. At the extreme right is shown another system for application to houses equipped with registers in the floors. In any event, the apparatus is

placed in a basement and the water container is located in a small closed room. The air is drawn out of this room and fresh air supplied through the intake pipe and through the water container. Here the air is both cooled and humidified and is then delivered to the home above.

Utilizing Electric Fans for Power



Left: Details of power transmitting device for fans having open centers. Clips hold plate to fan guard.

Power transmitting device for fans made with brass disks at center.

UTENSIL TO SHARPEN, CLEAN AND POLISH KNIVES.

SANDSTONE SOAPSTONE FELT

UTENSIL TO WHIP THE WHITE OF EGGS, CREAM ETC

POTATO OR APPLE-PEELER

Above: Details of handle to which various rotating implements may be attached and to which power is supplied by means of an electric fan motor through a flexible power transmitting shaft.

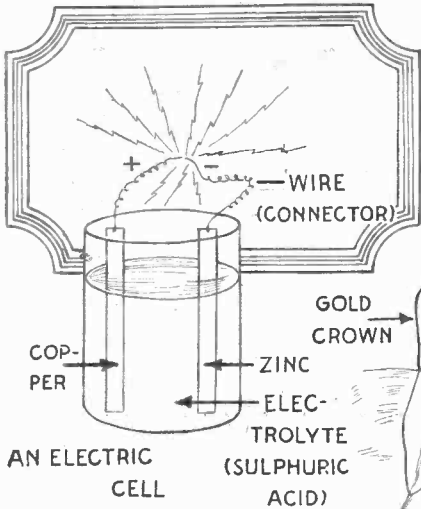
Above: Special utensil used in place of the usual hand type of beater with good results.

Above and to right: Various devices are shown here that can be used with the handle shown at the left, connected to fan.

With all these utensils, the coupling parts are made of tubing to slip over the tines of the handle illustrated.

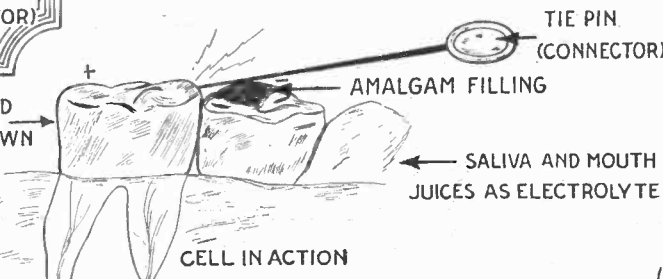
Is There a Battery in Your Mouth?

By CLYDE E. VOLKERS

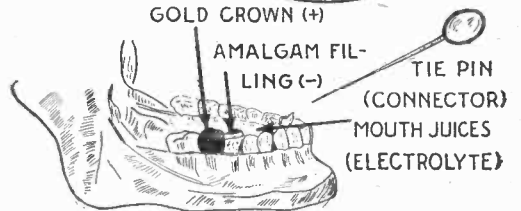


A simple electric cell is illustrated directly above. Connecting the elements produces a current.

SHOCK
REGISTERS THROUGH THESE NERVES



CELL IN ACTION
Where an amalgam filling is near a gold crown on your teeth, an electric current may be set up, registering on the nerves, by connecting gold and amalgam together. Fuller description below.

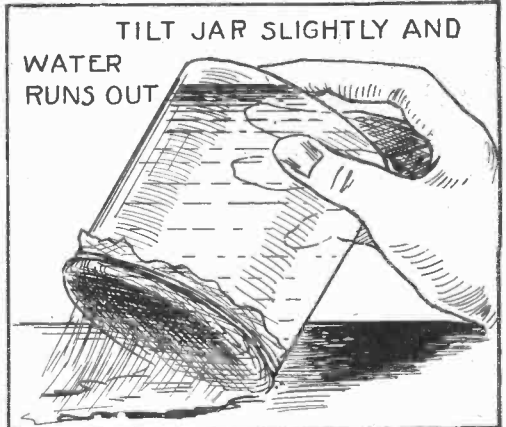
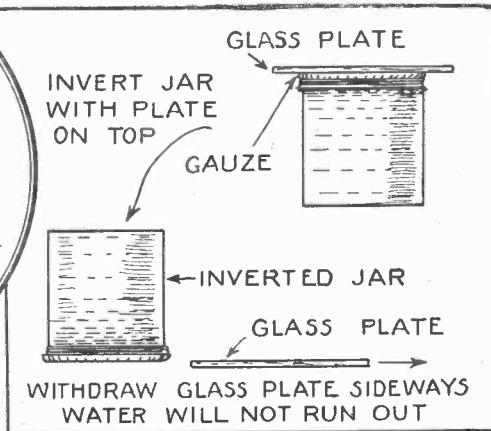
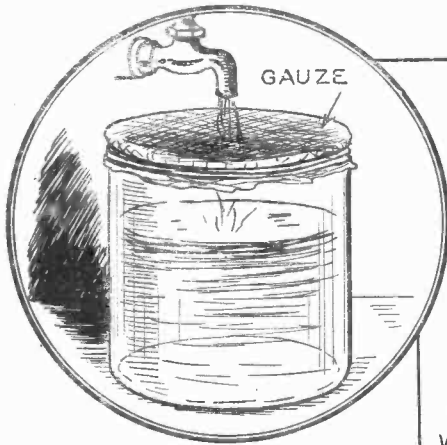


ELECTRIC CELL IN MOUTH

We have batteries in our automobiles, batteries in our radio sets, batteries in our pocket flashlights, and so we need not be surprised to find that we have one in our mouths. If a piece of wire or a pin is placed across an amalgam filling and gold crown, as shown above, a distinct and pain-

ful shock will be felt. This is because of the current of electricity set up by the action of the saliva upon the two dissimilar metals, which is much the same as that found in the simple electric cell illustrated at the left, although on a much smaller scale.

Mysterious Jar of Water

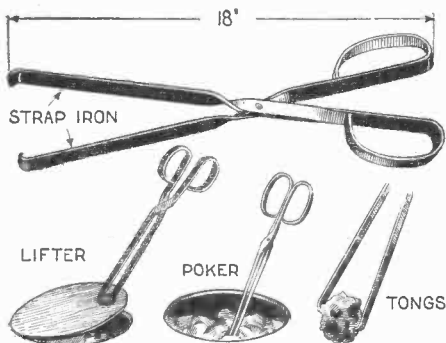


A very peculiar and interesting effect but one which is governed by a well known law of physics may be produced as illustrated above and at the right. Stretch a piece of gauze with about 14 threads to the inch over the mouth of the jar. Fasten it in place with thread and fill the jar with water as shown. Place a glass plate on top of the jar and then

invert. Upon withdrawing the plate the water will not run out, but if the jar is tilted, it will do so. As long as the jar is truly vertical, each opening in the gauze forms the end of a column of water upon which the atmospheric pressure acts. When the jar is tilted, the equilibrium is destroyed and the water runs out.

—C. A. Oldroyd.

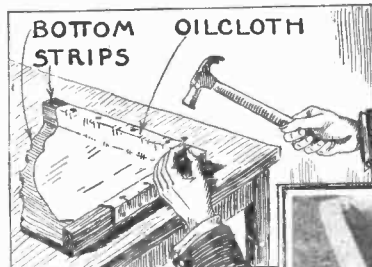
Tongs



A pair of tongs made of strap iron in the shape shown above are very handy around the kitchen stove. They may be used as a lid lifter, poker or tongs for removing clinkers.

—S. W. Wilt.

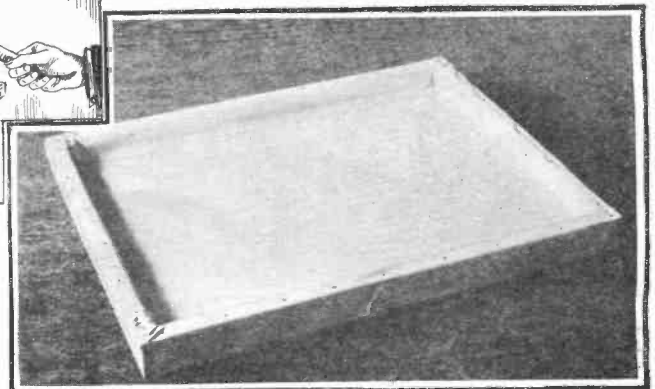
Inexpensive Photo Trays



Ready made photographic trays of a large size are exceedingly expensive but home-made ones cost practically nothing.

In making home-made photo trays, a wooden box of the required size is made and then lined with oilcloth, placing all of the tacks around the top and the outside. No leakage will result.

—J. G. Pratt.

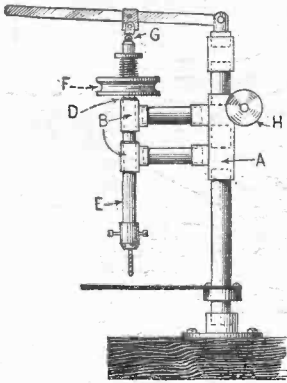




HOW TO MAKE IT

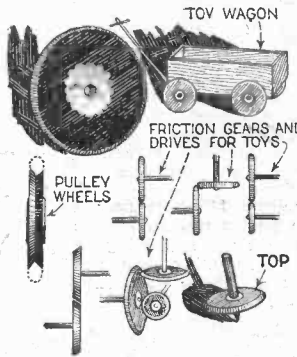


Bench Drill



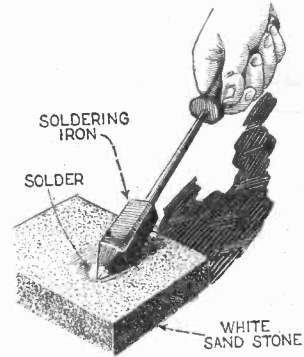
In the bench type of drill press illustrated at the left. A indicates two 3/4-inch by 1/2-inch center T pipe couplings; B, two 3/4-inch Ts; D, brass bushings; E, steel shaft; F, pulley; G, thrust bearing and coupling and H, another pulley. The entire press is mounted on a pipe flange.—L. J. Harris.

Uses for Erasers



Circular type-writer erasers may be put to various uses as illustrated at the left. Wheels for toy wagons are made without any changes in construction of the erasers. Friction gears and various other transmissions for small mechanical toys are easily constructed and work well.—John P. Howe.

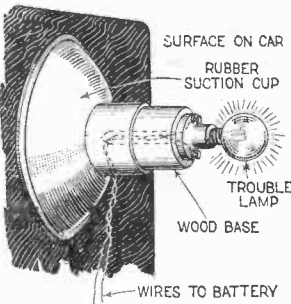
Cleaning Soldering Irons



The soldering iron tip needs frequent cleaning and retinning. Make a small hollow in the center of a sandstone block or smooth brick and place a small quantity of solder with some resin therein. Tin iron by rubbing the tip on the surface of the stone.—C. T. Torresen.

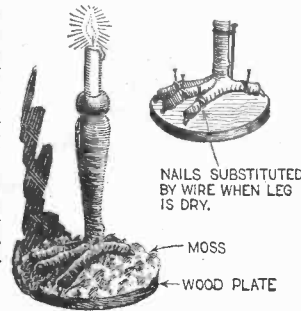
Trouble Light

For holding an electrical trouble light to a surface where the ordinary magnetic type will not operate, the kink illustrated at the right can be employed. Attach a suction cup with a short piece of wooden dowel.—C. A. Oldroyd, Rep. No. 4433.



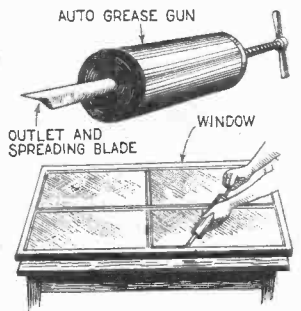
Candlestick

An unusual type of candle holder can be constructed from the leg of a fowl as shown at the right. Cut off the foot at the joint as shown, fasten it to a wooden base and allow it to dry for thirty to sixty days.—Hubert Slouka.

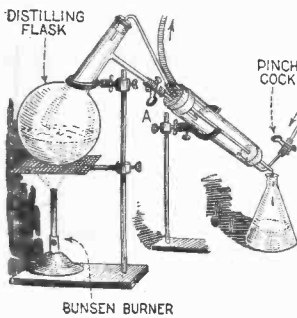


Putty Tool

If an automobile grease gun is changed so that its outlet is angular and flattened out as shown above, the body of the gun can be filled with putty and that material forced into cracks.—R. C. Leibe.

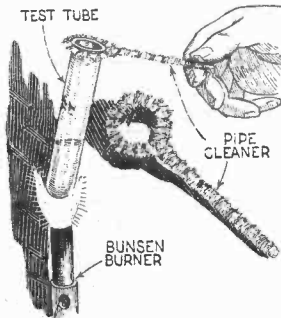


Continuous Still



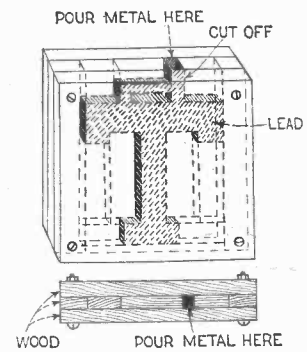
The pinchcock A is normally closed but when it is desired to fill the flask, the upper end of the condenser is heated slightly and then the pinchcock is opened. The flask will be filled by the water from the cooling system.—Ray Sabin, Rep. No. 14,356.

Test Tube Holder



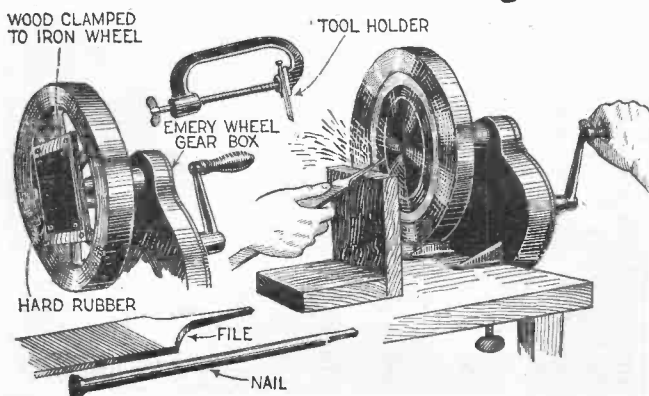
A very satisfactory holder for test tubes can be quickly and easily made by twisting an ordinary pipe cleaner into the shape shown in the illustration. If desired, use a wooden dowel as a handle.—C. A. Oldroyd, Rep. No. 4433.

Watch Fob



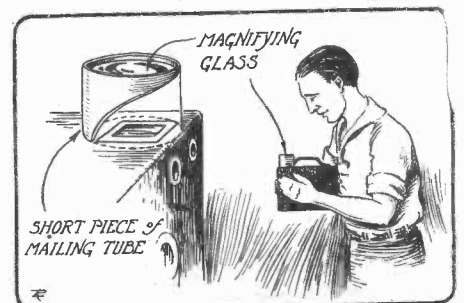
An initial emblem for a watch fob can be made by building up a mold out of wood as shown at the left and pouring molten metal into the opening. After cooling, take the mold apart, remove the metal and smooth with a file.—Walter Culin.

Disk Cutting Lathe



For cutting disks from various materials such as hard rubber, bakelite or wood, the hand lathe illustrated at the left may be employed. The abrasive wheel is removed from an emery grinder and an iron flywheel put on the shaft in place of it. A block of wood is then clamped to the spokes of the flywheel and the material from which disks are to be cut is screwed to this block. Tools made from file tangs or ends or from nails may be employed in the manner shown.—Don Home.

Focusing Camera



Place a short length of mailing tube, with a magnifying glass mounted at one end over the finder of a camera and focusing will be expedited.—L. B. Robbins.

HIBERNATION ONCE MORE

Editor, SCIENCE AND INVENTION:
In the September number of SCIENCE AND INVENTION, I read with interest the article, "Life Suspended in Ice," in which the question is raised, whether the statements found in some text-books regarding the fact that fishes and some other creatures may be frozen and then thawed out and still live may not be correct. As I, at one time, questioned this statement, I made lengthy experiments at different times, and while some of the experiments were failures as to proving the statements correct, nevertheless I found that the statement was correct when the conditions were as nature made them.

Now, to explain: In using the common method of artificial freezing, I found that, as the water is distilled before freezing, it is deprived of what air it previously contained and therefore, the fish was dead for want of air before it was actually frozen and, of course, it could not be brought to life being actually dead. (Not so in our experiments.)

—EDITOR.) Again I tried to freeze water taken from a stream in which the fish had lived, but the artificial method of freezing is different than nature, and again the fish were dead when thawed out. (So we found.—EDITOR.) Not being satisfied, I tried a different method. Taking a catfish about ten inches long from a brook with a metal container holding about three gallons of water, I placed it where the water could freeze by natural means, the atmospheric temperature was about two to three degrees above zero Fahrenheit, the water froze solid over night. Then placing my fish in a room where the temperature was about 32 degrees I let the ice with the fish slowly thaw out and when I looked at my fish several hours later he was flopping vigorously trying to get out and when I placed him in the aquarium, he swam around as naturally as ever, which certainly did prove that under certain conditions fish can be frozen up and still live.

Other experiments along this line were with reptiles. A common black snake, such as is found in the Allegheny mountains, was found frozen hard, as several of us out in the woods in cold weather were hunting what we might find in hollow logs and trees, and carefully digging it out so as not to injure it, it was placed near a fire so that it could thaw out gradually, and in the course of time it came to itself and crawled away from the fire. The common toad has been also found frozen solid in the ground and after being dug out and left to lie in the sun a short time, has hopped off as lively as ever.

There is an aquarium located in Gates Park, Topeka, Kansas, which contains numerous fish, mostly goldfish, which are never taken out. The water is fed in a small stream continually during the time it is not frozen, but when winter comes, and the temperature gets to zero, the water freezes to the bottom, but there are always fish swimming around in it when it thaws out again.

Experiments I found do not always prove the truth or falsity of a statement unless they are tried under the same conditions that existed when the statement was made. No doubt many affidavits can be procured from reliable sources to prove that fishes, toads and snakes are frozen up and come back to life when thawed out.

E. L. CORLE.
Arkansas City, Kan.

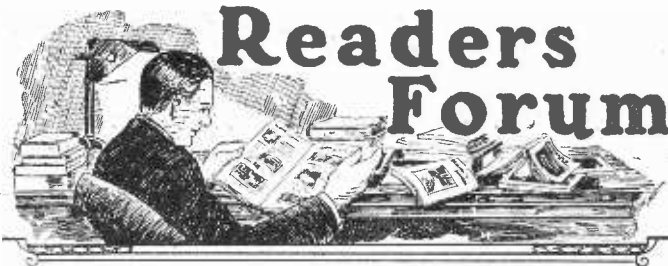
(In our artificial methods of freezing, we used ordinary water, not distilled water. This water was placed into a tank which was then put in the refrigerator. The temperature of the ice compartment was considerably below freezing. The only way in which our conditions differed from yours was that the freezing experiments were made during the summer time and not in the winter months. Nevertheless we thank you very much for your comment and thank the thousands of other readers who have commented upon our article "Life Suspended in Ice." This article carried with it a great deal of interest, and we have heard from many readers who have claimed to have actually noted instances where fish, reptiles and toads were actually frozen and then thawed out and on the other hand have heard from many who have carried out artificial experiments and who have received the same results which we outlined.)

Our own experiments were meant to produce artificially a state of completely suspended animation. When animation had been completely suspended, we found that life did not return. Of course there is always a possibility for a technical error somewhere. No one has as yet come forth and given us any statements of experimental proof and data for duplicating the experiments, or has demonstrated that such artificial hibernation may be induced.—EDITOR.)

PAGE DR. HACKENSAW

Editor, SCIENCE AND INVENTION:

I have just received the November SCIENCE & INVENTION and very much regret the demise of Doctor Hackensaw. When he didn't appear in October, I thought maybe he had run out of material for the time being, but the fact that he is still absent has made me worried about the illustrious doctor. I have taken this magazine I think from the beginning of its career and the Dr. Hackensaw articles in my opinion were great.



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.

They were always the first I read, and I am very sorry to say that I'll miss them. I like your present serial "Tarrano the Conqueror," very much! It is on account of articles like these that I buy your magazine. It is my favorite and I am always on the lookout for the next number.

R. J. PEARCE,
Cardinal, Ont.

(We are glad you like our scientific fiction stories, and "Dr. Hackensaw" may be back anon, but at present he cannot write articles for a while, as he has left Turkey and gone on to India where

AMAZING STORIES

THE new scientific fiction magazine, **AMAZING STORIES**, will be on the newsstands March 10th. Here's 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 new magazine contains only scientific fiction type stories and in the very first issue there is a story, "Off on a Comet," by the immortal Jules Verne, stories by H. G. Wells, George Allen England, G. Peyton Wertenbaker, and many others from the pens of the foremost scientific fiction writers.

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

Be sure to get your copy today.

The magazine is edited by Hugo Gernsback.

PRICE 25c PER COPY.

he will be for some time, according to his last letter.

We think you will find Mr. Cummings' story, "Tarrano the Conqueror," very interesting as it goes along, and we are gratified at your interest in SCIENCE AND INVENTION.—EDITOR.)

LIKES SCIENCE & INVENTION

Editor, SCIENCE AND INVENTION:

I consider your magazine a real educator in the field of science and especially liked the old issues in which gravitation, astronomy, Einstein and his theories, and many of the vastly important scientific subjects were discussed by your many authors.

I believe a school equipped with your magazines from the earliest dates possible to the present time would scarcely need a scientific encyclopedia. Your magazine contains more information considering dollar for dollar spent than any other "grand" set of books in the library, because in your publication more than one author discusses a subject, because one would have to have more than an encyclopedia to cover all the subjects you discuss, and because your discussions are timely and right up to the minute. I make it my duty to study your magazines every month, and will certainly continue to do so.

LELAND LOCKHART,
Rock Falls, Ill.

(We are glad that you enjoy SCIENCE AND INVENTION magazine and we will try to make it appeal to you more and more every month.—EDITOR.)

Editor, SCIENCE AND INVENTION:

I have been a reader of your magazine for over five years and thought I would write and tell you how I appreciate SCIENCE AND INVENTION. I also would like to state that I have been to various research clubs and heard many discussions on the subject—Does a dream take as long as the dream seems, or is it a "flash" thought? I believe I did have proof that it is an instant thought. Although you may know this, as I am in the com-

mon thinking class. I have heard hundreds who thought differently.

My room companion used to be sound asleep when I would come home late at night. I would roll up some newspapers and hit him on the head, lightly of course, but sharp enough to make him feel it. He would wake right up and say, "some dream." He would then relate some accident where he would have hit his head, or had a headache, etc., but always with reference to his head. If I hit him on the feet, arms, legs or any other part of the body, the effect was the corresponding one, and the dream accident would concern the feet, arms or legs as the blow was given. Does this not prove that dreams are instantaneous? I would like to see this brought up and discussed.

FRED LANKTON,
St. Johns, Mich.

(Your question concerning the length of time it takes to dream is very interesting. Most observers claim that a dream takes but a fraction of a second, and that the longest dream does not take any more than ten seconds. They all

hold to the theory that the dream takes place between the totally subconscious state and the conscious state, and it is during the passing from the subconscious to the conscious that the ideas develop and rapidly pass through the mind. Here is an interesting example of this and it constitutes a first hand experience which shows how quickly these ideas pass through a man's mind.

While attempting some high dives toward the fall of the year when the beaches were rather free of people, the writer leaped off a platform about twenty-eight feet above the surface of the water. In mid-air he saw a log floating beneath him. During the time that it took to strike the water, a vision of hitting the log with a complete crushing of the skull was seen. The writer saw his own body being dragged out of the water, placed into a patrol wagon and taken down to the city morgue, there to be identified by his relatives. He saw his own funeral and then saw his own home six months after the incident.

Now you must remember that a body will fall thirty-two feet in one second. Consequently the dive of twenty-eight feet took not far from a second to complete, and during this fraction of a second, scenes which naturally require six months, rapidly flashed through the mind.

This seems to prove that a dream takes place in a very short time, and the remarkable portion of the whole question lies in the fact that the dream took place while the subject was fully conscious.

Your own experiments are very interesting, but they have been made previously.—EDITOR.)

AIRPLANES IN THE NEXT WAR

Editor, SCIENCE AND INVENTION:

In the September number of SCIENCE AND INVENTION, an article, entitled "Airplanes and Tanks in the Next War," by H. Winfield Secor, contains a statement that, "In the next war, if it should occur, one of the greatest problems the army experts will have to solve will be how to protect our cities and towns from gas attacks by the enemy." I think that I have an adequate solution for this problem, which I will now describe:

Gas attacks by air can only be effective if the gas cloud is laid close over the city. Hence, if the strata of air from the housetops of a city up to about one thousand feet can be so guarded that it would not permit airplanes to enter, the city will be safe as far as gas attacks are concerned. My system will demand that captive balloons in groups of about eight or ten be sent up with a highly explosive bomb that can be exploded by an electric current controlled by a look-out in another captive balloon or dirigible. Any large city will be divided into squares, each having its four air stations where captive balloons with highly explosive bombs will be sent up. Enemy aircraft will not be able to send down the balloons by firing at them, because the airplanes will have to keep about three hundred feet away from the bomb to avoid the effect of the bomb exploding; besides, one shell will not be sufficient to bring down all the balloons in the group. The extreme difficulty of hitting the target, which is the protective balloon, is another advantage of this system.

B. SCHWARTZ,
Brooklyn, N. Y.

(We have read the explanation of your system of preventing gas attacks in future wars, but do not see that your system would prove particularly efficacious in any way, as the bombing planes can drop gas bombs from any height desired, and probably would not drop them from any lower altitude than four or five thousand feet over cities, owing to anti-aircraft guns firing at them, etc.)

The first thing about cities in a future war is that, owing to their large area, they prove an easy target for bombing from a high altitude of from five thousand to ten thousand feet, or even twenty thousand feet, as the bomber can hardly fail to do a lot of damage, nor can he miss the target in most cases. No matter where the bombs land and burst, they will do a lot of damage for the immediate areas will be charged with gas.—EDITOR.)

Prize Winners in our "Uses for Old Photo-Films" Contest will appear in the May issue of SCIENCE & INVENTION.

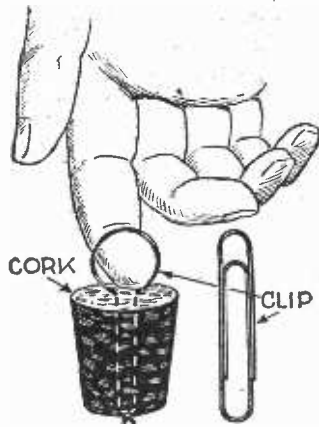


WRINKLES RECIPES & FORMULAS



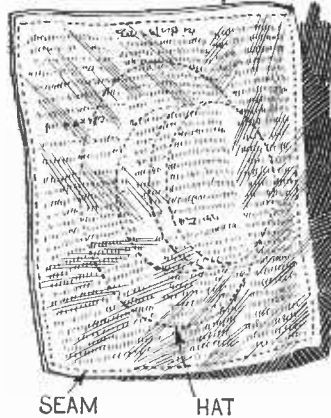
Edited by S. Gernsback

CORK PULLER



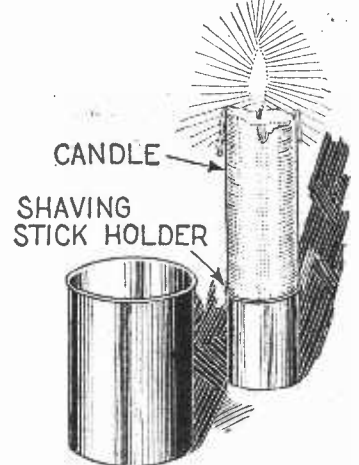
If a standard wire paper clip of the type shown is straightened out and the ends thrust through a cork so as to leave a small ring projecting from a bottle by pulling on the ring. The ends projecting past the lower end of the cork should be twisted together.
—John V. Tallas.

HAT PROTECTOR DOUBLE SHEETED NEWSPAPER



When hats are to be put away for any lengthy period of time, some provision should be made for protecting them from dust. If two double sheets of newspaper are placed on opposite sides of the hat, and the edges sewed together as shown above, ample protection will result.
—Mrs. Helen Smar.

CANDLE HOLDER



The ordinary candle will not usually stand upright on a smooth surface because of irregularities in its base. If it is placed in a metal candle shaving stick holder as shown above, this trouble will be overcome and the candle will stand straight. Author please send address.

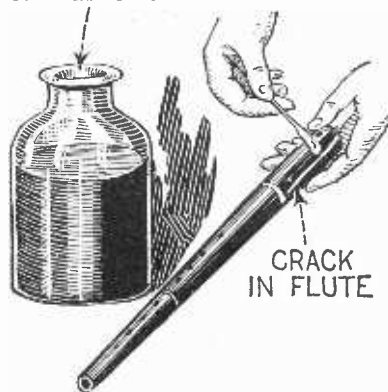
PAINT REMOVER



Paint stains that will not yield to ordinary soap can quickly be removed from the hands by applying a small quantity of carbon-disulphide and rubbing off with a piece of cotton waste. The same system can be applied to cloth or woodwork. As it is very inflammable use it away from any fire.—J. H. Byers.

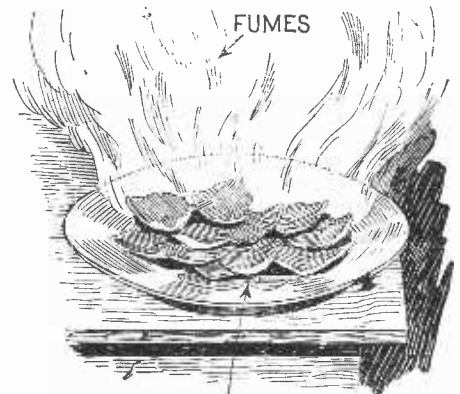
CEMENT

CONCENTRATED SOLUTION OF CELLULOID



A cement for mending such a musical instrument as a flute, a clarinet or an oboe or for mending celluloid articles can be made by dissolving celluloid in amyl acetate or acetone. Make concentrated solution.—W. M. Goldberg.

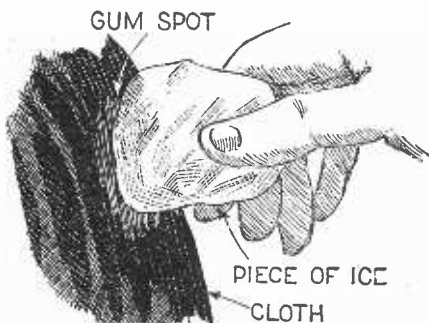
DEODORIZER



ONION LEAVES

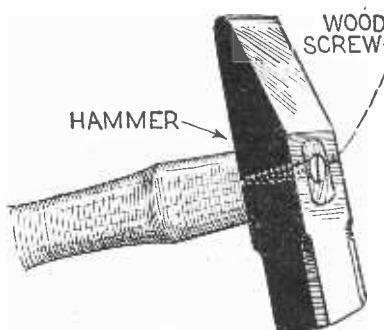
The odor of fresh paint is extremely nauseating to many people and it is a difficult one to remove. If a dish of pieces of one or two onions is placed in a freshly painted room, the odor of the paint will be quickly removed. This is a simple yet efficient method of performing this work.
—F. R. Moore.

CLEANER



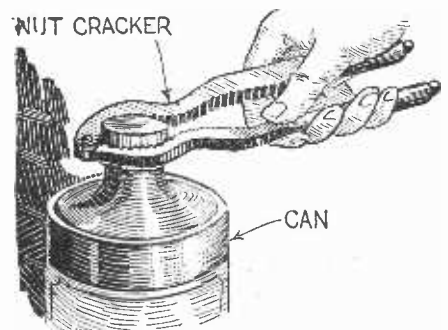
When chewing gum is found on clothing, place a piece of ice against the spot and when the gum has become hardened, due to the cold, it can readily be broken up and brushed off.
—Henry H. Sweet, Jr.

HAMMER KINK



If a wood screw is firmly imbedded in the handle of a hammer or axe, as shown above, the head will be found solidly attached and the attendant danger of it flying off will be removed. Author please send address.

BOTTLE OPENER



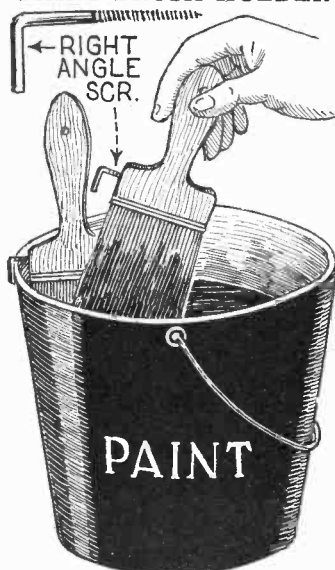
When the screw cap of a bottle or can is stuck, it can usually be removed by applying a nut cracker as shown above and twisting firmly and smoothly in the correct direction for unscrewing.
—Manuel Tubis.

MILK CAN SPOUT



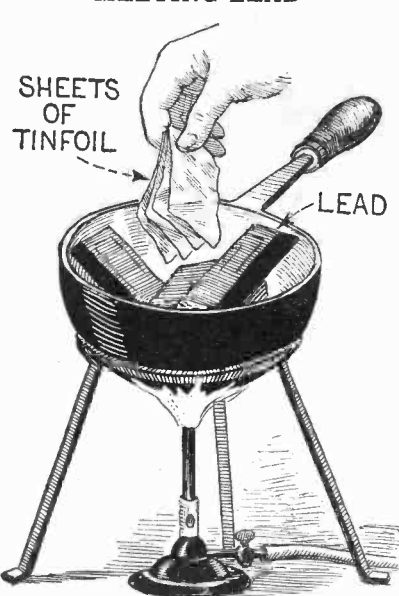
Trouble is often experienced when pouring evaporated milk from the can but if a small disk of paper is stuck to the edge of the can with a little of the milk and allowed to dry in place, a pouring spout will be formed which will render this operation quite simple. The paper must be placed so that it does not cover the hole from which the milk is to be poured.
—G. L. Lepage.

PAINT BRUSH HOLDER



A very easily made type of holder for paint brushes is illustrated above. A right-angle hook is screwed into the handle and by hooking it over the edge of the can, the brush will always be just where it is wanted and the bristles will be kept soft because they are immersed in the paint.
—T. Bernard Slater.

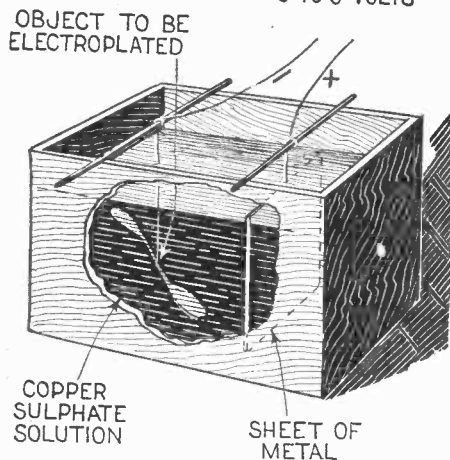
MELTING LEAD



When it is desired to make small objects from lead, the melting of that metal can be expedited by first placing some tinfoil in the crucible. By doing this, the melting point will be lowered and the melting can be done with a low temperature flame.
—K. Liu.

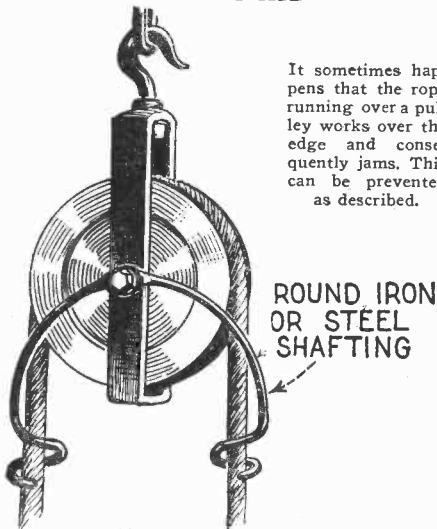
ELECTROPLATING

3 TO 6 VOLTS



A wooden box, the seams painted with tar or asphaltum, can be employed for an electroplating tank. The electrode plate connected to positive pole should be of the same metal as that which is to be deposited.
—John Vomacks.

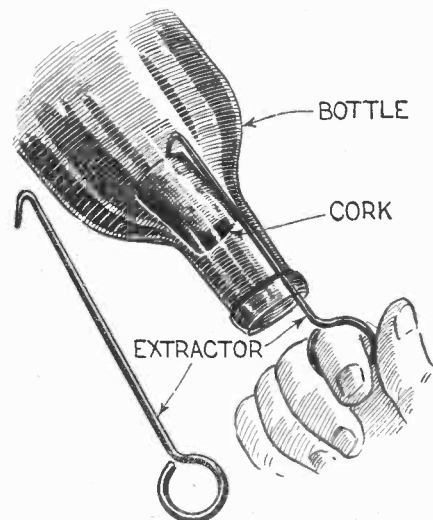
PULLEY AID



It sometimes happens that the rope running over a pulley works over the edge and consequently jams. This can be prevented as described.

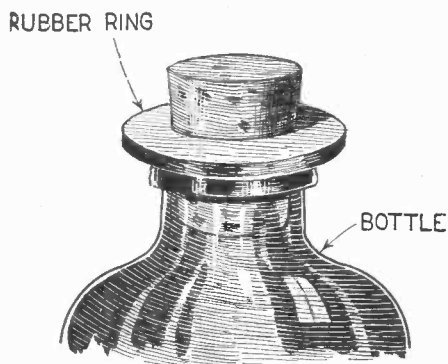
To prevent the rope from running off, bend a length of round iron or steel rod as shown, and fasten under one of the shaft nuts. This will hold the rope in place. Author please send address.

CORK EXTRACTOR



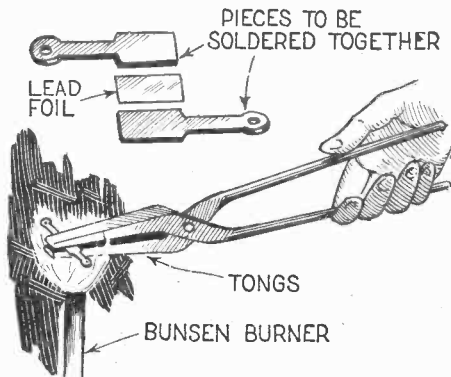
When a cork has been pushed down in a bottle it can be retrieved with a wire hook bent and sharpened as shown. A ring on the opposite end aids the operation.
—Joseph Kern.

BOTTLE PROTECTOR



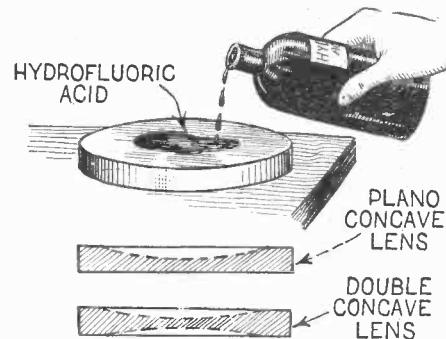
In order to prevent the accumulation of dust on the mouth of a bottle, a rubber washer may be cut and placed as shown in the above illustration. Liquids can then be poured without contamination.
—Manuel Tubis.

SOLDERING

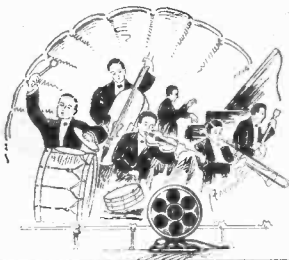


Flat pieces of metal can be readily soldered together by placing a strip of lead foil between them along with some flux and holding the assembly in a flame by means of a pair of pliers. See illustration above.
—F. J. Wilhelm.

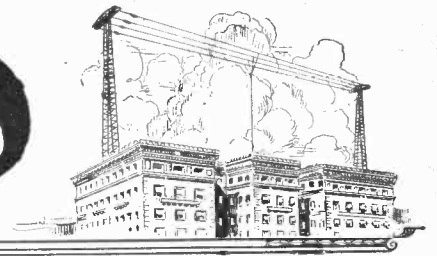
LENSES



Concave lenses may be made by allowing hydrofluoric acid to act on glass disks, continuing the action until the desired results are obtained. Two types possible by this method are shown above. For a double concave lens, treat both sides of the disk.
—Mannie Stroh.



RADIO

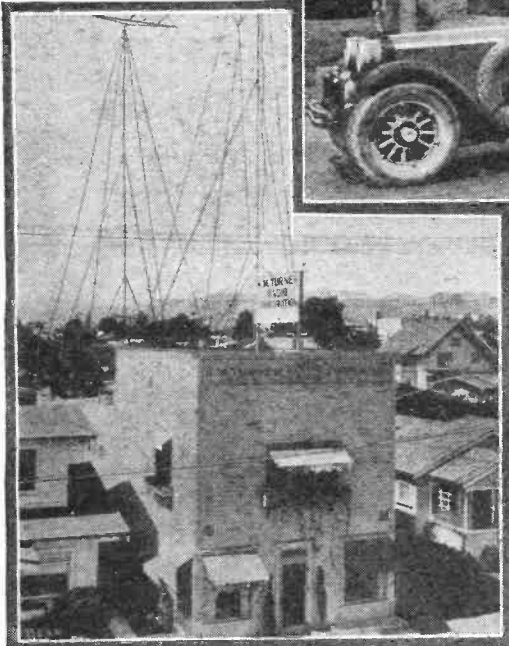
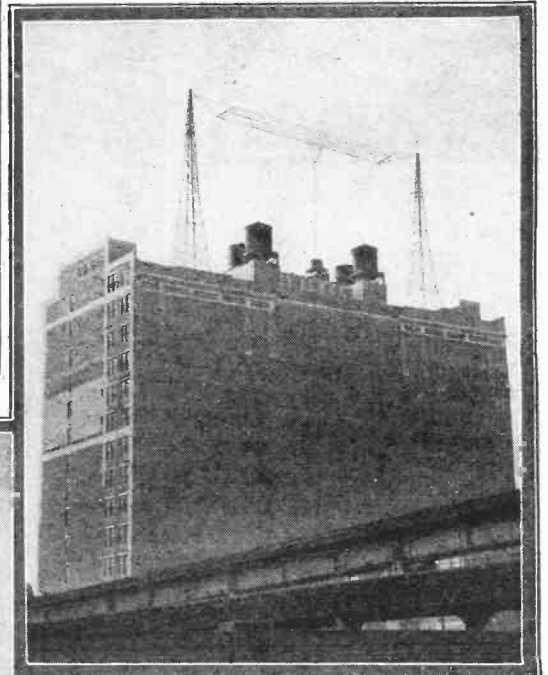


Latest Radio Broadcast News

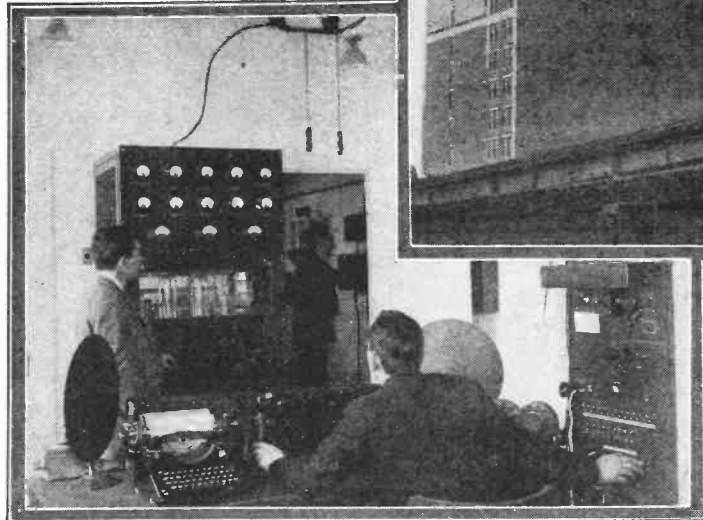
Keeping up-to-date with radio is the aim of the majority of successful dealers and broadcasters as is evidenced by the modern delivery and service car shown in the photograph at the immediate right. Advertising as well as utility are combined.



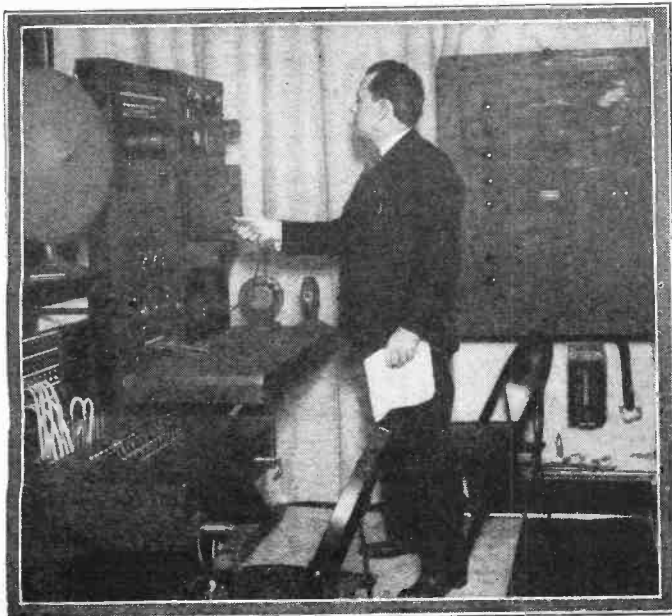
Below: The antenna masts and antenna of Station WHAP, from which jazz music is barred.



Above: The masts of station KFPG are of rather conventional yet rugged design. Below: The line amplifier used at station WHAP. This is used for remote control.



Left: The operating room at WHAP. This station is rated at 2,500 watts and the transmitter control panel is shown in the background of this photograph. Note how every part is handy to the operators and is always accessible for adjustment.



IT is indeed a far cry from the original broadcasters at Pittsburgh, KDKA; Newark, N. J., WJZ; and Roselle, N. J., WDY, with their scratchy phonograph records and tinny sounding player pianos, to the elaborate up-to-date equipment and arrangement of the various broadcasting studios spread throughout the country today. It was only a few short years ago that we were perfectly content to clamp the headphones tightly to our ears and listen with bated breath to the faint whisperings reproduced by our crystal or one-tube set. Today, however, we demand the most perfect possible reproduction and enough reproduced volume to fill an entire house. Otherwise we are not satisfied. Obviously, it has been necessary to constantly design new apparatus and redesign old instruments for transmitting purposes in order to meet the increasing demand. Not only has this been done, but, stations are becoming most particular in the types of programs that they broadcast for the general public. Years ago, any kind of music was received with gusto. Today, various radio listeners want to select their programs and pick and choose just what suits them. Things have gone so far that a new station, WHAP, recently opened on the east coast, made it a part of their policy to barr jazz and other more popular types of music from their programs and to broadcast only the classics and other more sedate selections. This station believes that the people today are developing more of a taste for the classical forms of music and so are catering to this demand. The success of their project will soon be determined. They have done everything possible to insure good transmission and are using a considerable amount of power. They should get out well and should fill a long felt want with many of our more sedate radio listeners. Aside from barring jazz, they also have eliminated advertising and propaganda of all kinds from their programs.

WRNY for New York Visitors

By CHARLES D. ISAACSON*

ARE you coming to New York? Then let me invite you at once to visit the RADIO NEWS Station at The Roosevelt. You will find the hotel one of the most beautiful in the country; and there you will hear one of the very best hotel orchestras I have ever known—I refer to Orlando's Roosevelt Concert Orchestra, under the direction of Herbert Sohman. You have doubtless heard this orchestra play to you three times a week through WRNY. Here you will also see Ben Bernie, and dance to his syncopating tunes—that is if you stay at The Roosevelt, or dine here in the Grill Room. But quite apart from that, please take this as your invitation to visit the RADIO NEWS Station on the eighteenth floor, also the RADIO NEWS Transmission Room on the twentieth floor. We will be happy to meet you and to greet you. You will always find something happening, and always find many celebrities on hand. WRNY folks will be glad to write you at any time and give you any information you desire in preparing for a visit to this city.

FOR LOVERS OF DRAMA

By the way, are you listening in every night at 7.15 to the Radio Theatre Index? For visitors to New York, this list is invaluable. Everyone who comes to the metropolis, of course, plans to attend the theatre, and does not want to waste an evening on a production that is only fair. The Radio Theatre Index will give you the exact information that you want—about the plays you want to see—where they are playing, the members of the casts, the type of plays, what you can expect in the way of music, laughter, thrills, etc.

Out-of-towners are asked, at this point, to write to the Program Director and tell what this Index means to them, and how valuable it is proving.

THE SHOPPERS' ADVISER

Another feature at WRNY that is particularly valuable to visitors to New York is the Radio Sales Analysis.

Visitors to New York want to buy; they want to buy the best things that are offered, and get the best values; and every morning WRNY is now selecting the most interesting offerings of the better grade department stores and shops, for the benefit of the women particularly. This service will enable those who are planning to come to New York in the next few days to know just which stores to shop at, and which stores are offering the things that visitors are anxious to buy.

GUIDE TO THE CHURCHES

For those who seek religious information
(Continued on page 1148)



EMITO ORTEZ
Spanish prima donna, who has starred in opera in Italy and France, whose splendid soprano is heard often at WRNY.



PANCHO FUENTES
Who joins to her voice his rich baritone, in the romantic Spanish melodies which have thrilled thousands.



VERA SUNDELSON
Assistant program director, hostess for WRNY's artists and soother of artistic tempers.



JACK WHEATON
You have heard Jack Wheaton's orchestra from WRNY and enjoyed its strains of lively dance music.



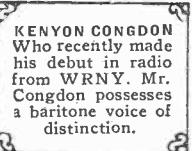
Channing Pollock
Distinguished playwright, author of "The Fool" and "The Enemy," is a frequent visitor to WRNY.



Charlotte Trystman
This gifted little pianiste is but 11 years old, though you may find difficulty in believing it, after hearing her at WRNY.



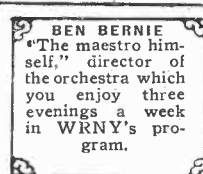
Walter F. Gruening
You have heard him in "Harper's Magazines's" regular book reviews at WRNY.



KENYON CONGDON
Who recently made his debut in radio from WRNY. Mr. Congdon possesses a baritone voice of distinction.



MAURICE SCHWARTZ
The famous director of the Yiddish Art Theatre, who has made "The Dybbuk" a dramatic success in two languages, appeared recently at WRNY in character as "The Meshulach," supported by his cast of players in a special version of this play adapted for the radio.



BEN BERNIE
"The maestro himself," director of the orchestra which you enjoy three evenings a week in WRNY's program.



Samuel Polonsky
Broadcasts through WRNY the finest and most soulful violin concert numbers. He is a pupil of Auer.

FRANCINE VYDE
Whom you know perhaps better on WRNY's program as "The Coloratura Soprano."



Henrietta Angstreich
Whose Piano Dances — not dance music, but concert selections based on dance themes you know.



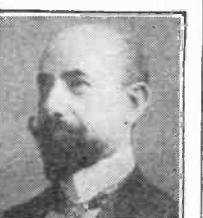
Sergei Klibansky
A famous teacher of singers, who has instructed many eminent artists, is the conductor of a series at WRNY.



JOHN ADAM HUGO
Composer of "The Temple Dancer," is now preparing the first opera written for radio production.



ROMUALDO SAPID
The veteran operatic conductor of whom you will read more in this article, is now directing at WRNY.



Harry Finkel, M. D.
Whose talks on "Diet" are not the least interesting of WRNY's weekly features. He tells what foods suit you.

* Program Director of WRNY.

The Radio Constructor

How to Build a "B" Battery Eliminator for Alternating Current That Delivers Excellent Results and Is Not Noisy

By A. P. PECK, Assoc. I.R.E.

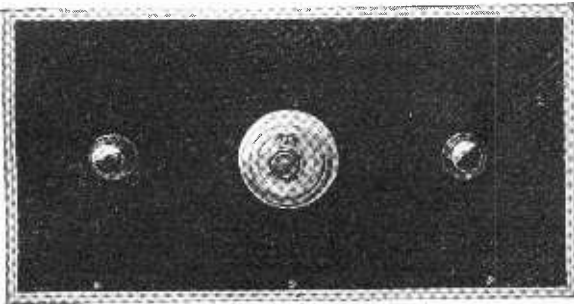


Fig. 1. The panel view of this home-made "B" eliminator shows the relative positions of the two voltage control knobs and of the snap switch in the "A" battery and 110-volt A.C. circuit.

WHEN contemplating the design and construction of a "B" battery eliminator, usually called "B" eliminator, there are a good many things that must be taken into consideration. First and foremost, our greatest desire is to produce an eliminator that will operate satisfactorily and consistently and that will not give rise to any audible hum either in the phones or loud speaker, regardless of which type of reproducer is employed and regardless of how many stages and what type of audio frequency amplification is used. Then we must also have safety. It is not wise to wire up any kind of an electrical instrument to be operated from the lighting circuit, and do so in a haphazard manner. We must provide good insulation for all of the circuits used and we must guard in every way against possible short circuits, which last will be attended with at least blown fuses if not with actual danger from fire. Also, the finished "B" eliminator unit must be built with the point in view in its construction that it can be used with any radio receiving set and will not look out of place. Ease of control must also be incorporated. All of these various points have been duly considered in designing the "B" eliminator which will be described in the following paragraphs, and there is at least one novel point incorporated in this instrument which the writer has not as yet seen in any home-made eliminator. This new point is in the switch that is employed. When everything is hooked up properly, the "A" battery switch on the receiver is disregarded and the entire set is controlled by means of the snap switch placed on the panel of the "B" eliminator unit. This snap switch is connected in both the 110 volt A.C. circuit and the "A" battery circuit. More of this later.

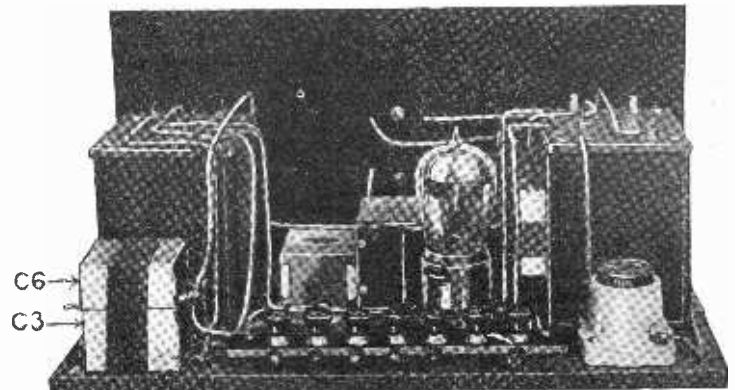
DOUBLE WAVE RECTIFIER TUBE

In making up a "B" eliminator, one of the most important parts of it is found to be

the rectifier. There has recently appeared on the market a type of rectifying tube that can be employed for rectifying or changing both halves of the cycle of an alternating current and that will deliver a pulsating direct current on the output side that can be easily and properly filtered. The exact construction of this tube is shown in the photograph on these pages and it will be noted that the elements are cut in half so as to show the internal construction. Inasmuch as this

In a "B" eliminator, we must have some sort of step-up transformer. This is necessary for two reasons. First, the rectifier tube employed will not operate properly at 110 volts potential and second, the voltage drop through any rectifier will be so great that if the 110 volt A.C. line is employed without an intermediate transformer, the voltage supplied by the rectifier will not be sufficient to operate the receiving set properly.

Right, Fig. 2: The rear view of the "B" eliminator with the special rectifying tube in its socket shows the placement of the various parts. To the extreme right is the transformer and to the extreme left is the choke coil. In front of the transformer is a socket to be connected to the 110-volt A.C. line.



is purely a constructional article, we will not enter into the discussion of the theory of the operation of this tube at this time. It is sufficient to say that the tube does not employ any filament that can be burned out and, therefore, with proper care it will last for a good long time. The manufacturers claim a tube life of many years, and it is almost impossible to measure the length of time that one of these tubes will last when not subjected to abnormal voltages. Inasmuch as a rectifier of this type will handle up to 300 volts, there need be no fear of harming it if the type of transformer called for in the list of parts given is employed.

After the current delivered by the transformer has been rectified by the tube, it is necessary to properly filter it so that the current will no longer be pulsating in character but will be as near pure D.C. as is possible to produce. It must be emphasized here that the desired results cannot be obtained with a cheap or inefficiently designed filter. If a large, well made choke coil and a high capacity condenser or group of condensers is not employed, the resulting current delivered to the set will not be sufficiently pure to give good reception results. A hum indicates in practically all cases that the filter is not correct.

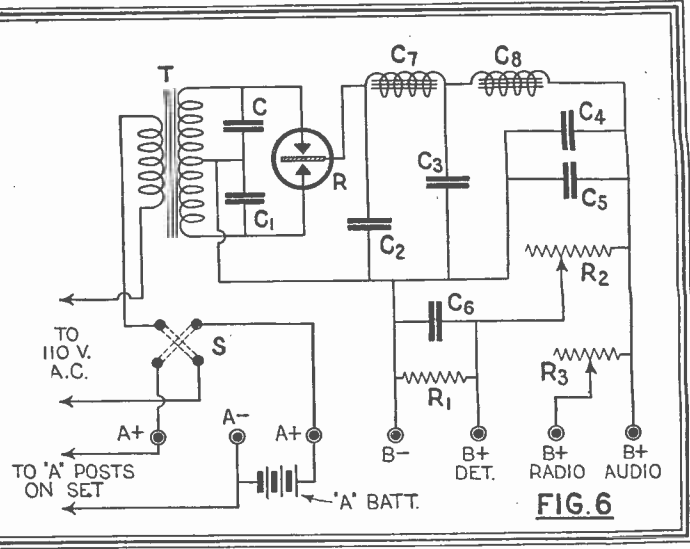
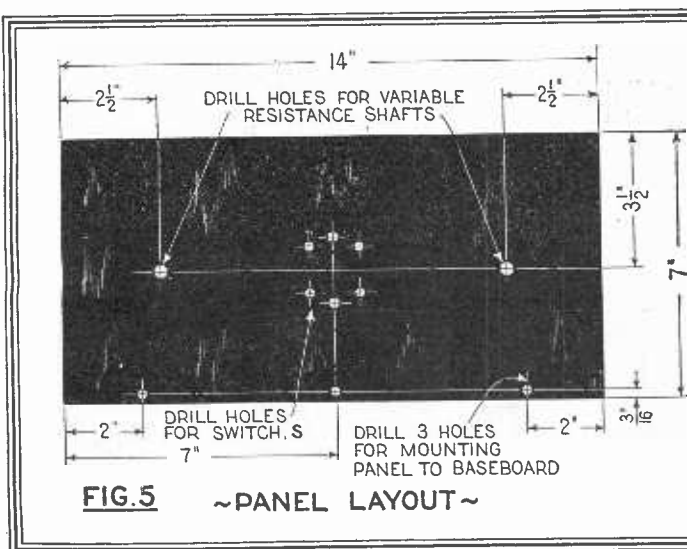


Fig. 5 shows the panel layout and Fig. 6 the complete schematic layout of the "B" eliminator. Note how the double-pole single-throw snap switch

is connected in both the lighting circuit and the filament circuit and also how the negative "A" post is utilized.

SPLIT CHOKE COIL

In the unit that is illustrated on these pages, the choke coil has an inductance of 100 henrys total and is split in the middle so that the necessary connections for the various condensers can be obtained. This type, especially designed for "B" eliminators, is now available on the market and can be obtained at a very reasonable figure.

are ample to provide the necessary variations in voltages. By mounting the two variable resistances on the panel of the eliminator, ready control of the detector and R. F. plate voltages is obtained. The eliminator shown in the photographs in Figs. 1, 2 and 3 is now

both cases, the operation is precisely the same and the only difference noticeable is that when the "B" eliminator is employed, the volume delivered by this set is greater than with "B" batteries. In fact, with most of the sets that have been tested, it is possible to

MATERIALS USED

Letters correspond to those given on photographs and drawings.

T—Transformer, 110 volt, 60 cycle A.C. input—200 to 250 volt A.C. output.

C and C1—.1mf. fixed condensers.

C2 and C3—2mf. fixed condensers.

C4 and C5—4mf. fixed condensers.

C6—5 mf. fixed condensers.

C7 and C8—two 50 henry choke coils in separate cases or in one unit.

R—Double wave rectifier tube.

R1—Fixed 7,500 to 12,500 resistance of carbon rod or wire wound type.

R2—Variable resistance of 10,000 to 100,000 ohms.

R3—Variable resistance of 1,000 to 10,000 ohms.

S—Double-pole single-throw indicating snap switch.

All fixed condensers must be tested at 500 volts.

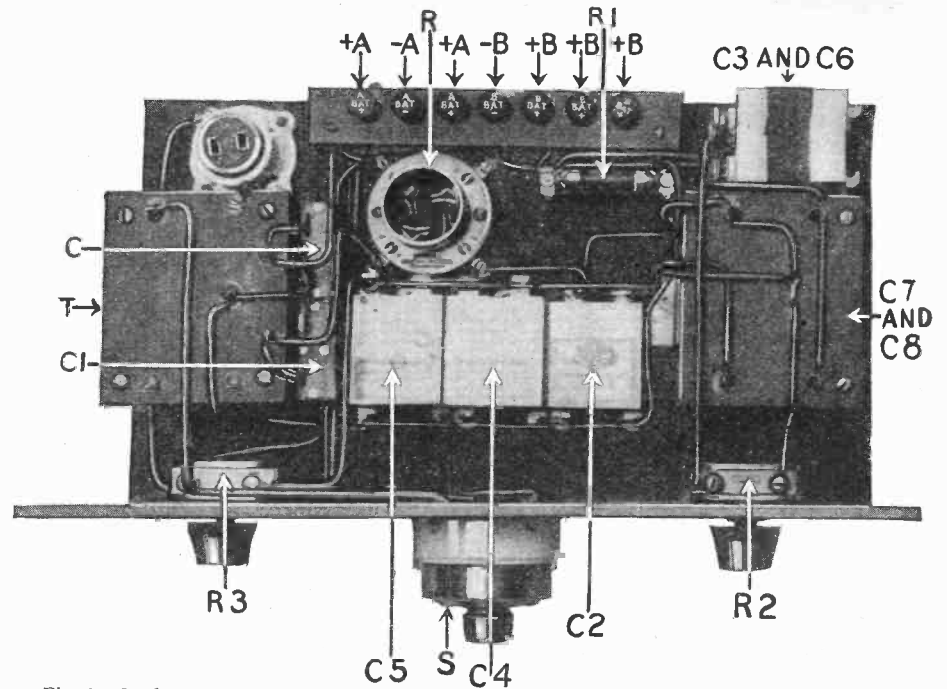


Fig. 3. In the top view of the highly efficient "B" battery eliminator described in these columns, the reader can readily perceive how every instrument is laid out on the baseboard and on the panel. This is about as compact a unit as can be easily and efficiently constructed.

Photos courtesy General Radio Co. and Allen-Bradley Co.

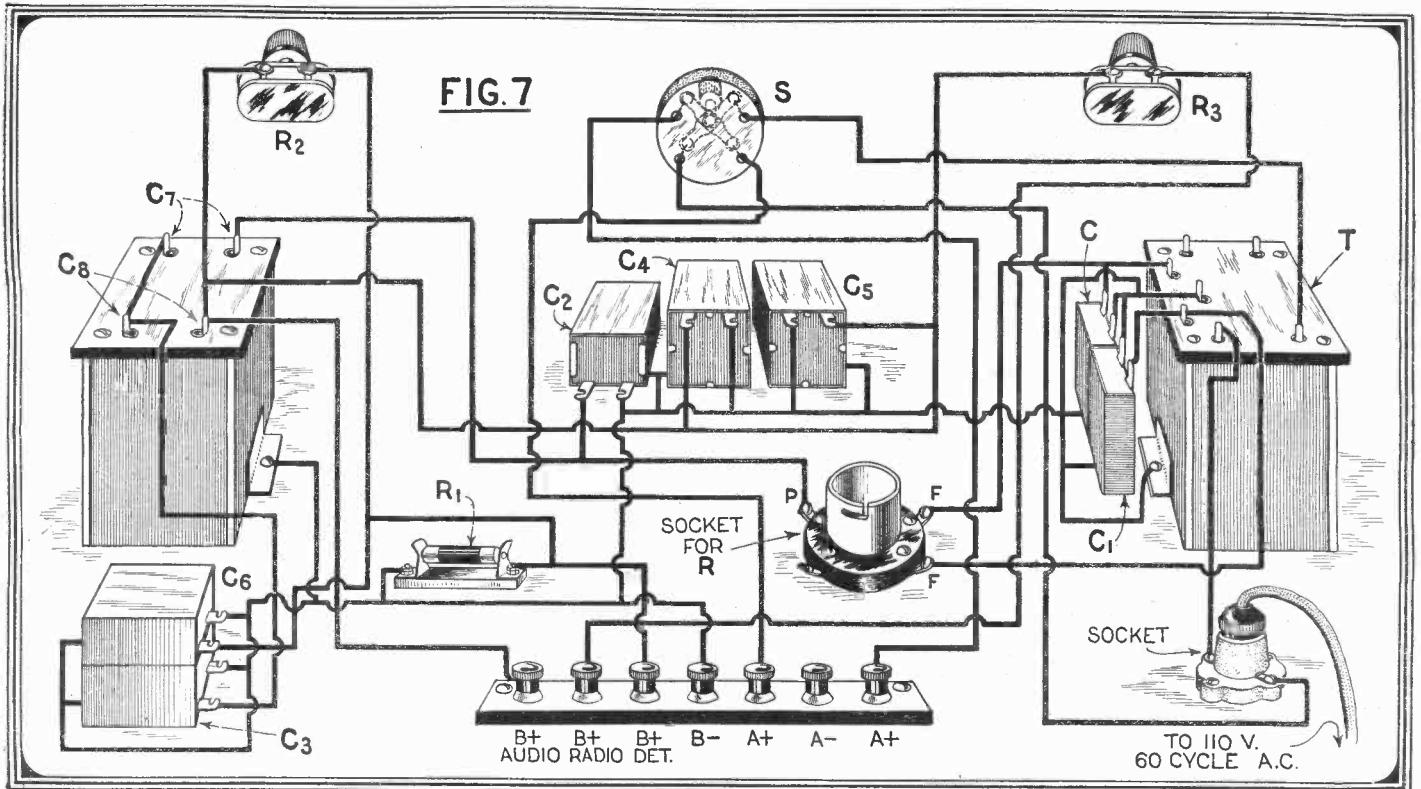
In order to adapt a "B" eliminator to all types of sets, there must be at least two variable output voltages. First, the voltage supplied to the detector tube must be comparatively low and this is obtained by connecting a 10,000- to 100,000-ohm variable resistance, R2, in the circuit as shown in the diagram in Fig. 6 and Fig. 7. Then again, most multi-tube receivers employing radio frequency amplification require a lower voltage for the R.F. amplifying tubes and this is obtained by means of the resistance R3. The voltage drops across these two resistances

in use in the writer's laboratory, in connection with the four tube tuned radio frequency receiver described in the March issue of SCIENCE AND INVENTION Magazine. With this combination, excellent results are obtained and there is absolutely no hum. In fact, it is practically impossible for anyone to tell whether the "B" eliminator or "B" batteries are used when one is substituted for the other without their knowledge. In

use only the first stage of audio frequency amplification for stations operating within a radius of 200 to 300 miles. To use the second stage of amplification on nearby local stations is usually disastrous to the loud speaker.

OPERATES MULTI-TUBE SETS

A good many people want to know just (Continued on next page)



In order to make the wiring of a "B" eliminator easy, we have made up a wiring diagram of all the component parts illustrated in perspective and it

is reproduced in Fig. 7 above. Note that the grid connection to the socket is not used and that all metal cases connect to - B.

How To Build a "B" Eliminator

(Continued from preceding page)

one thing about a "B" eliminator, after they find that it is free from hum. That is, "Will it operate a multi-tube set?" The answer for this "B" eliminator is, "Yes." It has been tried on various types of sets up to and including six tube receivers and the manufacturers of the parts and of the tube claim that it can be employed for any type of set using 12 tubes or less. Therefore, it is obvious that an eliminator of this nature will be most satisfactory for operating any of the usual receivers that are in use today.

And now, we come to the switching arrangement employed wherein a double-pole single-throw snap switch is used. One of the poles of this switch closes the 110 volt A.C. circuit through the primary transformer and the other closes the "A" battery circuit. You will notice that there are seven binding posts on the terminal block. Four of them are for the "B" potentials and the other three are for the "A" battery. The center one of these three is merely a convenience post and can be eliminated if desired, but standard binding post strips have seven holes in them, so why not use seven binding posts and have added convenience? The center post is not connected to any part of the circuit but is merely used for tying together the negative lead from the "A" battery to the eliminator and from the eliminator to the set. The exact connections will be plainly evident by reference to the circuit diagrams given in Figs. 6 and 7. Be sure that you hook this switch up properly so that

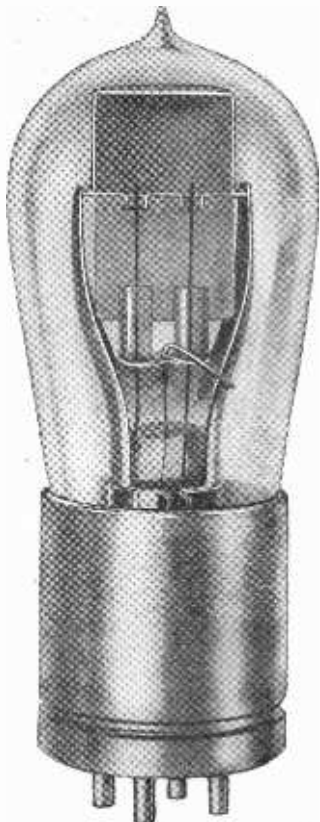


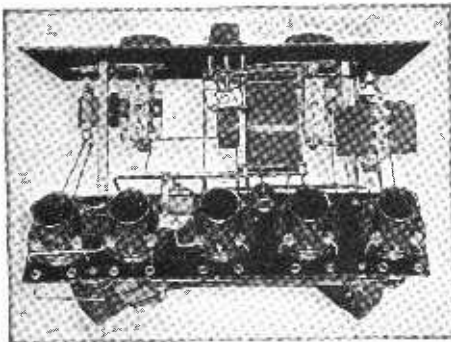
Fig. 4. This illustration shows the rectifier tube that makes a good "B" eliminator possible. Elements are in cross section. Photo, courtesy Raytheon Mfg. Co.

to the "on" position. Also, when reassembling the switch, after connecting up the terminals, be sure that the indicator dial is positioned correctly in relationship to the switch arms. After you have made all of these connections and run the wires from the "B" eliminator to the set, you can connect a metallic strap or a short piece of wire across the two terminals of the "A" battery switch that is incorporated in the receiver and can then turn both the "A" battery and the "B" eliminator off or on by merely turning the snap switch. In case your set employs filament control jacks, they can be disregarded as it is only necessary to leave the plug inserted in one of the jacks and turn off the snap switch which will automatically extinguish the tubes and also break the input circuit to the "B" eliminator.

USE INSULATED WIRE

When wiring up this unit, probably the best wire to employ is No. 14 solid conductor with a heavy layer of rubber insulation. This will effectively guard against short circuits and still is easy to bend and to use for making connections. Be sure to place a soldering lug under each instrument as it is mounted and connect all these lugs together. Also connect them to the negative side of the "B" supply as shown in Fig. 7. Then be sure that one side of the "A" battery in the receiver that the eliminator is to be used with is grounded. Taking these precautions will prevent stray electro-magnetic fields that emanate from the coils of the transformer and choke coil from affecting the inductances incorporated in the radio receiving set proper and, therefore, all possibility of any hum in the reproducing unit will be avoided.

After you have placed an eliminator in operation, it may be found necessary to increase the value of the "C" battery in order
(Continued on page 1146)

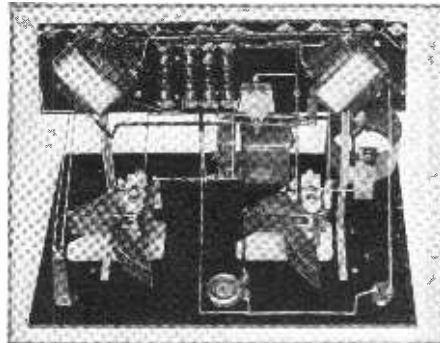


Above: All of the instruments mounted on special brackets and the connecting wires are plainly shown.

A Five Tube Tuned R.F. Receiver

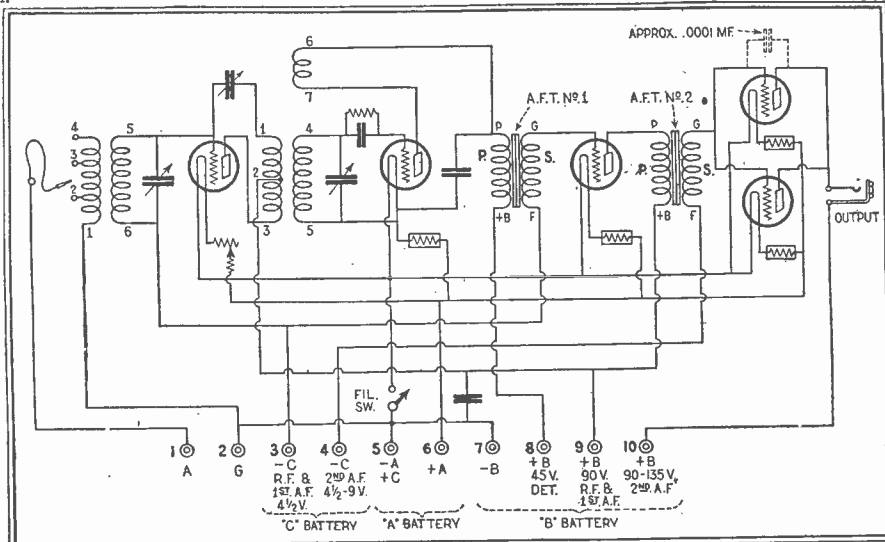
gether" that efficiency is sacrificed. In this particular set, there is no crowding of parts, yet there is no waste space. This is accounted for by the fact that some of the instruments are set quite far back from the panel resulting in a symmetrical and pleasing layout.

In this set, regenerative and tuned radio frequency amplification are combined in such a manner that the best features of both of these types of amplifications are retained and some of the undesirable fea-



Above: Bottom view of set described here. Transformers support sub-panel. Photos courtesy Hammarlund-Roberts.

THE general trend of the radio manufacturer today seems to be toward the exploitation of complete kits for the construction of radio receiving sets. By putting out materials in this form, the manufacturer saves the constructor a lot of work and also aids him in getting the best possible results from his particular set. In these columns we describe another receiver that has been made up from a standard kit of parts and that is exceptionally easy to build. Furthermore, this is one of the most compact five-tube receivers that is available today and that is not so "pushed to-



The schematic diagram of this receiver reproduced above shows its simplicity. Regeneration is employed in the detector circuit in order to increase sensitivity, and one stage of tuned R.F. also helps. Last two tubes are connected in parallel for greater volume.

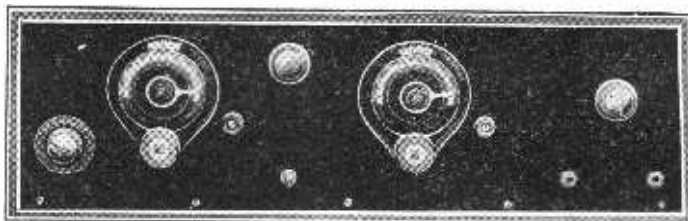
ures of each are eliminated. As will be noted, upon reference to the schematic diagram of the set given herewith, the radio frequency amplifier is neutralized. This makes set quieter.

In order to avoid overloading the last audio frequency amplifying tube, two standard tubes of the UV-201A type are connected in parallel. If after doing this, an audio frequency whistle is found to be present, it can often be eliminated by connecting a small condenser from grid to plate of one of the last audio frequency amplifying tubes as shown in dotted lines in the circuit diagram.

A Highly Efficient Six Tube Receiver

Three Stages of Tuned Radio Frequency Amplification Gives Sensitivity and Selectivity to a Remarkable Degree

By L. ABRAMS



Above: Fig. 1. The panel view of this receiver shows the positioning of the two main tuning control dials and of the other variable components. Note that vernier dials are absolutely essential with this receiver if the best possible results are to be obtained.

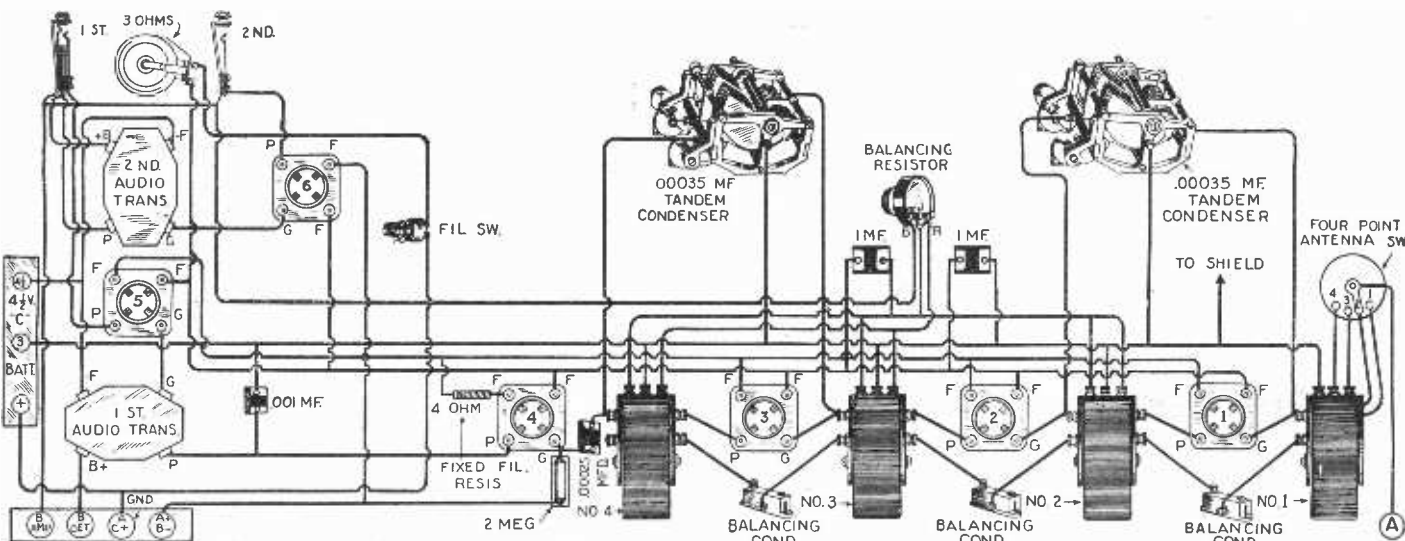
UP to the present time, the majority of manufactured and home-made receivers of the multi-tube type have been limited in scope to two stages of tuned radio frequency amplification. The addition of more stages of this type of amplification, except in Super-Heterodyne receivers has been considered by most radio men as impractical. Of course, there have been a few isolated instances where really interested experimenters have constructed sets employing three or four stages of radio fre-

quency amplification. The addition of more stages of this type of amplification, except in Super-Heterodyne receivers has been considered by most radio men as impractical. Of course, there have been a few isolated instances where really interested experimenters have constructed sets employing three or four stages of radio fre-

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SHIELDING THE SET



Above: Fig. 2. This picture diagram shows the relative positions of the various instruments used in this receiver and also illustrates how the shortest leads can be made between the parts. Note the balancing condensers placed between the inductances and the tiny verniers or "trimming" condensers that are integral parts of the tuning units. The adjustment of these capacities is critical and must be carefully made.

quency amplification, but usually the results were not all that could be desired. In the case of the set under discussion, however, it has been found entirely possible and practical to use three stages of tuned radio frequency amplification and to so balance the entire set that the receiver will work prop-

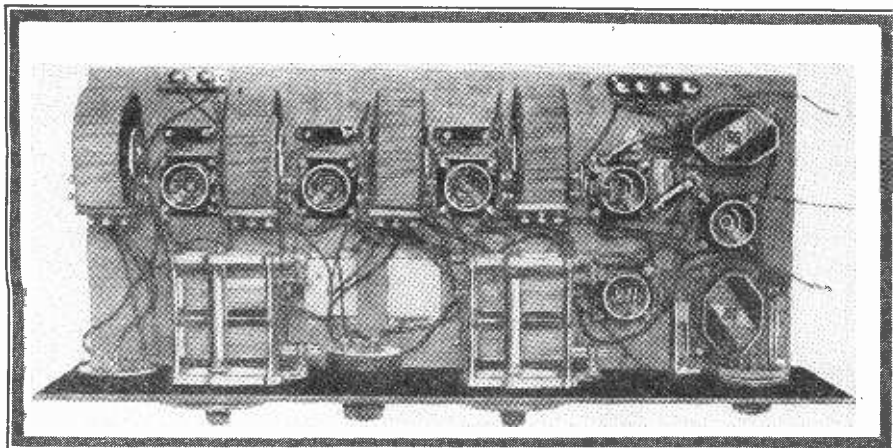
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quency amplification. The addition of more stages of this type of amplification, except in Super-Heterodyne receivers has been considered by most radio men as impractical. Of course, there have been a few isolated instances where really interested experimenters have constructed sets employing three or four stages of radio fre-

OSCILLATION CONTROLS

In the circuit diagram of this set, a balancing resistor will be noted. This is of special design although it is available on the market and consists of two resistances connected in series and arranged with two arms so positioned that as one resistance is increased, the other is decreased. This operates as a volume control as well as an oscillation control.

After this receiver has been constructed, it must be very carefully balanced and this is done by means of the three low capacity balancing condensers and the small "trimming" condensers mounted on the regulation tandem tuning condensers. When adjusting the balancing condensers for proper operation, use a long wooden or other insulating stick at least 15 inches long and sharpened at one end after the manner of a screw driver edge.



Above: Fig. 3. The set illustrated was constructed of standard manufactured parts and wired with the flexible leads provided by the makers. With this system no knowledge of soldering is necessary and anyone can wire up a complete six tube receiver in a very few hours. The ends of the flexible leads are equipped with terminals, making connecting easy.

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.

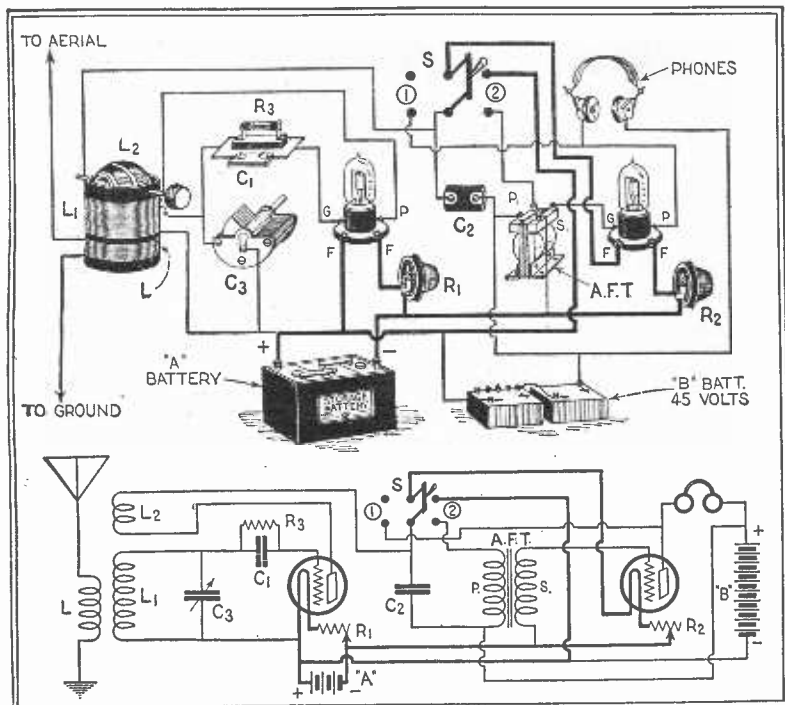


Fig. 1. With the circuit diagram shown above, it is possible to employ either one or two tubes and to automatically control the amplifier tube filament.

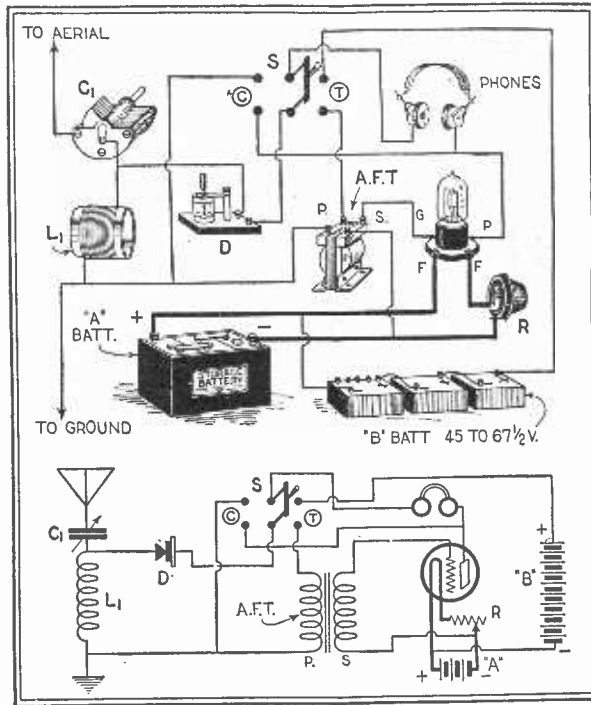


Fig. 2. With this system, the crystal detector may be used alone or by means of switch S, it may be used with an amplifier.

DUPLEX CIRCUITS

(458) Q. 1. Albert King, Bronx, N. Y., asks: Kindly show two-circuit diagrams by means of which the following effects can be obtained. (A) Show how two tubes can be hooked up with a single double-pole double-throw switch so that either the regenerative detector tube can be used alone or so that the detector and one stage of audio frequency amplification can be employed. This should be arranged so that the filament circuit of the audio tube will be automatically extinguished when the detector is being used alone. I do not want to use jacks. (B) Show a standard single coil crystal detector circuit, with one stage of audio frequency amplification, and a double-pole double-throw switch so arranged that the crystal detector can be used either alone or with the amplifier. In this case the tube need not be extinguished automatically as this will be controlled by a push-pull switch.

A. 1. The two requested circuit diagrams are given in these columns. Referring to Fig. 1, all of the constants are standard. L, L1 and L2 are a standard three circuit tuner. C has a capacity of .00025 mf., R1 and R2 are rheostats. R3 is a 1 to 5 megohm grid leak. C2 has a capacity of .001 mf. and S is a double-pole double-throw switch. When the switch is thrown to position 1, the detector is used alone and when in position 2, both tubes are employed and the filament of the second tube is lighted.

In Fig. 2, the requested crystal circuit is shown. C1 may be a .0005 mf. condenser, L1 a standard tuning coil to cover the broadcast wave-length band, D, the crystal detector and S, the switch. At position C of switch S, the crystal is used alone and at position T, the vacuum tube is used as an audio frequency amplifier for the crystal detector. With the latter combination good quality is had with increased volume.

"LC" TABLE

(459) Q. 1. Louis Terrin, Washington, D. C. asks: Kindly give the LC values to be used in tuning units from 10 to 500 meters. Also a list of the corresponding frequency in kilocycles of various wave-lengths.

A. 1. The table appended gives all the required information. The value LC is the product obtained by multiplying the inductance of a coil in microhenrys by the capacity of a shunt condenser in microfarads. When using this table suppose that we have a condenser with a maximum capacity of .0005 and we desire to obtain the inductance of a coil that will enable us to tune to a maximum wave-length of 200 meters with maximum condenser capacity. Referring to the table, we find that the

LC value for 200 meters is .01126. Dividing this by the maximum capacity of the condenser or .0005 mf., we find that the coil to be used with this particular condenser should have an inductance of 22.5 microhenrys.

MULTIPLE PHONE CONNECTIONS

(460) Q. 1. J. R. Cormany, Lenoir City, Tenn., says that he has a standard type of one-tube set but cannot use more than two pairs of phones in series on the set at the same time. He asks us if we can suggest any remedy for this.

A. 1. When you put more than two pair of phones in the plate circuit of your detector tube, the resistance becomes so great that your set fails to function properly. The best thing for

you to do would be to obtain one of the devices on the market today which are designed to have placed therein a single reproducing unit or telephone. Four or more rubber tubes radiate from the cover of the unit and terminate in pairs of ear-pieces similar to a stethoscope. Also try connecting phones in parallel instead of in series.

LOCATING POWER LEAKS

(461) Q. 1. J. A. Moorefield, Charlottesville Va., has had considerable trouble while operating his radio receiving set from interference probably caused by leaks in power lines. He asks how leaks of this nature can be located.

A. 1. The only practical method of locating interference of the nature you mention is to use a loop connected to a two or three tube receiver. This should preferably be of the oscillating type so as to be more sensitive to interference of the nature you mention. The outfit could then be carried around the locality where trouble is experienced and by swinging the loop, the general direction of the leak could be determined. Use the triangulation method.

Chart for Determining the Wave-length, Frequency and LC Value for Radio Frequency Circuits

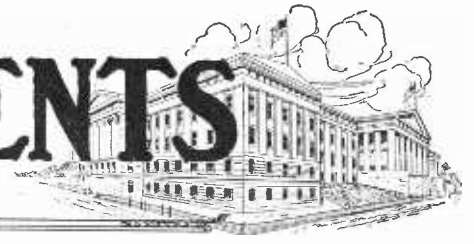
(L is in microhenrys and C in microfarads.)

Wave Length (Meters)	Frequency (Kilocycles)	LC Value	Wave Length (Meters)	Frequency (Kilocycles)	LC Value	Wave Length (Meters)	Frequency (Kilocycles)	LC Value
10	30,000.00	.0000282	65	4,615.00	.001188	230	1,304.00	.01489
11	27,273.00	.0000340	70	4,286.00	.001378	235	1,277.00	.01555
12	25,000.00	.0000405	75	4,000.00	.001583	240	1,250.00	.01622
13	23,076.00	.0000476	80	3,750.00	.001801	245	1,225.00	.01690
14	21,426.00	.0000552	85	3,529.00	.002034	250	1,200.00	.01760
15	20,000.00	.0000634	90	3,333.00	.002280	255	1,177.00	.01831
16	18,748.00	.0000720	95	3,158.00	.002541	260	1,154.00	.01903
17	17,646.00	.0000813	100	3,000.00	.002816	265	1,132.00	.01977
18	16,667.00	.0000912	105	2,857.00	.003105	270	1,111.00	.02052
19	15,788.00	.0001016	110	2,727.00	.003404	275	1,091.00	.02129
20	15,000.00	.0001126	115	2,609.00	.003721	280	1,071.00	.02207
21	14,284.00	.0001241	120	2,500.00	.004052	290	1,034.50	.02366
22	13,635.00	.0001362	125	2,400.00	.004397	295	1,017.00	.02450
23	13,042.00	.0001489	130	2,308.00	.004757	300	1,000.00	.02533
24	12,500.00	.0001622	135	2,222.00	.005130	310	967.70	.02705
25	12,000.00	.0001755	140	2,144.00	.005518	320	937.50	.02883
26	11,538.00	.0001903	145	2,069.00	.005919	330	909.10	.03066
27	11,110.00	.0002052	150	2,000.00	.006335	340	882.40	.03255
28	10,713.00	.0002207	155	1,935.00	.006760	350	857.10	.03448
29	10,343.00	.0002366	160	1,875.00	.007204	360	833.30	.03648
30	10,000.00	.0002533	165	1,818.00	.007662	370	810.80	.03854
32	9,374.00	.0002883	170	1,765.00	.008134	380	789.50	.04063
34	8,823.00	.0003255	175	1,714.00	.008620	390	769.20	.04277
36	8,333.00	.0003648	180	1,667.00	.009120	400	750.00	.04503
38	7,894.00	.0004065	185	1,622.00	.009634	410	731.70	.04733
40	7,500.00	.0004503	190	1,579.00	.01016	420	714.30	.04966
42	7,143.00	.0004966	195	1,538.00	.01071	430	697.70	.05204
44	6,818.00	.0005446	200	1,500.00	.01126	440	681.80	.05446
46	6,522.00	.0005960	205	1,463.00	.01183	450	666.70	.05700
48	6,250.00	.0006485	210	1,429.00	.01241	460	652.20	.05960
50	6,000.00	.000704	215	1,395.00	.01301	470	638.30	.06219
55	5,454.00	.000852	220	1,364.00	.01362	480	625.00	.06485
60	5,000.00	.001014	225	1,333.00	.01425	490	612.20	.06759
						500	600.00	.07039

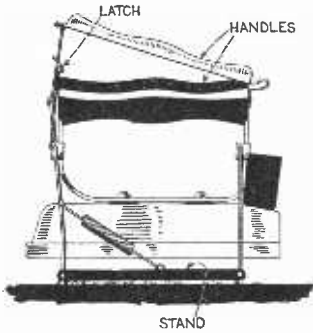
The chart for determining wave-length, frequency and LC values often comes in handy for use in various radio calculations. Clip this table out and keep it for reference.



LATEST PATENTS



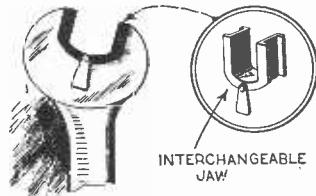
IRON STAND



No. 1,564,517 issued to Walter Bernard Brodin is illustrated below and protects an unusual type of automatic stand for sadirons. As shown, grasping the handle of the iron folds up the stand. When the handle is released, a spring action raises the iron off the surface to position shown.

WRENCH

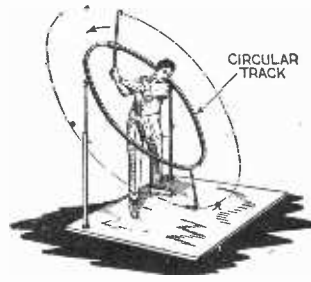
No. 1,564,222 issued to Charles L. Dunlap protects a novel type of open end wrench shown above. The jaws are interchangeable and the walls of the jaws are of varying thicknesses so that the actual openings may



be changed and therefore the same handle may be continually used on various sizes of nuts merely by changing the jaws. The interchangeable part is equipped with a spring clip which frictionally engages with the handle and prevents accidental displacement of the jaws when the wrench is in use.

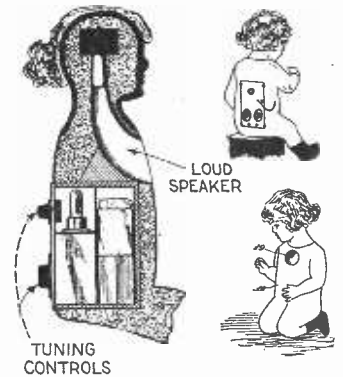
GOLF DEVICE

No. 1,567,530 issued to Ronald G. Macnaughton and Morton R. Walker



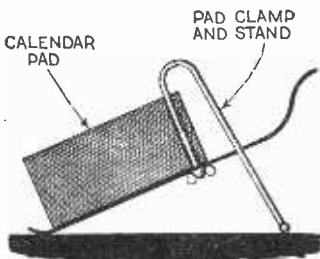
protects a device designed for the use of golf players and so constructed as to teach them to properly "follow through" their swing. The golf stick is loosely attached to a runner on a circular track so that the operator must continue his stroke.

RADIO DOLL



No. 1,565,145 issued to Beulah L. Henry was obtained to protect the design of a combination doll and complete radio set of the type shown in the above illustration. A combination of this nature should be attractive in many ways without any detrimental effect on the operation of the set.

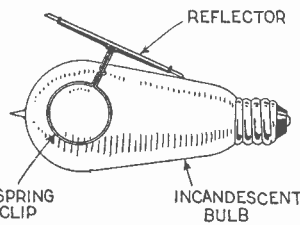
CALENDAR PAD



No. 1,566,054, issued to Frank A. Weeks describes a very simple type of calendar pad stand illustrated above. The base is a piece of sheet metal and the pad clamp and stand is a piece of metal rod bent to the shape shown, threaded at one end and equipped with a ball or other protective tip at the other end. Thus simplicity is combined with ruggedness.

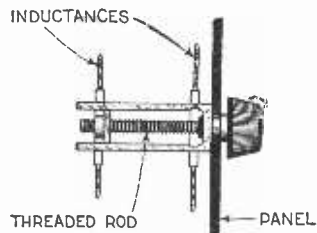
REFLECTOR

No. 1,566,327 issued to George Johnson was allowed on the simple design for a lamp shade or reflector il-



lustrated here. A simple spring clip holds any desirable size or shape of reflector to a standard incandescent bulb.

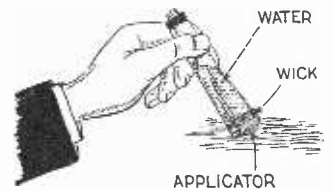
COIL MOUNT



No. 1,565,206 issued to George F. Ruzicka covers the design of a variable mounting for different types of radio inductance coils. As shown, one inductance is stationary and the other is mounted upon a threaded rod. By turning the control knob, the distance between the two inductances can be critically varied.

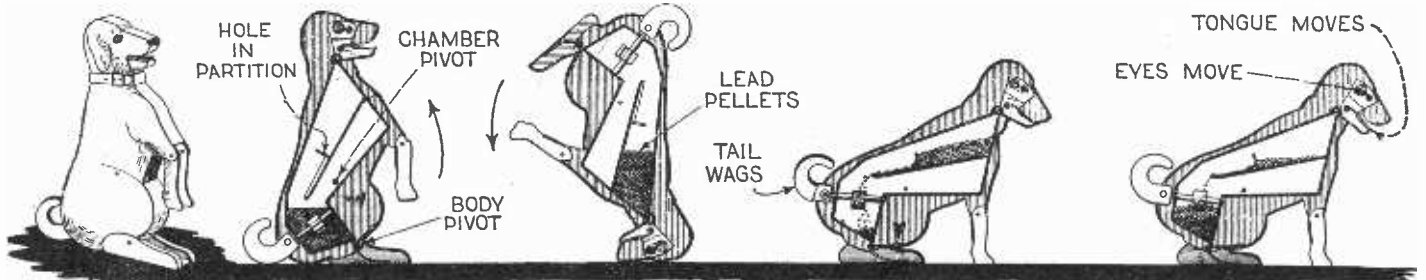
MOISTENER

No. 1,565,979 issued to Joseph Bachrach covers the design of a moisture applicator shown above. A small tube is filled with water and is



equipped at the end with a cylindrical applicator. A wick conducts water to the surface of the applicator which is rolled over the surface to be moistened. In this way, quick and easy moistening is obtained.

ANIMATED TOY DOG



No. 1,564,785 issued to William W. Harris describes one of the cleverest mechanical toys that has come to our attention in some time. Operating without springs or other devices that necessitate winding, this mechanical dog wags his tail, moves his eyes, lower jaw and tongue and sits up. This is all accomplished by the movement of lead pellets placed within a chamber in the dog's body. The dog is first placed upright in the position shown in Figs. 1 and 2 and then rotated in a counter clockwise direction to position

in Fig. 3. It is then placed in position Fig. 4 and the lead pellets start to roll through the hole in the partition shown. Hitting projections on the tail shaft, the tail is caused to wag. As the weight of pellets in the lower end of the chamber increases, the eyes, jaw and tongue move and finally the dog, without any assistance assumes the position shown in Fig. 1. This is caused by the weight in the lower end of the chamber overbalancing the body.

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.

Scientific Humor

GIVING HIM THE MITTEN

CUSTOMER: "This \$7.00 fountain pen you sold me for 99 cents leaks."

SALESMAN: "Ah, yes, you need one of our patented rubber writing gloves. Thirty-five cents, please."—*Leslie F. Carpenter.*

MANY OF US DO

SHE: "I think the radio is such a wonderful invention, don't you?"

HE: "Yeah—there's one thing about it I like, anyway."

SHE: "Why, what is that?"

HE: "Well, you can listen in on the broadcasting of the Sunday school lesson on your radio, and when they announce passing of the collection plate you can just sit back and smile without even kickin' in a nickel."—*Harmon C. Shelby.*

HE'S PICKING ON THEM

REFEREE (blowing whistle): "Foul."

SPECTATOR: "Where are the feathers?"

REFEREE: "Ain't any, this is a picked team."—*Raymond Costello.*

HE MIGHT TRY AN INK E-RAZER

DARN IT!



"I see where Mr. Jones tried to kill himself last night by cutting his throat."

"Did he die?"

"No."

"How's that?"

"Why he used one of those new fangled 'Double-

life' razor blades."—*Marvin Moore.*

A VOID

"Where I spent Christmas last year the thermometer dropped to zero."

"That's nothing."

"What's nothing?"

"Why, zero."—*Klayde Spaur.*

RUNNING KEEPS IT WARM

WIFE: "Is it cold?"

HUSBY: "Yes, mercury's running down the thermometer to keep warm."—*Edw. E. Grathwohl, Jr.*

RADIO OR BABY OH

BILL: "Radio is in its infancy."

JACK: "Yes, I know that by the way it howls."—*Edw. E. Grathwohl, Jr.*

HE GOT AN AIRING



"Son, I have proved to you that anything filled with air will go up. Have you any questions to ask?"

SON: "Pop, what's keeping you down?"—*Harold Hoyt.*

OR A DUCK ON THE SHORE

MAUD: "Dad, what is a drydock?"

DAD: "What? A drydock? Well, a thirsty surgeon, I presume."—*Martiniانو Crus.*

AN OILY WORKER

INQUISITIVE PERSON (to boy pouring kerosene oil on a wiggler-infested pond): "And what are you doing, lad?"

LAD: "Ah, just pouring oil on troubled waters."—*Joseph Elles.*

First Prize \$3.00

HIS OESOPHAGUS WAS HIS TEST



OH in his test tube.

"I wish to commune with the spirits," stated the smart chemistry student as he stepped up to the lab. supply window to get some C₂ H₆.

—*John H. Spicer.*

CAUSE FOR CORNS ON THUMBES

An Automatic Lunch: Where nickels are so thin from use it looks like the Indian is riding the Buffalo.—*Ted Thompson.*

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.

WE WONDER WHAT HE SAID

FRANK: "You know, Hank, one night Bill and I were out riding and Bill was all dressed up in his best clothes. Well, along about 11:30 we got lost, but we saw a sign ahead of us and Bill said he'd climb up it and light a match to see what it said. So he did."

HANK: "And what did it say?"

FRANK: "Wet paint."—*Leonard M. Asher.*

AN IMAGINARY NUMBER



PROFESSOR: (on entering classroom: — "Gentlemen, the subject to be discussed today is liars. How many of you have read the 6th chapter of the text?"

Evidently the entire class raised their hands. PROFESSOR: "Good! You are the very class I wish to speak to; there is no 6th chapter."—*Joseph Milota.*

NOT A DENTAL COLLEGE

LADY (to former Cadet of West Point): "And don't you think the drills are awful boring?"—*J. F. Harvey.*

REINCARNATED

QUACK SIDESHOW ANNOUNCER: "On my right you will perceive Cleopatra's skull at the age of 21. The other is at the age of 35."—*Frank E. Miller, Jr.*

NOT HARD TO BELIEVE

It is easy to believe cigarettes ruin a woman's complexion. Smoke always is hard on paint.—*R. W. Hicks.*

NO ROOM FOR NEW IMPROVEMENTS

HE: "You must admit Man is a wonderful invention."

SHE: "Maybe so. But Woman is an improvement on that wonderful invention."

HE: "Is that so? Now I know what keeps the young men out all night."

SHE: "Why so?"

HE: "They are looking up new improvements."—*H. Ward.*

HELPED HIM KEEP COOL

After the alarm of fire was given in a hotel, one of the guests joined his friends outside and laughed at them for being so excited. "There is nothing to get excited about," he said, "I took my time about dressing, lighted a cigarette, didn't like the knot in my necktie, so tied it over again. That's how cool I am."

"Fine," one of his friends said, "but why didn't you put on your pants?"

—*J. L. Sims, Jr.*



EXCITING FIELDS OF FORCE

"Well!" exclaimed the judge of the short-circuit court, "What I want to know is when Watt caused Rho Stat to walk ohm, where did Volt meet 'er?"

"Just as she had crossed the magnetic field, I saw the motor pick her up, your Honor," replied the lightning arrester of the Electro Motive force.

"Then," said the judge, as he turned to the man who was charged with animal magnetism, "I will give you thirty days behind the bus-bars, and if that fails to transform you, I am going to kill-a-Watt."—*Patrick J. Lynch.*

WHEN AN APPENDIX IS CUTE

DOCTOR: "I think you have a cute appendix."

FLAPPER: "Oh Doc, ain't you the flatterer."—*W. B. Grant.*



CURRENT EVENTS

SON: Father, why does a woodpecker usually peck on telephone poles?

FATHER: I suppose they are looking for the currents.—*Leland Ludcke.*

TWO WAYS AT ONCE

MOTHER: (searching in drawer) "I can't find a single pin anywhere. Where do they all go anyhow?"

SON: "It's hard to tell, because they are pointed in one direction and headed in another."—*Jack D. Purves, Rep. No. 25765.*



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.

LOCOMOTIVE HISTORY

(2019) Q. 1. Francis P. Otery, Philadelphia, Penna., asks for some information on the history of locomotives.

A. 1. The original locomotive was not designed for operation on rails such as we know today, but really might be considered as the fore-runner of the automobile inasmuch as it was designed to run on common roads. The first record found of the application of a locomotive to rails gives that honor to Richard Trevithick who, in 1804 in England, is said to have used the first locomotive in existence. This engine, however, is said to have made only one or two trips and was commercially a sad failure. In 1811, a locomotive was built in England by Mathew Murray which operated by a toothed wheel engaging with a toothed rail. Some histories credit George Stephenson with the invention of the locomotive but our records show that his first practical engine was completed in 1814.

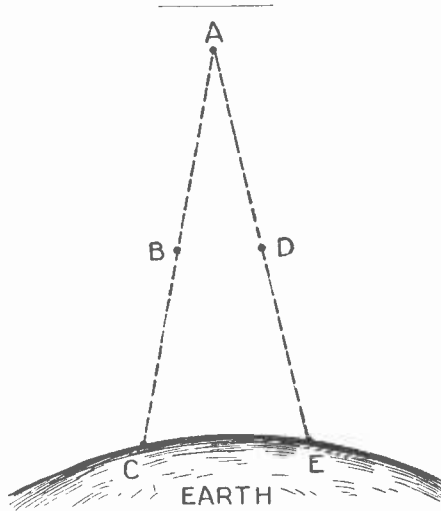
Prior to 1830, several locomotives had been in use in America but they were of English manufacture and had been imported from that country. In the year 1830 a locomotive was designed by Adam Hall, built in New York City and operated on the Baltimore and Ohio Railroad. This seems to be the first record available of an American built locomotive.

EXPLORING HIGH ALTITUDES

(2020) Q. 1. Raymond Williams, Stanford, Conn., says that he has often read of scientific observations dealing with the intensity of cold and air conditions that have been found at heights as great as 10 miles. He asks: How are such observations made when the highest airplane flight has not even reached the eight mile mark?

A. 1. The various observations that you mention are sometimes made by fastening registering instruments to captive balloons and allowing them to rise to the greatest possible heights. The instruments work automatically and make records of such phases of the condition of the upper strata of air as humidity, temperature, air pressure and light. Often the balloons used are not of the captive type, but are set free and allowed to rise upward until they burst due to the reduced atmospheric pressure and the pressure of the gas within them. The instruments carried by the balloon are equipped with small parachutes by means of which they float gently to the earth, whereupon they are recovered and their records made permanent. The instruments are, of course, protected from injury by various methods. The different types of instruments used for observation work of this nature are very small in dimensions and in some cases, it is necessary to read the records made by them with the aid of a microscope. By means of certain methods employed, it has been possible to obtain records at elevations as much as 14 miles above the surface of the earth.

dent are gently tapped with a lead or a wood faced mallet, the dent will usually be found to spring out and leave the tank quite smooth. Sometimes a strip of heavy tin can be soldered to the center of the dent, and by pulling on it the plate can be straightened out.

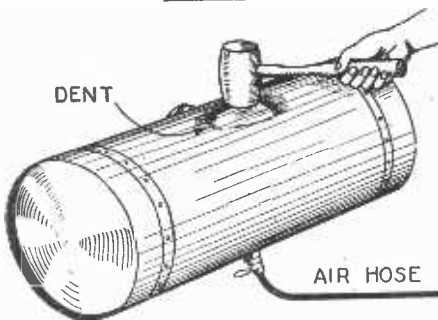


A very interesting problem in relative speeds is that shown above. There are several ways of approaching this problem and of discussing it to a satisfactory conclusion and one of these methods is gone into in detail below.

SPEED

(2022) Q. 1. Lester Morris, Hooker, Oklahoma, presents a purely hypothetical question regarding the appearance of a luminous body traveling from space toward the earth at a speed twice that of light. He asks: Will a person situated on the surface of the earth be able to see this body as it approaches?

A. 1. Leaving all factors out of the situation other than the body and the earth, and assuming that the body has a uniform speed of double that of light, this question can be readily answered as follows by referring to the diagram given in these columns. Assume that the body is traveling toward the earth along a line indicated by ABC and that it will strike the earth at a point C. Furthermore, assume that the observer is at point E. Points C and E can be considered as being so close together that the resulting discrepancy in calculations will have little bearing upon the actual result. Let points A and B and B and C be 186,000 miles apart. The same of course is true of AD and DE. Assuming this self-luminous body to be at point A, it will be two seconds after it reaches this point before the observer will see it in that location. This is because of the fact that it will take the light two seconds to travel the distance AE. In the meantime, however, the body has moved from A to B, consuming only one-half second of time, whereas the light has taken one second to travel this same distance. The light of the body when at B or its equivalent position D will take only one second to reach the point E and since the body has passed from A to B in one-half second, it is obvious that it will be seen at position B before it is seen at A. Therefore, at least for the space shown, the body will appear to an observer to be traveling outward into space or from B to A, rather than from space toward the earth or from A to B and its apparent speed will be one-half that of light. Of course, it must be realized that in this explanation round figures only are assumed. However, this has little bearing upon the actual solution which will remain the same even under careful calculations. There will be other discrepancies entering into this proposition such as the distance BE being different from that assumed in the proposition, which distance is DE. Here again, however, the final result is not affected. Of course, the entire problem is pure theory and has no practical application but it is a good example of an unusual physics problem.



An excellent method of straightening out dents in a tank is shown above.

REMOVING DENTS

(2021) Q. 1. Edward Ross, Philadelphia, Pa., wants to know how dents can be removed from the sides of an automobile gasoline tank.

A. 1. Probably the simplest method of accomplishing this work rapidly and effectively is to remove the tank from the automobile and fill it with water. Then connect a petcock screwed into the bottom of the tank to a compressed air supply of 20 pounds pressure. If now the edges of the

PHYSICS PROBLEM

(2023) Q. 1. C. C. Flanders, Des Plaines, Ill., refers to Scientific Problems And Puzzles article appearing in the October, 1925, issue of SCIENCE AND INVENTION Magazine and refers specifically to Fig. 7 of that article. Quoting from his letter, "You say the motor rotates at a constant speed. The only effects that I can see would be to reduce the load on the motor by shortening the string or increase the load by making the string longer. The statement regarding constant speed of course prevents us from figuring that the machine speeds up or slows down, and, therefore, the only thing that I can see is that the load on the motor changes. Am I correct?"

A. 1. Your query has been forwarded to the author of the article mentioned, Ernest K. Chapin, and his reply is given here.

"To make certain that no mistake has been made in this solution I set up the apparatus as illustrated and found that the ball behaved as I predicted. That is, the ball speeded up as its radius of gyration was shortened and the cord actually wound up on the stem supporting the ball. That the load on the motor was altered I do not doubt, but this was negligible so that I considered that the rotor was turning at practically a constant rate. If I have not satisfied you in this matter, let me hear from you again concerning it."

TATOOWING

(2024) Q. 1. Everell Reed, Viola, Wis., asks for some general information on tatoowing and how it is done.

A. 1. The method of performing this work resolves itself down to a mere puncturing of the skin and the introduction of some colored pigment into the punctures. The latter heal, the ink remaining under the skin and visible. Black India or colored inks are usually employed as the pigments, the water soluble type being commonly used.

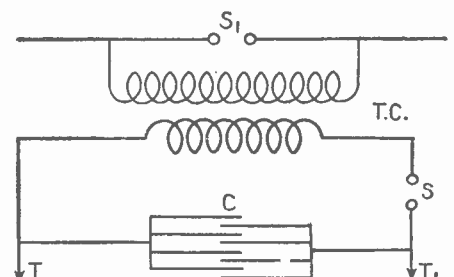
RECTIFIER

(2025) Q. 1. Ed. Jones, Fresno, Calif., asks how much current a small pint size electrolytic rectifier can pass and also asks for some general information on the same type of rectifier.

A. 1. This small electrolytic rectifier cannot be depended upon to pass more than 1 ampere of current. The electrodes should be at least 1 1/2 inches apart, although this distance is not critical. The aluminum plate goes to the positive of the battery. A saturated solution of borax is to be employed allowing any excess of the chemical to settle before the solution is placed in the rectifier.

TESLA COIL

(2026) Q. 1. Frank Spencer, Dayton, Ohio, asks for a standard circuit diagram showing how



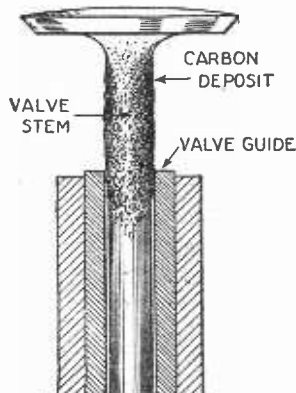
The circuit diagram for connecting a Tesla coil is simple and is shown above.

to connect up a Tesla coil with the required apparatus.

A. 1. The circuit diagram in these columns shows how this is accomplished. In this diagram, the terminals T and T1 connect to the secondary of a transformer supplying from 5,000 to 20,000 volts. A condenser, C, is connected across or in parallel with these terminals and the primary of the Tesla coil. T.C. and the spark gap, S, are connected in series with each other across this condenser in parallel therewith, as shown. The secondary of the Tesla coil is connected to a spark gap, S1, or to any other terminals that may be desired.

STICKING VALVES

(2027) Q. 1. J. H. Baldwin, Rochester, N. Y., asks: What causes the valves, particularly the exhaust valve, of a gasoline engine to stick open when the engine is in operation?
 A. 1. This is usually caused by either a warped or faulty valve stem or a heavy deposit of carbon that has collected on the stem as shown in the diagram here. When this carbon deposit becomes quite heavy it stops the valve from moving up and down in the guide and therefore, of course, it



When the valves in an internal combustion engine tend to stick and do not seat properly, the trouble may be due to a carbon deposit on the valve stem as shown at the left or to a warped stem. The remedy for the carbon deposit is scraping.

sticks. If this is the only cause for sticking, it can be removed by scraping the valve stem free of the deposit. If, however, the stem is warped in the least, it is advisable to install a new valve.

WEATHER FORECASTING

(2028) Q. 1. Leonard Price, New York City, asks: Can you give me some information regarding the making of devices that will change color due to changes in atmospheric conditions?

A. 1. It is known that a leaf of blotting paper or a strip of fabric made to change color according to the hygrometric state of the atmosphere has been employed for weather indications in place of a barometer. The following compound is recommended for this purpose: One part of cobalt chloride, 75 parts of nickel oxide, 20 parts of gelatin, and 200 parts of water.

A strip of calico, soaked in the following solution, will appear green in dry weather, but when moisture is present, the color disappears.

- Copper chloride 1 part
- Gelatin 10 parts
- Water 100 parts

The following is a method of making old-fashioned weather glasses containing a liquid that is supposed to cloud or solidify under certain atmospheric conditions:

- Camphor 2½ drachms
- Alcohol 11 drachms
- Water 9 drachms
- Sal ammoniac 38 drachms
- Saltpeter 38 drachms

Dissolve the camphor in the alcohol and the salts in the water and mix the solutions together. Pour in test tubes, cover with wax after corking and make a hole through the cork with a red-hot needle, or draw out the tube until only a very small hole remains. It is said that when the camphor appears soft and powdery, and almost filling the tube, rain with south or southwest winds may be expected; when crystalline, north, northeast, or northwest winds with fine weather may be expected; when a portion crystallizes on one side of the tube, wind may be expected from that direction. Fine weather: The substance remains entirely at bottom of tube and the liquid perfectly clear. Coming rain: Substance will rise gradually, liquid will be very clear, with a small amount of the solid in motion. A coming storm or very high wind: Substance partly at top of tube, and of a leaf-like form, liquid very heavy. These effects are noticeable 24 hours before the change sets in. In winter: Generally the substance lies higher in the tube. Snow or white frost: Substance very white and small starlike portions in motion. Summer weather: The substance will lie quite low. The substance will lie closer to the tube on the opposite side to the quarter from which the storm is coming. The instrument is nothing more than a scientific toy and is absolutely not to be relied upon.

LUMINOUS MATERIALS

(2029) Q. 1. Raymundo de Souza Santos, Philadelphia, Pa., asks: Can you give several formulas for the preparation of luminous materials that can be used for experimental purposes?

A. 1. The illuminating power of the phosphorescent masses obtained by heating strontium carbonate or barium carbonate to a white heat with sulphur is considerably increased by the addition, before heating, of small quantities of the nitrates of uranium, bismuth or thorium. Added to the calcium formula, these nitrates do not heighten the luminosity or phosphorescence. The product from strontium sulphide is more luminous than that of the barium compound. Among the best luminous paints are the following:
 1. One hundred parts, by weight, of strontium

carbonate; 100 parts, by weight, of sulphur; 0.5 parts, by weight, of potassium chloride; 0.5 parts, by weight, of sodium chloride; 0.4 parts, by weight, of manganese chloride. The materials are heated for three-quarters of an hour to one hour, at about 2,372 degrees F. The product gives a violet light.

2. One hundred parts, by weight, of strontium carbonate; 30 parts, by weight, of sulphur; 2 parts, by weight, of sodium carbonate; 0.5 parts, by weight, of sodium chloride; 0.2 parts, by weight, of manganese sulphate. The method of treatment is the same as in the first; the phosphorescence being deep yellow.

3. Sixty parts, by weight, of strontium thio-sulphate; 12 parts, by weight, of a 0.5 per cent. acidified alcoholic solution of bismuth nitrate; 6 parts, by weight, of a 0.5 per cent. alcoholic solution of uranium nitrate. The materials are mixed, dried, brought gradually to a temperature of 2,372 degrees F. and heated for about an hour. The phosphorescence is emerald green.

4. Twenty parts, by weight, of calcium oxide (burnt lime), free from iron; 6 parts, by weight, of sulphur; 2 parts, by weight, of starch; 1 part, by weight, of a 0.5 per cent. solution of bismuth nitrate; 0.15 parts, by weight, of potassium chloride; 0.15 parts, by weight, of sodium chloride. The materials are mixed, dried and heated to 1,300 degrees C. (2,372° F.). The product gives a violet light.

To make these phosphorescent substances effective, they are exposed for a time to direct sunlight; or a mercury lamp may be used. Powerful incandescent gas light also does well, but requires more time of exposure.

BURNS

(2030) Q. 1. O. E. Bergstrom, Roseau, Minn., asks several queries regarding electrical burns.

A. 1. We have referred your various queries regarding the treatment of burns to our Staff Medical Expert, and his composite reply is given below:

"The burns you have described is evidently a second to a third class burn and the best method of treatment is in the application of picric acid. This is slightly antiseptic and allays the pain incident to all these types of burns.

"Lately, medical men have had a great deal of success in excising the necrotic areas and then resorting to skin grafts when necessary, although grafting was only required in a few cases as the healing took place very readily after the necrotic tissue had been removed.

"There is no reason why a Dakin irrigation would not be effective, but it surely would be no better than the old method of using soap and water or boric acid.

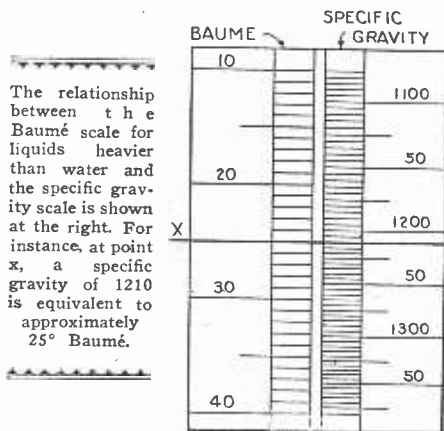
"There is always a danger of infection from a severe burn and a great danger of auto-intoxication. This, however, should be over in five to six days, but has occasionally persisted for twice this period. A prompt epidermization prevents absorption of a toxic substance formed during the injury. An injection of digalen can be practiced and coffee or other stimulants given. Water should be drunk freely to aid elimination. Morphine is occasionally given, but in cases of shock, care must be taken that the blood pressure is not further lowered. The main idea in preventing pain is to exclude air from the burn. This, of course, means that dry dusting powders or oils are generally placed over the area of the wound. At the same time, excluding the air interferes greatly with the plans of management in accordance with antiseptic precautions. We believe that picric acid dressings would be superior to a Dakins solution.

"Sodium bicarbonate has been used successfully, and olive oil on thick muslin bandages is excellent. A mixture of linseed oil and lime-water well shaken is often used by chemists for laboratory burns."

BAUME SCALE

(2031) Q. 1. Victor Townsley, Clayton, La., asks us to show the relationship between the Baumé scale and the specific gravity scale as applied to ascertaining the condition of the electrolyte in a storage battery.

A. 1. The diagram given here will show how the two compare. The scale that we have shown is calibrated from 1.100 to 1.350 on the specific gravity side and these figures for specific gravity are included within a space of 10° to 40° Baumé. This applies to the Baumé scale for liquids heavier



The relationship between the Baumé scale for liquids heavier than water and the specific gravity scale is shown at the right. For instance, at point X, a specific gravity of 1.210 is equivalent to approximately 25° Baumé.

than water. There is another scale of the same name for liquids lighter than water.

BATTERY CHARGER

(2032) Q. 1. Frank Wiesuski, Oglesby, Ill. says that he has a vibrating type of battery charger designed to charge at 4 amperes. He asks: How can I increase the charging rate to 6 amperes?

A. 1. This is rather impractical inasmuch as it would involve rebuilding the entire charger. However, you may be able to increase the charging rate slightly by careful adjustment of the vibrator. Do this with an ammeter in the circuit so that the exact change of the rate can be noted.

Q. 2. The needle of my charger meter formerly did not return to zero when the current was turned off. Instead it returned only to the 1 ampere mark. I bent the needle slightly so that it would return to zero but then found that when the charger was operating, the needle only read 3 amperes. Does this indicate that the battery is charging at only 3 amperes?

A. 2. Undoubtedly it does. Possibly, however, there is something wrong with your ammeter and in any event, the cheap types of meters that are furnished on the average battery charger are not as accurate as they might be. The ammeter readings are often as much as 25% inaccurate.

SMOKE DISSIPATION

(2033) Q. 1. Edward J. Lake, Clatskanie, Ore., asks: Can chemicals be used for precipitating the solid material in coal or wood smoke?

A. 1. It would be practically impossible to obtain any results which would be commercially valuable by the use of chemicals for separation of the solid material found in coal or wood smoke. Static electricity excitation has been used to precipitate this solid material and excellent results have been obtained in this manner. In many cases the fine dust from the smoke contains valuable constituents, which are extracted.

Q. 2. What is used in gas masks for filtering out the harmful ingredients of various poisonous gases?

A. 2. The composition through which air is breathed in gas masks is usually made up of some kind of charcoal. That formed by the ignition of peach pits was used to a very great extent in the gas masks issued to our army in the recent war. Other substances are also used; new gases present new problems for the mask-makers.

INK

(2034) Q. 1. J. Strothman, Brooklyn, N. Y., asks for a formula for a good grade of black ink and also requests directions for making the same heavier or lighter, according to the use to which it is to be put.

A. 1. Try a formula such as the following, increasing the alcohol content, if necessary, to produce a thinner ink. The formula is:

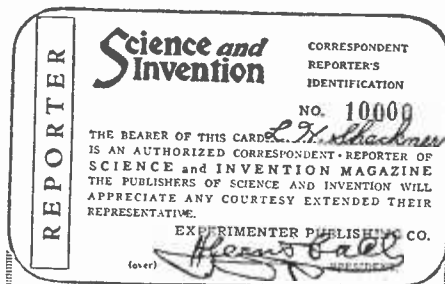
- Nigrosin 3 parts
- Water 15 parts
- Alcohol 15 parts
- Glycerine 70 parts

It will be necessary to thin this mixture and you should experiment with water and alcohol until the desired result is obtained.

DIAMONDS

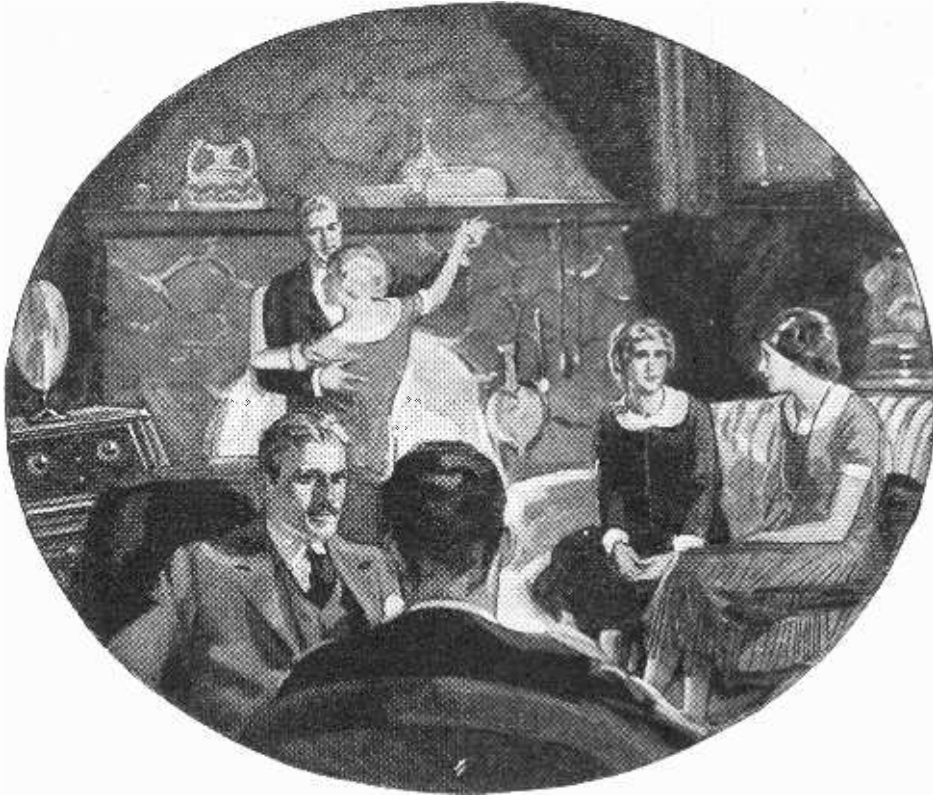
(2035) Q. 1. J. K. Waterbury, Woodland, Idaho, asks: What is the size of the largest diamond that has ever been mined?

A. 1. The largest stone of this nature of which we have any record is the so-called Cullinan diamond mined in South Africa in 1905. It was as large as an average sized man's fist and weighed a pound and a half.



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Tarrano the Conqueror

By RAY CUMMINGS

(Continued from page 1105)

He persisted; but his voice was gentle and earnest. "Soon we will be at my home, Lady Elza. And now—there are some things I would like to say while I have the opportunity. . . You will listen?"

"Yes," she said; and tried to keep from him the trembling within her. "I'll listen, of course."

He nodded. "Thank you. . . . My Elza, you have heard me talk of conquering the world. My dream—my destiny. It will come to pass, of course. Yet—" A smile pulled at his lips. "Do you know, my Elza, what you and I are doing now?"

She stared, and he did not wait for her to answer.

"We're making my first retreat. I wonder if you can realize how I feel, having to admit that? Tarrano in retreat! . . . Our escape from Venia? Puff! That was a jest. I was there on Earth merely to get you, and the Brende model. I had no thought of conquering the Earth just then. I accomplished my two purposes—and left It was not a retreat, merely a planned departure.

"But this, my Elza, is very different. I did not wish to do what I am doing now. I had planned—I had thought, had actually hoped, that I might maintain myself in the Great City. You see, I tell you this, little girl, because—well I am a lonely man. I walk alone—and because I am human—it does me good to have someone to talk to. I had hoped I might maintain myself in the Great City. Last night—at the start of the Water Festival—I began to realize it was impossible. I should have enlisted the *Rhaals*—the men of Science, Elza. But I had no time, and they are very aloof. I could have won them to me had I tried." He shrugged. "I must confess I was over-confident of my strength—the strength of my position. The *Rhaals* stayed out of the affair—stayed in their own city, which has always been their policy. That was what I expected, but now I see I should have had their aid. I did—well what I did to guard against the unhappy outcome you witnessed—what I did was wrongly planned. You see, I take all the blame. I alone am responsible for my destiny. There are some who in defeat cry bitterly, 'Luck! That cursed luck was against me!' Not so! Leadership is not a matter of luck. Destiny is what you make it. You see?"

"And so now I am making my first retreat. A set-back, nothing more. I shall launch my forces from the City of Ice, instead of marshalling them from the Central State as I had planned. And Mars is still mine. I still control Mars, little Elza. . . . A set-back just now—and it bothers me. It hurts my pride—and as you know, my Elza, Tarrano is very proud."

She had been listening to him, her fingers plucking idly at her robe. He bent closer to her; his voice turned tender. "I was thinking that perhaps—just perhaps you would scorn Tarrano in his triumphs, you might feel differently toward him now—in his first retreat. Do you?"

She forced her eyes up to his again. "I'm—sorry—from your viewpoint, I mean—that things are going wrong."

He smiled gently. "You are very conservative, Lady Elza. You want very much to avoid hypocrisy, don't you?"

"Yes," she said frankly. "You could hardly expect me to be sorry at your defeat."

"Defeat?" He rasped out the word, and his laugh was harsh. "You are too optimistic. Defeat? Things going wrong?"

That is not so. A slight setback. A strategic retreat—and in a week I will have regained more than I have lost. . . Oh, Lady Elza! I who would now—and always—be so gentle with you—why we are almost quarreling! That is not right. For the lives of a thousand of my servants, I would not have used that tone to you just now. Forgive me. . . .

"I was saying, my Elza—could not you feel more kindly to me now. A little hope from those gentle eyes of yours—a little word from those red lips—a word of hope for what some day might be for us—you and me—"

She dared to try and turn the subject. "You mentioned the Brende model—where is it? Have you it in the Cold Country?"

He frowned. "Yes. And I will use it—for you and me alone. You've always known that, haven't you? Just for you and me, my Elza." He took her hand. "Won't you try and love me—just a trifle? Is it really so hard?"

She did not move. "I—don't know." Then she faced him squarely. "I do not love you, Tarrano." Something in his eyes—a quality of pleading; a wistful smile upon his lips—suddenly struck her as pathetic. Strange and queerly pathetic that such a man as he should be reduced to wistfulness. Emotion swept her. Not love. A feeling of sympathy; a womanly desire to lighten his sorrow; to sympathize and yet to withhold from him the happiness he sought.

"I do not love you, Tarrano. But I do respect you. And I am sorry—"

"Respect! I have told you I can command that from everyone. But love—your love—"

"I would give it if I could, Tarrano."

"You mean—you're trying to love me—and cannot?"

"I mean—Oh, I don't know what I mean, save that I do not love you yet."

He smiled. "I think you speak the truth when you say you do not know what you mean. Your love! If I had it, I should know that I would have it always. But—having it not—" He was very sincere, but his smile broadened. "Having it not, my Elza, there is no power in all the Heavens that can tell me how to get it. It may be born in a moment from now—or never. Who can tell?"

She was silent; and after a moment, he added; "Enough of this. I would ask you just one thing. You are not afraid of me, are you?"

"No," she said; and at that moment she meant it.

"I would not have you ever be afraid, Lady Elza. Love is not conceived by fear. And you must know I could never force my love upon you. For if I did—I should withhold forever the birth of this love of yours which is all I seek—this love I am trying to breathe into life. . . Enough!"

He did not mention the subject again. For hours—eating what meager stock of tabloid food with which their vehicle was provisioned—they flew onward. Rising now to top the line of jagged mountains. Over them the platform swept. In the crisp air the snow down there gleamed blue-white; the ice with an age-old look filled the valleys between the peaks.

The arctic! It was nothing like the Polar regions of Earth. Stark desolation. A naked land seemingly upheaved by some gigantic cataclysm of nature, lying tumbled and broken where it had fallen in con-

(Continued on page 1138)



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Tarrano the Conqueror

(Continued from page 1136)

vulsive agony; and then congealed forever in a grip of ice.

The Sun hung level as the vehicle advanced. In these latitudes it would swing sidewise in a slow, low arc, to dip again below the horizon and vanish. Here in the Cold Country it was morning of the Long Day. Summer!

On over the crags and glaciers Tarrano guided their frail flying platform. Houses occasionally showed now—huts of ice, congealed dwellings, blue-white in the flat sunlight.

And then at last, over the horizon came the ramparts of a city. The City of Ice. The size of it—the evidences of civilization here in this brittle land of deadly cold—made Elza gasp with wonderment.

CHAPTER XXIV

THE ATTACK ON THE PALACE

I must take you back now to the Water Festival and the events in the Great City which followed it. Slaans in murderous frenzy were plunging through the throng of erstwhile revelers. Maida could not quell them. The revolt which she had started against Tarrano seemed now a self-created monster to destroy us all.

But there were Earth-men among us. A hundred of them, no more. They had come from Washington that same day; had landed, I learned later, secretly near the Great City, sent with our Earth-Council's plans to communicate with Maida. Beneath the water, coming individually, they had entered the festival; and helping Maida's girls (the diving girls whom I had encountered) they had made away with most of Tarrano's guards.

In those first moments of frenzy, I got to the balcony—joined Maida and Georg. Elza was gone! My heart went cold, but in those hurried, frantic moments, grave disaster as it was, I did not dwell upon it. "We must get away—back to the palace!" Georg exclaimed as I joined them.

The Earth-men on the main floor were holding the Slaans partially in check. Bodies were lying in a welter—I shall not describe it. Then abruptly, upon a table a huge Slaan leaped—his garments blood-stained from his victims, a blade of dripping steel in his hands. He shouted above the tumult—words not in the Universal language, but in the dialect of the Slaans. His command carried throughout the building. Other slaans took it up; we could hear it echoed outside as others shouted it over the waters.

The bloodshed abruptly ceased. The slaans leaped away from the Earth-men, who were glad enough to let them go—rushed for the archways of the pavilion. Outside, we could hear the water splashing. Swimmers—and boats scurrying off. Then comparative silence. The scream of a slaan woman in the grove nearby, still desiring vengeance; the groans of the dying at our feet; the hiss and splutter of weapons discarded, with circuits still connected. And over it all, the great whine of a danger whistle, which some distant official had plugged. . . . A lull. And around us lay strewn stark tragedy where a few moments before had been festive merry-making. A crimson scene, with the body of the Red Woman lying like a symbol in its midst. . . .

Within an hour we were back at the palace. The whole city was seething. Boats and lights were everywhere. Control of everything seemed lost. Warning

(Continued on page 1143)

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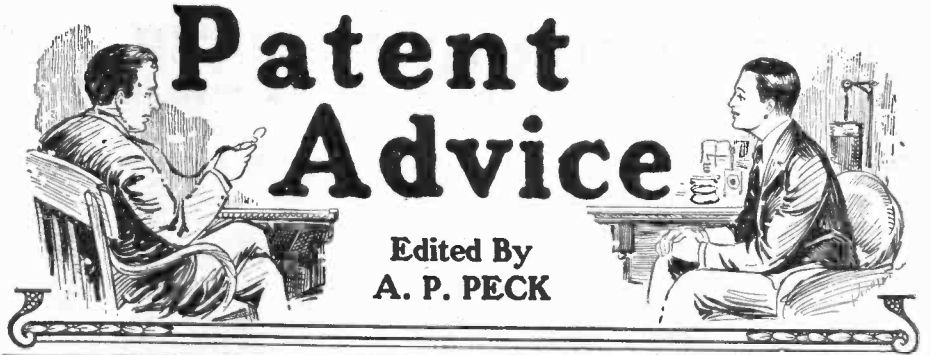
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CONNECTING ROD

(929) Q. 1. Donald Beidler, Lancaster, N. Y., submits complete details on a type of connecting rod bearing which is eccentrically arranged, and which when used in a four cylinder engine, will force the piston to the extreme top of the cylinder on the exhaust stroke; yet on the firing stroke it will leave sufficient room for the firing chamber. This work is accomplished by means of a rather complicated gearing system to be located in the opposite end of each connecting rod to that where the piston is attached.

A. 1. While the theory of your proposed type of piston connecting rod is correct, still we do not believe that the device would be practical under actual operating conditions. It is entirely too complicated and the strain on a connecting rod is far too great to allow the use of a series of gears and an eccentric such as you have designed. Until you have tried your device out in actual practice, we would not advise you to continue with any attempt to patent it. You must realize that a patent cannot be obtained on an idea alone. The subject must invariably be reduced to practice before it can be patented.

IDEA HAS BEEN PATENTED

(930) Q. 1. J. E. Whitfield, East Pittsburgh, Penn., has been granted a patent upon a particular type of carpenter's tool and has been attempting to induce some company to manufacture it. He says that all the companies he has written to desire to be paid in advance and so he is suspicious of their intentions. He asks us to advise him.

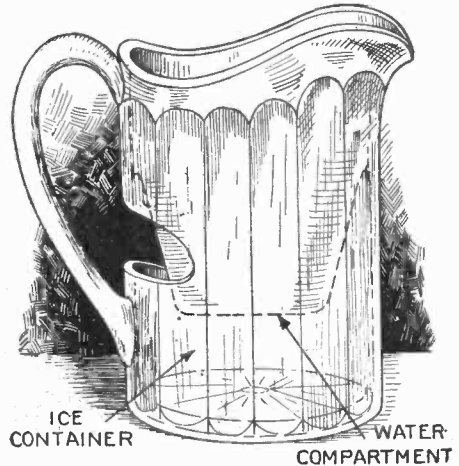
A. 1. As long as you are protected by a patent, you can just as well go ahead and have your device manufactured, paying the manufacturers in advance without any fear of their stealing your idea. You have come to the hardest part of the inventor's career and you will undoubtedly have some difficulty in placing your device upon the market. Extensive advertising and quantity production will be necessary before you can ever realize on your device and of course such a procedure takes a good deal of money. We do not believe that you need hesitate further about having your device placed under manufacture by any of the companies with whom you have been in communication.

ICE PITCHER

(931) Q. 1. Miss Margaret Russell, Gary, Indiana, refers to an article published in this magazine some time ago wherein it was suggested that inventors work on the proposition of producing drinking glasses and water pitchers, in which water can be kept cold by means of ice, but in which the ice will not come in contact with the water. She submits a design for a water pitcher of this nature which design is reproduced in these columns and upon which she has obtained a patent.

She asks our opinion as to the advisability of marketing this device.

A. 1. Since the publication of the short item that you mention, many designs for drinking glasses and pitchers have been submitted to this magazine. Several of them were quite similar to yours and the one big objection to them all is that they are far too complicated to manufacture and sell at a reasonable price. We have not as yet seen one that, in our opinion, would ever command a very wide sale, and the same holds true for the one that you have designed. We do not believe that it would be profitable for you to proceed with manufacturing this device, although since your patent has been allowed, you might be able to do something with it by communicating with several large glass manufacturers and attempting to sell them the idea either outright or to have them manufacture the item and sell it on a royalty basis.



ICE CONTAINER WATER COMPARTMENT

Above is the design of a water pitcher so constructed as to hold not only water but also cracked ice and at the same time to keep the ice separate from the water. It is not a new idea and we do not believe it will meet with much enthusiasm.

GASOLINE TURBINE

(932) Q. 1. M. J. Peterson, Berkeley, Calif., has devised a rotary gasoline turbine upon which he desires advice.

A. 1. Several types of gasoline turbines have been patented and are quite efficient in operation. For instance, one has been developed by Dr. Nikola Tesla. Records of similar machines will be found in the Patent Office. Frankly, we do not believe that it would be profitable for you to proceed further with your particular system. This is in view of the fact of the existence of other patents and also because gasoline turbines do not seem to be well received by automotive manufacturers.

PATENT SEARCH

(933) Q. 1. D. E. Lounsbury, Ardmore, So. Dakota, asks how he can obtain the numbers of all patents that have been issued in the past five years dealing with a certain process.

A. 1. The only way in which you could obtain the information that you mention in your letter of recent date would be to employ some reliable patent attorney to conduct a search for you. This process should cost in the neighborhood of \$15.00 and possibly will be even less.

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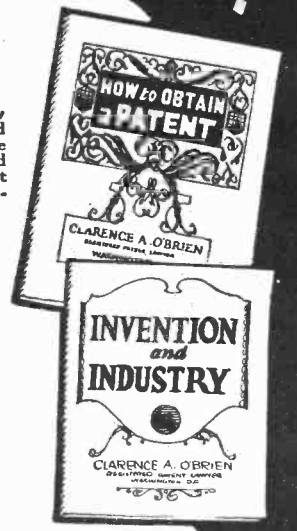
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Model Boiler

(Continued from page 1109)

screwed into a socket could easily be mounted in the firebox.

One of the most efficient electrical heaters for this or any type of steam driven model is that employing two metal sheets immersed in the water and separated about one inch from each other. Not only is steam generated in great quantities by such a form of heater, but the decomposition of water ordinarily taking place when two plates are immersed into it and connected with a source of current supply, aids in making the device run faster. In this particular type of heater, it is desirable to insert a resistance at the point marked off, which resistance may take the form of a flat iron, a heating coil or several incandescent lamps. This resistance placed in the circuit will prevent a short circuit and also prevent burning out of fuses. The alcohol gas burner illustrated in the diagram which has been used with great success with this model is simply built up as indicated. The two small pilot burners are then lit and the heat produced by them causes gas to be rapidly evolved, which coming through the small openings in the covers for the wicks, or burners as they may be called, produces a flame possessing a yellowish color but developing a great amount of heat. Note that the overflow pipe leading to the alcohol reservoir serves a double purpose, namely, that of permitting expanded alcohol to flow out through it and also preventing an accumulation of air inside, and thus possibly spraying the interior of the fire box with alcohol. This particular burner may be put out by simply blowing into the fire box. There is never any danger with its use. The manometer contains a flattened copper tube bent in the form of a semi-circle. When steam pressure is applied the tube tends to straighten in direct ratio to the pressure applied.

For blueprints of previous pages, 1109 and 1110, a nominal charge of \$1.00 is made. The complete set of blueprints, four in all, may be had at \$2.00, and those desiring the same should address their communications to the Editor of the Model Department, Blueprint Division.

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Tarrano the Conqueror

(Continued from page 1138)

signals shrilled in crazy fashion. Public mirrors were dark, or turned to places and time wholly irrelevant.

In the palace itself we soon secured a semblance of order. Maida's girls were here, with wet veils and long dank tresses clinging to their sleek bodies. Lips painted alluring red. But eyes which now were solemn and grim. Their demeanor alert and business-like. Unconscious of themselves they moved about the palace, executing Maida's orders.

A dozen or so of Maida's personal retainers were here—and most of the Earthmen. Keen-eyed young men of the Washington Headquarters Staff. One of them—Tomm Aften by name, a ruddy, blue-eyed fellow—was in command. He stayed close by Georg and me.

The city was seething. But out of the chaos was coming a comparatively orderly menace. We could sense it at first; and then in a few brief minutes so swift that we had no time to prepare—the menace became obvious and was at hand.

The slaans had withdrawn from the festival for a greater, more organized effort. Their revolt against Tarrano in which Maida had joined, was bigger, more deep-rooted than a mere revolt. It was against Maida herself. Trickery of the down-trodden slaans against the ruling class. Against the old order of government. Even against the Rhaals, who in their distant city were all-powerful, but who obeyed the laws and took no part in anything.

Revolution! From down the waterways of streets which converged into the broad lagoon before the palace, boats began arriving. Boats crowded with slaans. Disheveled, unkempt men and women with primitive weapons of steel and wire brandished aloft. They surged into the lagoon. A murderous, frenzied mob—thoughtless of itself, suicidal to attack us, yet daring everything in its frenzy.

Soon the lagoon was crowded—a chaos of pushing, shoving boats. Then the boats began landing, disgorging their occupants, wild-eyed slaans each a potential murderer. The gardens of the palace were presently jammed with them. They did not at first come within our thresholds; they stood milling about under the palms, trampling the tropic flowers, screaming threats and epithets at us. But waiting—as a mob always does—for some leader to advance, that they might follow him upon us.

We stood on the palace roof-top. I must confess that we were in a flurry for the moment. There were undoubtedly weapons at hand, but I at least did not have them, nor did I know where they were. Excusable flurry possibly for the thing had come so quickly, and most of us were strangers here of but a few hours.

The roof had a low railing waist-high, but broad. We stood clustered behind it. In the garden beneath, the mob was shouting up at us. And, before I could stop her, Maida had leaped to the top of the rail. Georg and I clutched at her, then steadied her.

"Slaans—"

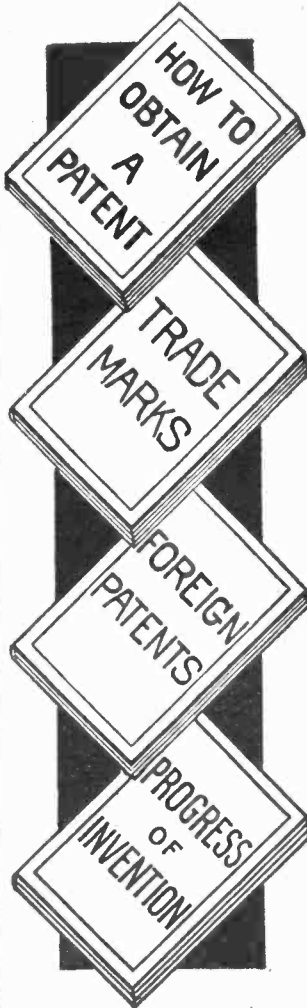
But they would not hear her. Shouts went up; a roar of threats. The press of additions to the mob landing from other boats, forced the front ranks forward. They were now on the palace steps, jammed there waving their weapons yet still hesitating to advance.

"Slaans—my people—"

(Continued on page 1146)

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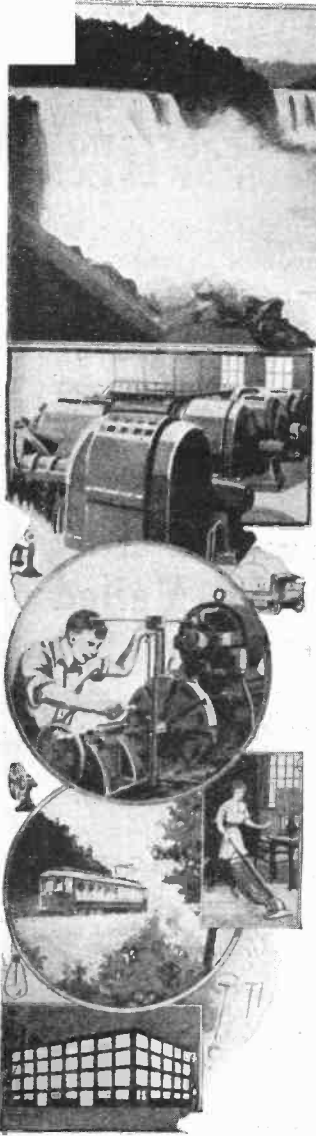
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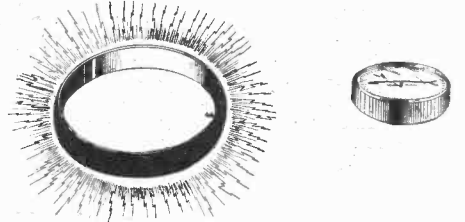
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Medical Frauds

By JOSEPH H. KRAUS
(Continued from page 1084)

executed on the gallows, and was a specific for anything from ingrowing toenails to falling hair. A serious article on "Usnea" and "Mummy" may be found in the first edition of the Encyclopedia Britannica, and,



So-called magnetic or electric rings have absolutely no value in a medical sense.

incidentally, in Dr. James J. Walsh's book, called "Cures."

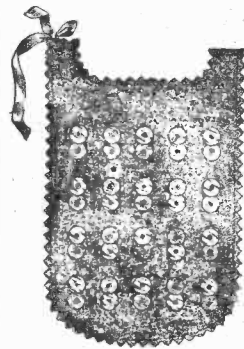
FETISHES AS CURES

A little later a hangman's noose or portions of the rope with which a person was hung, were supposed to "turn the blood current," when a person was touched with the piece of rope, and thus were expected to cure paralysis, disabled limbs or wasted fingers.

Coming down through the ages a few more years, we find rattlesnake oil used extensively in the West. As a matter of fact, there are many medicine men traveling through the Middle and Western States, and occasionally making their appearance along the East Coast, who are still selling rattlesnake oil. This oil is supposed to have been made from rattlesnakes. It is, however, no more efficacious than ordinary butter. On analysis, the oil is no different from other oils extracted from animal fat tissue.

ABANDONED MEDICINES

Then along came sarsaparilla. Millions of people swore by it. Hundreds of thousands of bottles were purchased every year, but no one takes any sarsaparilla now except as a seasoning for soda water. The product



At the left is shown a typical "electrical" chest protector in which series of copper and zinc disks are placed. The curative powers of a contraption of this nature are absolutely nil. Money invested in a device such as that shown is wasted.

is sometimes used to mask the taste of unpleasant medicine, but otherwise it does no good.

We next hear of the long line of bitters and whiskey tonics. These were wonderful medicines, and cured everything from idiocy to rheumatism. Cheap whiskey and colored water, to which some bitter drugs were added, were remedies for every known ailment or disease, but they, too, passed away.

OTHER FADS USED TO TREAT DISEASES

At about the time that the bitters were so popular, there was a "blue glass-cure" craze. People would sit for hours behind a blue glass window taking blue-glass baths, and it was not very long ago that I listened to a lecture given at a well-known New

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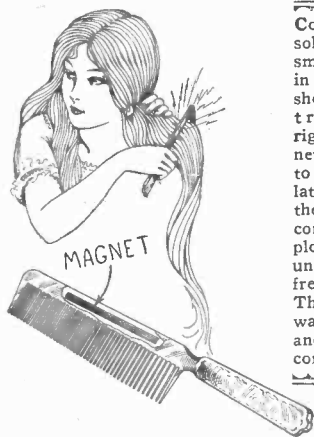
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York hotel, where the "doctor" advised that every light color has its distinct effect upon the human organism, and that a person born under violet light was bound to be healthy, while those born under the influence of yellow light, or in a room lighted by yellow lamps, had practically no chance of surviv-



Combs are often sold that contain small bar magnets in the back as shown in our illustration at the right. These magnets are supposed to have a stimulating effect on the hair when the combs are employed. This is untrue as has been frequently proven. Therefore, do not waste your time and money on a comb of this type.

ing. The "doctor," himself a healthy specimen, claimed that he was not born under the influence of violet light.

QUACK REMEDIES

Many of our readers can remember when electric belts and magnets were used as the treatment for any kind of an ailment. These batteries, which were strapped around the waist, became polarized almost the instant they were applied and, consequently, gave no current. Nevertheless, according to their wearers, they produced remarkable effects, and testimonial upon testimonial piled in to the concerns handling the articles. Among the electric cure-alls were the electric shoe-soles, electric combs, magnetic combs to stop the hair from falling out, electric rings and magnetic rings, generally made of steel, which "drew the poison out of the body," as the finger showed when the ring was removed, because a brown stain was left behind. This stain was merely a stain of rust. Rings of zinc were also worn.

How many of our readers remember the flaming red chest protectors that could be obtained at any local pharmacy, and may be found in some of them even to this day? Many of us recall the vacuum cup craze, or the kidney-shaped plasters, which were to relieve pains in the back and cure all sorts of diseases. Many will recall the absurd "liver pads" of a generation ago.

Now, the fact of the matter is, that, with the exception of acute nephritis or a stone in the kidneys, the kidneys themselves give no pain whatsoever. The worst cases of Bright's disease, representing more than seven-eighths of all the kidney diseases, so called, run their course without any discomfort. These lumbar pains are located primarily in the muscles of the back.

Our advice to readers is to know what they are purchasing before they buy it, and not to depend on the glaring advertisements in the shop windows, which are meant to deceive. The statements on the box are all that count. No concern has been prosecuted for window advertising, and window placards may make any irresponsible or misleading statements, but the Government keeps a rigid control over the statements printed on the labels of all drugs.

In this magazine we will only discuss the reputable, bona fide systems of treatment. Cancer cures are not recorded, because, up to the present time, such a thing as a cancer cure has not been discovered. Treatments for cancer are numerous, but they are not found in dollar packages to be purchased at the local drug store and used indiscriminately.

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Tarrano the Conqueror
(Continued from page 1143)

Maida's frail voice was lost in the uproar. Then a missile was thrown upward—a portion of a broken generator—a heavy chunk of metal. It barely missed Maida, and fell with a thump to the roof behind us. Then came others—a rain of them about us. I tried to pull Maida back, but she fought me, her voice still calling out its appeal.

With a bound, Georg was up on the rail beside her. Aft—the young Earthman—had quietly handed him a cylinder. Georg waved it at the mob with one hand, and his other arm was about Maida's waist.

"Slaans—" His stronger voice caught their attention. A sudden hush fell.

"Slaans—it is I, Georg Brende. Your Princess Maida rules you now only under me. A new ruler, Slaans—the man of Earth—Georg Brende who must be obeyed—Georg Brende, soon to be husband of your Princess—"

But they would not hear him out. The din from them submerged his voice. His lips snapped tight as abruptly he ceased talking; his brows lowered grimly and I saw his finger press upon the cylinder.

Maida's voice screamed: "Georg! Have mercy! Do not kill them!"

She spoke barely in time. His cylinder swept upward. The rays from it caught only the upper portions of the palms and the tree tops. The foliage withered, shriveled before that soundless, invisible blast.

Not a blast of heat. The mob, surprised, then frightened, stared upward. The soft tropical foliage in a great wide swath was dead, with naked sticks of limbs. Black, then turning white. Not with heat—but cold. Ice was forming from the moisture in the humid air. And then the sudden condensation brought snow—a thick white fall of it sitting down into the palm-laden garden; falling gently, then swirling in a sudden wind which had begun.

As though itself stiffened by the cold just overhead, the mob stood transfixed. Then a murmur of horror came. And I saw through the veil of whirling snow, that into some of the trees slaans had climbed. Their bodies, frozen now, slid and fell—black plummets hurtling downward through the swirling snow-flakes.

(To be continued)

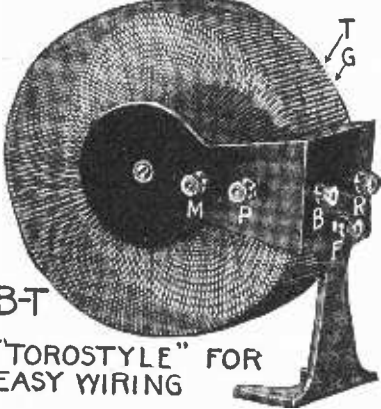
The Radio Constructor
By A. P. PECK
(Continued from page 1128)

to prevent distortion. Where a 4½-volt "C" battery is usually accepted as standard, a 7- to 9-volt battery may be necessary when the eliminator is used.

When considering the construction of a "B" battery eliminator, do not be misled by attempting to incorporate inferior or makeshift parts in it. It pays to buy the best in the beginning even though they cost a little more. Since the tube life as mentioned above is a good many years, you can safely count upon using a well made "B" eliminator for as long a period of time as you desire to think of. Even at that the instrument will probably exceed your expectations both in operation and in length of life. We are quite sure if you build an eliminator of the type shown in this article that you will be more than pleased with the results obtained.

In case you are not sure just where to buy the various parts for this unit, a stamped addressed envelope addressed to the attention of the writer will bring a list of the manufacturers to you.

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MORE HB ONE DAY BATTERY CHARGERS ARE IN USE THAN ANY OTHER MAKE



The New Cosmic Ray
By PROF. D. H. MENZEL, Ph.D.
(Continued from page 1092)

PROBABLE SOURCE OF COSMIC RAYS

Where do these rays come from? It is clear that they do not come from the sun, for no change in their intensity was observed throughout the day or night. In view of the enormous quantities of energy necessary to produce X-rays, it is obvious that still greater sources of energy are needed for the cosmic rays. Professor Millikan suggests that it is probable that these rays originate from the decomposition of atoms in the far off stars and nebulae—transformations similar to those whereby radium gives off the gamma rays, but about fifty times as powerful. When we recall the disastrous effects of X-rays and their serious burns we are thankful that the cosmic rays do not exist in sufficient enough quantity to cause any harm.

LEAD BOX 1 CM. OR MORE THICK

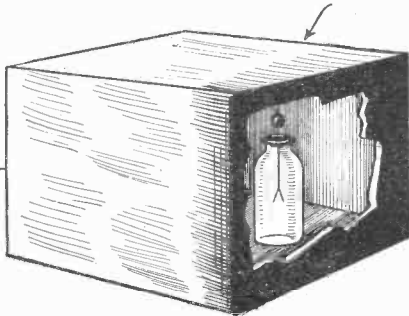


FIG. 6

An electroscopes enclosed within a lead box was affected by the cosmic ray almost as readily as if there had been no enclosure.

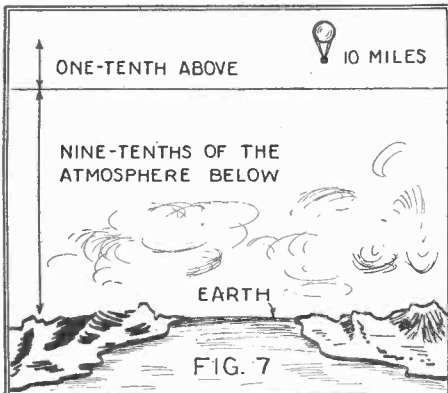


FIG. 7

The presence of cosmic rays was detected at almost the limit of the earth's atmosphere, proving that the rays were coming from space.

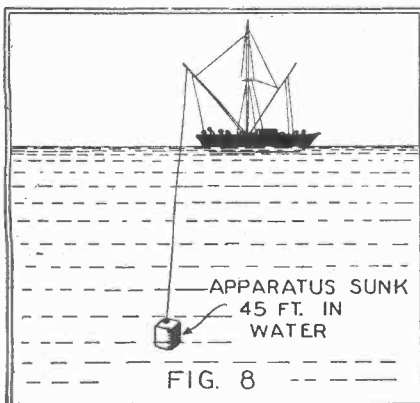


FIG. 8

The penetrative power of cosmic rays was noted and proven in an experimental way by lowering the detecting apparatus into 45 feet of water which had no radio-active powers. At a depth of 45 feet, the effect stopped.



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Fifty years ago Alexander Graham Bell, the inventor of the telephone, gave to the world a new art. He had the vision of a nation-wide telephone

system by which people near at hand and far apart could talk to one another as if face to face. He fore-saw a usefulness for the telephone which could not be achieved without innumerable developments, inventions and improvements, to him unknown. But not even he fore-saw the marvelous applications of telephony which gave to the American armies that fighting efficiency which is possible only when there is instant exchange of complete information.

Since the completion of its service in time of war, the Bell System has devoted itself to the extension of the telephone art as one of the great agencies for the development of the pursuits of peace.

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NO. 701



SIDE CUTTING NIPPER, LAP JOINT

For cutting all kinds of wire. Jaws hardened and oil tempered. Natural steel finish with polished jaws. Length 6 inches.

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NO. 201



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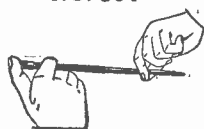
Especially designed for the Radio Constructor. Made of the finest material and equipped with the highest grade high steel cutting bits. It does three things at once. It drills its own pilot, cuts out plug and puts bead or scroll around the hole in one operation. Cuts holes 3/4 to 4 in. in diam.

PRICE—No. 402\$3.00

Nos. 401 & 402



NO. 304



401. Same tool but smaller and not fitted with bead or scroll in one operation.

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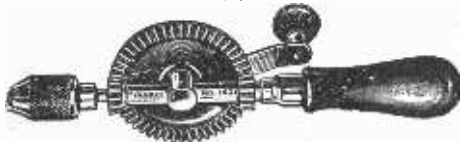


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New York, N. Y.

WRNY for New York Visitors

By CHARLES D. ISAACSON

(Continued from page 1125)

WRNY carries a *Church Index*. Every Sunday morning the services at churches of all creeds are announced. Of course, in addition, Dr. Christian F. Reinsner preaches. Services are broadcast from Temple Emanuel, and other religious bodies are heard from. There are Protestant, Jewish and Catholic circles, which are of interest to all faiths. We have as well our "Music of All Religions" period each Sunday afternoon.

A big night was that when the whole company of "The Taming of the Shrew" appeared in the "Up and Down Broadway Review."

I wonder if out-of-towners were with us at the back-stage broadcasting of "Earl Carroll's Vanities," when all the beautiful girls and comedians spoke into the microphone. Frank Tinney was there and told the people he was a lecturer and not a comedian; that he had lectured on the sex of cantaloupes that very afternoon.

Contents for April Issue of Radio News

The Experimenter's Own T R F Set
By A. P. Peck

This constructional article will be sure to interest all fans who like to experiment with new circuits. This adaptaton of Tuned R.F. is one of the best we have seen.

Other interesting articles in this issue:
Around the World in a Radio Equipped LifeboatBy A. Dinsdale
The Phantom Radio Dinner

By G. C. B. Rowe
The Radio Watchman at the Gate

By Dr. K. Schuette
New Developments in Radio Apparatus

By William J. Griffin
A Crystal Hook-up Using Both Halves of the Wave

A VETERAN OF THE BATON

Did you listen in that night when Romualdo Sapio conducted an operatic period with Louis Stallings, the famous American soprano? Romualdo Sapio was at one time conductor of the Metropolitan Opera House; was on tour as conductor for Patti and for Calve. While he was at the studio, I showed him an old autograph album of my aunt, Kate Brand, who was second leading woman in the Patti company. In this is a page which bears an autograph from Romualdo Sapio to Kate Brand, written in Boston in 1865, so Sapio added "Still Alive and Kicking at 1926."

The Charles D. Isaacson Sunday night concerts continue to be of extreme interest, and are probably the distinctive musical events of our program. For visitors to New York, the invitation is ever extended, that you make it your business to be our guests at these concerts, which are held in De Witt Clinton Hall, at 59th Street and Tenth Avenue.

We broadcast also a card party which was held in The Roosevelt by the Federated Women's City Clubs. There were 1,900 women present. The feature of the afternoon was the grand march of the four hundred presidents of city clubs, and each president spoke a few words into the microphone.

I hope I may meet you all, face to face, soon.

NOTICE

Sentence in first physics problem page 1009 March issue should read "Aim along line AB to hit the fish" and on page 1038 should read "... necessary to aim behind the fish. . . ."

IMPORTANT

TO NEWSSTAND READERS

IN order to eliminate all waste and unsold copies it has become necessary to supply newsstand dealers only with the actual number of copies for which they have orders. This makes it advisable to place an order with your newsdealer, asking him to reserve a copy for you every month. Otherwise he will not be able to supply your copy. For your convenience, we are appending herewith a blank which we ask you to be good enough to fill in and hand to your newsdealer. He will then be in a position to supply copies to you regularly every month. If you are interested in receiving your copy every month, do not fail to sign this blank. It costs you nothing to do so.

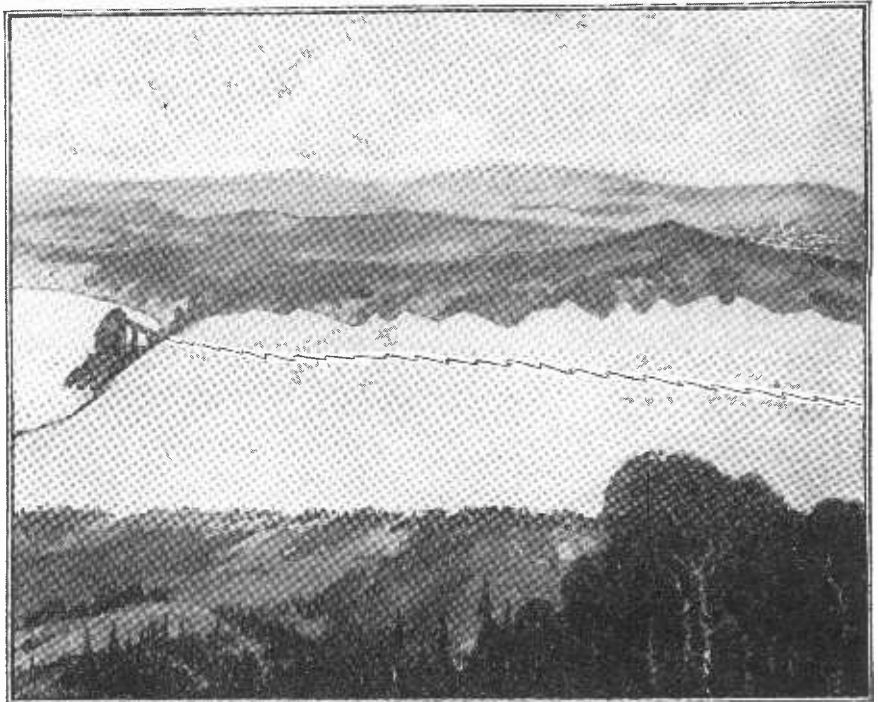
To Newsdealer

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A cross section of an underground coal conveyor in a Pennsylvania mine.

A wheelbarrow four miles long



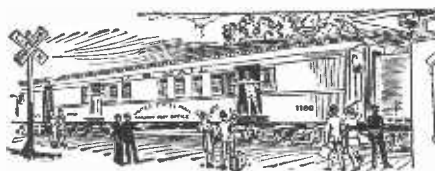
To meet the colossal demands of the mining industry the General Electric Company produces locomotives and conveyors; it designs motors, large and small, for huge stripping shovels, loaders, fans, pumps, hoists, and undercutting machines—all bearing the monogram G-E.

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TUNE IN ON WRNY

\$11,000 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 practice upon the poor, seeking words from loved ones?

We have \$11,000.00 offered by this publication and Joseph F. Rinn which will be awarded wholly or in part to the one producing a phenomenon devoid of trickery.



“There’s the new Bill Tyson”

He’s making \$6500 a year now

“I USED to know him when I was a kid—we went to grammar school together. Then his father died and he had to go to work. Got a job with Brooks & Watson as a clerk, but couldn’t seem to get ahead. Then overnight something seemed to wake him up. He began making suggestions to the firm—helped them to save a great deal of money. Then Old Man Brooks became interested—wanted to know how Bill happened to know so much about the business. Bill told him he’d been studying at home at nights through the International Correspondence Schools. ‘H’m,’ said Mr. Brooks, ‘I’ll remember that.’ He did too. Put Bill out on the road as a salesman for a year or so and then brought him into the main office as sales manager. He’s getting \$6500 a year now and everybody calls him ‘the new Bill Tyson.’ I’ve never seen such a change in a man in my life. The I. C. S. deserves a lot of credit.”

An International Correspondence Schools course will help you just as it helped Bill Tyson. It will help you to have the happy home—the bigger salary—the comforts you’d like to have. Start today to make good. At least find out what this great school can do for you.

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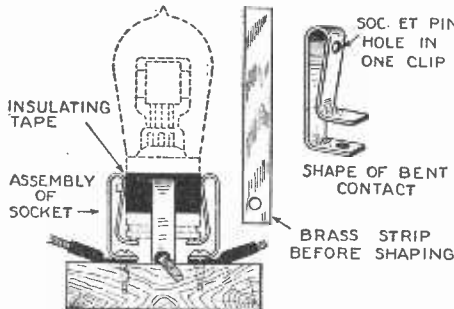
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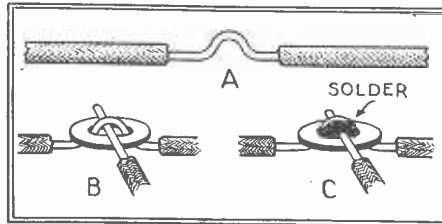
UNDER this heading we are going to publish items of interest to everyone who likes to build radio instruments. In order to continue this department it is necessary for our readers to tell us about their latest experiments. Write us a short description of some time- or money-saving kink you have discovered and send it to us along with a few sketches. Our regular rates will be paid for this material. Be brief and try to put everything in the drawing. Don't be too elaborate. Address "RADIO WRINKLES" Editor, care of SCIENCE AND INVENTION.

Socket



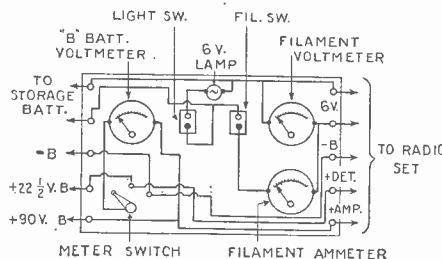
A very good type of low loss socket that is easy to make and that will give exceptional results is illustrated above. This can be adapted to any type of tube. When a bakelite base type tube is employed, the insulating tape will not be found necessary. The socket pin hole is drilled in only one of the clips.—George A. Luers.

Neat Connections



To make very neat and efficient connections, remove the insulation from the wires to be joined, bend the one that is to be tapped as at A; slip a washer over it and the end of the other wire through the loop as at B and sweat solder into the entire assembly as at C.—William H. Lee.

Charging Panel



The diagram above shows a simple type of battery testing panel. Meters and switches are supplied so that a constant check can be kept on all of the batteries. A six-volt lamp mounted on the switchboard serves to illuminate the instruments. The "B" battery may be tested in sections by manipulating the switch.—Author please send address.

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GET READY FOR BIG-PAY AUTO JOB

Can the Dead Be Re-united?

By HUGO GERNSBACK

(Continued from page 1089)

The fastest thing we know of on earth is light. It may be doubted that there is anything faster than light, although some scientists believe that gravitation travels faster. It would take a beam of light traveling at the rate of 186,500 miles per second, one minute and 54 seconds to travel the distance these souls would occupy, providing they were in line, close to each other and measured only one-eighth of an inch in their largest dimensions.

If we assume that the souls can not immediately communicate with each other, we may liken the problem to taking a bottle and throwing it into the ocean, in the hope that another bottle thrown into the ocean at the same spot two or more years later will meet the first one. What are the chances? They may be stated as follows:

If a bottle 4 5/16 inches in diameter were thrown into the Atlantic Ocean, which has an area of 41,321,000 square miles; there would be one chance in 115,096,336,640,000 of finding it.

We may explain this in another way, as follows:

If your vision were restricted to an area of the diameter of 4 15/16 inches, and you looked in eleven places, it would be just as easy for you to find that bottle dropped at random into the Atlantic Ocean, as it would be to communicate with one of the souls which have passed into the Great Beyond. In other words, the chance would be practically nil.

We may explain it in still another way, as follows:

\$11,000.00 Challenge

SCIENCE & INVENTION and Joseph F. Rinn will pay this amount for positive demonstration before our experts of spirit manifestations, ectoplasm, spirit slate writing, et cetera. Read details of our challenge in August, 1923 issue of SCIENCE & INVENTION.

Take a pyramid of hay, measuring 300 feet square and 900 feet high. It would be just as easy to find a needle two and a half inches long in this pyramid as to find a soul that has passed on.

Again, the man of religion will tell me that all these figures are meaningless, because he will say that once you are dead you are dead a long time, as the popular saying goes. As a matter of fact, as I have mentioned in previous writings, there is no such thing as time in empty space. For that reason it would not make any difference how long it would take for two souls to reunite, even with these tremendous handicaps. Even though there were not one chance in a billion trillions of finding a certain soul, if we allowed enough time, say a billion trillion years, the two souls would, in the end, certainly meet, because, given infinite time, the chances of meeting naturally become unlimited.

It is also interesting to note here what the mass of the ten trillion human beings who have died during the last 250,000 years would look like. For purposes of illustration, I have had the following data computed:

Mount Everest, the highest peak on earth, is 5 1/2 miles high, and has never been scaled. If we were to take all of the bodies of the human beings who have died for 250,000 years, and arrange them in the form of a pyramid, we would create a mountain that would dwarf into insignificance Mount Everest. The pyramid would be 19 1/2 miles high, and would have a base of 6 1/2 miles, a structure so large that it staggers the imagination.

As it should be

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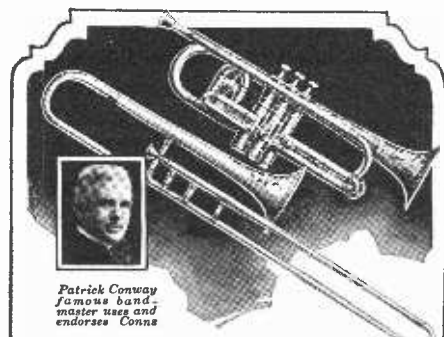
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Broadcast Calls

(Corrected to date)

Call Letters	Location and Name	Power & Wave Length
KDKA	East Pittsburgh, Pa., Westinghouse Electric & Mfg. Co.	Variable—309.1
KDLR	Devils Lake, N. D., Radio Electric Co. & Wilson Insurance Agency	5—231
KDPM	Cleveland, Ohio, Westinghouse Electric & Mfg. Co.	500—250
KDYL	Salt Lake City, Utah, Newhouse Hotel	50—246
KDZB	Bakersfield, Calif., Frank E. Siefert	100—209.7
KFAB	Lincoln, Neb., Nebraska Buick Auto Co.	1000—340.7
KFAD	Phoenix, Ariz., McArthur Bros. Mercantile Co.	100—273
KFAF	San Jose, Calif., Montgomery Hotel	50—217.3
KFAJ	Boulder, Colo., University of Colorado	100—261
KFAU	Boise, Idaho, Boise High School	750—280.2
KFBB	Havre, Mont., F. A. Buttrey & Co.	50—275 10—224
KFCB	San Diego, Calif., W. K. Azbill	100—248
KFBK	Sacramento, Calif., Kimball-Uspon Co.	100—224
KFBL	Everett, Wash., Leese Bros.	100—224
KFBS	Trinidad, Colo., School District No. 1	15—238
KFBU	Laramie, Wyo., The Cathedral (Bishop N. S. Thomas)	50—270
KFCB	Phoenix, Ariz., Nielson Radio Supply Co.	100—238
KFDD	Boise, Idaho, St. Michaels Cathedral	50—278
KFDM	Beaumont, Tex., Magnolia Petroleum Co.	500—315.6
KFDX	Shreveport, La., First Baptist Church	100—250
KFDY	Brookings, S. Dak., South Dakota State College of Agriculture and Mechanic Arts	100—273
KFDZ	Minneapolis, Minn., Harry O. Iverson	10—231
KFEC	Portland, Ore., Meier & Frank Co.	50—248
KFEL	Denver, Colo., Winner Radio Corp.	50—254
KFEQ	Oak, Nebr., Scroggin & Co. Bank	500—268
KFEY	Kellogg, Idaho, Bunker Hill & Sullivan Mining & Concentrating Co.	10—233
KFFP	Moberly, Mo., First Baptist Church	50—242
KFFY	Alexandria, La., Louisiana College	50—275
KFGC	Baton Rouge, La., Louisiana State University	100—268
KFGH	Stanford University, Calif., Leland Stanford Junior University	500—270
KFGQ	Boone, Iowa, Crary Hardware Co.	10—226
KFH	Wichita, Kan., Hotel Lassen Rigby-Gray Hotel Co.	50—268
KFHA	Gunnison, Colo., Western State College of Colorado	50—253
KFHL	Oskaloosa, Iowa, Penn College	10—240
KFI	Los Angeles, Calif., Earle C. Anthony (Inc.)	3000—468.5
KFIF	Portland, Ore., Benson Polytechnic Institute	100—248
KFIO	Spokane, Wash., North Central High School	100—265.3
KFIQ	Yakima, Wash., First Methodist Church	100—256
KFIU	Juneau, Alaska, Alaska Electric Light & Power Co.	10—226
KFIZ	Fond du Lac, Wis., Daily Commonwealth and Wisconsin Radio Sales, Inc.	100—273
KFJB	Marshalltown, Iowa, Marshall Electric Co.	10—248
KFJC	Junction City, Kansas, Episcopal Church (R. B. Fegan)	10—218.8
KFJF	Oklahoma, Okla., National Radio Mfg. Co.	500—261 10—246
KFJI	Astoria, Ore., Liberty Theatre	100—278
KFJM	Grand Forks, N. Dak., University of North Dakota	100—278
KFJR	Portland, Oregon, Ashley C. Dixon & Son	50—263
KFJX	Cedar Falls, Iowa, Iowa State Teachers' College	50—258
KFJY	Fort Dodge, Iowa, Tunwall Radio Co.	50—246
KFJZ	Fort Worth, Tex., South-Western Baptist Theological Seminary	50—254
KFKA	Greelev, Colo., Colorado State Teachers' College	50—273
KFKU	Lawrence, Kans., University of Kansas	500—275
KFKX	Hastings, Nebr., Westinghouse Electric & Mfg. Co.	5000—288.3

(Continued on page 1153)



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Call Letters	Name	Location	Power & Wave Length
KFKZ	Kirkville, Mo., F. M. Henry..		10-266
KFLR	Albuquerque, N. Mex., University of New Mexico		100-254
KFLU	San Benito, Tex., San Benito Radio Club		10-236
KFLV	Rockford, Ill., Swedish Evangelical Mission Church.....		100-229
KFLX	Galveston, Tex., George R. Clough		10-240
KFLZ	Anita, Iowa, Atlantic Automobile Co.		100-273
KFMQ	Fayetteville, Ark., University of Arkansas		750-299.8
KFMR	Sioux City, Iowa, Morningside College		100-261
KFMW	Houghton, Mich., M. G. Saterren		50-263
KFMX	Northfield, Minn., Carleton College		500-336.9
KFNF	Shenandoah, Iowa, Henry Field Seed Co.		500-263
KFOA	Seattle, Wash., Rhodes Dept. Store		1000-454.3
KFOB	Burlingame, Calif., KFOB inc. (Albert Sherman)		50-226
KFON	Long Beach, Calif., Echophone Radio Shop		500-233
KFOO	Salt Lake City, Utah, Latter Day Saints University		250-236
KFOR	David City, Nebr., David City Tire & Electric Co.		100-226
KFOT	Wichita, Kans., College Hill Radio Club (College Hill Methodist Church)		50-231
KFOX	Omaha, Nebr., Technical High School		100-248
KFOY	St. Paul, Minn., Beacon Radio Service		50-252
KFPL	Dublin, Texas, C. C. Baxter..		15-252
KFFM	Greenville, Texas, New Furniture Co.		10-242
KFPR	Los Angeles, Calif., Los Angeles County Forestry Department		500-230.6
KFPW	Cartersville, Mo., St. Johns M. E. Church		20-258
KFPY	Spokane, Wash., Symons Investment Co.		100-266
KFQA	St. Louis, Mo., The Principia.		100-261
KFQB	Fort Worth, Texas, Searchlight Publishing Co.		1000-263
KFQD	Anchorage, Alaska, Chovin Supply Co.		100-227.1
KFQP	Iowa City, Iowa, George S. Carson, Jr.		10-224
KFQU	Alma (Holy City), Calif., W. E. Riker		100-217.3
KFQW	North Bend, Wash., C. F. Knierim		50-215.7
KFQZ	Hollywood, Calif., Taft Products Co.		50-225.4
KFRB	Beeville, Tex., Hall Brothers.		250-248
KFRC	San Francisco, Calif., City of Paris Dry Goods Co.		50-268
KFRU	Columbia, Mo., Stephens College		500-499.7
KFRW	Olympia, Wash., United Churches of Olympia		50-218.8
KFSG	Los Angeles, Calif., Echo Park Evangelistic Assn.		500-275
KFUL	Galveston, Tex., Thomas Goggan & Bros. Music Co. ...		50-258
KFUO	St. Louis, Mo., Concordia Seminary		500-545.1
KFUP	Denver, Colo., Fitzsimons General Hospital		50-234
KFUR	Ogden, Utah, Peery Building Co.		50-224
KFUS	Oakland, Calif., Louis L. Sherman		50-256
KFUT	Salt Lake City, Utah, University of Utah		100-261
KFUU	Oakland, Calif., Colburn Radio Labs		50-220
KFVD	San Pedro, Calif., McWhinnie Electric Co.		50-205.4
KFVE	St. Louis, Mo., Film Corporation of America		500-240
KFVG	Independence, Kansas, First Methodist Epis. Church...		15-236
KFVH	Manhattan, Kansas, Whan Radio Shop		15-218.8
KFVI	Houston, Texas, Fifty-sixth Brigade, Headquarters Troop		10-240
KFVN	Welcome, Minn., Carl E. Bagley		50-227
KFVR	Denver, Colo., (near) Moonlight Ranch, Route 6, Eugene Rossi		50-244
KFVS	Cape Girardeau, Mo., Cape Girardeau Battery Station, Oscar C. Hirsch		50-224
KFVW	San Diego, Calif., Airfan Radio Corp.		500-246
KFVV	Albuquerque, N. Mex., Radio Supply Co.		10-250

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Call Letters	Name	Location	Power & Wave Length
KFWA	Ogden, Utah, Browning Bros. Co.	Utah, Browning Bros. Co.	500—261
KFWB	Hollywood, Calif., Warner Bros. Pictures (Inc.)	Hollywood, Calif., Warner Bros. Pictures (Inc.)	500—252
KFWC	Upland, Calif., L. E. Wall	Upland, Calif., L. E. Wall	50—211.1
KFWF	St. Louis, Mo., St. Louis Truth Center	St. Louis, Mo., St. Louis Truth Center	250—214.2
KFWH	Chico, Calif., F. Wellington Morse, Jr.	Chico, Calif., F. Wellington Morse, Jr.	100—254
KFWI	South San Francisco, Calif., Radio Entertainments (Inc.)	South San Francisco, Calif., Radio Entertainments (Inc.)	500—226
KFWM	Oakland, Calif., Oakland Education Society	Oakland, Calif., Oakland Education Society	500—206.8
KFWO	Avalon, Calif., Lawrence Mott	Avalon, Calif., Lawrence Mott	250—211.1
KFWU	Pineville, La., Louisiana College	Pineville, La., Louisiana College	100—238
KFWV	Portland, Ore., Wilbur Jerman	Portland, Ore., Wilbur Jerman	50—212.6
KFXB	Big Bear Lake, Calif., Bert-ram O. Heller	Big Bear Lake, Calif., Bert-ram O. Heller	500—202.6
KFXC	Santa Maria, Calif., Santa Maria Valley R. R. Co.	Santa Maria, Calif., Santa Maria Valley R. R. Co.	100—209.7
KFXD	Logan, Utah, Service Radio Co.	Logan, Utah, Service Radio Co.	10—205.4
KFXF	Colorado Springs, Colo., Pikes Peak Broadcasting Co.	Colorado Springs, Colo., Pikes Peak Broadcasting Co.	500—250
KFXH	El Paso, Texas, Bledsoe Radio Co.	El Paso, Texas, Bledsoe Radio Co.	50—242
KFXJ	Denver, Colo., Mountain States Radio Distributors, Inc. (Portable)	Denver, Colo., Mountain States Radio Distributors, Inc. (Portable)	10—215.7
KFXM	Beaumont, Texas, Neches Electric Co.	Beaumont, Texas, Neches Electric Co.	10—227
KFXR	Oklahoma, Okla., Classen Film Finishing Co.	Oklahoma, Okla., Classen Film Finishing Co.	15—214.2
KFXZ	Flagstaff, Ariz. (Orpheum Theatre), Mary M. Costigan	Flagstaff, Ariz. (Orpheum Theatre), Mary M. Costigan	50—205.4
KFYF	Oxnard, Calif., Carl's Radio Den (Newcomb Radio Co.)	Oxnard, Calif., Carl's Radio Den (Newcomb Radio Co.)	10—205.4
KFYJ	Houston, Tex., Houston Chronicle Publishing Co. (Portable)	Houston, Tex., Houston Chronicle Publishing Co. (Portable)	10—238
KFYO	Texarkana, Tex., Buchanan-Vaughan Co.	Texarkana, Tex., Buchanan-Vaughan Co.	10—209.7
KFYR	Bismarck, N. Dak., Hoskins-Meyer, Inc.	Bismarck, N. Dak., Hoskins-Meyer, Inc.	10—248
KGO	Oakland, Calif., General Electric Co.	Oakland, Calif., General Electric Co.	4000—361.2
KGTT	San Francisco, Calif., Glad Tidings Tabernacle	San Francisco, Calif., Glad Tidings Tabernacle	50—206.8
KGU	Honolulu, Hawaii, Marion A. Mulrony	Honolulu, Hawaii, Marion A. Mulrony	500—270
KGW	Portland, Ore., Portland Morning Oregonian	Portland, Ore., Portland Morning Oregonian	500—491.5
KGY	Lacey, Wash., St. Martins College	Lacey, Wash., St. Martins College	50—246
KHJ	Los Angeles, Calif., Times-Mirror Co.	Los Angeles, Calif., Times-Mirror Co.	500—405.2
KHQ	Spokane, Wash., Louis Wasmer	Spokane, Wash., Louis Wasmer	500—273
KJBS	San Francisco, Calif., Julius Bruunton & Sons Co.	San Francisco, Calif., Julius Bruunton & Sons Co.	5—220
KJR	Seattle, Wash., Northwest Radio Service Co.	Seattle, Wash., Northwest Radio Service Co.	1000—384.4
KLDS	Independence, Mo., Reorganized Church of Jesus Christ of Latter Day Saints	Independence, Mo., Reorganized Church of Jesus Christ of Latter Day Saints	1000—440.9
KLS	Oakland, Calif., Warner Bros. Radio Supplies Co.	Oakland, Calif., Warner Bros. Radio Supplies Co.	250—250
KLX	Oakland, Calif., Oakland Tribune	Oakland, Calif., Oakland Tribune	500—508.2
KLZ	Denver, Colo., Reynolds Radio Co.	Denver, Colo., Reynolds Radio Co.	250—266
KMA	Shenandoah, Iowa, May Seed & Nursery Co.	Shenandoah, Iowa, May Seed & Nursery Co.	500—252
KMJ	Fresno, Calif., Fresno Bee	Fresno, Calif., Fresno Bee	50—234
KMMJ	Clay Center, Neb., M. M. Johnson Co.	Clay Center, Neb., M. M. Johnson Co.	1000—228.9
KMO	Tacoma, Wash., Love Electric Co.	Tacoma, Wash., Love Electric Co.	100—250
KMOX	Kirkwood, Mo., Voice of St. Louis, (Inc.)	Kirkwood, Mo., Voice of St. Louis, (Inc.)	1500—280.2
KMTR	Los Angeles, Calif., K. M. Turner Radio Corp. (Oliver S. Garretton)	Los Angeles, Calif., K. M. Turner Radio Corp. (Oliver S. Garretton)	500—238
KNRC	Los Angeles, Calif., Clarence B. Juneau	Los Angeles, Calif., Clarence B. Juneau	250—208.2
KNX	Los Angeles, Calif., Los Angeles Evening Express	Los Angeles, Calif., Los Angeles Evening Express	1000—336.9
KOA	Denver, Colo., General Electric Co.	Denver, Colo., General Electric Co.	5000—322.4
KOAC	Corvallis, Oregon, Oregon Agricultural College	Corvallis, Oregon, Oregon Agricultural College	500—280.2
KOB	State College, N. M., New Mexico College of Agriculture and Mechanic Arts	State College, N. M., New Mexico College of Agriculture and Mechanic Arts	1000—348.6
KOCH	Omaha, Neb., Omaha Central High School	Omaha, Neb., Omaha Central High School	250—258
KOCW	Chickasha, Okla., Oklahoma College for Women	Chickasha, Okla., Oklahoma College for Women	200—252
KOIL	Council Bluffs, Iowa, Monarch Mfg. Co.	Council Bluffs, Iowa, Monarch Mfg. Co.	500—278
KOWW	Walla Walla, Wash., Blue Mountain Radio Association (Frank A. Moore)	Walla Walla, Wash., Blue Mountain Radio Association (Frank A. Moore)	500—256
KPO	San Francisco, Calif., Hale Bros.	San Francisco, Calif., Hale Bros.	1000—428.3
KPPC	Pasadena, Calif., Pasadena Presbyterian Church	Pasadena, Calif., Pasadena Presbyterian Church	50—229
KPRC	Houston, Texas, Post Dispatch	Houston, Texas, Post Dispatch	500—296.9
KPSN	Pasadena, Calif., Pasadena Star News	Pasadena, Calif., Pasadena Star News	1000—315.6
KQP	Portland, Ore., H. B. Read	Portland, Ore., H. B. Read	500—212.6



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KQV	Pittsburgh, Pa., Doubleday-Hill Electric Co.	500-275
KQW	San Jose, Calif., First Baptist Church	500-231
KRE	Berkeley, Calif., Berkeley Daily Gazette	100-256
KSAC	Manhattan, Kans., Kansas State Agricultural College	500-340.7
KSD	St. Louis, Mo., Post Dispatch	500-545.1
KSL	Salt Lake City, Utah, Radio Service Corp. of Utah	1000-299.8
KSO	Clarinda, Iowa, A. A. Berry Seed Co.	500-242
KTAB	Oakland, Calif., Tenth Avenue Baptist Church	1000-240
KTBI	Los Angeles, Calif., Bible Inst. of Los Angeles	750-293.9
KTBR	Portland, Ore., Brown's Radio Shop	50-263
KTCL	Seattle, Wash., American Radio Telephone Co.	1000-305.9
KTHS	Hot Springs, Ark., New Arlington Hotel Co.	500-374.8
KTNT	Muscatine, Iowa, Norman Baker	500-256
KTW	Seattle, Wash., First Presbyterian Church	1000-454.3
KUO	San Francisco, Calif., Examiner Printing Co.	150-250
KUOM	Missoula, Mont., University of Montana	250-244
KUSD	Vermillion, S. D., University of South Dakota	100-278
KUT	Austin, Texas, University of Texas	500-231
KVOO	Bristow, Okla., Voice of Oklahoma	500-374.8
KWCR	Cedar Rapids, Iowa (H. F. Paar)	500-278
KWG	Stockton, Calif., Portable Wireless Telephone Co.	50-248
KWKC	Kansas City, Mo., Wilson Duncan Studios	100-236
KWKH	Kennewick, La., W. G. Patterson	500-261
KWSC	Pullman, Wash., State College of Washington	500-348.6
KWWG	Brownsville, Texas, City of Brownsville, Board of City Development	500-278
KYW	Chicago, Ill., Westinghouse Electric & Mfg. Co.	3500-535.4
KZIB	Manila, P. I., I. Beck (Inc.)	20-249.9
KZKZ	Manila, P. I., Electrical Supply Co.	100-270
KZM	Oakland, Calif., Preston D. Allen	100-240
KZRQ	Manila, P. I., Manila Hotel, Far Eastern Radio (Inc.)	500-222
KZUY	Baguio, P. I., F. Johnson Elser	500-360
NAA	Arlington, Va., United States Navy Department	1000-434.5
WAAD	Cincinnati, Ohio, Ohio Mechanics Institute	25-258
WAAF	Chicago, Ill., Chicago Daily Drovers Journal	200-278
WAAW	Omaha, Neb., Omaha Grain Exchange	500-278
WABB	Harrisburg, Pa., Harrisburg Radio Co.	10-204
WABC	Asheville, N. C., Asheville Battery Co.	20-254
WABI	Bangor, Me., First Universalist Church	100-240
WABO	Rochester, N. Y., Lake Avenue Baptist Church	100-278
WABQ	Haverford Pa., Haverford College Radio Club	100-261
WABR	Toledo, Ohio, Scott High School	50-263
WABW	Wooster, Ohio, College of Wooster	50-206.8
WABX	Mount Clemens, Mich. (near), Henry B. Joy	500-246
WABY	Philadelphia, Pa., John Magaldi, Jr.	50-242
WABZ	New Orleans, La., Coliseum Place Baptist Church	50-275
WADC	Akron, Ohio, Allen Theatre	500-258
WAFD	Port Huron, Mich., Albert B. Parfet Co.	500-275
WAGM	Royal Oak, Mich., Robert L. Miller	50-225.4
WAHG	Richmond Hill, N. Y., A. H. Grebe & Co.	500-315.6
WAIT	Taunton, Mass., A. H. Wait & Co.	10-229
WAIU	Columbus, Ohio, American Insurance Union	500-293.9
WAMD	Minneapolis, Minn., Hubbard & Co.	500-244
WAPI	Auburn, Ala., Alabama Polytechnic Inst.	500-248
WARC	Medford Hillside, Mass., American Radio & Research Corp.	100-261
WATT	Boston, Mass. (portable) Edison Electric Illuminating Co. of Boston	100-243.8
WBAA	West Lafayette, Ind., Purdue University	250-273
WBAK	Harrisburg, Pa., Pa. State Police	500-275
WBAL	Baltimore Md., Consolidated Gas, Electric Light & Power Co.	5000-245.8

(Continued on page 1156)



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WBAO	Decatur, Ill., James Millikin University		100—270
WBAP	Fort Worth, Texas, Wortham-Carter Publishing Co. (Star-Telegram)		1500—475.9
WBAX	Wilkes-Barre, Pa., John H. Stenger, Jr.		100—256
WBBL	Richmond, Va., Grace Covenant Church		100—229
WBBM	Chicago, Ill., Atlas Investment Co.		1500—226
WBBP	Petoskey, Mich., Petoskey High School		200—238
WBBR	Rossville, N. Y., Peoples Pulpit Assn.		500—273
WBBS	New Orleans, La., First Baptist Church		50—252
WBBW	Norfolk, Va., Ruffner Junior High School		50—222
WBBY	Charleston, S. C., Washington Light Infantry		10—268
WBBZ	Chicago, Ill. (Portable), C. L. Carrell		50—215.7
WBCN	Chicago, Ill., Foster & McDonnell		500—266
WBDC	Grand Rapids, Mich., Baxter Laundry Co.		500—256
WBES	Tacoma Park, Md., Bliss Electrical School		100—222
WBNY	New York, N. Y., Shirley Katz		500—209.7
WBOQ	Richmond Hill, N. Y., A. H. Grebe & Co.		100—236
WBPI	Newark, N. J., I. R. Nelson Co.		500—263
WBRC	Birmingham, Ala., Bell Radio Corporation		50—248
WBRE	Wilkes Barre, Pa., Baltimore Radio Exchange		100—231
WBT	Charlotte, N. C., Charlotte Chamber of Commerce		250—275
WBZ	Springfield, Mass., Westinghouse Electric & Mfg. Co.		2000—331.1
WBZA	Boston, Mass., Westinghouse Elec. & Mfg. Co.		250—242
WCAC	Mansfield, Conn., Connecticut Agricultural College		500—275
WCAD	Canton, N. Y., St. Lawrence University		250—263
WCAE	Pittsburgh, Pa., Kaufmann & Baer Co.		500—461.3
WCAJ	University Place, Neb., Nebraska Wesleyan University		500—254
WCAL	Northfield, Minn., St. Olaf College		500—336.9
WCAO	Baltimore, Md., Albert A. and A. Stanley Brager		100—275
WCAP	Washington, D. C., Chesapeake & Potomac Telephone Co.		500—468.5
WCAR	San Antonio, Texas, Southern Radio Corporation of Texas		500—263
WCAT	Rapid City, S. D., South Dakota State School of Mines		50—240
WCAU	Philadelphia, Pa., Universal Broadcasting Co. (Durham & Co.)		500—278
WCAX	Burlington, Vt., University of Vermont		100—250
WCBA	Allentown, Pa., Queen City Radio Station		15—254
WCBD	Zion, Ill., Wilbur G. Voliva		5000—344.6
WCBE	New Orleans, La., Uhalt Brothers Radio Co.		5—263
WCBH	Oxford, Miss., University of Mississippi		50—242
WCBM	Baltimore, Md., Hotel Chateau		50—229
WCBQ	Nashville, Tenn., First Baptist Church		100—236
WCBR	Providence, R. I. (portable), Charles H. Messter		30—205.4
WCCO	Minneapolis, Minn., Washburn-Crosby Co.		5000—416.4
WCEE	Elgin, Ill., Liberty Weekly		1000—275
WCLO	Camp Lake, Wis., C. E. Whitmore		50—231
WCLS	Joliet, Ill., H. M. Couch		150—214.2
WCSH	Portland, Me., Congress Square Hotel Co.		500—256
WCSO	Springfield, Ohio, Wittenberg College		100—248
WCWS	Providence, R. I., United States (Portable) Chas. W. Selen		100—209.7
WCX	Pontiac, Mich., Detroit Free Press		5000—516.9
WDAD	Nashville, Tenn., Dad's Auto Accessories (Inc.)		150—226
WDAE	Tampa, Fla., Tampa Daily Times		250—273
WDAF	Kansas City, Mo., Kansas City Star		500—365.6
WDAG	Amarilla, Texas, J. Laurance Martin		100—263
WDAH	El Paso, Texas, Trinity Methodist Church (South)		50—267.7
WDAY	Fargo, N. D., Radio Equipment Corporation		50—261
WBDC	Lancaster, Pa., Kirk, Johnson & Co.		50—258
WBDE	Atlanta, Ga., Gilham-Schoen Electric Co.		100—270
WDBJ	Roanoke, Va., Richardson-Wayland Electrical Corporation		50—229

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Call Letters	Name	Location	Power & Wave Length
WDBK	Cleveland, Ohio, M. F. Broz Furniture, Hardware & Radio Store		100—227
WDBO	Winter Park, Fla., Rollins College		500—240
WDBZ	Kingston, N. Y., Boy Scouts of America		10—233
WDOD	Chattanooga, Tenn., Chattanooga Radio Co.		500—256
WDRG	New Haven, Conn., Doolittle Radio Corp.		100—268
WDWF	Cranston, R. I., Dutee W. Flint, Lincoln Studios, Inc.		500—440.9
WDZ	Tuscola, Ill., James L. Bush		10—278
WEAF	New York, N. Y., American Tel. & Tel. Co.		5000—491.5
WEAI	Ithaca, N. Y., Cornell University		500—254
WEAM	North Plainfield, N. J., Borough of North Plainfield		.250—261
WEAN	Providence, R. I., Shepard Co.		500—270
WEAO	Columbus, Ohio, Ohio State University		500—293.9
WEAR	Cleveland, Ohio, Goodyear Tire & Rubber Co.		750—389.4
WEAU	Sioux City, Iowa, Davidson Bros. Co.		100—275
WEBC	Superior, Wis., Walter C. Bridges		100—242
WEBD	Anderson, Ind., Electrical Equipment & Service Co.		15—246
WEBE	Cambridge, Ohio, Roy W. Walker		10—234
WEBH	Chicago, Ill., Edgewater Beach Hotel Co.		1500—370.2
WEBJ	New York, N. Y., Third Avenue Ry. Co.		500—273
WEBL	New York, N. Y., Woolworth Bldg., United States (portable), R. C. A.		100—226
WEBM	New York, N. Y., United States (Portable) Woolworth Building		100—226
WEBQ	Harrisburg, Ill., Joseph R. Tate		10—226
WEBR	Buffalo, N. Y., H. H. Howell		100—244
WEBW	Beloit, Wis., Beloit College		500—268
WEBZ	Savannah, Ga., Savannah Radio Corp.		50—263
WEEL	Boston, Mass., Edison Electric Illuminating Co. of Boston		500—348.6
WEHS	Evanston, Ill., Robert E. Hughes		10—202.6
WEMC	Berrien Springs, Mich., Emmanuel Missionary College		500—285.5
WENR	Chicago, Ill., All American Radio Corp.		1000—266
WEW	St. Louis, Mo., St. Louis University		1000—248
WFAA	Dallas, Tex., Dallas News & Dallas Journal		500—475.9
WFAM	St. Cloud, Minn., Times Publishing Co.		10—273
WFAV	Lincoln, Nebr., University of Nebraska		500—275
WFBC	Knoxville, Tenn., First Baptist Church		50—250
WFBD	Philadelphia, Pa., Gethsemane Baptist Church		5—234
WFBE	Seymour, Ind., Van de Walle Music and Radio Co.		10—226
WFBG	Altoona, Pa., William F. Gable Co.		100—278
WFBH	New York, N. Y., Hotel Majestic (Concourse Radio Corp.)		500—273
WFBI	Camden, N. J., Galvin Radio Supply Co.		250—236
WFBJ	Collegeville, Minn., St. John's University		100—236
WFBK	Syracuse, N. Y., Onondaga Hotel Co.		100—252
WFBM	Indianapolis, Ind., Merchants Heat & Light Co.		250—268
WFBP	Baltimore, Md., Fifth Infantry, Maryland N. G.		100—254
WFBZ	Galesburg, Ill., Knox College		20—254
WFDF	Flint, Mich., Frank D. Fallian (Police Building)		100—234
WFI	Philadelphia, Pa., Strawbridge & Clothier		500—394.5
WFKB	Chicago, Ill., Francis K. Bridgman		500—217.3
WFRL	Brooklyn, N. Y., Robert M. Lacey and James A. Bergner (Flatbush Radio Laboratories)		100—205.4
WGAL	Lancaster, Pa., Lancaster Electric Supply & Construction Co.		10—248
WGBB	Freeport, N. Y., Harry H. Carman		100—244
WGBC	Memphis, Tenn., First Baptist Church		10—278
WGBF	Evansville, Ind., Finke Furniture Co.		500—236
WGBI	Scranton, Pa., Frank S. Megargee		10—240

(Continued on page 1159)



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2—CONTESTS
Every month RADIO NEWS offers hundreds of dollars in prize contests which are open to all readers. In a recent \$300 "What's Wrong" contest over ninety-seven hundred replies were received.

3—UNIVERSAL INTEREST ARTICLES
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4—RADIOTICS
This is the humor section of RADIO NEWS. It contains some very unusual jokes pertaining to radio and makes very interesting light reading.

5—RECENT RADIO PHOTOS
This department keeps you in a picture way in touch with the very latest inventions in radio.

6—ARTISTS OF THE MICROPHONE
Every month this department of RADIO NEWS gives the reader a group of the people who entertain during the month from our prominent broadcast stations.

7—U. S. BROADCAST STATION LIST
This regular monthly feature contains an absolutely active and up-to-date list of every broadcast station in the United States, together with wave length and power.

8—RADIO SET DIRECTORY
Annually, in RADIO NEWS, is published a free service for radio readers. It is a directory giving complete information as to size and type of all radio sets manufactured in the United States.

9—TECHNICAL INFORMATION
To those readers of RADIO NEWS who are more advanced in radio this department offers plenty of technical information on the new developments in radio transmitters and receiving apparatus.

10—CONSTRUCTIONAL ARTICLES
The construction of radio sets will never cease to be an interesting hobby to those who "build their own" sets, RADIO NEWS offers many pages of constructional articles for them.

11—STANDARD HOOK-UPS
Every month RADIO NEWS offers many practical standard hook-ups for the set builders. This is always a live section for many radio fans

12—WITH THE AMATEUR
RADIO NEWS has not overlooked the amateur radio fan. This is a big section for the active group of radio readers.

13—RADIO NEWS LABORATORIES
Established in 1922 the RADIO NEWS Laboratories have maintained a wonderful reputation for the testing of radio parts. Their seal of approval is the guarantee of value.

14—"I WANT TO KNOW"
This is the RADIO NEWS question and answer department. Where you can submit your problems to our radio engineers for solution each month. There appears answers to questions asked by many people.

15—INTERNATIONAL RADIO
This department keeps you in touch with what is going on in radio outside of the United States. It is one of RADIO NEWS's most interesting departments.

16 SCIENTIFIC ARTICLES
The march of radio develops many events which are of interest to the general public. These are covered in a special department of RADIO NEWS.

17—RADIO MANUFACTURING
The production and marketing of the radio receivers or parts you use are shown in this section of RADIO NEWS. It is always an interesting corner for our readers.

18—CORRESPONDENCE FROM READERS
In this department you can know what is going on from day-to-day of various readers. It keeps you in touch with the ideas of the day.

19—RADIO BEGINNER
This is one of the most valuable departments of RADIO NEWS for the average listener. In itself it makes every copy worth while to the reader.

20—SET OWNERS INFORMATION
This is for everyone, containing the opinions and advice of the best Radio Experts—Don't miss it.



Everywhere in radio we find opportunities for development and improvement. 1926 will surely bring forth many novel devices for the standardizing and improvement of radio transmitting and receiving and perhaps many new devices for enlarging and broadening the sphere of radio to the people of the world.

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(Continued from page 1157)

Call Letters	Name	Location	Power & Wave Length
WGBM	Providence, R. I., Theodore N. Saaty		30—234
WGBR	Marshfield, Wis., George S. Ives		10—229
WGBS	New York, N. Y., Gimbel Brothers		500—315.6
WGBU	Fulford-by-the-Sea, Fla., Florida Cities Finance Co.		500—278
WGBX	Orono, Me., University of Maine		100—252
WGCP	Newark, N. J., D. W. May, Inc.		500—252
WGES	Oak Park, Ill., Oak Leaves Broadcasting Station (Coyne Elec. School)		500—250
WGHB	Clearwater, Fla., The George H. Bowles Developments		500—266
WGHP	Detroit, Mich., George H. Phelps		1500—270
WGMU	Richmond Hill, N. Y. (portable) A. H. Grebe & Co.		100—236
WGN	Chicago, Ill., The Tribune (Drake Hotel)		1000—302.8
WGR	Buffalo, N. Y., Federal Radio Corp.		750—319
WGST	Atlanta, Ga., Georgia School of Technology		500—270
WGY	Schenectady, N. Y., General Electric Co.		500—379.5
WHA	Madison, Wisconsin, University of Wisconsin		750—535.4
WHAD	Milwaukee, Wis., Marquette University and Milwaukee Journal		500—275
WHAM	Rochester, N. Y., University of Rochester (Eastman School of Music)		100—278
WHAP	New York, N. Y., Wm. H. Taylor Finance Corp.		500—240
WHAR	Atlantic City, N. J., Seaside Hotel		500—275
WHAS	Louisville, Ky., Courier-Journal & Louisville Times		500—399.8
WHAT	Minneapolis, Minn., George W. Young		500—263
WHAU	Wilmington, Del., Wilmington Electrical Specialty Co.		100—266
WHAZ	Troy, N. Y., Rensselaer Polytechnic Institute		1000—379.5
WHIB	Kansas City, Mo., Sweeney School Co.		500—365.6
WHBA	Oil City, Pa., Shaffer Music House		10—250
WHBC	Canton, Ohio, Rev. E. P. Graham		10—254
WHBD	Bellefontaine, Ohio, Chas. W. Howard		20—222
WHBF	Rock Island, Ill., Beardley Specialty Co.		100—222
WHBG	Harrisburg, Pa., John S. Skane Culver, Ind., Culver Military Academy		20—231
WHBH	Fort Wayne, Ind., Lauer Auto Co.		100—222
WHBJ	Fort Wayne, Ind., Lauer Auto Co.		50—234
WHBK	Ellsworth, Me., Franklin Street Garage		10—231
WHBL	Chicago, Ill. (portable), C. L. Carrell		50—215.7
WHBM	Chicago, Ill., C. L. Carrell		20—215.7
WHBN	St. Petersburg, Fla., First Ave. Methodist Church		10—238
WHBP	Johnstown, Pa., Johnstown Automobile Co.		100—256
WHBQ	Memphis, Tenn., Men's Fellowship Class of St. John's M. E. Church South		50—233
WHBU	Anderson, Ind., Riviera Theatre and Bings Clothing		10—218.8
WHBW	Philadelphia, Pa., D. R. Kienzle		100—215.7
WHBY	West De Pere, Wis., St. Norbert's College		50—250
WHDI	Minneapolis, Minn., William Hood Dunwoody Industrial Institute		500—278
WHEC	Rochester, N. Y., Hickson Electric Co.		100—258
WHK	Cleveland, Ohio, Radio Air Service Corp. (Warren R. Cox)		1000—272.6
WHIN	New York, N. Y., George Schubel		500—361.2
WHO	Des Moines, Iowa, Bankers Life Co.		5000—526
WHIT	Deerfield, Ill., Radiophone Broadcasting Corp.		2500—238
WIAD	Philadelphia, Pa., Howard R. Miller		100—250
WIAS	Burlington, Iowa, Home Electric Co.		100—254
WIBA	Madison, Wis., Capital Times Studio		100—236
WIBC	St. Petersburg, Fla., L. M. Tate Post No. 39, Veterans of Foreign Wars		100—222
WIBG	Elkins Park, Pa., St. Paul's Protestant Episcopal Church		50—222
WIBH	New Bedford, Mass., Elite Radio Stores, James T. Moriarty		30—209.7

(Continued on page 1161)

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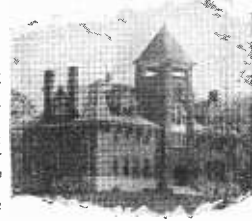
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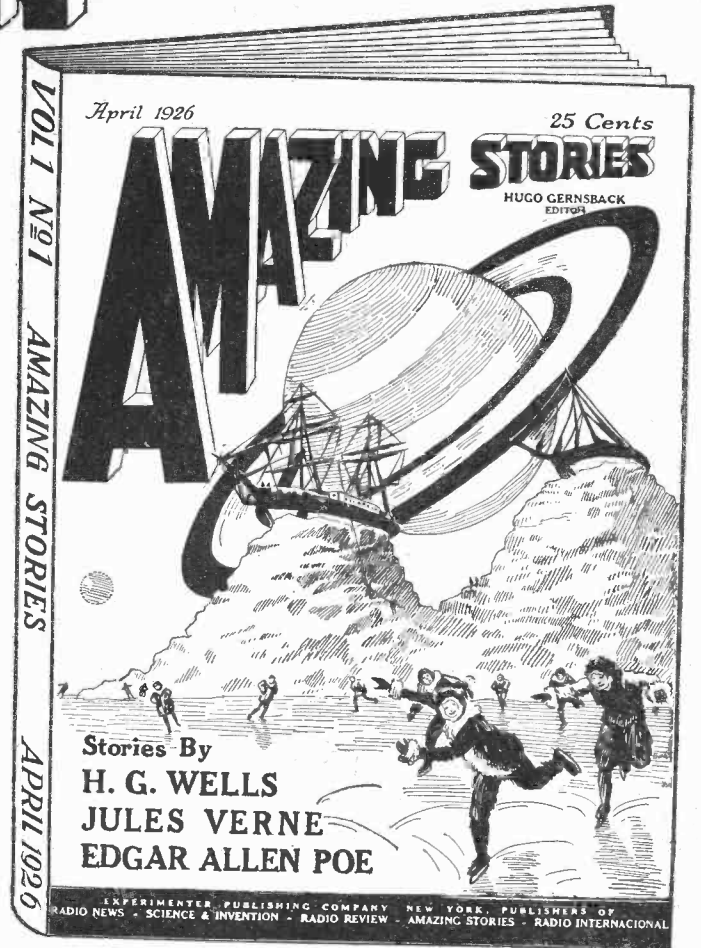
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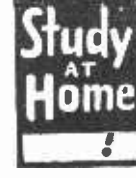
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(Continued from page 1159)

Call Letters	Name	Location	Power & Wave Length
WIBI	Flushing, N. Y., Frederick B. Zittell, Jr.		50—218.8
WIBJ	Chicago, Ill. (Portable), C. L. Carrell		50—215.7
WIBM	Chicago, Ill. (portable) Billy Maine		10—215.7
WIBO	Chicago, Ill., Nelson Bros., (Russo & Fiorito Orchestra Exchange)		1000—226
WIBR	Weirton, W. Va., Thurman A. Owings		50—246
WIBS	Elizabeth, N. J., (portable) N. J. Nat'l. Guard, 57th Infantry Brigade		10—202.6
WIBU	Poyette, Wis., The Electric Farm		20—222
WIBW	Logansport, Ind., L. L. Dill		100—220
WIBX	Utica, N. Y., Grid Leak (Inc.)		150—205.4
WIBZ	Montgomery, Ala., A. D. Trum		10—231
WIL	St. Louis, Mo., St. Louis Star & Benson Radio Co.		250—273
WIOD	Miami Beach, Fla., Carl G. Fisher		1000—247.8
WIP	Philadelphia, Pa., Gimbel Brothers		500—508.2
WJAD	Waco, Texas, Frank P. Jackson		500—352.7
WJAG	Norfolk, Nebr., Norfolk Daily News		200—270
WJAK	Kokomo, Ind., Rev. Clifford L. White		50—254
WJAM	Cedar Rapids, Iowa, D. M. Perham		100—268
WJAR	Providence, R. I., The Outlet Co. (J. Samuels & Bro.)		500—305.9
WJAS	Pittsburgh, Pa., Pittsburgh Radio Supply House		500—275
WJAX	Jacksonville, Fla., City of Jacksonville		1000—336.9
WJAZ	Mount Prospect, Ill., Zenith Radio Corp.		1500—322.4
WJBA	Joliet, Ill., D. H. Lentz, Jr.		50—206.8
WJBB	St. Petersburg, Fla., L. W. McClung		10—254
WJBC	La Salle, Ill., Hummer Furniture Co.		100—234
WJBG	Charlotte, N. C., Interstate Radio (Inc.)		10—224
WJBI	Red Bank, N. J., Robert S. Johnson		250—218.8
WJBK	Ypsilanti, Mich., Ernest F. Goodwin		10—233
WJBL	Decatur, Ill., Wm. Gushard, Dry Goods Co.		500—270
WJBO	New Orleans, La., Valdemar Jensen		100—268
WJBU	Lewisburg, Pa., Bucknell University		100—211.1
WJJD	Mooseheart, Ill., Supreme Lodge, Loyal Order of Moose		500—370.2
WJR	Pontiac, Mich., Jewett Radio & Phonograph Co.		5000—516.9
WJY	New York, N. Y., R. C. A.		1000—405.2
WJZ	New York, N. Y., R. C. A.		Variable—454.3
WKAF	Milwaukee, Wis., WKAF Broadcasting Corp.		500—261
WKAQ	San Juan, P. R., Radio Corp. of Porto Rico		500—340.7
WKAR	East Lansing, Mich., Michigan State College		1000—285.5
WKAV	Laconia, N. H., Laconia Radio Club (Portable)		50—224
WKBB	Joliet, Ill., Sanders Brothers		100—214.2
WKBE	Webster, Mass., K & B Electric Co.		100—231
WKBG	Chicago, Ill. (Portable), C. L. Carrell		100—215.7
WKRC	Cincinnati, Ohio, Kodel Radio Corp.		1000—325.9 & 422.3
WKY	Oklahoma, Okla., E. C. Hull and H. S. Richards		100—275
WLAL	Tulsa, Okla., First Christian Church		100—250
WLAP	Louisville, Ky., W. V. Jordan		20—275
WLBL	Stevens Point, Wis., Wisconsin Department of Markets		500—278
WLIB	Elgin, Ill. (near), Liberty Weekly		4000—302.8
WLIT	Philadelphia, Pa., Lit Bros.		500—394.5
WLS	Crete, Ill., Sears, Roebuck & Co.		5000—344.6
WLSI	Cranston, R. I., Dutee W. Flint Lincoln Studios (Inc.)		500—440.9
WLTS	Chicago, Ill., Lane Technical High School		100—258
WLW	Harrison, Ohio, Crosley Radio Corp.		500 & 5000—422.3
WLWL	New York, N. Y., Missionary Society of St. Paul the Apostle		1500—288.3
WMAC	Cazenovia, N. Y., Clive B. Meredith		100—275
WMAF	Dartmouth, Mass., Round Hills Radio Corp.		1000—440.9

(Continued on page 1163)

Brain-Feast

Solvent fruit, such as grapefruit, berries, tomatoes UNDER PROPER CONDITIONS:
(1) Dissolve or disintegrate tumors, goitres, gallstones, deposits of lime in joints.
(2) Dissolve phlegm or mucus, remove the source of colds, catarrh and constipation.
(3) Correct liver and kidney troubles; headaches.
(4) Dissolve blood clots as in paralysis.
(5) Dissolve the impurities which cause blemishes to the skin, as acne, eczema.



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The following extracts are from sworn statements of pupils:
PARALYSIS. Age 61. Right hand and leg helpless three years, restored in three weeks.
Another, age 65. bedridden, hemiplegia. Sensation restored in three days. Could walk two miles daily after six weeks.
ARTHRITIS. All joints swollen with lime deposits. Knees and wrists locked immovable for eight months. Blind for two years. Can now see, walk and do home work.
CATARH. HAY FEVER, RESULTING DEAFNESS decreased from the first meal.
GALLSTONES. Age 80. Bedridden, cholc every week for years, but not one attack since instruction over a year ago: now can do housework.
TUMORS. Age 40. Tumors weighing several pounds dissolved within a year.
GOTRE. Collar reduced 17 to 15, normal size.
URINE HEMORRHAGE. Age 50. Three years in rolling chair, weak from constant discharges. Now does housework, including washing.
EYZEMA. Age 69. Eyebrows lost. Skin cracked and scaling. Normal in three months.
PYORRHOEA. Age 65. Pus ceased on 7th day.
PREGNANCY. Age 30. With last two children suffered no nausea, no swollen feet, nor constipation as previously. Delivery painless.
CONSTIPATION. Three Healthy Eliminations Daily.
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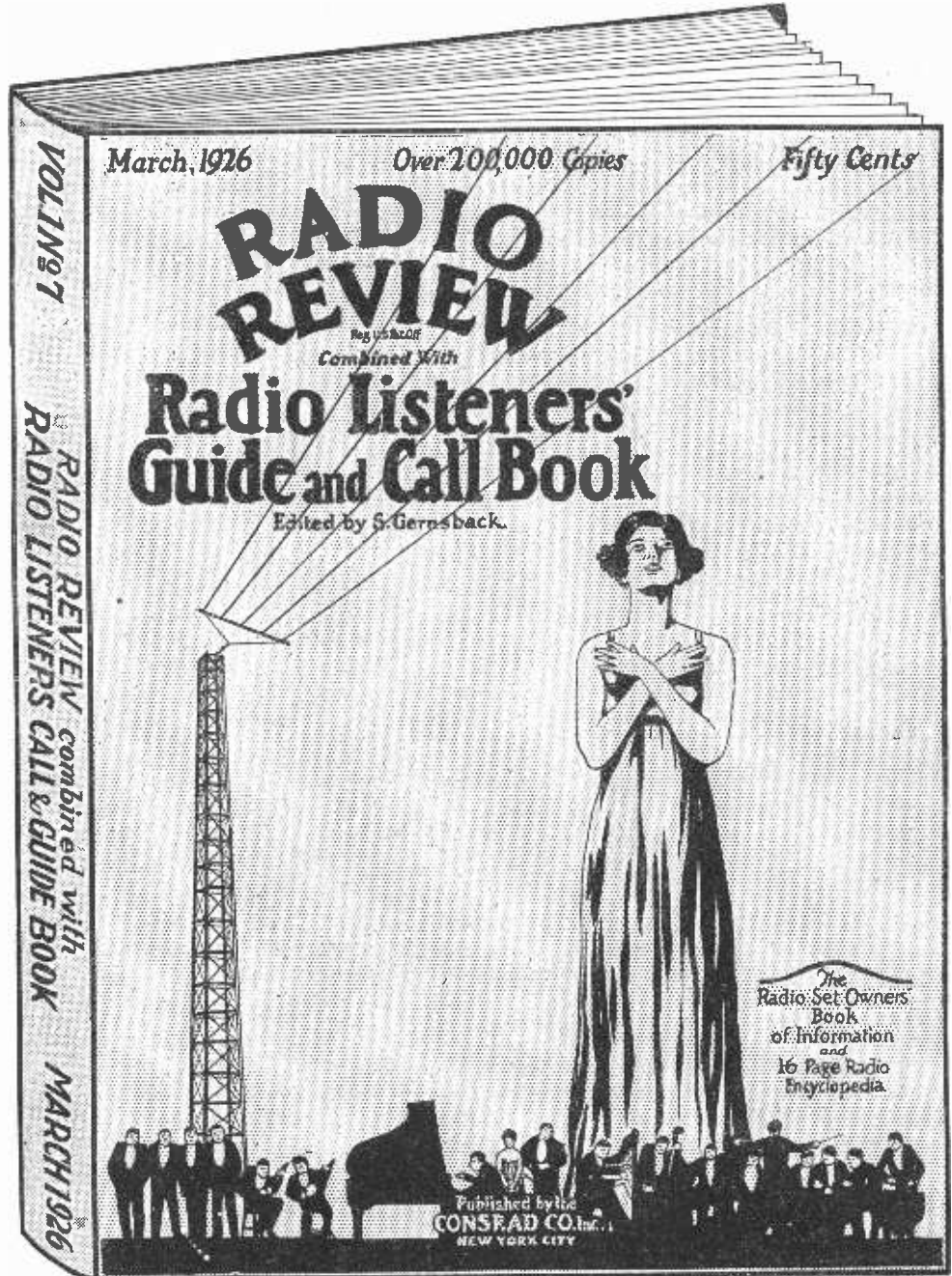
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(Continued from page 1161)

Call Letters	Location and Name	Power & Wave Length
WMAK	Lockport, N. Y., Norton Laboratories	500—266
WMAL	Washington, D. C., M. A. Leese Optical Co.	15—212.6
WMAN	Columbus, Ohio, First Baptist Church	50—278
WMAQ	Chicago, Ill., Chicago Daily News	1000—447.5
WMAY	St. Louis, Mo., Kingshighway Presbyterian Church	100—248
WMAZ	Macon, Ga., Mercer University	500—261
WMBB	Chicago, Ill., American Bond & Mortgage Co.	500—250
WMBC	Detroit, Mich., Michigan Broadcasting Co. (F. G. Siegel)	100—256.4
WMBF	Miami Beach, Fla., Fleetwood Hotel Corp.	500—384.4
WMC	Memphis, Tenn., "Commercial Appeal"	500—499.7
WMCA	Hoboken, N. J., Hotel McAlpin (Greeley Square Hotel Co.)	500—340.7
WNAB	Boston, Mass., Shepard Stores	100—250
WNAC	Boston, Mass., Shepard Stores	500—280.2
WNAD	Norman, Okla., University of Oklahoma	500—254
WNAL	Omaha, Nebr., Omaha Central High School	50—258
WNAT	Philadelphia, Pa., Lenning Brothers Co.	100—250
WNAX	Yankton, S. Dak., Dakota Radio Apparatus Co.	100—244
WNBH	New Bedford, Mass., Irving J. Vermilya and A. J. Lopez	250—248
WNJ	Newark, N. J., Radio Shop of Newark	150—252
WNOX	Knoxville, Tenn., Peoples Telephone & Telegraph Co.	100—268
WNYC	New York, N. Y., City of New York	1000—526
WOAI	San Antonio, Tex., Southern Equipment Co.	2000—394.5
WOAN	Lawrenceburg, Tenn., James D. Vaughn	500—282.8
WOAW	Omaha, Nebr., Woodmen of the World	1000—526
WOAX	Trenton, N. J., Franklyn J. Wolff	500—240
WOC	Davenport, Iowa, Palmer School of Chiropractic	5000—483.6
WOCL	Jamestown, N. Y., Hotel Jamestown	15—275
WODA	Paterson, N. J., O'Dea Temple of Music	250—224
WOI	Ames, Iowa, Iowa State College	750—270
WOK	Homewood, Ill., Neutrowound Radio Mfg. Co.	5000—217.3
WOKO	New York, N. Y., Otto Baur	50—233
WOO	Philadelphia, Pa., John Wanamaker	500—508.2
WOOD	Grand Rapids, Mich., Grand Rapids Radio Co.	500—242
WOQ	Kansas City, Mo., Unity School of Christianity	1000—278
WOR	Newark, N. J., L. Bamberger & Co.	500—405.2
WORD	Batavia, Ill., Peoples Pulpit Association	5000—275
WOS	Jefferson City, Mo., Missouri State Marketing Bureau	500—440.9
WOWL	New Orleans, La., Owl Battery Co.	10—270
WOWO	Fort Wayne, Ind., Main Auto Supply Co.	500—227
WPAK	Agricultural College, N. Dak., North Dakota Agricultural College	50—275
WPCC	Chicago, Ill., North Shore Congregational Church	500—258
WPG	Atlantic City, N. J., Municipality of Atlantic City	500—299.8
WPRC	Harrisburg, Pa., Wilson Printing and Radio Co.	100—215.7
WPSC	State College, Penna., Pennsylvania State College	500—261
WQAA	Parkersburg, Pa., Horace A. Beale, Jr.	500—220
WQAC	Amarillo, Texas, Gish Radio Service	100—234.2
WQAE	Springfield, Vt., Moore Radio News Station	50—246
WQAM	Miami, Fla., Electrical Equipment Co.	100—263
WQAN	Scranton, Pa., Scranton Times	100—250
WQAO	New York, N. Y., Calvary Baptist Church	100—360
WQJ	Chicago, Ill., Calumet Rainbo Broadcasting Co.	500—447.5
WRAF	Laporte, Ind., The Radio Club, Inc.	100—224
WRAM	Galesburg, Ill., Lombard College	100—244
WRAV	Yellow Springs, Ohio, Antioch College	100—263
WRAW	Reading, Pa., Avenue Radio & Electric Shop	10—238
WRAX	Gloucester City, N. J., Flexon's Garage	500—268

(Continued on page 1165)

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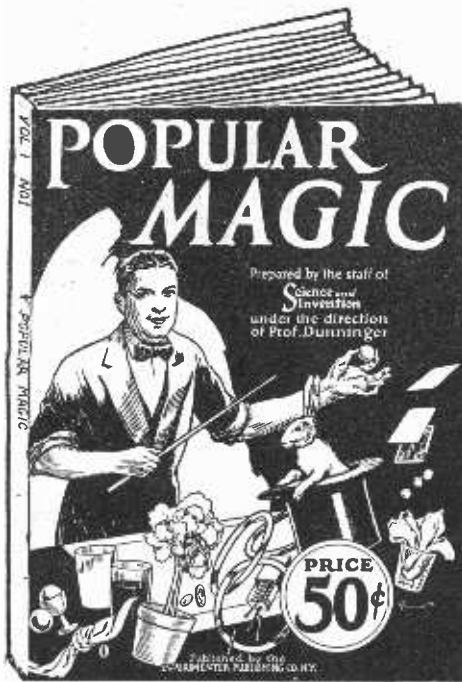
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(Continued from page 1163)

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WRBC	Valparaiso, Ind.	Immanuel Lutheran Church	500—278
WRC	Washington, D. C.	Radio Corp. of America	1000—468.5
WRCO	Raleigh, N. C.	Wynne Radio Co.	100—252
WREC	Coldwater, Miss.	Wooten's Radio & Elec. Co.	10—254
WREO	Lansing, Mich.	Kco Motor Car Co.	500—285.5
WRHF	Washington, D. C.	Washington Radio Hospital Fund	50—258
WRHM	Minneapolis, Minn.	Rosedale Hospital	50—252
WRK	Hamilton, Ohio	Doron Bros. Electrical Co.	100—270
WRM	Urbana, Ill.	University of Illinois	500—273
WRMU	Richmond Hill, N. Y.	M U-1 (Yacht) A. H. Grebe	100—236
WRNY	New York, N. Y.	Experimenter Publishing Co.	500—258
WRR	Dallas, Tex.	City of Dallas, Police and Fire Signal Department	500—246
WRST	Bay Shore, N. Y.	Radiotel Mfg. Co.	250—215.7
WRVA	Richmond, Va.	Larus & Bro. Co.	1000—256
WRW	Tarrytown, N. Y.	Tarrytown Radio Research Laboratory (Koenig Bros.)	500—273
WSAI	Mason, Ohio	United States Playing Card Co.	5000—325.9
WSAJ	Grove City, Pa.	Grove City College	250—229
WSAN	Allentown, Pa.	Allentown Call Publishing Co.	100—229
WSAR	Fall River, Mass.	Doughty & Welch Electrical Co.	100—254
WSAU	Chesham, N. H.	Camp Marienfeld	10—229
WSAX	Chicago, Ill.	Zenith Radio Corp.	100—268
WSAZ	Pomeroy, Ohio	Chase Electric Shop	50—244
WSB	Atlanta, Ga.	Atlanta Journal	1000—428.3
WSBC	Chicago, Ill.	World Battery Co.	1000—209.7
WSBF	St. Louis, Mo.	Stix Baer & Fuller	250—273
WSBT	South Bend, Ind.	South Bend Tribune	250—275
WSDA	New York, N. Y.	City Temple	250—203
WSKC	Bay City, Mich.	Worlds Star Knitting Co.	100—261
WSM	Nashville, Tenn.	National Life & Accident Ins. Co.	1000—282.8
WSMB	New Orleans, La.	Saenger Amusement & Maison Blanche Co.	500—319
WSMH	Owosso, Mich.	Shattuck Music House	20—240
WSMK	Dayton, Ohio	S.M.K. Radio Corp.	500—275
WSOE	Milwaukee, Wis.	School of Engineering of Milwaukee	500—246
WSRO	Hamilton, Ohio	Radio Co. (Harry W. Fahrlander)	100—252
WSSH	Boston, Mass.	Tremont Temple Baptist Church	100—261
WSUI	Iowa City, Iowa	State University of Iowa	500—483.6
WSVS	Buffalo, N. Y.	Seneca Vocational School	50—218.8
WTAB	Fall River, Mass.	Daily Herald Publishing Co.	100—266
WTAD	Carthage, Ill.	Robert E. Compton	50—236
WTAG	Worcester, Mass.	Worcester Telegram Publishing Co.	500—268
WTAL	Toledo, Ohio	Toledo Radio & Electric Co.	10—252
WTAM	Cleveland, Ohio	Willard Storage Battery Co.	3500—389.4
WTAP	Cambridge, Ill.	Cambridge Radio & Electric Co.	50—242
WTAQ	Osseo, Wis.	S. H. Van Gorden & Son	100—254
WTAR	Norfolk, Va.	Reliance Electric Co.	100—261
WTAW	College Station, Tex.	Agricultural & Mechanical College of Texas	500—270
WTAX	Streator, Ill.	Williams Hardware Co.	50—231
WTAZ	Lambertville, N. J.	Thomas J. McGuire	15—261
WTIC	Hartford, Conn.	Travelers Insurance Co.	500—475.9
WWAD	Philadelphia, Pa.	Wright & Wright, Inc.	250—250
WWAE	Plainfield, Ill.	Lawrence J. Crowley (Electric Park)	500—242
WWAO	Houghton, Mich.	Michigan College of Mines	250—263
WWGL	Richmond Hill, N. Y.	Radio Engineering Corp.	500—212.6
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Agents—Best seller: Jem Rubber Repair for tires and tubes; supercedes vulcanization at a saving of over 500 per cent; put it on cold. It vulcanizes itself in two minutes and is guaranteed to last the life of the tire or tube; sells to every auto owner and accessory dealer. For particulars how to make big money and free sample, address Amazon Rubber Co., Dept. 601, Philadelphia, Pa.

Agents—Write for Free Samples. Sell Madison "Better-Made" Shirts for large Manufacturer direct to wearer. No capital or experience required. Many earn \$100 weekly and bonus. Madison Company, 566 Broadway, New York.

Big money and fast sales. Every owner buys Gold Initials for his auto. You charge \$1.50; make \$1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept. 71, East Orange, N. J.

Earn \$10 daily silvering mirrors, plating and refinishing metalware, chandeliers, bedsteads, headlights, outfits furnished. N. Decie Laboratories, 1133 Broadway, New York.

\$60—\$200 a week. Genuine Gold Letters for store windows. Easily applied. Free samples Liberal offer to general agents. Metallic Letter Co., 441 B., North Clark, Chicago.

\$10 daily silvering mirrors, plating and refinishing lamps, reflectors, autos, beds, chandeliers by new method. Outfits furnished. Write Gunmetal Co., Ave. D, Decatur, Ill.

Only one sale a day means \$200 per month! Marvelous new adding machine. Retail \$15.00. Work equals \$350 machine. Adds, subtracts, multiplies, divides, automatically. Computer feet and inches. Speedy, accurate, durable, handsome. Five year guarantee. Offices, Stores, factories, garages, lumbermen buy one to dozen. A fortune for live agents. Write quick for protected territory and free trial. Lightning Calculator Co., Dept. W, Grand Rapids, Michigan.

Bankrupt and Rummage Sales. Make \$50.00 daily. We start you, furnishing everything. Distributors, Dept. 171, 609 Division, Chicago.

Wash clothes the new way. Use the Torrent Automatic Washer. You will be delighted. Special offer to one in each locality. Storm Royalty Co., 3602 Enright Ave., St. Louis, Mo.

No Dull Times Selling Food. People must eat. Federal distributors make big money; \$3,000 yearly and up. No capital or experience needed; guaranteed sales; unsold goods may be returned. We furnish you with license. Your \$20.00 starting order sent on trust. Free Samples to customers — Repeat orders sure; Exclusive territory. Ask now. Federal Pure Food Co., 882311 Archer, Chicago.

Make Money Silvering Mirrors, refinishing auto headlights, tableware, metal plating, bedsteads, chandeliers. Outfits furnished. International Laboratories, Dept. 69, 309 Fifth Ave., New York.

Agents—No canvassing. No delivering. No money invested. Pleasant work. Big Money. Appointing local agents to introduce welcome foods. Welcome Products, 326 Harvey, Illinois.

Quit Ringing Doorbells. I made \$800 monthly, no soliciting, no goods to buy. Why not you? Details free. R. McNew, 326 Wilkinson, Omaha, Neb.

At Last! Diamond Rival Discovered! Amazing blue white Rajah Gem Astounds jewelry world and deceives experts. Beautiful sample case free! \$100 weekly! Write quick! Rajah Diamond Co., Dept. E11, Salisbury, N. C.

Marvelous New Invention 400 per cent profit liquid quick mend for hosiery and fabrics, tremendous demand. Over hundred other fast sellers. Local and general agents. J. E. Johnson Co., Dept. 840, 69 E. South Water St., Chicago.

\$5 to \$15 daily (Sworn proof) Introducing New Guaranteed Hosiery. Must wear or replaced free. No capital or experience required. You simply write orders. We deliver and collect. **YOUR PAY DAILY**, monthly bonus besides. Spare time satisfactory. Samples furnished. All colors, grades including silks, Hoses, chignons. Macoche Textile Company, Card 8701, Cincinnati, Ohio.

Mirrors Re-Silvered at Home. Costs Less 5 cents per square foot; you charge 75 cents. Immense profits, plating like new, brassy, worn-off autparts, reflectors, tableware, stoves, etc., outfits furnished. Details FREE. Sprinkle, Plater, 955, Marion, Indiana.

Over 100% Profit. Self Lighting Gas and Clear Lights. Everybody interested, repeat business. Sell individually, dealers, subagents. Particulars FREE. S. I. Bernhard, 127 West 30th, New York.

A large Hosiery concern wants responsible men and women as local representatives working spare time. Big success. Write for details. Jennings Co., Dept. 655, Dayton, Ohio.

Big Money—fast sales, every owner buys Gold Initials for his auto. You charge \$1.50, make \$1.44. Ten orders daily easy. Samples free. World Monogram, Dept. 32, Newark, N. J.

Build splendid business making chipped glass number and name plates. Particulars free. Simplex Co., Dept. 93, 1133 Broadway, New York.

Earn \$5.00 Every Hour Monogramming Automobiles. It's easy with our "Radio" transfer letters. cost 5c. Get \$1.50. Sample free. "Radio," 1043 Washington, Boston, Mass.

Agents Wanted (continued)

Newest invention! Sells everywhere. Automatically prevents telephone and iron cords from tangling and kinking. \$90 weekly. Samples for test if desired. Neverknot, Dept. G4, McClurg Bldg., Chicago.

Manufacture in home or shop. Newest, fast-selling, novelties, toys, preparations, mail-order, agents' goods. Free list reliable, plans, patterns, processes, commercial information. Manufacturers' Bureau, 3937L Tracy, Kansas City, Mo.

Men wanted to sell my new puncture-proof inner tube. Demonstrate by driving nails into tire. In tests have given good service after having 500 nail holes in them. Doubles tire mileage. Sold under money-back guarantee. Big money and exclusive territory. Free Tube Offer. Write L. M. Milburn, 334 West 47th, Chicago.

\$20 Daily. World's greatest seller. Marvelous 3-in-1 home necessity. Retail \$3.50. Amazing plan. No capital. Write today, C125, Lobi Company, Middleboro, Mass.

Agents: America's fastest selling shirt, lumberjack and necktie line. \$100.00 weekly easy. Shirts as low as 2 for \$2.95. Big commission and bonus. Free gifts insure volume sales. Elaborate outfit free to first 500 who write. Howard Shirt Co., 105 So. Dearborn, Dept. 112, Chicago.

If I send you Shoes made-to-your measure in any one 69 leathers, 50 different styles, will you keep them, wear them, show them to your friends as sample of my \$10 Made-to-Order shoes to sell at \$6.85. Advise me today. Your sample outfit will go forward absolutely free at once. Dept. 8079, Forrest Dustin, 932 S. Wrightwood Ave., Chicago.

—PROOF— That Classified Advertising Pays

Pisgah, Ala.,
Jan. 27th, 1926

SCIENCE & INVENTION:

I am using a number of the big national magazines and I regard Science & Invention one of the best. I have been with you about four years and have no intention of cancelling my advertisement. Very truly yours,

LEE MOUNTAIN.

—still another one

Oshkosh, Wis.
Jan. 25th, 1926.

SCIENCE & INVENTION:

My advertisement has been appearing month after month in your publication and the results have always come out way on top. Very truly yours,

OAKS MAGICAL CO.

Read Our Rates at Top of Page Then Send Your Order

Marvelous Invention! Does away with phonograph needles. Preserves records. Saves \$25 in needles. Pays \$90 weekly. Sample on approval if requested. Everplay, Desk E-4, McClurg Bldg., Chicago.

Selling Like Blazes! Eleven Piece Toilet Goods assortment at \$2.00 with two piece carving set FREE to your customers. 100% profit. Davis Products Co., Dept. 67, 1311 Carroll, Chicago.

"Gets-U-Out" Tire Lug. New Patented Auto Accessory. Just out. One minute demonstration. Sure sale. Absolutely prevents auto getting stuck in mud, sand or snow. Big profits. Money back guarantee. Write for exclusive sales territory. Arthur J. Benson, 47th and Shields Ave., Room 419, Chicago.

Furniture refinishing, polishing, painting, handyman shop; wonderful profits; start yours on nearly nothing. John Braceland, 1459 So. Ninth, Philadelphia, Pa.

Agents—Snappiest household line on earth. Red hot sellers, steady repeaters—100% profit. 300 light weight, fast selling, popular priced necessities. Selling outfit free. Get busy quick—write today, postal will do. American Products Co., 5809 American Bldg., Cincinnati, Ohio.

Succeed With Your Own Products. Make them yourself. Formulas, Processes, Trade-Secrets. Modern Master methods. Catalog free. D. Thaxly Co., Washington, D. C.

Aviation

Boys—Get a three-foot model aeroplane free. Write to Aero Shop, 3050 Huribut Ave., Detroit, Mich.

Battle Photos and War Relics

For Dens: Relics Collected from Europe's Battlefields. Firearms, medals, helmets, etc. Illustrated catalogue and sample War photographs 25c. Lieut. Welch, 1889 Albany Ave., Brooklyn, N. Y.

Books

Free—Upon request will send you my literature illustrating the following books: Astrology, Character, Clairvoyance, Concentration, Health, Hypnotism, Magnetism, Mediumship, Personal Magnetism, Personality, Physiology, Salesmanship, Seership, Success, Sex, Will, Yogi Philosophy, Gazing Crystals, etc. A. W. Martens, E. E. 6, Burlington, Iowa.

"Master Key" Success Wonderful. 410 Pages, cloth, \$2.65. Bargain lists 10c. Phillips Library, 1014 Belmont, Chicago

Business Opportunities

Free Book. Start little Mail Order business. Pier, 996 Cortland Street, New York.

You can have a business-profession of your own and earn big income in service fees. A new system of foot correction; readily learned by anyone at home in a few weeks. Easy terms for training; openings everywhere with all the trade you can attend to. No capital required or goods to buy; no agency or soliciting. Address Stephenson Laboratory, 18 Back Bay, Boston, Mass.

Stop Flooding! Be Successful. Operate a Tire Repair Shop. Make big profits in any locality. We teach you and furnish complete equipments \$100 up. Book of Opportunity free. Haywood's, 1312 South Oakley Avenue, Chicago.

Dollars yearly in your backyard. No mushroom dope. Particulars free. Metz, 313 East 89th, New York.

Responsible Manufacturer wants competent men to manage office and salesmen. \$300 to \$1500 necessary; will allow expenses to Trenton if you qualify. Address Manager, 536 Forst Richey Bldg., Trenton, N. J.

Independence—Our twenty scientific processes put you wise. Excellent. We make money, so can you. Only 50c. Holland Laboratory, Box 473, Astoria, Oregon.

Foreign Bonds, stocks, drafts and currencies. All nations. Frank X. Everett Co., 35 Wall St., New York.

\$212.00 a month, spare time work, no manufacturing or canvassing. Want to know how? Particulars for stamp. Specialty Supplies, 410 Mfgs. Bldg., Denver, Colo.

Toymakers—Make money at home. Proposition and blueprints 30c. Weesho-Uko, 31st Station, Detroit, Mich.

Chemistry

Develop latent finger prints with non-eradicating powders. With directions 35 cents prepaid. The Rogers Laboratory, Rib Lake, Wis.

Experimenters Chemical apparatus and radio supplies. Catalog 5c. Chemical Apparatus Co., 4400 West End, Chicago.

Coins

44 Different Coins \$1.00. 50 assorted bills \$1.00 11 different coins or 11 different bills 25c. Otto Oddehon, Independence, Missouri.

Correspondence Courses

Used correspondence school courses. All kinds. Sold on repurchase basis. Big saving. Money back guarantee. Lists free. (Courses bought). Lee Mountain, Pisgah, Alabama.

Duplicator

Rotosend Duplicator, like new, ready to operate, \$30.00. Anton Ponsetti, Spring Valley, Illinois.

Educational

Correspondence courses. All schools. Lowest prices. Terms. Catalog Free. Mention Subject. Fred Goetz, 440-H Sansome, San Francisco.

Used Correspondence School courses save over half. Bargain catalog 1000 courses free. Used courses bought. Students' Exchange, Dept. A, 47 West 42d Street, New York.

Farms, Land, etc.

Seized and sold for taxes. 4 1/2 acres on Georgian Bay \$40.50. 12 1/2 acres for farm \$43.20. 25 acres hunting campsite \$60.30. 50 acres Muskoka Lake District \$63.00. 100 acres hunting and trapping \$61.80. 160 acres farm Canadian West \$315.00. Mining claim near mines that have paid millions \$378.00. These prices are not first payments, or price per acre, but the total amount asked. Also beautifully situated hunting and fishing camps for moose, deer, caribou, ducks, partridge, trout, whitefish, bass, etc., best in North America. Summer cottage sites, farms, heavily wooded tracts, acreages large and small, for pleasure and investment, all offered at ten cents on the dollar of their value, and on easy monthly payments of \$5. and upwards. Send for illustrated list describing the above and hundreds of other properties seized and sold for taxes. Every property is fully described and offered at a stated price. Send no money. Send for list today so you will have first choice. Tax Sale Service, Room 618, 72 Queen Street, West, Toronto 2, Ontario, Canada.

For Advertisers

I write letters, folders, booklets, complete followup for manufacturers, mail order dealers. Long experience. Write for details. L. Taylor, Box 344, Freeport, Ill.

Drawings—Cuts—Printing—that tell your story. Webber Art Engravers, Willoughby, Ohio.

For Inventors

Unpatented Ideas Can Be Sold. I tell you how and help you make the sale. Free particulars (Copyrighted). Write W. T. Greene, 803 Jenifer Bldg., Washington, D. C.

Your Chemical problems solved and working process furnished for Five Dollars. Write me, W. Steadman Richards, Consulting Chemist, Box 2402, Boston, Mass.

Inventors—Get this pamphlet, "What to Invent." No theory or guess work, but things actually asked for by manufacturers. Sent prepaid for only \$1.00. Inventor's Syndicate, 22 Paladium Bldg., St. Louis, Mo.

Cashing In—If you have a practical, useful invention to sell, write promptly American Patents Corporation, Barriester Building, Washington, D. C.

U. S. and foreign patents, trademarks, moderate rates, 25 years experience, George C. Hielnick, 32 Union Square, New York, registered in U. S. and Canada.

Mechanical drawing and designing work. Send sketch for free estimation or write for free particulars. Tobler Engineering Bureau, Box 295, Waterbury, Conn.

Suggestions for inventors as to inventions needed. Price 50c. Tobler, Box 295, Waterbury, Conn.

For the Photographer

Have you a Camera? Write for free sample of our big magazine, showing how to make better pictures and earn money. American Photography, 118 Camera House, Boston, 17, Mass.

Games and Entertainment

Free with \$25 order our large die box. Send 20c for our large catalogue of tricks, puzzles, wigs, sensational escapades. Oaks Magical Co., Dept. 549, Oquirrh, Wis.

Book of Magic, Set Trick Cards and Illustrated Catalog 10c. Piedmont Novelty Shop, 631, Danville, Va.

Magic tricks, books, novelties. Catalogue FREE. Peltier, Dept. 1A, 58 Steele St., Willimansett, Mass.

Tricks—Jokes—Novelties. Catalog free. Kelley, 32 Ellsworth, Worcester, Mass.

Health

Tobacco Habit Banished. No matter how long you have been a victim, no matter how strong your craving, no matter in what form you use tobacco, there is help for you. Just send postcard or letter for our Free Book. It explains everything. Newell Pharmaceutical Co., Dept. 788, Clayton Station, St. Louis, Mo.

Edison's Way—Scientific Proof. Natural Diet, 20c. Better Foods Bureau, Willoughby, Ohio.

Help Wanted

Silvering Mirrors, French plate. Easily learned. Immense profits. Plans free. Wear Mirror Works, Dept. 36, Excelsior Springs, Mo.

All men-women, 18 to 60, wanting to qualify for Government Position. \$140-\$225 monthly, local or traveling, write, Mr. Ozment, 293, St. Louis, Mo., immediately.

Detectives Earn Big Money. Travel. Excellent opportunity. Great demand everywhere. Experience unnecessary. Particulars free. Write. American Detective System, 1974 Broadway, N. Y.

Detectives Needed Everywhere. Work home or travel. Experience unnecessary. Write. George Wagner, former Government Detective, 1968 Broadway, N. Y.

Quality for \$150-\$300 railroad jobs. Fireman, Brake-man, Baggage-man, Sleeping Car or Train Porter. 897 Railway Bureau, East St. Louis, Ill.

Earn \$10 to \$20 per day. Learn Sign Painting. Auto Painting, Paperhanging, Decorating, Show Card writing at a real school—no mall courses. All practical training—short time. Low cost. Chicago Painting School, 132 West Austin Ave., Chicago, Ill.

Be a Detective. Work home or travel. Experience unnecessary. Particulars free. Write, George Wagner, former government detective, 1968 Broadway, N. Y.

Boys make money at home copying names. Address Wright, 150 N. 15th St., East Orange, N. J.

U. S. Government Jobs. Men-women 18 up. \$95 to \$250 month. Steady work. Life positions. Short hours. Vacation with pay. Common education sufficient with our coaching. List positions and full particulars, free. Write today sure. Franklin Institute, Dept. F19, Rochester, N. Y.

How To Entertain

Plays, musical comedies and reviews, minstrel music, blackface skits, vaudeville acts, monologs, dialog, recitations, entertainments, musical readings, stage handbooks, make-up goods, Big catalog free. T. S. Denison & Co., 623 So. Wabash, Dept. 99, Chicago.

Insects Wanted

Why Not Spend Spring, Summer and Fall gathering butterflies, insects? I buy hundreds of kinds for collections. Some worth \$1 to \$7 each. Simple outdoor work with my instructions, pictures, price-list. Send 10 cents (not stamps) for my illustrated Prospectus before sending butterflies. Mr. Sinclair, Dealer in Insects, Dept. 41, Box 1424, San Diego, Calif.

Instruction

Correspondence Courses sold complete; one-third usual prices because slightly used; easy terms; money back guarantee. All schools and subjects. Write for special Free catalog. Courses bought for cash. Economy Educator Service, H202, West 49th St., New York.

Machinery and Tools

Concrete Building Block Machines and Molds. Catalogue free. Concrete Machine Co., 5 N. First St., St. Louis, Mo.

Mail Order Business

\$1 Starts You mail order business. Particulars Free. Reia Co. (Importers), Los Angeles.

Business Progress, Magazine, The mail dealers' guide. Three months trial 25c. Landers Agency, 67 S Upham St., Malden, Mass.

Manufacturing

Mechanical Work: all branches. Perfect models. Articles manufactured to order. Reliable. Parma Engineering Works, Brooklyn Station, Cleveland, Ohio.

New invented articles for manufacturers. Tobler Engineering Bureau, Box 295, Waterbury, Conn.

Miscellaneous

Homeopathic and Brochemic Preparations sent postpaid to all parts of the world. Manual and booklets free. Halscy Bros. Co., 615 St. Clair St., Chicago, Ill. Established 1855.

Motor Campers! We supply camp car plans for amateur builders. Pacific Vehicle Works, Box 574, Los Angeles.

Beautiful registered bull pups \$15. Bulldozers, 501 Rockwood, Dallas, Texas.

Gummed Labels, Name and Address, 500, 2 lines 30c. 3 lines 50c. Catalogue. Eastern Label Co., Y Clintonville, Conn.

Moving Picture Films! Westerns, Comedies, Cartoons, Everything! Big Assortment, \$1.00. Write Quick. No stamps. W. C. Gillis, 52 Winship St., Brighton, Mass.

Motorcycles—Bicycles

Don't buy a Bicycle Motor Attachment until you get our catalogue and prices. Shaw Mfg. Co., Dept. 6, Galesburg, Kansas.

Musical Instruments

Violins—Deep, Mellow, Soulful—on easy credit terms. High grade, wonderful instruments of my own make. Development of many years' experience. Write for book. Gustav A. Henning, 2424 Gaylord St., Denver, Colo.

Old Coins

California Gold, quarter size, 27c; half-dollar size, 53c. Columbian nickel and catalogue, 10c. Norman Shultz, Box 126, Colorado Springs, Colo.

German Govt. Bond, 100,000 Mk. 1923 \$1.40, 5,000,000 Mk bond 1924, \$1.50, 100,000 Mk. bill and catalogue 10c. Norman Shultz, Colorado Springs, Colorado.

Bunker Hill Half Dollar 95c. Columbian Half Dollar 75c. Large Cent and bargain price list 10c. Marcy, Box 483, Muskogee, Okla.

Old Money Wanted

\$2 to \$500 Each paid for hundreds of Old or Odd Coins. Keep all old money, it may be very valuable. Send 10c for new illustrated Coin Value Book, 4x6. Guaranteed Prices. Get Postcard, We pay Cash. Clarke Coin Company, 14 Street, LeRoy, N. Y.

Patent Attorneys

Patents. Send for free booklet. Highest references. Best results. Promptness assured. Send model or drawing for examination and opinion. Watson F. Coleman, Patent Attorney, 644 G Street, N. W., Washington, D. C.

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"Inventor's Advisor," the valuable Patentbook with 139 Mechanical movements and illustrations, sent free upon request. M. I. Labiner, Patent Attorney, 3 Park Row, New York.

Get your own patents. Application blanks, complete instructions \$1. Cutting Bros., Campbell, Calif.

Patents. Time counts in applying for patents. Don't risk delay in protecting your ideas. Send sketch or model for instructions or write for Free book, "How to Obtain a Patent" and "Record of Invention" form. No charge for information on how to proceed. Commitment strictly confidential. Prompt, careful, efficient service. Clarence A. O'Brien, Registered Patent Attorney, 92F Security Bank Building (directly across street from patent office), Washington, D. C. See page 1041.

Patents

Patents Prepared. Comprehensive, experienced development. Finished without delay for disclosing. Owen Bldg., York.

Patents: Trade Office, Consular, 150 Nassau

Inventors: Obtain simple Patent book Patent Lacey, 614 F

Millions spent Patent yours are how to protect we help you Kresge Bldg., Wash

Patents—Send signed and witnessed Lancaster and All United States and D. C.

Monroe E. Miller, Oiler, Lawyer, Mechanical, priority record blank grat

Patents: My fee in instant Frank T. Fuller, Washington

Richard E. Babcock, Patent Trust Bldg., Washington, D. C.

Patents

Inventions commercialized. Patented or unpatented. Write Adam Fisher Mfg. Co., 205 Enright, St. Louis, Mo.

Photography

Send Us Your Films. We develop, print, enlarge. Careful attention to details that make superior quality pictures. Rolls developed 9c. prints 3c each. trial 6"x8" enlargement in folder 40c. Wellington Photo Services, Riverdale, Md.

Photoplays Wanted

\$\$\$ For Ideas. Photoplay Plots considered in any form. Write for free booklet. Universal Scenario Corporation, 223 Security Bldg., Western and Santa Monica Blvd., Hollywood, Calif.

Printing Outfits and Supplies

Print your own cards, stationery, circulars, paper, etc. Complete outfits \$8.85; Job Presses \$12, \$35; Rotary \$150. Print for others, big profit. All easy, rules sent. Write for catalog presses, type, paper, etc. Press Company, A-6 Meriden, Conn.

Build Your Own: \$1.00 up. Simple, practical. Blue Print, etc., 50c. Arts-Craft Press, Willoughby, Ohio.

Salesmen Wanted

Take orders for coffee, sugar, flour, meats, canned goods, staple groceries, also paints, radio sets, tires, auto and tractor oils. No capital or bond required. We deliver and collect. Permanent business. Big pay. Write at once. Hitchcock-Hill Co., Dept. 83, Chicago.

Sells for \$9.75. Prints ad on wrapping paper, envelopes, etc. \$4.00 commission. Send 10c for sample work. Automatic Ad-Stamper, Joplin, Mo.

Song Poems

Song Poem Writers—Send for proposition. Ray Hibbler, 121, 4010 Dickens Ave., Chicago.

Song poems wanted. Radio Publicity, Bureau S. 24 Times Square Station, New York.

Stammering

St-Stu-T-T-Tering and Stammering Cured at Home. Instant booklet free. Walter McDonnell, 105 Arcade, 1126 Granville Ave., Chicago, Ill.

Stop Stammering. All speech defects successfully corrected. Samuel Robbins, 399 Boylston St., Boston.

Stamps and Coins

Stamps 100 All Different 3 cents. S. I. Quaker Stamp Company, Toledo, O.

Stories or Manuscripts Wanted

Stories, poems, descriptive articles, plays, etc., are wanted for publication. Submit Mss or write Literary Bureau, 165, Hannibal, Mo.

Typewriters and Ribbons

Used Typewriters, \$16.50 Guaranteed. Ribbons 3 for \$1.00. Wm. Phelps, 4 Franklin Street, New York.

Typewriters, all standard makes, \$10 up. Fully guaranteed. Free trial. Write for complete illustrated lists. Northwestern Exchange, 121 N. Francisco Ave., Chicago.

Ventriloquism

Ventriloquism taught almost anyone at home. Small cost. Send 2c stamp today for particulars and proof. Geo. W. Smith, Room 877, 125 N. Jefferson Ave., Peoria, Ill.

Wanted

Detectives Earn big Money. Work home or travel. Experience unnecessary. Write. George Wagner, former Government Detective, 1968 Broadway, N. Y.

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Please submit me for free examination, HAWKINS ELECTRICAL GUIDE (Price \$1 a number). Ship at once prepaid, the 10 numbers. If satisfactory, I agree to send you \$1 within seven days and to further mail you \$1 each month until paid.

Name

Occupation

Employed by

Home Address

Reference

S. I., April

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