August

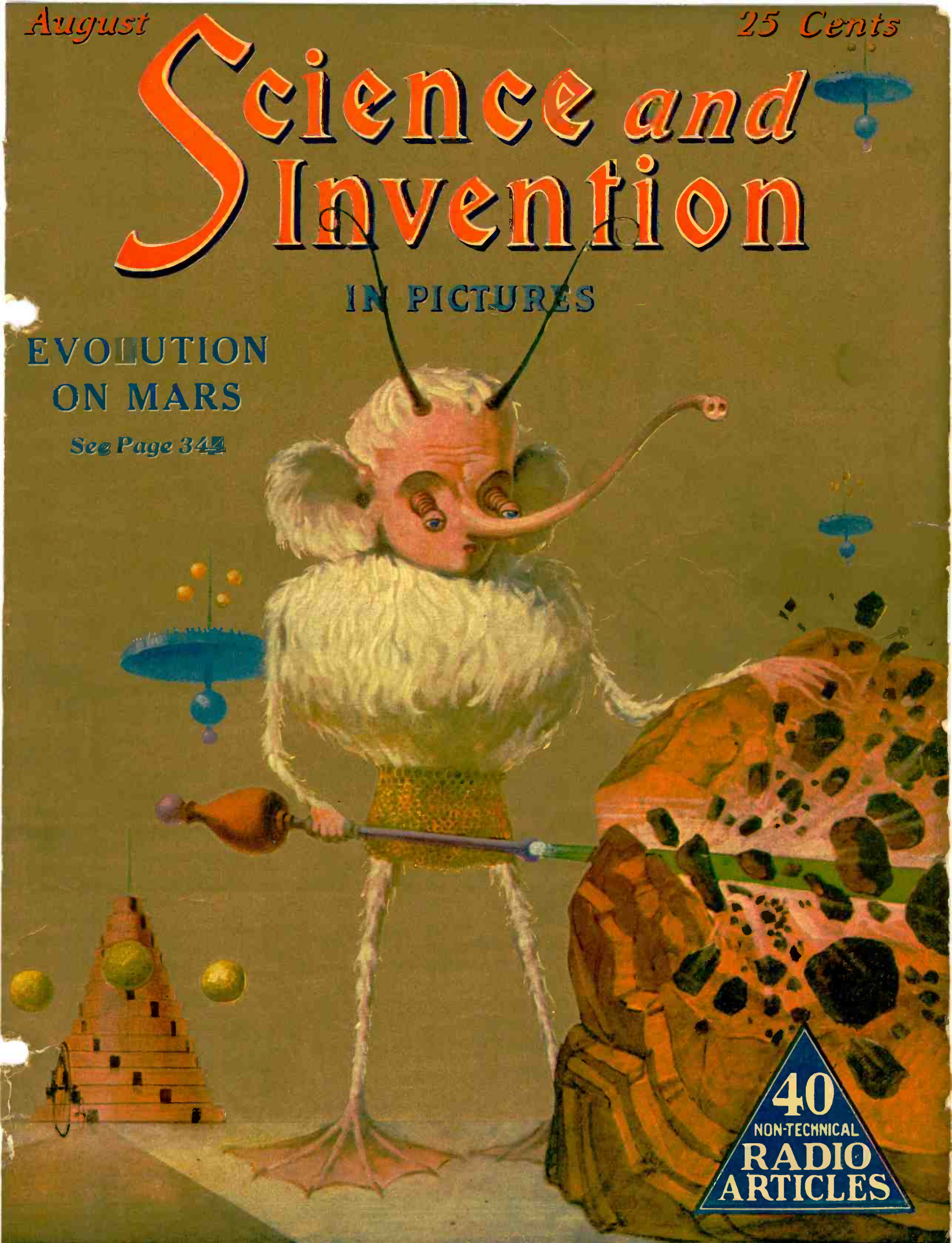
25 Cents

Science and Invention

IN PICTURES

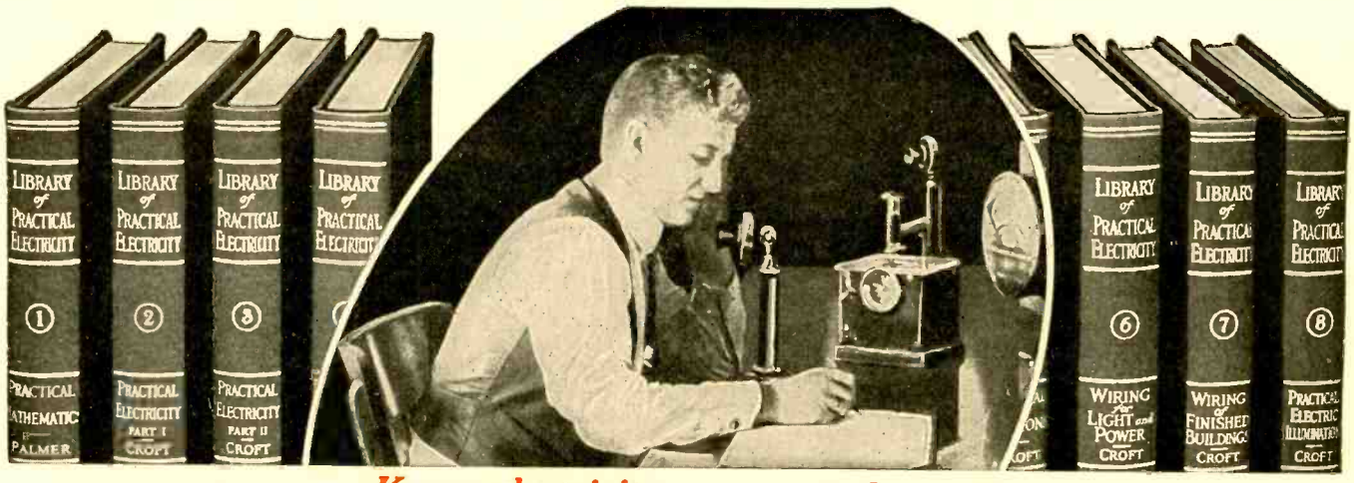
EVOLUTION ON MARS

See Page 344



40 NON-TECHNICAL RADIO ARTICLES

EXPERIMENTER PUBLISHING COMPANY, NEW YORK, PUBLISHERS OF
RADIO NEWS SCIENCE & INVENTION PRACTICAL ELECTRICS MOTOR CAMPER & TOURIST



Know electricity as experts know it
and get an expert's pay

Get busy with Croft this summer for a big pay job in the fall

YOU have a great chance this summer to prepare yourself for a bigger and better job in the fall. A few of your spare hours each week with the Croft books and at the end of the summer you will have a practical knowledge of electricity that will be worth money to you—a knowledge of how to do the work that draws big pay.

The Croft books were written by a man who has spent 20 years in electrical work. He has done the work you are doing now and has risen to his present position in the electrical world simply by studying his job. If you really want to be earning more money by September or October, get busy with Croft now—this month.

The Croft Library of Practical Electricity

A combined home-study course and reference library

8 volumes—3000 pages—2100 illustrations—flexible Keratol binding

THERE is plain evidence before us that opportunities in the world of electricity are increasing constantly. Today there are more big-paying positions open than at any time in the history of electricity—even during the high production period of the war. New uses are being found for electricity every day, and the progress of the world more and more depends upon it.

Terrell Croft is doing his share in teaching men the correct principles of electrical practice. He knows the game from experience. He has poured out all his knowledge, all the short cuts, all the time savers, in language that anyone can easily grasp. Yet the text is so scientifically correct that thousands of the highest paid electrical engineers are using the books as a reference set.

Thousands of problems at your fingers' ends

Three thousand pages, with twenty-one hundred of the clearest illustrations ever put into book form. Each of the eight volumes is indexed so that everything you want to know about electricity is at the fingers' ends. And when you find what you want, there is not merely a short question and a short answer. You are told everything you want to know. The explanation is clear to you, regardless of whether you have had a previous knowledge of electricity or not.

Croft teaches you electrical practice complete. He takes you in quick, easy steps from the simplest principles to the complete and economical operation of a great central station.

He tells you the things you need to know about motors, generators, armatures, commutators, transformers, circuits, current switch-boards distribution systems—electrical machinery—wiring for light and power—wiring of finished buildings—underwriters and municipal requirements—how to do a complete job, from estimating it, to completion—illumination in its every phase—the latest and most improved methods of lighting—lamps and lighting effects, etc.

No other course or set of books sticks so closely to actual practice as the Croft Library. It is complete—it is up to date—it is practical—it is easily understood. It contains a mine of methods and working details. It tells you all that Croft has learned in twenty years of shirtsleeve practice. It enables you to master electricity quickly and thoroughly—to know it as experts know it.

This coupon starts you to bigger pay! →

In these eight books Croft gives you the essentials of a complete electrical education—he gives you the sound, hardheaded facts you need to fit yourself for a bigger job with bigger pay.

Now only $19.50—no money down
$2.00 a month
Sent for your free examination

The Croft Library has always been the leader among the higher grade electrical libraries. At its new price of $19.50 it is the biggest value in electrical books on the market. Men who are using Croft will tell you that no set of electrical books published, regardless of price, can equal the Croft Library in completeness, up-to-date-ness and all-round practical value. The price is cut, but not the value.

Fill in and mail the coupon attached and we will send you the entire set of eight volumes for ten days' Free Examination. We take all the risk—pay all charges. You assume no obligation—you pay nothing unless you decide to keep the books. Then $1.50 in ten days and the balance at the rate of $2.00 a month. Send the coupon NOW and see the books for yourself.

Send the coupon and see these great electrical books for 10 days FREE!

FREE EXAMINATION COUPON

McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York

Gentlemen:—Send me the LIBRARY OF PRACTICAL ELECTRICITY (shipping charges prepaid), for 10 days' free examination. If satisfactory, I will send $1.50 in ten days and $2 per month until $19.50 has been paid. If not wanted, I will write you for return shipping instructions. (Write plainly and fill in all lines.)

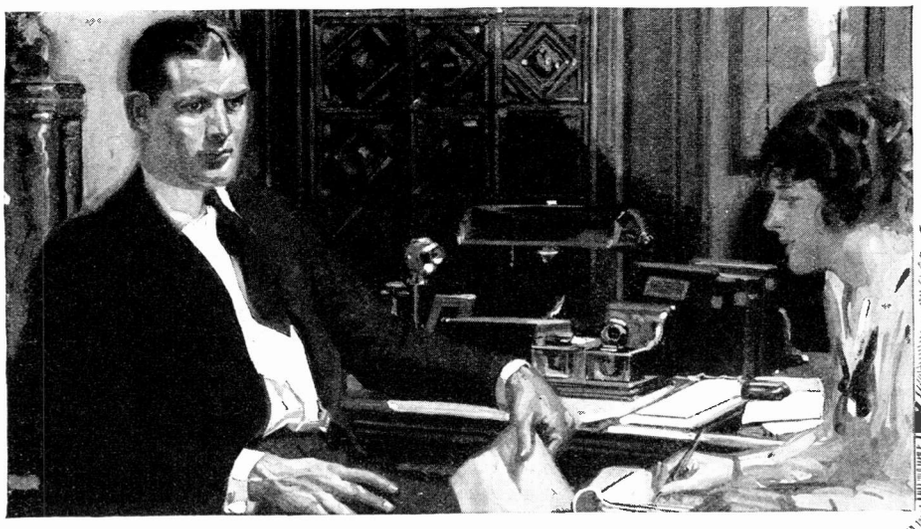
Name .....

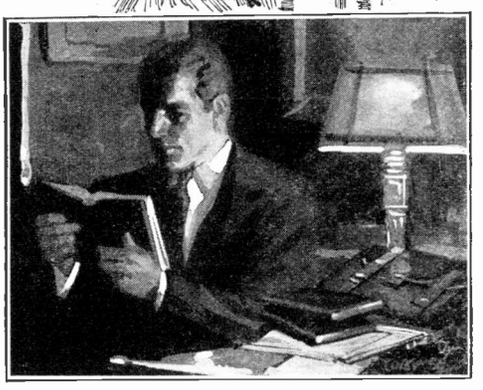
Home Address .....

City and State .....

Firm or Employer .....

Occupation S.I.-8-24





Making Successful Men
by Home-Study Training

How can I make more money? How can I advance more rapidly in business? Literally millions of untrained men—yourself, perhaps, among them—are continually disturbed by those two questions.

"Be industrious; keep everlastingly at it"—that's the way the writers of *copy-book maxims* would tell you to go about it. But honestly—are you fooled by that sort of talk? Why, you yourself know dozens of fellows who work just as hard as beavers, yet draw barely enough to keep them alive!

Argue it any way you like, it takes something beside mere *work* to push men ahead—it takes *specialized* work.

And to suggest, for a second, that an untrained man—no matter how hard he works—is going to be promoted to a highly specialized position—such as that of Auditor, or Traffic Manager, or Sales Executive, or Expert Correspondent, or Production Manager, or Legal Counsellor—without first *equipping* himself for that position, is as absurd as to intimate that the boatman in the park who has been on the job for twenty years is likely to be chosen captain of a trans-Atlantic liner!

* * *

Recognizing these facts—and surely no one can dispute them—what is the wise thing to do to change one's situation for the better?

Many a happy-go-lucky chap will tell you that all you need do is to keep your eyes open and promotion will take care of itself.

It will. *But, oh, how slowly!*

While one man is advancing by this tedious route from $25-a-week to $30-a-week to $35-a-week, another chap, not a bit smarter than he, is climbing from $15-a-week to $30-a-week to $50-a-week to $100-a-week.

If you doubt it, look about you! Talk with the men still in their twenties and early thirties who are swinging $5,000 jobs!

No—there's more to advancement than merely "catching onto things." TIME is the all-important factor—and that is the big reason why thousands of earnest men have refused to wait, but have turned instead to LaSalle Extension University and have shortened by many years their journey to success.

That they—in so doing—have acted to their own advantage is borne out by the fact that during only three months' time as many as 1193 members reported definite advancement which they were frank to attribute to home-study training under the LaSalle Problem Method. The total salary-increases so reported amounted to $1,248,526, *an average increase per man of eighty-nine per cent.*

* * *

Your future is, of course, your own problem—and no one can solve it but yourself. If you are content to drift, you will find plenty of company though little profit.

If, on the other hand, you are really in earnest when you say that you want to get ahead in business, you will find both companionship and gain in home-study training under the LaSalle Problem Method.

Below this text there's a coupon—very similar to the one which has set many, many thousands on the path to success.

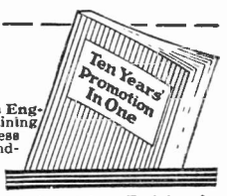
A good way to gauge your strength of purpose is—by what you do with that coupon—NOW.

LA SALLE EXTENSION UNIVERSITY

The Largest Business Training Institution in the World

LASALLE EXTENSION UNIVERSITY Dept. 8384-R Chicago, Illinois

Please send me catalog and full information regarding the course and service I have marked with an X below. Also a copy of your book, "Ten Years' Promotion in One," all without obligation to me.



☐ **Business Management:** Training for Official, Managerial, Sales and Departmental Executive positions.

☐ **Modern Salesmanship:** Training for position as Sales Executive, Salesman, Sales Coach or Trainer, Sales Promotion Manager, Manufacturer's Agent, Solicitor, and all positions in retail, wholesale, or specialty selling.

☐ **Higher Accountancy:** Training for position as Auditor, Comptroller, Certified Public Accountant, Cost Accountant, etc.

☐ **Law:** Training for Bar; LL. B. Degree.

☐ **Commercial Law:** Reading, Reference and Consultation Service for Business Men.

☐ **Traffic Management—Foreign and Domestic:** Training for position as Railroad or Industrial Traffic Manager, Rate Expert, Freight Solicitor, etc.

☐ **Railway Station Management:** Training for position of Station Accountant, Cashier and Agent, Division Agent, etc.

☐ **Banking and Finance:** Training for executive positions in Banks and Financial Institutions.

☐ **Modern Foremanship and Production Methods:** Training for positions in Shop Management, such as that of Superintendent, General Foreman, Foreman, Sub-Foreman, etc.

☐ **Industrial Management Efficiency:** Training for positions in Works Management, Production Control, Industrial Engineering, etc.

☐ **Personnel and Employment Management:** Training in the position of Personnel Manager, Industrial Relations Manager, Employment Manager, and positions relating to Employee Service.

☐ **Modern Business Correspondence and Practice:** Training for position as Sales or Collection Correspondent, Sales Promotion Manager, Mail Sales Manager, Secretary, etc.

☐ **Expert Bookkeeping:** Training for position as Head Bookkeeper.

☐ **Business English:** Training for Business Correspondents and Copy Writers.

☐ **Commercial Spanish:** Training for position as Foreign Correspondent with Spanish-speaking countries.

☐ **Effective Speaking:** Training in the art of forceful, effective speech, for Ministers, Salesmen, Fraternal Leaders, Politicians, Clubmen, etc.

☐ **C. P. A. Coaching for Advanced Accountants.**

Name ..... Present Position ..... Address .....

Vol. XII.
Whole No. 136

Science and Invention

FORMERLY
ELECTRICAL EXPERIMENTER

August, 1924
No. 4

Members Audit Bureau of Circulations

EDITORIAL & GENERAL OFFICES: 53 Park Place, New York City
Published by Experimenter Publishing Company, Inc. (H. Gernsback, Pres.; S. Gernsback, Treas.; R. W. DeMott, Sec'y).
Publishers of SCIENCE AND INVENTION, RADIO NEWS, PRACTICAL ELECTRICS and MOTOR CAMPER & TOURIST.

24 Table of Contents for August

HOW TO SUBSCRIBE FOR "SCIENCE AND INVENTION." Send your name, address and remittance to Experimenter Publishing Co., 53 Park Place, New York. Mention the name of the magazine you are ordering. We also publish RADIO NEWS, PRACTICAL ELECTRICS and MOTOR CAMPER & TOURIST.

RATES AND TERMS. The subscription rate for SCIENCE AND INVENTION is $2.50 per year (12 numbers). When remitting do so by check, money order or registered letter. If cash is enclosed. Avoid sending cash through the mail if possible. Subscriptions for less than one year are not accepted. Subscriptions may be made in combination with RADIO NEWS, PRACTICAL ELECTRICS or MOTOR CAMPER & TOURIST with considerable saving. Send postal for special rates. Subscriptions start with the current issue, unless otherwise ordered.

POSTAGE. We prepay postage in all parts of the United States, Mexico and Island possessions. For foreign or Canadian subscriptions we require 50 cents in addition to the subscription price for additional postage charges.

CHANGE OF ADDRESS. Notify us as far in advance as possible. It requires several weeks to make an address change on our records. Always write clearly, giving your old address as well as your new. ON EXPIRATION of your subscription we enclose a renewal blank in our last number to you and notify you otherwise. Unless we receive your order for a renewal, with your remittance, we stop our delivery to you on expiration.

COMMUNICATION to us should always bear your full name, address and when possible the number which appears on your wrapper every month.

SCIENCE AND INVENTION is published on the 25th of each month. There are 12 numbers per year. Subscription price is $2.50 a year in U. S. and possessions. Canada and foreign countries $3.00 a year. U. S. coin as well as U. S. stamps accepted (no foreign coin or stamps). Single copies, 25 cents each. A sample copy will be sent gratis on request. Checks and money orders should be drawn to order of EXPERIMENTER PUBLISHING CO., Inc. If you change your address notify us promptly, in order that copies are not miscarried or lost.

All communications and contributions to this journal should be addressed to Editor, SCIENCE AND INVENTION, 53 Park Place, New York City, N. Y. Unaccepted contributions cannot be returned unless full postage has been included. ALL accepted contributions are paid for on publication. A special rate is paid for novel experiments; good photographs accompanying them are highly desirable.

SCIENCE AND INVENTION. Monthly. Application as second class matter made at New York, N. Y. with additional entry at Long Island City, N. Y. Post Office, under act of Congress of March 3, 1879, formerly entered at Jamaica, N. Y. Title Registered at the Patent Office.

SCIENCE AND INVENTION is for sale at all newsstands in the United States and Canada; also at Brentano's, 37 Avenue de l'Opera, Paris. Member of the Audit Bureau of Circulations.

New York City
General Advertising Dept.
53 Park Place

Western Advertising Representatives
Finucan & McClure
720 Cass St., Chicago, Ill.

Pacific Coast Advertising Representatives
A. J. Norris Hill Co.
Hearst Bldg., San Francisco, Calif.

Kansas City Advertising Representatives
George F. Dillon
Republic Building, Kansas City, Mo.

Be an Electrical Expert

Get Ready For a Big Pay Job

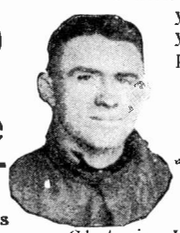
Men like you are needed right now to fill big-paying jobs in the electrical field. There never was a time when opportunities for money-making were as good as they are now. Good jobs are open everywhere to men who know "what's what." Electrical Experts earn from $12 to $30 a day. Even the ordinary electricians get top-notch pay. Why don't you get in on this and get a real man's size job now? With my simplified Electrical Course I can quickly fit you to hold one. Read W. E. Pence's letter below. This is only one of thousands of such letters I have received.

You Can Be a Big Money Maker

I have trained over 20,000 men in electricity—thousands of successful men all over the world attribute their success to my training. I can make you successful too. In fact I will guarantee your success. If you will follow my home-study course you can become an expert, drawing a fat salary, in the same time it takes you to get a little raise in the work you are doing now.

Jumps From $125 A Month to $750 and Over

READ the Story of W. E. Pence



W. E. Pence in his working togs

Chehalis, Wash.

Mr. Cooke:—

When I enrolled with you less than a year ago I was a common mechanic earning $25 to $30 a week. Today I am an "Electrical Expert" with a business of my own that gives me a clear profit of over $750 a month.

I have more work than I can do. The people around Chehalis come to me to fix their starters, generators and ignition troubles because they know that I know how to do it right.

My success I owe to you, Mr. Cooke. The thorough practical training which you gave me through your Easily-learned Home Study Course in Electricity has made me an independent, highly respected business man in this community. Sincerely yours, W. E. Pence.

Age or Lack of Education No Handicap

No matter how old or how young you are, or what education you have, there is a real future for you in electricity. If you can read and write I can put you on the road to success. I can help you to a position that will make people admire you and look up to you.

Cash In on Your Spare Time

Use your spare time to get a better job. Most of us have enough spare time every day to sell a little at about $10.00 an hour. Sell some to yourself at this price. Watch how quick you will earn the money back if you put the time into study.

Electrical Working Outfit Free

Every man who enrolls for my electrical course gets a big outfit of tools, material and instruments free. This includes an electric motor and other things not usually found in a beginner's outfit. These are the same tools and the same material you will use later in your work. Everything practical and good right from the start.

I Guarantee Your Complete Satisfaction

I am so sure I can make a big pay electrical expert out of you that I guarantee your success. I agree under bond to return every cent you pay me for tuition when you have finished the course, if you are not satisfied that it is the best investment you have ever made. If you don't make good, this million dollar institution will.

Act Right Now

Let me send you my big free book giving details of the opportunities electricity offers you and a sample lesson also free. Mail the coupon and get this at once. Learn how other men "got themselves ready to hold good paying jobs" and how I can help you do the same. This is your big chance—take it.

Earn $75 to $200 a Week

L. L. COOKE, Chief Engineer
CHICAGO ENGINEERING WORKS, Dept. 2-C
2150 Lawrence Ave., Chicago

L. L. Cooke
Chief Engineer, Chicago Engineering Works,
Dept. 2-C 2150 Lawrence Ave., Chicago, Ill.

Dear Sir: Send me at once Sample Lessons, your Big Book, and full particulars of your Free Outfit and Home Study Course—all fully prepaid without obligation on my part.

Name .....

Address .....

SCIENCE and INVENTION READERS' BUREAU

Time and Postage Saver

IN every issue of SCIENCE and INVENTION you undoubtedly see numerous articles advertised about which you would like to have further information.

To sit down and write an individual letter to each of these respective concerns, regarding the article on which you desire information, would be quite a task.

As a special service to our readers, we will write the letters for you, thus saving your time and money.

Just write the names of the products about which you want information, and to avoid error the addresses of the manufacturers, on the coupon below and mail it to us.

If the advertiser requires any money or stamps to be sent to pay the mailing charges on his catalogue or descriptive literature, please be sure to enclose the correct amount with the coupon.

We will transmit to the various advertisers your request for information on their products.

This service will appear regularly every month on this same page in SCIENCE and INVENTION.

If there is any Manufacturer not advertising in this month's issue of SCIENCE and INVENTION from whom you would like to receive literature, write his name, address and the product in the special section of the coupon below.

TEAR ALONG THIS LINE

READERS' SERVICE BUREAU,
Experimenter Publishing Co., Inc., 53 Park Place, New York, N. Y.

Please advise the firms listed below that I would like to receive detailed information on their product as advertised in the ..... issue of SCIENCE and INVENTION.

NAME	ADDRESS	List here specific article on which you wish literature.	If Catalogue of complete line is wanted, check in this column.

NOTE—This Form Should Not Be Used For Technical Questions.

If you desire any special information from a manufacturer whose advertisement does not appear in this month's issue, use this space.

.....

.....

.....

Your own name here.....

If you are a dealer check here. ☐

Address.....

City..... State .....

Volume XII
Whole No. 136

Science and Invention

AUGUST, 1924
No. 4

H. GERNSBACK, EDITOR AND PUBLISHER
H. WINFIELD SECOR, ASSOCIATE EDITOR
T. O'CONOR SLOANE, Ph.D., ASSOCIATE EDITOR

Editorial and General Offices, - - - 53 Park Place, New York

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

Mars

By HUGO GERNSBACK

ON August 22nd of this year the planet Mars will be in opposition to the earth. In their journey around the sun the two planets vary considerably in their distances from each other, due to the fact that the earth runs on the inner track and Mars on the outer track. On very rare intervals the two planets line up so that the Sun, Earth and Mars lie in the one straight line. This position is called *opposition* because Mars and Earth oppose each other at close points of their orbits.

This year the distance that separates the two planets will be only 34,600,000 miles, which is less than it has been for over one hundred years. The earth is a globe of roughly 8,000 miles diameter, while Mars, a much smaller body, is not much larger than our Moon, measuring only some 4,300 miles in diameter.

I BELIEVE

that man's greatest enemy is his ignorance.

Scientists and astronomers are agreed that when the solar system came into being all the planets were born at about the same time. Now we know from our physics and everyday observation that the larger a body the longer it takes to cool. A pebble heated red hot when exposed will cool in a few minutes. A large stone, however, when similarly heated will take hours to cool. A large steel dynamo casting used in our mammoth generators will take days to acquire the temperature of the air. It follows, therefore, that if Mars cooled down from its original liquid state in so many million years, it would take the earth possibly ten times as many million years to do the same, because it is so much larger a body. Just as Jupiter and Saturn and some of the other major planets are even today in a molten, or gaseous, non-solid state to remain so for ages to come.

Right before our eyes we have another similar example, namely our own moon, which, having cooled down millions of years ahead of the earth, has by this time become a barren world without water and without atmosphere, unable to support life as we know it. Whatever water and air there was on the moon has been absorbed by the rocks and the crevices and has vanished from the surface to the interior. If there is any life on the moon it certainly will not be on the surface, but will be on the interior of the satellite. An analogous condition we find on Mars, which body, being a trifle larger than the moon, has not as yet become a totally dead world, but is rapidly approaching this state.

I BELIEVE

that one of the scarcest things in this world is an original and practical idea.

Our astronomical instruments show us that whereas the moon has practically no atmosphere at all, Mars still has left a vestige of [illegible] atmosphere capable of sustaining life as we know it.

To be sure, Mars is much further away from the Sun than is the Earth and, therefore, does not get as much light and heat; furthermore, the denser and moister the atmosphere of a planet the better that planet will hold its heat, because the atmosphere absorbs the heat readily, but does not radiate it as fast into space. The thinner the atmosphere the sooner the heat will be lost, consequently the mean temperature of Mars, according to Lowell, will be a good deal lower than the mean temperature on earth. It probably will be freezing on Mars nearly all of the year, even at the equator, and temperatures below zero are rather the rule than the exception. But all this does not argue against life—quite the contrary. Life, one of the strangest phenomena of nature, has a habit of manifesting itself under even almost impossible conditions. We find life at the bottom of the ocean, where the pressure is so tremendous that before we had deep sea fishing apparatus scientists figured out mathematically that it would be impossible for life to exist at such depths. Nevertheless thousands of different living specimens have been brought up from ocean depths of over 20,000 feet.

There is life on top of the Himalayas, where the atmosphere is extremely thin. There is life at the poles of our Earth, where the temperatures are below zero for the greater part of the year. There is even life in a cake of ice.

Svante Arrhenius, the famous physicist, has calculated that life can even be transmitted from planet to planet on life bearing spores, which spores are propelled by the pressure of the Sun's light rays. Consequently, if life cannot exist on Mars, as some scientists claim, all these arguments should be taken into consideration. Of course, we cannot guess as to what form life might take on Mars. We also cannot say positively that Mars is inhabited by intelligent thinking creatures, but the chances are very much in the affirmative.

I BELIEVE

that coming inventions cast their shadows before.

Throughout nature we find that everything is duplicated. We find exactly the same elements on our earth as in the stars, billions of miles away from us and millions of light years distant. In fact, we find the same conditions throughout the universe. We find the same stars, the same nebulae throughout the universe; why, then, should there be any exception as to life? Logic opposing these views would seem ridiculous on the face of it. Nature nowhere runs in singles. There is duplication galore and life on Mars is no exception to this fundamental rule.

The universe contains not thousands, not millions, but actually billions of stars. These stars are huge suns, the same as our own sun.

Millions of these suns have their own planetary systems, the same as has our own sun. Throughout our universe, therefore, there are hundreds of thousands of planetary systems, probably the exact duplicates of our own, some on a smaller scale, some on a larger scale.

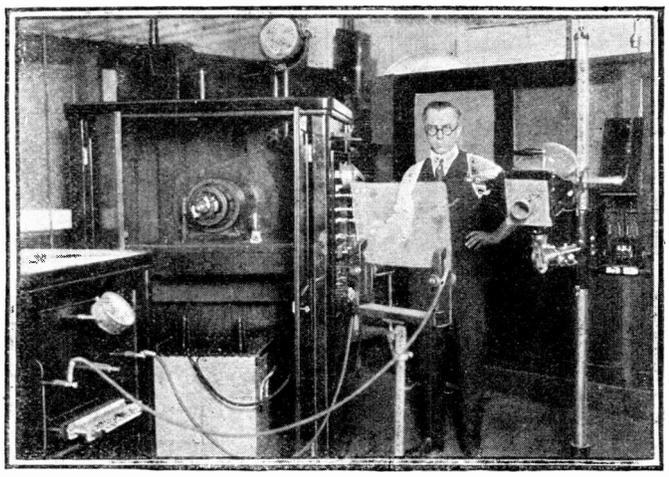
Spectrum analysis tells us that nearly all of these stars have the same chemical elements as our own sun, although billions of miles separate them from each other; consequently their planets will have the same make-up as our own earth. This refers only to our own universe, but again it must be remembered that our universe, large as we think it is, is itself only a small grain of sand in the entire make-up of the larger world of which our universe is only a microscopical part. To pick out our puny little earth, less than a pin-point in a mountain and to think that this little speck of dust, of all others, was singled out to bear life, surely is a grotesque thought and unworthy of serious consideration.

In summing up, it may be said that the chances overwhelmingly favor the existence of life on Mars either past or present, because it is possible that after Mars had attained its greatest point of evolution, the intelligent rulers of the planet gradually became extinct due to the lack of air and lack of heat. But there certainly will have remained sufficient life on Mars today to support a number of low organisms the same as probably would be found on our moon today.

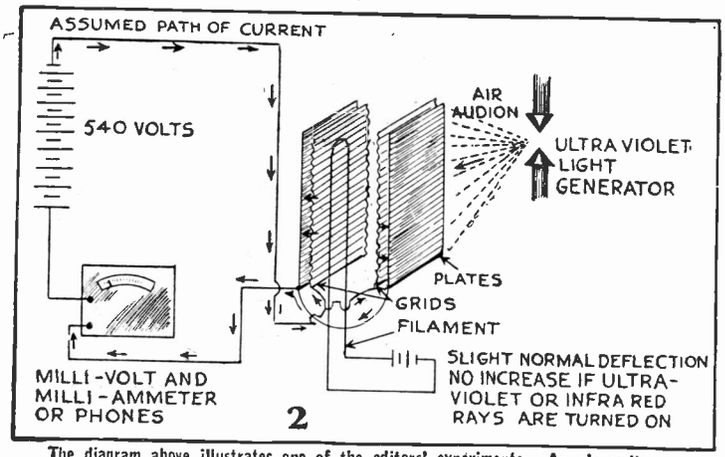
The Diabolic Ray--

By C. A. OLDROYD, A.E., H. W. SECOR, E.E., and J. H. KRAUS

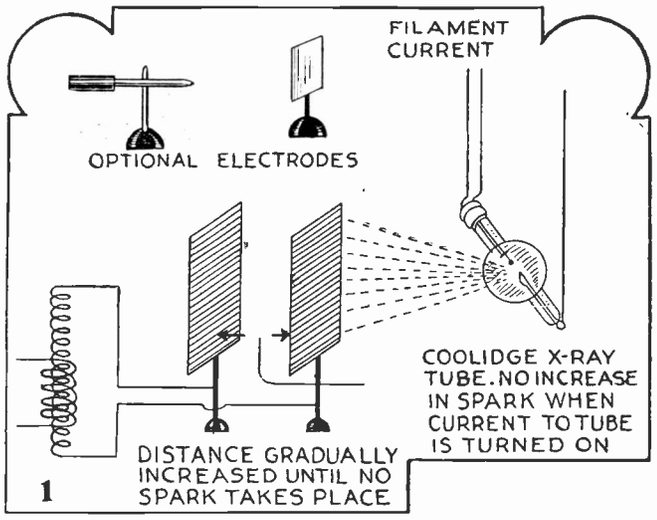
The daily press has just announced that Mr. H. Grindell-Matthews, a British inventor living in London, has discovered a new death-dealing ray. The article on the page at the right was officially passed upon by the inventor himself. Immediately upon receiving the report of the ray discovery, American scientists voiced arguments and the American press published statements of "Doubting Thomases." The Editors of SCIENCE AND INVEVNTION, on the other hand, went about a series of systematic researches, and arrived at the conclusion that if a new ray unknown to science (which is doubtful) has not been discovered, known rays could not possibly produce the results claimed.

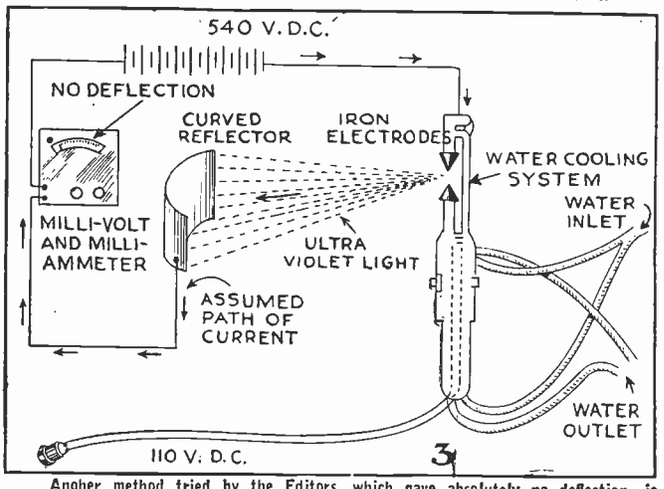


The above photo was taken in the X-ray testing laboratories of the Kny-Scheerer Company. The Coolidge X-ray tube shown gave a perfect skiagraph of the hand, when the individual was 100 feet from the tube. There was a brick wall one and one-half feet thick between the individual and the tube. These powerful rays did not ionize the air sufficiently to permit passage of a spark between metal plates one foot from the tube.

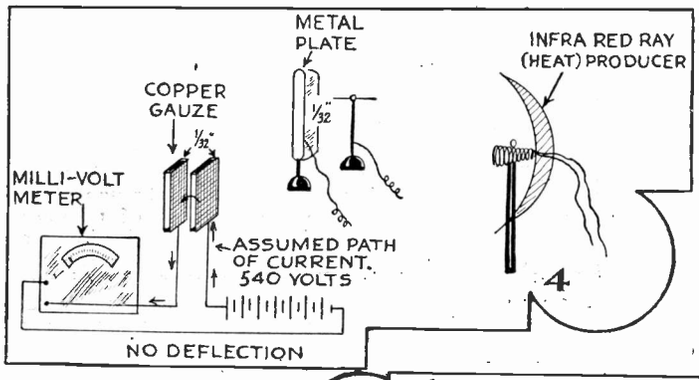


The diagram above illustrates one of the editors' experiments. An air audion had its filament heated by means of a battery. This audion is the same as the vacuum tube used in radio receiving sets except that it does not possess a glass bulb. Current at a pressure of 540 volts was impressed on the grid, and although a minute deflection of the milli-voltmeter was noticed when the filament was incandesced, the deflation did not increase under influence of ultra-violet or infra red rays. Arrows indicate the assumed path of the current.

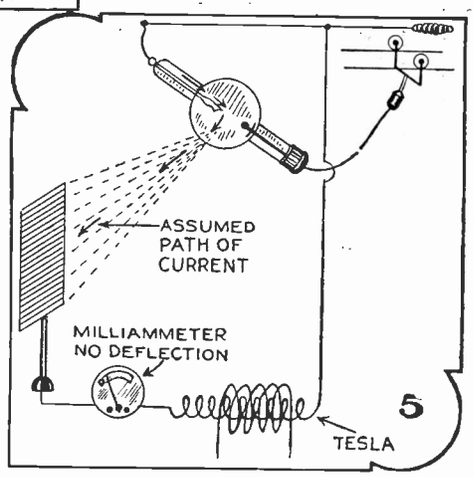


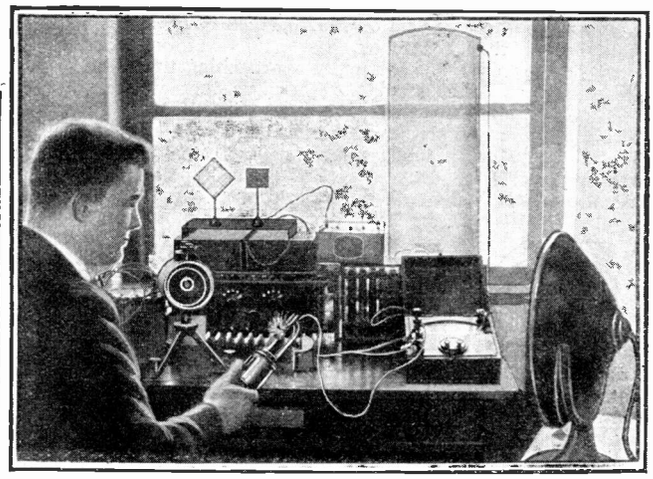


Another method tried by the Editors, which gave absolutely no deflection, is shown above. One lead of the direct current circuit was attached to the ultra-violet ray electrodes which were held in the focus of a parabolic mirror.



In the photo at the top of the page the X-ray machine shown delivered a full ten kilowatts while the current impressed on the two metal screens was under a pressure of 500,000 volts. The plates were separated gradually until the spark would no longer leap across the air gap (un-ionized), yet the X-rays did not ionize the air to such an extent that the current would leap across the gap. The optional electrodes and the diagram of the circuit is illustrated in Fig. 1. We are safe to assume that X-rays are not used in Grindell-Matthews' system. In diagram 4, infra-red rays were used, and although the current was at a pressure of 540 volts, the air gap of one-thirty-second of an inch sufficed to prevent a passage of current. The system shown at the right was subsequently used, and again the possibility of employing X-rays was definitely eliminated.

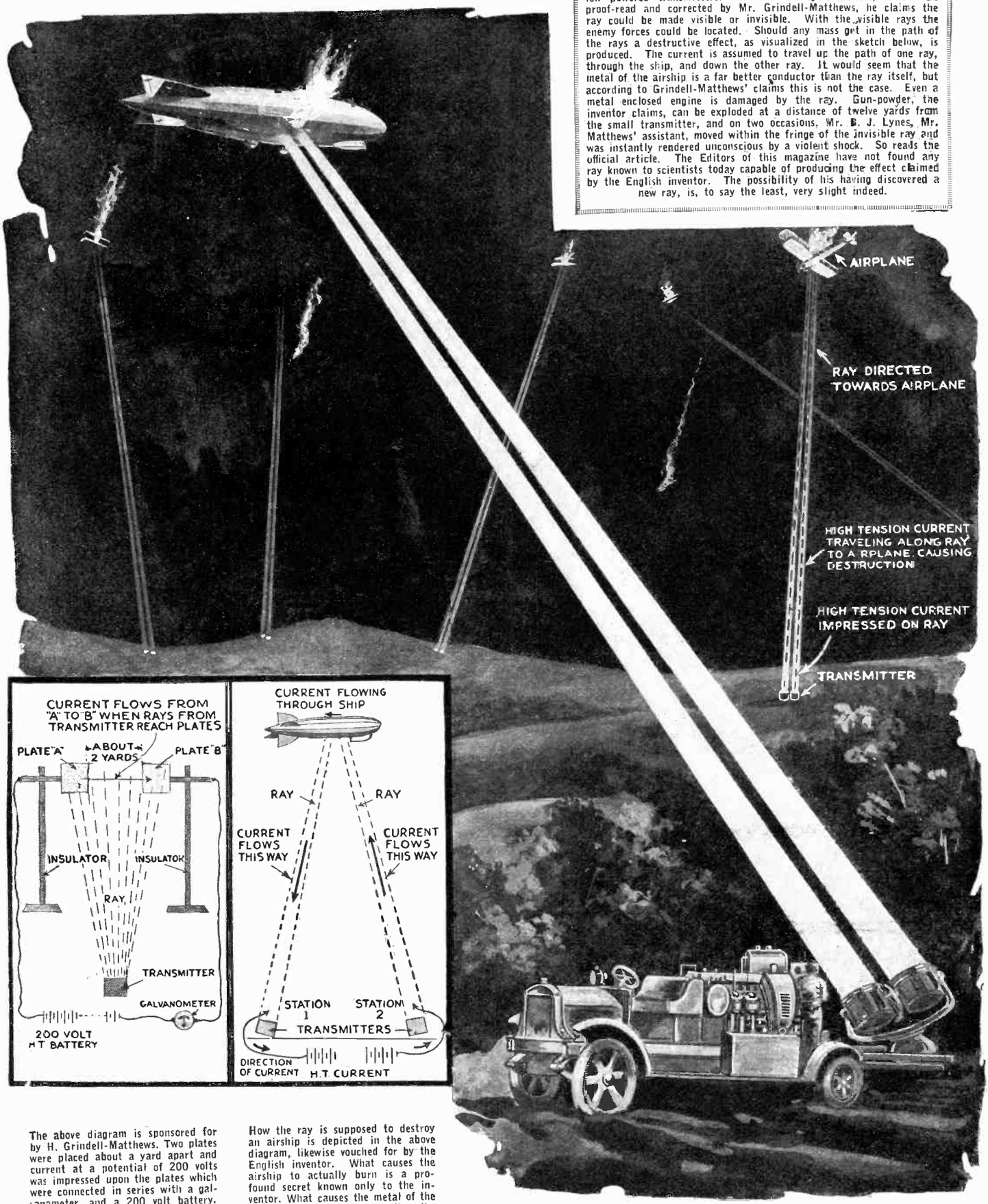




In the above photo the ultra-violet ray producers are shown. Notice the various types of screens and sensitive measuring instruments employed and also the veritable power house of batteries. Now see what Mr. Grindell-Matthews says.

Is It Possible?

A FAMOUS inventor, H. Grindell-Matthews of London claims to have discovered a very dangerous ray. He states he used very low powered transmitters. In Mr. Oldroyd's article, which was proof-read and corrected by Mr. Grindell-Matthews, he claims the ray could be made visible or invisible. With the visible rays the enemy forces could be located. Should any mass get in the path of the rays a destructive effect, as visualized in the sketch below, is produced. The current is assumed to travel up the path of one ray, through the ship, and down the other ray. It would seem that the metal of the airship is a far better conductor than the ray itself, but according to Grindell-Matthews' claims this is not the case. Even a metal enclosed engine is damaged by the ray. Gun-powder, the inventor claims, can be exploded at a distance of twelve yards from the small transmitter, and on two occasions, Mr. B. J. Lynes, Mr. Matthews' assistant, moved within the fringe of the invisible ray and was instantly rendered unconscious by a violent shock. So reads the official article. The Editors of this magazine have not found any ray known to scientists today capable of producing the effect claimed by the English inventor. The possibility of his having discovered a new ray, is, to say the least, very slight indeed.



The above diagram is sponsored for by H. Grindell-Matthews. Two plates were placed about a yard apart and current at a potential of 200 volts was impressed upon the plates which were connected in series with a galvanometer, and a 200 volt battery. When the ray was turned on, as indicated in the diagram, the space between the two plates became conductive and the galvanometer registered the current flowing across the plates, according to Grindell-Matthews. He states the space across the plates was as conductive as though a wire actually connected them. We found the converse to be true with every ray.

How the ray is supposed to destroy an airship is depicted in the above diagram, likewise vouched for by the English inventor. What causes the airship to actually burn is a profound secret known only to the inventor. What causes the metal of the airship to be less conductive than the ray is not mentioned, and why the ray does not naturally become short-circuited cannot easily be seen. Our experiments definitely prove that these claims are fictitious. Radio, X-rays, ultra-violet and infra-red rays, the only useful rays that are invisible, cannot be made to duplicate Grindell-Matthews' claims.

The artist's conception of how the Grindell-Matthews' ray will bring down hostile airplanes and airships is depicted above. On the motor truck two powerful ray transmitters are mounted on swivels so that the beams of the transmitters may be directed on enemy aircraft. When the ray strikes, the airship burns. American and European scientists deny the reported discovery. Has Mr. Matthews discovered the impossible?

Photographer's Make

By W. B.

PRODUCERS had almost forgotten that photographic stunts may be made howlingly funny if a little imagination is used along with the cameraman's pranks. Recently, however, "Sherlock, Jr.," with Buster Keaton in the leading rôle, was released in New York and drew large crowds day after day. And the drawing power of the picture rested almost solely upon the ability of a clownish photographer. The first of the five reels set a terribly rapid pace which was maintained throughout the entire photoplay.

Of course, many of the stunts are children of the wildest sort of a slapstack imagination, but the fact remains they are side-splitting in their effects.

The one trouble with the film, if there is any, is that the action moves along so fast that the onlooker does not have time in many cases to thoroughly enjoy the plights into which the young detective forces himself. There is no end of thrills, one follows immediately upon the heels of the preceding one, until the spectator simply sits and gasps and wonders what will be the next fool thing Buster will do.

A notable point in the work of the cameraman, and a point that would be ordinarily overlooked, is that an exceedingly small amount of double exposure is used in the manufacture of the film. Whenever a producer starts to do trick stuff, the first thought to enter his mind usually is, where can double exposure be used.

WHILE BUSTER KEATON SLEEPS ON HIS JOB AS MOVIE OPERATOR, HIS SPIRIT LOOKS THROUGH PEEP-HOLE AND SEES THE CHARACTERS ON SCREEN CHANGE TO THOSE IN HIS OWN ROMANCE

FIRST HE IS IN A FORMAL GARDEN – LEANS AGAINST TREE

FALLS, AND LOOKS UP INTO THE OPEN JAWS OF TWO LIONS

JUMPS UP AND RUNS WITH LIONS AFTER HIM

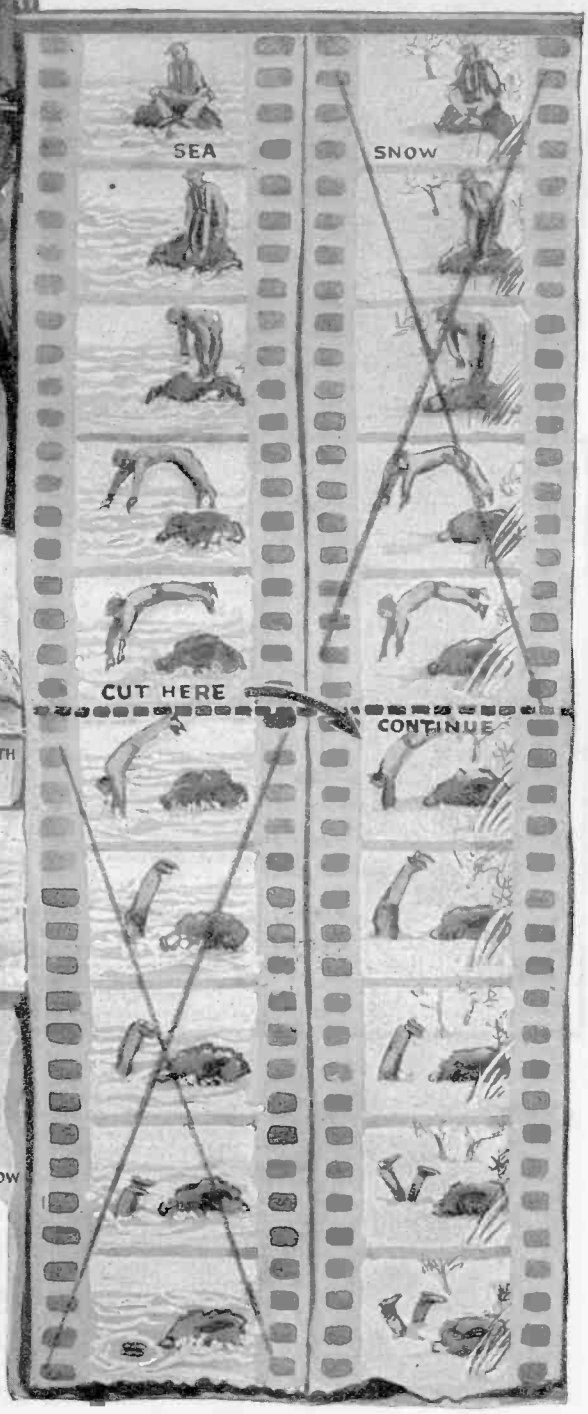
STOPS SHORT AT BRINK OF PRECIPICE

SITS DOWN AND FAST EXPRESS TRAIN TEARS ACROSS SCREEN A FEW INCHES BEHIND HIS BACK

SITS DOWN ON ROCK AND DESERT CHANGES TO OCEAN

DIVES OFF ROCK AND

OCEAN CHANGES TO SNOW



The picture opens with Buster Keaton as a poor motion picture operator with highly romantic dreams. He starts his machines, one night, sits on his stool and falls asleep. His spirit leaves his body, looks through the peep-hole and then things begin to happen. The spirit leaving the body is, of course, a double exposure stunt. The phantom passes out of the booth, down the aisle of the theatre and up into the frame of the picture. There he meets the most marvelous episodes. He goes into a formal garden, leans against a tree which bends under his weight, sits on a stone and immediately the garden becomes a desert. A moment later an express train passes a few inches behind him and the sand is transformed into an ocean. He jumps off the rock and lands in a snowdrift instead of the water. The illustrations at the right show how the stunt was performed. The film of two different jumps were spliced in the middle of the jump as shown.

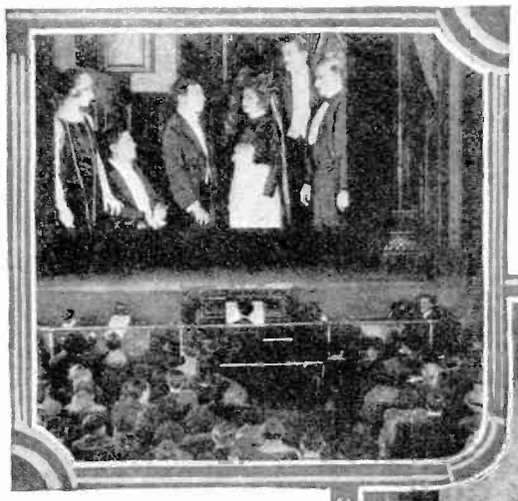
Movie Comedy Hilarious

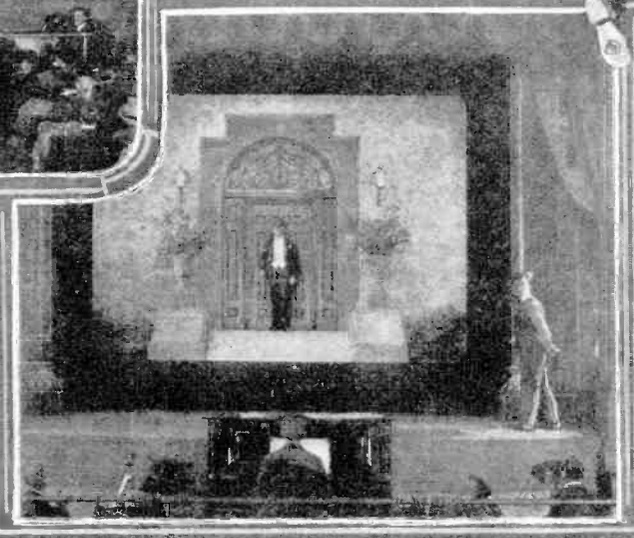
ARVIN

The result is that a great amount of it comes into play and many times a large part of the film does not reach a high point of perfection. This is especially the case where the producer is working on some spectacle where no large amount of money is available and the expense question is all important.

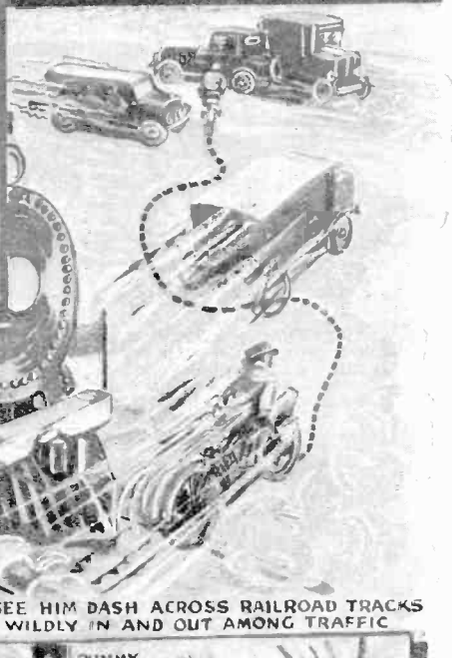
One of the best trick effects in the picture was obtained cheaply in the miraculous ride Keaton made on the handle-bars of a swiftly moving motorcycle, shown at the bottom of this page. A great part of the picture was taken with Keaton actually riding the machine. By running the camera slowly and allowing him to sit well back on the frame of the motorcycle, he could actually make the terrible feats (at slow speed), which look almost impossible on the screen, with little or no danger to himself. The camera was running at less than half speed for the exposure of the scene, so that when it was printed and projected the actual speed of the motorcycle seemed more than twice real speed.

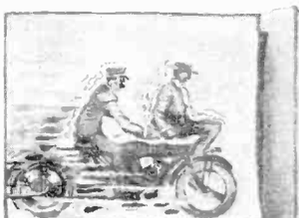
Immediately at the right is shown one of the most humorous stunts in the production. Buster seemingly jumps through the body of an old peddler. The sketch immediately below the picture shows how it is done. Of course, there was a trap door through which he jumped and a mattress upon which to land.





The two scenes immediately bordering this caption show how the movies of the movie were shown. The movie in the picture was projected from the back of the screen. At the beginning of the picture, Buster walks into the frame of the picture and becomes a part of the movies. Of course, this was done by using a painted set very close to a black frame similar to that found in almost all movie theatres. The characters moved in this miniature stage formed between the background and the frame and Buster had only to step over the frame to be in the "movie." By setting the camera a good distance away the flat effect, as if he really stepped into the movie, was obtained.





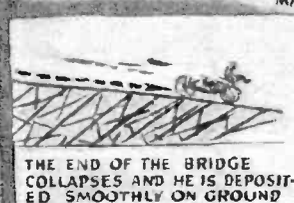
CHASED BY ROBBERS, HE ESCAPES ON HANDLE-BARS OF HIS ASSISTANT'S MOTORCYCLE

THEY HIT DITCH AND ASSISTANT IS THROWN OFF

BUSTER CONTINUES ON ALONE AT HIGH SPEED, MAKING OCCASIONAL REMARKS OVER HIS SHOULDER,

YOU SEE HIM DASH ACROSS RAILROAD TRACKS AND WILDLY IN AND OUT AMONG TRAFFIC

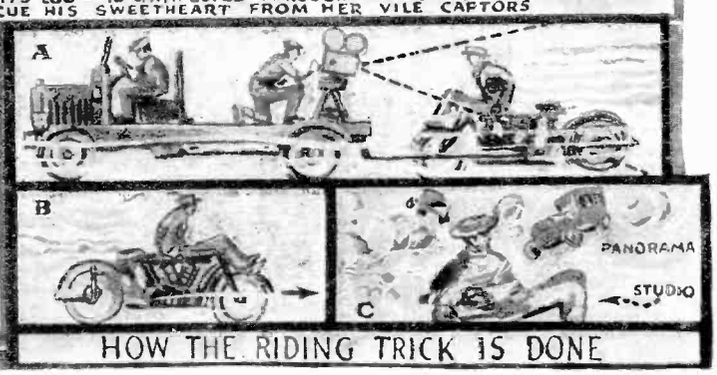
A BRIDGE IS BROKEN, BUT TWO MOVING VANS HAPPEN TO BE PASSING AT THE INSTANT HE GOES OVER



THE END OF THE BRIDGE COLLAPSES AND HE IS DEPOSITED SMOOTHLY ON GROUND

HE HITS LOG – IS CATAPULTED THROUGH WINDOW JUST IN TIME TO RESCUE HIS SWEETHEART FROM HER VILE CAPTORS

One of the most interesting episodes in the picture was a breath-taking ride performed on a motorcycle. Being chased by robbers, Buster jumped on the handle bars of the cycle. Shortly after the beginning of the ride a bump dislodges the operator of the motorcycle and Buster rides serenely on, not knowing it. He then passes through the thick of traffic, jumps across an open trestle which is open at the opposite end. As he draws near the end, the structure falls gracefully to the ground, thus saving his neck. He then hit a log and is catapulted into the window of a house and upon the center table in the room. Part of the ride is taken as shown at A opposite. The cycle is held up by a supporting rod from a truck on which the camera is set. The camera is so placed as to not take the support in the picture. The cross-country speed is taken as at C with the aid of a revolving panorama on which the passing scenery is painted. Buster, of course, sits still in the studio while the scenery is revolved behind him. Other parts of it are taken simply with Buster actually riding the motorcycle and operating it from the handle bars, the camera being turned slowly. The catapult stunt is done, as usual, with the aid of a dummy, but the greater part of this ride was actually made.

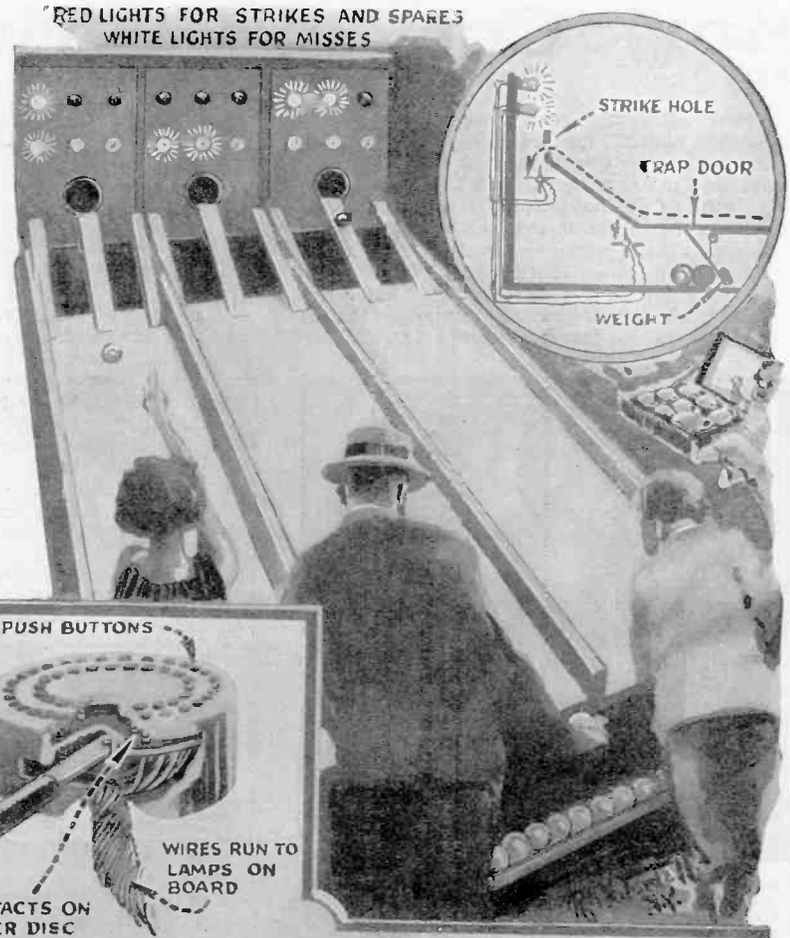


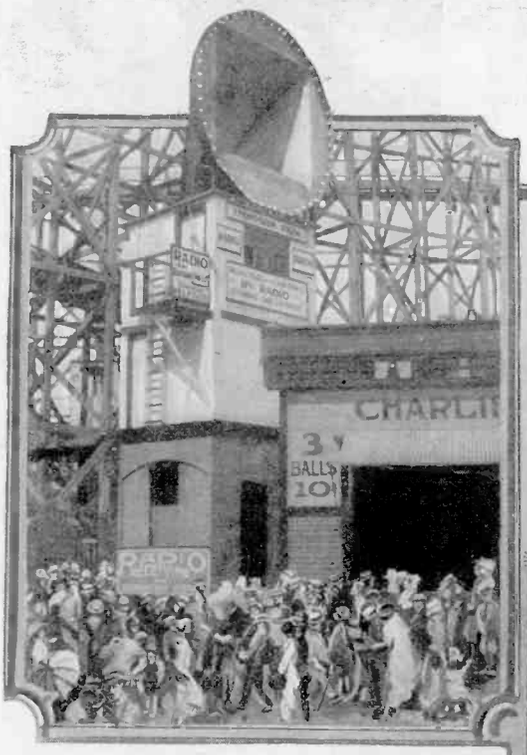
HOW THE RIDING TRICK IS DONE

The Season's New Fun-Makers

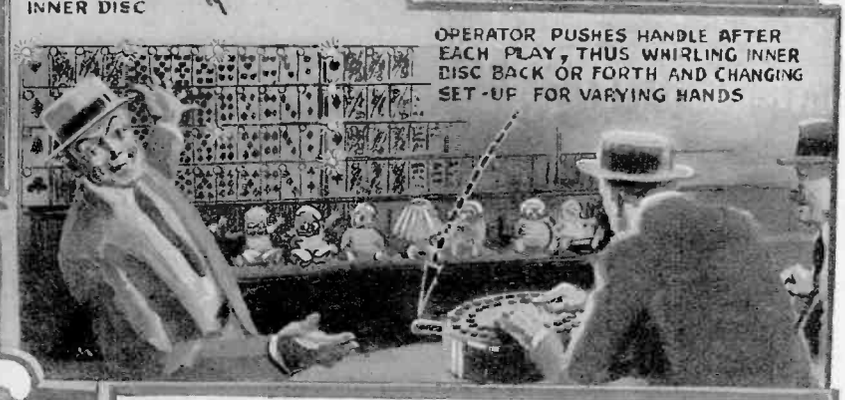
By GEORGE HOLMES

One of the newest games of skill to put in an appearance at the amusement parks is the electric bowling device shown at the right. The balls are rolled up the alley in the regular way. Once behind the back, however, the ball falls into one of several slots according to the skill of the player. As the ball falls it passes over a wheel which switches on a light indicating the score made. Detail of the operation of the machine is shown in the insert at the top of the illustration. White and red lights indicate the score.

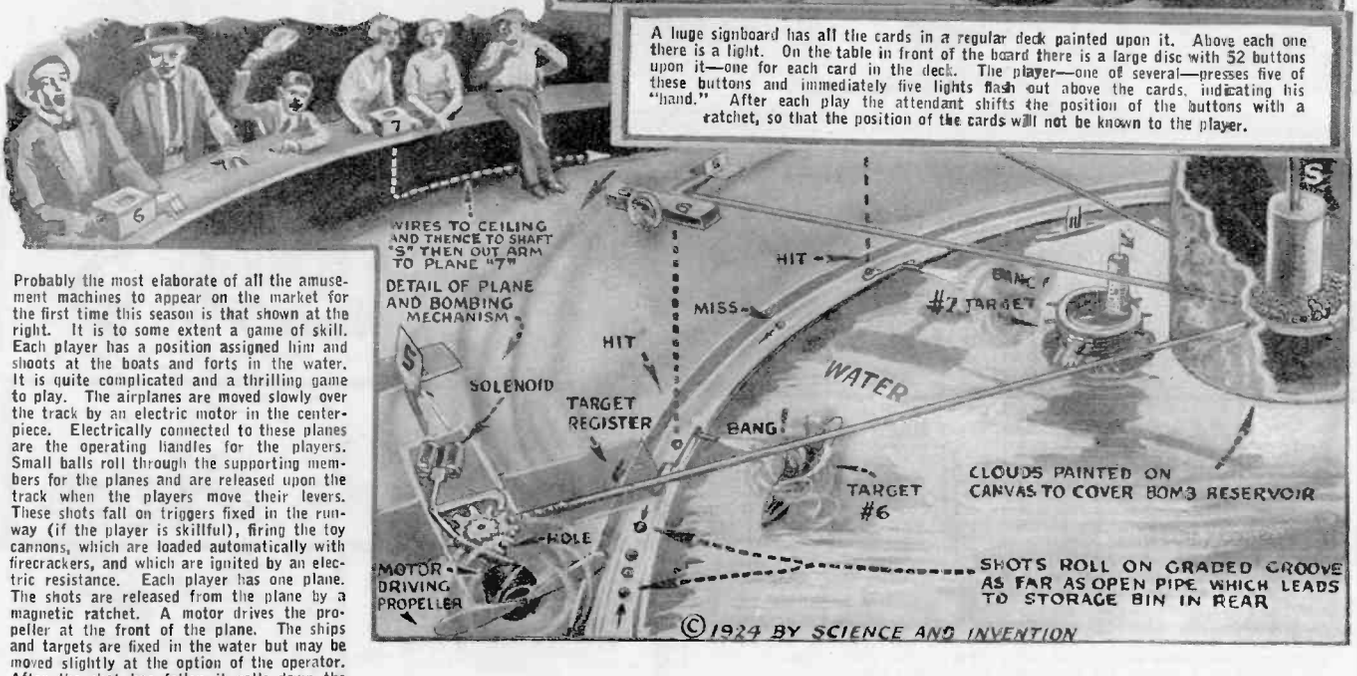




With the ever-increasing importance of radio, one of the largest of the entertainment parks near New York has installed a receiving set and a powerful loud speaker, which may be heard over a large area. A sign board in front of the speaker horn tells what station is being listened to and gives the name of the performer.

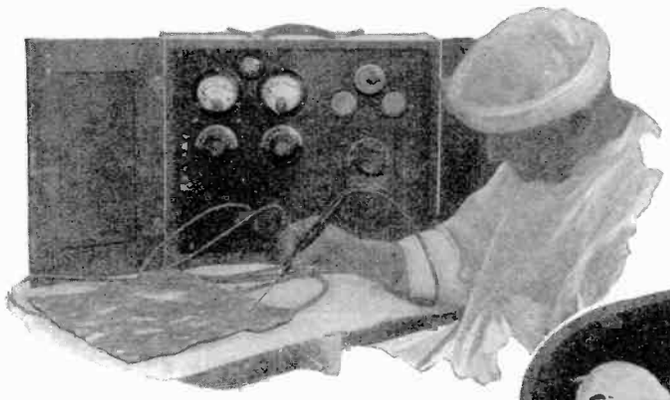


A huge signboard has all the cards in a regular deck painted upon it. Above each one there is a light. On the table in front of the board there is a large disc with 52 buttons upon it—one for each card in the deck. The player—one of several—presses five of these buttons and immediately five lights flash out above the cards, indicating his "hand." After each play the attendant shifts the position of the buttons with a ratchet, so that the position of the cards will not be known to the player.

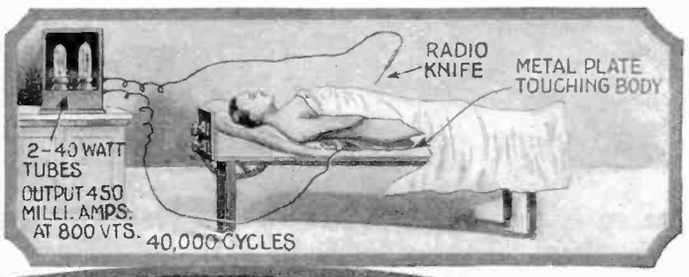


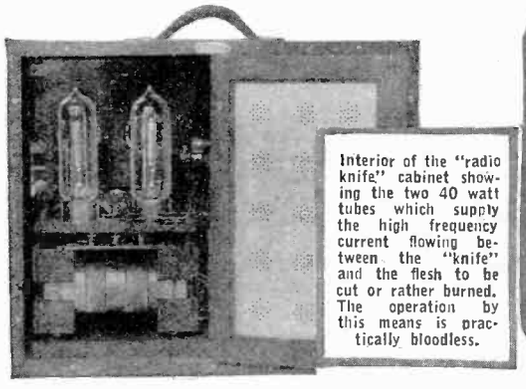
Probably the most elaborate of all the amusement machines to appear on the market for the first time this season is that shown at the right. It is to some extent a game of skill. Each player has a position assigned him and shoots at the boats and forts in the water. It is quite complicated and a thrilling game to play. The airplanes are moved slowly over the track by an electric motor in the centerpiece. Electrically connected to these planes are the operating handles for the players. Small balls roll through the supporting members for the planes and are released upon the track when the players move their levers. These shots fall on triggers fixed in the runway (if the player is skillful), firing the toy cannons, which are loaded automatically with firecrackers, and which are ignited by an electric resistance. Each player has one plane. The shots are released from the plane by a magnetic ratchet. A motor drives the propeller at the front of the plane. The ships and targets are fixed in the water but may be moved slightly at the option of the operator. After the shot has fallen it rolls down the path and back into the shot reservoir at the center of the device.

Radio Knife Aids Surgeons

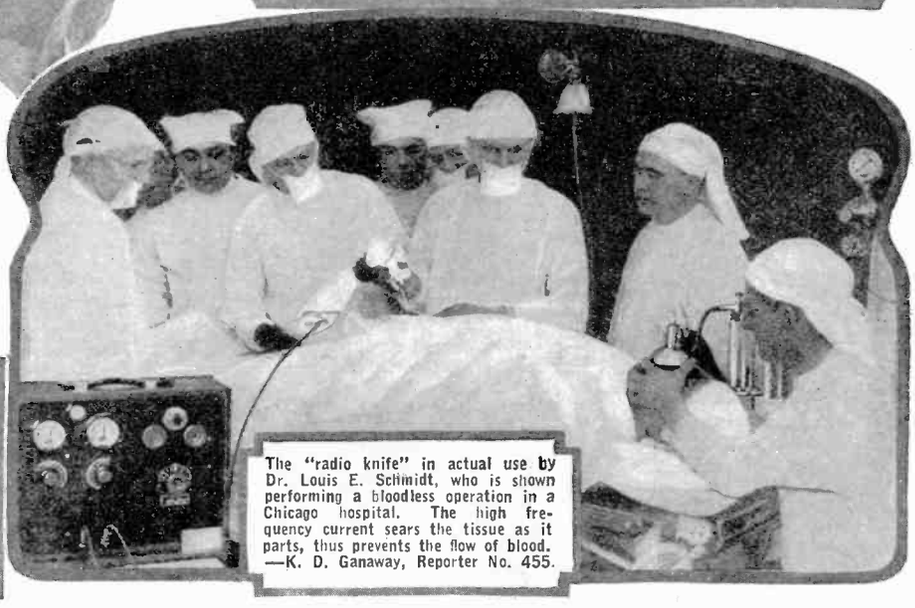


A front view of the "radio knife" apparatus, which is really a modified radio transmitting set with two 40 watt tubes, as shown in the diagram at the right.





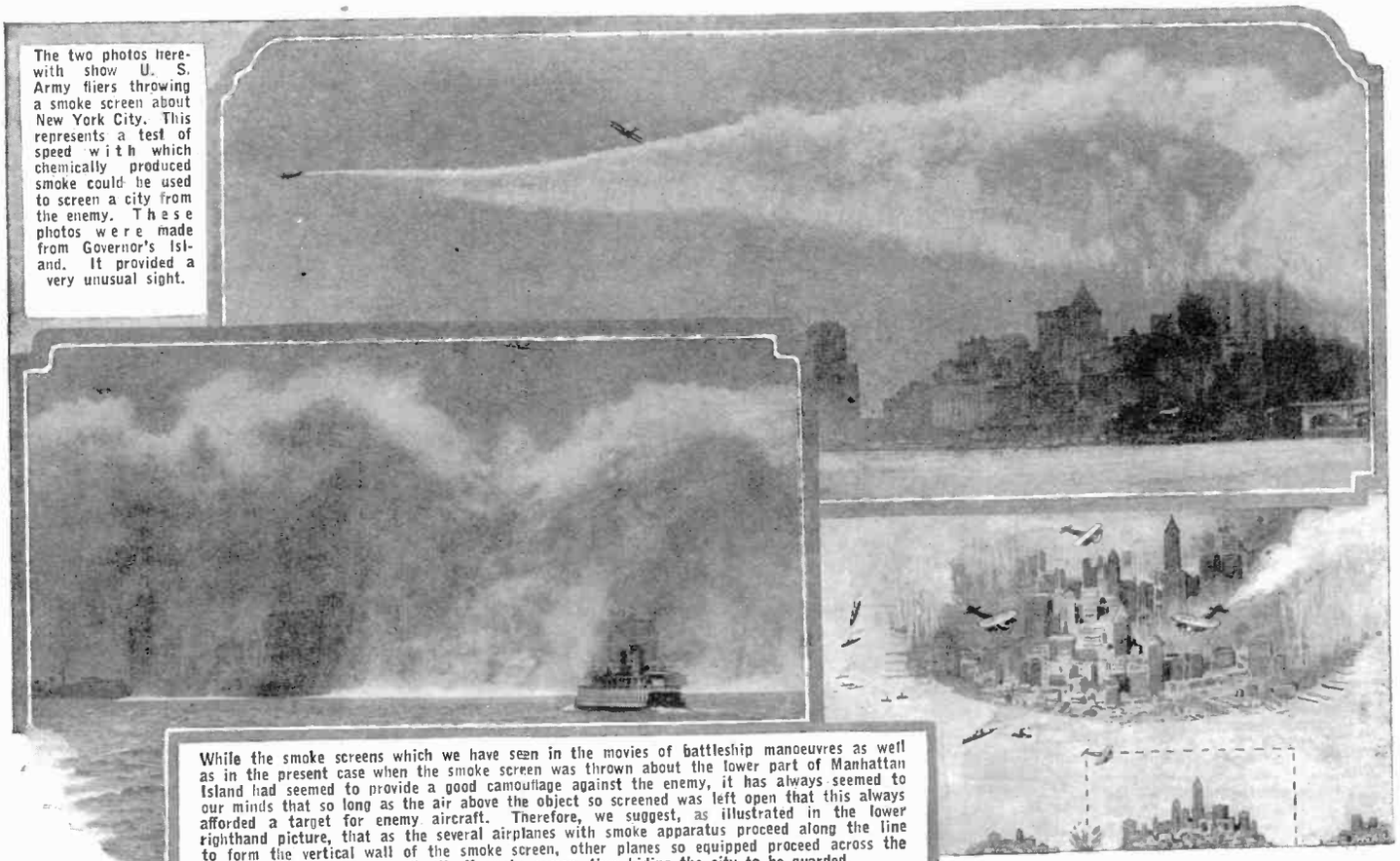
Interior of the "radio knife" cabinet showing the two 40 watt tubes which supply the high frequency current flowing between the "knife" and the flesh to be cut or rather burned. The operation by this means is practically bloodless.



The "radio knife" in actual use by Dr. Louis E. Schimidt, who is shown performing a bloodless operation in a Chicago hospital. The high frequency current sears the tissue as it parts, thus prevents the flow of blood. —K. D. Ganaway, Reporter No. 455.

Smoke Screen Hides City

The two photos herewith show U. S. Army fliers throwing a smoke screen about New York City. This represents a test of speed with which chemically produced smoke could be used to screen a city from the enemy. These photos were made from Governor's Island. It provided a very unusual sight.

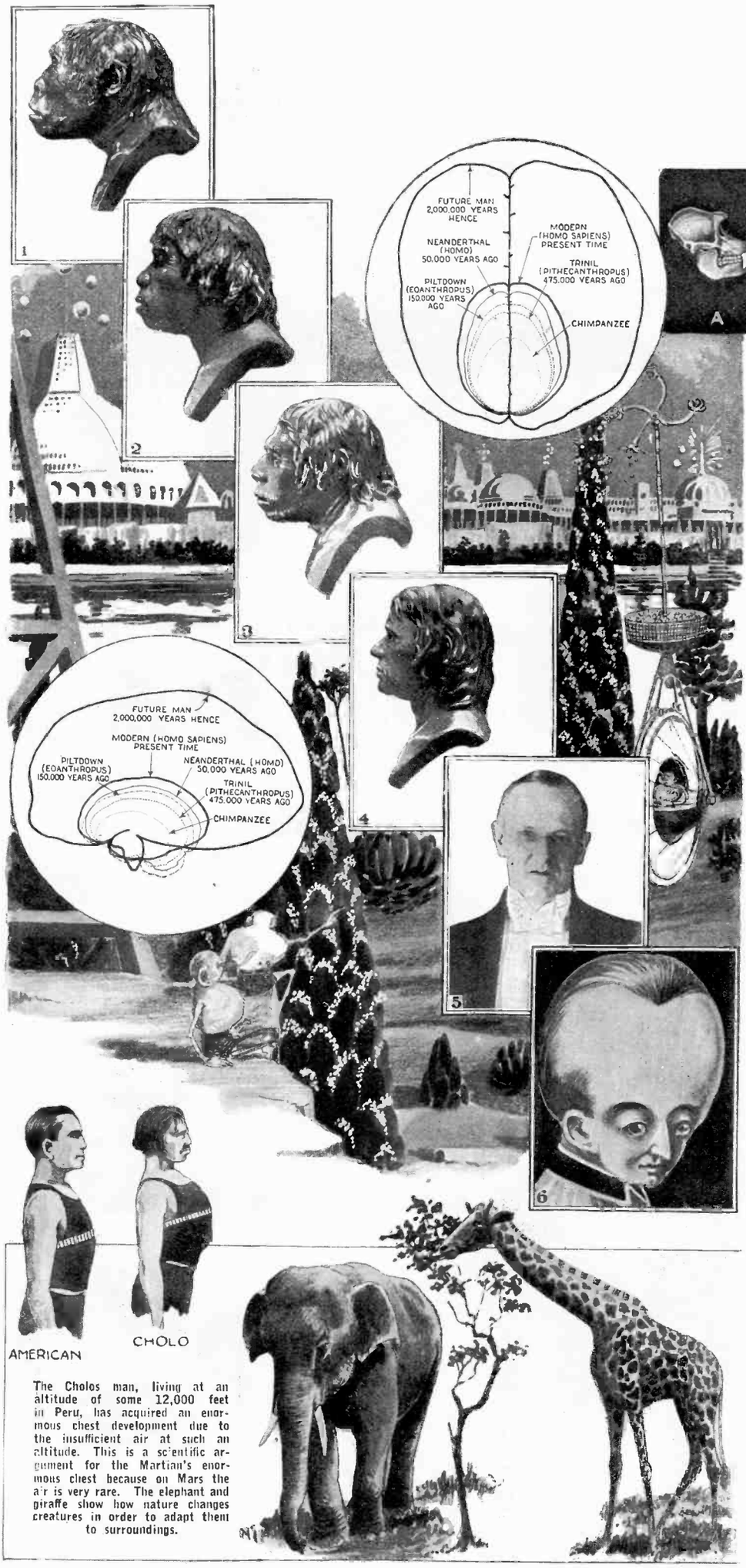


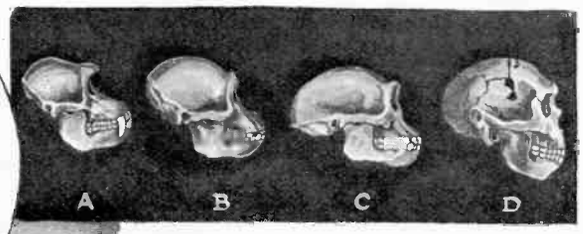
While the smoke screens which we have seen in the movies of battleship manoeuvres as well as in the present case when the smoke screen was thrown about the lower part of Manhattan Island had seemed to provide a good camouflage against the enemy, it has always seemed to our minds that so long as the air above the object so screened was left open that this always afforded a target for enemy aircraft. Therefore, we suggest, as illustrated in the lower righthand picture, that as the several airplanes with smoke apparatus proceed along the line to form the vertical wall of the smoke screen, other planes so equipped proceed across the top so as to form a "ceiling" smoke screen, thus hiding the city to be guarded.

Evolution

By HUGO

MEMBER, AMERICAN





The Cholos man, living at an altitude of some 12,000 feet in Peru, has acquired an enormous chest development due to the insufficient air at such an altitude. This is a scientific argument for the Martian's enormous chest because on Mars the air is very rare. The elephant and giraffe show how nature changes creatures in order to adapt them to surroundings.

THIS month the opposition of Mars brings anew the speculation as to the inhabitants of the mysterious planet. Science to-day knows that Mars being a much smaller body than the earth, must have cooled down millions of years before the earth reached a similar stage. Scientists argue that this being the case evolution on Mars must in consequence be just as many million years advanced beyond our own.

Granting that conditions are roughly alike on the two planets, evolution would in all probability work out as on our earth. If this were the case, of which of course we cannot be sure, it would be possible for us to form a general picture of what conditions are on Mars, but in order to understand evolution on Mars we must first understand evolution on earth.

The top strip on these pages lettered from "A" to "G" shows the evolution of our planet's most highly developed intelligent creatures. "A" shows the skull of a low form of monkey. "B" the skull of a chimpanzee. "C" the first real human being known as such to science and designated *pithecanthropus*. We now know that he lived some 475,000 years ago. "D" shows the skull of the *Neanderthal* race which lived some 150,000 years ago. "E" shows the skull of the *Aurignac* race which lived some 25,000 years ago and "F" shows the skull of the present day human being. What will be the appearance of the skull of man two million years hence? By studying our race which started almost a half million years ago, we see that the skull, that is that part which encloses the brain, has a tendency to become larger and larger. The figure "G" therefore will give a fairly accurate idea of what a human being will look like two million years hence.

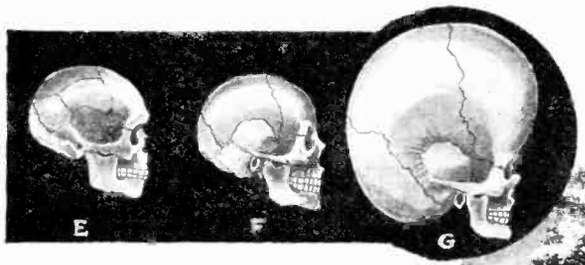
This illustration has been carefully prepared from the diagramatic curves shown in the cross-sectional views of the skulls illustrated in the two round circles on this page. The upper one shows top sections of the brains of the various races while the lower circle shows the side views of the brains of the races. On this our artist has plotted the appearance of the brain two million years hence.

So much for the skulls, now for the actual appearance of the various human beings. Fig. 1 shows a reconstructed head of the Pithecanthropus, prehistoric man. Fig. 2 shows the restoration of the head of a Piltdown man. Fig. 3 shows the head of the Neanderthal man, while Fig. 4 shows the head of the Cro-Magnon man. Fig. 5 shows the modern man as represented by President Coolidge, while Fig. 6 shows the future man two million years hence.

Coming to Mars we know that some of the conditions of this planet differ somewhat from those on earth. Mars, to begin with, has practically no more atmosphere. It is certain that the planet once had the same kind of atmosphere as the earth.

On Mars

GERNSBACK
PHYSICAL SOCIETY



This atmosphere, however, vanished little by little, until today about as little is left as is present on the top of the Himalayas. This means but one thing—due to lack of atmosphere and oxygen as well, the chest must become enlarged during the ages until it assumes extraordinary proportions. This is not at all a theory and has been proved on our own earth. There exists a race of Cholos Indians which race lives in the Peruvian mountains at an altitude of some 12,000 feet. Professor J. Barcroft, C.B.E., F.R.S., who made exhaustive studies of this race noted that the Cholos chest development had been increased from the normal or 79 c.m. to the abnormal 92 c.m. (see illustration in lower left hand corner page 342). On Mars which is also a much smaller planet the gravitational pull is much less, thus a man weighing 150 pounds on earth would weigh only 53 pounds on Mars. A human being can jump 4 feet, the Martian 11 feet with the same effort. A human being can lift 200 pounds while the Martian can lift 564 of the same earth pounds with the same effort.

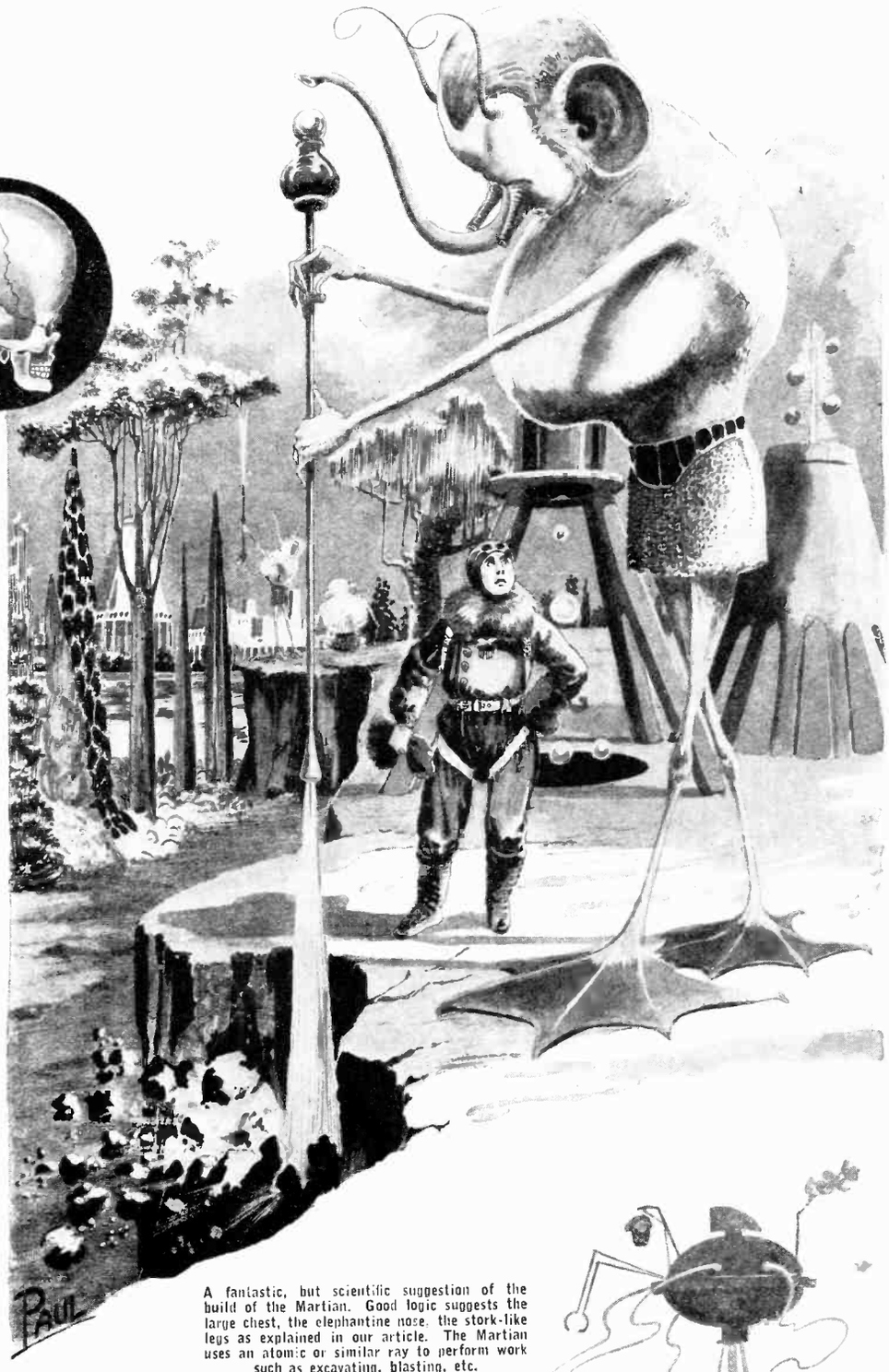
Gravitational pull being so much smaller the Martian, if he exists, is probably very much taller than the human being, possibly from 15 to 20 feet tall. Having attained a far more advanced civilization, performing all work by machines and hardly ever attempting manual labor, the Martian's arms have shrunk until they are little more than bones with skin covering them. The body weighing much less on Mars and the Martian probably moving around only in mechanical contrivances, his legs have become almost useless and are therefore similarly attenuated. They also have but tiny muscles covered with skin. But in order to support such a tall body, (the gravitation being low), the Martian must have large feet.

Now the scant Martian atmosphere makes it very difficult to smell. Scents are propagated very slowly in a scant atmosphere. For that reason the Martian must go to the smell rather than the smell come to him. We should therefore find an elephantine nose to compensate the Martian's shortcoming in this respect, just as the elephant had to grow a long trunk in order to make it easier for him to get to his water and just as the giraffe has a long neck to reach the food he likes.

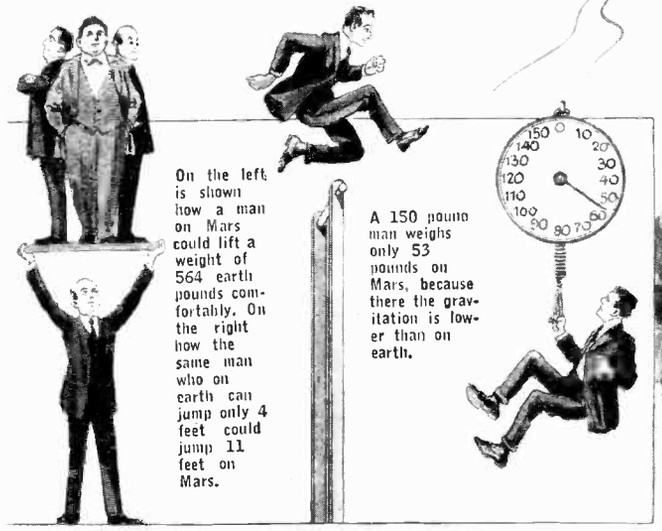
In a thin atmosphere loud sounds become very weak. We should expect to find the Martian therefore equipped with large bat-like ears to catch more sound.

We may expect to find the Martian with projecting eyes if our deductions are correct and the temperature on Mars being nearly always freezing even at the Equator and going below zero at higher lattitude, the Martians will probably be covered with thick fur or feathers in order to keep him warm.

The two horn like projections on his forehead are antennae, and constitute the Martian's telepathic organ.

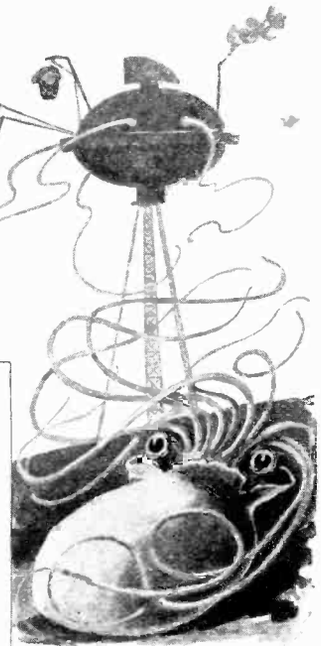


A fantastic, but scientific suggestion of the build of the Martian. Good logic suggests the large chest, the elephantine nose, the stork-like legs as explained in our article. The Martian uses an atomic or similar ray to perform work such as excavating, blasting, etc.



On the left is shown how a man on Mars could lift a weight of 564 earth pounds comfortably. On the right how the same man who on earth can jump only 4 feet could jump 11 feet on Mars.

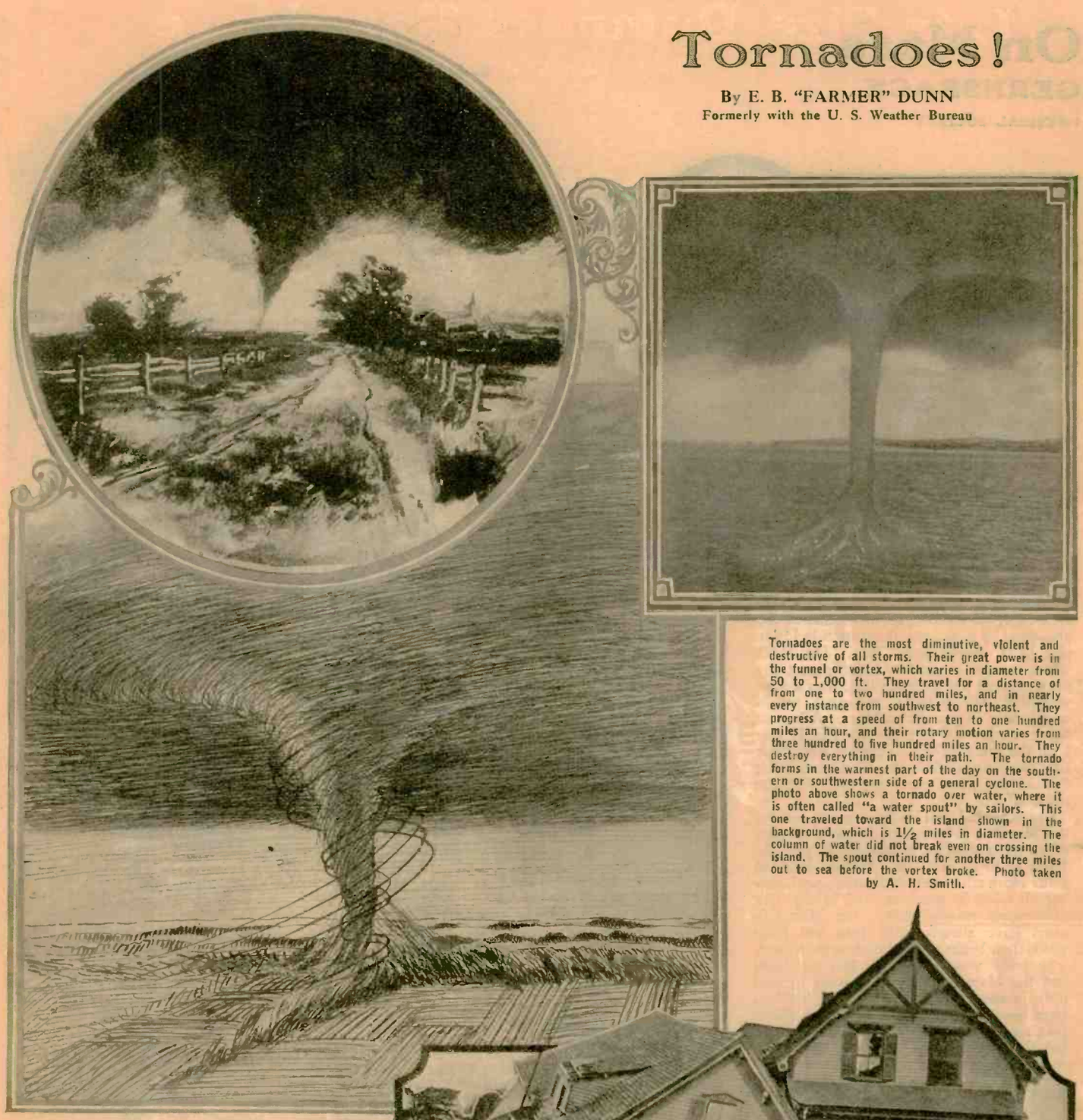
A 150 pound man weighs only 53 pounds on Mars, because there the gravitation is lower than on earth.



H. G. Wells' conception of a Martian. This Martian is composed of nothing but brains, legs and tentacles. In order to move about he uses a tripod "walking" machine which is shown above him.

Tornadoes!

By E. B. "FARMER" DUNN
Formerly with the U. S. Weather Bureau



The drawing at the top shows the approach of a tornado. It will inflict untold damage before it finally quiets down with the breaking of the vortex. The sketch immediately above is a cross-section of a tornado. The lines indicate the whirling motion produced. The cold air rushes in at the bottom, and forms an envelope around the whirling hot air, rising upward in the center.

Tornadoes are the most diminutive, violent and destructive of all storms. Their great power is in the funnel or vortex, which varies in diameter from 50 to 1,000 ft. They travel for a distance of from one to two hundred miles, and in nearly every instance from southwest to northeast. They progress at a speed of from ten to one hundred miles an hour, and their rotary motion varies from three hundred to five hundred miles an hour. They destroy everything in their path. The tornado forms in the warmest part of the day on the southern or southwestern side of a general cyclone. The photo above shows a tornado over water, where it is often called "a water spout" by sailors. This one traveled toward the island shown in the background, which is 1½ miles in diameter. The column of water did not break even on crossing the island. The spout continued for another three miles out to sea before the vortex broke. Photo taken by A. H. Smith.

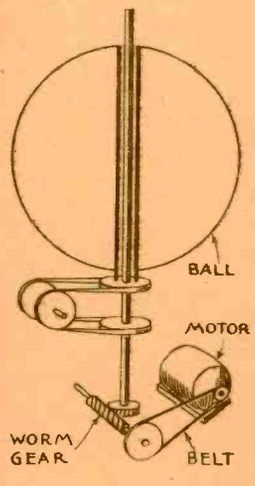
Explosions frequently occur when a tornado passes. This is due to the expansion of air in houses, the doors and windows of which are closed. The center of the tornado creates a partial atmospheric vacuum, drawing nearly all the air from its surroundings. Naturally the air in the houses creates a pressure and causes the walls and doors to be blown outward.

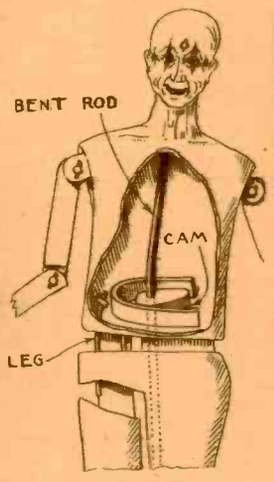
The photo above shows what happened to a house which was in the path of a tornado. It was lifted bodily from its foundation and dropped into the street. The vortex of the tornado passing the house did the damage. Photo at the left gives a graphic illustration of the destruction produced in the path of a St. Louis tornado.

Life Size Dummies That Move

By JOSEPH H. KRAUS

The animals shown in the photo immediately above are all life size and are remarkable reproductions. The man on the elephant is a real honest-to-goodness individual and by comparing the animal with the man an estimate of the size of the reproductions can be obtained. The elephants move their trunks, heads, ears and eyes. The zebra in addition moves his jaw and wags his tail.





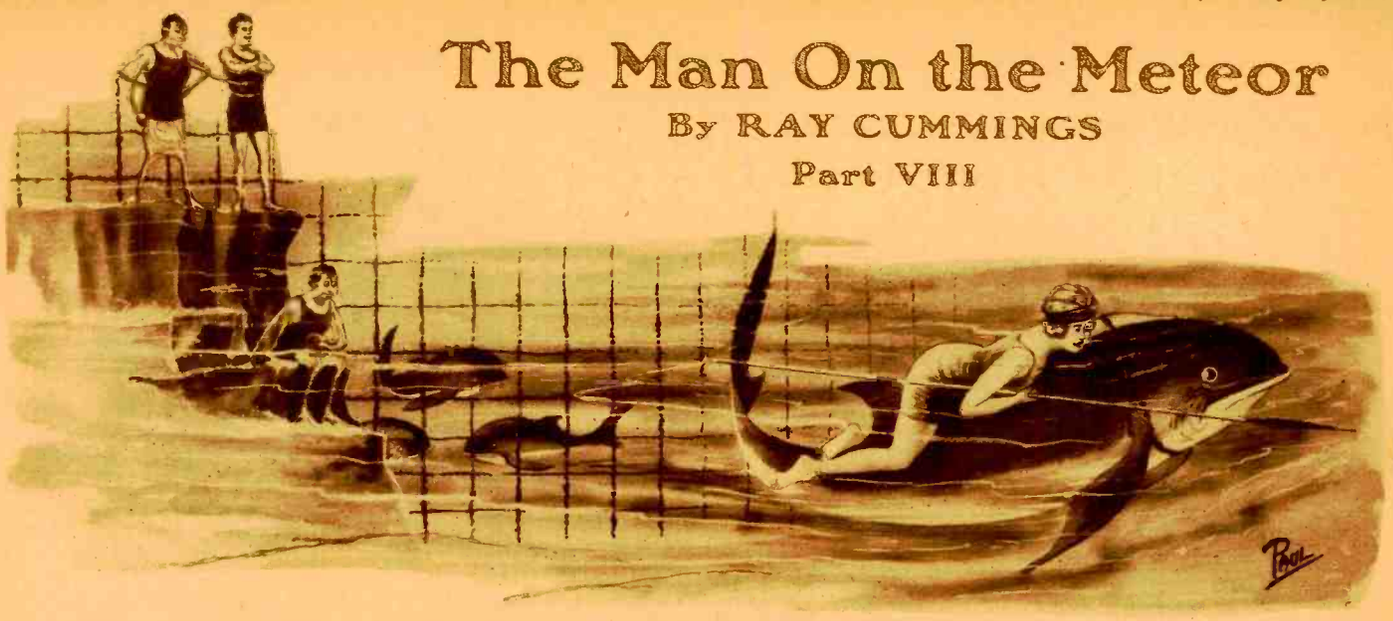
The photo at the top shows the mechanism for operating the lion. A fractional horse-power motor drives the rods extending to the lower jaw of the lion shown in the top center photo of this page where it is seemingly snarling at the girl. Another rod extends to the back and wags the tail of the lion. The elephant also shown above juggles a ball on the top of his head, which ball rotates constantly. Immediately above we see the undraped figure of a clown. This clown seemingly tries to maintain his position on the ball and at the same time continues to spin the ball with his toe. His body rocks from side to side and his foot moves back and forth. The construction of the ball mechanism is shown in the line drawing above and completed clown at right.

Above at the top is the mechanism for operating the zebra. The small electric motor drives the chain of gears, causing the zebra's head to twist from side to side, the ears to move, the eyes to roll, the mouth to open and the tail to move. All the animals on this page are covered with the finest imitation skin. They are life-like in respect to size, color and physical structure. Their movements are perfectly natural. On the right is the undraped figure of the elephant illustrated at the left of this page and immediately above the mechanism for causing the ball under the clown figure at the left to turn. The drawing above illustrates the manner in which the clown moves his leg and body. These objects were all constructed by Messmore & Damon of New York.

The Man On the Meteor

By RAY CUMMINGS

Part VIII



She was ready. Lying flat on the dolphin's back, her slender body seemed welded to it. A collar was about the dolphin's head; and into it she thrust an arm to hold herself. The young Marinoid told her how the creature was guided. A kick of the heel, pressure of an arm against its head—or even a whispered word.

WITH no memory of past events, a young man suddenly comes to his senses on a meteor which is part of one of the rings of Saturn. He looks for nourishment and finds the mouth of a cave. As he looks toward the cave a girl comes into view. One day, upon returning to the cave, Nona, the girl, shows Nemo, as the man calls himself, several mollusks which make good food. To gather more of this food, they wade into a stream. Nemo sees Nona's head is completely engulfed. Soon his head goes under water and he feels the liquid rush into his lungs. However, by violent effort he is able to breathe the water.

Later they see coming toward them a party of ten people, four men and six women, who are somewhat human in form, but have four arms like the tentacles of a cuttlefish. Nemo and Nona are captured and tied by them.

They are taken by the Marinoids, as the members of the party call themselves, to the city called Rax. This city is built in the stream of underwater vegetation.

A man named Og insulted Nemo and challenged him to a fight. The fight took place in front of the palace of the ruler and Nemo was defeated because Og had a peculiar property, which was characteristic of the Marinoids, enabling him to send a charge of animal electricity into the body of Nemo, thereby rendering him unconscious.

For a year things go along peacefully, when suddenly the daughter of a Marinoid family disappears. This is repeated again and again until thirty of the young women of the city were stolen. Later Nemo saw a strange figure in the street. Suddenly all light is obliterated and Caan and Nemo, swimming through the darkness, find a woman unconscious, shocked into insensibility by animal electricity. Nemo comes to grips with the man attempting to abduct the woman and finds it to be his old enemy Og. Nemo returns to his home to find that Nona is gone.

The Water of Wild Things, an unknown stretch of sea, is the home of the tribe doing the kidnaping. An expedition is organized to bring the stolen girls back, and led by Atar, the king's son, they go into the Water of Wild Things. Atar, Nemo and Caan penetrate a barrier of vegetation, which guards the entrance, descend the side of a perpendicular cliff and soon see lights in some sort of a dwelling place. They enter the place and find it to be crowded with other people. Og is seen talking to them and on a raised platform is Nona.

Og declares his love for Nona to the people and says that he will lead them to victory over the Marinoids and that Nona will be their Queen. One of Og's lovers becomes jealous and protests. She is waved away and suddenly returns with a dagger to kill Nona. Nemo interferes and releases Nona. They start away from the Water of Wild Things.

Later in the day, through the aid of Og's jealous lover, Nemo with Nona and the remainder of the party, make their escape, after learning that Og, as leader of the tribe who call themselves the Maagogs, plan to make war on Rax and capture the city. The party on returning home tells the king of their discovery who begins preparations for war.

There is a season of merry-making after the war has been announced to the Marinoid citizens. During its course a half-breed hurls a needle fish in an attempt to kill the Marinoid King. A Marinoid girl thrusts herself in the fish's path, saving the King's life. The Prince and Nemo make a reconnoiter to a neighboring city and find that the half-breeds within the kingdom have already begun a massacre. The war is on!

THE Maagog's were striking. The war had begun!

I do not like to remember in detail the scene around the King's palace which followed this sinister news. The city, so gay, so care free a few hours before, was a turmoil of confusion, of terror—almost of panic.

To the palace the people crowded. The cube of water was jammed with a frightened, expectant throng—a throng that looked to its ruler for protection—for advice, for commands.

There are those on your Earth who scoff at government. Let them be menaced by an outside enemy; let that enemy threaten the very doors of their homes—threaten their women. Ah! then those who scoff at their government will scoff no longer. Like frightened children they will run to their lawful ruler for protection.

This throng before the palace clamoured for the King to tell them what to do. With my Nona and Boy beside me I was inside the building—in a room with the King and Queen, Atar and Caan.

I shall never forget that scene. To make you appreciate it, I shall have to remind you that never before in the reign of this King had an enemy menaced his domains. And this Marinoid civilization—as I now realize it to have been—was very primitive.

"Women of the Marinoids——" Her voice to the women of the crowd rang out clear and silenced the confusion. "Women of the Marinoids! This is war! We women—our virtue—our children—our homes, are threatened! Do we fight or do we sit by while our men defend us? Women of the Marinoids—answer me!"

In a word, our King at this crisis was flurried. His preparations for war were in truth but vague and impractical. The Marinoids did not know the meaning of an army. Maagogs were coming to kill them; Marinoids must fight in defense.

That was the extent of the King's plans. He sat in his carved shell on the throne-platform, and we others crowded around him anxiously. Outside the palace, the shouts of the frightened mob floated in to us through the water.

"The Maagogs!" said Atar. "They are coming through the coral barrier! Our guards there have been defeated—killed most of them—and the rest have fled."

"Coming—here?" I asked. "Will they come here to Rax, do you think?"

The King looked at us hopelessly. "Here—to Rax? They cannot. I am not ready. We must arm to repulse them. They must not come so soon."

"Before this Time of Sleep is over they will be here," Caan declared gloomily.

Two of the King's Councillors appeared swimming into the room—old men, terrified nearly out of their wits. They huddled down beside us; and one of them said:

"At the Cavern, my King, they are waiting your orders."

The shouts outside grew louder, more insistent.

"The King!"

"Where is the King?"

"Let him speak to us—tell us what to do!"

"We are ready to fight! Death to the Maagogs! Our King! We want our King!"

"Father!" cried Atar. "Speak to them! Command them! Now, or panic will come and we are lost."

The King rose to his feet uncertainly. "Yes, speak to them—of course I will."

A woman swam hurriedly into the apartment—a serving woman to the Queen. "My King, the people are arriving from the forests and the mudbanks. They are crowding into Rax—they do not know where to go or what to do."

The rural population! Coming into the city for protection.

"I will speak to them," the King repeated—he said it numbly, as in a daze. "I must tell them something. . . . Atar, my son, we must plan something, you and I. But there is no time—the Maagogs are coming so soon."

It was then that my Nona whispered to me. Vehemently, with her soft arms en-

twined about my neck. Inspiring words! My blood raced hot through my veins.

"I?"

"You!" she insisted. "You, Nemo!"

Where was I born? I do not know. But I must have come from some great civilization. Latent within me were powers I little realized; and in that instant of crisis, with the inspiration of Nona's words, the blood of my ancestors dominated me.

I flung myself up into the water and waved my arms at the astonished King.

"A leader!" I cried. "We Marinoids need a man who will lead us to victory. It is I—Nemo—who will command! Og is coming. *I* will oppose him. I—the Stranger—with my woman Nona!"

I caught Atar's excited gaze; I added: "With you, Atar, to help me, we will win!"

The King was more confused than ever, but I saw that he was pleased—relieved. And my Nona's eyes were upon me. Pride, joy and love for me was in them.

"Come," I said to the King. "I will talk to the people, with you beside me. And you will tell them that Nemo—the Stranger within their gates—is in command!"

II—NEMO BECOMES A LEADER

We went to a little balcony outside the throne-room window. The crowd fell silent when it saw us. At the railing we stood beside each other, with Nona, Atar and the rest crowding the doorway behind us.

The King, with the responsibility of leadership removed from him so unexpectedly, had recovered his poise. He put one of his arms about my shoulder as smilingly he showed me to the people. It was a throng so dense that all I could see was a mass of faces and bodies. Silence, then a wavering cheer.

The King extended his other arms; and he told the hushed people that I was to be their leader. They cheered; but there was an ominous undercurrent of murmuring that went with it.

I was thinking swiftly—planning what I would say—what I should tell them to do. And I must admit that in that first moment I was confused myself. But no one should see it. I knew that most of all I must appear confident; and talk to them inspiringly—perhaps bombastically.

"My beloved people, the great God of the Marinoids sent me to you." I began. "To lead you against this traitor Og. Glorious

Within five minutes, I had hacked through the stem. Nona held the light. "Quietly," she whispered. "If they should hear us——" The stalk was severed. A tremor seemed to run over the upper part, and it moved slightly sidewise.

times are ahead of us, my people. Victory——"

But the murmur of dissent was growing! A voice shouted a raucous jibe.

"Wait! Listen to me, all of you. This Og, whom once I fought before you all——" It was an unfortunate allusion; I had lost that combat with Og. "Silence!" I shouted over the noise. "Into the Water of Wild Things I have just been—and from this self-same Og recovered my woman Nona."

But the mingled cheers and jibes halted me. I could feel that the King's arm around me was trembling.

He whispered to me quaveringly: "Go on, Nemo. Tell them——"

But my Nona suddenly sprang forward, up to the parapet.

NONA SPEAKS

"Women of the Marinoids——" Her voice to the women of the crowd rang out clear and silenced the confusion.

"Women of the Marinoids! This is war! We women—our virtue—our children—our homes, are threatened! Do we fight, or do we sit by while our men defend us? Women of the Marinoids—answer me!"

They did answer her. Their shouts of applause came up—enthusiastic shouts of the women in, which the cheering voices of the men were mingled.

And over it all came Nona's cry: "I knew you would say that!"

My wonderful Nona! She was dominating them. Her glorious arms—smooth as pink marble—went out to them appealingly.

"We are but women, frail of body. But the spirit of battle is strong within us. Our virtue—could we fight for anything more sacred? To our men, it is everything. Let us help them preserve it—not with words—with deeds!"

Then she called upon all the women who were young and strong like herself—bade them come now to the palace roof-top.

"Come!" she cried. "All you women who will fight for your virtue. Let us show our men what sort of women are theirs. Come now, and Nona—the Stranger's woman—will command you in the battle!"

They came. From out of the crowd they swam upward—the fairest, most beautiful of the Marinoid girls—and settled upon the palace roof. Two hundred of them perhaps. It was inspiring. It could not help but be—and my Nona knew it and had planned it thus. The men, seeing them gather, cheered loudly and called upon me to lead them to protect their women.

It saved the situation for the King and me. Nona swam upward.

"My man Nemo will command you men," she shouted. "And I will lead the women."

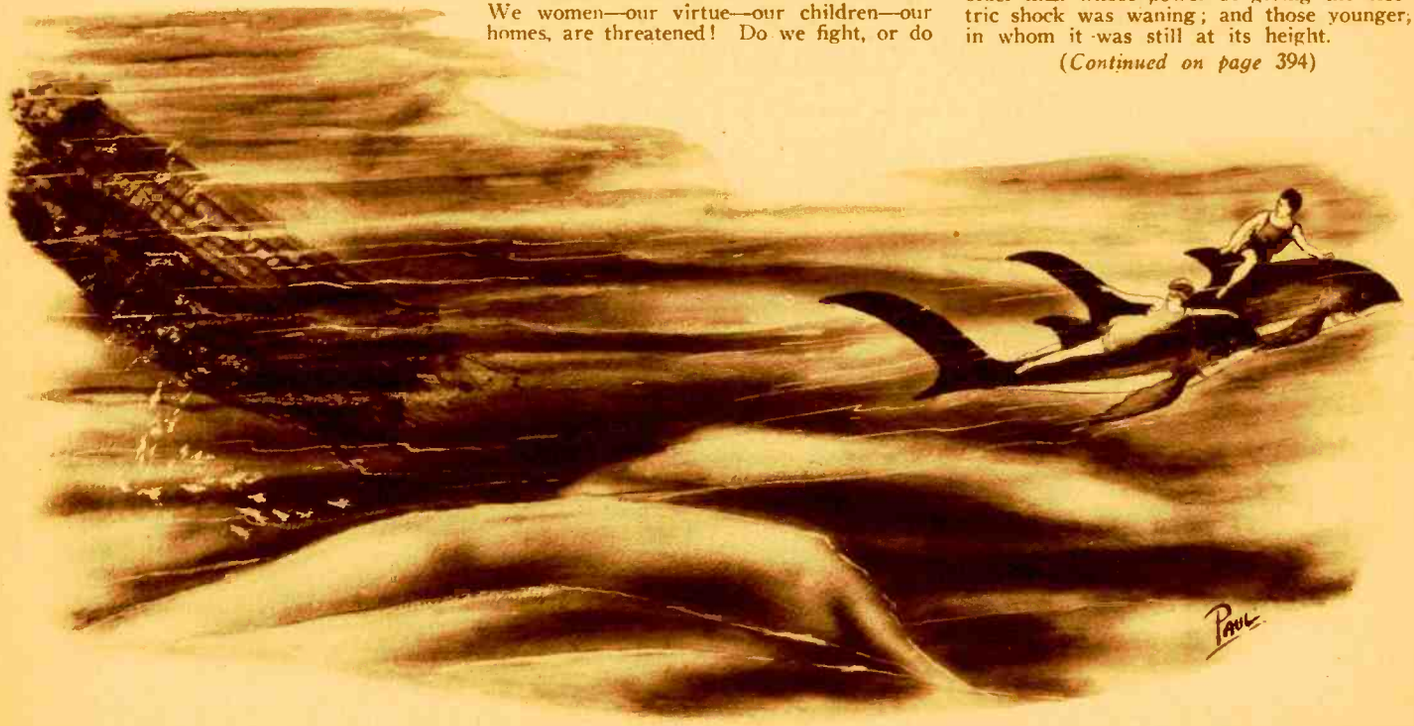
She gazed down at me. "We women will wait for your orders, my Nemo. For after all—we are but women."

And among the girls she took her place—waiting.

I had made my decisions. The crowd now was with me. In a breath, I knew, the news of my leadership would spread through the city.

I spoke. I knew that my voice now carried the real confidence of authority; and the crowd knew it. I commanded that all the older women, old men and children should go to their homes, bar their doors and windows, and wait. All men, able-bodied, I ordered to the roof of the city, there to wait for their arms and equipment which very soon would be furnished them. They were to divide themselves into two groups; older men whose power of giving the electric shock was waning; and those younger, in whom it was still at its height.

(*Continued on page* 394)

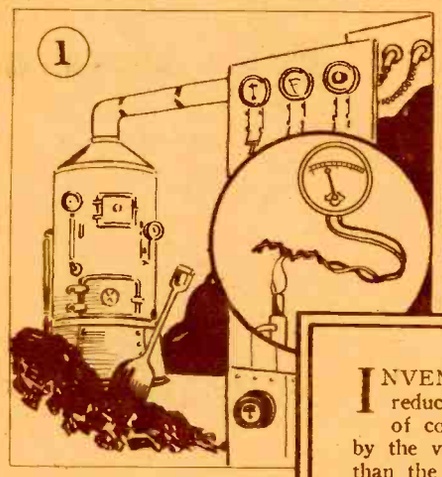


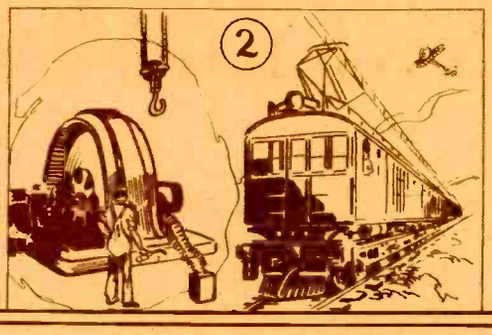
Back to our dolphins. They were waiting; we mounted them—turned to look at the city. It was turning over in the water and floating away. Slowly, then faster, down toward that black opening into which the current would sweep it.

The Ten Most Needed Inventions

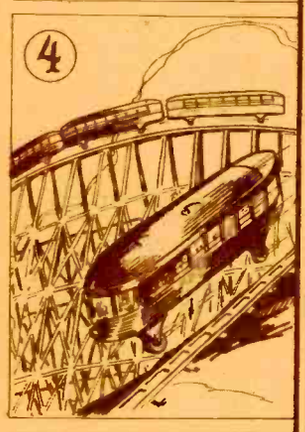
Puzzling questions confronting scientists.

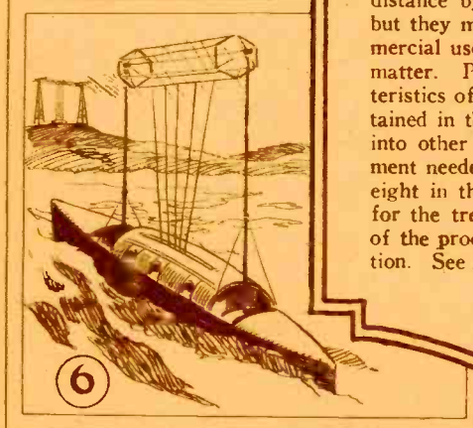
By RAYMOND FRANCIS YATES

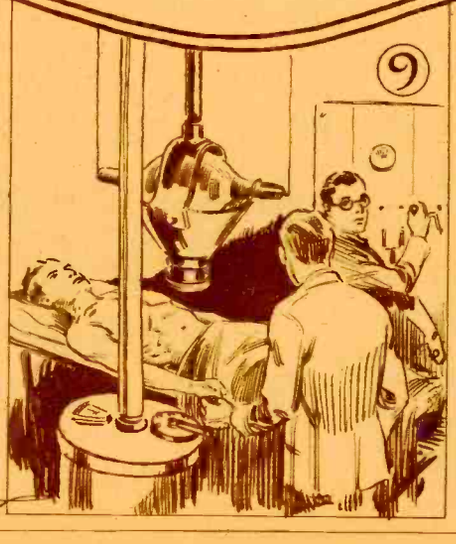




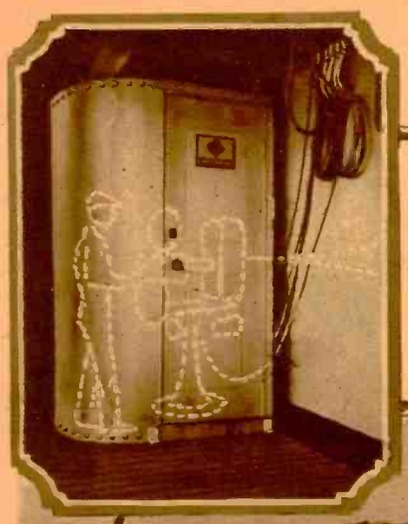
INVENTIONS most needed by civilization are those which will reduce the enormous amount of waste present in our methods of converting fuel into power. The waste, the tribute taken by the various power machines of today, is many times greater than the actual amount used by the consumer. The first most needed invention is a means for converting fuel directly into electricity without the intervention of boilers and steam engines. Such a method is hinted at in Fig. 1. Following closely on this need is the necessity for the production of a power reservoir which will store much energy in small space. Such an invention would greatly simplify our present methods of transportation, it would make electric airplanes possible. See Fig. 2. Then comes cold light. Only eight per cent. of the power delivered to the bulbs of the present day electric light is utilized in actual light. The remainder is wasted in useless heat. .3. The fourth most needed invention is more rapid and economical transportation. Here the monorail comes again into consideration. Aircraft may be used for light freight and express but for the present it is not considered as a carrier of the bulky, heavy materials. The fifth great need is the wireless transmission of power. Experiments have already been conducted along this line. Next in line of importance seems to be the perfection of traveling mechanisms controlled entirely at a distance by means of radio. Such mechanisms have been made but they must be brought to a stability which will withstand commercial use. 6. Then there is the problem of the transmutation of matter. Physicists and chemists have discovered that the characteristics of matter are due entirely to the number of electrons contained in the atoms which make it up. At present radium changes into other elements. Some day we shall be able to make any element needed by changing one form of matter to another. Number eight in the list is television. Then comes the perfection of rays for the treatment of various of man's diseases and the perfection of the process by which eyes may be grafted and grown to perfection. See Figs. 9 and 10.







Movies in Trans-Atlantic Liner Salon



So cleverly hidden is the movie projector and screen aboard the steamship Deutschland that it was only through accident that a SCIENCE & INVENTION reporter discovered the equipment. Above at the left is shown the steel operator's booth and its hiding place. This is an all steel enclosure fitted with a fire-proof door, so that there is no danger of fire while the projection machine is in use. The movies are projected through a small hole about 3" in diameter in the steel front of the projection booth, which rests up against the steel wall of the salon. As the perspective picture below shows, the movies are projected over the heads of the people on to a screen which is stretched when needed just back of the grand staircase. In daytime one would never suspect that the Deutschland carries movies aboard, as there is no evidence to give this impression to the passengers. Even the hole in the wall through which the movies are projected is covered by a panel door finished to match the wall.

Printing Names on Cigars and Fruit

ORANGES

GRAPEFRUIT

APPLES

TOMATOES

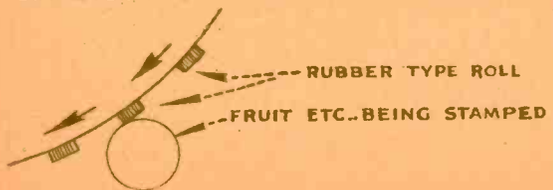
NUTS

GOLF BALLS

BASEBALLS

ORANGE PRINTER

(50,000 ORANGES PER HOUR) TAKES 2" TO 4" DIAMETER FRUIT WITHOUT ADJUSTMENT

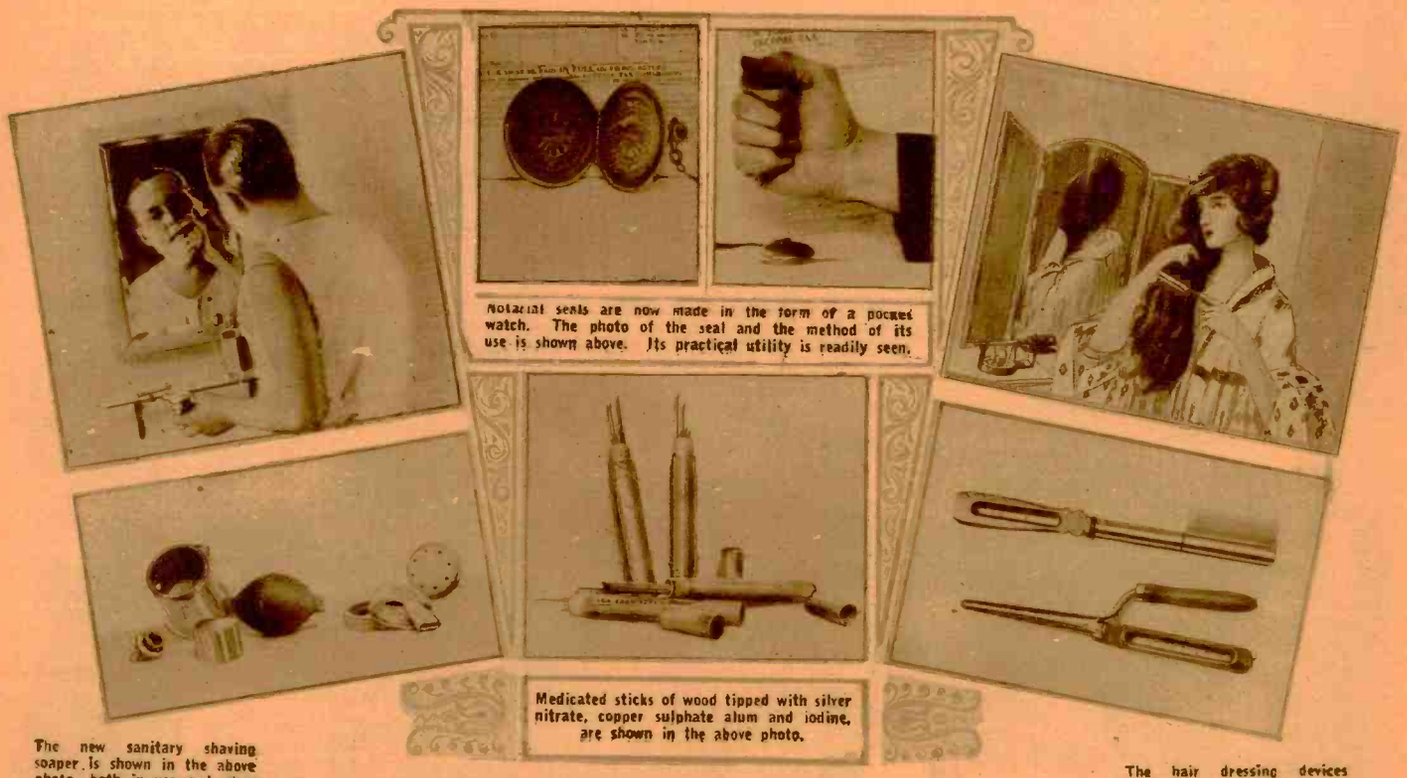


CYLINDER PRINTER

CIGAR PRINTING MACHINE (LABELS 150 CIGARS PER MINUTE)

An enterprising eastern concern has developed and perfected several styles of printing machines which will rapidly and effectively stamp a trade name or monogram on fruit, nuts, baseballs, and cigars. The orange industry is one of the largest users of these trade marking machines. One of the machines is shown in use at the left. One of these orange stamping machines has a capacity of 50,000 oranges per hour, and will take 2" to 4" diameter fruit automatically without readjustment. These machines use rubber type, so as not to injure the surface of the fruit. The center picture above shows a cylinder printer suitable for stamping trade marks on cylindrical surfaces, such as cardboard boxes. The cigar printing machine is shown directly above at the right, and the small machine shown has a capacity of 150 cigars per minute. A special type of non-poisonous ink is used with all the machines. Our readers may remember that some years ago we published the details of a contest in which a large sum of money was offered by a California association for a perfect machine to stamp walnuts. The machines made by the present concern go far beyond the problem of stamping walnuts. Imagine stamping tomatoes!

The Month's New Devices



Notarial seals are now made in the form of a pocket watch. The photo of the seal and the method of its use is shown above. Its practical utility is readily seen.

Medicated sticks of wood tipped with silver nitrate, copper sulphate alum and iodine, are shown in the above photo.

The new sanitary shaving soaper is shown in the above photo, both in use and when taken apart. There is a bulb mounted at the end of a highly nickel-plated container provided with an aperture for pouring water into it. A piece of soap is put into the container and on top of the soap a perforated disk is placed. Finally the cover is locked in place. Pressing the bulb produces a profuse lather, which is applied to the face by the hand.

The hair dressing devices shown in the above photo will find immediate acceptance in the boudoir. Generally, milady has a difficult time judging the temperature of a curling iron. With the marcel iron shown above, she needs but look at the handle where a thermometer indicates the temperature. Two lines on this thermometer give a maximum and minimum working temperature. The comb is for straightening crinkly hair.

—Walter H. Sammons.

The above photo shows an apple parer and corer. The machine, although appearing complicated, is very simple in construction, and is, incidentally, very rigidly constructed. The apple is placed on a three leaved spindle until it almost touches the nuts. A few turns of the wheel and the knife will have passed from one end of the apple to the other, and will have taken off an extremely thin shaving of skin. As soon as the operation is completed, the knife moves away from the apple which is automatically thrown from the spindle. The peeled apple is then put down on a plate and the corer and slicer pressed down upon it. The core is instantly removed and the apple cut into fourteen or eighteen slices. Irregularly shaped apples work equally well in this machine.

—Robert Buchi.

The kettle illustrated above is ideal for campers and for those living in mountainous regions where water boils at a temperature below 212° F. The kettle is double and has a cover held in place by a spring, which permits of a high temperature being reached because the tight cover increases the internal pressure, and consequently raises the boiling point. Potatoes are boiled much more quickly in this device than in the ordinary type.

The center photos show a novel form of check protector. In the center of this check a translucent space is found in which the amount for which it is drawn is printed by a device in the cover of the check book. This device consists of a series of racks, upon which are metal numbers embossed and grooved for receiving a slide, having corresponding grooves. The check is put down upon the amount to be printed upon it, and the roller is passed from one end to the other, causing the window to show up the amount in white perforated numbers. All attempts at erasure will fail. —F. E. Jones

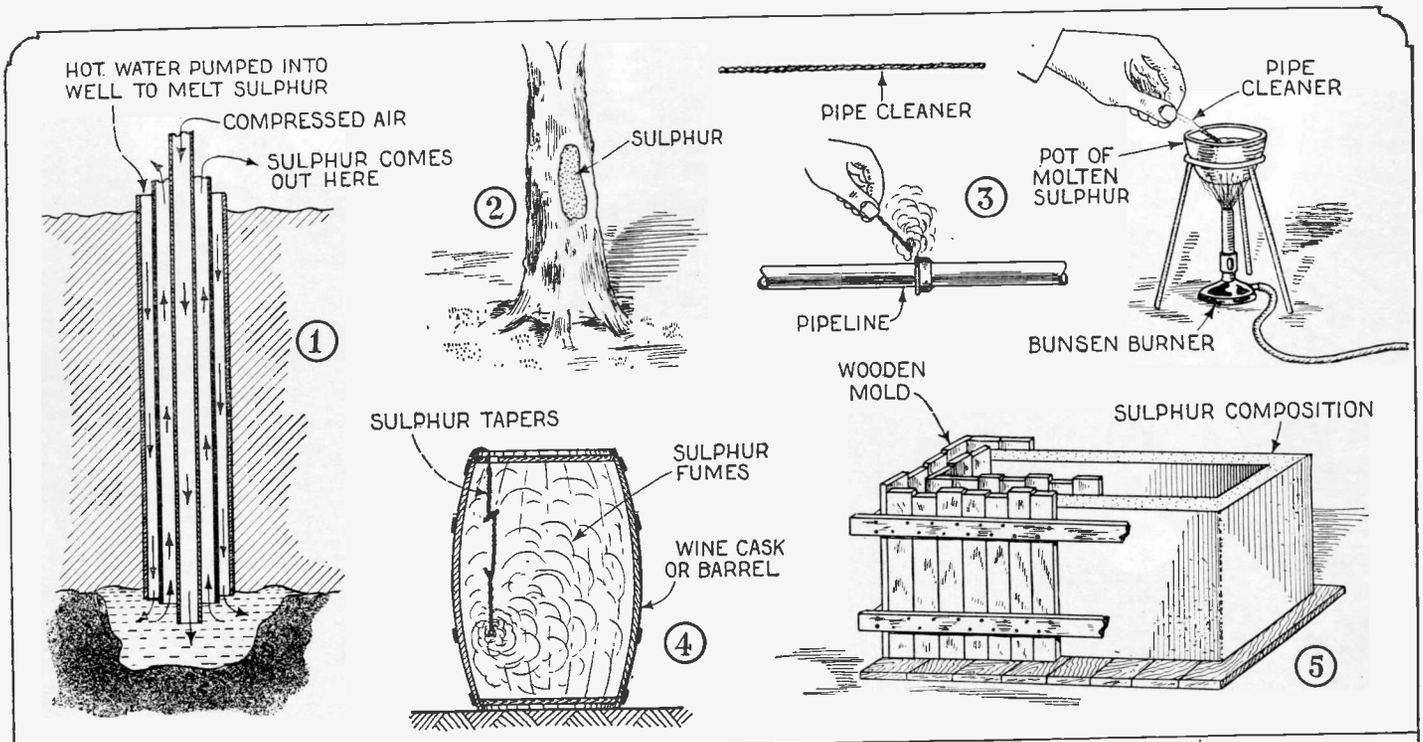
The drink mixer shown above can be used for beating eggs, churning milk, whipping cream, etc. Due to its wonderful design, its action is practically instantaneous.

—L. W. Jones.

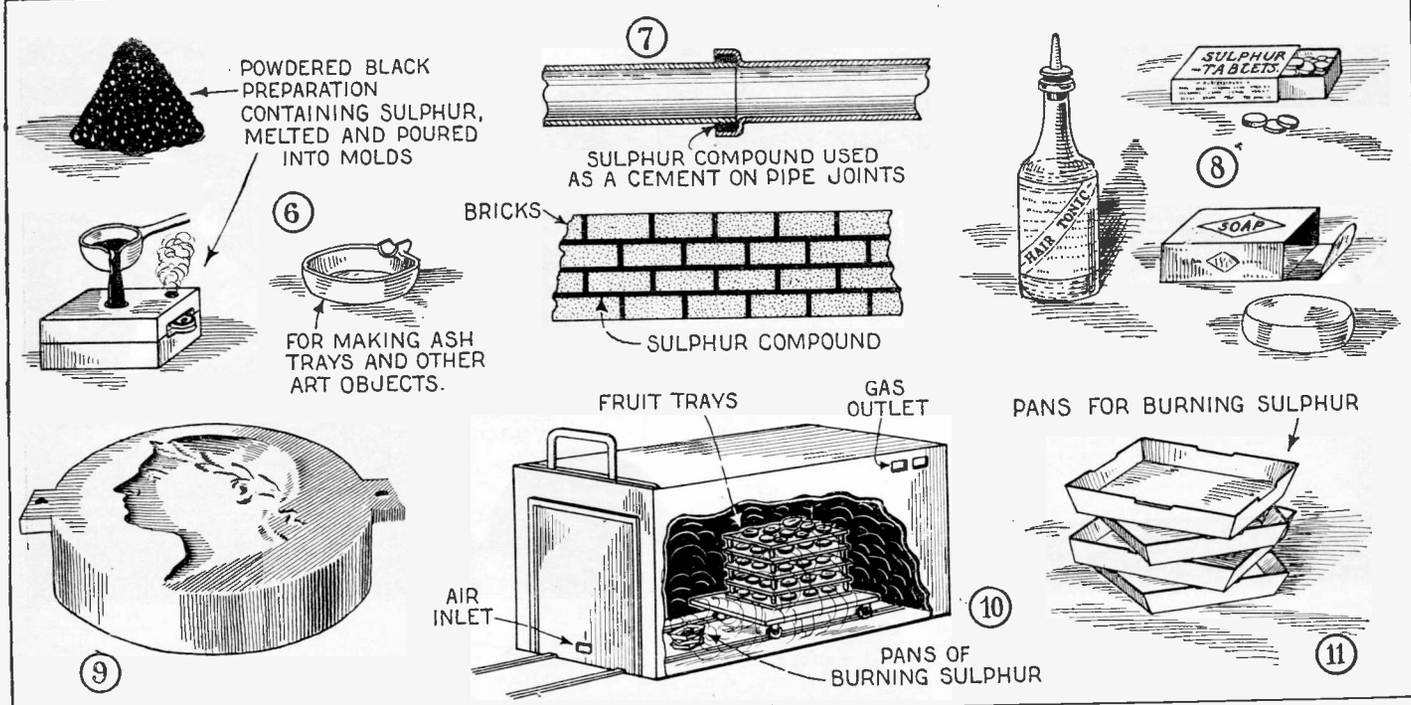
Sulphur--Its Uses and Adaptations

Showing methods of mining and uses of the material.

By ISMAR GINSBERG, B.SC., CHEM. ENG.



Sulphur is one of the most widely used of household chemicals. The methods of its preparation and mining as well as a number of its uses are graphically shown on this page. A large part of our present supply of domestic sulphur is mined in Louisana and Texas by the method shown at 1 in the above drawing. Beds of the material are found beneath quicksands and below other earth deposits. The mining process is very simple. Boiling water is forced down the outside pipe in the well casing and so melts the material. Compressed air is connected to the center pipe forcing a heavy pressure on the surface of the bed. As the sulphur melts the pressure forces it up through the second pipe from which it is delivered for shipping. One of the least known uses of sulphur is shown at 2. Trees, having cavities due to decay are filled with the material in a molten state. At 3 is shown another important use. In refrigerator plants, pipe lines carrying ammonia often spring a leak. They are exceptionally hard to find without the method employing sulphur. This method consists simply in applying the material to an ordinary tobacco pipe cleaner, in the method shown (dipping the cleaner in a pot of molten sulphur) lighting the taper and carrying it along the pipe suspected of leaking. When the leak is reached the combination of sulphur and ammonia will form a thick white cloud. For the fumigation of barrels that are to be used a second time there is no better method than the one shown at 4. Acid-proof tanks are shown at 5.

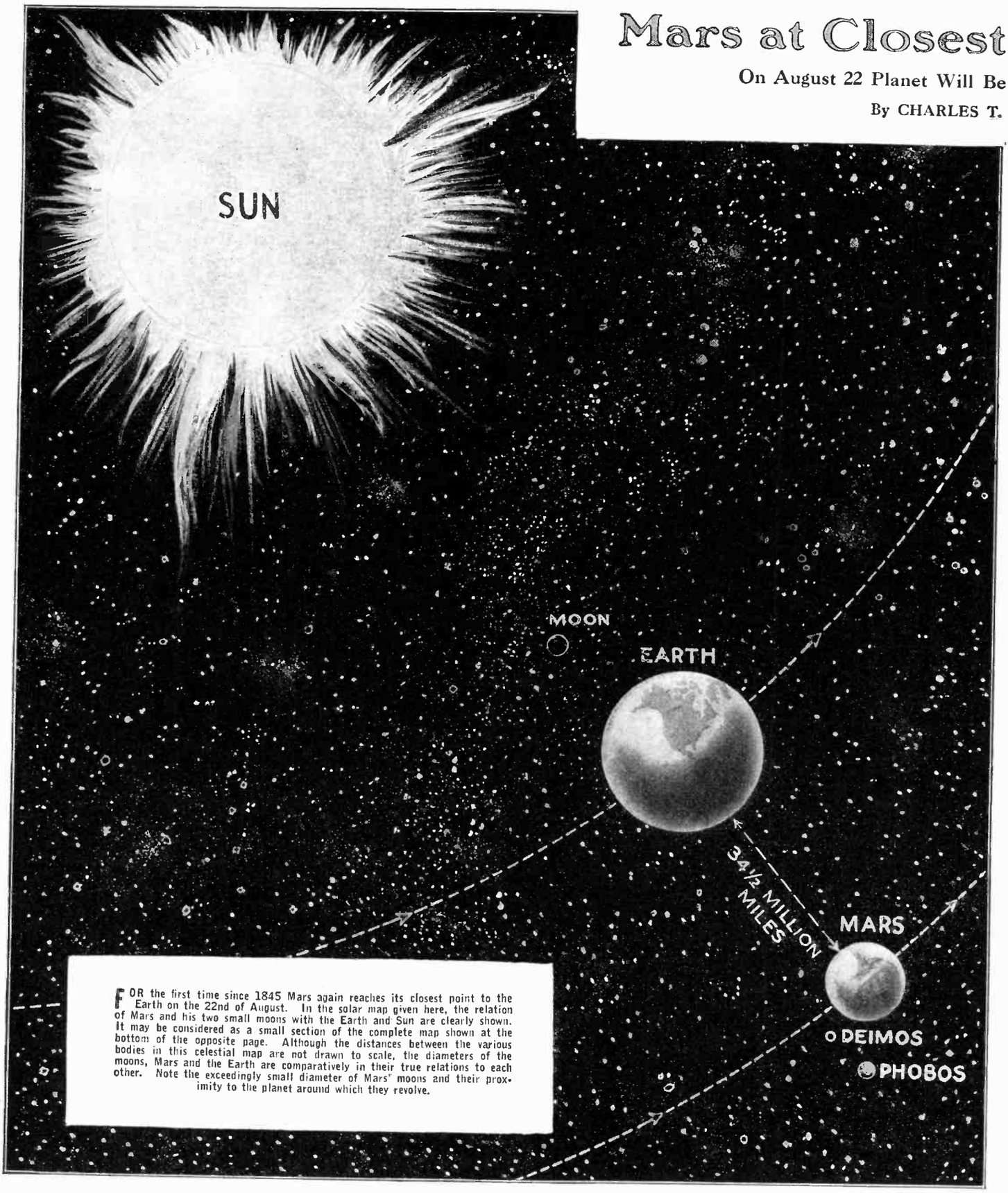


The uses of sulphur compounds are legion. Aside from its use in moulded insulators and insulating compounds—which use takes in a large part of the annual production of the substance—much of it is used in other compounds for making moulded vessels to be used in the home. At 6 is shown the method of moulding such a compound for making an ash tray. Combined with some other elements a product that is hard, takes a high polish and resists atmosphere and acids, results. The additional advantage, gained by the fact that such a material may be cast when melted and worked similar to wood after casting, is a large factor in its favor. Many pipe joint cements are made of sulphur compounds as they are easy to work and comparatively inexpensive. This use is illustrated at 7. There is almost no end to the number of medicines which contain sulphur in some form or other. Just a few of them are illustrated at 8. Many hair tonics are built on it as a base while a large number of soaps and cosmetics use it. There are several stomach disorders for which it is a specific. Many walls which are to be subjected to acid or other chemical fumes are put together with sulphur cement on account of its ability to withstand such uses where the ordinary mortar would disintegrate. At 9 is shown a mould for making plaster plaques. Such a mould will last for forty years or more and needs only to be oiled to be used. In the fruit packing and many other industries where bleaching is necessary sulphur finds a wide use. At 10 is shown one method. The product to be bleached is placed in an oven with large pans of sulphur which is burned; the pans containing it should be stacked as shown at 11.

Mars at Closest

On August 22 Planet Will Be

By CHARLES T.



FOR the first time since 1845 Mars again reaches its closest point to the Earth on the 22nd of August. In the solar map given here, the relation of Mars and his two small moons with the Earth and Sun are clearly shown. It may be considered as a small section of the complete map shown at the bottom of the opposite page. Although the distances between the various bodies in this celestial map are not drawn to scale, the diameters of the moons, Mars and the Earth are comparatively in their true relations to each other. Note the exceedingly small diameter of Mars' moons and their proximity to the planet around which they revolve.

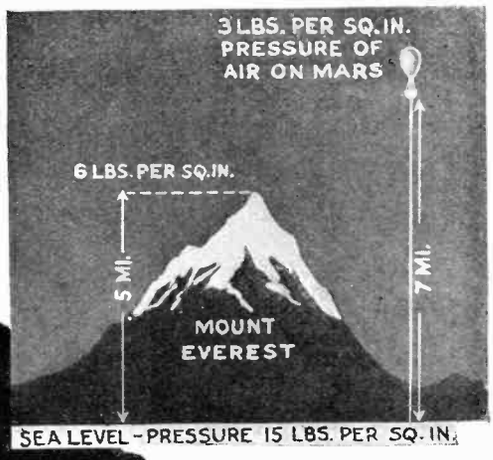
WITH the exception of the moon, astronomers know more of Mars than of any other celestial body. The planet Venus approaches nearer the earth, but is usually surrounded by clouds defeating observations. The rarity of the atmosphere on Mars, however (even less dense than that atop Mt. Everest), allows excellent observations. As seen through a telescope, his surface resembles red sandstone. The polar caps, surely of snow, are white while tinges of green in certain spots indicate the existence of vegetation. This point, however, is disputed since the rarity of the atmosphere would make it impossible for vegetable life as we know it to exist on the planet. With so little air, the sky of Mars would not have the blue tint familiar to the earth. Even at noon the sky would be almost jet black. Stars would be visible by day. As seen from Mars the Earth would be a spectacle of beauty, about as bright as Venus is to us, with the added attraction of the moon, which would appear with practically the same luminosity as Sirius.

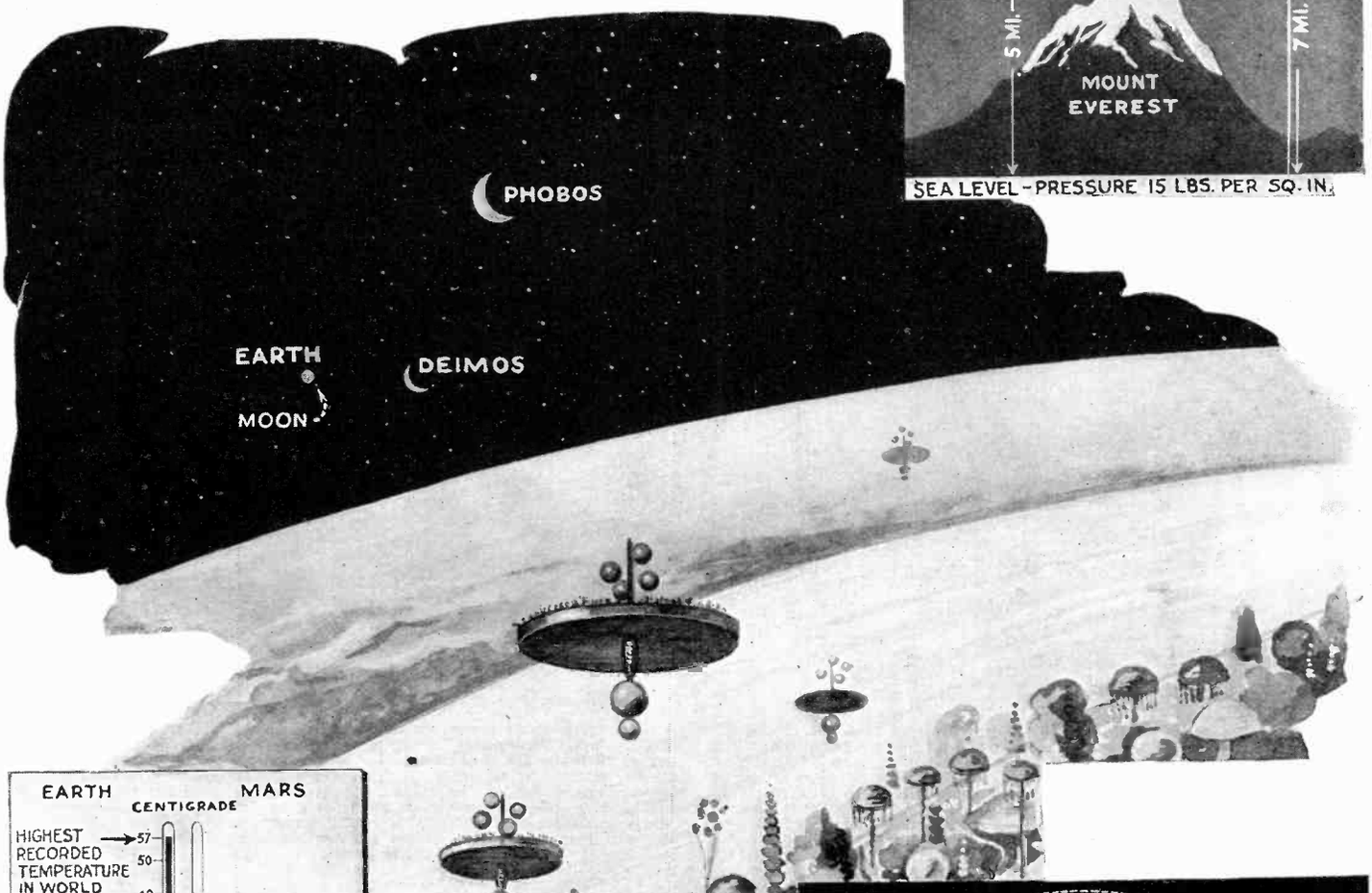
Clouds about the earth's surface might dim her glory upon occasion, however.

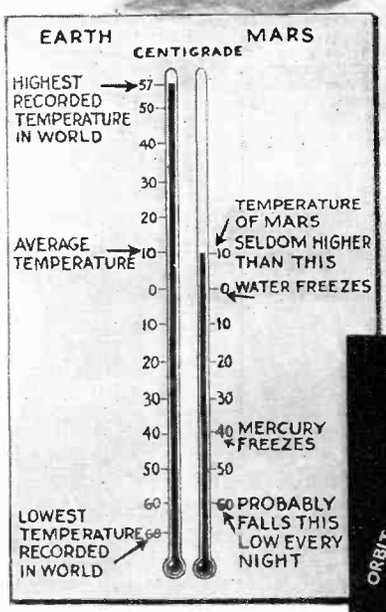
Point to Earth

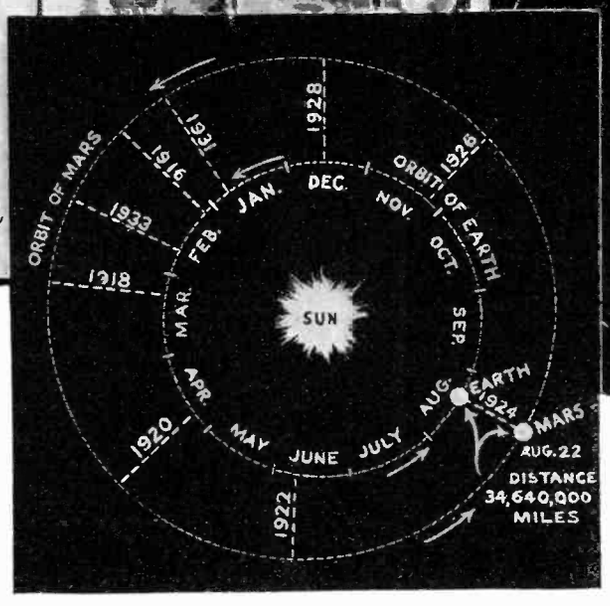
Only 34 Million Miles Away.

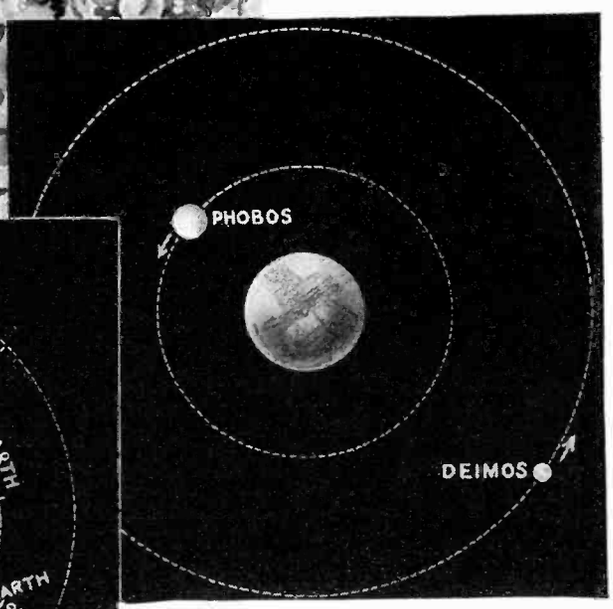
DAHAMA, Ph. D.









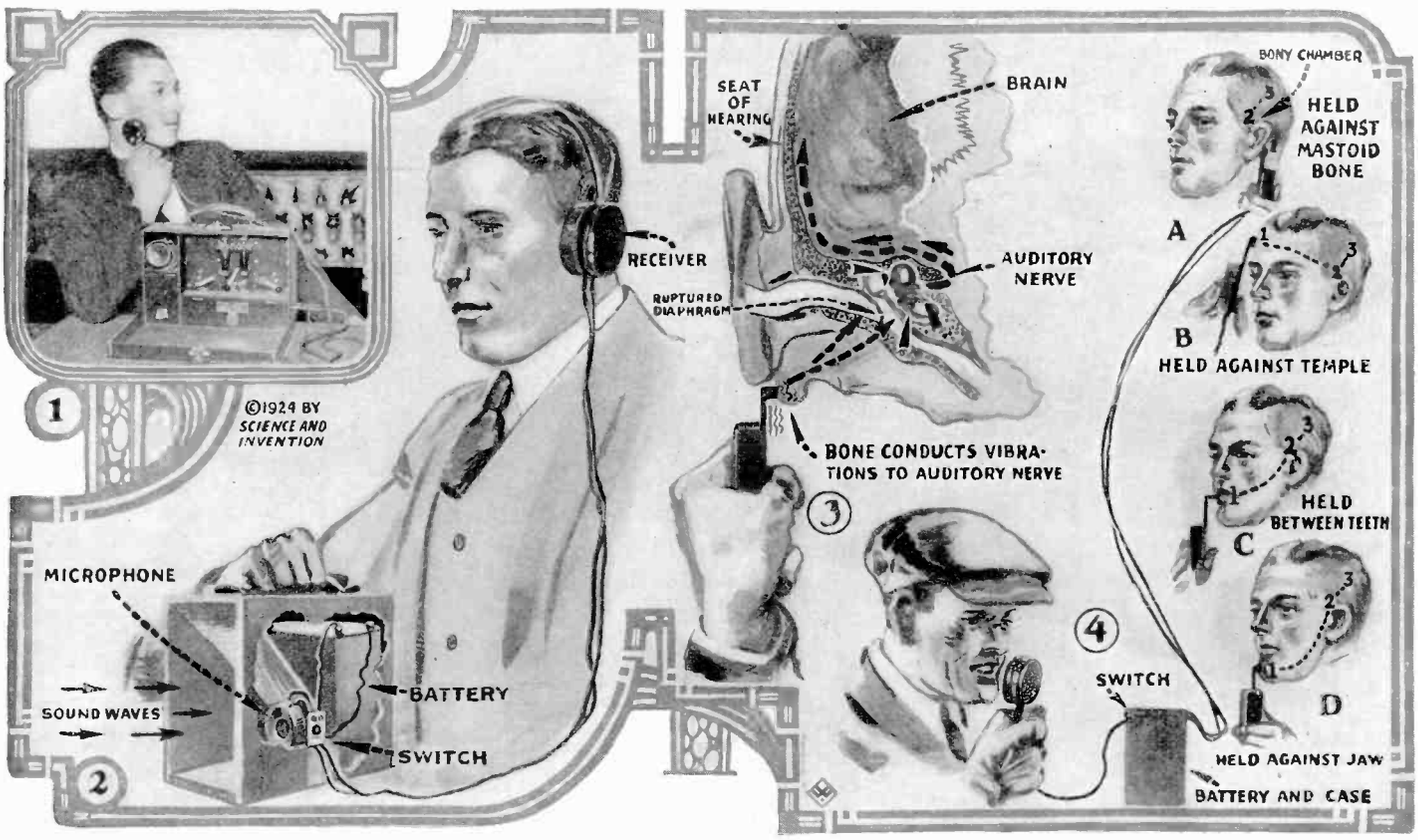


The large center illustration gives a scientific deduction of the appearance of a Mars' landscape. The two moons of the planet, as well as the Earth and moon, are shown in the sky. In the foreground is one of the hypothetical Martian canals, along the edge of which there is queer vegetation, while above floats Mr. Gernsback's conception of a Martian aerial flyer. Mars has two moons, discovered in 1877 by Prof. Hall of the U. S. Naval Observatory. The nearer one, Phobos, is only about 3,700 miles above Mars' surface, and it performs a single revolution in seven hours thirty-nine minutes, less than one-third the Martian day.

At the extreme top of the page is shown a comparison by which the reader may judge the density of the Martian atmosphere. Were a balloonist to ascend seven miles above the earth, he would reach the approximate density which obtains at the surface of Mars. The thermometers at the left show graphically the range of temperatures through which the surface air on the red planet passes every day. The map at the immediate left shows the two orbits of the Earth and Mars, while the sketch above gives an idea of the relation between the planet and his two moons.

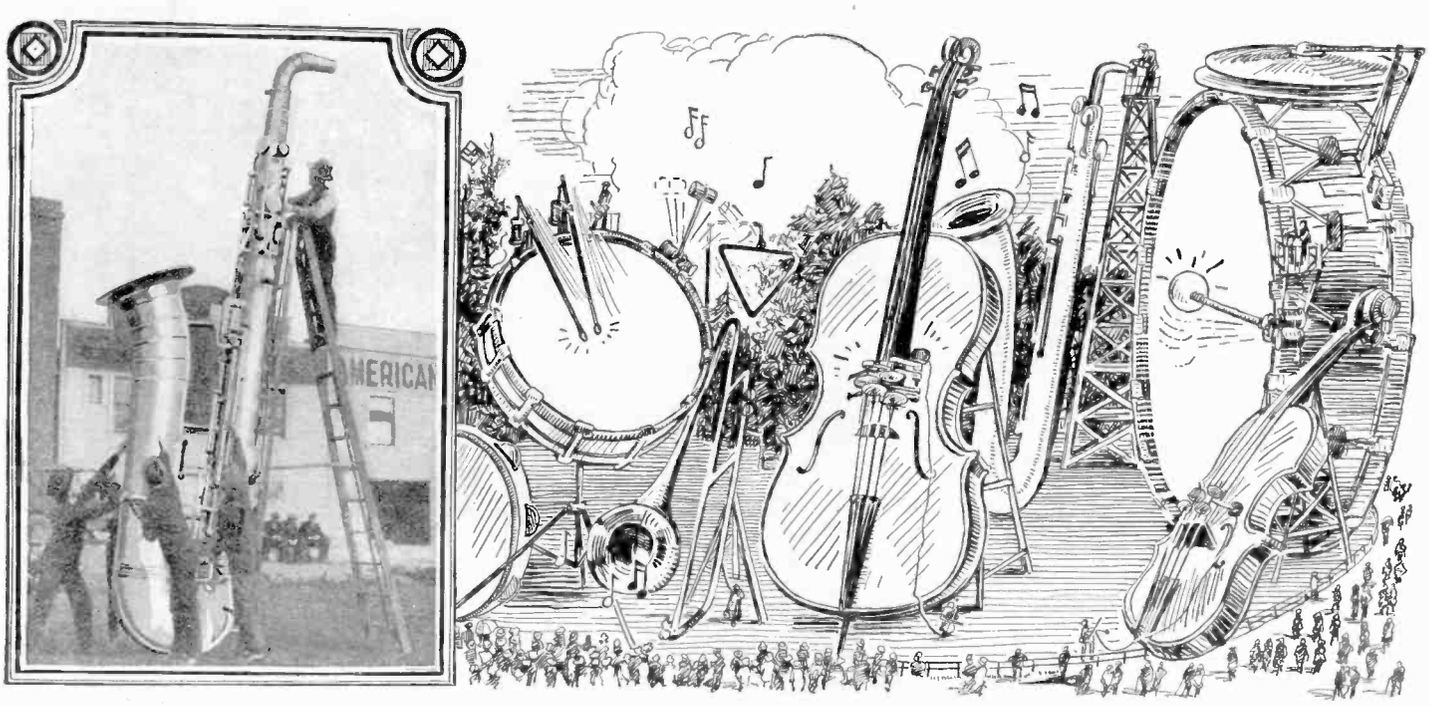
An English Ossiphone

New Instrument Aids the Partially Deaf to Hear



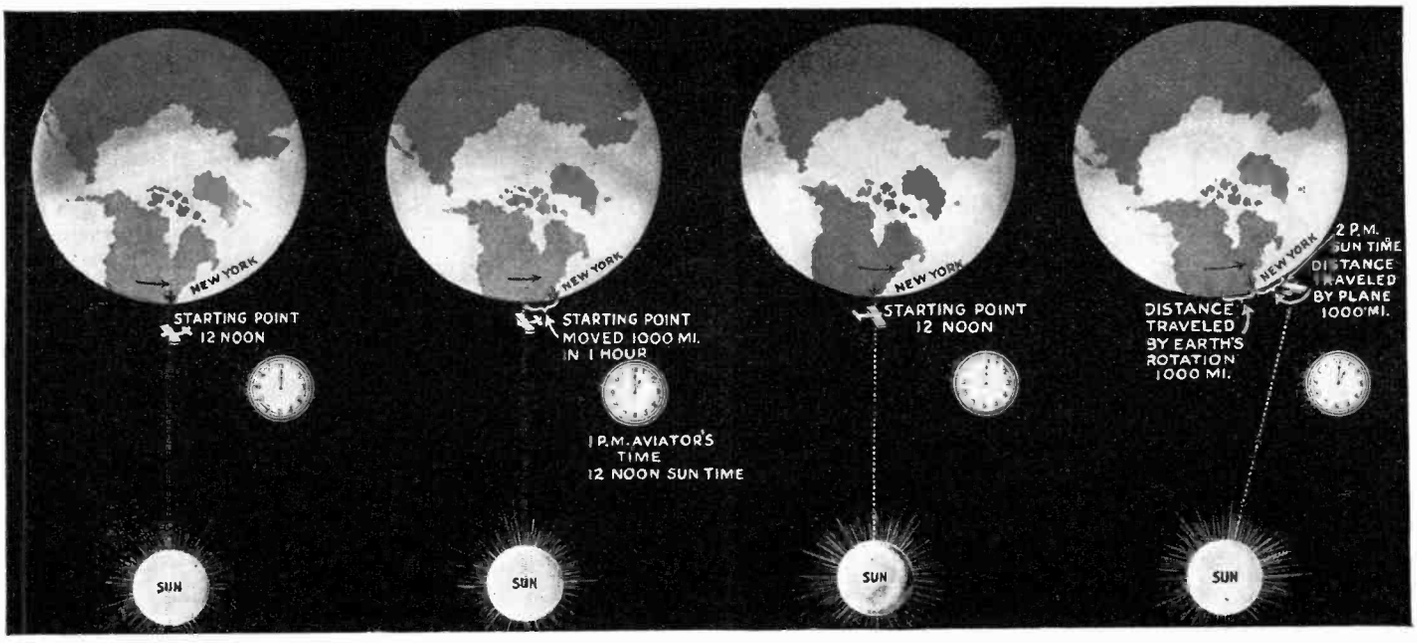
A few months ago SCIENCE AND INVENTION published an article showing how easily the partially deaf could be made to hear by the simple means of transmitting the sound through the bony structure of the head to the ear drum. Following out this principle, an English concern have just announced the manufacture for sale of an instrument working on this principle. It consists primarily of a microphone which picks up the sound waves in the same manner as the ordinary telephone transmitter, and communicates them to a receiver, to whose diaphragm is attached a stiff vibrating member. The pulsating current of the microphone passes through the magnets in the field of which the diaphragm with the vibrating member attached, is placed. This agency changes the air waves of the sound into mechanical vibrations which may effectually be transmitted to the ear drum through the bony structure of the head. The illustration at 4 shows some of the positions in which the vibrating member may be placed. The apparatus is also supplied with an ordinary telephone receiver (at left) for the use of those who are only slightly deaf. The arrangement of the transmitter allows the person using the instrument to hear the general conversation, instead of only the voice of one person, as instruments of somewhat similar construction allow. One model, shown above at left, embodies an audion amplifier.

A GIANT JAZZ BAND



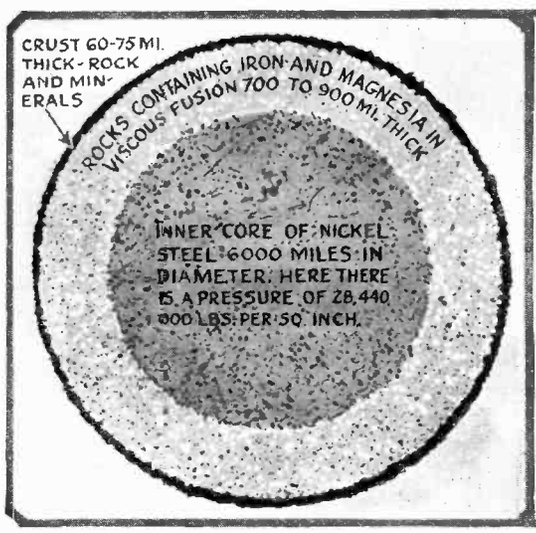
The photograph at the left shows the largest saxophone ever made. Its manufacture was recently completed by a San Francisco musical instrument maker. The instrument weighs upwards of 500 pounds, and required the work of several men for weeks to complete it. If the popularity of jazz continues, it may be necessary in the future to manufacture a complete set of orchestral instruments of a relative size to the saxophone shown in the photograph, in order that the ever-growing love of the populace for this brand of music may be satisfied. The imagination of our artist gives some idea of what a future community concert may look like.

What Airplanes Can Do To Time

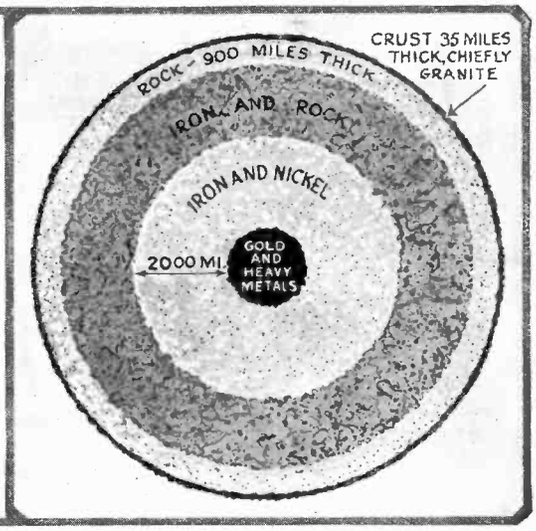


If airplanes attain a much greater speed, about 1000 miles per hour, it will be possible for them to eliminate time. In the above illustration the first sketch shows a plane starting at New York and flying opposite to the rotation of the earth. When it reaches Chicago the aviator's watch says 1 o'clock, but the sun is still in the noontime position. This graphically illustrates why long flights are usually made from east to west. They have daylight. Flying in the opposite direction the daylight time is cut down as shown by the two illustrations at the right. —Dr. Russell G. Harris.

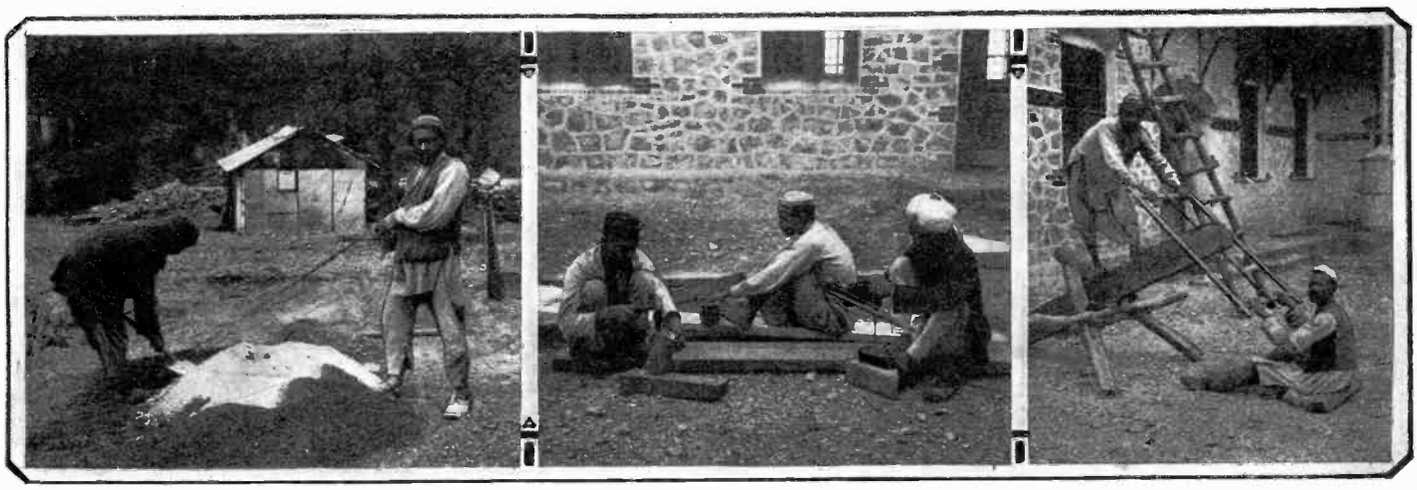
Composition of the Earth



At present there are two ideas as to the interior composition of the earth. They are illustrated here. At the left is shown one in which the center core of the earth is composed of nickel steel. This idea is arrived at from the fact that the specific gravity of the earth has been pretty closely calculated at 8.6, while the usual minerals found in the crust of the earth run from 2.6 to 3.3. The center core must, therefore, be composed of heavier metals, presumably nickel steel with a specific gravity between 7.9 and 8.8. The mass must be solid since if it were liquid there would be tidal movements in it due to the attraction of the moon. A study of earthquake waves leads to the conclusion that there must be another layer in fusion between this center layer and the outer crust.—Dr. G. S. Schmitz. At the right is shown the conception of the Earth's cross-section, due to Drs. E. D. Williamson and L. G. Adams of the Carnegie Institution. At the center is a core of gold and platinum. Surrounding this is a layer of iron and nickel alloy. Then there follows a belt of iron and rock crowned by a layer of rock, and then the thick outer granite crust.



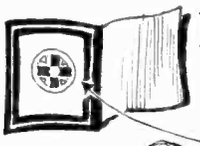
The Building Industry of India

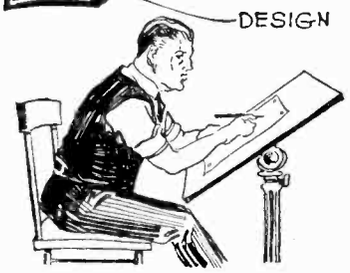


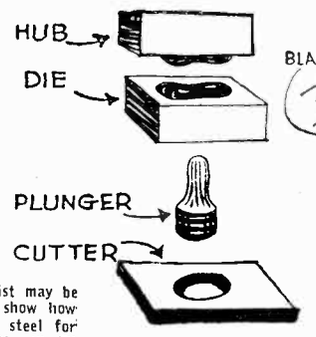
The building industry of India is shown in full swing in the above photograph. At the left is shown a concrete mixer. Note the rope attached to the shovel. The carpenters in the center photograph are of the highest order. The photograph at the extreme right illustrates an Indian sawmill working at top speed.

How Your Lodge Button is Made

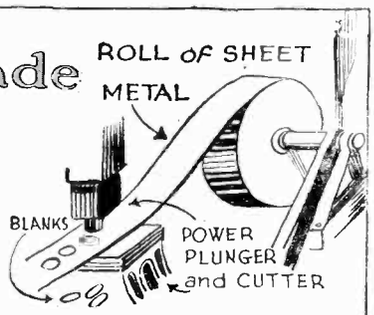
By L. B. ROBBINS



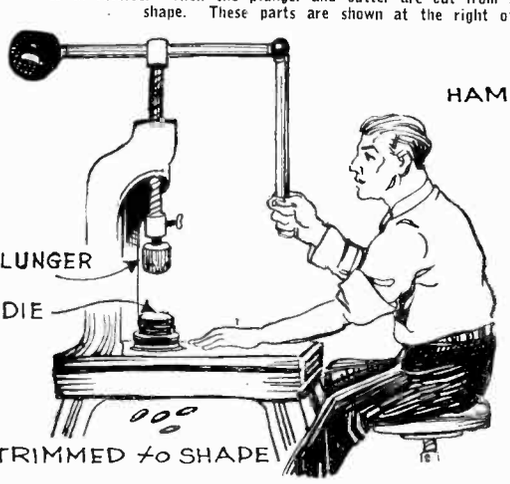


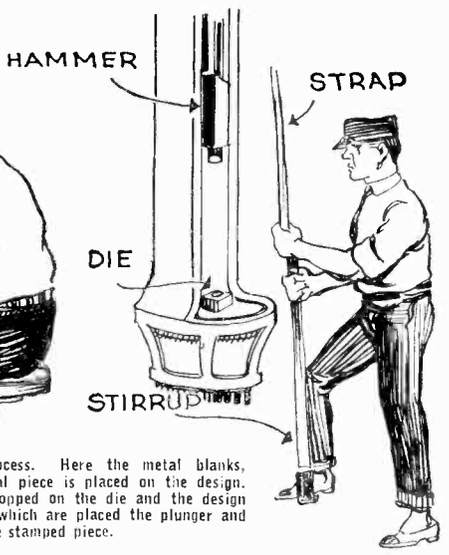


The manufacture of a Lodge Button is an interesting process. In the figure above an artist may be seen making a sketch of the button. This sketch is colored, and when complete, will show how the button will appear. To the right the tool-maker may be seen cutting the dies in steel for striking up the design. The "hub" is modeled in relief in steel, the die struck up from the "hub" is in reverse. Then the plunger and cutter are cut from steel by which the piece is trimmed to shape. These parts are shown at the right of the die cutting operation.

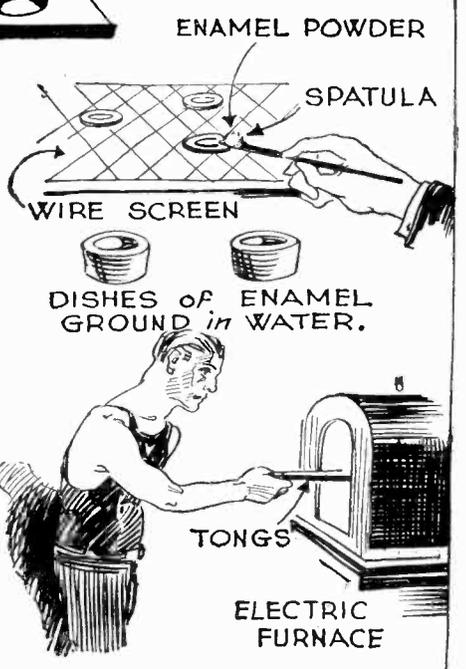


In the figure above a roll of metal ribbon is being punched out to form rough shaped pieces, or blanks, which are to be used in stamping, the next stage of the process.

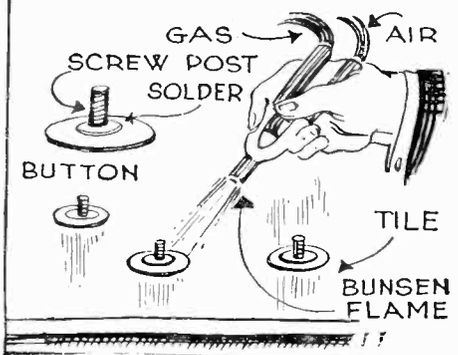




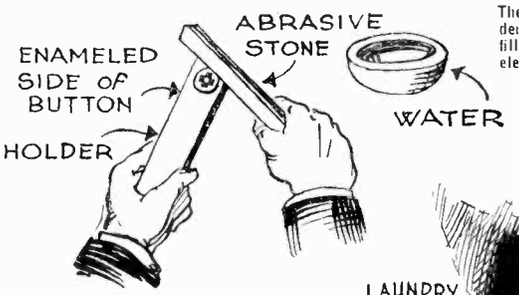
Above, the right illustration shows the stamping process. Here the metal blanks, are placed on the die containing the design. The metal piece is placed on the design. The hammer, with the othed half of the die, is now dropped on the die and the design embossed. The machine at the left is a screw-press in which are placed the plunger and the cutter for trimming the edges of the stamped piece.



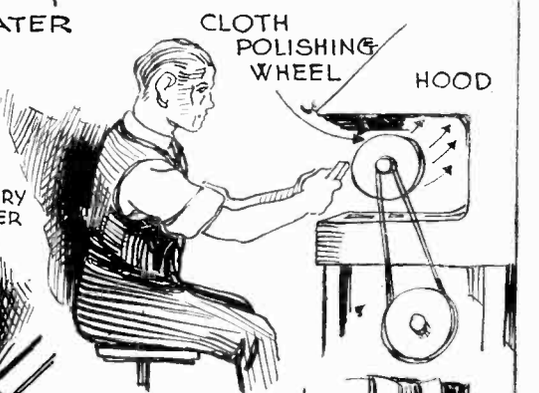
The button is enameled by covering it with powdered enamel mixed with water. A metal screen filled with the covered buttons is then placed in an electric furnace and baked until the enamel melts and spreads over the button.



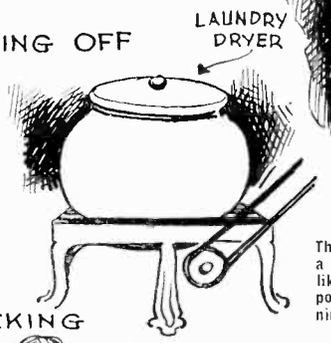
The buttons are now turned upside down and a small piece of solder is placed upon the back. Over this a screw post is held and then the whole is soldered together by a blow-pipe flame as illustrated above.

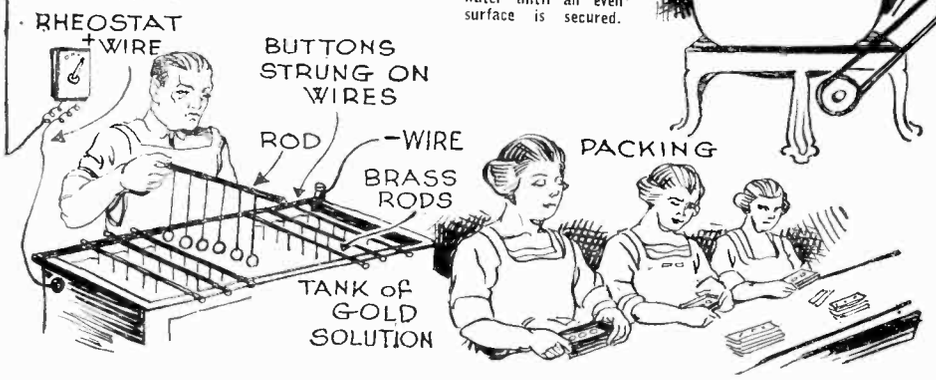


The buttons are then set in wooden holders and stoned off with an abrasive stone and water until an even surface is secured.



The buttons are given a high and glass-like finish on a cloth polishing wheel running at a high speed.





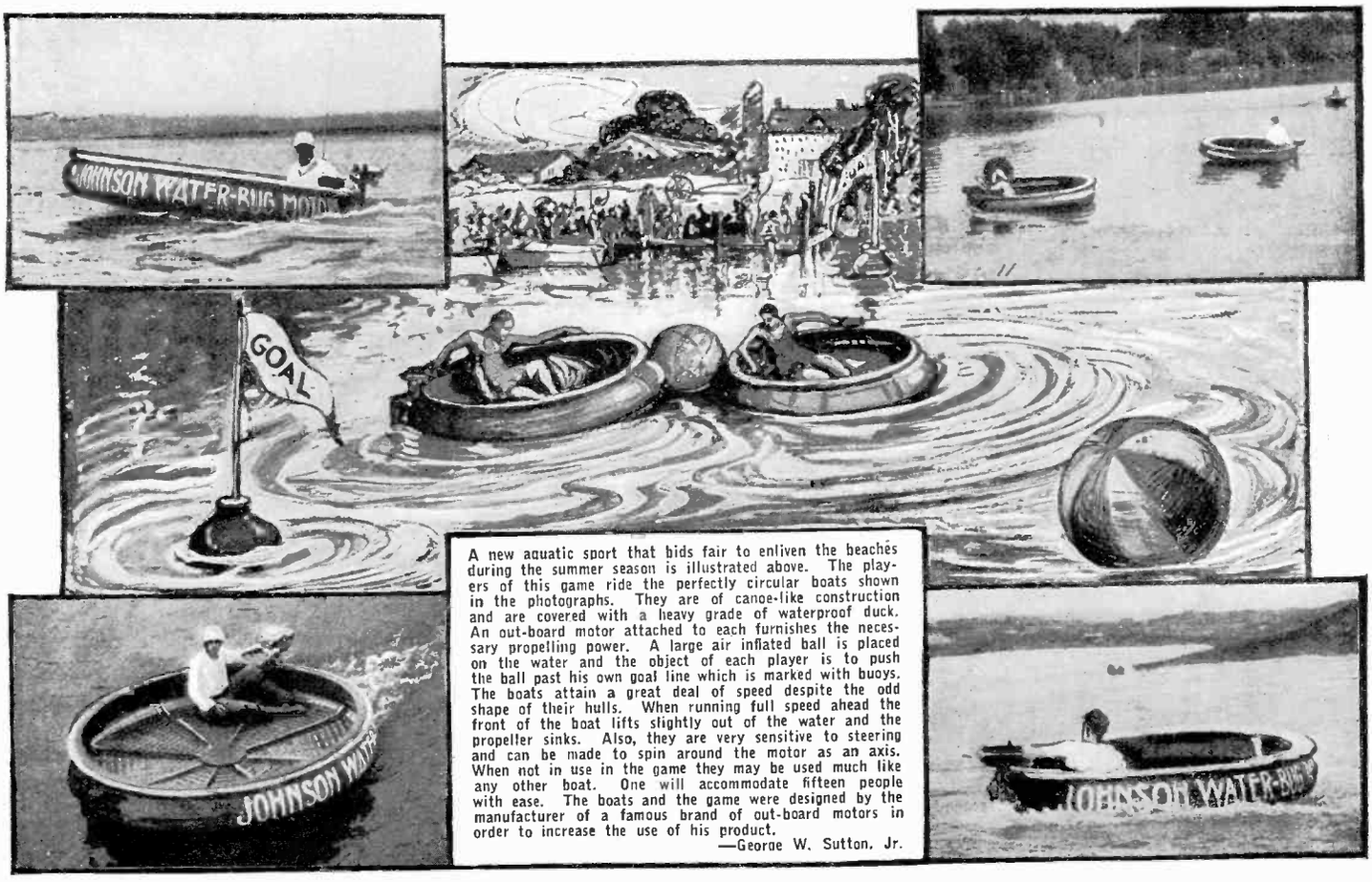
The above figure illustrates the method of plating. Buttons are suspended from brass rods and are then hung in a tank containing a gold or a silver plating solution. The metal is electrically deposited.

Most large batches of jewelry are dried by placing them in a centrifugal laundry dryer. They are then packed by girls, and are placed on cards, and wrapped in tissue for shipping. Back screws are put on.

After these many stages the lodge button is completed. The purchaser proudly displays it, but he never realizes the many steps through which that little button was taken in order to make it.

The Newest Water Sport

Players Ride Circular Boats

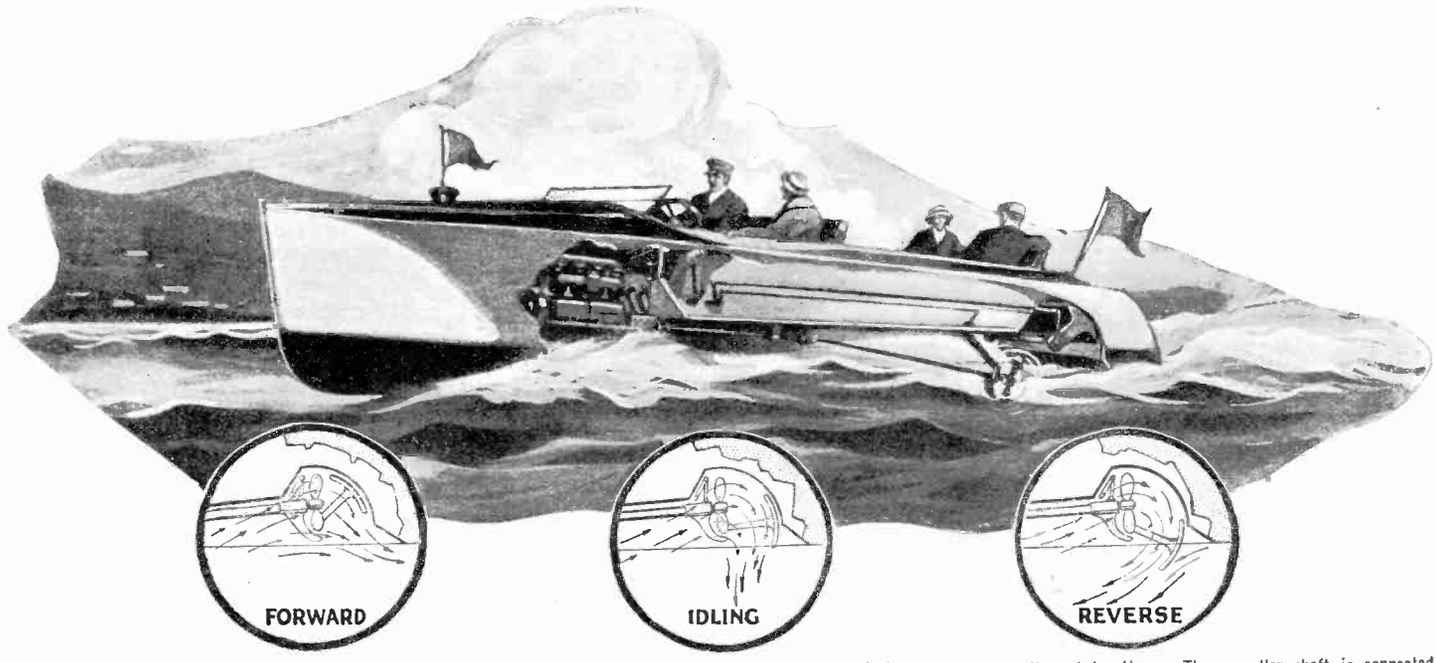


A new aquatic sport that bids fair to enliven the beaches during the summer season is illustrated above. The players of this game ride the perfectly circular boats shown in the photographs. They are of canoe-like construction and are covered with a heavy grade of waterproof duck. An out-board motor attached to each furnishes the necessary propelling power. A large air inflated ball is placed on the water and the object of each player is to push the ball past his own goal line which is marked with buoys. The boats attain a great deal of speed despite the odd shape of their hulls. When running full speed ahead the front of the boat lifts slightly out of the water and the propeller sinks. Also, they are very sensitive to steering and can be made to spin around the motor as an axis. When not in use in the game they may be used much like any other boat. One will accommodate fifteen people with ease. The boats and the game were designed by the manufacturer of a famous brand of out-board motors in order to increase the use of his product.

—George W. Sutton, Jr.

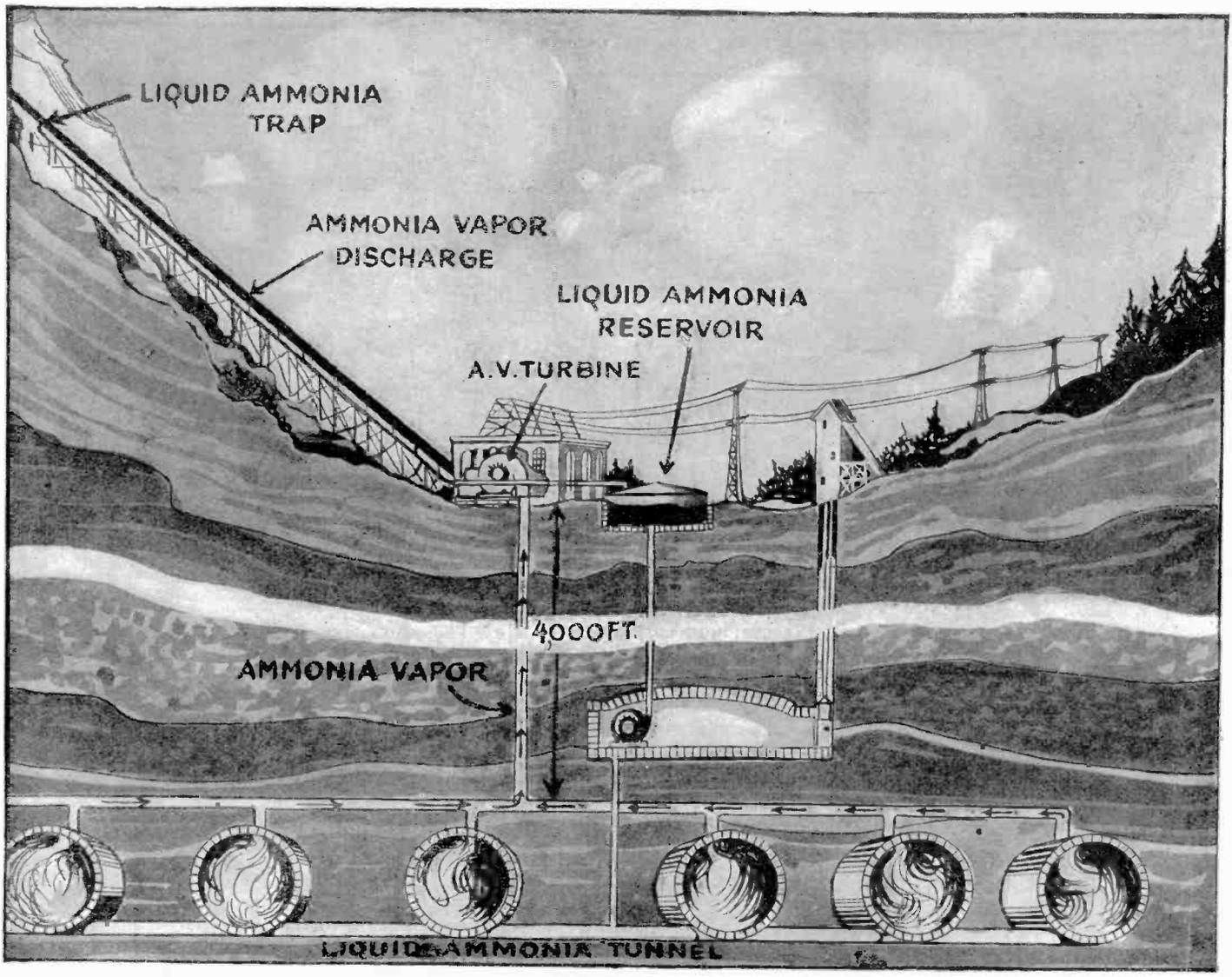
Deflector for Reversing Boats

Propeller Raised into Hull for Shallow Draft



Stopping in its own length a motor boat traveling at the rate of 25 miles an hour seems quite a feat, but it is entirely possible with the design shown above. Also, the boat may be run in reverse or idled without touching the motor or the driving column. These possibilities are gained with the use of the deflector shown fixed just behind the propeller in the hull of the craft. Another advantage of the design is that in cruising in shallow water the propeller may be drawn up into the hull of the vessel, reducing the danger of picking up weeds or other obstructions. The propeller shaft is connected with the engine through a universal joint and the screw itself may be raised or lowered by means of a bell crank arrangement. The deflector which governs the speed and the direction of the boat's run simply slides up and down behind the screw, regulating the direction of the water current generated by the screw. The positions for the deflector for the various directions and speeds are shown in the circular inserts.

Power From Earth's Heat

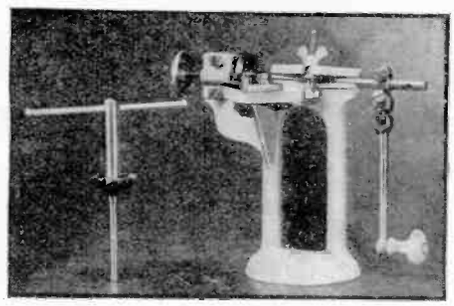


This is a more or less novel scheme for utilizing the interior heat of the earth for producing power. As shown in the illustration above large hollow tanks are placed at a depth of 4,000 feet beneath the earth's surface, where the temperature remains constantly about 96° F. Ammonia is fed down to these tanks through a liquid pump. The heat of the earth immediately vaporizes the ammonia, and the vapor passes up through a communicating pipe to an ammonia vapor turbine at the earth's surface. The vapor exhausts to the decreased temperature of a mountain top, where it liquefies and returns to the reservoir to be used again. —Albert Pedazus.

Earth and Moon Compared

At the left the two pictures give a very clear idea of the relation of the sizes of the earth and its satellite. The first one shows how the moon appears to us on earth. The other picture gives a very clear idea to scale of the earth's appearance to an observer on the moon. Note the clarity of definition of earth land areas.

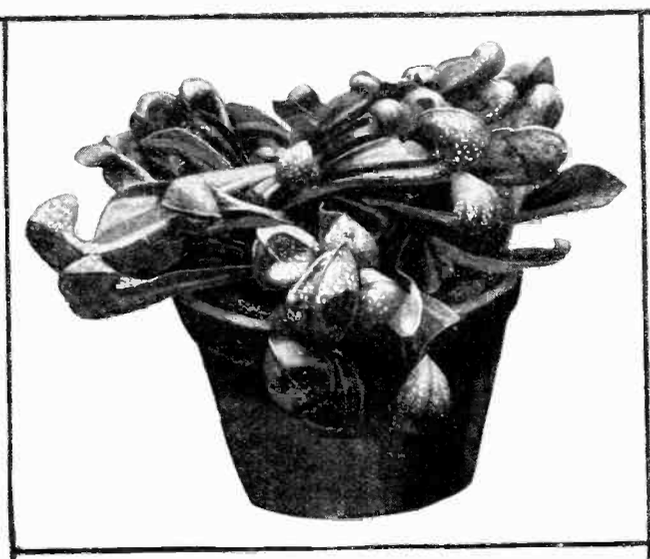
Valve Grinder



The reseating of automobile engine valves is greatly facilitated through the use of the little machine illustrated above at left. The valve refacer at right is built on the idea of a lathe. The handle attaches to the valve shaft which rests in a special cradle accurately centered. The angle of the cutting tool is adjustable.—Allen P. Child.

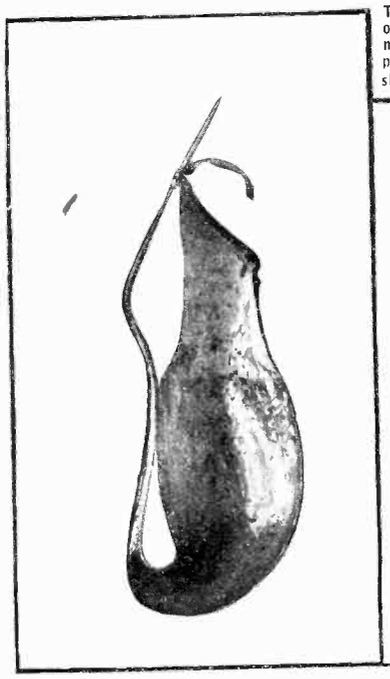
When Plants Eat Animals

By DR. ERNEST BADE

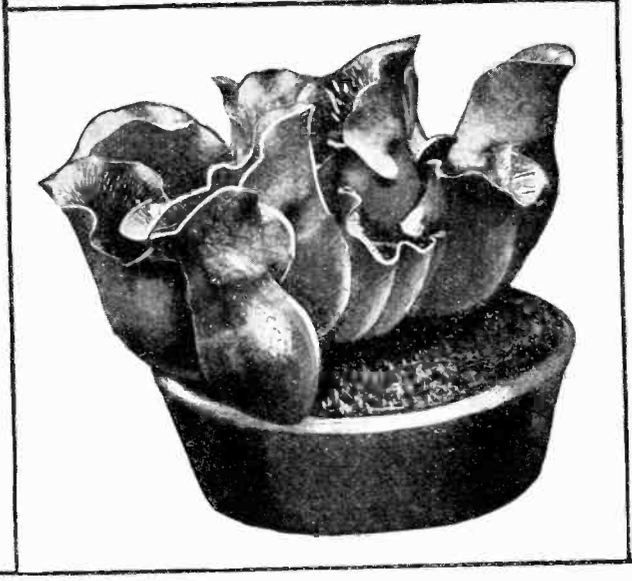


The bog is the natural home of all insect eating plants, and, these, through adaptation to their environment, have become accustomed to the peculiar food requirements necessary in such locality. Here there is a great lack of nitrogenous material, the nitrogen demanded by the plant being secured from the animal world, and these plants have become animal traps. The photo above illustrates Sarracenia psittacina.

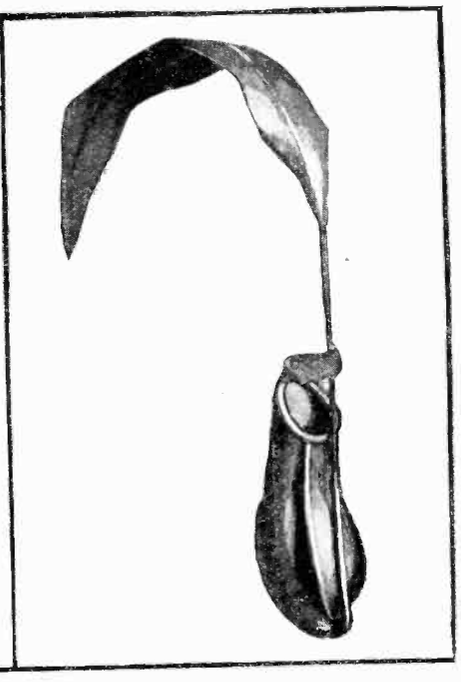
The photo on the extreme upper left is Sarracenia rubra. Only about 500 of all the many thousands of species of plants are characterized by organs modified or adapted for catching animals. They dissolve their prey with a pepsin-like secretion. Elongated leaves form tubes provided with downward sloping hairs which permit entrance of insects but prevent their emerging.



The Venus Fly Trap is shown in the upper right hand corner. The victim touches a hair, which springs the trap. The leaf closes, and holds the insect, then digests it.

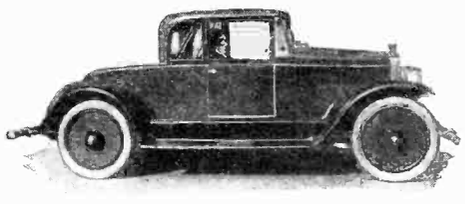


The pitcher of the pitcher plant is illustrated on the right. The bottom of the can is the tip of the leaf. The can cut open is shown on the left. Here the petiole has developed into a leaf-life structure while the leaf itself represents the pitcher.

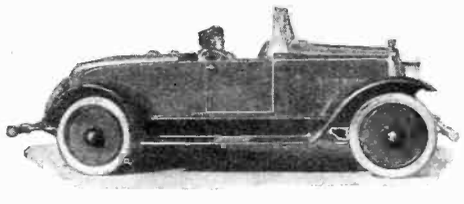


Each pitcher is partially filled with a fluid secretion. This kills and digests the insects caught. The decomposition of these dead bodies causes a disagreeable odor which attracts other insects.

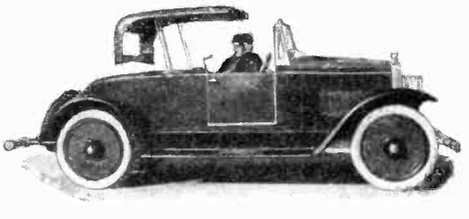
Convertible Coupé Automobile



The picture shows new coupe which is instantly convertible into an open roadster, as shown at right.

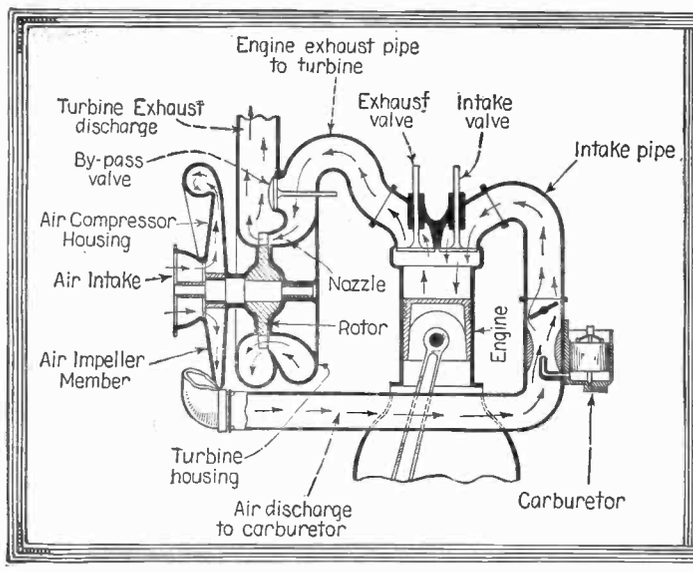


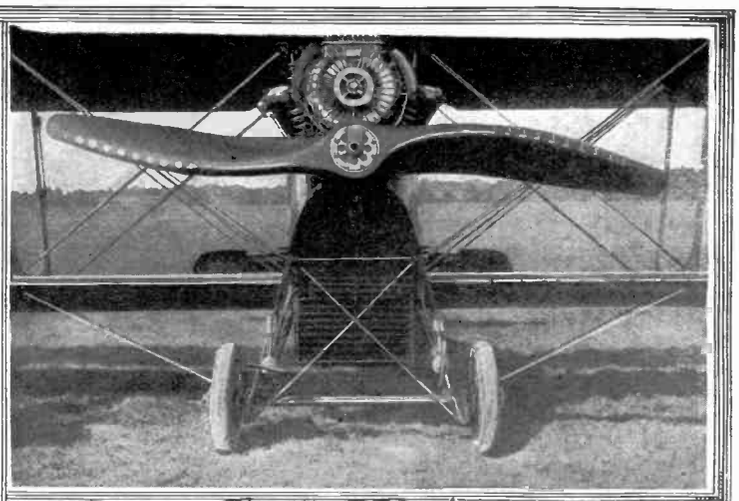
Above we see the car converted into an open roadster, the glass enclosed top being at once available.

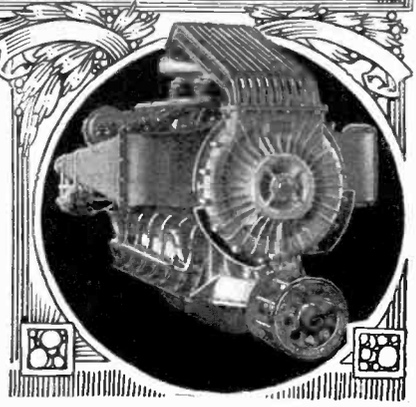


In the event of rain or a cold day, the driver closes the car in by simply turning a crank. —B. B. Ellerbeck.

Super-Charger for Planes







The diagram above shows a centrifugal type of supercharger similar to the one developed by Dr. S. A. Moss. The action of the supercharger is as follows: At high altitudes as the air becomes thinner and thinner, the blower or air compressor at the left of the device sucks the air in at high velocity, and compresses it, so as to feed the carburetor at or near normal sea-level atmospheric pressure. The exhaust gases from the engine drive a turbine connected to the blower shaft. In this way a sufficient amount of oxygen is supplied to the gasoline vapor mixture fed to the cylinders. The supercharger developed by Dr. Moss was tested on a Liberty engine at the summit of Pike's Peak and developed approximately sea-level horse-power there, at an altitude of 14,000 feet. It was capable of making the engine pre-ignite at that height.

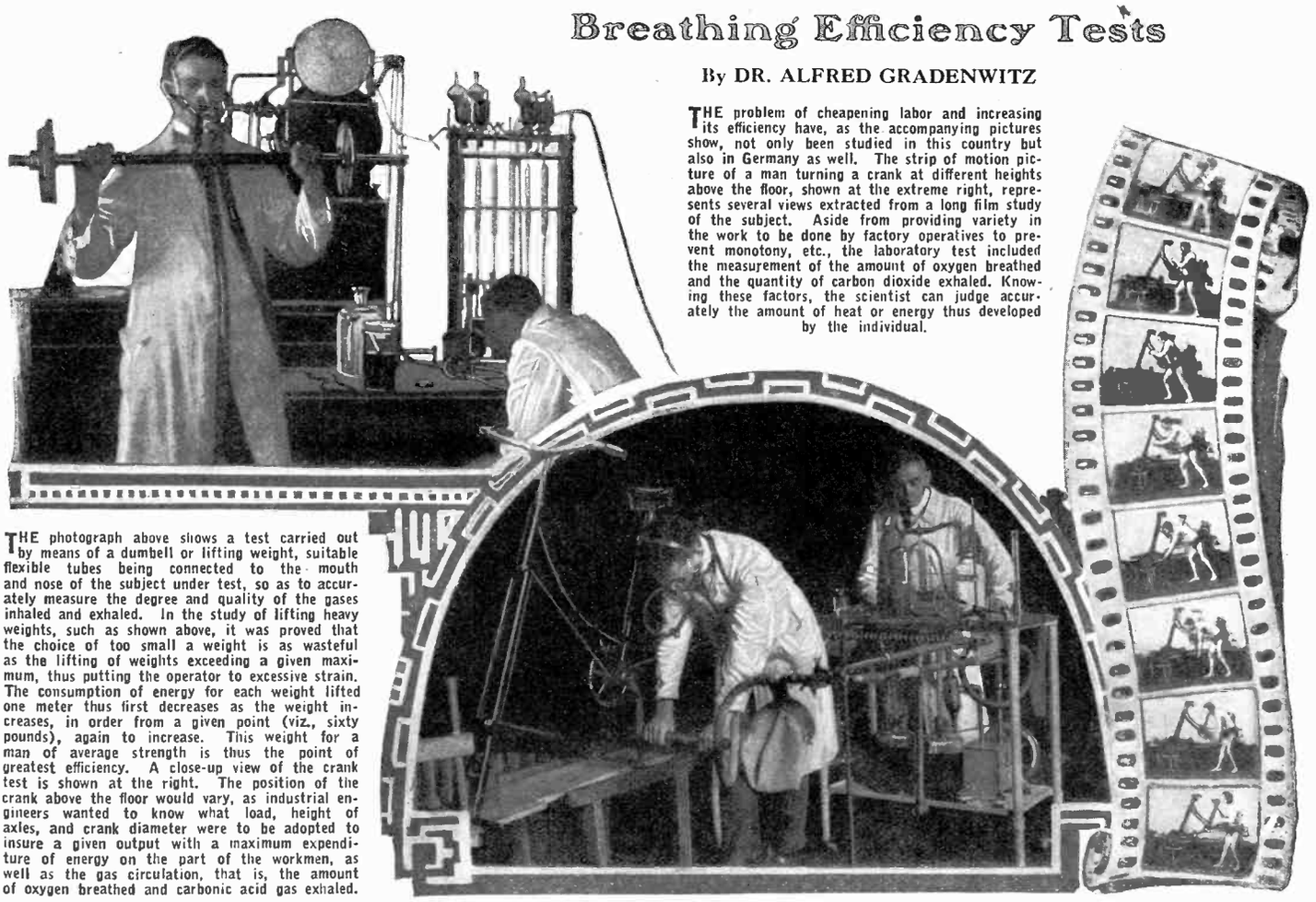
At 20,000 ft. altitude the atmospheric pressure is roughly one-half that at sea level; hence about one-half the weight of charge is drawn into the engine and less than one-half the power is developed. At 25,000 ft. altitude less than 25 per cent of sea-level power is delivered. If at these altitudes air is supplied to the carburetor at sea-level pressure, or approximately 14.7 pounds per square inch, the power developed by the same engines becomes approximately the same as when running at sea level. The low atmospheric pressure and density at great altitudes offer greatly reduced resistance to high airplane speeds; hence the same power that will drive a plane at a speed of 120 miles per hour at sea level will drive it much faster at 20,000 feet, and still faster at 30,000 feet and at approximately the same consumption of fuel per horse-power hour.

The picture at lower right shows a turbine supercharger with automatic control installed on Liberty twelve-cylinder engine. The picture at upper right shows front view of G. E. supercharger on Liberty motor of a La Pere biplane.

Breathing Efficiency Tests

By DR. ALFRED GRADENWITZ

THE problem of cheapening labor and increasing its efficiency have, as the accompanying pictures show, not only been studied in this country but also in Germany as well. The strip of motion picture of a man turning a crank at different heights above the floor, shown at the extreme right, represents several views extracted from a long film study of the subject. Aside from providing variety in the work to be done by factory operatives to prevent monotony, etc., the laboratory test included the measurement of the amount of oxygen breathed and the quantity of carbon dioxide exhaled. Knowing these factors, the scientist can judge accurately the amount of heat or energy thus developed by the individual.



THE photograph above shows a test carried out by means of a dumbell or lifting weight, suitable flexible tubes being connected to the mouth and nose of the subject under test, so as to accurately measure the degree and quality of the gases inhaled and exhaled. In the study of lifting heavy weights, such as shown above, it was proved that the choice of too small a weight is as wasteful as the lifting of weights exceeding a given maximum, thus putting the operator to excessive strain. The consumption of energy for each weight lifted one meter thus first decreases as the weight increases, in order from a given point (viz., sixty pounds), again to increase. This weight for a man of average strength is thus the point of greatest efficiency. A close-up view of the crank test is shown at the right. The position of the crank above the floor would vary, as industrial engineers wanted to know what load, height of axles, and crank diameter were to be adopted to insure a given output with a maximum expenditure of energy on the part of the workmen, as well as the gas circulation, that is, the amount of oxygen breathed and carbonic acid gas exhaled.

More Gamblers' Tricks Exposed

By MARK MELLEN

The Man Who Fooled P. T. Barnum

THIS month we shall show some of the devices used by amusement park operators to soak the yokels. The barkers do not have to be so very careful. Much of their stuff is extremely crude, but since prizes rather than money are the playing stakes, little, if anything, would be said if they were caught. However, all the apparatus shown on this page is known to street fair and amusement park frequenters, and all of them are nice, simple ways for taking your money without giving you anything in return. Every stand has its shilaber or "shil," working with the operator, who is allowed to win in order to encourage the suckers. In one of the biggest amusement parks near New York, any night, the barker may be heard saying: "Three balls for a quarter, three balls for a shil." This is the method used for calling the accomplice. A bit of advice: When buying tickets at an amusement park booth, with a large bill, always make yourself wait. The seller will shoot you a dollar's worth of change very quickly and he will be very slow with the bills, hoping you will run off and leave the bill change—just what he intends to happen.

Hit the clown's mouth, put three balls in for a 24c doll—if you can. The "shil" may put them in, but when you step up, the operator presses a foot pedal which draws a wood bar under the edges of the holes, making it impossible for the ball to drop through. "Shil" uses smaller balls.

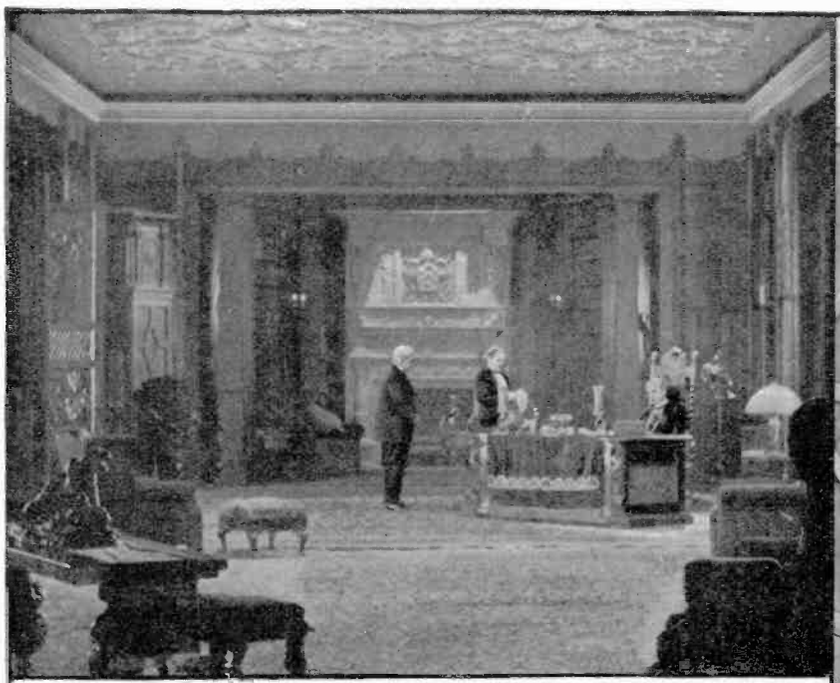
Try and throw the rings over the block and win the prize lying on top of it! The rings with which the spectators play are just a little bit smaller than the blocks themselves. Also, as they are made of wood they bounce easily, so that you don't get a chance to see it is impossible for them to fall over the blocks. The "shil" has a ring that is slightly larger, and he takes away the prize. Both square and triangular blocks are used in this game. That the "shil" is busy is proven by the small photograph under the first sketch where he is shown "returning" a prize to the stand owner.

The cats on the shelf remain a favorite with suckers. It seems so simple and so hard to "fix" that all the boys fall for it. However, the cats are under the control of the operator at all times. A thin wire, placed behind their necks, properly shaded and not exposed to the bright sunlight, keeps the cats from falling off the shelf, and keeps the player out of his prize. When the "shil" comes along, it is only necessary for the operator to release the wire.

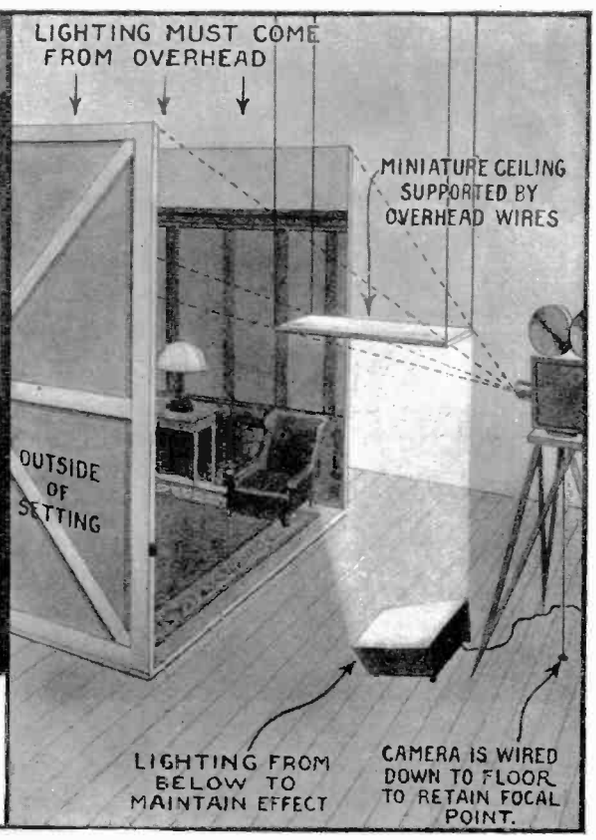
Good old game of the Huckley Buck. A tennis ball invariably bounces out of the kegs when outside money is being paid to the stand operator. However, when the "shil" steps up, a small pedal under the operator's foot tilts the bottom of the kegs, so that the line of the bounce is broken, as shown in the small sketch at the left, keeping the balls in the bucket. He wins, of course.

And who has not played the good old sledge game? Test your strength! A boy steps up and rings the gong. An ordinary man steps up and falls short by several feet. The trick here, as in the remainder of the devices, is the foot of the operator. When the wire on which the weight slides is kept taut, the weight shoots up easily and very little force is required to send it clean to the gong. Release of the foot pedal slacks the wire, making it practically impossible to send the weight to the top. At the immediate left is an actual photograph of one of these machines, showing the operator's pedal.

Miniature Ceilings in Movies



Since it is impossible to get sufficient light into a movie set which is constructed with an ordinary ceiling, it has long been the custom of movie makers to cut their pictures of interiors just below the ceiling line, many times leading to unreal effects. In a new Metro production, called "The Man Life Passed By," the technical directors have overcome this obstacle by using a miniature ceiling installed only a few feet in front of the camera, as shown in the illustration. This method gives the picture a complete effect and at the same time allows the use of the heavy overhead lighting method which is so necessary for certain lighting effects. —Phil Gersdorf.



Methods for Testing Gasoline

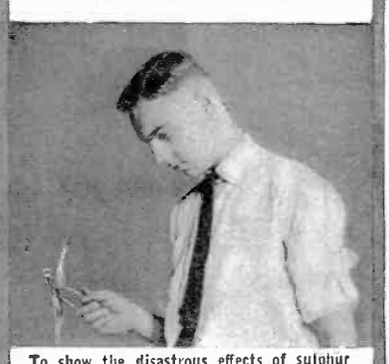
Sulphur in gasoline causes pitting of engine cylinders. To test gasoline for sulphur immerse a copper strip or a bright silver coin in the gasoline, which must be heated with steam. If the metal does not discolor in fifteen minutes, the gas contains but little sulphur.

If there is an excess of residue left after gasoline has been evaporated with steam heat it is a poor grade fuel for use in internal combustion engines. This residue turns gummy. It should be minute in quantity.

To test for excess acid add methyl orange. A pink color shows acid.

To test gasoline for water it is only necessary to heat a crystal of copper sulphate in a spoon until it turns white. Immerse the white salt in the gasoline and shake well. The salt will turn blue if there is water in the gasoline.

As a test for the quality of the gasoline, add sulphuric acid to it slowly. This will discolor and reduce the volume of the fuel. The amount of the discoloration and reduction of volume is a direct gauge of the quality of the material; the less the better.



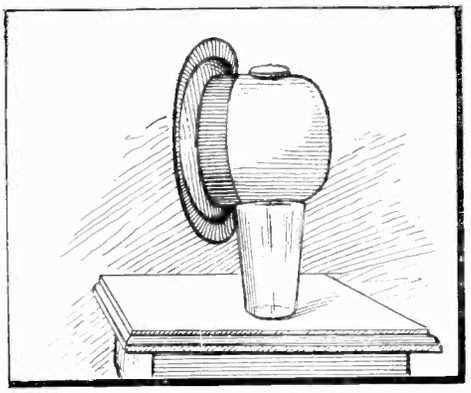
To show the disastrous effects of sulphur in gasoline add some sulphur to iron filings in a test tube and heat the mixture. The iron will be attacked with great violence and will glow vividly. —Raymond B. Wailes.

Scientific Coin Puzzles

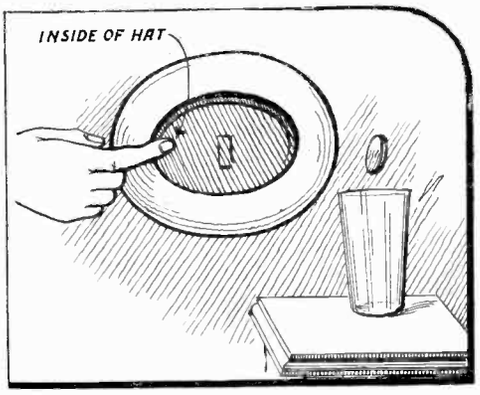
Simple Stunts With Ordinary Articles

By WALTER B. GIBSON

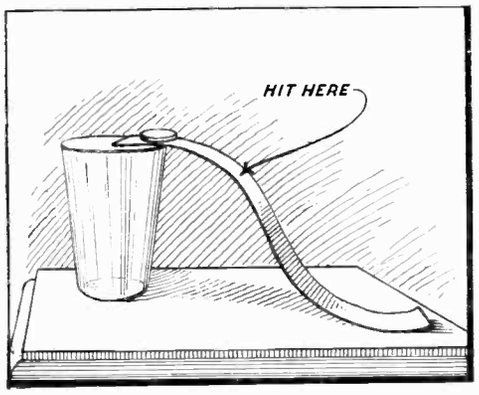
This surprising little novelty is easily performed. The one cent piece sticks against the forehead as though it were glued there. The trick is performed simply by pressing the coin to the forehead and moving it upward. Dampening may help.



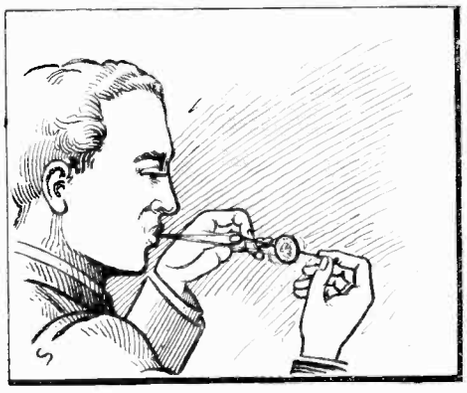
Set the coin on top of the hat as shown, so that the coin is directly above the tumbler. Give the hat a sharp jerking blow and it comes out from under the coin which drops into the glass. Ask a bystander to attempt the same stunt. He will probably fail unless he knows how.



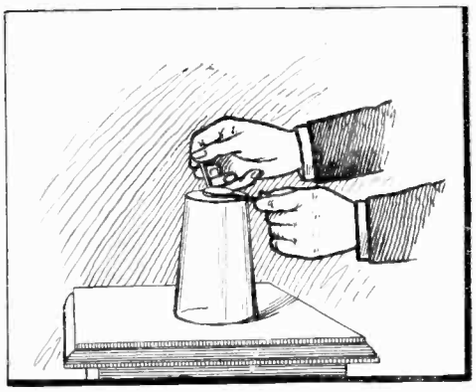
The success of the preceding stunt depends entirely upon the fashion of the blow and the point at which the hat is struck. To make the stunt successful, the operator must hit the inside of the brim of the hat, as illustrated above, a very sharp fast blow, so that the coin falls perpendicularly.



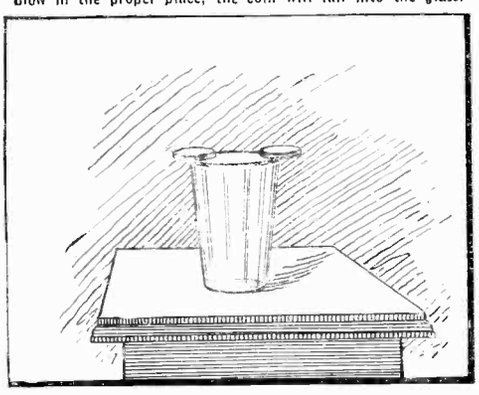
If a heavy strip of paper is laid on the edge of the tumbler and a coin balanced across the edge of the tumbler and paper as shown, and the paper is struck a sharp downward blow in the proper place, the coin will fall into the glass.



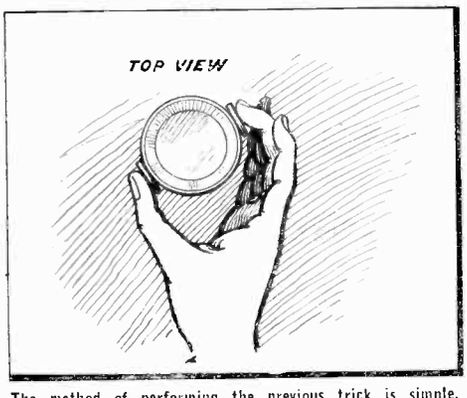
Another stunt which requires a bit of practice before the performer may work it successfully is illustrated above. A quarter or half dollar is balanced between two needles and caused to spin by blowing on it.



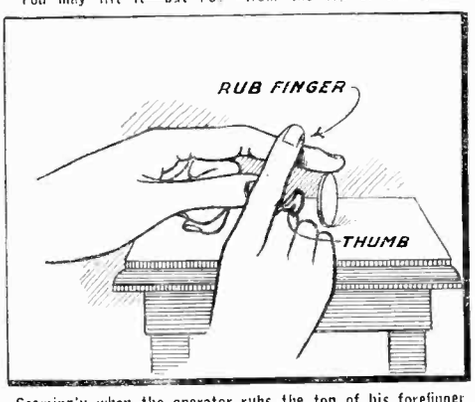
Lay a coin on the bottom of an inverted tumbler and tell the audience that it is impossible for anyone to lift the coin "from the top of the glass" with two matches. You may lift it—but not "from the top of the glass."



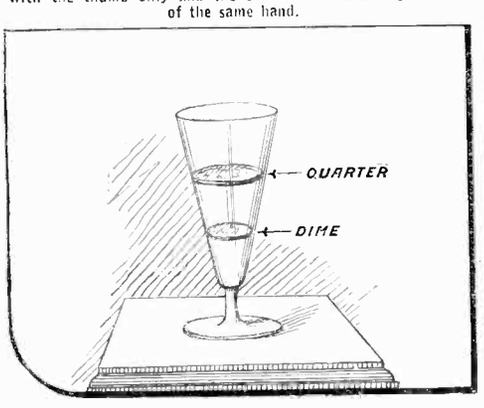
Balance two coins on the edge of a tumbler as shown above and challenge someone to remove them at the same time, and hold them between finger and thumb, touching one coin with the thumb only and the second with one finger only of the same hand.



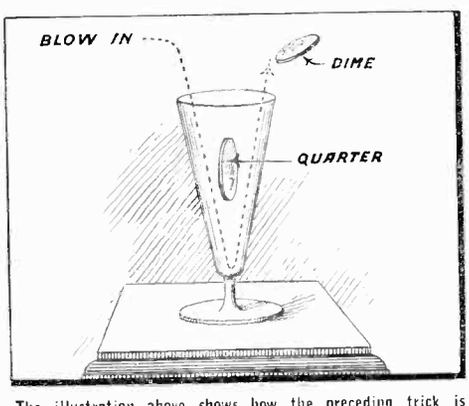
The method of performing the previous trick is simple. With a great deal of care, grip the coins as shown, causing them to slide down the side of the tumbler. Then draw them around the side of the glass and snap them together.



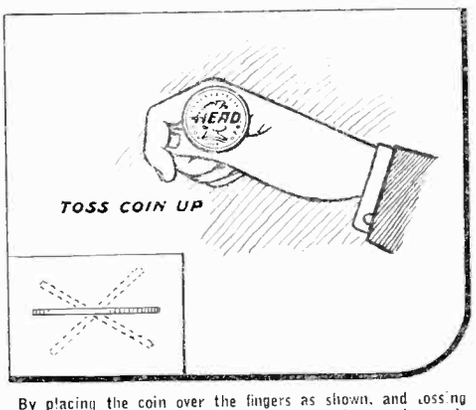
Seeming'y when the operator rubs the top of his forefinger which balances the coin, the coin rotates as a result of the massaging movement. However, note the thumb and the ease with which it can strike coin and make it spin.



Set a dime and a quarter in a tapering goblet as above. The dime being smaller sits below the larger coin in the glass. The problem is to remove the dime from beneath the quarter without touching or removing the quarter.



The illustration above shows how the preceding trick is performed. The operator simply blows down one side of the tumbler, causing the larger coin to tilt over edgewise and the small coin to slide out past the large coin.

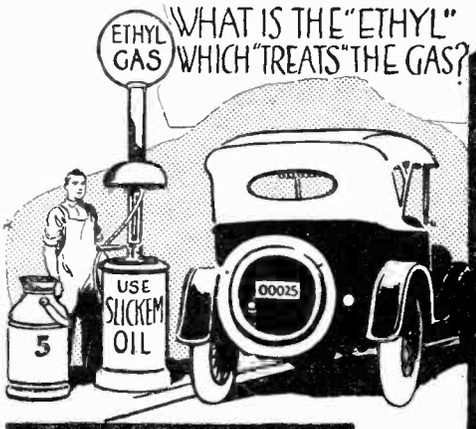


By placing the coin over the fingers as shown, and tossing it—not spinning it—into the air, the coin can be made to fall with the same face up as the coin lay on the fingers. The coin wiggles and seems to spin.

Everyday Chemistry

By RAYMOND B. WAILES

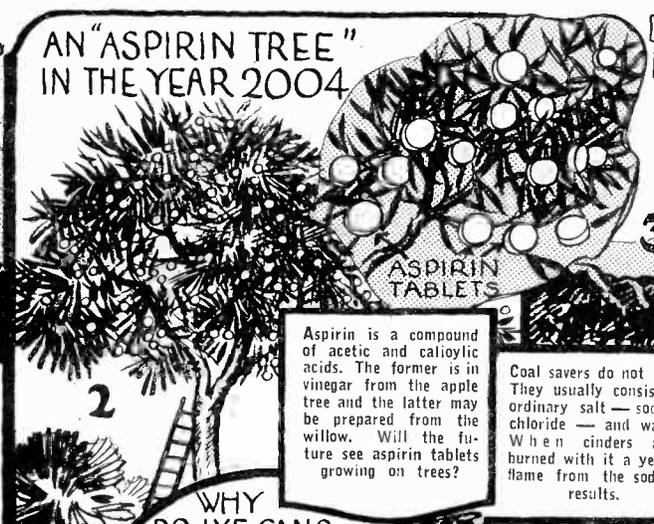
WHAT IS THE "ETHYL" WHICH "TREATS" THE GAS?



1

Ethylene gas prevents knocking or pre-ignition. It is made by mixing lead tetra-ethyl with the gasoline. This compound—lead tetra-ethyl—could be said to be a cross between a lead pipe and grain alcohol.

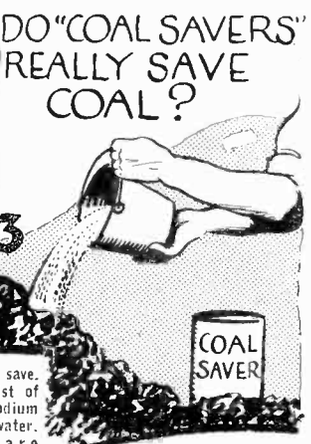
AN "ASPIRIN TREE" IN THE YEAR 2004



2

Aspirin is a compound of acetic and calioylic acids. The former is in vinegar from the apple tree and the latter may be prepared from the willow. Will the future see aspirin tablets growing on trees?

DO "COAL SAVERS" REALLY SAVE COAL?



3

Coal savers do not save. They usually consist of ordinary salt — sodium chloride — and water. When cinders are burned with it a yellow flame from the sodium results.

WHY DO LYE CANS "RUN OVER"?

5

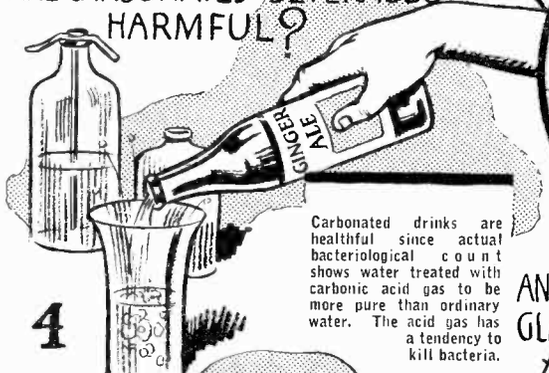
Lye cans "run over" because the crude product tends to absorb water and carbon dioxide.

WHAT IS THE "MYSTERY" OF PYREX GLASS?

6

Pyrex glass—the glass that does not crack when heated—is made by adding boric anhydride and salts of aluminum and sodium. They reduce the co-efficient of expansion.

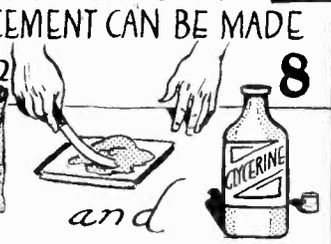
ARE CARBONATED BEVERAGES HARMFUL?



4

Carbonated drinks are healthful since actual bacteriological count shows water treated with carbonic acid gas to be more pure than ordinary water. The acid gas has a tendency to kill bacteria.

AN EXCELLENT STONE AND GLASS CEMENT CAN BE MADE from

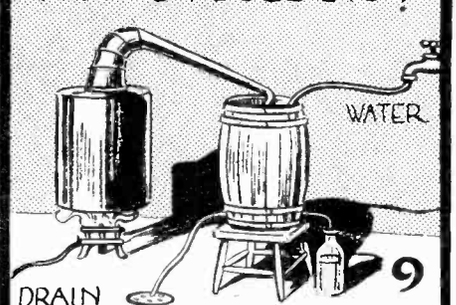


8

and

An excellent cement for stone, crockery and glass can be made from a mixture of litharge—a compound of lead and oxygen—and glycerine—a form of alcohol.

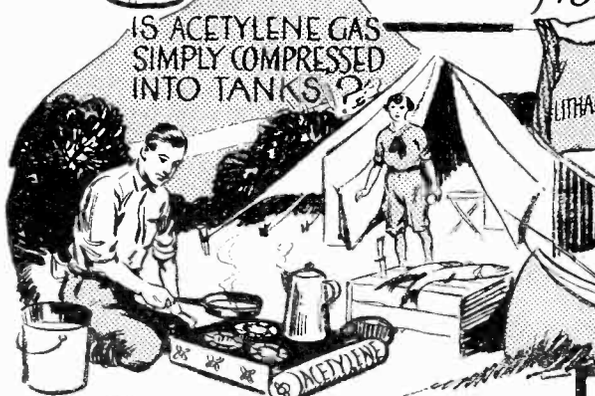
WHAT IS FUSEL OIL?



9

In the distillation of liquor more than one kind of alcohol results. Fusel oils is a mixture of propyl, butyl and amyl alcohols, which have an acrid taste. They must be removed from the completed product which should contain only ethyl alcohol.

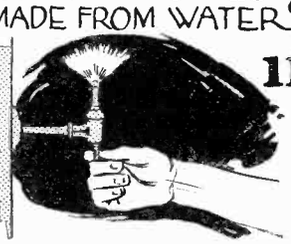
IS ACETYLENE GAS SIMPLY COMPRESSED INTO TANKS?



7

No. Instead the tank is filled with pumice stone and acetone. The acetone dissolves the acetylene which is forced into the tank under pressure. When the pressure is released the gas is liberated for use.

IS "WATER GAS" WHICH IS BURNED IN THE MAJORITY OF HOMES MADE FROM WATER?



11

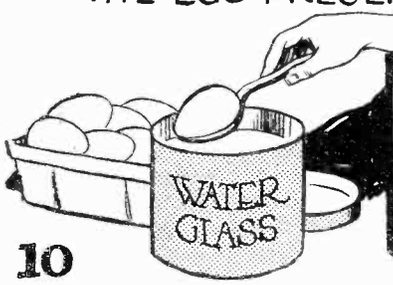
Water gas is made by passing steam over a bed of hot coke and through a stream of petroleum vapor; three gallons of oil being added to each 3,000 cubic feet of the steam.

WHY DOES MORTAR HARDEN?

12

Contrary to popular belief mortar does not harden because it dries out. It hardens because it is transformed into a sort of marble or limestone through its absorption of carbon dioxide from the air. A drop of sulphuric acid poured on ordinary mortar will fizzle just as it would if poured on limestone or marble.

WHAT IS WATER-GLASS THE EGG PRESERVER?



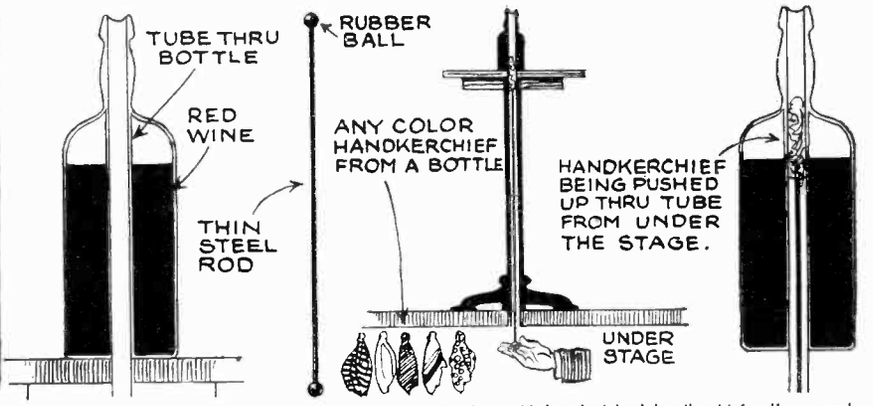
10

Water glass is possibly the cheapest of all "chemicals." It is made by heating sand and sodium carbonate or hydroxide together. It is used as a stone cement, as a filler for soaps and to preserve eggs.

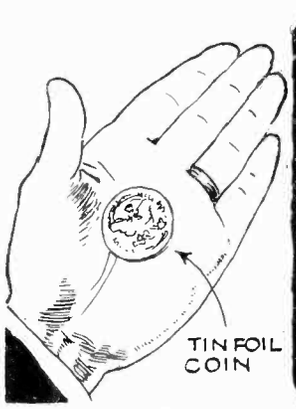
Magic for Everybody

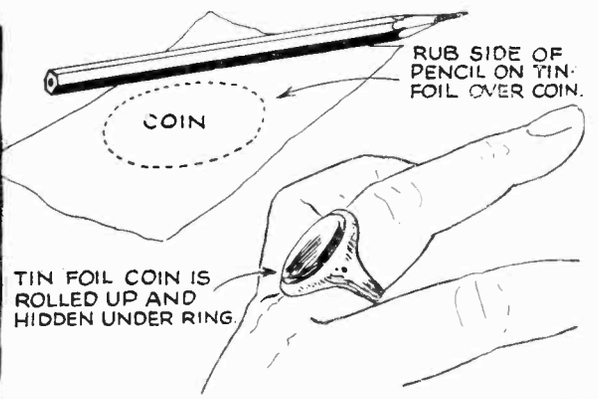
By Prof. JOSEPH DUNNINGER

NO. 17 OF A SERIES

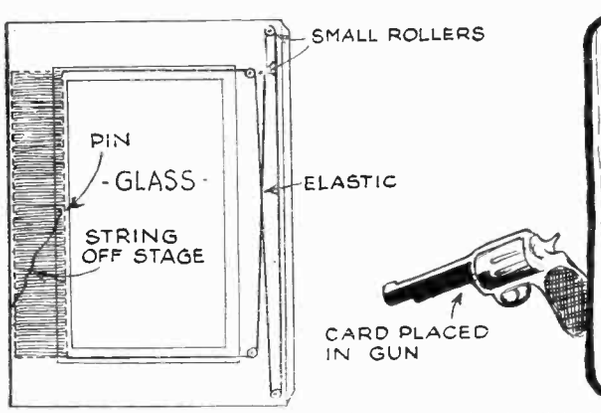


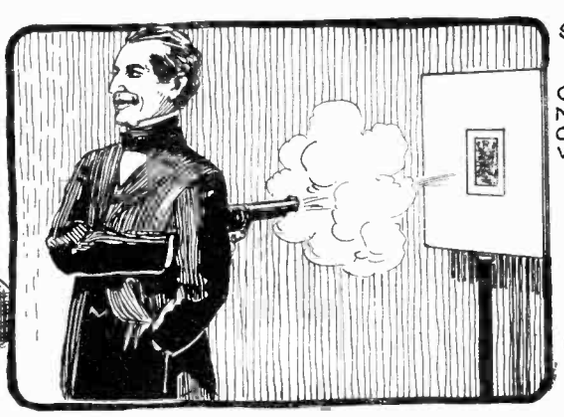
The performer places a bottle on a table and then states that the bottle has a remarkable dyeing solution in it, and will color a handkerchief in any color desired. A red, blue or orange kerchief are called forth, and each is removed from the bottle as requested. The assistant below stage has these colored, speckled and striped handkerchiefs all arranged on hooks and pushes those called for up through the bottle, which has an opening in the bottom, by means of a rod fitted with a rubber ball at the top.

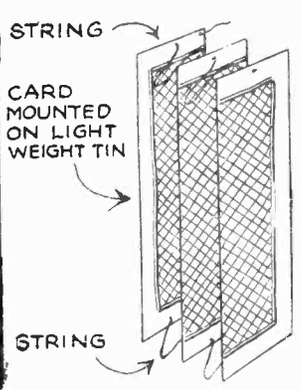




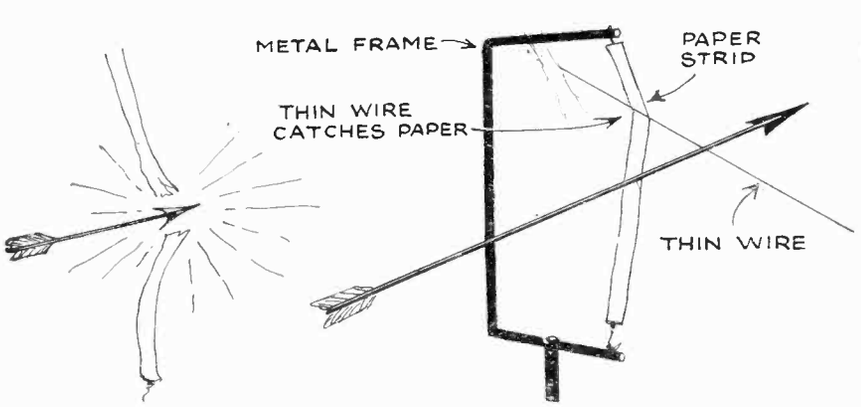
A coin is he'd in the palm of the hand and is then rubbed between the fingers whereupon it immediately vanishes. No palming is required in this stunt. The coin is an imitation one made of tin-foil by rubbing a real coin with the side of a pencil. The tin-foil duplicate is easily rolled into a small pellet and concealed beneath a ring.

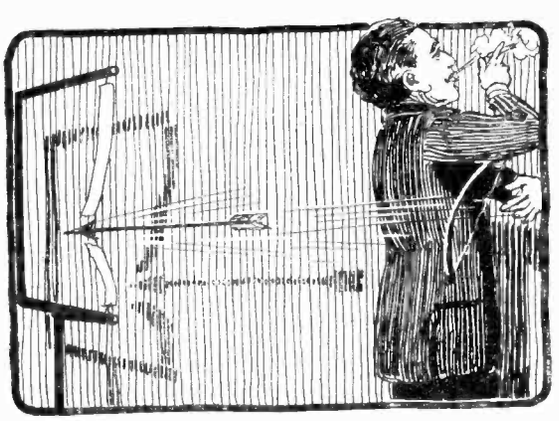






A torn card is put into a pistol which is then fired at a target. Without breaking the glass covering the target, the card will be found to have made its appearance. The card is specially prepared and concealed in the border of a frame. Two opposite corners of the card are connected together by means of an elastic band which passes over rollers, as indicated in the illustration. A pin holds the card in this position until the assistant off stage pulls the string releasing it. Details are given above.



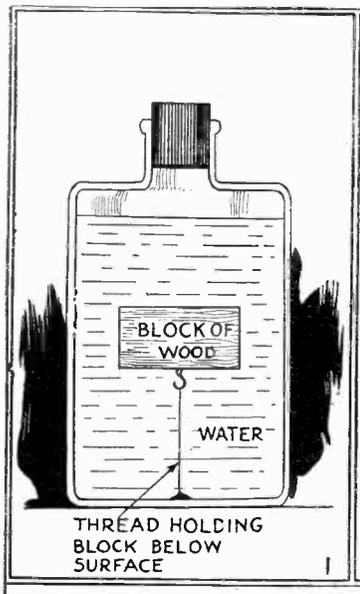


The magician is an expert marksman and regardless of how he holds his bow and arrow he always hits the target, which in this instant is a thin strip of paper. If the arrow itself does not cut the paper strip, then the thin wire projecting on either side of the arrow will do so. It is impossible to miss. The audience is completely mystified.

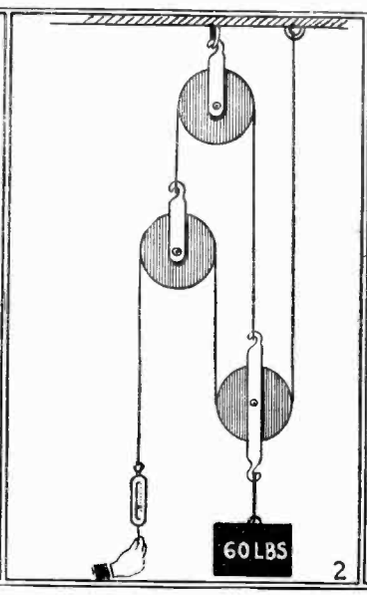
Scientific Problems and Puzzles

Examples of Kinks Involving Scientific Laws

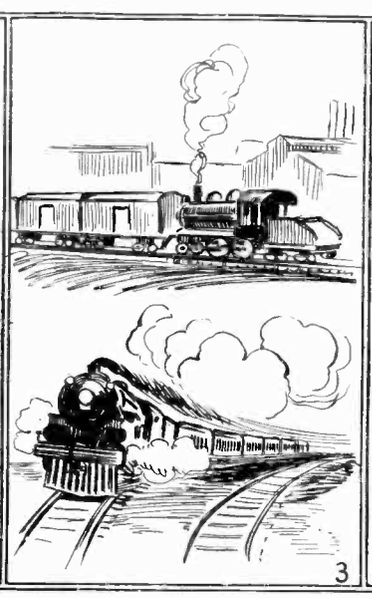
By ERNEST K. CHAPIN, M.A.



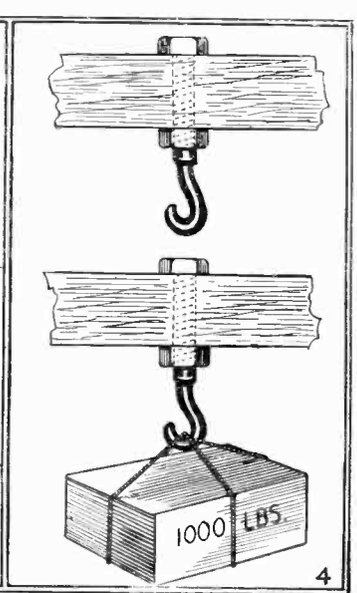
A block of wood is held submerged in a closed container of water. The method used to hold the block under the surface by means of a thread and hook is shown in the above illustration. If it were desired to break the thread holding the block, what method should be used? Would giving the jar a quick upward jerk do it, or should the bottle be swiftly jerked downward? The problems involve well known principles and may be solved according to established physical laws.



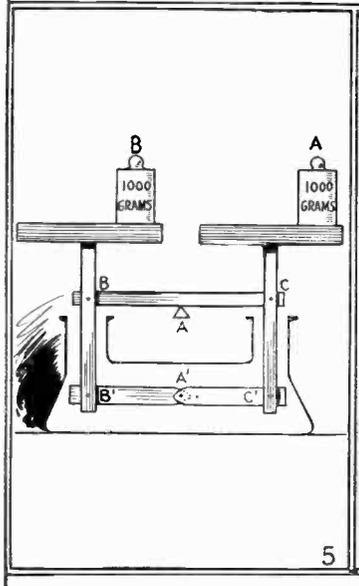
Suppose, in the above system of pulleys, each of the pulleys to weigh one pound and that a weight is suspended at the bottom of the system as shown. Disregarding the weight of the rope used, what would be the amount of force necessary to support the pulleys and weights? In order to check the problem, support the whole through a balance at the output end as shown in the illustration. This problem is one which will necessitate a complete analysis of the weights involved and a close study of their method of suspension and distribution.



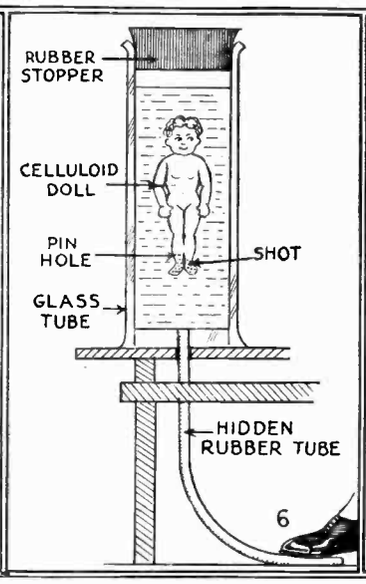
Of course, the front of the train is the logical position to attach the locomotive, but aside from the fact that this position gives the engineer a clear view of the track ahead and of the signals along the line, is there any engineering reason for putting the engine at the front of the train? Would there be any added advantage or disadvantage in placing the engine at the rear instead of at the front, as done at present? Would this advantage be more manifest during the running or more noticeable in starting and stopping?



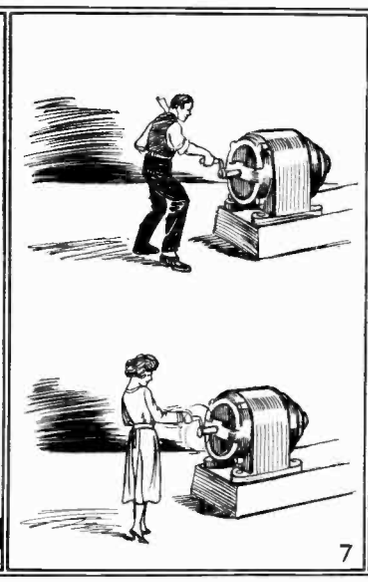
Suppose the tension on the actual bolt member, i.e., that part of the bolt between the two nuts, in the above sketch, to be 1,000 pounds. This tension is a result of tightening the nuts. Now suppose a weight of 1,000 pounds to be placed upon the bottom of the hook attached to the bolt as shown. With the additional stress on the bottom of the bolt, what would be the tension on the original bolt member between the nuts? Would the tension of the nuts be relieved and where would the weight be supported?



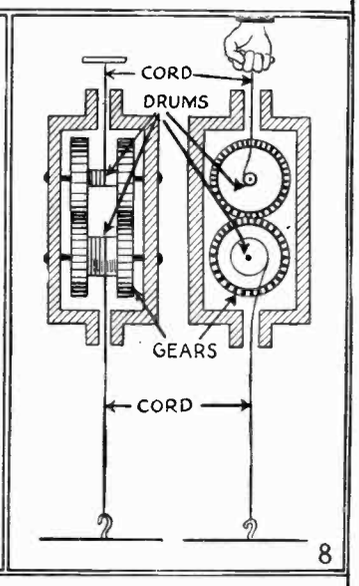
Above is given a diagrammatic illustration of an equal arm, platform balance. If the two equal weights are placed off the center of the pans as shown, what effect, if any, would there be on the balance? Suppose the weights were placed in some other position on the pan leaving their location relative to the pivotal points the same. Would the effect be the same? Would it be possible for an apothecary to cheat by placing the article and the weights in some particular positions on the pans of the balance?



The familiar Cartesian diver may be made to operate without, apparently, touching the mechanism in any way, if the parts are arranged as shown in the diagram. After loading the diver so as to barely float, a delicate adjustment can be made by means of the upper stopper so that a very slight pressure of the foot on the rubber bulb concealed under the table is sufficient to control the motion of the figure. Can you explain the action of the diver, and why is it that the adjustment of the pressures can be made so fine?

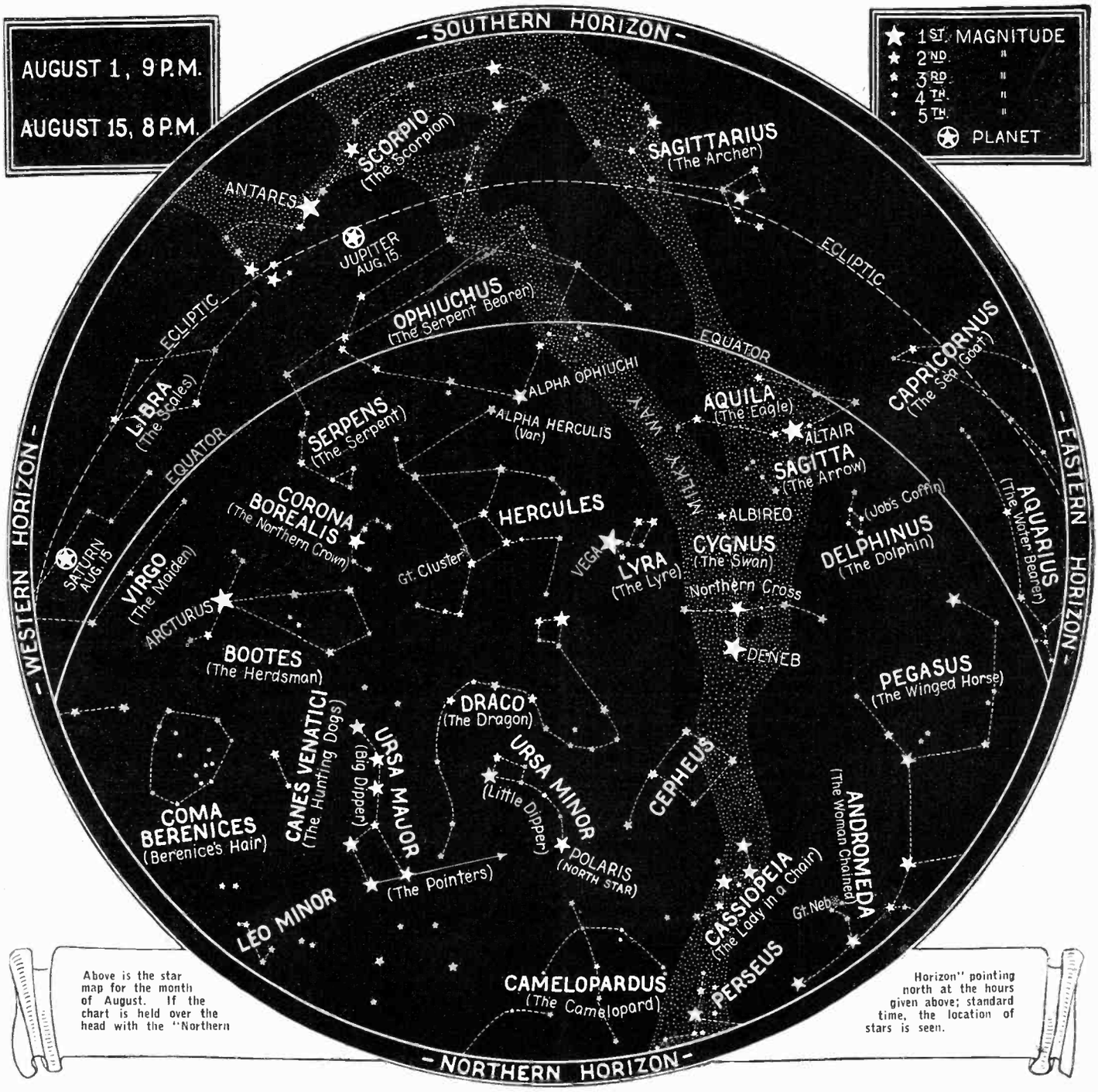


In a trick sometimes performed at scientific expositions a husky male member of the audience is invited to spin the armature of a dynamo by means of a crank. With his utmost effort he can turn it but very slowly. When, however, a young slip of a girl is persuaded to take a try at the machine she finds it very easy to spin. The demonstrators, moreover, will show that no wires are connected to the armature to furnish it with power or control its action. How, then, did they manage the trick, for it is obviously a trick?



If an upward pull is maintained on the upper handle, what motion, if any, will be given the device above illustrated? This problem is one very similar to another one given in these columns a few months ago, in which a spool of thread was placed upon an inclined plane. The device used in this instance is nothing more than two drums, the ends of which are fitted with gears which are interacting. The problem is one dealing with the distribution of forces. The answers to all the problems found on this page are on page 401.

(*Answers to these problems given on page* 401)



Above is the star map for the month of August. If the chart is held over the head with the "Northern Horizon" pointing north at the hours given above; standard time, the location of stars is seen.

The Heavens in August

By ISABEL M. LEWIS, M.A.
of the U. S. Naval Observatory

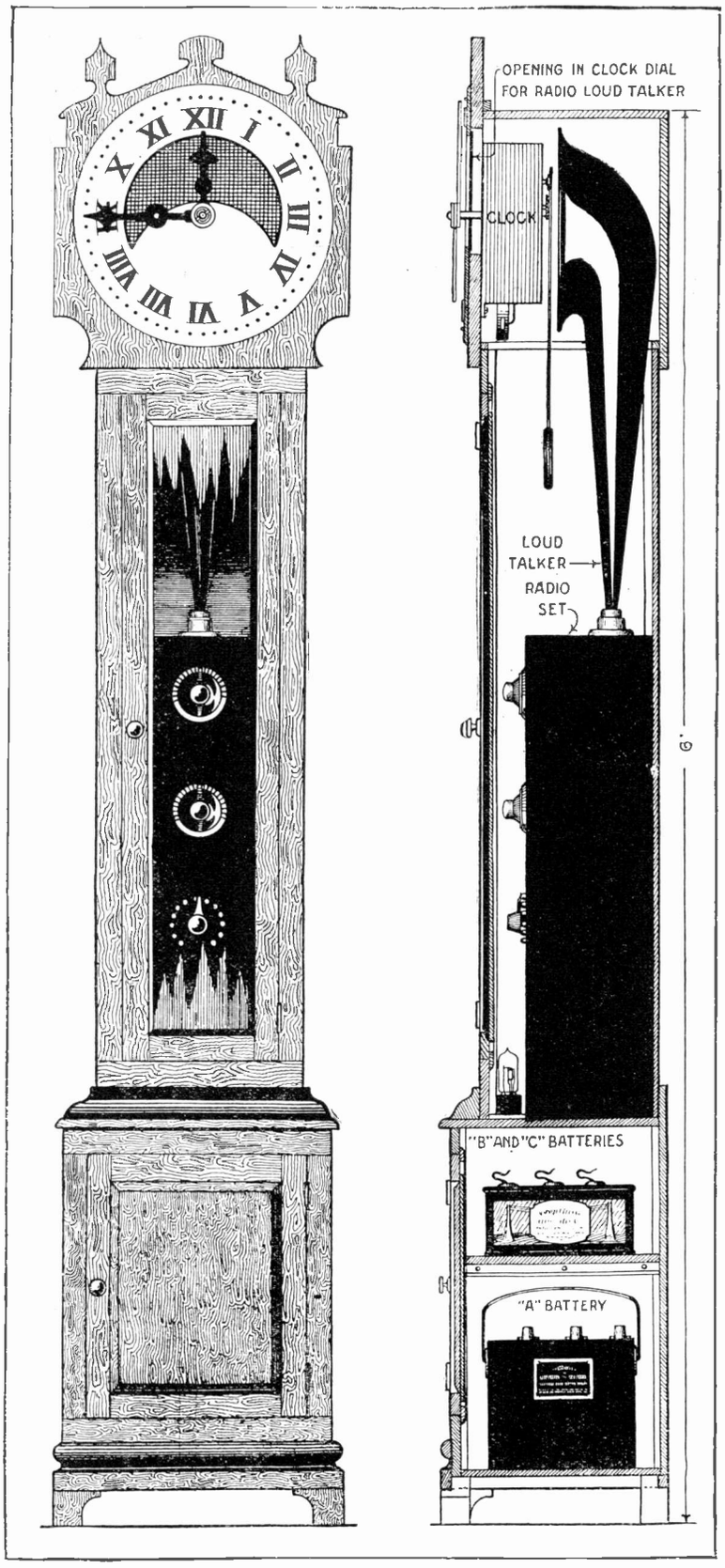
THE most beautiful feature of the heavens in August is the Milky Way now arching high across the eastern sky. It is impossible to see it to any advantage in the city where the glare of lights dim the splendors of the heavens, but on a clear, dark night at the sea-shore or in the country with a view of the eastern heavens limited only by the horizon one is struck with awe at its magnificence. It can then be easily traced as a single brilliant stream of nebulous light, a blend of the light of countless faint stars, from Cassiopeia and Cepheus in the northeast to the Northern Cross in Cygnus. Here it divides, apparently, into two streams, one flowing through Aquila to Sagittarius in the southeast and the other, the more westerly branch, through the eastern part of Ophiuchus to Scorpio in the south and southwest. This dark cleft in the Milky Way running from Cygnus to the southern horizon was once believed to represent a true separation of the Milky Way into two parts through which one looked into a starless void. Now it is strongly suspected that this is rather a dark nebulous region which absorbs and cuts off the light from stars beyond it. The nearer edge of this dark region is estimated to be at a distance of about six hundred and fifty light years from the earth. To the north of this region in Cygnus one will find other dark, nebulous tracts looking like yawning abysses in the midst of brilliant star clouds, but having in reality form and substance and consisting most probably of clouds of minute cosmic particles, star dust that has ceased to shine. Other similar dark regions will also be found farther south in Ophiuchus and Scorpio and Sagittarius and below the southern horizon in Centaurus and Crux, the Southern Cross.

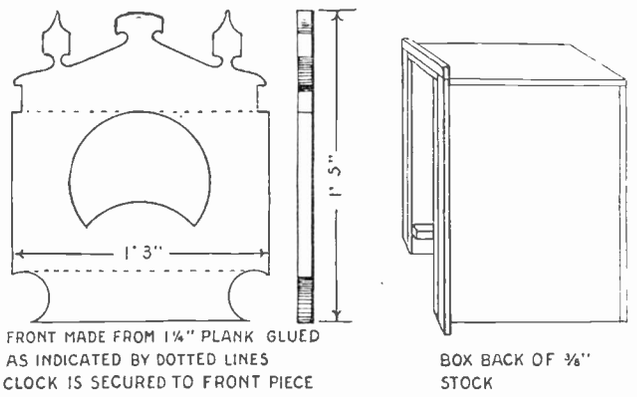
Our own solar system is but fifty light years or so to the north of the great central plane of the Milky Way and lies near the border of relatively near star-clouds in Cygnus. The center of the Milky Way lies far away,—sixty thousand light years it has been estimated by Dr. Shapley,—among the star-clouds of Sagittarius. Here we are dealing with distances almost beyond human comprehension. It is staggering to the imagination to think of, but we cannot grasp, distances of the order of sixty thousand light years, sixty thousand times six trillion miles! Light traveling for sixty thousand years, that is, with a speed of 186,000 miles a second would just cover this distance! And

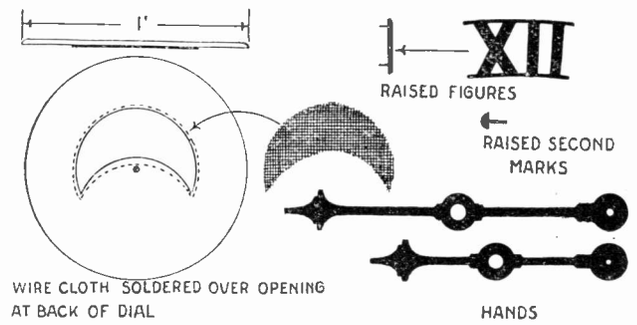
(*Continued on page* 418)

Home Mechanics

Putting the Radio Set in Grandfather's Clock

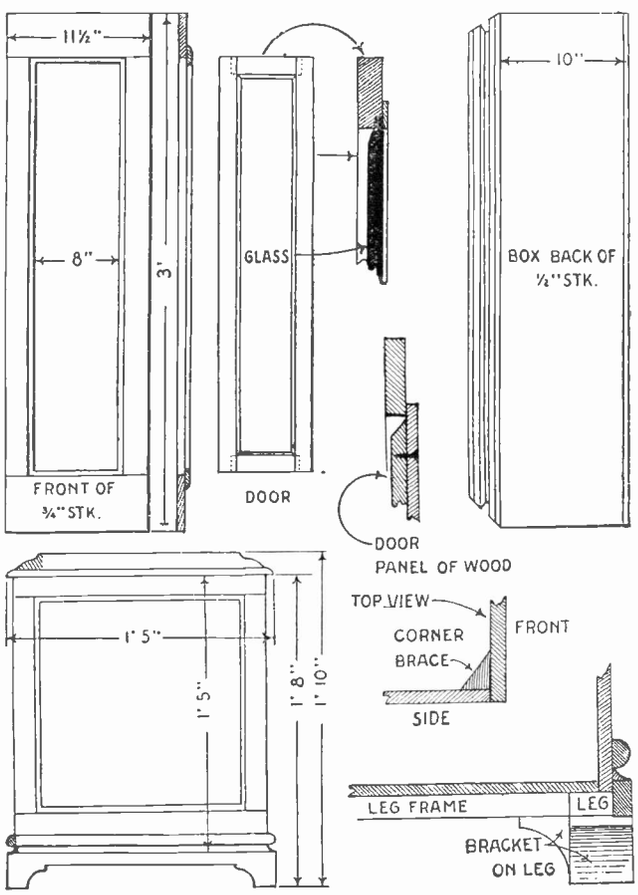




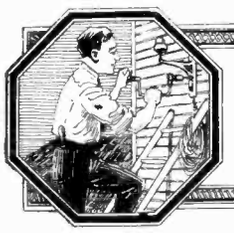


Above is shown in detail the construction methods for the top of the clock. The front is composed of two or three separate pieces glued together to give the necessary width. The box to contain the clock is fairly simple. Note the brackets for fastening the front to it. The dial may be of brass or copper, with a few coats of enamel. The numbers may be procured at almost any hardware store and are enameled black. The same is the case with the hands. The numbers and minute marks are fastened to the dial with pins as shown. The wire cloth outlet for the loud speaker is soldered to the rear of the dial.

—William Butterfield.



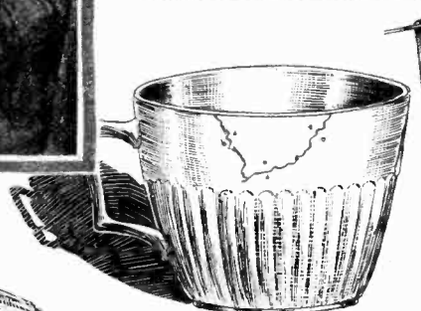
The furnishings of no home are complete without a Grandfather's Clock. One of the best adaptations for it is the installation of the radio set in its body. The illustrations here not only show how to place the radio set in the clock but also show how to construct the clock itself. Directly above is shown a front and side elevation of the complete piece. The clock work is contained in the top, the radio set proper is installed in the pedestal and the batteries necessary for operating the set are placed in the bottom. The radio cabinet is, of course, set on end. The loud speaker is placed on the top of the radio cabinet and the horn delivers sound through a perforated metal aperture in the dial of the clock. The actual design of the radio cabinet must be such that it will leave room for the horn on top, which must set evenly on end and be held fast to the back of the clock case. Details for the construction of the pedestal and base of the clock case are shown at the right. All trim used is standard and may be obtained at any lumber yard. It will be found best to use walnut or oak throughout, though other woods will serve. The completed piece may be finished in any style to suit the builder. All joints should be tongue and groove style and should be glued. Likewise the corner braces should be glued and tacked. Heavy ordinary glass or beveled edge plate glass may be used for the pedestal door.



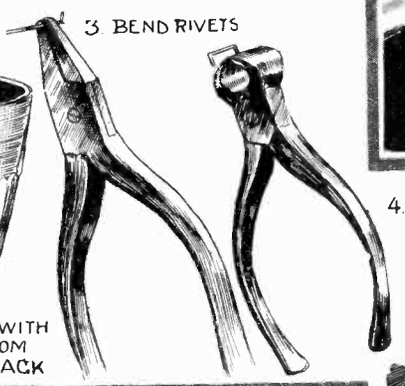
THE CONSTRUCTOR

Repairing Broken Pottery

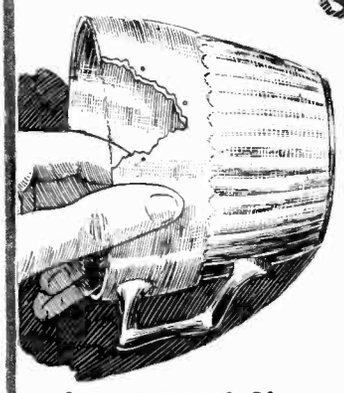
Valuable pieces of pottery are repaired easily and the point of repair is often stronger than the rest of the object. The pieces are first assembled, the largest being put in place first, and then ink dots are placed on a line at right angles to the break, one on either side of it and spaced about ⅛" from the edge or ¼" apart, to mark the place for drilling. The sharp corner of a file is then used to break the glaze so that the drill will start truly. Holes are then drilled, using by preference the diamond chip in an Archimedes drill. The finger or a cork is placed under the drill for support. When the drill starts to come through, pressure is decreased. The rivets are made of brass wire, 1/16" in diameter or less, the points being bent down slightly past a right angle with a pair of pliers, so that they point inwardly. This gives them a spring when forced into place and pulls the edges of the break together. A thin water-proof China glue or white lead is applied to the edges of pieces before the rivets are inserted.—H. S. Trecartin.



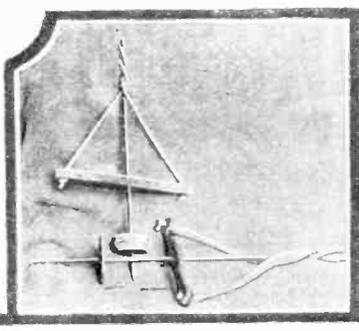
3. BEND RIVETS

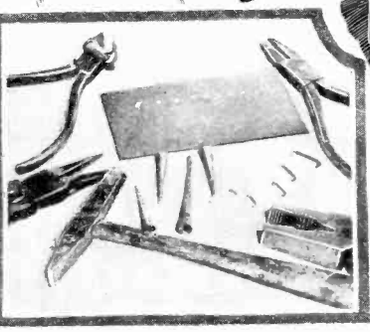


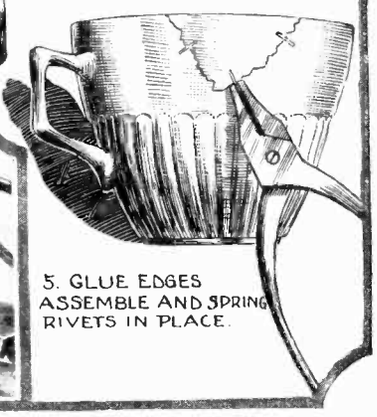
4. CUT POINTS TO LENGTH



1. ASSEMBLE PARTS AND MARK WITH DOTS FOR HOLES, ABOUT ⅛" FROM CRACK



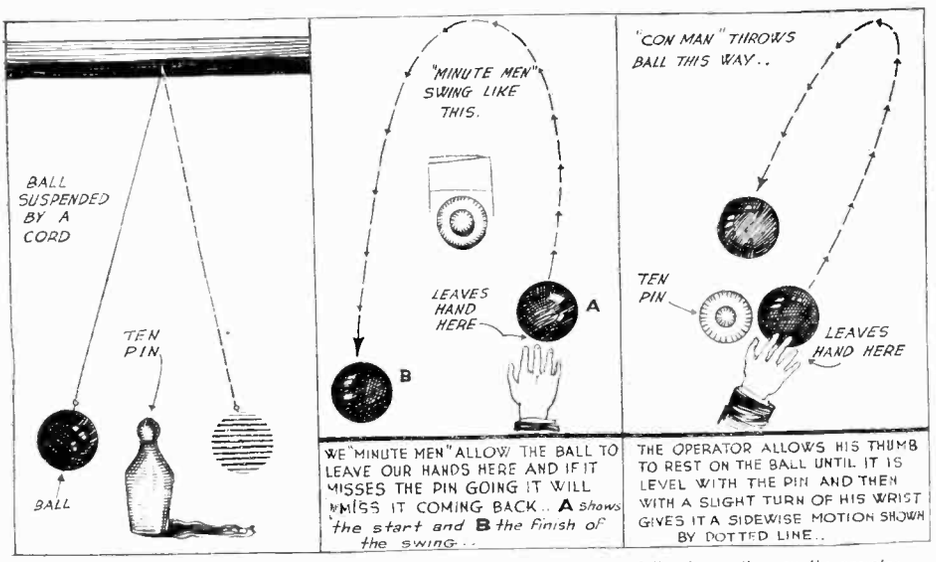




2. DRILL ALL HOLES.

5. GLUE EDGES ASSEMBLE AND SPRING RIVETS IN PLACE.

A Game of "Skill"?



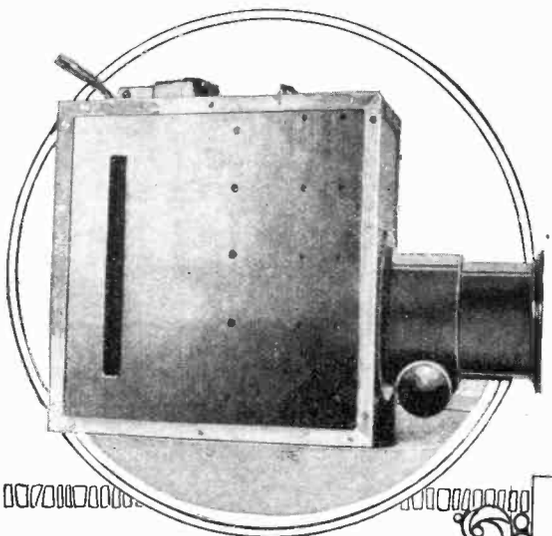
The next time you go to a fair and try your luck at the ten pin game, carefully observe the way the operator handles the ball. You will notice that the ball leaves the hand directly alongside the ten pin. If you duplicate his system exactly, the ball will hit the pin every time. The secret is shown above.

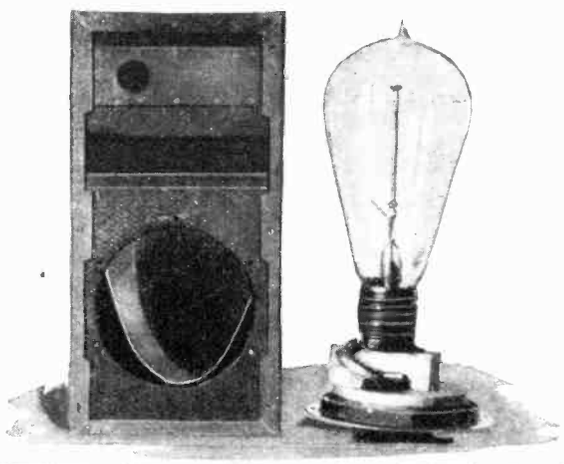
Protecting Floors

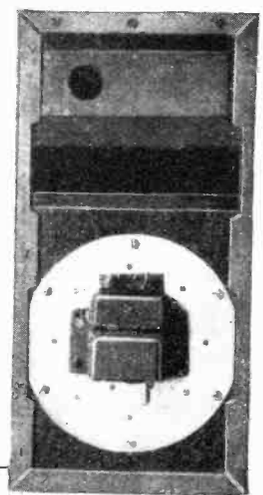
It is occasionally necessary to move a heavy trunk from one part of the house to another over polished floors. This can be done with great ease and without damaging the floor by inverting an ordinary fibre (jute) door mat, and slipping it under the trunk.
—S. J. Phillips.

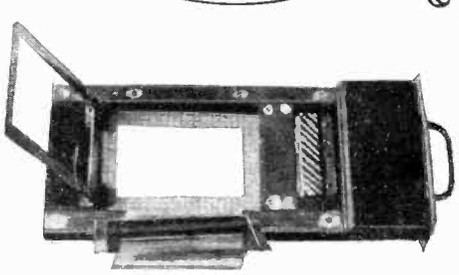
Enlarging Vest-Pocket Camera Negatives

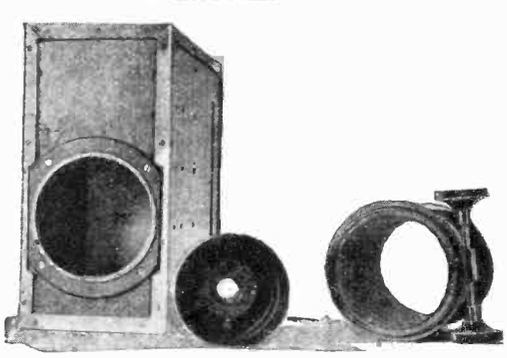
By HERBERT E. HAYDEN

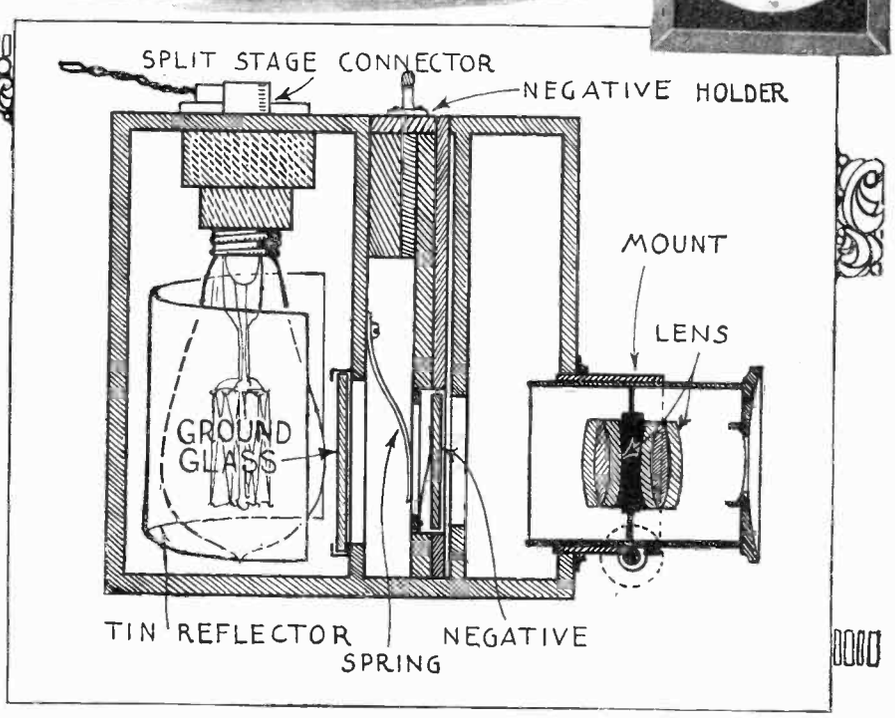






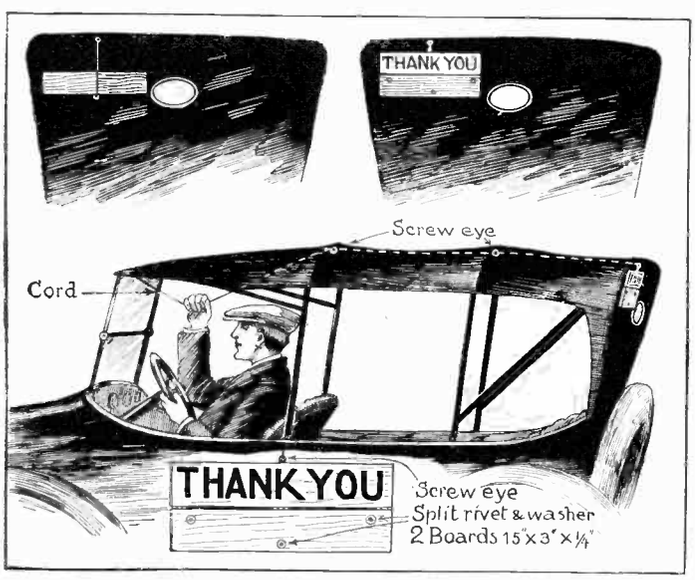




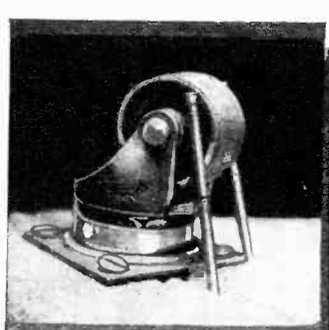


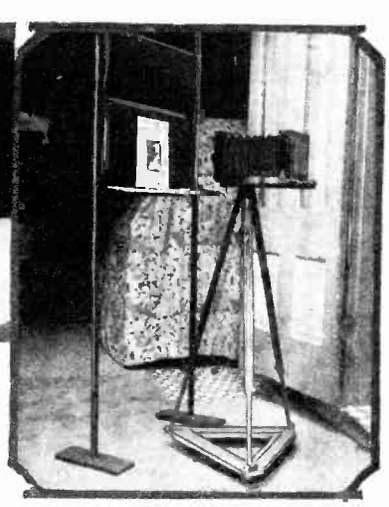
The box is constructed of 1/4" wood and measures 7 1/2" x 7 1/2" x 3 3/4". The focusing device is made from an old stereopticon mount with a vest-pocket camera anastigmat lens fitted in the sliding tube arrangement. The mount has an inside measurement of 2 5/8". Top right hand photos show top view of the apparatus, with lamp removed, and also with lamp in place. Notice the circular air vent. The negative plate holder is indicated in one of the photos. This holds the negative between two plain sheets of glass. The gate is made of brass and is shown open in this photo. The negative carrier measures 7 3/16" x 3 3/16" x 1/4" thick. Drawing above shows arrangement of parts.

Courtesy Signal



Tripod Truck

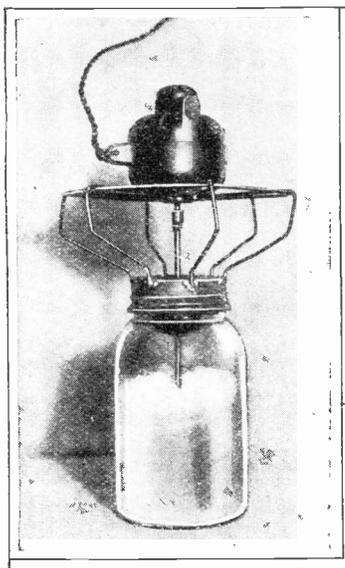


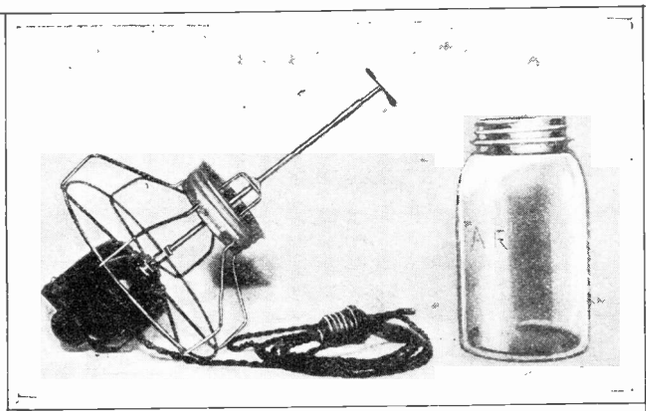


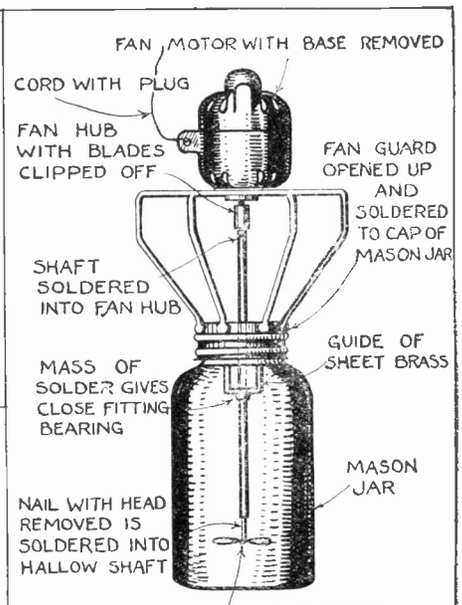
The tripod truck illustrated at the right was made in triangular form. Three rollers were placed at the corners and were then trued up. They were wired in place, so that they could not swing from side to side and as a further check to prevent swinging, nails were driven as shown.
—Leslie H. Phinney.

The illustration at the left shows a simple method of appreciating traffic favors as applied to a touring car. When another tourist permits you to pass him on the road, the least you can do is to thank him. Two hinged pieces of wood mounted on the back of the car, one bearing the imprint "Thank You," unfold when the string is pulled.
—F. C. Fish.

Electric Drink and Egg Beater

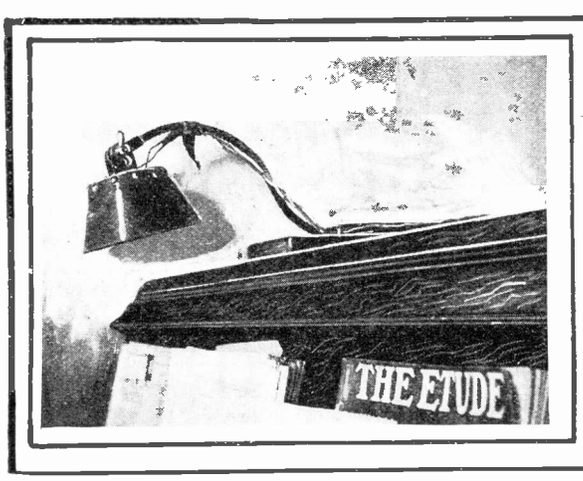


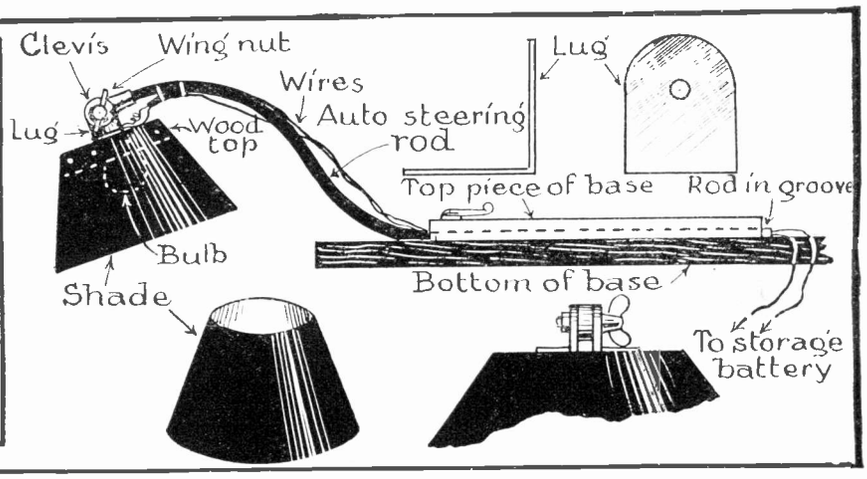




With the aid of a standard Mason jar and a small electric motor such as those used to drive sewing machines a drink mixer and egg beater that will be found exceptionally useful around the house may be made. The illustrations clearly show the major details in the construction. The top of the jar is first removed and the glass inside cap taken out. Then the wire supporting frame is soldered to the cap. This frame may be made from heavy iron wire and its final shape will depend upon the type of motor used. An extra guide for the shaft is then soldered to the bottom of the cap as shown. Before the bearing hole for the shaft is drilled in the cap a large lump of solder is dropped about where this hole is to be placed. This gives a tight bearing. The extension shaft that attaches to the motor and to the mixing propeller may be of any good grade of steel. In the instrument shown in the illustrations it was cut from a steel ramrod taken from an old army rifle. Also, in this mixer motor support was made by opening out the fan guard that came with the motor which was used. The actual mixing element consists of a small propeller with a very slight pitch. It may be steel or aluminum. —S. I. Phillips.

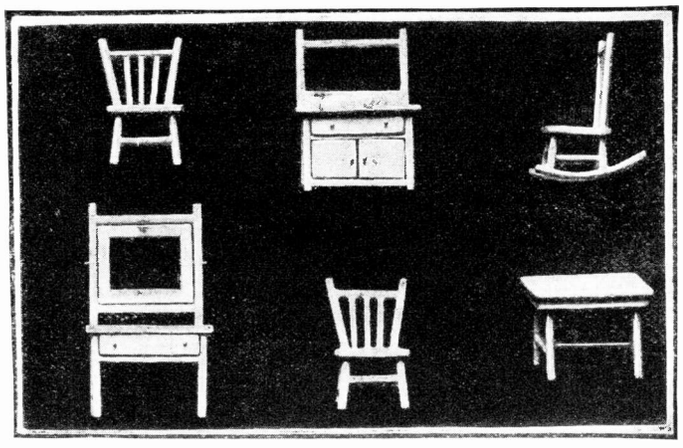
Piano Lamp from Scrap Parts





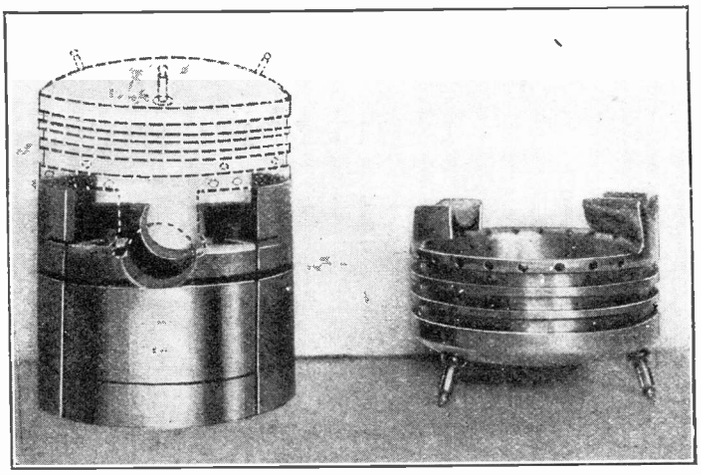
The piano lamp shown in the above illustration, operated by a storage battery, will be found especially adapted to summer cottages that are not equipped with electric current. The construction of the lamp is exceptionally simple. The first step is to make the base. It is composed of a bit of board 14 inches long. Atop this and attached to it with a wing nut is a second piece slightly shorter. This is grooved on the side opposite the clamp to take the lamp support which is constructed of a Ford tie rod, bent as shown. The socket for the bulb, which was taken from an automobile head-light, is screwed to the circular board which forms the support for the shade also. The details of the method of clamping this board to the support are clear. —L. B. Robbins.

Toy Furniture



In the home where there are small children, especially girls, no gift will make the childish heart happier than toy furniture. The pieces shown in the above illustration were all constructed from lollipop sticks and cigar box wood. The design may be changed to suit the builder. The only tools necessary are a small hammer and a good pocket-knife. The pieces are put together with brads and glue. —Edw. E. Howe.

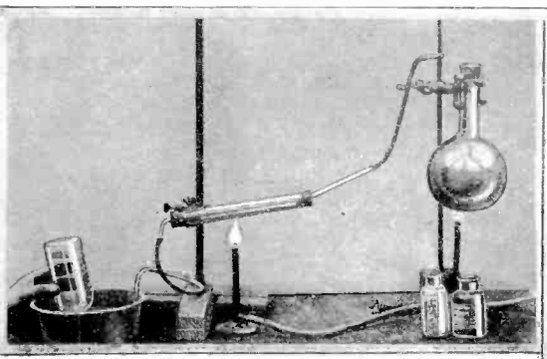
"Auto" Ash Tray



By removing the top of an aluminum piston and working it into the form shown above a decorative ash tray results. The tieft prongs support a match box. The legs are taken from an old automobile curtain. The complete stand may be made with the aid of a hack saw and a couple of good files. —Ben V. Lauth.

Catalysis and Catalytic Action

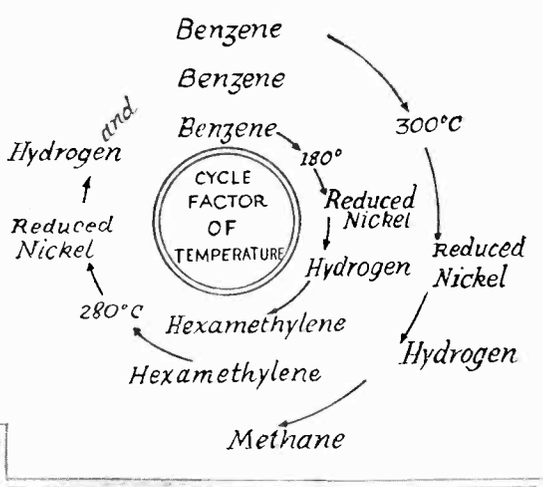
Above is shown the preparation of oxygen by means of potassium chlorate mixed with a fair amount of manganese dioxide. This latter substance is a catalytic agent and it does not change in composition, but only aids in the formation of oxygen gas. The two substances are mixed, placed in a test tube, heated, and the gas is collected by means of displacement of water.

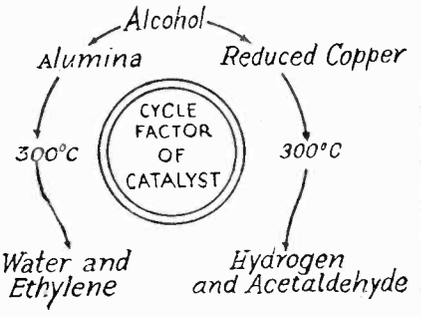


A small quantity of ethylene gas can be prepared by passing the vapors of alcohol over alumina heated to a little more than 300° C. Here we have a catalyst which produces a directive action. If the alcohol vapors were passed over reduced copper at the same temperature, they would be split up into hydrogen and acetaldehyde, but here water and ethylene are produced.

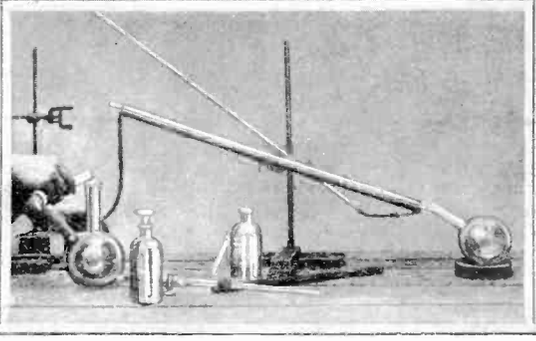
Pouring hydrochloric acid into a cane sugar solution for the purpose of inverting it. Here the catalyzing agent again remains unchanged at the end of the action. A catalyst is a substance which induces certain chemical changes or reactions to take place.

Below. Testing inversion of sugar, with Fehling's solution. At the right is a diagram showing the influence of temperature on the catalyst. Different temperatures will produce different chemicals. For instance, starting with benzene and using reduced nickel as the catalyst, we obtain hexamethylene and hydrogen at a temperature of 180°. Then at 280° and commencing with hexamethylene, with same catalyst, hydrogen and benzene are produced.

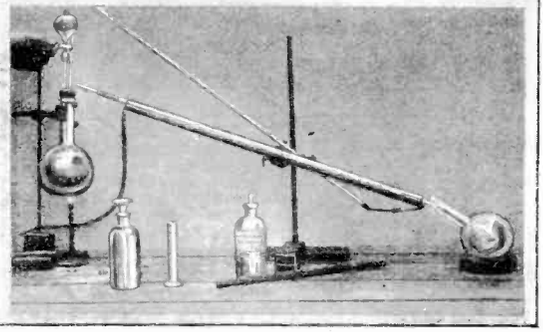




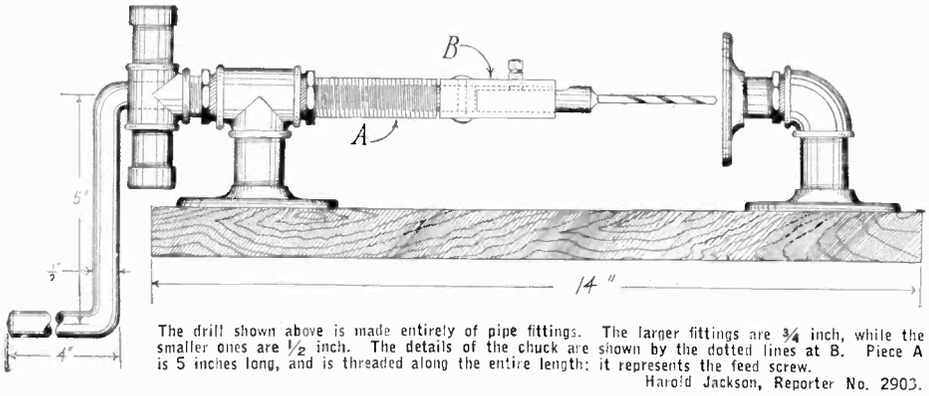
In the photo below alcohol is being poured into a flask to which hydrochloric acid is to be added. The flask is then stopped with a three-holed stopper, the funnel filled with alcohol, which is permitted to drip slowly into the flask, which is being heated. Ether is formed and may be collected in the receiver.



In converting alcohol to ether, sulphuric acid acts in a certain sense as the carrier. The sulphuric acid and alcohol mixture is heated to a temperature of 140° to 145° C, and fresh alcohol permitted to drip into the flask. A small quantity of acid converts large amount of alcohol into ether.—Dr. E. Bade.



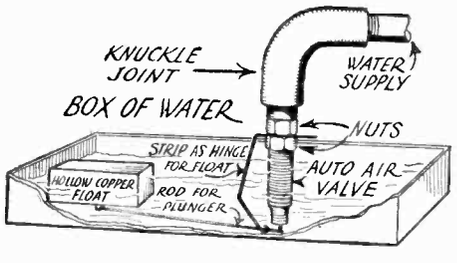
Drill of Pipe Fittings



The drill shown above is made entirely of pipe fittings. The larger fittings are ¾ inch, while the smaller ones are ½ inch. The details of the chuck are shown by the dotted lines at B. Piece A is 5 inches long, and is threaded along the entire length; it represents the feed screw.

Harold Jackson, Reporter No. 2903.

Chicken Font



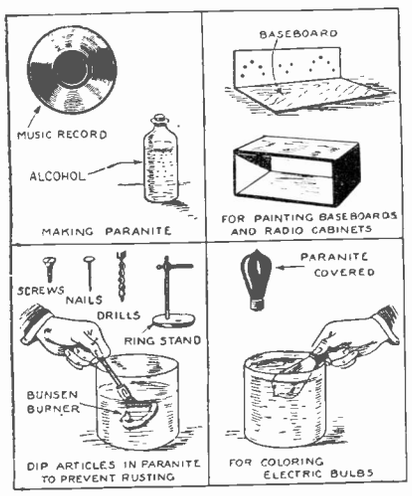
The water supply for the chicken font is controlled by an ordinary auto tire valve secured to the pipe line. A float made of copper opens the valve when the water supply is low.

—J. Baxter Gardner.

This department will award the following monthly prizes: First prize, $15.00; second prize, $10.00; third prize, $5.00.
The purpose of this department is to stimulate experimenters toward accomplishing new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department a monthly series of prizes will be awarded. For the best idea submitted a prize of $15.00 is awarded; for the second best idea a $10.00 prize, and for the third best a prize of $5.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings. Use only one side of sheet. Make sketches on separate sheets.

Useful Solution

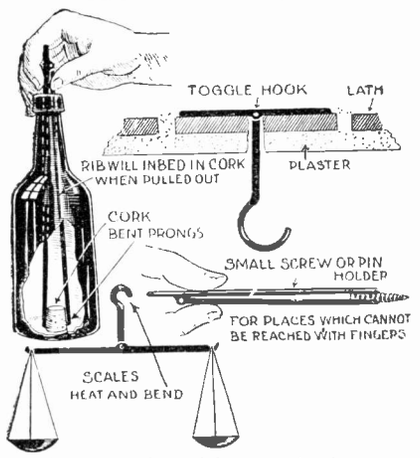
FIRST PRIZE $15



Paranite consists chiefly of shellac, lamp black and rotten stone dissolved and partly suspended in alcohol. It is useful for painting baseboards, preventing rust and may be made from old phonograph records.
—Wm. M. Goldberg, Reporter No. 516.

Uses for Umbrella Ribs

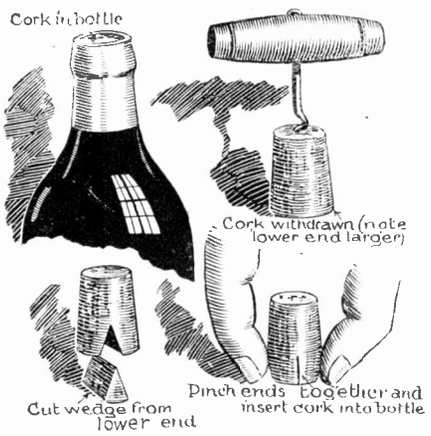
SECOND PRIZE $10



Umbrella ribs can be used for a variety of purposes. For instance, if the prongs are bent inwardly, they make an excellent cork extractor. They are admirable for holding screws and make good scales.
—W. T. Markowski.

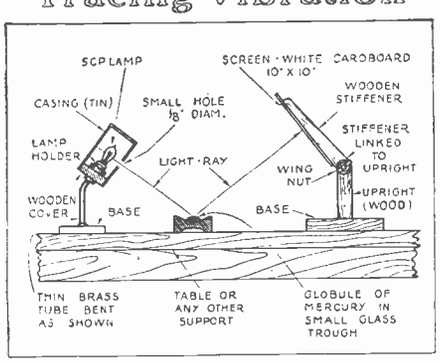
Simple Cork Wrinkle

THIRD PRIZE $5



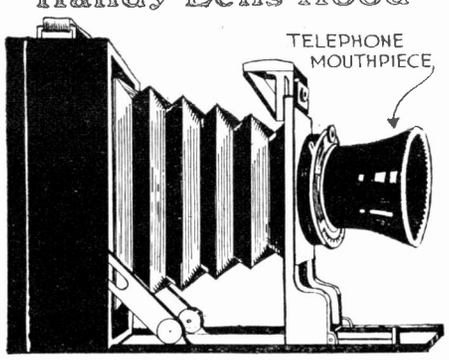
Often one will find that the corks on being extracted from bottles are larger at the bottom than at the top, and are difficult to force into the bottle again. If a small wedge is cut out of the lower end, the process of reinserting the cork is greatly simplified.
—N. O. Edema.

Tracing Vibration



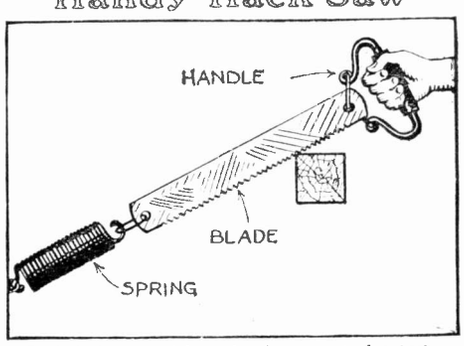
Mercury placed in a shallow container such as is used by water color painters, and the apparatus shown above will enable one to determine the amount of vibration in a room or in machinery. The light spot dances on the screen, and may be photographed.
—C. A. Oldroyd.

Handy Lens Hood



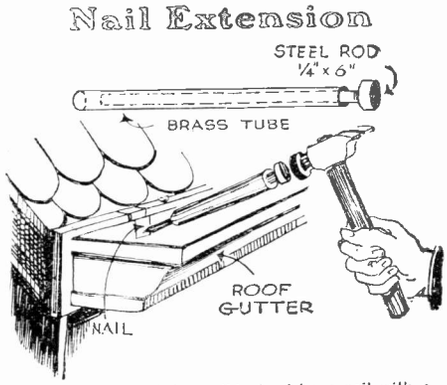
Oblique rays of light often fog the picture by striking the lens. To overcome this, a lens hood may be made by cutting off the threaded portion of a telephone mouthpiece, and enlarging the hole to make a tight fit over the lens tube. —Dr. Hugh Winfrey.

Handy Hack Saw



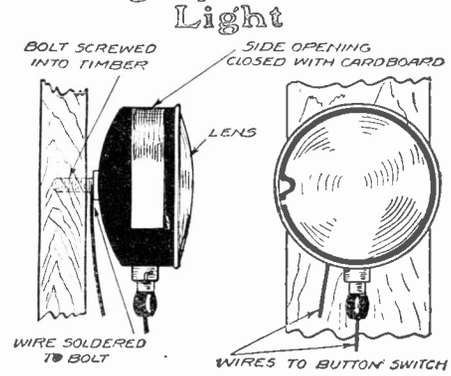
By fastening a curtain spring to one end of a hack-saw blade and a handle similar to those put on packages, a serviceable saw is obtained. The same system can be employed in using a scroll saw.
—N. Webster, Jr., Reporter No. 7165.

Nail Extension



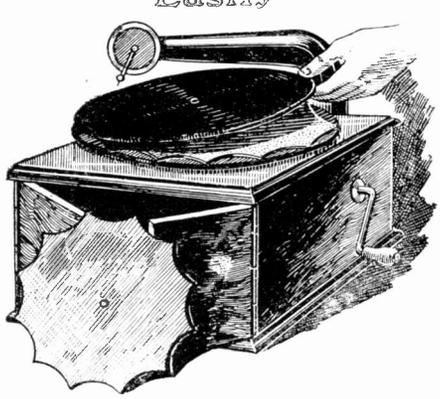
Where it is almost impossible to drive a nail with a hammer, the nail extension shown is very handy. The steel rod may be magnetized for holding the nails.
—L. A. Parker.

Photographer's Ruby Light



Removing the nut from the back of an old tail light, and screwing the light to a support, then covering the side opening with cardboard, and connecting the wires to the battery, a ruby lamp is made.
—L. B. Robbins.

Removing Records Easily



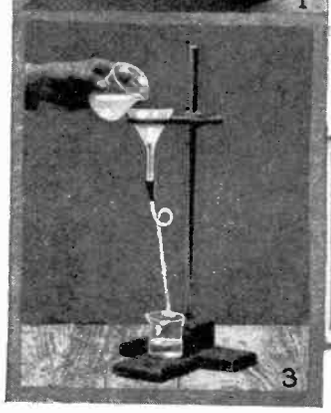
A serrated disk of blotting paper is glued to the turntable of a phonograph. The serrations are cut to a depth of one inch, and provide spaces beneath the edge of the record to allow for insertion of the finger nail.
—G. E. Hendrickson.

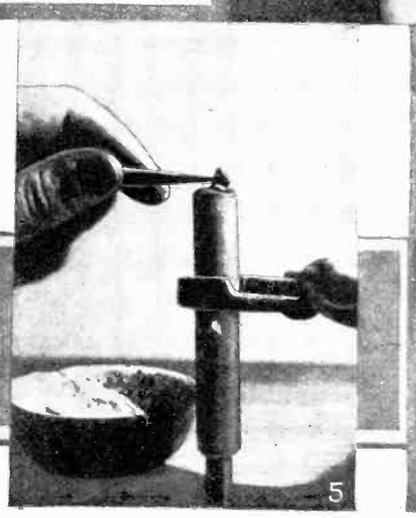
WRINKLES
RECIPES & FORMULAS

Speeding Up Laboratory Work

By DR. ERNEST BADE

LITTLE pieces of apparatus will greatly speed up the work in a chemical laboratory and can be constructed by anyone. In photo 1, one sees a home-made wash bottle. The bent glass tube is brought out to a point at one end and extends through a two holed stopper to the bottom of the bottle. The straight tube terminates just below the cork. Photo 2 shows the construction of a calcium chloride tube for drying gases. An open tube is plugged at either end with a one holed stopper and glass tube. A wad of glass wool is placed at either end and the space between is filled with calcium chloride. If one or more loops are formed in a glass tube, as illustrated in photo 3, filtering speed is greatly increased. The longer the distance from the bottom of the funnel to the receiver, the greater is the vacuum. Filtering oils through a funnel two-thirds full of calcium chloride, as shown in photo 4 will remove the moisture or water in the oil. Photo 5 shows the construction of a glass cutter. A crystal of carborundum is fastened in a package handle and set in melted lead or tinfoil.





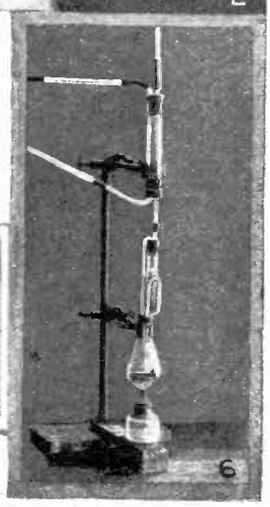
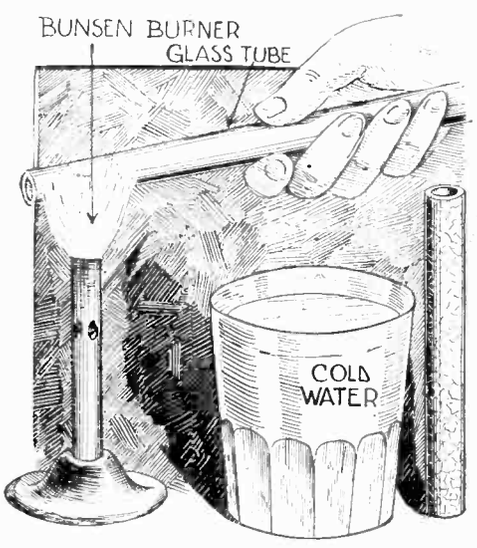


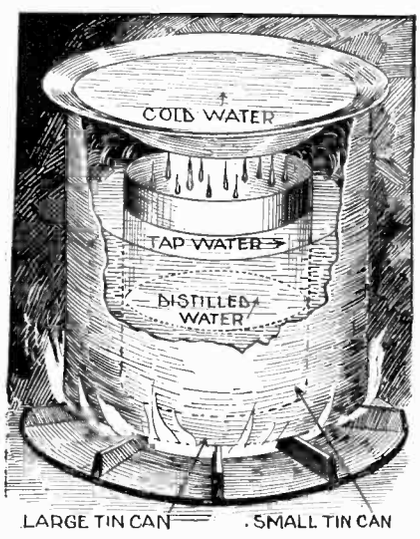
Photo 6, extreme right, shows a simple Soxhlet extractor. It consists of a tube ¾" or more in diameter open at both ends. The bottom is closed with a one holed stopper. This contains a glass tube of smaller diameter first bent upwards half way to the large tube, and then downwards again, reaching the bottom of the flask. The top of the large tube contains a two hole stopper. One hole is closed by a glass tube which is bent downward, enters the flask and extends for a distance of ¾" below the neck of the flask. The other hole connects to a water condenser. The substance to be extracted is placed on filter paper in the glass tube back of the loop.

Ornamental Glass



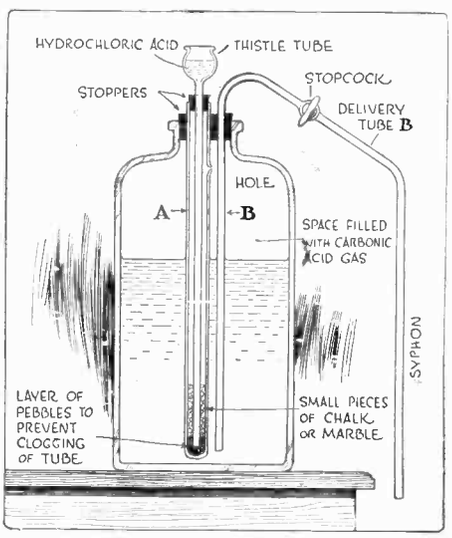
Heat a glass tube to redness over a Bunsen burner. Take it out of the flame for two or three seconds, then dip in cold water. If it is not too hot, the glass will crack, but not break. Place in flame and heat carefully, melting the cracks together slightly.
—Billy Bryant.

Distilling Water



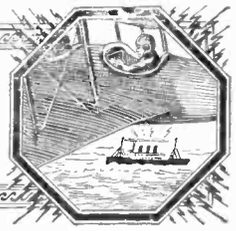
A small tin can and a larger can, an old China plate and a source of heat, complete the distilling apparatus for supplying water for storage batteries. The inner can is weighted, and the plate filled with cold water. Distilled water collects in the smaller can.
—Joseph Liebowitz.

Water Supply



Large containers of distilled water are difficult to handle. When fitted with the apparatus shown above, water under pressure is constantly delivered. As soon as stop-cock is turned on, the decrease in pressure permits acid to act on marble producing gas and driving out the water.—C. A. Oldroyd, Reporter No. 4433.

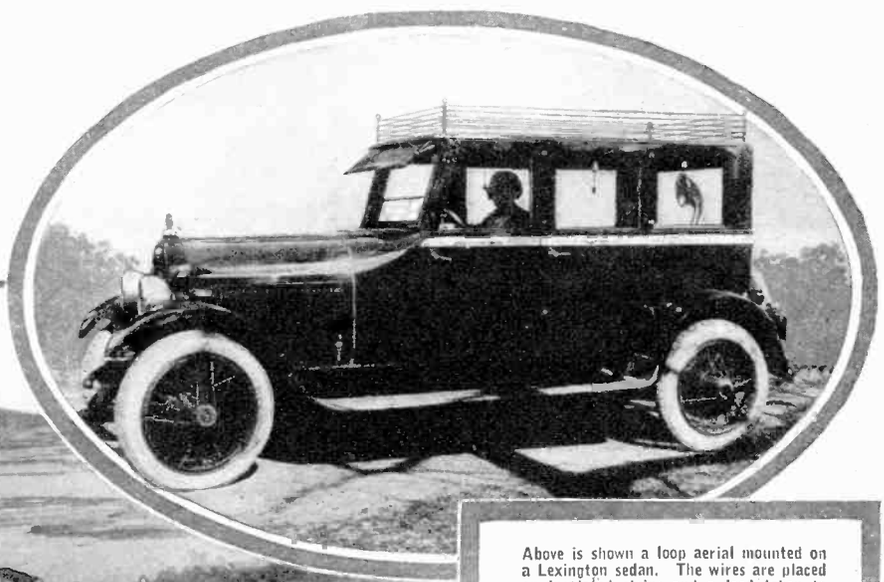
RADIO



Radio to Guide Tourists

By JACK BRONT

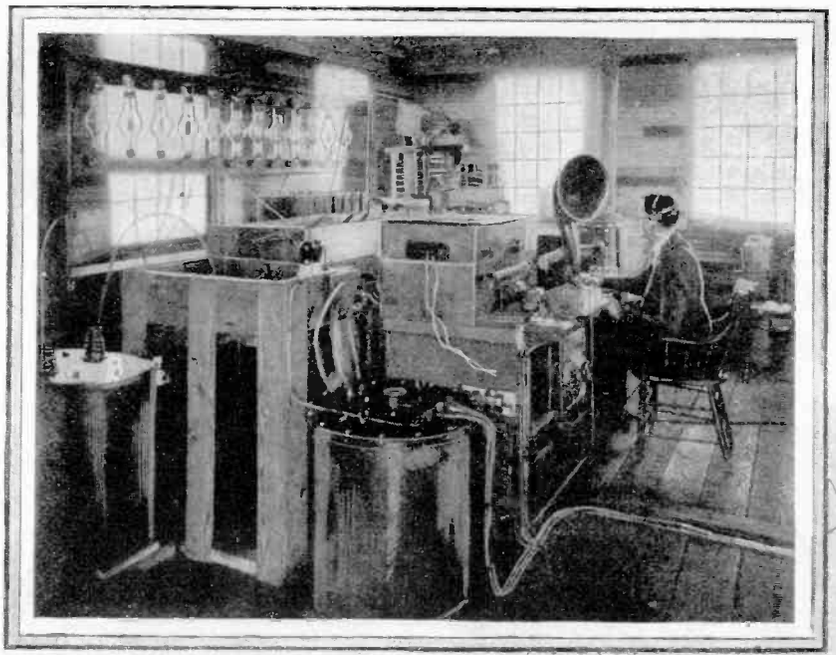
THE tourist of the future will be guided in his travels by radio. The scheme by which it will be done is depicted here. The Automobile Club, Chamber of Commerce or a similar body will establish small radio stations at convenient points along the road from which directed beam signals will be sent down the main roads, which may be picked up by travelers. Such information as the location of best detours, impassable spots in the road, load limit of bridges and dangerous curves will be sent out.



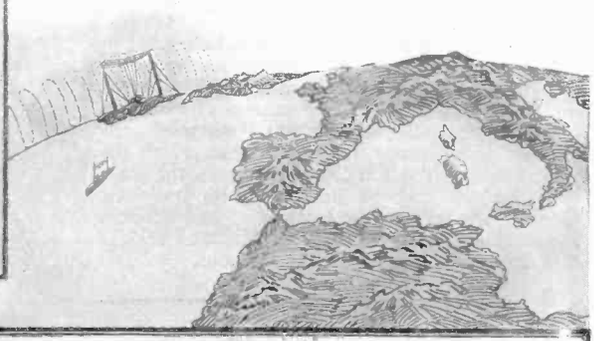
Above is shown a loop aerial mounted on a Lexington sedan. The wires are placed on insulated strips and a lead taken to the set. A ground, if used, may be in the form of a counterpoise, made of a large metal strip placed underneath a seat or the floor of the machine. A set which would work well on such an aerial system need not be complicated.

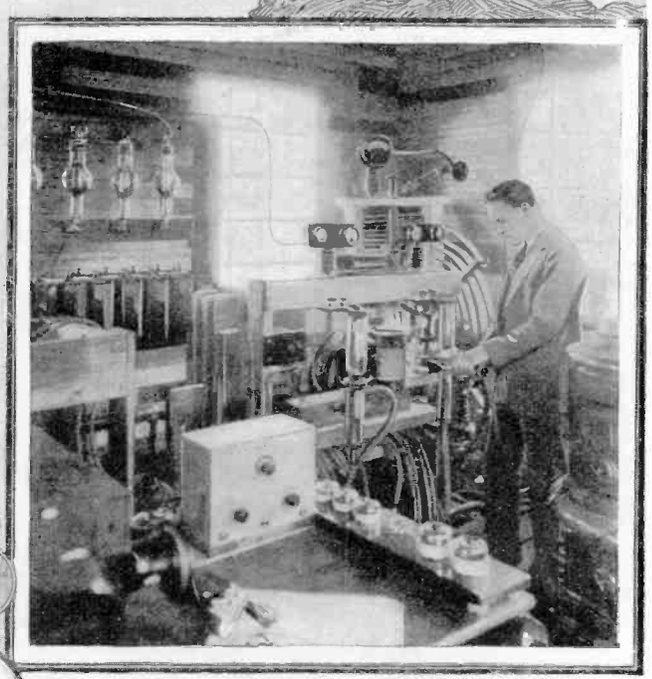
The diagrammatical illustration explains fully the working of the future beacon system. Suppose a car, C1, traveling to Smithsburg, S. The bridge, P, (all important locations along the road will be marked with lettered signboards) is in bad condition, which necessitates its being crossed slowly. Such a message is sent from an automatic record sender at the beam station, B, which is under distant-control from the offices of the town automobile club which is a subsidiary of a state or national association. At Jonesville, J, a few miles away, the same is the case. The car, C2, must take the detour to avoid a marshy place in the regular road, M. The aerial and set on the car picks up the signal and announces the necessity of the detour to the driver. The system seems practicable.

Short Wave Transmission for Relay Work

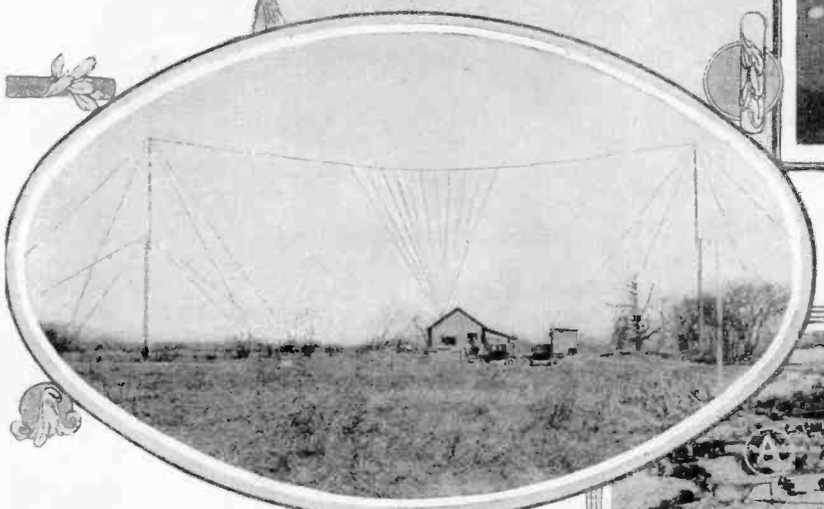


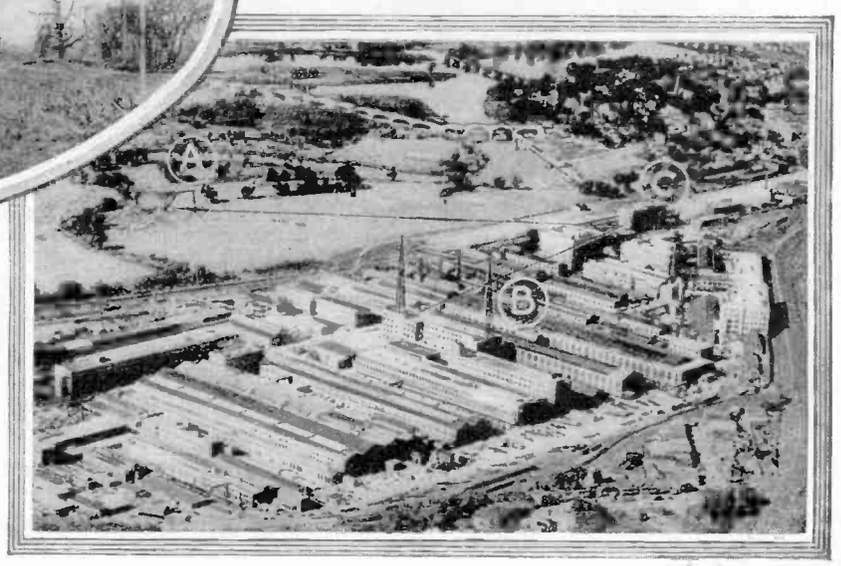
Another epoch marking experiment was recently carried out successfully from the General Electric radio broadcast station, WGY, when a complete program given in the studio of the station was picked up by the English station, 2LO, in London and rebroadcast throughout the British Isles. This feat was accomplished through the use of the new short wave transmission, the wave-length in this instance being 107 meters. The above illustration shows a bank of twelve oscillator tubes used as a part of the short wave equipment. A great many new difficulties arose with the use of the extremely short waves which were not common in the use of longer ones. The ultra high frequencies involved makes the question of insulation one of extreme importance. Also, the danger in working about the set while it is in operation is extremely great. A 60-watt incandescent lamp held in the hand near the set while it is in operation will light up to full brilliancy.





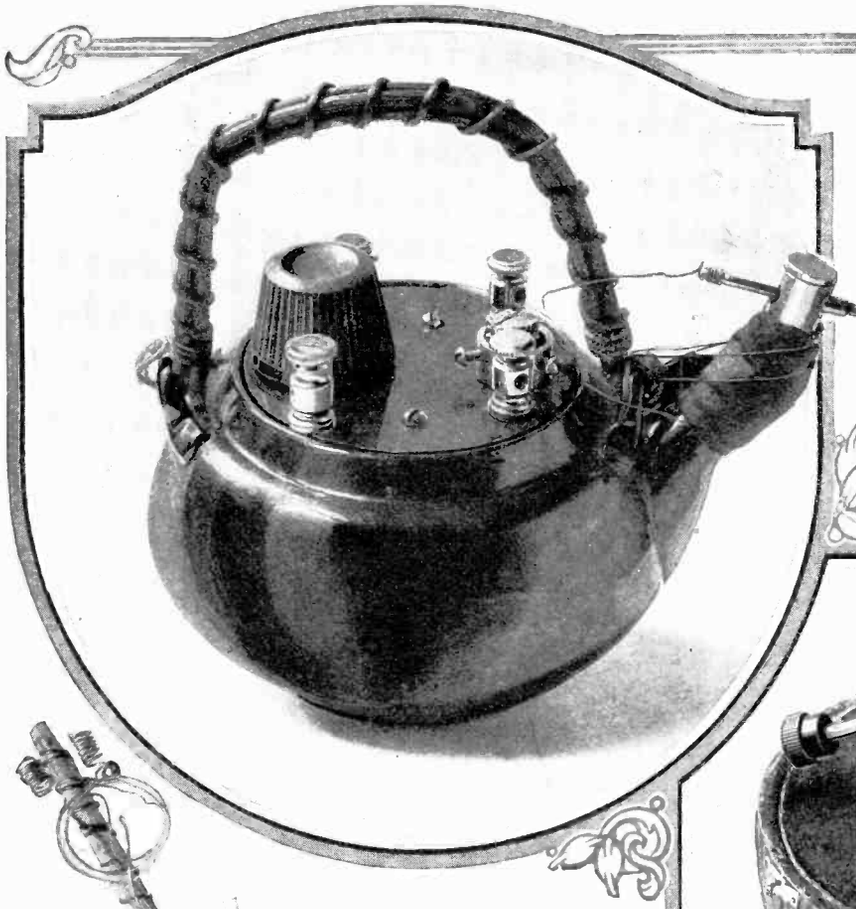
Although the short-wave installation is rated at 30 K.W. capacity the complete set is surprisingly compact as may be seen by the above photograph which shows the oscillator and modulator water-cooled tubes, grid and plate coils and coupling inductances. Various pieces of checking apparatus may be seen on the table in the foreground.



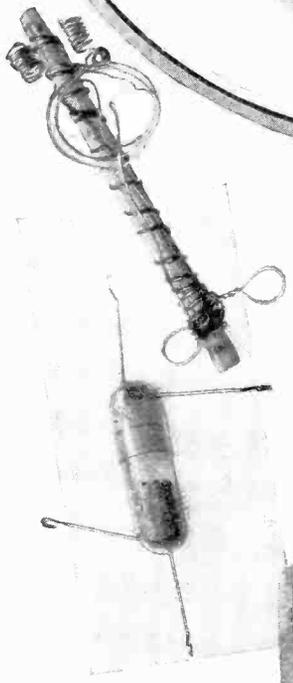


Above is a photograph of the short wave transmitting station, located about a mile from the nearest building, in a wilderness outside of Schenectady. It is, of course, connected with the main station, WGY, by land line and a control system. The site was selected for its isolation in order that there would be as little absorption of the waves as possible as they leave the fan antenna. Although loose coupling is employed, it was desired to have the emitted wave-length as nearly constant as possible since long distances were to be covered. The masts are just twice as strong as necessary and every precaution was taken to make them absolutely free from vibration. The transmitter design is regulation type with a few minor exceptions necessitated by the diminutive wave used. At the right is an airplane view of the General Electric plant at Schenectady and the radio stations with it. At the circle A is the location of the new short wave transmitter which is connected with the main studio and control room, the location of which is marked by the circle C. The main transmitter, the one known to the fans throughout the United States which transmits regularly on 380 meters, is at the circle B. This station likewise is connected with the main control room and studio.

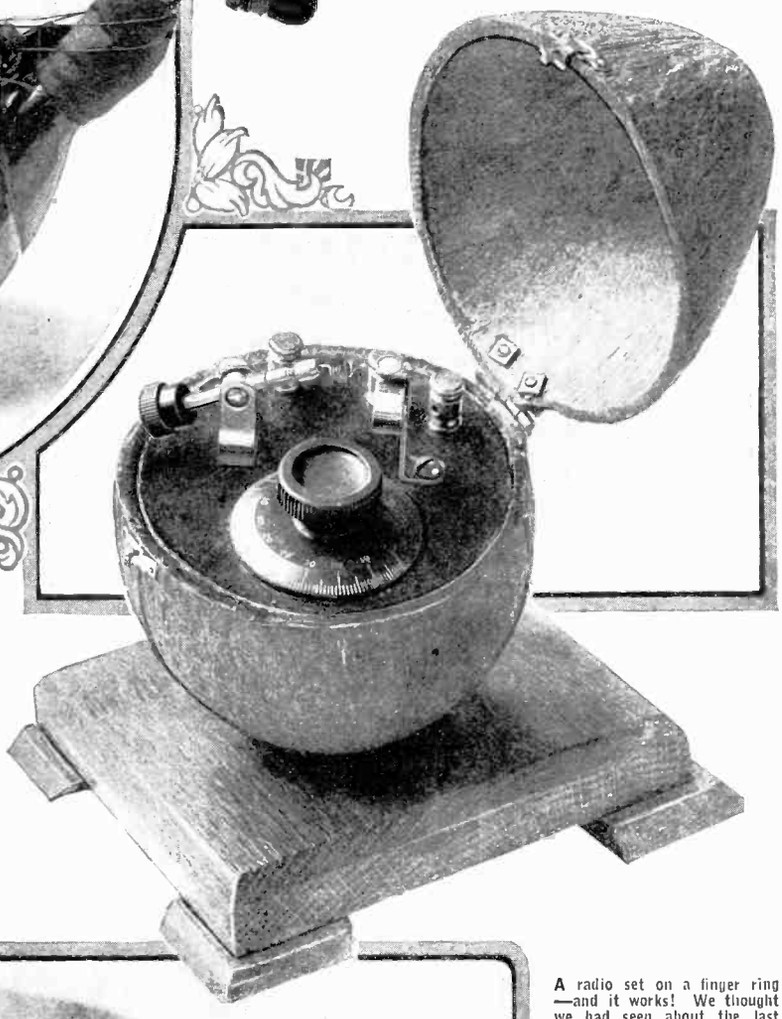
Curious Crystal Receivers



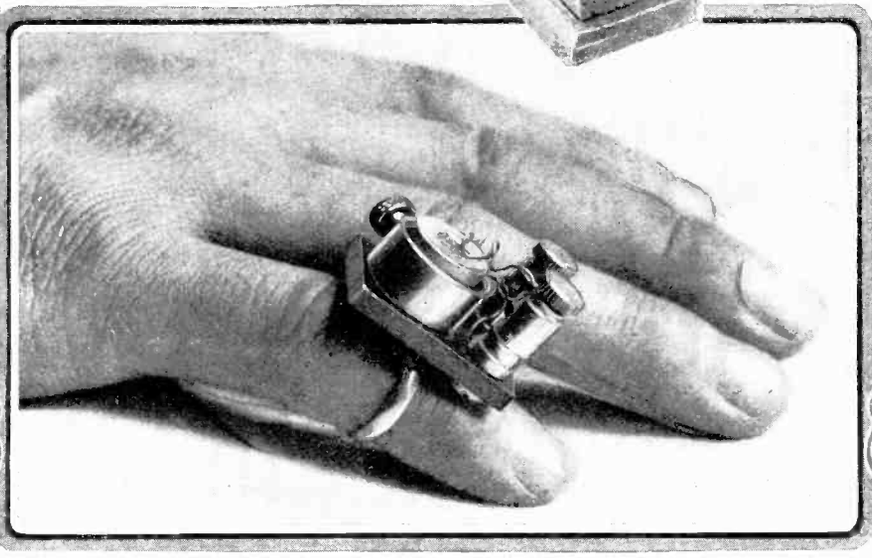
Here is a brand new idea in teapots—one that will sing and talk. In other words, the photo at the left shows a clever conception in the form of a radio teapot, all of the apparatus, including the crystal detector and the tuning condenser are incorporated in the body of the teapot. The only thing that is needed extra are the headphones. This set as well as the other outfits shown below were recently exhibited at Chicago and all of them worked when tested by experts.



Remember the capsules in which the druggists puts bitter medicines? Well, in the picture above we have a radio set built in such a capsule about the smallest one we have seen so far. Also in the same photograph is shown a radio set made on a match stick. We suppose the next time we have a contest like this, someone will build a radio set on the head of a pin, so that we will have to use a magnifier to manipulate the dials or adjust the detector.



If there is one thing that the editor always wanted to do it was to build something useful out of the steel backed cocoanut shell. It always seemed a pity to throw them away after eating the juicy white filling and here at least is one way of utilizing old cocoanut shells; a complete radio set is mounted within the shell, one half of which forms a cover when swung over. This set is of the crystal detector type, complete with tuning condenser, knob and inductance. The sets here shown were constructed by boys and girls under thirteen years of age and the cost had to be 75c. or less.



A radio set on a finger ring—and it works! We thought we had seen about the last thing in mechanical or other devices which could be mounted on a finger ring when we beheld a fine jeweled watch built in a seal ring, the watch being about ¼ inch in diameter. But it seems that our radio bugs have some ingenious ideas about finger rings also. The photos shown above were supplied by Mr. K. D. Ganaway, Reporter No. 455

Radio Aboard S. S. Deutschland

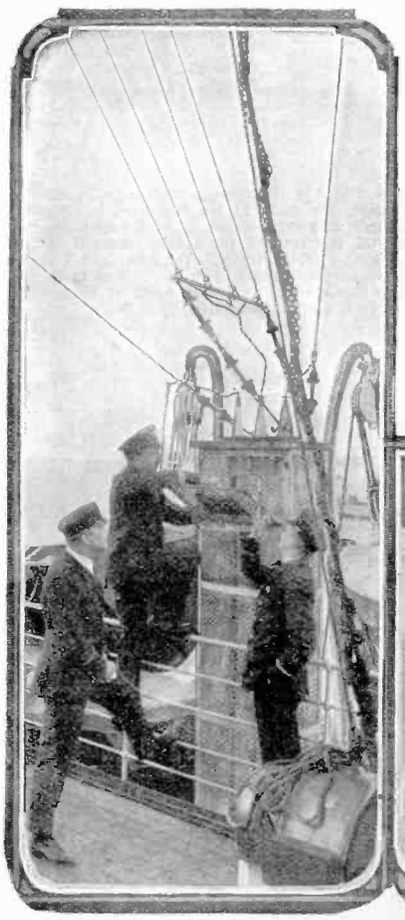
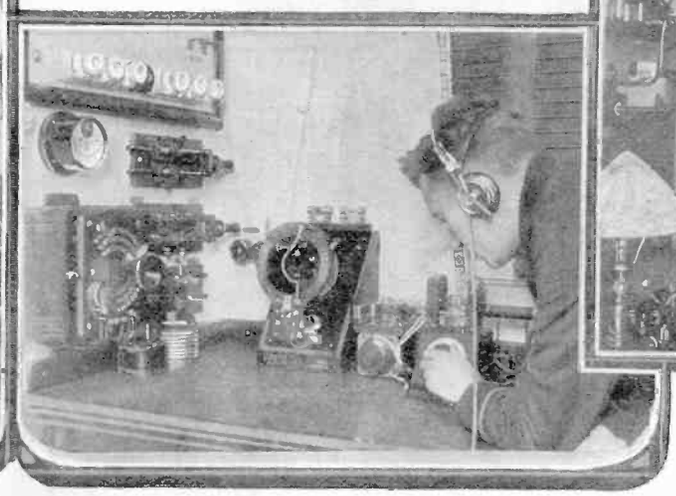
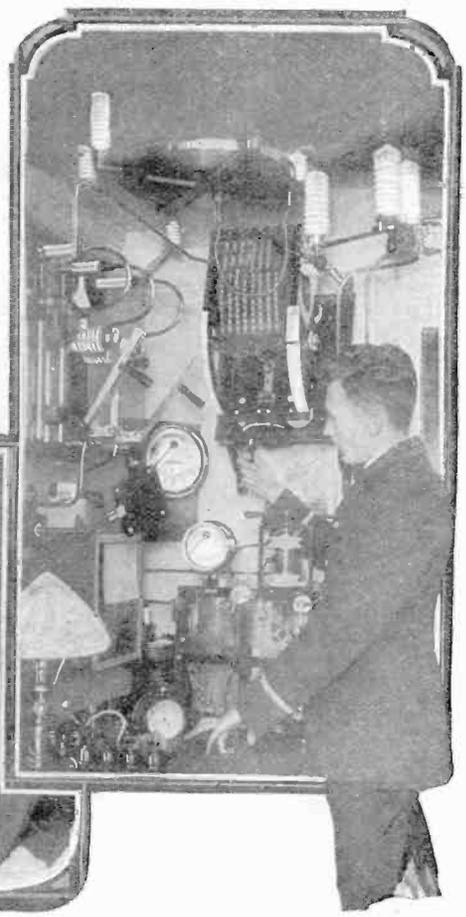


Photo at right shows the latest German built radio installation aboard the steamship Deutschland recently placed in the German-American service. This photo shows Chief Radio Officer, Karl Kasel, adjusting wave-length on transmitting variometer. Both vacuum tube and quenched spark transmitters are supplied in the ship's equipment.

Photo below shows part of the receiving equipment. Just below the operator's head may be seen a tuning instrument in which inductances are inserted by means of separable plugs, one-half of the inductance turning about its axis so as to vary the inductance.

Three of the radio personnel of the steamship Deutschland are shown inspecting the lead-ins which are protected by a cage extending well above the deck rail so that passengers cannot receive an electric shock from it.

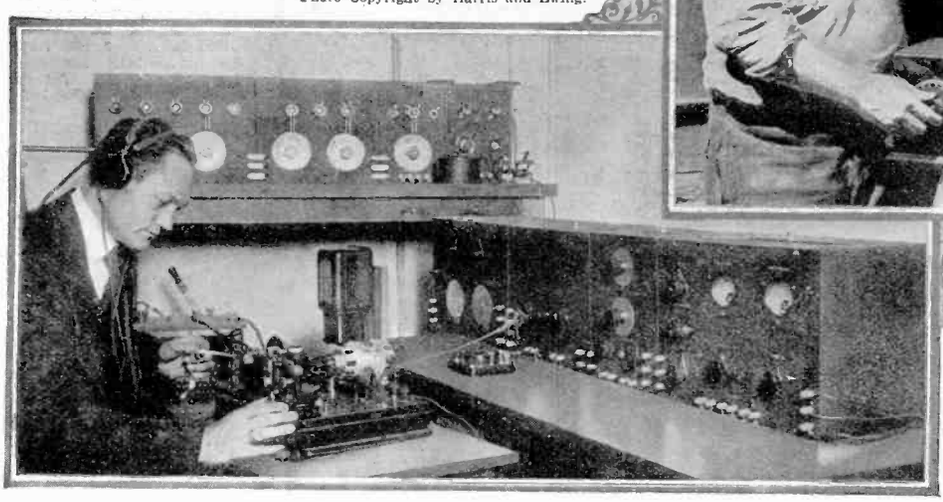


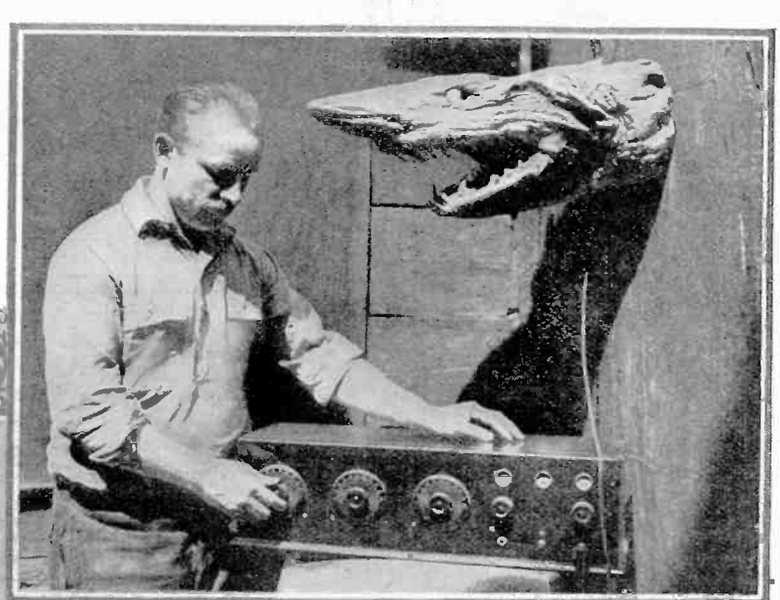


Loud Speaker and Radio Recorder

THE photograph below shows a new automatic radio recorder capable of copying radio signals, even though static interference is three times as great as the signal strength. The apparatus is the invention of Dr. A. Hoyt Taylor of the U. S. Navy Department. The machine shown is said to be capable of copying radio signals at the rate of one hundred words per minute. The recording apparatus is shown in the immediate foreground. In military and naval radio operations it has always been very desirable to have an accurate recorder of the paper tape or other type. In time of war, if a message is incorrectly copied by an operator unimaginable trouble can be developed by the wrong orders being given in consequence. If an accurate tape record is made available, there is slight chance of the wrong orders being given in the first place, and also if wrongly interpreted, when writing out the radiogram, the operator may be held accountable.

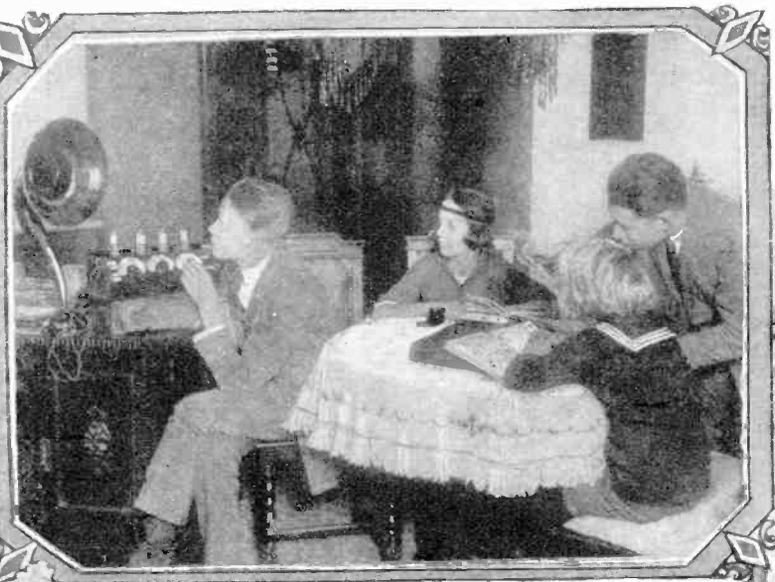
Photo Copyright by Harris and Ewing.





We thought the list of possible freak loud-speakers had been about exhausted, but lo and behold! here's another brand new one in the form of a shark's head. This extremely novel loud-speaker comprises a talking unit installed in the preserved head of a 25 ft. man-eating blue-nose shark. This remarkable loud-speaker is owned by Mr. Joseph Walker, a New York taxidermist, and Mr. Walker enjoys the latest news about the Yankees and the Giants, as well as the latest jazz music and weather reports, as he goes about his daily taxidermy tasks.

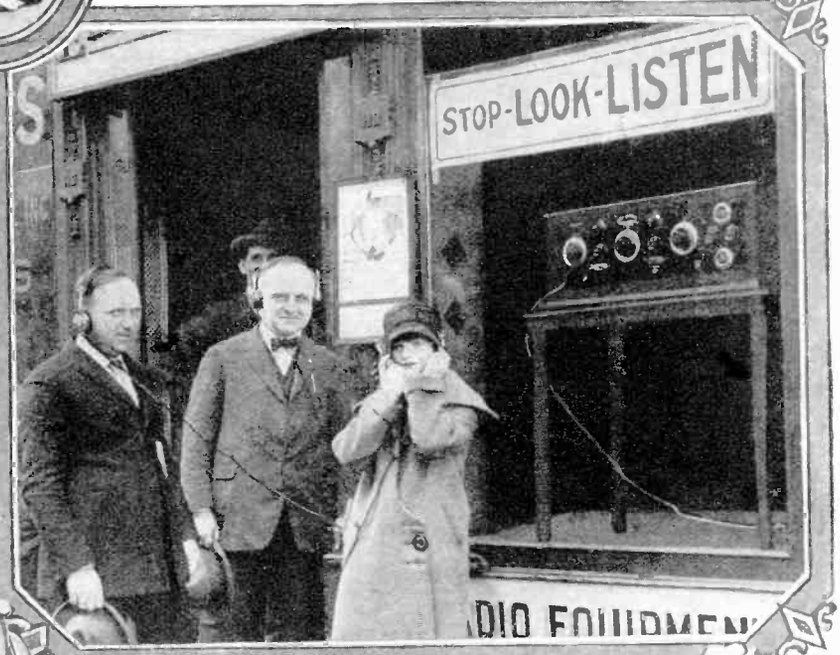
Radio Finds Novel Uses



Radio is rapidly becoming a long arm of our schools and universities. Here we see a group of German children receiving lessons in foreign languages via radio. The instructor teaches thousands of pupils in this way with one lecture, whereas previously he could only lecture to 100 pupils or less. Those of us who have heard some of the French lessons being broadcasted from a New York station will appreciate what the future may see in the realm of radio teaching.

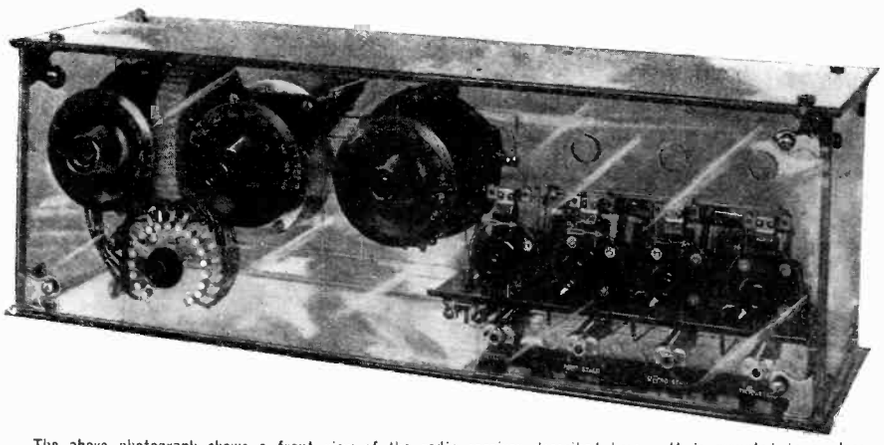
Radio has recently found many ship-board uses. Some ocean travelers have received radio concerts in their state-room on a portable set provided with a simple loop antenna. The picture above shows a fair damsel enjoying a radio broadcast concert received on a six tube radio receiving set with a small antenna. This set is shown in use on a steamboat plying between New York and Atlantic City.

No, friends, this is not a movie camera, but an honest-to-goodness two bulb radio receiving set mounted on a camera tripod for portability. The antenna wire is shown strung about the legs of the tripod. The photo shows Mr. R. C. Nussbaum listening in to a radio concert on his "radio-movie" set. Almost a case of talking movies—eh, what?

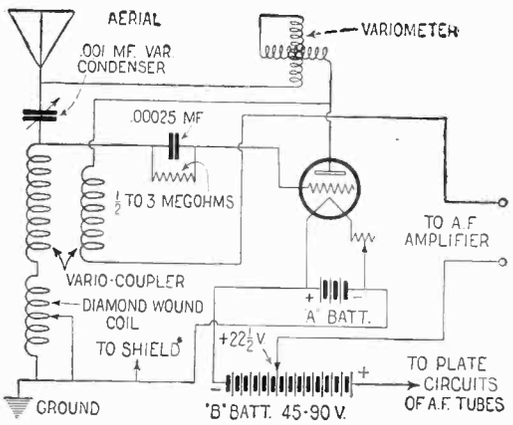


A New York City radio dealer has here adopted a novel method of advertising. The police ban on loud speakers was overcome by this enterprising dealer in a novel manner; he simply hooked up a few sets of headphones to the set on display inside the window; then when passersby manifest interest in the display, he simply hands them a set of headphones. They hear the concert much more clearly and the crowd is thus limited.

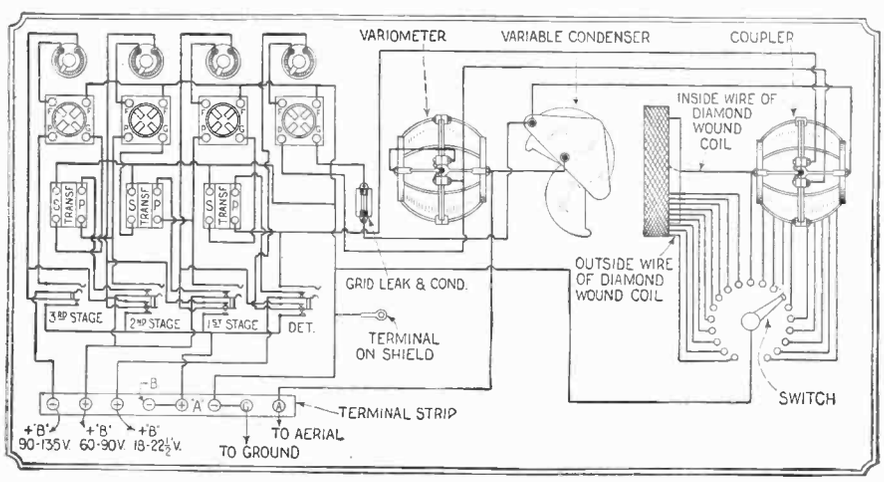
A Well Made Broadcast Receiver



The above photograph shows a front view of the radio receiver described here. It is mounted in a glass cabinet, although models which are furnished for sale are mounted in the standard manner with bakelite panels.

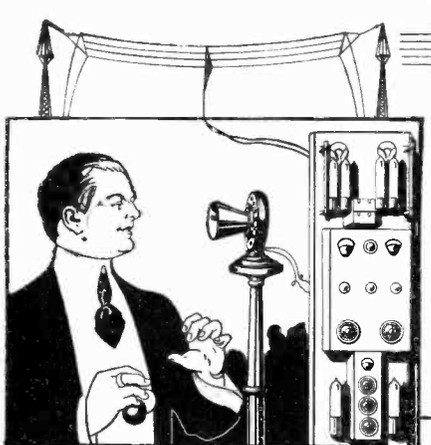


The receiving set illustrated in the upper left hand corner of this page employs a rather unique tuning arrangement and has one of the best three stage audio frequency amplifying arrangements that we have seen in a long time. The arrangement of the various parts reduces howling and other tube noises to a minimum and allows the production of a great volume without the usual attendant disturbance. The complete circuit diagram of this receiving set is given at the right. Filament control jacks are supplied so as to increase convenience and eliminate unnecessary controls in the operations of the set. An insulating strip is provided for the mounting of all the terminal posts.

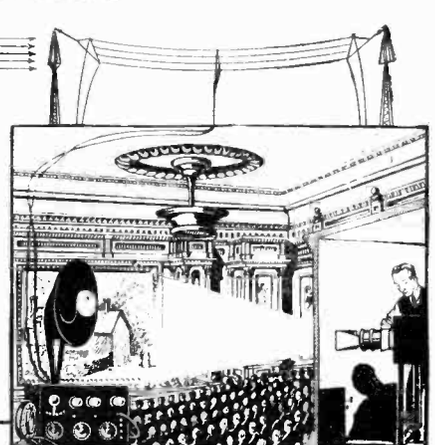


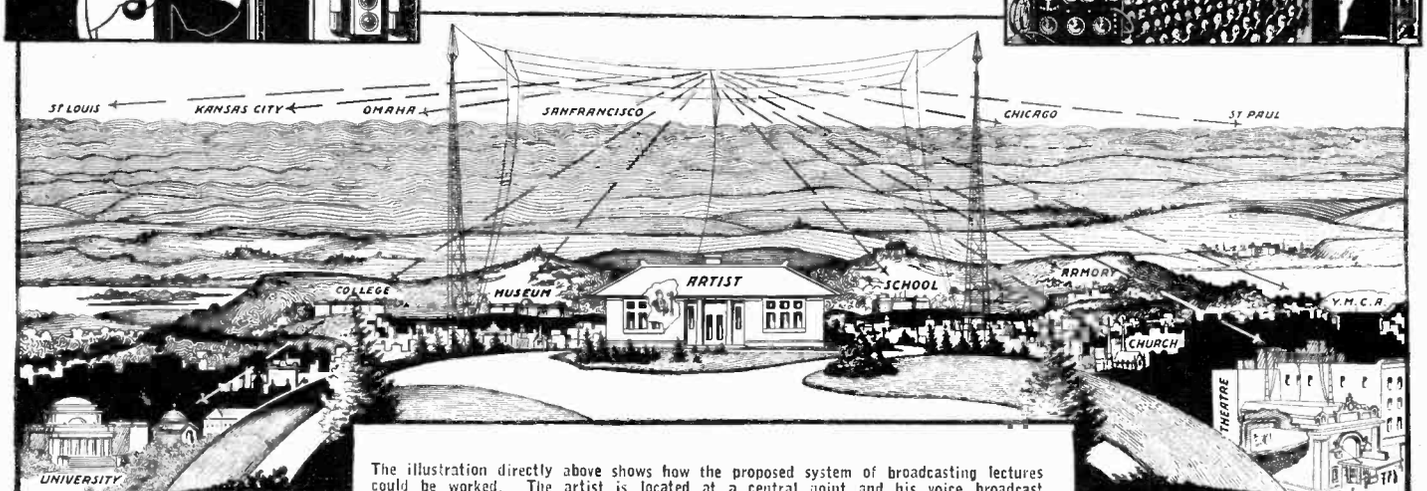
The diagram of the detector circuit which is employed in the receiving set illustrated is given directly above. The diamond wound coil is placed by the side of the variocoupler so as to provide a greater range of wave-lengths. Two methods of regeneration are used in this circuit and the combination gives excellent results. Tickler feed-back is used, as is also a variation of the tuned plate system. A variometer is used in the latter position. Results with this set are surprising and the tuning is comparatively simple. This receiver is being put out by a prominent radio manufacturer.

Stereopticon Lectures by Radio



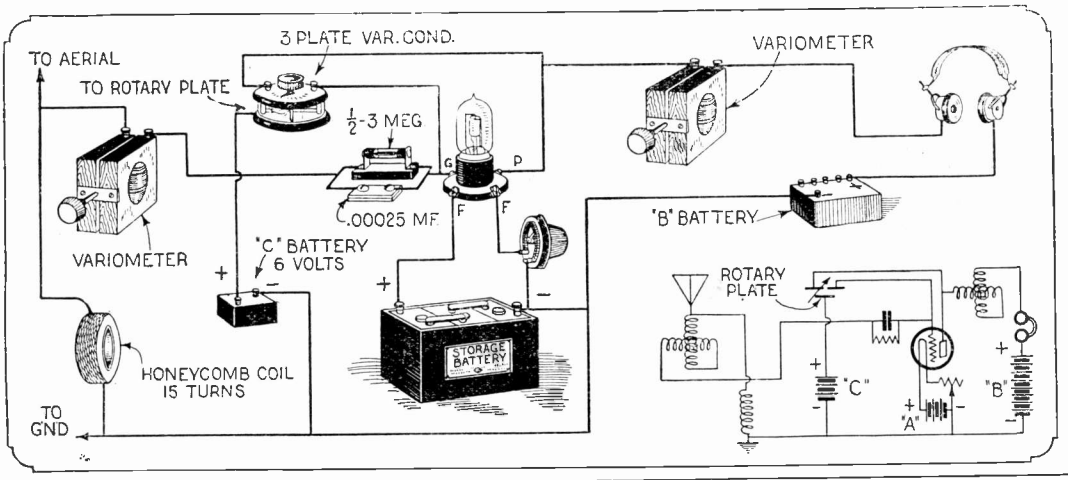
A patent has recently been issued to Alexander F. Victor of New York City for a system of broadcasting lectures and songs by radio to be used in connection with stereopticon machines. This method will do away with the necessity of having a separate lecturer at each point where a certain subject is to be discussed as one man may control a dozen or more different entertainments. This method of doing this is illustrated at the left and right as well as below. The lecturer speaks into a microphone at the transmitting station. The resulting radio waves are picked up at various points where the lecture is to be delivered to an audience and reproduced by means of a loud talker. The lecturer uses a pair of castanets to notify the stereopticon operator when the scene or slide should be changed. Thus the voice and photographs on the screen are synchronized. The use of the castanets was undoubtedly suggested to the inventor by the clicking arrangements used by various stereopticon lecturers.





The illustration directly above shows how the proposed system of broadcasting lectures could be worked. The artist is located at a central point and his voice broadcast over the entire country.

Four Good Hook-Ups

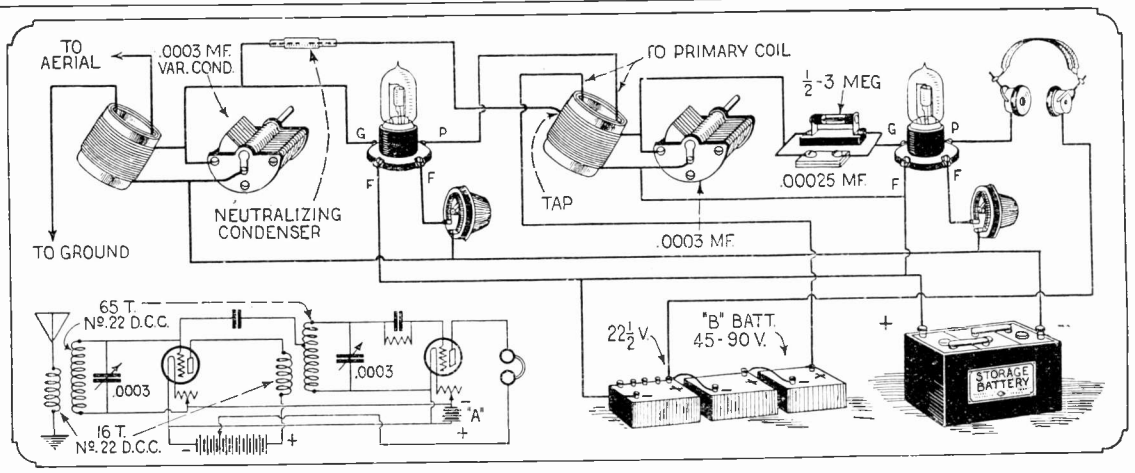


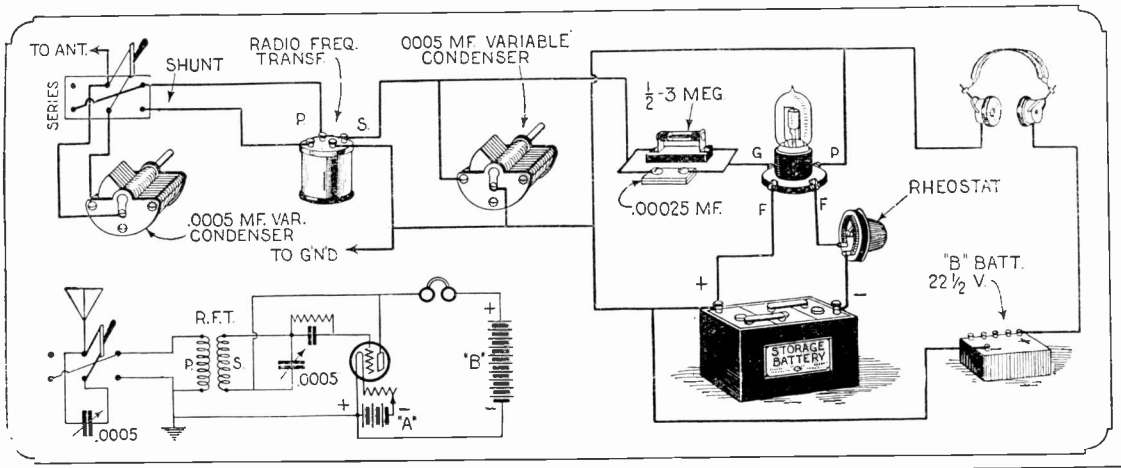
Those who desire exceptional volume and at the same time good distance will be interested in building the one tube set shown herewith. It is a single tube super-regenerative set and gives remarkably loud signals for distant as well as local stations. Tuning is accomplished by two variometers. One in the antenna circuit and the other in the plate circuit to increase regeneration. Here a three plate variable grid-condenser besides the usual fixed condenser is used and gives very sharp tuning. Instead of the usual six volt tube, a dry cell tube can be used with very little appreciable diminution in volume. This set is extremely sensitive and one can hear the tick of a watch, the breathing of the announcer, and other extremely delicate sounds created in the broadcast station. Although an outdoor aerial is to be recommended as with every other set except the super-heterodyne, a loop can be used very successfully and distant stations will be received with surprising clarity. A loud speaker can be operated very successfully.

—Wm. J. Smith, Reporter No. 4976

Many people desire a set capable of bringing in extraordinary distance. The Neutrodyne fulfills this want admirably. Generally the Neutrodyne is a four or five tube set. It is not necessary to go to the expense of buying so many parts, so a two tube Neutrodyne to which can be added if desired, one or two stages of audio frequency amplification as shown here. Of course, the circuit consists of one stage of tuned radio frequency, neutralized, and a detector. Although it is not shown in the diagram, a variometer may be inserted in the plate circuit of the detector tube. This will cause regeneration and resultant increase of signal strength. Neutroformers are advised for the radio frequency transformers. With a set of this nature, extremely long distance reception can be readily accomplished and no radiation will be experienced.

—Lee Marvin



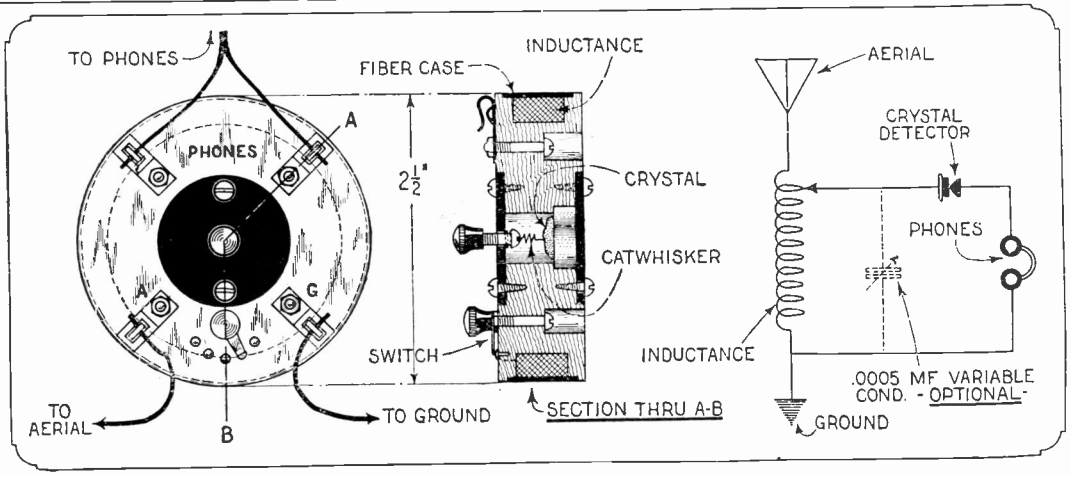


Vacationists and others desiring extreme compactness in a radio set will welcome this circuit. It is the well known adaptation of the ultra-audion and instead of using large cumbersome inductances, uses a small radio frequency transformer for the receiving transformer. A miniature double pole double-throw switch is used to connect an ordinary 23 plate variable condenser in series or in parallel with the primary circuit. Instead of the storage battery, a dry cell tube can of course be used and will give extreme clarity on all stations. Entirely free from body capacity effects, being very easy to tune and giving sufficient volume on local stations on a short aerial, this set will be found a highly enjoyable asset to radio fans who desire to expend a minimum and secure a maximum.

—J. C. Hanhauser.

Where reception of local stations is desired, and where a small pocket radio set will serve the purpose, the one shown will surpass your expectations. It can be made by using a small round block of fiber or wood which has been grooved and wound with 60 turns of No. 22 D. C. C. wire and tapped at every twelve turns. A miniature crystal detector is centrally mounted and adjustment made by means of a small machine screw to which has been soldered a piece of wire acting as the cat-whisker. Being only 2½ inches in diameter and incorporating all the essential parts for a complete yet very simple receiving set, the range and selectivity can be greatly increased by the addition of a 23 plate variable condenser connected as shown in the diagram. This can be placed in the other pocket. If a sensitive crystal is used, an ordinary umbrella can successfully be used as the aerial.

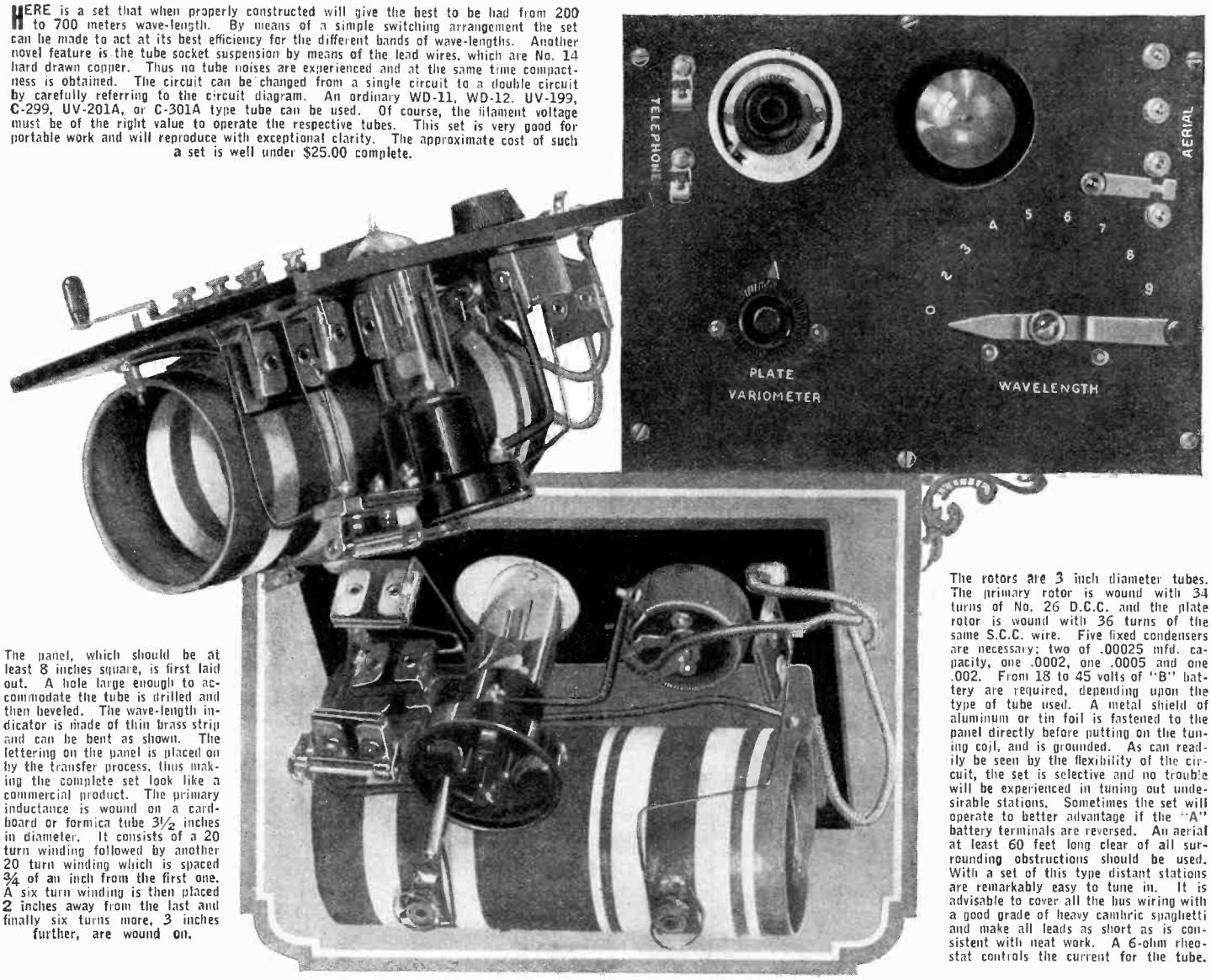
—James Stayton.



Long Distance One Tube Receiver

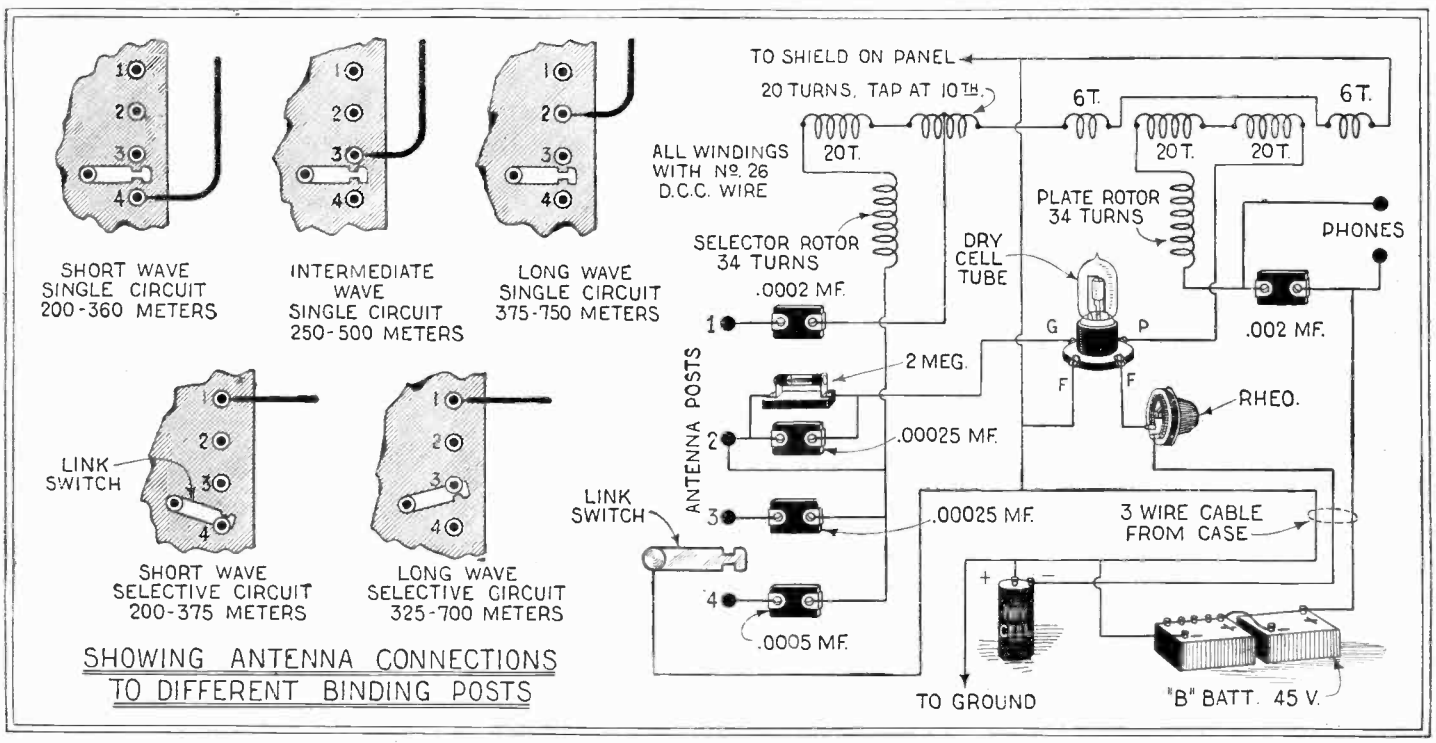
By HERBERT E. HAYDEN

HERE is a set that when properly constructed will give the best to be had from 200 to 700 meters wave-length. By means of a simple switching arrangement the set can be made to act at its best efficiency for the different bands of wave-lengths. Another novel feature is the tube socket suspension by means of the lead wires, which are No. 14 hard drawn copper. Thus no tube noises are experienced and at the same time compactness is obtained. The circuit can be changed from a single circuit to a double circuit by carefully referring to the circuit diagram. An ordinary WD-11, WD-12, UV-199, C-299, UV-201A, or C-301A type tube can be used. Of course, the filament voltage must be of the right value to operate the respective tubes. This set is very good for portable work and will reproduce with exceptional clarity. The approximate cost of such a set is well under $25.00 complete.

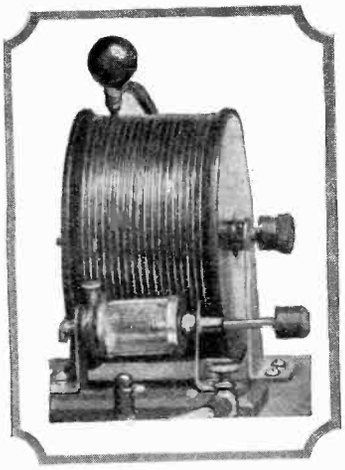


The panel, which should be at least 8 inches square, is first laid out. A hole large enough to accommodate the tube is drilled and then beveled. The wave-length indicator is made of thin brass strip and can be bent as shown. The lettering on the panel is placed on by the transfer process, thus making the complete set look like a commercial product. The primary inductance is wound on a cardboard or formica tube 3½ inches in diameter. It consists of a 20 turn winding followed by another 20 turn winding which is spaced ¾ of an inch from the first one. A six turn winding is then placed 2 inches away from the last and finally six turns more, 3 inches further, are wound on.

The rotors are 3 inch diameter tubes. The primary rotor is wound with 34 turns of No. 26 D.C.C. and the plate rotor is wound with 36 turns of the same S.C.C. wire. Five fixed condensers are necessary; two of .00025 mfd. capacity, one .0002, one .0005 and one .002. From 18 to 45 volts of "B" battery are required, depending upon the type of tube used. A metal shield of aluminum or tin foil is fastened to the panel directly before putting on the tuning coil, and is grounded. As can readily be seen by the flexibility of the circuit, the set is selective and no trouble will be experienced in tuning out undesirable stations. Sometimes the set will operate to better advantage if the "A" battery terminals are reversed. An aerial at least 60 feet long clear of all surrounding obstructions should be used. With a set of this type distant stations are remarkably easy to tune in. It is advisable to cover all the bus wiring with a good grade of heavy cambric spaghetti and make all leads as short as is consistent with neat work. A 6-ohm rheostat controls the current for the tube.



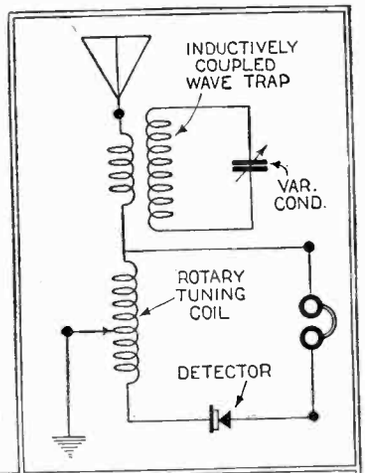
Results of $100 Crystal Detector Contest

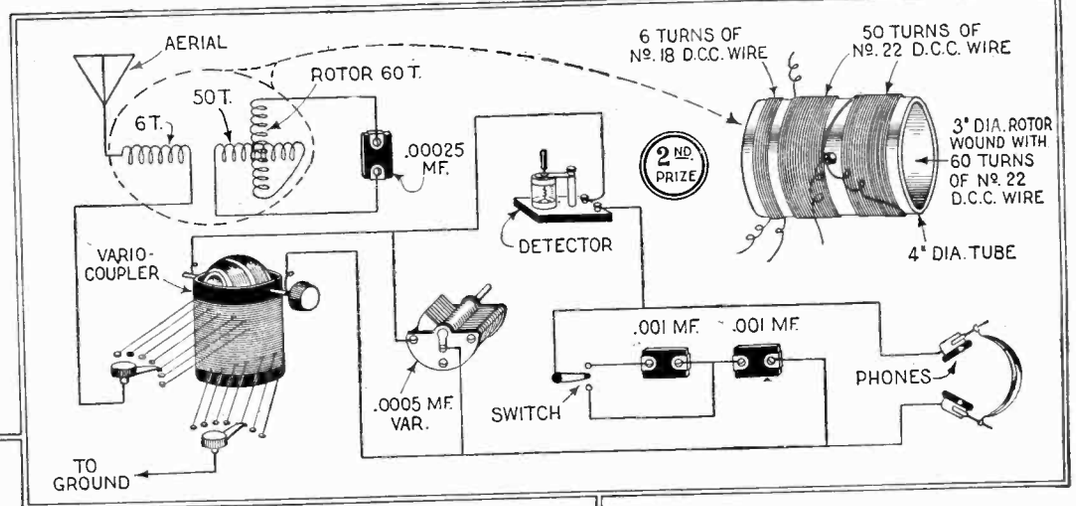


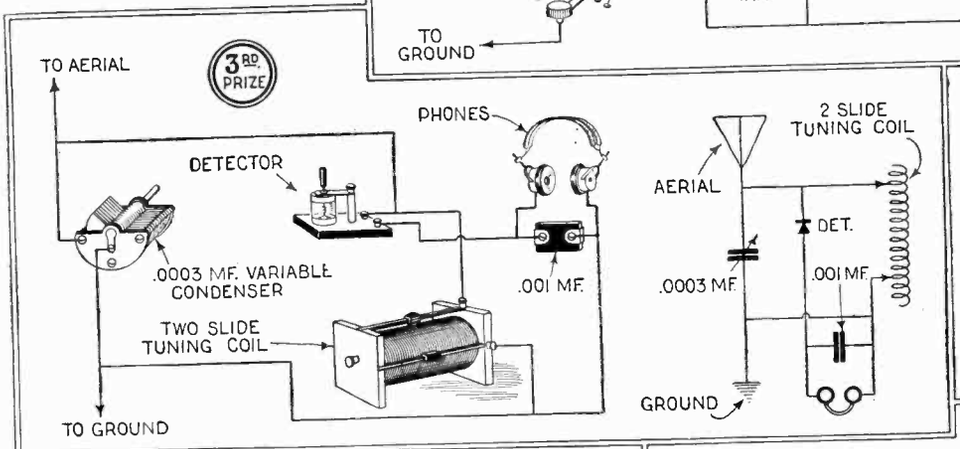
Second prize winner was A. P. Peck of Plainfield, N. J., and to him is awarded $20 in gold. By using a variometer shunted with a fixed condenser, the whole being coupled to the antenna circuit, this very selective receiver brings in KFKX, Hastings, Neb., and 6KW, Cuba, with surprising clarity and volume. A very successful stunt is shown in the diagram in reference to the fixed condensers shunted across the phones. This gives unsurpassed sharpness in tuning. A small variable condenser can be used in their stead, but these were employed to cut down expense. As regards the wave-trap, it is a very efficient one and, although not exactly new, it fulfills all that could possibly be desired of such an instrument. In conjunction with a long aerial, such stations as Pittsburgh, Schenectady, Atlanta and Chicago have been heard quite regularly.

First prize of $50 is awarded to Henry Cormack, Quincy, Mass. A very novel arrangement of an extremely variable tuning device which gives utmost selectivity is employed. Oldtimers will recall Prof. Fessenden's original rotary tuning inductance which has been incorporated in this efficient little crystal set. A unique wave-trap inductively coupled to the primary and variable by means of a sliding plate condenser is employed.

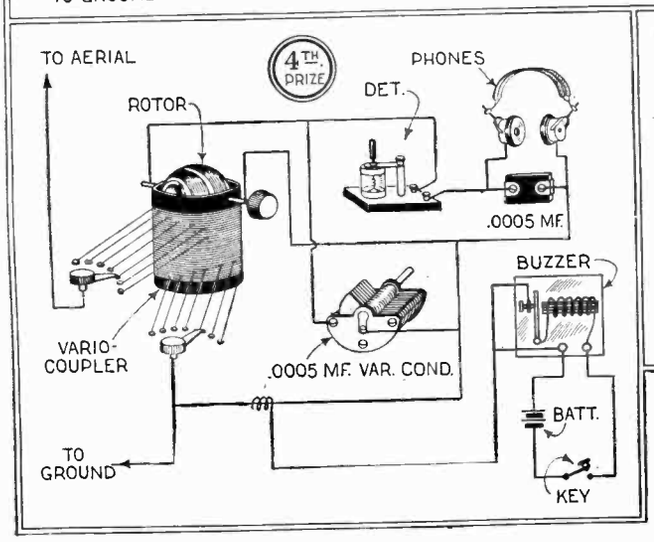
1ST PRIZE

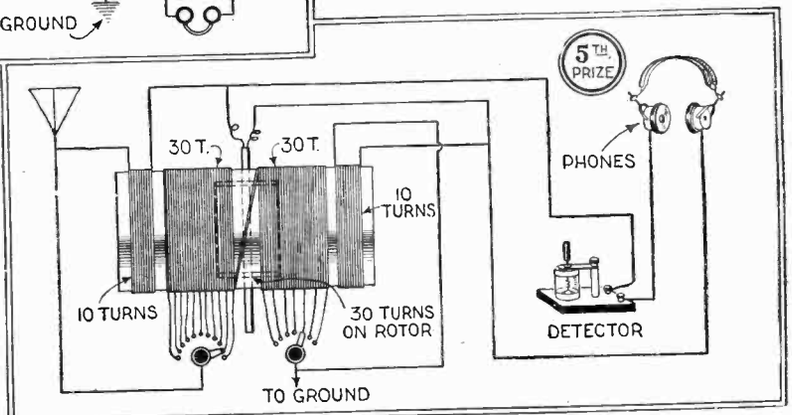






Although a double slide tuning coil is used in this hook-up, the results that Richard Kelly of Zanesville, Ohio, testifies to have been obtained through its use cause us to award him third prize of $15. The entire cost of the set was about $15 and this prize will surely bring joy to him who has won it. A very sensitive detector and high resistance phones are used. The whole is arranged in cigar box cabinets and, although diminutive in size, presents a rather pleasing appearance. KDKA, 200 miles distant, has been heard more than a block away on the phones and with regularity. The surprising fact is that the set employs a loop most of the time and results are not diminished in any way. When using the loop, which is five feet square with fifteen turns of wire, enough energy is collected to operate a loud speaker.

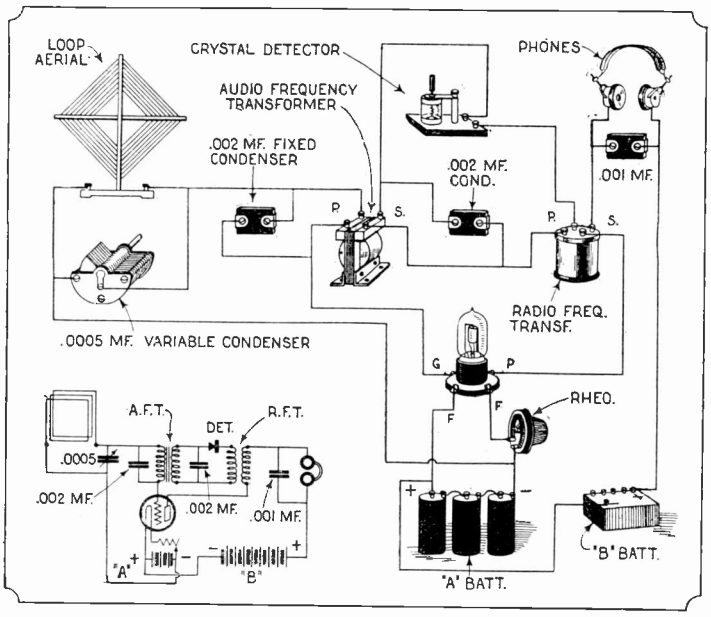




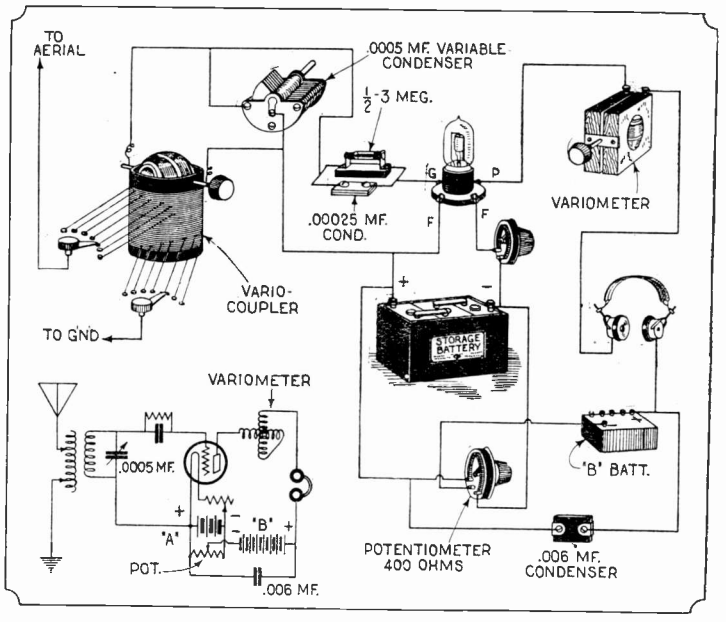
The fourth prize of $10 is awarded to Charles T. Marcy of Syracuse, N. Y., for the extreme long distance reception he acquired by using a very long single wire aerial, 6000 ohm phones, a very sensitive dust-proof detector and low loss tuner, wound with No. 12 D.C.C. wire. A buzzer test is used and comes in very handy to readjust the detector. The fifth prize of $5 goes to Raymond Hensley, Portland, Ore., for the originality of his set. The coils are wound on a tube 4 inches in diameter by 6 inches long with No. 22 S.C.C. wire and covers a range of from 100 to 600 meters.

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 25c. is made for all questions where a personal answer is desired.



(Q. 274). The reflex set will find many adherents among fans requiring a set capable of bringing in DX with a minimum of controls. Of course a dry cell tube can be used, thus increasing the set's compactness.



(Q. 275). As is well known, a single tube regenerative set acts both as a radio frequency amplifier and detector. The regenerative circuit shown here is without doubt the most efficient. A 400 ohm potentiometer and a .006 mfd. fixed condenser are used.

ONE TUBE REFLEX

(274) Edward J. Hill, Louisville, Ky., requests:

Q. 1. Kindly publish a one tube reflex circuit with which I can use a loop?

A. 1. The circuit you desire is given herewith.

SINGLE TUBE CIRCUIT

(275) Joseph P. Delaney, Ft. Worth, Texas, says that after several years of experimenting he has failed to find the ideal single tube circuit. He asks:

Q. 1. Will you please publish that hook-up?

A. 1. We believe that the hook-up published herewith is the most efficient circuit which employs a single tube.

DRY CELL TUBES

(276) Earl Davis, Grey Eagle, Minn., asks:

Q. 1. Can any of the dry cell tubes be used in standard circuits?

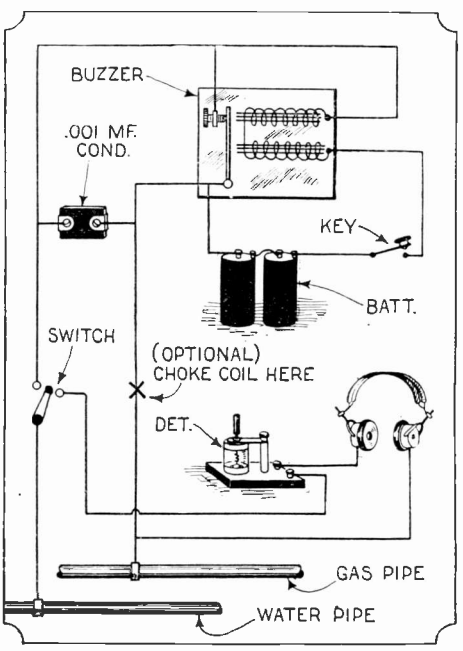
A. 1. Dry cell tubes may be used in any standard vacuum tube circuit. Many of these circuits have been published in various past issues of SCIENCE AND INVENTION.

HONEYCOMB COIL CONNECTIONS

(277) W. F. Friedhofer, Kirk, Colo., asks:

Q. 1. What precaution should be taken in connecting up a three coil honeycomb set as regards the direction of the windings in the coils?

A. 1. The primary and secondary coils in the circuit diagram you mention may be connected either way, but the windings of the two coils must run in the same relative direction. The polarity of the tickler coil will have to be determined by experiment, trying it first one way and then reversing the leads.



(Q. 278). It is not necessary to obtain a Government license to use this sending set. Great fun can be derived by having several wireless devotees in the neighborhood use sets similar to it.

WATER PIPE TELEGRAPHY

(278) Geo. A. Moore, Versailles, Ohio, wants to know:

Q. 1. Is it possible to telegraph over a water pipe or a water pipe and a gas pipe for a distance of one city block?

A. 1. On page 318 of the September, 1917, issue of the *Electrical Experimenter* you will find a very good description of various methods of telegraphing over water and gas pipes. One of the hook-ups is given herewith. The instruments necessary are a buzzer, key, battery, fixed condenser, receiver, crystal detector and two point switch.

PHONE CORD TROUBLE

(279) C. R. Doronus, Philadelphia, Penna. says that he has a radio receiving set, which causes considerable trouble due to a rattle in the phones, which only increases as each successive stage of amplification is used.

Q. 1. Can you help me to locate this trouble?

A. 1. From the description of your trouble we would very strongly suspect the phone cords. It would seem that there is a broken circuit therein which by means of the movement of the wearer of the phones would cause such a rattle as you mention. Without further information on the latter we can give you no further data. If you care to communicate with us and state whether or not the rattle is continuous or intermittent and any other information you may have, we will be only too glad to investigate further.

CRYSTAL DETECTOR TROUBLE

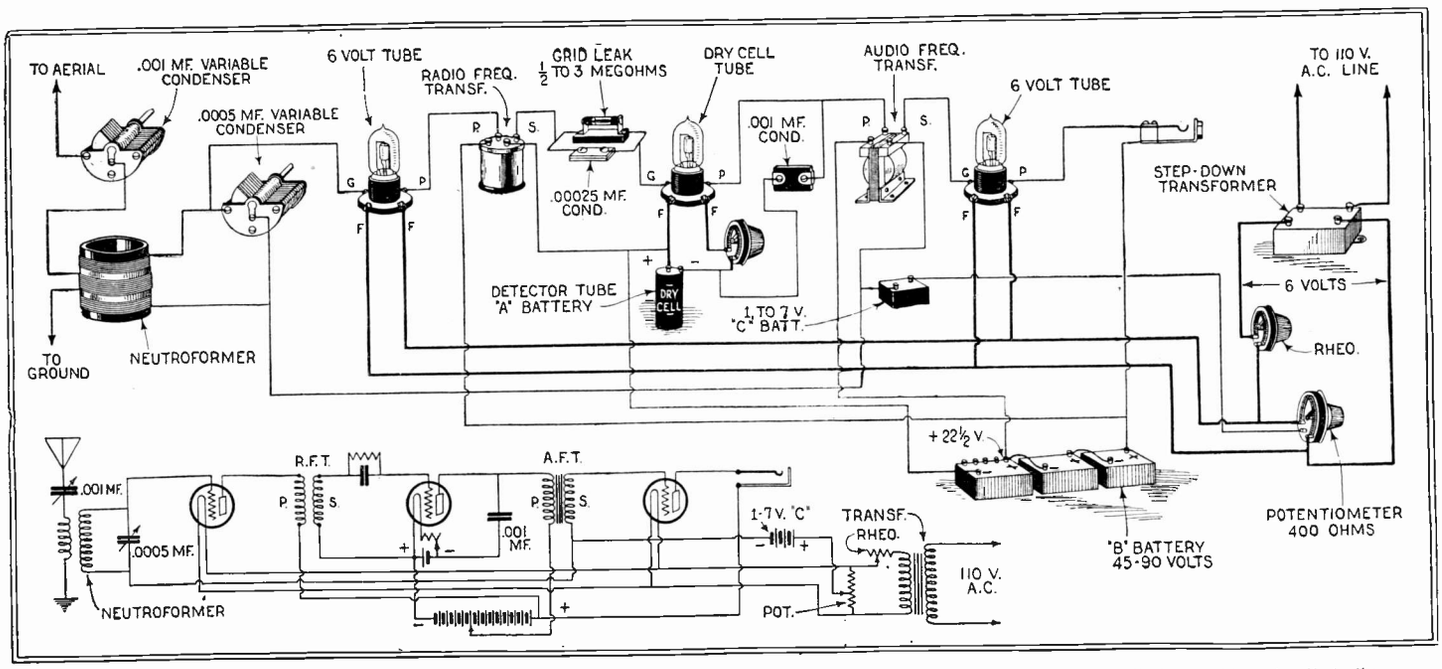
(280) T. A. Dow, Bronx, New York, says that his crystal receiving set will not operate satisfactorily, but that he has tested each and every instrument separately and finds them to be in perfect condition. He asks:

Q. 1. Can you make any suggestions which may help me in this matter?

A. 1. Evidently something is radically wrong with your radio receiving set and since you say all your instruments are in perfect condition, we would strongly suspect that the crystal used is not sensitive. A fine phosphor bronze wire would, no doubt, be better for use as the cat-whisker in your detector than the one you are using.

WANTED!!! RADIO ARTICLES

WE want descriptions of new radio ideas which you have worked out in practice. Take photographs of the important parts and make pencil or pen and ink sketches of the hook-ups or mechanical details, et cetera. We are particularly desirous of obtaining new hook-ups and descriptions of single tube sets, reflex and other types which have proven satisfactory. We like articles on new single tube receptors. We will pay good prices for your ideas. —Editor.



(Q. 281). The question of operating tubes on alternating current has often arisen a nd has been met with indifferent success. The circuit shown, while not entirely the ultimate, is being used very successfully with both dry cell and storage battery tub es, care being taken to introduce a resistance of sufficient amount to prevent burning out the filaments. A 2 mfd. condenser may be shunted across the six volt terminals o f the transformer, although this instrument is not shown in the diagram.

A. C. FILAMENT SUPPLY

(281) Fred Ormonde, New Orleans, La., asks:

Q. 1. How can I use a small filament lighting transformer from which I can light my tubes instead of using batteries?

A. 1. It is entirely possible with a minimum of trouble from resulting alterating current hum, to utilize the alternating current, to heat the filaments of both radio and audio frequency amplifying tubes in a receiving set. However, this cannot be done successfully with a detector tube. The circuit given shows clearly that it is necessary to use a separate source of supply for the filament of the detector tube. If using UV-199's, 2 ordinary dry cells will do admirably. By careful manipulation of the potentiometer, the hum can be balanced out quite successfully and the resultant music reproduced may be rendered surprisingly free from noise and distortion.

INDUCED HUM

(282) Raymond Spitser, Santa Barbara, Calif., states that he has considerable trouble when using his receiving set because of the fact that a hum is reproduced by the receivers which is so annoying that, at times, it drowns out reception. He asks:

Q. 1. Can you help me in this matter?

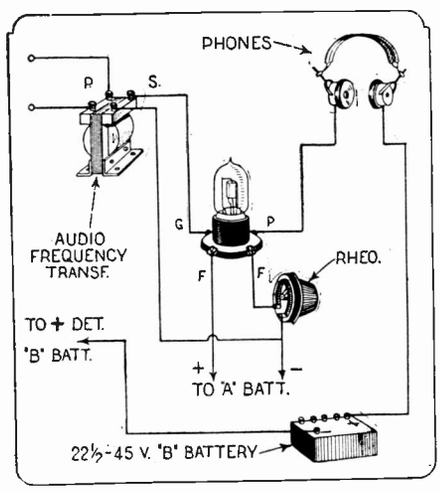
A. 1. Evidently your antenna runs parallel with a high-tension line. You will cut down the hum considerably if you change the antenna so that it runs at right angles with the power line. You will also help matters considerably if you install a loop antenna with about two stages of radio frequency and two stages of audio frequency amplification. If it is not possible for you to do this, the first suggestion is the only remedy available, other than to move your radio set to a point distant from the high tension lines.

ONE STAGE AMPLIFIER CIRCUIT

(283) James J. Turner, Union City, Tenn., asks:

Q. 1. Can you give a circuit diagram showing the connections of a one stage audio frequency amplifier that can be added to any standard receiving set?

A. 1. The circuit for this work is given in these columns. Connect the input binding posts of the amplifier to the output posts of the set and use a common "A" battery. Connect the negative side of the amplifier "B" battery to the positive side of the detector "B" battery as indicated.



(Q. 283). To increase the volume of an incoming signal and to retain clarity at the same time is quite a problem. No higher than a four to one ratio transformer should be employed in this one stage audio frequency amplifier.

CODE PRACTICE

(284) J. Ballman, Cleveland, Ohio, asks:

Q. 1. What is the difference between the code used in telegraphy and that used in radio work?

A. 1. The radio code is very similar to that used in Morse telegraphy with the exception of a few of the characters and the numerals.

Q. 2. What is the best method for practicing the code, aside from a machine, when one does not have anybody to practice with? Our correspondent also states that he is an experienced telegrapher.

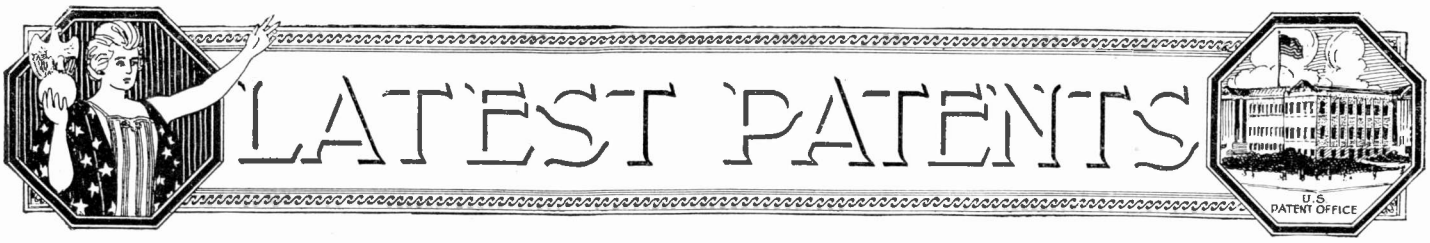
A. 2. All that will be necessary to practice this code with would be a key, a buzzer, and a battery. It may be hooked up in exactly the same manner as a Morse practice set. The only difference in the work will be that you will receive the dots and dashes in short and long buzzes instead of double clicks. We believe that you should have no trouble whatsoever in picking up speed in this work since you already have a good foundation in Morse work.

SHIELDING

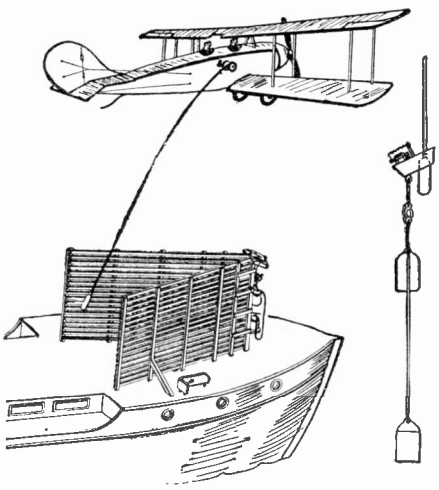
(285) Edward E. Craven, Youngstown, Ohio, wants to know:

Q. 1. What connections, if any, should be made to the tinfoil used in shielding the back of a pane!?

A. 1. The tinfoil used for shielding the back of a radio panel is to be grounded by connecting directly to the ground post of the set.

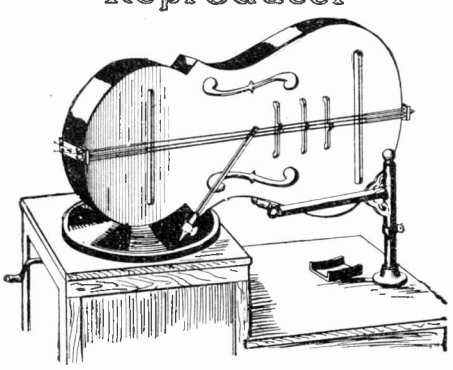


Plane Fueler



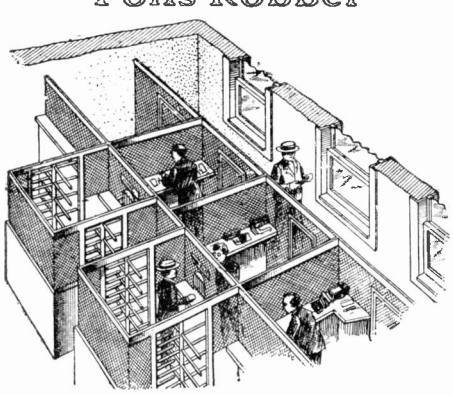
No. 1,479,222, issued to Godfrey L. Cabot. The old idea used by mail trains to pick up mail pouches at points where the train does not stop is made use of in this patent. The plane lets down a cable which passes into the V-shaped arrangement on the forecastle of the attendant ship. In the crotch of this apparatus there is an automatic hook which is attached to one or more fuel tanks. As the plane speeds along it raises the cables and the fuel tanks automatically attached to it.

Reproducer



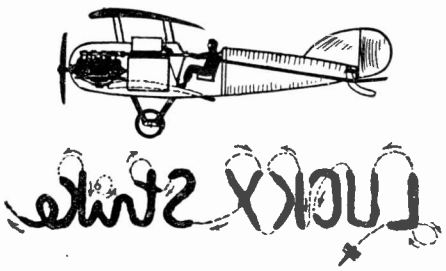
No. 1,489,494, issued to Eert V. Iwwerts. By attaching the reproducing needle of a phonograph to a violin body as shown in the above sketch, the inventor hopes to improve the tone quality of the instrument.

Foils Robber



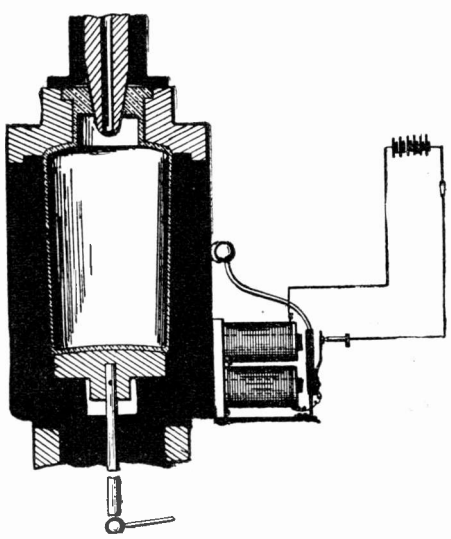
No. 1,490,938, issued to G. Robinson. With the constant increase in bank robberies, the inventor hopes to reduce the large losses of money incurred in them, by the installation of a system of turnstiles such as shown in the above illustration. The space before each paying teller's window is enclosed in a cage with two of the stiles which may be locked by the teller or other bank attendant, locking the robbers in the small cage before the window.

Sky Writing



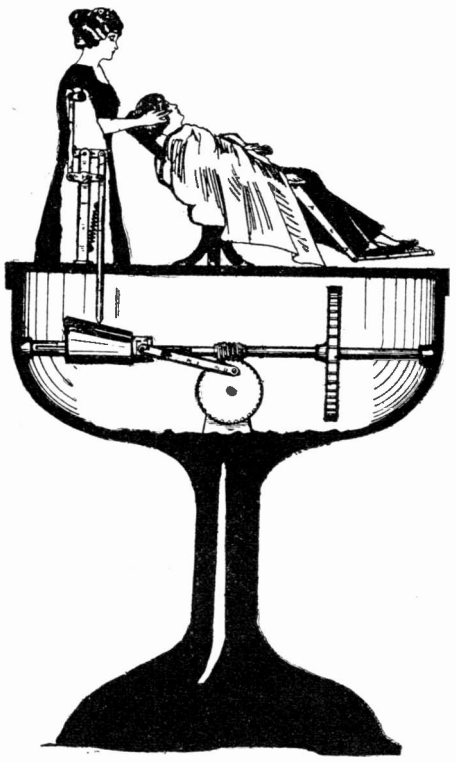
No. 1,482,820, issued to J. C. Savage. This is the patent issued to Col. Jack Savage on his sky-writing. A long article fully explaining the methods used in this new form of advertising was published in Science and Invention a few months ago. This particular patent covers only the idea of advertising by means of smoke "suspended in the air." There are a large number of other patents pending on the same idea covering all details of sky-writing.

Casting Glass



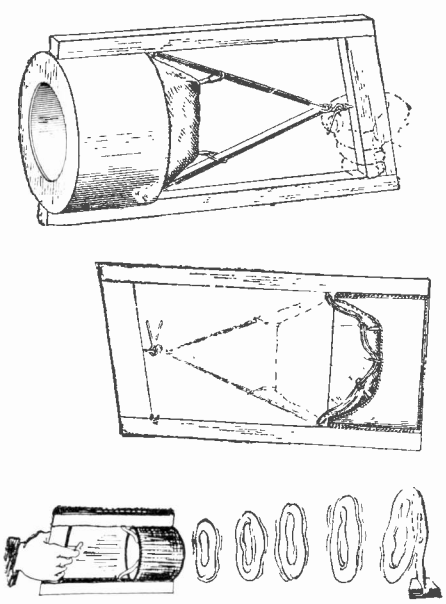
No. 1,482,760, issued to J. A. Milliken. Everyone has noticed ordinary pieces of glass-ware in which there were bubbles. If these bubbles are too obvious the piece must be thrown away as useless. The frequency with which they appear is the cause of great loss to manufacturers. The device illustrated above obviates this loss. After the molten glass is poured into the mold the clapper of a huge electric bell constantly taps the side of the mold, giving any bubbles in the glass a chance to float to the top and dissipate themselves.

Display Machine



No. 1,482,820, issued to Leo B. Simonson. This device is just another of the many attention-catchers built for those who advertise. A motor concealed in the base works the arms of the attendant standing behind the figure in the chair. It is a well known fact that in these latter days when advertising is so profuse that one of the surest methods of catching the attention of the passer-by is through the use of some moving object. This device takes advantage of that fact. It is primarily designed for use in beauty parlor windows, although its adaptation is universal.

For Smoke Rings



Perfect smoke rings may be blown with this device. The charge is placed in the cylinder and when the operator releases a trigger in the handle the rubber diaphragm pushes outward as shown in the illustration.

Scientific Humor

THE MELTING POT

"Strange case of heredity in that family," mused Jones.

"How is that?" inquired Green.

"Well, one of the girls has a golden voice, one boy is in the prize ring and has a tin ear; one is a press agent with all the brass in the world; one is a silver-tongued orator; one is an aluminum ware canvasser; one a steel peddler, one a copper——"

"But where does the heredity come in?" asked Green.

"Why," returned Jones, "when they were young their father ruled them with an iron hand."—*M. L. Piggins.*

SHOCKED

SHE: "Weren't you simply electrified by that lecturer last night?"

HE: "No, merely gassed."—*Paul K. Beemer.*

HOW ABOUT THE CAPITAL OF FRANCE?

BIOLOGY PROFESSOR, to lazy student: "Name a parasite."

STUDENT: "Me?"

BIOLOGY PROFESSOR: "Yes, but name another one."—*Edward M. Carr, Reporter No. 10224.*

RADIO DICTIONARY

"A" Battery—The part of a radio set that takes your money and makes light of it.

Aerial—That which catches messages, and our chins when cutting across lots at night.

Arc—A method of transmission invented by Noah.

Copper—A good conductor, but collects no fares.

Jack—That substance used to buy and run a radio set.—*Clifton Ask.*

EGGSACTLY

PROFESSOR: "When are eggs and batteries alike?"

STUDENT: "When they're storage, sir."—*Lambros D. Callimahos.*

A POOR TUNE

"How did you like my sermon Sunday?" asks the modern clergyman.

"I couldn't get you," replies the radio churchgoer. "Too much Theology?" asks the minister.

"No," replies the radio lost sheep, "too much interference."—*Albert Greenstein.*

JUST WHAT'S NEEDED

1ST STUDENT: "I wish I had some microbes for my arithmetic examination."

2ND STUDENT: "What good would a few microbes be at an arithmetic examination?"

1ST STUDENT: "This morning the Professor in the Science Class said that 'microbes multiply rapidly.'"—*John Zakowski.*

FATHER WILL BE AS EXTINCT AS THE DODO

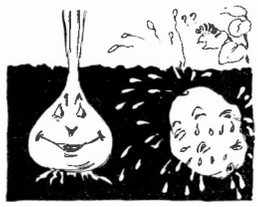
FATHER: "Your talk is just like the musical scale."

DAUGHTER: "Musical scale, father?"

FATHER: "Yes! You start with dough and you end with dough!"—*Milton Konecke.*

First Prize $3.00

A CRYING NEED



TRANS: "I see by the paper that Burbank has at last found a way to grow potatoes in a dry country."

FORMER: "How is that?"

TRANS: "He plants a row of potatoes and then a row of onions, and the onions makes the potatoes' eyes water and the field is irrigated."—*Donald A. Hunt.*

NO CELL-IBATES

STANG: "How do bees dispose of their honey?"

STUNG: "Oh, they cell it!"—*Clifton Ask.*

AN ALCOHOL RUB

JONES: "What chemical term would you apply to a drunken man who has fallen in the street?"

BONES: "Ask me another. What?"

JONES: "An alcoholic precipitation."—*Lorne Macbean.*

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 jokes 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.

AN EMBARRASSING DEVELOPMENT

DARING PHOTOGRAPHER: "I was scaling the bluff, attempting to get a close-up of the cliff bird's nest, when suddenly my suspenders broke."

AWED LISTENER: "Yes! Yes! And then . . ."

D. PH.: "Why . . . er . . . an under-exposure resulted."—*Sam Y. Caldwell.*

FIRST HIGH FREQUENCY AMPLIFIER

Speaking about radio some of us can remember when the music from the heir was broadcast from the woodshed.—*Albert Greenstein.*

MECHANICAL LOVE

Pawl Pin and Fan Belt went for a stroll around the block. On a bench they started to spark, but found the place too universal, so retired to a spot a rod or two away.

Their heads were together, and no one within hearing radius, when Pawl whispered something about a "housing for you, and the little pins that may come knocking around in time." Then trouble started over a ring. She called him a crank. He said it wasn't the case.

A pinion of the law approached, and they bolted, but soon he had them in his clutch, and at court they were fined a straight eight for kicking.—*Glen F. Stillwell.*

AND THE TRAFFIC COP

"So you traded your car for an aeroplane?"

"Yes; and I occasionally get lonesome."

"For what?"

"A blow-out."—*Les Van Every.*

SOME OF THE THINGS I WOULD LIKE TO HAVE

A man to awaken the sleepers of a railway track.

A hat for the head of a nail.

A key to fit an elephant's trunk.

A splinter from a sunbeam.

A train of cars to run on the branch of a tree.

The club with which an idea struck the poet.

A ruler to measure narrow escapes.

The hook and line with which an angler caught a cold.

An umbrella used in the reign of tyrants.

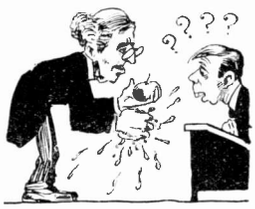
A knot from the board a man paid fifty dollars a week for.—*A. Zimmerman.*

"RADIO DOCTORS" WILL PRESCRIBE THEM!

FIRST BOY: "I heard there was a boy who made a radio so little it goes into a capsule."

SECOND BOY: "Huh, I wonder who he thinks is going to swallow the darn thing!"—*Helen Clements.*

"A NEWTON PIPPIN"



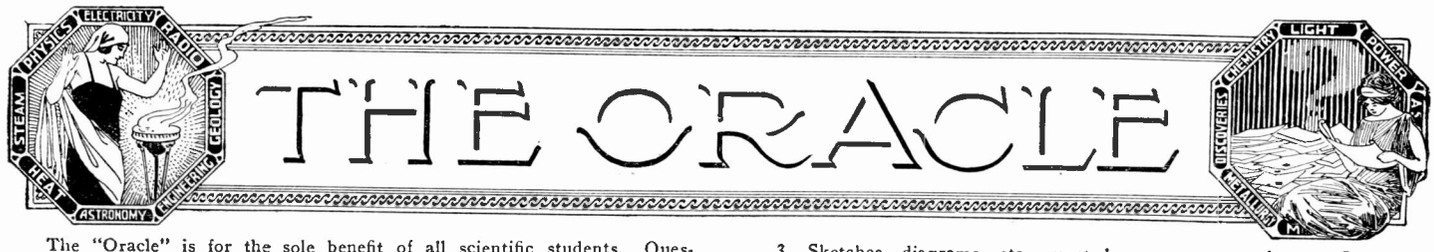
The physics class was having difficulty in grasping some of Newton's fundamental laws of motion. The discussion finally simmered down to plain arithmetic when the Prof. asked a particularly dumb student: "If we were dealing in apples and you gave me one, doubling the number I had in my hand, what did I have to start with?"

At this point a sarcastic drawl interrupted from the back of the room: "Applesauce!"—*Harry R. Lubcke.*

A VEXING ANSWER

INSTRUCTOR to James, who was not giving close attention: "James, will you name the six types of lens and tell the difference between the two I have just discussed?"

JAMES: "Convex, double convex, concave, double concave, convex-concave, and concave-convex; the convex-concave is more concave than the concave-convex and the concave-convex is more convex than the convex-concave."—*Robert Wright.*



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:

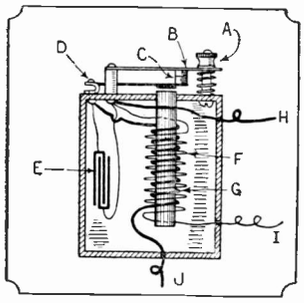
1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 25 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.

AUTOMOBILE SPARK COIL CONSTRUCTION

(1710) Fred J. Spalding, Rohcester, N. Y., asks the Oracle:

Q. 1. Can you show by means of a diagram the internal construction of a Ford spark coil?

A. 1. The diagram given herewith shows all the various parts.



In the diagram of the Ford spark-coil shown here, A adjusts the vibrator contact point on B. C is the vibrator and point on mounting D. E is a high value condenser, F the secondary, G the primary, J and H the primary leads and I the secondary lead.

CHEMICAL QUERIES

(1711) H. E. Maris, Berkeley, Calif., says that he has found that by dipping an aluminum spoon into red mercuric oxide, mercury will be formed on the spoon. He asks:

Q. 1. Why does this happen?

A. 1. Aluminum will precipitate mercury from practically any of its compounds. Therefore, mercury was formed on the aluminum spoon when it rubbed against red mercuric oxide.

Q. 2. Is there any way in which mercuric bromide may be made into mercury?

A. 2 Mercuric bromide can be made into mercury by precipitating with metallic copper. If you have the bromide in a dry form, heat with sodium carbonate and condense the mercury as it volatilizes.

Q. 3. Kindly give a good method of making hydrogen sulphide?

A. 3. Hydrogen sulphide can be evolved by heating together paraffin wax and sulphur in equal parts.

CHARGING A STORAGE BATTERY

(1712) Alden Johnson, Nyack, N. Y., wants to know:

Q. 1. Can a storage battery be charged directly from a high tension magneto?

A. 1. It is impossible to use a high tension magneto to charge a storage battery and we would not advise you to attempt any experiments along this line if your storage battery is valuable.

IRON SOLDER

(1713) W. E. Hollenbeck, Lentner, Mo., asks the Oracle:

Q. 1. Can you tell me how to prepare cast iron so that it can be soldered and give formulas for the solder to be used?

A. 1. A solder for iron consists of copper 67 parts, and zinc 33 parts. The surface of the parts to be soldered is first cleaned by means of hydrochloric acid. A composition of 10 parts of brass and 10 parts of silver may also be used. Another combination consists of 20 parts of silver, 30 parts of copper and 10 parts of zinc. Another way is to rub the rough surface of the cast iron with a bundle of thin brass wires made into a brush. This gives a coating of brass which will take solder.

The Diabolical Ray

has been discussed in this issue of SCIENCE AND INVENTION. However, you will find a more elaborate and somewhat different version of the subject in the August issue of PRACTICAL ELECTRICS. This article by Mr. H. Gernsback supplements the article in this issue of SCIENCE AND INVENTION and gives a lot of details which it was not possible to give here.

Electric Protection of Docks.

Mysterious Sign.

When Sound Was Annihilated.
By Robert Joergenson.

Loud Speakers

Photographic Burglar Alarm.

Electric Chronograph and Recording Drum.
By Dr. Russell G. Harris.

ARTIFICIAL WOOD

(1714) F. L. Ferdurman, Los Angeles, Calif., wants to know:

Q. 1. How can artificial wood be made, using saw dust?

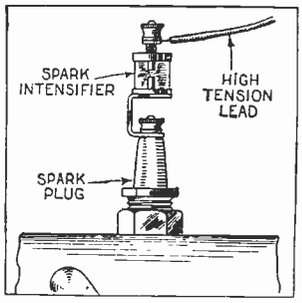
A. 1. Boil together equal quantities of glue and saw dust with water, and then add macerated tissue or newspaper. Just before forming or molding the mass, add a small quantity of formaldehyde, to make it waterproof.

SPARK INTENSIFIERS

(1715) W. G. Pilkivlow, New Orleans, La., asks the Oracle:

Q. 1. What is the advantage of spark gaps or so called transformers on the spark plugs of gasoline engines? Do they increase the spark and do they injure the magneto, distributor or any other part of the electrical system?

A. 1. The intensifiers or auxiliary spark gaps used on the spark plugs of gasoline engines allow the potential of the ignition system to build up to a higher degree, similar to condenser action, before discharging across the gap inside the plugs and therefore, a hotter spark will be produced when they are used. They may save gas to a certain extent by giving more power to the engines, said power being developed by a complete combustion of the compressed gas. They do not injure any part of the engine although they do not always work very well when magneto ignition is used. They work much better on standard battery ignition.



Here is shown a spark intensifier. It allows the potential to build up before the current is admitted to the spark plug, resulting in a hot spark.

SPARKLERS

(1716) S. W. Hutchinson, Oakland, Calif., wants to know:

Q. 1. Can you supply me with a formula for the making of sparklers such as are used in Fourth of July celebrations?

A. 1. It will require some experimentation on your part to produce satisfactory sparklers. However, you should adhere to the following formula somewhat.

Potassium Chlorate, 2 parts.
Strontium Chlorate, 2 parts.
Copper, 1 part.
Alcohol, 5 parts.
Water, 10 parts.
Steel Filings, 5 parts.

Stir all these ingredients together slowly.

OUR $12.000 PRIZE CONTEST

IT will be noted from recent issues and the present one that our prize contest has been a whale of a success. Over $1,000 has been paid out this month for worth while contributions to SCIENCE AND INVENTION, either in pictures, suggestions, ideas or articles. We now have on our staff, close to 12,000 correspondent reporters who are scouting the world for new material that can be written up for SCIENCE AND INVENTION. And the formula is simple—just keep your eyes open. Even if you were totally deaf or blind, you could still win a prize by simply using your head and sending us ideas of a scientific nature, or of a nature directly or indirectly attached to new inventions.

ARTICLES FOR SEPTEMBER SCIENCE AND INVENTION

Human Hair, Microscope and Crime.
By Mel Wharton.

Lightning Versus Dirigibles.
By C. A. Oldroyd, Aeronautical Engineer.

New Scheme for Generating Electric Power From the Wind.

Acqueducts of Ancient Rome—Beautifully Illustrated and Interestingly Described.
By Charles Beecher Bunnell.

Photographing Sound Vibrations.
By C. A. Oldroyd.

The Many Uses of Vacuum.
By H. Winfield Secor.

Centrifugal Force and the Earth.
By Cleve Hallenbeck.

How Radio "Drammer" is Produced.
By Raymond Wardell.

A Super-Neutrodyne—Illustrated with Photos and Diagram.

A Super-Heterodyne de Luxe—Fitted with Push-Pull Power Amplifier and Radio Frequency Amplification Before the First Detector. By Leon L. Adelman

Chlorine Gas for Treating Colds.
By Joseph H. Kraus.

Science of Athletics. By R. Leon Hall.

Magic for Everybody—Don't Miss These Entertaining Articles.
By Prof. Joseph Dunninger.

FREE INFORMATION

IF you want additional information concerning any of the subjects illustrated and described in this number of SCIENCE AND INVENTION we shall be glad to give you other data we have at our command. To make this work as easy as possible for our editors, please be brief. Write only on one side of the paper and state exactly in a few words just what it is you desire further information on. We have the original manuscripts and drawings of many of these articles in our files and can furnish much additional data in most cases. Please do not fail to send stamped and self-addressed envelope. Make all questions concise and specific.

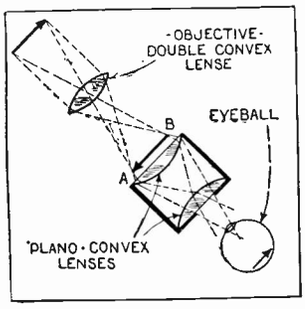
Address all inquiries of this nature to INFORMATION EDITOR c/o Science and Invention, 53 Park Place, New York City.

TELESCOPE QUERY

(1717) A. D. White, Denver, Colo., says he has built a telescope following the instructions given in our magazine and fails to get results with the same. He asks:

Q. 1. How can you account for this?

A. 1. You state in your letter that your object lens has a focal length of 44 inches and that you use a tube only 40 inches long. If you cannot lengthen your tube at least six inches, you must get an object lens with a focal length of no more than 38 inches. Thirty inches is recommended.



The proper arrangement for the lens system of an astronomical telescope is illustrated here. For terrestrial use an inverting lens must be added between objective and eyepiece.

FINGER PRINT DETECTION

(1718) D. T. Desmavais, Hackensack, N. J., asks:

Q. 1. What chemicals or materials are used in the detection of finger prints on paper or other surfaces?

A. 1. Where finger prints are to be brought out on a white paper, finely powdered graphite is used. Where the prints are on dark surfaces, finely powdered zinc oxide is employed. In either case, the surface on which the prints have been placed is covered with the fine powder and the excess is then shaken off. A sufficient quantity of the powder adheres to the lines of the finger print to enable it to be seen clearly.

RELATIONSHIP OF ETHER TO RELATIVITY

(1719) James M. Stanton, Ogden, Utah, refers to Query No. 1638 in the Oracle Department of the March issue of SCIENCE AND INVENTION and disagrees with Mrs. Lewis in her answer to the said query. He quotes Dr. Steinmetz and other authorities as having said that ether did not exist. He requests Mrs. Lewis's opinion on this matter and she answers as below.

A. 1. I note that you quote from Mr. Larkin in your letter as follows: "The belief in an ether had to be abandoned as being contradicted by the Einstein theory of relativity, which is now meeting with general acceptance."

Now I maintain as before that the Einstein theory of relativity is not founded upon any assumption as to the existence or non-existence of the ether. What the Einstein theory does say is, that it is impossible to detect the unaccelerated motion of a system of reference (for example, the earth) by observations made on that system of reference alone with the units of measurement belonging to the system. Whether the motion is through *space alone* or through *some hypothetical medium pervading space, such as the ether,* is left an open question entirely independent of the assumptions of the theory of relativity and the results that follow from them. I should like to quote here in support of my contention from "The Theory of Relativity" by Robert D. Carmichael (second edition, 1920), page 14, as follows:

"* * * the laws stated in the postulates (of the theory of relativity) are in no way dependent for their truth on either the existence or the non-existence of the ether or on any of its properties. It is important to keep this in mind on account of the confusion which has sometimes arisen as to the relation between the theory of relativity and the theory of the ether."

Personally I am not inclined to believe in the existence of the ether, but that is not a result of my belief in the Einstein theory. I consider the two, the ether theory and the relativity theory, to be entirely independent.

Of course, if anyone could detect by experiments any motion of the earth with respect to the ether, or to space, the Einstein theory would collapse because it has as a fundamental postulate that such motion cannot be detected by observations on the earth alone. It would also collapse if a velocity greater than that of light could be found. Up to the present time, however, the theory of relativity seems to be resting very securely upon its foundations and to be strengthening them through the confirmation of the three Einstein predications.

THEORY OF THE MOTORCYCLE

(1720) Angelo Costel, New York City, asks:

Q. 1. Since centrifugal force enters into the problem of a motorcycle turning a corner, will not the weight of the driver of a certain sized motorcycle have to be taken into consideration? That is, would not it be harder for a heavyweight driver to keep his balance on a curve than for a light driver under the same conditions and with the same weight machine?

A. 1. Theoretically, the weight of a motorcycle driver will have something to do with the ease with which the motorcycle can be made to turn a corner. Practically, however, the heavier rider will cause his machine to lean at a slightly greater angle from the perpendicular and, therefore, the results will be evened up between himself and the lighter rider.

WATER-PROOFING GLUE

(1721) William Myers, Chicago, Ill., wants to know:

Q. 1. How can I make ordinary glue water-proof?

A. 1. A solution of potassium bichromate added to glue will render it water-proof after exposure to light. Formaldehyde is also used. This will not in any way affect its sticking qualities.

DIMMING HEADLIGHTS

(1722) Roger C. Redd, Knobnoster, Mo., asks:

Q. 1. Why do the headlights of a car equipped with a storage battery become dim when the speed of the engine is lessened, and brighter as the speed is increased?

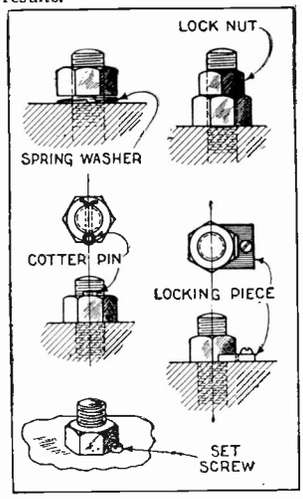
A. 1. The reason for the headlights of a car becoming dim when the speed of the engine is decreased is that your battery is weak and the lights are supplied in part from the generator whose voltage is regulated by the speed of the engine. This might also mean that the overload relay is sticking and that the battery has nothing to do with the lighting except when the car is standing still.

LOCKING NUTS

(1723) James K. Doley, Poughkeepsie, N. Y., asks:

Q. 1. Can you show several methods of securely fastening nuts on machinery where excessive vibration is present? I desire several usages so that one type may be used in a place where another type might not be advisable.

A. 1. The illustration herewith shows five methods of locking nuts securely. The first one uses a spring or lock washer; the next, a second nut which securely locks the bottom nut; the third, a split pin or cotter pin which is passed through a hole in the bolt; the fourth makes use of a set screw which prevents the hexagonal nut from turning, and in the fifth, a piece of sheet steel screwed securely to the surface upon which the nut is drawn up prevents the latter from turning. Any one of these methods may be used with very good results.



Five methods for preventing the turning of nuts and for locking them in place are shown in this illustration. All the above methods shown are approved in mechanics.

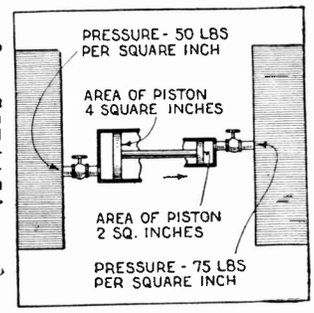
AIR PRESSURE

(1724) Howard Boyce, Syracuse, New York, asks:

Q. 1. What is the law governing the motion of a piston head in a cylinder?

A. 1. To find the total pressure on the head of the piston in the air chamber, you multiply the surface area of the piston in square inches by the pounds pressure per square inch. In your case, we have 50 pounds by four square inches, giving a total pressure of 200 pounds on the left and 75 pounds by two square inches or 150 pounds on the right, in which case of course you will see that the 200 pound force is larger and naturally, the piston head will move towards the right.

Here is given a simple explanation of the method used to ascertain the total amount of pressure exerted upon the head of a piston.



CONDENSER CAPACITY FORMULA

(1725) Michael L. Faysash, Akron, Ohio, asks:

Q. 1. Will you kindly publish formula for the capacity of small fixed condensers?

A. 1. Herewith is given a formula for the capacity of fixed condensers.

$$C = \frac{.0885\ K\ (N - 1)\ S}{r}$$

in which C is the capacity in microfarads; K is the dielectric constant of the insulating material; N is the number of plates; S is the area in square centimeters of one plate, and R, the thickness of the dielectric in millimeters.

Q. 2. Is it necessary to get a patent and trade mark for such and what is the approximate cost of the same?

A. 2. It is advisable to get a patent on the condensers which you wish to manufacture. A trade mark can be obtained and will be advantageous. The approximate cost of a patent is $125.00.

Q. 3. Can you give me a formula for a good liquid cement for impregnating coils?

A. 3. Use solution of shellac in alcohol.

EXISTENCE OF ETHER

(1726) Frederick A. C. Strubel, Ridgefield, N. J., asks:

Q. 1. If there was no ether, would we have daylight?

A. 1. Light is theoretically transmitted by vibrations in the ether which is supposed to exist. It may be well to recall to your mind that an ordinary electric light bulb has its filament in a vacuum (ether exists there, however) so as to prevent its oxidization or burning up. Of course, we know that light is emitted when the current flows through the filament. Presumably, without ether, there would be no light.

Q. 2. If a searchlight was placed in a large glass tank, and the air exhausted, would there be a beam of light emitted?

A. 2. This would have no bearing or effect on the light emitted from the searchlight. However, what you may have in mind is that sound will not be transmitted without the medium of air or some material substance.

PLATING WITH CHROME

(1727) A. C. Foder, New York City, wants to know:

Q. 1. Is it possible to plate iron with chrome? If so, please give a formula for solution and other necessary details.

A. 1. As regards plating iron with chrome, we have no definite information on the subject. It will be of course necessary to thoroughly clean the iron and use a pure chromium anode with a solution of double salt of chromium for the electrolyte. A voltage of about two to four is required with a relatively heavy current of about 10 to 20 amperes per square foot of cathode.

HEATING HOUSE WITH ELECTRICITY

(1728) A. Wallace, South Bend, Ind., asks the Oracle:

Q. 1. What horse-power would be required to drive a dynamo of sufficient capacity to heat a four room house electrically?

A. 1. It is not very feasible to heat a house with electricity as the expense entailed is too high. An ordinary four room apartment would contain approximately 6,000 cubic feet. Assuming the expenditure of one watt to heat every cubic foot, six kilowatts would be required to heat the four rooms or about 8 horse-power. At the rate of 10c per kilowatt hour, one would soon go broke paying the electric bill.

Q. 2. How can I copper plate a model of bees wax?

A. 2. To plate on beeswax, it is necessary to coat it with a thin layer of graphite and immerse it in the plating solution of copper sulphate and it can be plated to any thickness desired. Use a pure copper anode. Sprinkle with iron dust.

Awards in $1000 Monthly Contest

The Regular Departments Pay Prizes of Their Own. Authors on Contract Receive Their Own Rates; Making the Total Paid for Articles in Excess of $1500.00 Monthly.

FIRST PRIZE $100.00

"The Diabolic Ray—Is It Possible?" by C. A. Oldroyd, Reporter No. 4433 ..... 336, 337

TWO PRIZES OF $50.00 EACH

"The Ten Most Needed Inventions," by Raymond Francis Yates 350
"Some Facts About Mars," by Charles T. Dahama, Ph. D...354, 355

TEN PRIZES OF $25.00 EACH

"The Season's New Fun-Makers," by George Holmes..... 340
"Tornadoes!" by E. B. "Farmer" Dunn, formerly of the U. S. Weather Bureau 344
"Sulphur—Its Uses and Adaptations," by Ismar Ginsberg, B.Sc., Chem. Eng. 353
"How Your Lodge Button Is Made," by L. B. Robbins..... 358
"When Plants Eat Animals," by Dr. Ernest Bade..... 361
"Methods For Testing Gasoline," by Raymond B. Wailes..... 364
"Repairing Broken Pottery," by H. S. Trecartin..... 371
"Enlarging Vest Pocket Camera Negatives," by Herbert E. Hayden 372
"Radio to Direct Tourists," by Jack Bront..... 377
"A Selective Summer-Time Radio Receiver," by Herbert E. Hayden 384

FIVE PRIZES OF $20.00 EACH

"What Airplanes Can Do to Time," by Dr. Russell G. Harris.. 357
"Newest Water Sport," by George W. Sutton, Jr..... 359
"Breathing Efficiency Tests," by Dr. Alfred Gradenwitz..... 362
"Miniature Ceilings in Movies," by Phil Gersdorf..... 364
"Catalysis and Catalytic Action," by Dr. Ernest Bade..... 374

TEN PRIZES OF $15.00 EACH

"Radio Knife Aids Surgeons," by K. D. Ganaway, Reporter No. 455 341
"Tornadoes!" Photo by A. H. Smith 344
"Apple Parer," by Robert Buchi 352
"The Building Industry of India," by G. E. Jones..... 357
"Power From Earth's Heat," by Alfred Pedazus..... 360
"Convertible Coupé," by B. B. Ellerbeck..... 361
"Electrical Drink and Egg Beater," by S. I. Phillips 373
"Piano Lamp," by L. B. Robbins 373
"Speeding Up Laboratory Work," by Dr. Ernest Bade..... 376
"Radio Set On Finger Ring," by K. D. Ganaway, Reporter No. 455 379

TWENTY PRIZES OF $10.00 EACH

"Hair Dressing Device," by Walter H. Sammons..... 352
"Check Protector," by F. E. Jones 352
"Drink Mixer," by L. W. Jones 352
"Valve Grinder," by Allen P. Child 360
"A Game of 'Skill'?" (Author, please send address)..... 371
"Protecting Floors," by S. I. Phillips 371
"Courtesy Signal," by F. C. Fish 372
"Tripod Truck," by Leslie H. Phinney 372
"Drill of Pipe Fittings," by Harold Jackson, Reporter No. 2903.. 374
"Photographer's Ruby Light," by L. B. Robbins..... 375
"Handy Lens Hood," by Dr. Hugh Winfrey..... 375
"Nail Extension," by L. A. Parker 375
"Ornamental Glass," by Billy Bryant 376
"Distilling Water," by Joseph Liebowitz 376
"Teapot Radio Set," by K. D. Ganaway, Reporter No. 455..... 379
"Radio Set in Cocoanut Shell," by K. D. Ganaway, Reporter No. 455 379
"Radio Hook-up," by Wm. J. Smith, Reporter No. 4976..... 383
"Radio Hook-up," by Lee Marvin 383
"Radio Hook-up," by J. C. Hanhauser 383
"Pocket Radio Set," by James Stayton 383

TEN PRIZES OF $5.00 EACH

"Toy Furniture," by E. E. Howe 373
"Auto Ash Tray," by B. V. Lauth 373
"Chicken Font," by J. Baxter Gardener 374
"Tracing Vibration," by C. A. Oldroyd 375
"Handy Hack-Saw," by N. Webster, Jr., Reporter No. 7165.... 375
"Removing Records Easily," by G. E. Henrickson..... 375
"Water Supply," by C. A. Oldroyd 376
"Radio Wrinkle," by B. G. Switzer 416
"Radio Wrinkle," by T. B. Marsden 416

TWENTY PRIZES OF $2.00 EACH

(No Entries)

TEN PRIZES $1.00 EACH

(No Entries)

Here Is How You Can Get in the Contest:

$12,000 or More in Gold

EVERY month SCIENCE AND INVENTION pays $1,000 or more in gold in prizes. Every text article published will receive a prize—(most of the departments have awards of their own which they give every month). Ideas are what the Editors want. The ideas must be told simply, so that your mother or your sister can understand them—in pictures or sketches or both. But the idea must be new and must have something to do with science or invention.

The Editors want pictures and sketches—must have them—but what they want most is IDEAS. These ideas will be handsomely paid for. We have published a pamphlet showing the rules of the contest which we shall be glad to send to anyone free on receipt of a postal card with your name and address. The pamphlet gives full details, the rules and how to submit articles. The magazine itself shows you what is wanted. Study it closely and submit your ideas.

The closing date for all prize contributions is the 15th of the month preceding date of issue, *i.e.*, the 15th of Aug. for the Oct. issue, the 15th of Sept. for the Nov. issue, etc.

88 monthly prizes will be given as follows:

FIRST PRIZE	$100.00			
2	PRIZES of	$50.00	each	
10	"	"	25.00	"
5	"	"	20.00	"
10	"	"	15.00	"
20	"	"	10.00	"
10	"	"	5.00	"
20	"	"	2.00	"
10	"	"	1.00	"

$12,000 or More in Gold

is IDEAS. These ideas will be handsomely paid for. We have published a pamphlet showing the rules of the contest which we shall be glad to send to anyone free on receipt of a postal card with your name and address. The pamphlet gives full details, the rules and how to submit articles. The magazine itself shows you what is wanted. Study it closely and submit your ideas.

The closing date for all prize contributions is the 15th of the month preceding date of issue, *i.e.*, the 15th of Aug. for the Oct. issue, the 15th of Sept. for the Nov. issue, etc.

WILL YOU BE OUR REPORTER?

IN connection with our $12,000 prize contest announced herewith, it goes without saying that you will have to do a little work in order to win a prize. The Editors do not wish to make it hard for you, quite the contrary. We want pictures and ideas and we cannot have too many of them.

Herewith is reproduced our reporter's card. Up to now we have issued over 12,000 of these. Note in our awards how our reporters are winning prizes right along. We shall be glad to send the reporter's card free to anyone who makes an application for it. By means of this card you will be able to secure entry into industrial plants, business houses, motion picture studios, steamships, docks, public buildings, etc. This reporter's card will prove an open sesame to you in many instances. Every card is numbered and only one is given to a correspondent. A postal card from you and a request for this reporter's card is all that is necessary to obtain one. It will be sent to you by return mail. With it we will send you a pamphlet giving rules of the contest and how to proceed in order to get photographs, to send in sketches, and other information in order to obtain a valuable prize. Not only will this card help you to obtain material for this magazine, but it will train you to become a news gatherer, and will be the means of helping you to earn a good deal of money during your spare hours.

Address Field Editor, SCIENCE AND INVENTION, 53 Park Place, New York

REPORTER

Science and Invention

CORRESPONDENT REPORTER'S IDENTIFICATION

NO. 10000

THE BEARER OF THIS CARD L. W. Shackner IS AN AUTHORIZED CORRESPONDENT-REPORTER OF SCIENCE and INVENTION MAGAZINE. THE PUBLISHERS OF SCIENCE AND INVENTION WILL APPRECIATE ANY COURTESY EXTENDED THEIR REPRESENTATIVE.

EXPERIMENTER PUBLISHING CO.

(over) Hugo Gernsback PRESIDENT

$112,600 in prizes For Inventors

NEVER before were there such wonderful opportunities for inventors. New inventions are wanted by the hundreds. So urgent is this need that an amazing offer has just been made to stimulate the inventive instincts of Americans. $112,600 in prizes will be given within one year for useful, wanted inventions! More will be offered. What are your chances to win one of these prizes? Will you be fortunate enough to carry off some of the big prizes—one of them for $10,000!

A Fortune For You

Here is a glorious opportunity for you to earn a handsome sum of money. Surely thousands and thousands of persons will compete for these prizes. But, as you know, those who know how to invent, those who have had training in practical inventions have the best chance to win.

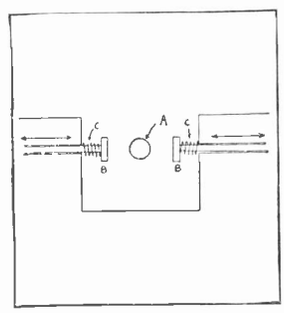
Yet big as these prizes are, they don't begin to compare with the startling opportunities open in this great field of invention. Invention is the easiest and quickest way to earn a fortune. Just one single idea—one little invention—can bring you honor, fame and fortune.

What Some Inventors Have Made

It isn't necessary to invent anything big to make real money. Little things have brought their inventors wealth and luxury. King C. Gillette is said to get as much as TWO MILLION FIVE HUNDRED THOUSAND DOLLARS A YEAR! The man who invented the President Suspenders is now worth FIVE MILLION dollars! Waterman is a millionaire many times over. The inventor of the tiny snap-fastener recently paid an income tax of $29,000! The inventor of the autographic camera sold his patent rights for $300,000.

Other things like the humped hairpin, the metal-tip shoelace, the paper clip, the pencil eraser, have brought fortunes to their inventors. These inventions are simple—so simple in fact that no douht hundreds of people thought about them. The only difference between these persons and the inventors who made money is that the inventors DID something with their ideas!

This Simple Test Proves That You Can Invent



Here is an interesting little problem and its solution will be found very simple, if we really think.

"A" is the end of a shaft. The two members "B B" are free to move in either direction indicated by the arrows. If they are pushed back, the springs "C C" will immediately pull them forward again. Our problem is to put some kind of an attachment on the revolving shaft "A" so that the members "B B" will be pushed back both at the same instant every time the shaft "A" makes a single revolution. The device on shaft "A" must also allow the two members "B B" to come forward once in every revolution. What would you suggest putting on the shaft "A"?

This Test Proves You Can Invent

Perhaps even now you have ideas which can be turned into wonderful inventions that will make you famous and wealthy, that will bring you everything you dreamed of. The only reason you haven't developed your ideas yet is because you doubt your own ability.

Here is a simple test which proves that you can learn to invent. Even so successful an inventor as Thomas A. Edison says that you actually must learn invention. Read what he says: "Invention is a science and should be taught as a profession."

Now look at the test here. You can easily solve the problem in a few minutes if you think inventively. And yet this same simple idea is the basis of the electric light switch which brought its inventor tens of thousands of dollars!

This test, simple as it is, illustrates exactly how every invention has been produced. First you see a problem—something to be "fixed." Then you think of some mechanical, physical or natural principle which solves the problem—in other words, which "fixes it." That is all—and everything—to invention. Every time you "fix" a leaky faucet, a wabbly table, a rattling window, you are using the same scientific processes of invention, which Edison, Armstrong, De Forest, and every great inventor uses.

RAYMOND F. YATES, who with fourteen other famous inventors, now makes it easy to learn how to invent in spare time at home.

Fifteen Famous Inventors Now Teach You Inventive Science—In Spare Time At Home

That is why you can learn how to invent! Invention is a science, with rules as exact, as definite and as easily learned as the rules of arithmetic. All you need to do now is to develop your instinct to make it worth real money to you. Now for the first time you can actually learn inventive science! The Bureau of Inventive Science offers you the first course in practical invention ever devised. No previous technical or mechanical experience is necessary. Fifteen famous inventors tell you WHAT TO INVENT and HOW TO INVENT. They tell you the secrets of invention which every successful inventor knows. They explain how to originate ideas, how to develop and perfect them, how to get patents. But they tell you even more: Thousands of inexperienced inventors have been defrauded of their rewards because they did not know how to protect their patent rights. This great course tells you everything you want to know—how to sell your invention, how to get royalties—how to get the most money for your ideas.

Write For This Free Book

A wonderful book explaining this fascinating course will be sent to you free. It explains the course in detail, and proves that regardless of who you are, where you live, what you do, you can easily train your mind to think inventively so you may become a successful inventor. It shows how this course gives you in a short time, a wealth of information which other inventors learned only after years of hard work and bitter experience. Get the advice of these fifteen famous inventors. Send for this book today. There is no cost or obligation. This bureau is not connected with patent attorneys or manufacturers. Our only work is to teach you how to develop your inventive ability so it will bring you big money.

Bureau of Inventive Science

Dept 78 Wisner Building Rochester, N. Y.

BUREAU OF INVENTIVE SCIENCE,
Dept. 78, Wisner Building, Rochester, N. Y.

Please send me without cost or obligation your free book "The Science of Invention."

Name .....

Address .....

City .....State.....

The Man On the Meteor

By RAY CUMMINGS

(*Continued from page 347*)

As I began giving orders, the things I must do multiplied in my mind. A score of the fastest swimmers in the city I bade come to me at once in the throne-room of the palace. I wished to send them to the entrance of the Water of Wild Things to bring us news of the enemy's advance; to send them throughout the forests and the mudbanks—to order everyone living there to come into Rax.

There were three other Marinoid cities besides Rax and Gahna—small, unimportant cities. My couriers would order them to prepare as Rax was preparing—and send their fighting men at once to the roof of Rax.

Other things I thought of. Gahna, we must abandon. Its Marinoid population was massacred; the half-breeds held it in full possession. I did not mention this now to the crowd. But I told them that every half-breed encountered in Rax was to be killed.

"The refugees coming here from the mudbanks," Atar whispered, to remind me.

All refugees into Rax I ordered to divide into two groups, the fighting men to come to the roof of the city; the others, women, old men and children, to seek quarters in the homes of Rax. Any household would take them in. . . .

The people were dispersing, following my orders. Nona, with her girls, was waiting on the palace roof. I signed her to swim down to me.

"Select a girl to command them, under you," I said swiftly. "And my Nona, you were wonderful."

Her caress answered me.

"Give Boy to Caan's woman, Nona—to take home. Kiss him for me—our Boy."

Even in the haste of that moment, I remember how thankful I was that Boy was too young to fight. Yet Nona wished to fight, you exclaim! True—but can you guess how cold my heart was within me at the thought of it?

"Then, Nona, join me in the throne-room. We must go to the Cavern."

I dispatched my couriers. And those I sent to spy upon the enemy carried with them my unspoken prayer that they would bring back word we had at least a few hours to prepare. A few hours! This Marinoid was a very little nation, as *you* would reckon it. Yet warfare cannot be planned upon such short notice. And in my heart then, I cursed the pacifist stupidity that had brought such a tragedy upon us.

III—TO THE ARSENAL

My duties at the palace for the moment were over. With Atar, Caan and Nona, I hurried to the Cavern. Atar led us—none of us others had ever been there.

It was not far from Rax—a broad entrance cunningly disguised with removable foliage. A tunnel, short and steeply downward, led us under the sea-bottom. It was dark. Lights at intervals illumined the water—dim, wavering lights, lending to everything a ghostly unreality.

Several times we were stopped; but at sight of Atar the guards let us pass. Ahead of us presently we could see more open water—a broad shallow amphitheatre, artificially lighted. Figures were moving about in it, busy at various tasks. Human figures—most of them, but not all. Some were dolphins. And then I saw a great cage within which two or three hundred of the graceful creatures were swimming idly about.

With Atar to show us the way, we swam slowly the length and breadth of the cavern. Here, he said, were the weapons being made. I looked them over. A thousand of them possibly. Small, dagger-like things; swords; others long as a lance; still others very thin, but heavy in front to be thrown through the water like javelins.

The sight of the weapons standing in racks inspired me. With them, I could equip a thousand fighting men. More perhaps.

Further along we came upon a side cave. In it I saw a dozen sleighs to be drawn through the water by dolphins. They were not unlike the King's sleigh in which I had already ridden upon two memorable occasions, save that these were smaller—to carry one man only. And slimmer, with streamlines, so that they might offer a minimum of resistance in passing through the water.

I examined them more closely. Each had along its sides, banks of lights—small, torpedo-shaped pods filled with extraordinarily luminous organisms. The lights were shrouded; but Atar uncovered those of one sleigh. A blinding glare, pointing only forward, shot like a search-light beam through the water.

LIGHT-SLEIGHS TO BLIND THE ENEMY

These "light-sleighs," Atar explained, were designed to precede an advancing army. They would blind the enemy, throw him into clear light. And in the comparative darkness behind them, our Marinoid forces could advance.

We passed along—quickly, for we had little time for these explanations. Atar was giving orders; the workmen were preparing everything for immediate action.

There were other sleighs—"sleighs of darkness." These were in shape like the others—but larger, for two men. Around them were ink-bags. I remembered the squid which had attacked us in the Water of Wild Things. These bags, when squeezed, emitted an inky fluid—a screen of darkness that could be thrown over the scene of battle at any critical moment of disaster or retreat.

I was enumerating in my mind the forces at my command. I had men famed for their power of giving the electric shock. I would use them in a separate division—to combat the black fishes of the Maagogs.

The black fishes! My heart sank as I thought of them. Fearless! Suicidal little brutes whose only instinct was to fight until death. How many of them would Og have to hurl against us?

But we had dolphins. I demanded of Atar what the dolphins were for. There were several hundred of them, and a score or so were all that could be needed to draw the sleighs.

"Our men will ride them," said Atar. "Small, slim, very skillful men will have to be chosen. Men without the electric power. It would be useless on a dolphin. We can arm these men with the long, thin spears. They can go swiftly, anywhere."

Such words on the very eve of battle! How would we have time to select such men, train them? And where were the men? There were no small, slim skillful men except among the younger group whose electric power would be more valuable to us.

Again had I reckoned without Nona. Her eyes were shining, her beautiful face flushed with excitement.

"We women will ride your dolphins. Small, slim, skillful—without the electric power—we are the ones you need."

It was then I protested. Indeed, I tried

(*Continued on page 396*)

"All Starrett's!"

"Boy—you certainly come well recommended."

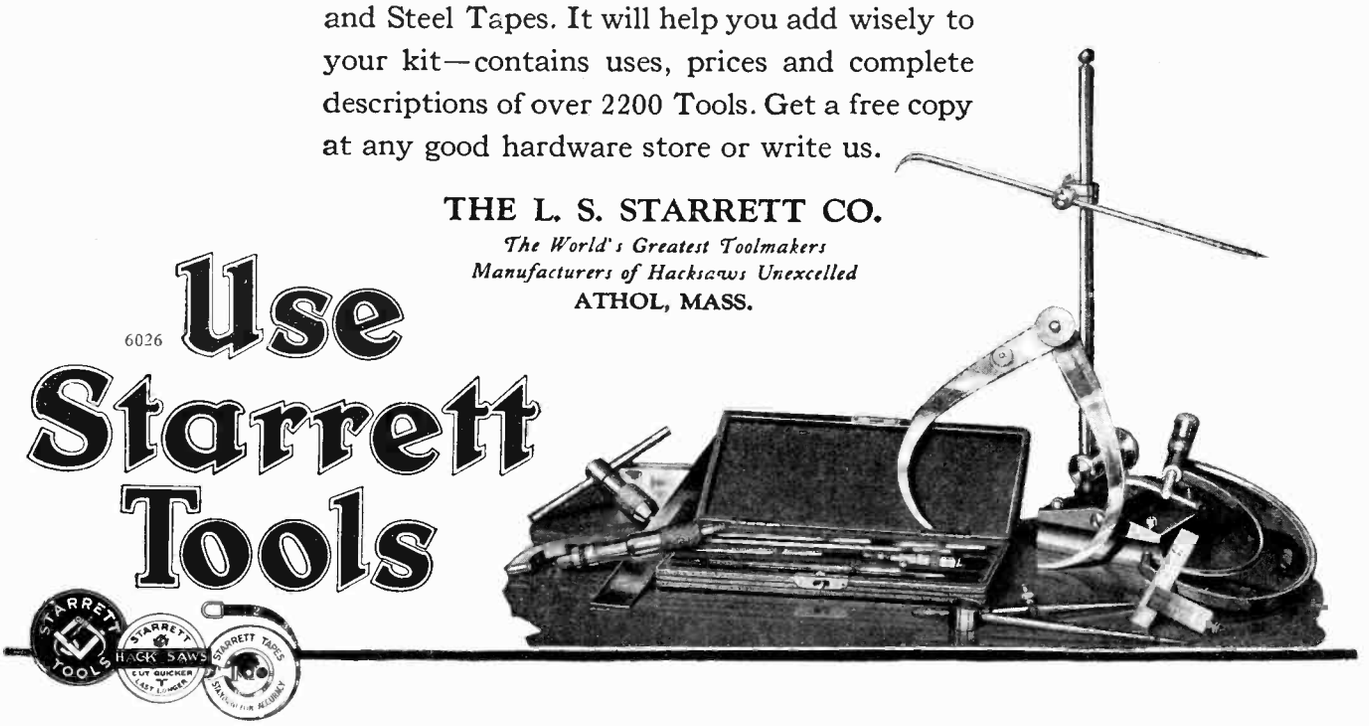
"Yes—that's what the foreman said when he looked over my kit this morning. And right away he wanted to know how soon I could come to work."

Send for New Starrett Catalog

No. 23 "LE" has all the newest additions to the Starrett Line of Fine Precision Tools, Hacksaws and Steel Tapes. It will help you add wisely to your kit—contains uses, prices and complete descriptions of over 2200 Tools. Get a free copy at any good hardware store or write us.

THE L. S. STARRETT CO.
The World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
ATHOL, MASS.

6026 **Use Starrett Tools**



The Man On the Meteor

(*Continued from page* 394)

my best to get her to stay with Boy, at home. I failed. And now I realize that in spite of my fears for her, I was more proud of her then than I had ever been before. Fighting for the virtue of the Marinoid girls! My Nona!

NONA LEARNS TO RIDE DOLPHIN

A single dolphin out of its cage, swam past us—sleek, graceful creature longer than my body, its every line denoting speed. Atar called to it. Like a dog it came and fawned upon us. With her arm about its neck, Nona caressed it.

"This one will I ride," she exclaimed. "Let me try now. Atar, make him let me try."

Atar summoned a young Marinoid—one who had helped train the dolphins. He showed Nona how to mount it. She had on an outer garment at the moment, and at the lad's direction she discarded it.

Then he brought thongs of grass, and bound her hair tightly around her head.

She was ready. Lying flat on the dolphin's back, her slender body seemed welded to it. A collar was about the dolphin's head; and into it she thrust an arm to hold herself. The young Marinoid told her how the creature was guided. A kick of the heel, pressure of an arm against its head—or even a whispering word.

She was away! Back and forth through the water before us the dolphin sped; and Nona's body flat against it caused hardly a ripple. Then they gave her one of the long, lance-like spears. She carried it; held it poised; flashed it above her, below—lunging at imaginary enemies, as the dolphin darted out under her commands.

The grace and skill of it! I was amazed. Woman, with such a thing, learns faster than man. Soon she was twisting her body down to use the dolphin as a shield, lunging with the lance over its back.

Then she dashed over to where we were waiting, and slipped to the cave floor, standing there panting and triumphant—a little jockey, flushed with victory.

"You see, my Nemo? We women can do it! We will ride your dolphins!"

An hour or more had gone by. For another, we talked and planned, Atar, Caan and I. Nona had taken the dolphins with their four trainers—taken them to the palace roof to organize the girls. Soon our messengers would return from the Water of Wild Things with the news of the enemy's progress.

I went up to the palace to join Nona. The men from the cavern under Caan's direction were on the roof of the city, distributing weapons to our forces gathered there. I had no sooner reached the palace than one of my couriers came in.

Good news! Good news indeed! The Maagog forces were not coming at once to Rax. Gahna was in the hands of their half-breed allies. It was closer to them than Rax. They were heading for Gahna, occupying it—massing there; and from there, doubtless, would presently attack us.

It was the breathing space we wanted—needed so badly. Now we could organize.

Nona with her dolphin was with me as the courier poured out his news. Quick-witted, fertile-minded woman! Never will I cease to marvel at her. She whispered to me a plan—daring—yet almost certain of success. A plan that she and I alone could execute. A plan. . . . But presently you shall hear it in detail, for we lost no time in attempting it.

(*Continued on page* 398)

"BUILD YOUR OWN" WITH "RASCO" PARTS!

Buy from the Oldest and Original Exclusive Radio Parts House in the United States

We pay ALL transportation charges in U. S. ALL GOODS SENT PREPAID IN 24 HOURS

Order direct from this page.

NEW AND EXCLUSIVE "RASCO" GOODS

Money refunded if goods do not satisfy

"RASCO" Double Acting Snap Switch

25c

At last a REAL radio switch constructed for radio purposes, not just a battery switch that may be adapted for radio. The RASCO switch is the only switch with a POSITIVE DOUBLE spring action. No more guess work if the circuit is open or closed. A push of the finger and the current is on. A slight pull and THE HANDLE SNAPS BACK of its own accord. An internal coil spring pushes the handle back when a little pull is applied. This switch is intended as a battery switch to disconnect your "A" batteries.

Only one hole to drill. **No tools required** to mount except your finger and thumb. Also this switch takes up a minimum of room, much less than other switches, the base of the switch measuring only 1¼"x½". All metal parts nickel plated. A switch you will be proud to possess.

No. G 4850—RASCO Snap Switch, each..... $0.25

5c

G-4870

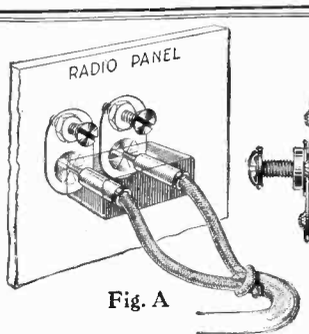


Fig. A

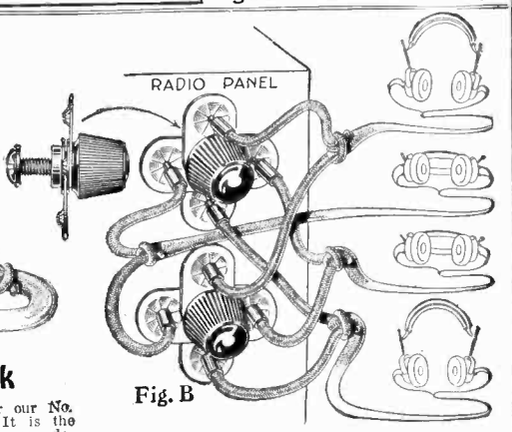


Fig. B

"RASCO" "Jiffy" Cord Tip Jack

This jack has been specially designed for our No. G-4860 cord plug shown on this page. It is the simplest and most efficient cord tip jack ever designed. It is stamped from a single piece of metal and it grips any style cord tip of any make phone or loud speaker. The "Jiffy" Jacks take but a minimum of room. All you are required to do is to drill two small holes in your panel and mount the "Jiffy" Jacks with screw and nut furnished. No soldering is necessary as the wire goes right under the nut. Our X-Ray view, Fig. A, shows how two of the "Jiffy" Jacks are used in conjunction with our cord plug. Note that Jacks go on back of panel; only the screws show in front. The illustration, Fig. 4870 of the "Jiffy" Jack is full size. They take practically no room at all when mounted and will not extend more than about ⅛" from back of panel. Made of best spring brass, that will not wear out, even through extended use.

We also show a few illustrations of some other uses for the "Jiffy" Jack. Eight of them can be mounted on two binding posts as shown (Fig. B) which will make it possible to connect 4 pairs of phones to your outfit. The same system can be used by mounting eight of the jacks behind the panel by drilling a few simple holes; then the cord tips may be pushed through these holes, making it possible to connect one or more phones in the circuit.

We will pay $1.00 for every new use for Jiffy Jacks.

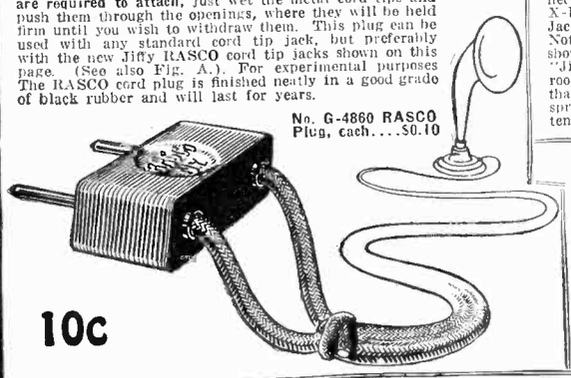
No. G-4870 RASCO Jiffy Jack, complete with nut and screw, each **$0.05**

No. G-4871 RASCO Jiffy Jack, without nut and screw, two for **$0.05**

"RASCO" Phone Cord Plug

Again RASCO leads with a small but important radio novelty. Here is a bit of semi-hard rubber into which the tips of your phones or radio speaker are pushed. This makes positively the cheapest and simplest radio jack ever designed. Its small size and neatness has made it famous over night. Illustration is full size (1" long, ½" wide, ⅜" thick). **No tools of any kind are required to attach,** just wet the metal cord tips and push them through the openings, where they will be held firm until you wish to withdraw them. This plug can be used with any standard cord tip jack, but preferably with the new Jiffy RASCO cord tip jacks shown on this page. (See also Fig. A.). For experimental purposes The RASCO cord plug is finished neatly in a good grade of black rubber and will last for years.

No. G-4860 RASCO Plug, each....$0.10



10c

Wanted

THIS Company is always in the market for new ideas. Any small specialties in demand by the radio fan will be highly welcomed by us. Some of the articles shown on this page originated with our customers, whom we paid well for the ideas. Send your sketch or model addressed to Research Department, c/o this Company.

Dealers and Jobbers

WRITE or wire for territory that is still open on the specialties described on this page. These articles are widely advertised and you will have a demand for them almost immediately.

We shall be glad to send samples to responsible and rated concerns. Address all wholesale inquiries to

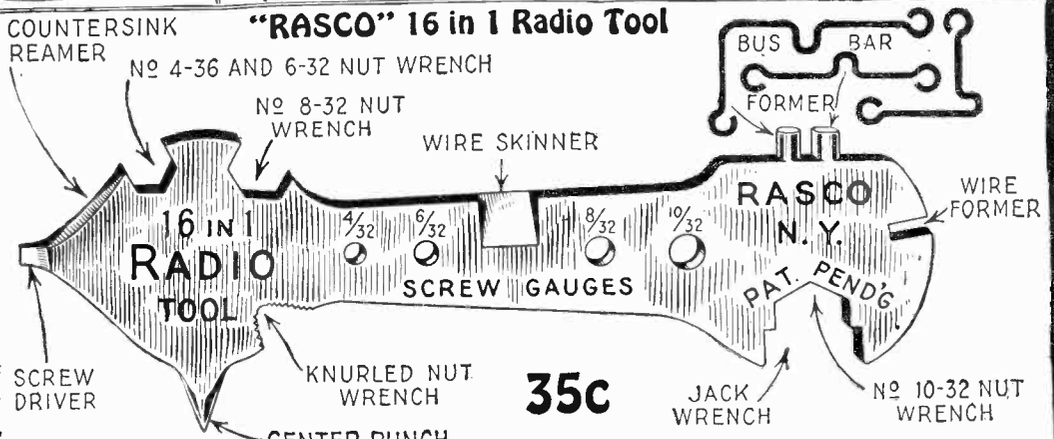
RADIO SPECIALTY COMPANY,
Wholesale Department,
25A West Broadway New York City

"RASCO" 16 in 1 Radio Tool

Here it is! The radio tool that will bring happiness to all radio experimenters and constructors. Here is a tool that does 16 different things and does them well. A tool that does practically everything required in building your radio set. The tool is built of hardened steel, size exactly as per illustration, highly finished. Here are some of the uses: 1. Screwdriver. 2. Center punch. 3. Countersink. 4. Bus bar wire bender. 5. Bus bar and wire bender for 8/32 screw. 6. Bus bar and wire bender for 6/32 screw. 7. Socket wrench for jacks. 8. Socket wrench for 4/36 nuts. 9. Socket wrench for 6/32 nuts. 10. Socket wrench for 8/32 nuts. 11. Wrench for knurled nuts. 12. Screw gauge for 4/36 screw. 13. Screw gauge for 6/32 screw. 14. Screw gauge for 8/32 screw. 15. Screw gauge for 10/32 screw. 16. Knife for wire skinning.

These are only the important uses of the tool, but many other uses will readily suggest themselves to every radio experimenter. You will wonder how you have gotten along before without the 16 in 1 radio tool. Get one of these happiness tools. You will never again be without it.

No. G-4800 RASCO 16 in 1 Radio Tool, each **$0.35**



35c

NEW THINGS FROM CATALOG No. 11 AT CUT PRICES

Dial Marker

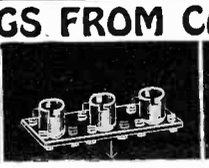
The big little thing you have been waiting for. Just drill a hole in the panel and mount the marker above the dial. Very neat, nicely nickel plated and polished.

G7788 Dial Marker, each ..... $.05

Vacuum Tubes

Only best make tubes carried in stock. All tubes guaranteed to work or exchanged if filament lights.

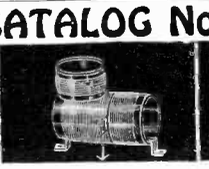
G201A 5 v., 25 amp. $2.50
G199 3 v., .06 amp. 2.50
G12 1½ v., 25 amp. 2.50



Three-Gang Socket

Aluminum shells, genuine heavy bakelite base, 3 brackets for mounting, 12 nickel binding posts. Length 7¼".

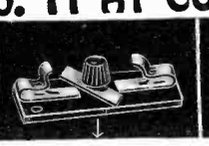
G5995 Three-gang socket $1.50



Cockaday Coil

Guaranteed best make. Three windings of No. 18 D C C Magnet wire. Has brass brackets for panel or base mounting. Results guaranteed or money back.

G2750 Cockaday coil $1.50



Neutralizing Condenser

Latest pattern. Genuine bakelite base. Fahnstock connectors, hard rubber composition knob, easiest to regulate. Size 5⅝" long, 1" wide and 1" high.

G1202 Neutralizing condenser ..... $.40

Neutro-Transformer

Can be used for all neutrodyne circuits, also for all tuned radio frequency circuits. Made for usual broadcast waves. Secondary has one center tap. Two genuine bakelite tubes. Two nickel mounting brackets.

G6909 Neutro-transformer $1.65

Sponge-Rubber Cushions

Get rid of tube noises due to vibration. Softest sponge rubber made. Also used under cabinets to absorb shock and vibration. Size 2½"x3", ⅝" thick.

G8989 Sponge-rubber cushions, each ..... $.12

RADIO SPECIALTY CO., 100 Park Place, New York City

Factories Brooklyn, N. Y. Elkridge, Md.

The Man on the Meteor

(*Continued from page* 396)

IV—NONA AND NEMO START ON MYSTERIOUS JOURNEY

Nona and I started, each on a dolphin, and each bearing a short- broad-bladed sword. Only Atar knew where we were going, or what we were about to try and do.

Riding the dolphins, we started slowly at first, for I was inexperienced. The creature's sleek body was beneath me and I clung to it, stretching myself out along its back, my fingers gripping its woven-grass collar. Nona rode ahead on a dolphin slightly smaller, but, I soon was to learn, equally as fast as my own.

"Nemo, are you all right?" Her sober, earnest little face was turned back toward me.

"All right," I said. "Yes, of course."

Would you let a woman know when you were perturbed? Not I.

At once Nona increased the pace, and my own mount followed hers. We were leaving the city, passing out along one of its horizontal streets. It was nearly deserted. The fighters had gone to the city roof; the others were barred in their darkened houses. Occasionally a face would show at a window. A courier came along—returning from one of the other cities. We stopped him. My orders were being obeyed, he reported; the fighters from the other cities were swimming in to join our own men on the roof of Rax.

I sent the courier on to the palace to receive further orders from Atar. We wished to spread the news that the enemy was not attacking at once. And while Nona and I were away on this enterprise, Atar and Caan were to organize the army; and the girl whom Nona had appointed, was to drill the other girls in riding the dolphins.

We passed on, out of Rax. As we left the city—heading for our first objective, the entrance to the Water of Wild Things—I caught a glimpse of the roof of Rax. The open spaces up there were thronged with our men.

Nona increased our pace and very soon Rax with its activities was left out of sight in the dimness behind us. The open water was almost deserted. Refugees were straggling in; occasionally we came upon parties of them—families who had fled from their isolated homes. They all halted and gazed after us curiously as we dashed past them.

"All right, Nemo?"

"Yes. Of course."

We went faster. The water pressed against me, roared in my ears, blurred my vision. I clung tighter, and bent my head in the crook of my arm.

Then, after a time that seemed ages but was doubtless very brief, we slackened. Nona signalled to me, and I rode my dolphin close alongside of hers.

"See," she whispered. "We are here."

Ahead of us in the dim water, moving lights showed. We were almost at the entrance to the Water of Wild Things. The last of the Maagog forces were coming through. We did not dare go close enough to see much. Moving lights disclosed double lines of swimming figures. They were coming out through the passageway they had cut in the coral, and swimming off toward Gahna. The line of their lights extended out of sight in that direction.

We were just in time to see the last of them come through. Og and his black fishes! We assumed it was Og; we had gone closer, but not close enough to distinguish features. A lone male figure carrying a light and surrounded by that swarming pack.

The figure closed the passageway gate at this end carefully. Like ourselves, Og wanted no unruly monsters to get through into Marinoid waters.

We waited until his single light was well on its way to Gahna.

"We can follow now," I said. "Nona—we will succeed. We can do it, my girl—and it is you who have planned it."

She did not answer me; she had already started her dolphin. Like shadows in the gloom, silently, without a ripple of the water as we slipped through it, we followed close after the Maagog invading army.

V—IN THE REALM OF THE UNKNOWN

To Gahna. It took us a long while to get there, for the Maagog army advanced slowly. Following the lights we found ourselves descending at once to the sea-bottom. These Maagogs, lumbering and ungainly, were poor swimmers; the line of them was walking along the bottom.

It made my heart leap to realize that. What match would they be for us Marinoids in battle—our men so active in the water—our alert girls on the dolphins. We would cut them to pieces . . . would rout . . .

I whispered my thoughts to Nona.

"Be not too sure, my Nemo," she said soberly. "It may be so, but first we must do what we are now planning."

We went on, through the forest road where the Maagogs had tramped aside the tall, tenuous growth of foliage. It was much dimmer in here. Beside us the trees and ferns spread as a dark lacework of green and brown. They met overhead, wavering, tenuous, but impenetrable to our sight.

What a spot for ambush! A thousand hiding-places all about us. An army could lurk here in ambush unseen.

It is very easy to look backwards upon life and say what should have been done. We Marinoids—how stupidly we had done things! Our army—if it had been organized and ready—could have lurked here in this dark forest . . . leaped upon the Maagogs . . . defeated them at once in one great surprise attack . . .

"What?" I whispered.

Nona, from her dolphin beside mine, had reached out and gripped my arm. I followed her gaze, caught a glimpse of a figure hovering amid the air-pods overhead and just in advance of us. A man, coming down now toward us, swimming cautiously.

My heart leaped; my grip on my sword tightened. Then I saw it was a Marinoid—one of my own couriers stationed here to watch the enemy pass.

He joined us. "Og," he said, "and his black fishes were last to pass. I would have given my own life to the fishes could I have killed him. But it did not seem possible."

I sent the courier back to Rax and we went on as before. Out of the forest now, across an open stretch, with the lights of the Maagogs still before us.

Then—Gahna. There it stood, leaning sidewise in the press of current. Traveling so slowly, we could feel the sweep of the moving water. A gentle current here; but just beyond Gahna, I knew there was an opening in the side wall of rock which bordered in the Marinoid domain. It was a large opening leading diagonally downward—an opening larger than the city itself—and into it the water rushed swiftly.

"Wait!" whispered Nona.

We halted our mounts, and waited while the last of the occupying Maagogs dispersed themselves about the city. From this distance we could see their lights but hear no sounds. Evidences of the recent half-breed massacre of the Marinoid population, were about us. Broken, inert bodies lying here and there on the sea-bottom; and the smell of blood in the water.

I shuddered to remember it. Gahna, bloody from end to end—a city of death

now; and these triumphant Maagogs occupying it, making it a base from which to attack Rax.

At last they were all in. Cautiously, we advanced further. Moving lights on the city's outer surface—a murmur of sounds. Nothing more.

A few moments and we were under the city! In its cellar, let me say. No one lived down here; sand under our feet; woven vegetation twenty feet overhead—a cellar ceiling which formed the lowest tier of the city.

It was black in here; and almost soundless, just the murmur of the city above us. We stood motionless, listening. Were we alone? Dared we light our lights? I knew that if they caught us in here we could not escape. Yet we could see nothing without lights.

We unshrouded them finally—little pods which threw tiny wavering green beams. With them, we poked around, cautiously, with our swiftly beating hearts seeming about to smother us.

DESTROYING A CITY

Gahna was a small city. Four thick stalks of vegetation—each about twice the thickness of my body—formed its main stems. I stood beside one of them, dug my sword into it.

Within five minutes, I had hacked through the stem. Nona held the light.

"Quietly," she whispered. "If they should hear us——"

The stalk was severed. A tremor seemed to run over the upper part, and it moved slightly sidewise.

Trembling ourselves, we attacked another. Severed it; then the third.

The city over us was shifting, toppling. The fourth stalk was twisted and bent by the strain. . . I severed it with a few blows.

"Swim! Nona! Quickly!"

The ceiling overhead was lifting—shifting. Smaller stalks and vines which had taken root in the sand were tearing away. Above us came a cry—shouts—confusion. . . .

We swam to extricate ourselves. Tearing vines seemed to leap at us, but we avoided them.

Back to our dolphins. They were waiting; we mounted them—turned to look at the city. It was turning over in the water, and floating away. Slowly, then faster, down toward that black opening into which the current would sweep it.

The city of death! But every living thing in it was pouring out. Lights—dark blobs of figures—shouts—commands. . . .

The Maagogs were escaping! In a turmoil; and they would lose whatever apparatus they had for war; but they were escaping nevertheless. We had hoped the catastrophe would come more quickly. But it did not. The city toppled slowly over, while those terrified figures leaped from it. Slowly it floated away—then plunged into the torrent.

It was gone with its murdered Marinoid dead; but on the sand, and in the water ahead of us, the Maagogs and the half-breeds remained. Some had gone to their death, no doubt; the others . . .

"They will not wait to attack us now," Nona whispered suddenly. "We have crippled them, but . . ."

"We must get back," I exclaimed. "It is we who must attack at once—finish them up—now, before they can recover——"

VI

In Rax, we found Atar with his work well done. We Marinoids were ready. And within an hour or very little more, we set forth to meet the advancing Maagogs.

The battle? Patience—in good time you shall hear.

(*To be continued*)

Answers to Scientific Puzzles

(*Continued from page 368*)

HOW WOULD YOU BREAK THE THREAD?

THE thread could be broken by giving the bottle and contents a quick upward jerk, because in accelerating the bottle upward the resistance of its inertia upon the block is thereby increased. A downward jerk would have the opposite effect, for then the water would pass to the upper part of the bottle and its buoyant force would be reversed so that the block would be forced toward the bottom instead of toward the top.

PUSHING OR PULLING A TRAIN

When an engine is attached to the rear of a train the cars tend to bind against the tracks as the train is pushed forward. When, however, the engine is attached to the front and is pulling the cars it keeps the train straightened out so as to diminish the binding effect to a minimum.

THE OBSTINATE DYNAMO

To manage this trick the operators short-circuit the armature of the dynamo and connect the field magnets by means of a hidden switch to the power lines. When a man attempts to turn the crank the switch is closed and the field magnets act as a brake on the revolving armature. When, however, a lady steps up the switch controlling the field magnets is obligingly left open.

THE PULLEY PROBLEM

In this problem the two movable pulleys balance each other and so their weight need not be considered. The sixty pound load is supported by three cords in each of which there will be a tension of twenty pounds. Then since the tension must be the same all along any one cord it is evident that the tension on the last rope A must be twenty pounds also and hence this is the force required.

THE TENSION ON THE BOLT

Before the 1,000 lb. load is added to the bolt it is apparent from the conditions of the problem that the lower nut presses with a force of 1,000 lbs. upward against the lower surface of the supporting beam. When, therefore, the load is added to the bolt the effect must be to remove this pressure from the lower surface and thus leave the net force on the bolt unchanged.

THE PLATFORM BALANCE

Platform balances will balance, if properly constructed, even when equal loads are placed at different distances from the pivot. From the drawing illustrating the construction of such a balance it can be seen that since pivot A is always above A^1 pivot B will be above B^1 and C above C^1.

THE CARTESIAN DIVER

The diver is first adjusted so that it barely floats. To make it sink a slight pressure is applied to the tube until enough water is forced into the diver to make it heavier than the surrounding liquid. On releasing the pressure from the tube the air within the diver expands and expels the water that had been previously forced in, thus restoring the diver to its original condition.

ASCENDING OR DESCENDING

From the drawing of the device it will be seen that the tension that is applied to the cord will have a greater tendency to turn the lower drum than the upper one because the former is the larger of the two. If, then the lower drum unwinds, the upper one must wind up. But, since the lower drum unwinds more cord than the upper one winds up it is clear that the device will ascend as a constant pull is applied to the upper handle.

In this Department we publish such matter as is of interest to inventors and particularly to those who are in doubt as to certain Patent Phases. Regular inquiries addressed to "Patent Advice" cannot be answered by mail free of charge. Such inquiries are published here for the benefit of all readers. If the idea is thought to be of importance, we make it a rule not to divulge all details, in order to protect the inventor as far as it is possible to do so.

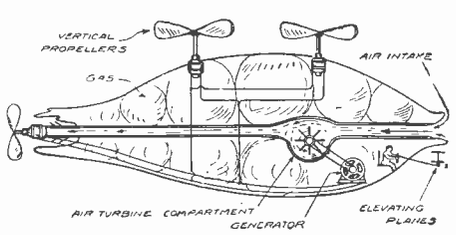
Should advice be desired by mail a nominal charge of $1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

NOTE:—Before mailing your letter to this department, see to it that your name and address are upon the letter and envelope as well. Many letters are returned to us because either the name of the inquirer or his address is incorrectly given.

SELF-DRIVEN AIRSHIP

(813) J. B. Jaquish, Corning, N. Y., asks whether he should patent a lighter-than-air machine made as shown. The air enters the tube at the front, drives a turbine which in turn drives a generator. The generator supplies current to the motors which propel the ship.

A. Your device would under no circumstances operate. It is practically the same as drilling a hole from one end of a boat to the other, interposing a turbine in the tube and expecting the boat to be driven forward by a motor operated by the turbine driven generator. In other words, the device is a very crude attempt at perpetual motion. We would suggest that you forget the idea entirely.



A Proposed Self-Driven Airship on Which the Querist Requests Our Advice.

ALARM GONG.

(814) C. Rye, Winnipeg, Man., Canada, submits an idea for the improvement in alarm bells, in which the gong has a long central slot, so that the bell can be shifted to come in contact to a greater or lesser extent with the hammer.

A. The idea which you have advanced is very old indeed, and we doubt if you could possibly patent the same. As a matter of fact, placing the post of a bell off its direct center is a means employed by many companies. It is not as efficient as shifting the position of the bell in its entirety, which could be done by locking the bell post into an elongated slot. In this way the center of the bell remains central, and the entire position of the bell is changed. The device in our opinion is not patentable.

LATHE

(815) Ed. J. Rediski, Mayville, Wis., requests information regarding patenting a lathe having a hardwood frame instead of steel.

A. Choice of materials does not constitute a claim for a patent. We doubt if you can secure a patent on a lathe having a hardwood frame instead of a steel or other metal frame. Inasmuch as you have not forwarded a design of this lathe we cannot answer more fully. If the design differs from anything published, in use or patented, a patent would undoubtedly be allowed.

WIND POWER DEVICE

(816) Mr. Herbert R. Henderson, Kansas City, Mo., submits a drawing of a wind mill and asks our advice regarding its possibility.

A. There is nothing unusual in your wind motor, as styles similar to this are already found upon the market. With your particular device, unless some mechanism is devised, which will swing over the vanes sufficiently at least to warrant their closing, the device would be inoperative. It is evident that the bearings will after a time rust considerably, and that the hinges upon which these vanes move will not work very easily. In that event the vanes would probably stay open along their entire course if the wind pressure is very slight.

The same thing would hold true if a view of the wind mill is taken from the opposite angle, namely, as the already closed vanes reach the extreme end of their travel, there is very little surface for the wind to act against, and these vanes may not open until they were pretty well on the next half of their journey.

We would advise that a wind mill with curved vanes may now be found upon the market, which is self-regulating, opening to a greater extent when the wind is weak, and closing almost wholly when the wind is powerful. Cross braces between the vanes insure the proper opening and closing of the same. This device is far more efficient than the flat propeller type.

(*Continued on page* 404)

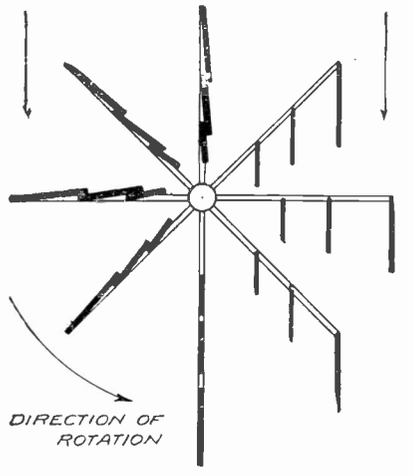


FIG. II — TOP VIEW

Top View of Wind Mill with Feathering Vanes.

Patent Advice

(*Continued from page* 402)

MUSIC OVERCOMES WEIGHT?

(817) Mrs. Venus G. Booth, Chickasha, Okla., visualizes an instrument to fill a ship with sound waves and overcome weight. The nature of the other questions are made clear in the answers.

A. Pardon us for saying that your article "Weight Overcome by Music" is wrong to our way of thinking. Weight can never be overcome by music either on this earth, or on any other planet, as the vibrations of music are of such slight consequence that they have no effect on real material weight.

If soldiers were traveling across a bridge all in step, it would not be the music of their feet as they go marching across the bridge, that would cause the bridge to vibrate, which would be detrimental.

The vibrations are so few per second that they cannot be confused with music. If weight were overcome by music, then an immense band playing would be able to cause a single individual listening to them to be raised bodily upward into the air. No such thing takes place. The effect is purely physiological.

A girl dancing to music does not mind the fatigue produced, primarily because of the extreme pleasure which dancing creates; an individual under a hypnotic trance can be made to dance for hours and hours without music, and without any feeling of fatigue. It is merely the fact that a conscious mind makes no note of the tiresome proceeding recorded by the subconscious mind. In this case the conscious mind overpowers the effect of fatigue.

Furthermore, there is no music of the spheres. There can be none, inasmuch as the planetary bodies are traveling through an immense space scientifically thought to contain ether, not the ether used in anesthesia, but the ether of space. Consequently, it is not and cannot be music which maintains the worlds in their orbits.

PERPETUAL MOTION

(818) S. V. Boatman, Carlinville, Ill., submits a suggestion for a machine using air to drive it which air is to be supplied by the machine.

A. Your device certainly will not work. The compressed air power plant which you have submitted a design of will be less than 3% efficient, and the result is that you will constantly have to supply it with 97% of energy. Your system is purely a perpetual motion device, nothing more than that, and although you do not claim perpetual motion for it, it is simple enough to see that is what is intended.

We are confident that you cannot obtain a patent on the system, unless you build a working model, and are sure that you can never construct a working model of this device which will operate any longer than the original driving force operates, which original driving force may either be an electric motor, steam engine or some other prime mover. SCIENCE & INVENTION will pay $1,000.00 to anyone merely demonstrating a working model of this device which will operate in these offices.

AUTOMATIC GRID LEAK

(819) Benjamin Bartzoff, Buffalo, N. Y., says he has designed a grid leak which regulates the grid bias on a tube automatically. He requests our advice.

A. If the grid leak which you claim to have designed does what you say it will do, the idea is surely worth patenting and placing upon the market at utmost speed. Remember, however, that this grid leak must be automatic and when the filament current controlled by a special ballast is likewise automatic, the grid leak must assume the correct value for the respective tube. Have you ever tried to place a potentiometer in the circuit so that you could control the negative charge on the grid, and then inserted your automatic ballast into the same circuit to determine whether or not there is any effect in varying the potentiometer? The potentiometer should produce no effect whatever. We can assure you that if your claims and statements are correct, your idea if properly handled, will practically eliminate all potentiometers.

We trust that you will send us further information, when you see fit, regarding said superleak and ballast, and wish you the best of success in your venture.

NON-COUNTERFEITING MONEY

(820) Gottlieb Bessemer, Chicago, Ill., suggests a way of preventing counterfeiting by superimposing one wavy line upon another slightly wider and similarly waved.

A. We do not understand where you got the idea that your form of money would be of value. Certainly this is not the case. Whatever one engraver can do another can duplicate, and therefore, your suggestion falls down on its very first point.

Regardless of whether you super-impose, one line upon the other, or whether you use any other method of trying to make your design complicated, a counterfeiter could duplicate the system. The more lines an engraving has, the more difficult it is to detect the fraud, yet incidentally the more difficult is it to duplicate the engraving.

Radio Broadcast

Revised and corrected to date.

First Group of Figures Indicate the Power in Watts in the Antenna of the Transmitting Station. The Second Group Gives the Wave-Length.

Call Letters	Name	Location	Power & Wave Length
KDKA	Westinghouse Electric & Mfg. Co.,	East Pittsburgh, Pa.	1000—326
KDPM	Westinghouse Electric & Mfg. Co.,	Cleveland, Ohio	500—270
KDPT	Southern Electrical Co.,	San Diego, Calif.	50—244
KDYL	Newhouse Hotel,	Salt Lake City, Utah	100—360
KDYM	Savoy Theatre,	San Diego, Cal.	100—280
KDYQ	Oregon Institute of Technology,	Portland, Ore.	50—360
KDYX	Star Bulletin,	Honolulu, Hawaii	100—360
KDZB	Frank E. Siefert,	Bakersfield, Calif.	100—240
KDZE	Rhodes Co.,	Seattle, Wash.	100—270
KDZI	Electric Supply Co.,	Wenatchee, Wash.	50—360
KDZR	Bellingham Publishing Co.,	Bellingham, Wash.	50—261
KFAD	McArthur Bros. Mercantile Co.,	Phoenix, Ariz.	100—360
KFAE	State College of Washington,	Pullman, Wash.	500—330
KFAF	Western Radio Corporation,	Denver, Colo.	50—360
KFAJ	University of Colorado,	Boulder, Colo.	100—360
KFAN	The Electric Shop,	Moscow, Idaho	50—360
KFAR	Studio Lighting Service Co. (O. K. Olsen),	Hollywood, Calif.	200—280
KFAU	Independent School District of Boise City, Boise High School,	Boise, Idaho	150—270
KFAW	The Radio Den (W. B. Ashford),	Santa Ana, Calif.	10—280
KFAY	Virgin's Radio Service (W. J. Virgin),	Medford, Ore.	50—283
KFBB	F. A. Buttrey & Co.,	Havre, Mont.	50—360
KFBC	W. K. Azbill,	San Diego, Calif.	15—278
KFBE	Reuben H. Horn,	San Luis Obispo, Calif.	50—242
KFBG	First Presbyterian Church,	Tacoma, Wash.	50—360
KFBK	Kimball-Upson Co.,	Sacramento, Calif.	100—283
KFBL	Leese Bros.,	Everett, Wash.	15—224
KFBS	Trinidad Gas & Electric Supply Co., and Chronicle News,	Trinidad, Colo.	10—360
KFBU	The Cathedral (Bishop N. S. Thomas),	Laramie, Wyo.	50—283
KFCB	Nielsen Radio Supply Co.,	Phoenix, Ariz.	10—238
KFCF	Frank A. Moore,	Walla Walla, Wash.	100—360
KFCP	Ralph W. Flygare,	Ogden, Utah	10—360
KFCV	Fred Mahaffey, Jr.,	Houston, Texas	10—360
KFCY	Western Union College,	Le Mars, Iowa	50—252
KFCZ	Omaha Central High School,	Omaha, Neb.	50—258
KFDA	Adler's Music Store,	Baker, Ore.	5—360
KFDD	St. Michaels Cathedral,	Boise, Idaho	10—252
KFDH	University of Arizona,	Tucson, Ariz.	50—268
KFDJ	Oregon Agricultural College,	Corvallis, Ore.	50—360
KFDO	H. Everett Cutting,	Bozeman, Mont.	50—248
KFDV	Gilbrech & Stinson,	Fayetteville, Ark	200—360
KFDX	First Baptist Church,	Shreveport, La.	100—360
KFDY	South Dakota State College of Agriculture and Mechanic Arts,	Brookings, S. D.	150—360
KFDZ	Harry O. Iverson,	Minneapolis, Minn.	5—231
KFEC	Meier & Frank Co.,	Portland, Ore.	50—248
KFEL	Winner Radio Corp.,	Denver, Colo.	50—254
KFEQ	J. L. Scroggin,	Oak, Neb.	150—360
KFER	Auto Electric Service Co.,	Fort Dodge, Iowa	10—231
KFEV	Felix-Thompson Radio Shop,	Casper, Wyo.	50—263
KFEX	Augsburg Seminary,	Minneapolis, Minn.	100—261
KFEY	Bunker Hill & Sullivan Mining and Concentrating Co.,	Kellogg, Idaho	10—360
KFEZ	Assoc. Engineering Societies of	St. Louis, St. Louis, Mo.	250—248
KFFB	Jenkins Furniture Co.,	Boise, Idaho	10—240
KFFE	Eastern Oregon Radio Co.,	Pendleton, Ore.	10—360
KFFO	Dr. E. H. Smith,	Hillsboro, Ore.	5—229

Call Letters	Name	Location	Power & Wave Length
KFFP	First Baptist Church, Moberly, Mo.		50—266
KFFQ	Marksheffel Motor Co., Colorado Springs, Colo.		100—286
KFFR	Nevada State Journal (Jim Kirk), Sparks, Nev.		10—226
KFFV	Graceland College, Lamoni, Iowa		100—360
KFFX	McGraw Co., Omaha, Neb.		100—278
KFFY	Pincus & Murphey, Alexandria, La.		50—275
KFFZ	Al G. Barnes Amusement Co., Dallas, Texas (portable)		20—226
KFGC	Louisiana State University, Baton Rouge, La.		100—254
KFGD	Chickasha Radio & Electric Co., Chickasha, Okla.		200—248
KFGH	Leland Stanford University (P. O.), Stanford Univ., Calif.		273—360
KFGL	Snell and Irvy, Arlington, Ore.		10—234
KFGQ	Crary Hardware Co., Boone, Iowa		10—226
KFGV	Heidbreder Radio Supply Co., Utica, Neb.		10—224
KFGX	First Presbyterian Church, Orange, Texas		500—250
KFGZ	Emmanuel Missionary College, Berrien Springs, Mich.		500—286
KFHA	Western State College of Colorado, Gunnison, Colo.		50—252
KFHB	Rialto Theatre (P. L. Beardwell), Hood River, Ore.		5—280
KFHD	Utz Electric Shop Co., St. Joseph, Mo.		100—226
KFHF	Central Christian Church, Shreveport, La.		150—266
KFHH	Ambrose A. McCue, Neah Bay, Wash.		50—261
KFHJ	Fallon & Co., Santa Barbara, Calif.		100—360
KFHR	Star Electric & Radio Co., Seattle, Wash.		50—283
KFHX	Robert W. Nelson, Hutchinson, Kan.		150—229
KFI	Earle C. Anthony, Inc., Los Angeles, Calif.		500—469
KFID	Ross Arbuckle's Garage, Iola, Kan.		20—246
KFIF	Benson Polytechnic Institute, Portland, Ore.		100—360
KFIL	Windisch Electric Farm Equipment Co., Louisburg, Kan.		50—234
KFIO	North Central High School, Spokane, Wash.		50—252
KFIQ	Yakima Valley Radio Broadcasting Asso., Yakima, Wash.		50—242
KFIU	Alaska Elec. Light & Power Co., Juneau, Alaska		10—226
KFIX	Reorganized Church of Jesus Christ of Latter Day Saints, Independence, Mo.		250—240
KFIZ	Daily Commonwealth and Oscar A. Huelsman, Fond du Lac, Wis.		100—273
KFJB	Marshall Electric Co., Marshalltown, Iowa		10—248
KFJC	Seattle Post Intelligencer, Seattle, Wash.		100—270
KFJF	National Radio Mfg. Co., Oklahoma City, Okla.		20—252
KFJI	Liberty Theatre (E. E. Marsh), Astoria, Ore.		10—252
KFJK	Delano Radio & Electric Co., Bristow, Okla.		100—233
KFJL	Hardsacg Mfg. Co., Ottumwa, Iowa		10—242
KFJM	University of North Dakota, Grand Forks, N. D.		100—280
KFJQ	Electric Construction Co., Valley Radio Division, Grand Forks, N. D.		5—280
KFJR	Ashley C. Dixon & Son, Stevensville, Mont. (near)		5—253
KFJV	Thomas H. Warren, Dexter, Iowa		10—224
KFJX	Iowa State Teachers College, Cedar Falls, Iowa		50—280
KFJY	Tunwall Radio Co., Fort Dodge, Iowa		50—246
KFJZ	Texas National Guard, 112th Cavalry, Fort Worth, Texas.		20—254
KFKA	Colorado State Teachers College, Greeley, Colo.		50—273
KFKB	Brinkley-Jones Hospital Association, Milford, Kan.		500—286
KFKQ	Conway Radio Laboratories (Ben H. Woodruff,) Conway, Ark		100—250
KFKV	F. F. Gray, Butte, Mont.		50—283
KFKX	Westinghouse Electric & Mfg. Co., Hastings, Neb.		1000—286
KFKZ	Nassour Bros. Radio Co., Colorado Springs, Colo.		10—234
KFLA	Abner R. Willson, Butte, Mont.		5—283
KFLB	Signal Electric Mfg. Co., Menominee, Mich.		50—248
KFLD	Paul E. Greenlaw, Franklinton, La.		20—234
KFLE	National Educational Service, Denver, Colo.		25—268
KFLH	Erickson Radio Co., Salt Lake City, Utah		50—261
KFLQ	Bizzell Radio Shop, Little Rock, Ark.		20—261
KFLR	University of New Mexico, Albuquerque, N. M.		100—254
KFLU	Rio Grande Radio Supply House, San Benito, Texas.		20—236

Call Letters	Name	Location	Power & Wave Length
KFLV	A. T. Frykman,	Rockford, Ill.	100—229
KFLW	Missoula Electric Supply Co.,	Missoula, Mont.	10—234
KFLX	George R. Clough,	Galveston, Texas	10—240
KFLZ	Atlantic Automobile Co.,	Atlantic, Iowa	100—273
KFMB	Christian Churches of Little Rock,	Little Rock, Ark.	10—254
KFMQ	University of Arkansas,	Fayetteville, Ark.	100—263
KFMR	Morningside College,	Sioux City, Iowa	10—261
KFMS	Freimuth Department Store,	Duluth, Minn.	100—275
KFMT	George W. Youug,	Minneapolis, Minn.	5—231
KFMU	Stevens Bros.,	San Marcos, Texas	20—240
KFMW	M. G. Sateren,	Houghton, Mich.	50—266
KFMX	Carleton College,	Northfield, Minn.	500—283
KFMY	Boy Scouts of America,	Long Beach, Calif.	20—229
KFMZ	Roswell Broadcasting Club,	Roswell, N. M.	500—250
KFNC	Monk Alonzon, Jr., First Methodist Church,	Corsicana, Tex.	20—234
KFNF	Henry Field Seed Co.,	Shenandoah, Iowa	500—266
KFNG	Wooten's Radio Shop,	Coldwater, Miss.	10—254
KFNH	State Teachers College,	Springfield, Mo.	20—236
KFNJ	Warrensburg Electric Shop,	Warrensburg, Mo.	50—234
KFNL	Radio Broadcast Association,	Paso Robles, Calif.	10—240
KFNV	L. A. Drake,	Santa Rosa, Calif.	5—234
KFNX	Peabody Radio Service,	Peabody, Kan.	10—240
KFNY	Montana Phonograph Co.,	Helena, Mont.	5—261
KFNZ	Royal Radio Co.,	Burlingame, Calif.	10—231
KFOA	Rhodes Company (Dept. Store),	Seattle, Wash.	500—455
KFOC	First Christian Church,	Whittier, Calif.	100—236
KFOD	The Radio Shop,	Wallace, Idaho	10—224
KFOF	Rohrer Electric Co.,	Marshfield, Ore.	10—240
KFOH	Radio Bungalow,	Portland, Ore.	15—283
KFOJ	Moberly High School Radio Club,	Moberly, Mo.	5—246
KFOL	Leslie M. Schafbuch,	Marengo, Iowa	10—234
KFON	Echophone Radio Shop,	Long Beach, Calif.	100—234
KFOO	Latter Day Saint's University,	Salt Lake City, Utah	10—261
KFOP	Willson Construction Co.,	Dallas, Texas	100—268
KFOQ	Ora W. Chancellow,	Galveston, Texas	50—240
KFOR	David City Tire & Electric Co.,	David City, Neb.	10—226
KFOT	College Hill Radio Club,	Wichita, Kan.	50—231
KFOU	Mommel Manufacturing Co.,	Richmond, Calif.	100—254
KFOV	Davis Electrical Corp.,	Sioux City, Iowa	10—234
KFOX	Technical High School (Board of Education),	Omaha, Neb.	100—248
KFOY	Beacon Radio Service,	St. Paul, Minn.	50—226
KFOZ	Leon Hudson Real Estate Co.,	Fort Smith, Ark.	20—233
KFPB	Edwin J. Brown,	Seattle, Wash.	15—224
KFPG	Garretson & Dennis,	Los Angeles, Calif.	100—238
KFPH	Howard C. Mailander,	Salt Lake City, Utah	50—242
KFPL	C. C. Baxter,	Dublin, Texas	50—242
KFPN	Missouri National Guard, Headquarters Company, 70th Infantry Brigade,	Jefferson City, Mo.	10—242
KFPM	New Furniture Co.,	Greenville, Texas	10—242
KFPP	G. & G. Radio & Electric Shop,	Olympia, Wash.	20—236
KFPO	Clifford M. Esler,	Denison, Tex.	10—231
KFPR	Los Angeles County Forestry Department,	Los Angeles, Cal.	500—231
KFPS	Carter A. Ross Motor Service Co.,	Casper, Wyo.	10—242
KFPT	Cape & Johnson,	Salt Lake City, Utah	500—268
KFPV	Heintz & Kohlmoos,	San Francisco, Calif.	50—236
KFPW	St. Johns Church,	Carterville, Mo.	20—268
KFPX	First Presbyterian Church,	Pine Bluff, Ark.	100—242
KFPY	Symons Investment Co.,	Spokane, Wash.	100—283
KFQA	The Principia,	St. Louis, Mo.	50—261
KFQB	Searchlight Publishing Co.,	Fort Worth, Texas	100—254
KFQC	Kidd Brothers Radio Shop,	Taft, Calif.	100—227
KFQD	Chovin Supply Co.,	Anchorage, Alaska	100—280
KFQE	Dickenson-Henry Radio Laboratories,	Colorado Springs, Colo.	5—224

Call Letters	Name	Location	Power & Wave Length
KFQF	Donald A. Boult,	Minneapolis, Minn.	10—224
KFSG	Echo Park Evangelistic Association,	Los Angeles, Calif.	500—278
KGB	Tacoma Daily Ledger,	Tacoma, Wash.	50—252
KGG	Hallock & Watson Radio Service,	Portland, Ore.	50—360
KGN	Northwestern Radio Mfg. Co.,	Portland, Ore.	100—360
KGO	General Electric Co.,	Oakland, Calif.	1000—312
KGU	Marion A. Mulrony,	Honolulu, Hawaii	500—360
KGW	Portland Morning Oregonian,	Portland, Ore.	500—492
KGY	St. Martins College,	Lacey, Wash.	5—258
KHJ	Times Mirror Co.,	Los Angeles, Calif.	500—395
KHO	Louis Wasmer,	Seattle, Wash.	100—360
KJFU	Central Power Co.,	Kearney, Neb.	10—234
KJO	C. O. Gould,	Stockton, Calif.	5—273
KJR	Northwest Radio Service,	Seattle, Wash.	100—270
KJS	Bible Institute of	Los Angeles, Calif.	750—360
KLS	Warner Bros. Radio Supplies Co.,	Oakland, Calif.	250—360
KLX	Tribune Publishing Co.,	Oakland, Calif.	250—509
KLZ	Reynolds Radio Co.,	Denver, Colo.	500—360
KMJ	San Joaquin Lt. & Power Corp.,	Fresno, Calif.	50—248
KMO	Love Electric Co.,	Tacoma, Wash.	10—360
KNT	Walter Hemrich,	Kukak Bay, Alaska	100—263
KNX	Electric Lighting Supply Co.,	Los Angeles, Calif.	100—360
KOB	New Mexico College of Agriculture and Mechanic Arts, State	College, N. M.	500—360
KOP	Detroit Police Dept.,	Detroit, Mich.	500—286
KPO	Hale Bros.,	San Francisco, Cal.	500—423
KQP	Apple City Radio Club,	Hood River, Ore.	10—360
KQV	Doubleday Hill Electric Co.,	Pittsburgh, Pa.	500—270
KQW	Chas. D. Herrold,	San Jose, Calif.	50—360
KRE	Berkeley Daily Gazette,	Berkeley, Calif.	50—275
KSD	Post Dispatch (Pulitzer Pub. Co.),	St. Louis, Mo.	500—546
KTW	First Presbyterian Church,	Seattle, Wash.	500—360
KUO	Examiner Printing Co.,	San Francisco, Calif.	150—360
KUY	Coast Radio Co.,	El Monte, Calif.	50—256
KWG	Portable Wireless Telephone Co.,	Stockton, Calif.	50—360
KWH	Los Angeles Examiner,	Los Angeles, Calif.	250—360
KYQ	Electric Shop,	Honolulu, Hawaii	100—270
KYW	Westinghouse Electric & Mfg. Co.,	Chicago, Ill.	1000—536
KZM	Preston D. Allen,	Oakland, Calif.	100—360
KZV	Wenatchee Battery & Motor Co.,	Wenatchee, Wash.	50—360
WAAB	Valdemar Jensen,	New Orleans, La.	100—268
WAAC	Tulane University,	New Orleans, La.	400—360
WAAD	Ohio Mechanics Institute,	Cincinnati, Ohio	25—360
WAAF	Chicago Daily Drover's Journal,	Chicago, Ill.	200—286
WAAM	I. R. Nelson Co.,	Newark N. J.	250—263
WAAN	University of Missouri,	Columbia, Mo.	50—254
WAAW	Omaha Grain Exchange,	Omaha, Neb.	500—360
WABA	Lake Forest College,	Lake Forest, Ill.	100—266
WABB	Harrisburg Sporting Goods Co.,	Harrisburg, Pa.	10—256
WABD	Parker High School,	Dayton, Ohio	5—283
WABE	Young Men's Christian Association,	Washington, D. C.	100—283
WABG	Arnold Edwards Piano Co.,	Jacksonville, Fla.	10—275
WABH	Lake Shore Tire Co.,	Sandusky, Ohio	10—240
WABI	Bangor Railway & Electric Co.,	Bangor, Maine	100—240
WABL	Connecticut Agricultural College,	Storrs, Conn.	100—283
WABM	F. E. Doherty Automotive & Radio Equipment Co.,	Saginaw, Mich.	100—254
WABN	Ott Radio, Inc.,	LaCrosse, Wis.	250—244
WABO	Lake Ave. Baptist Church,	Rochester, N. Y.	10—283
WABP	Robert F. Weinig,	Dover, Ohio	100—266
WABQ	Haverford College Radio Club,	Haverford, Pa.	50—261
WABR	Scott High School,	Toledo, Ohio	50—270
WABS	Essex Manufacturing Co.,	Newark, N. J.	50—244

Call Letters	Name	Location	Power & Wave Length
WABT	Holliday-Hall,	Washington, Pa.	100—252
WABU	Victor Talking Machine Co.,	Camden, N. J.	50—226
WABV	John H. De Witt,	Nashville, Tenn.	20—263
WABW	College of Wooster,	Wooster, Ohio	20—234
WABX	Henry B. Joy,	Mount Clemens, Mich. (near)	150—270
WABY	John Magaldi, Jr.,	Philadelphia, Pa.	50—242
WABZ	Coliseum Place Baptist Church,	New Orleans, La.	50—263
WBAA	Purdue University,	West Lafayette, Ind.	250—360
WBAH	The Dayton Co.,	Minneapolis, Minn.	500—417
WBAN	Wireless Phone Corporation,	Paterson, N. J.	100—244
WBAO	James Millikin University,	Decatur, Ill.	50—360
WBAP	Wortham-Carter Publishing Co. (Star-Telegram),	Fort Worth, Texas	750—476
WBAV	Erner & Hopkins Co.,	Columbus, Ohio	500—390
WBAX	John H. Stenger, Jr.,	Wilkes-Barre, Pa.	20—360
WBAY	The Western Electric Co.,	N. Y.	500—492
WBBA	Newark Radio Laboratories,	Newark, Ohio	10—240
WBBD	Barbey Battery Service,	Reading, Pa.	50—234
WBBF	George School of Technology,	Atlanta, Ga.	500—270
WBBG	Irving Vermilya,	Mattapoisett, Mass.	500—248
WBBH	J. Irving Bell,	Port Huron, Mich.	50—246
WBBJ	Neel Electric Co.,	West Palm Beach, Fla.	50—258
WBBL	Grace Covenant Church,	Richmond, Va.	5—283
WBBM	Frank Atlas Produce Co.,	Lincoln, Ill.	200—226
WBBN	A. B. Blake,	Wilmington, N. C.	10—275
WBBO	Michigan Limestone & Chemical Co.,	Rogers, Mich.	500—250
WBBP	Petoskey High School,	Petoskey, Mich.	10—246
WBBQ	Frank Crook,	Pawtucket, R. I.	50—252
WBBR	Peoples Pulpit Association,	Rossville, N. Y.	500—273
WBBS	First Baptist Church,	New Orleans, La.	100—250
WBBT	Lloyd Brothers,	Philadelphia, Pa.	5—234
WBBU	Jenks Motor Sales Co.,	Monmouth, Ill.	10—224
WBBV	Johnstown Radio Co.,	Johnstown, Pa.	5—248
WBBW	Ruffner Junior High School,	Norfolk, Va.	50—222
WBBY	Washington Light Infantry,	Charleston, S. C.	10—268
WBBZ	Noble B. Watson,	Indianapolis, Ind.	50—227
WBS	D. W. May (Inc.),	Newark, N. J.	50—360
WBT	Southern Radio Corp.,	Charlotte, N. C.	500—360
WBZ	Westinghouse Electric & Mfg. Co.,	Springfield, Mass.	1000—337
WCAD	St. Lawrence University,	Canton, N. Y.	250—280
WCAE	Kaufman & Baer Co.,	Pittsburgh, Pa.	500—462
WCAG	Clyde R. Randall,	New Orleans, La.	100—268
WCAH	Entrekin Electric Co.,	Columbus, Ohio	100—286
WCAJ	Nebraska Wesleyan University,	University Place, Neb.	500—360
WCAK	Alfred P. Daniel, Asst. Division Mgr., A. R. R. L.,	Houston, Texas	10—263
WCAL	St. Olaf College,	Northfield, Minn.	500—360
WCAM	Villanova College,	Villanova, Pa.	150—360
WCAO	The Sanders and Stayman Co.,	Baltimore, Md.	50—360
WCAP	Chesapeake & Potomac Telephone Co.,	Washington, D. C.	500—469
WCAR	Southern Radio Corp. of Texas,	San Antonio, Texas	100—360
WCAS	Wm. Hood Dunwoody Industrial Institute,	Minneapolis, Minn.	100—280
WCAT	South Dakota State School of Mines,	Rapid City, S. D.	50—240
WCAU	Durham & Co.,	Philadelphia, Pa.	250—286
WCAV	J. C. Dice Electric Co.,	Little Rock, Ark.	20—360
WCAX	University of Vermont,	Burlington, Vt.	50—360
WCAZ	Carthage College,	Carthage, Ill.	50—246
WCBA	Charles W. Humbach,	Allentown, Pa.	10—280
WCBC	University of Michigan,	Ann Arbor, Mich.	200—280
WCBD	Wilbur G. Voliva,	Zion, Ill.	500—345
WCBE	Uhalt Radio Co.,	New Orleans, La.	5—263
WCBF	Paul J. Miller,	Pittsburgh, Pa.	50—236
WCBG	Howard S. Williams,	Pascagoula, Miss. (portable)	10—268

Insure your copy reaching you each month. Subscribe to Science and Invention—$2.50 a year. Experimenter Publishing Co., 53 Park Place, N. Y. C.

Call Letters	Name	Location	Power & Wave Length
WCBH	University of Mississippi, Oxford, Miss. (near)		20—242
WCBI	Nicoll, Duncan & Rush, Bemis, Tenn.		50—240
WCBJ	J. C. Mans, Jennings, La.		20—244
WCBK	E. Richard Hall, St. Petersburg, Fla.		500—266
WCBL	Northern Radio Mfg. Co., Houlton, Me.		50—280
WCBM	Charles Schwarz, Baltimore, Md.		50—229
WCBN	James P. Boland, Lieutenant, U. S. A., 3d F. A., Fort Benjamin Harrison, Ind.		50—266
WCBO	Radio Shop (Inc.), Memphis, Tenn.		20—250
WCBQ	First Baptist Church, Nashville, Tenn.		100—236
WCBR	Charles H. Messter, Providence, R. I. (portable)		5—246
WCBT	Clark University, Worcester, Mass.		250—238
WCBU	Arnold Wireless Supply Co., Arnold, Pa.		50—254
WCBV	Tullahoma Radio Club, Tullahoma, Tenn.		10—252
WCBW	George P. Rankin, Jr., and Maitland Solomon, Macon, Ga.		10—226
WCBX	Radio Shop of Newark (Herman Lubinsky), Newark, N. J.		100—233
WCBY	Forks Electrical Shop, Buck Hill Falls, Pa.		10—268
WCBZ	Coppotelli Brothers Music House, Chicago Heights, Ill.		50—248
WCK	Stix Baer & Fuller Dry Goods Co., St. Louis, Mo.		100—360
WCM	University of Texas, Austin, Texas		500—360
WCX	The Detroit Free Press, Detroit, Mich.		500—517
WDAE	Tampa Daily Times, Tampa, Fla.		250—360
WDAF	Kansas City Star, Kansas City, Mo.		500—411
WDAG	J. Laurance Martin, Amarillo, Texas		100—263
WDAH	Trinity Methodist Church (South), El Paso, Texas		50—268
WDAK	The Courant, Hartford, Conn.		100—261
WDAO	Automotive Electric Co., Dallas, Texas		50—360
WDAP	Drake Hotel (Whitestone Co.), Chicago, Ill.		1000—360
WDAR	Lit Bros., Philadelphia, Pa.		500—395
WDAS	Samuel A. Waite, Worcester, Mass.		10—360
WDAU	Slocum & Kilburn, New Bedford, Mass.		100—360
WDAY	Radio Equipment Corp., Fargo, N. D.		50—244
WDBA	Fred Ray, Columbus, Ga.		20—236
WDBB	A. H. Waite & Co., Taunton, Mass.		10—229
WDBC	Kirk Johnson & Co., Lancaster, Pa.		50—258
WDBD	Herman E. Burns, Martinsburg, W. Va.		5—268
WDBE	Gilham-Schoen Electric Co., Atlanta, Ga.		10—252
WDBF	Robert G. Phillips, Youngstown, Ohio		50—246
WDBH	C. T. Sherer Co., Worcester, Mass.		100—268
WDBJ	Richardson-Wayland Electrical Corp., Roanoke, Va.		20—229
WDBK	M. F. Bros. Furniture, Hardware & Radio Co., Cleveland Ohio		100—248
WDBN	Maine Electric Light & Power Co., Bangor, Me.		5—252
WDBO	Rollins College, Winter Park, Fla.		50—240
WDBP	Superior State Normal School, Superior, Wis.		50—261
WDBQ	Morton Radio Supply Co., Salem, N. J.		10—234
WDBR	Tremont Temple Baptist Church, Boston, Mass.		100—256
WDBS	S. M. K. Radio Corp., Dayton, Ohio		5—283
WDM	The Church of the Covenant, Washington, D. C.		50—234
WDZ	J. L. Bush, Tuscola, Ill.		10—278
WEAA	Frank D. Fallain, Police Building, Flint, Mich.		10—280
WEAF	American Telephone & Telegraph Co., New York, N. Y.		1000—492
WEAH	Wichita Board of Trade, Wichita, Kan.		50—280
WEAI	Cornell University, Ithaca, N.Y.		500—286
WEAJ	University of South Dakota, Vermillion, S. D.		100—283
WEAM	Borough of North Plainfield (W. Gibson Buttfield), North Plainfield, N. J.		150—286
WEAN	Shepard Co., Providence, R. I.		100—273
WEAO	The Ohio State University, Columbus, Ohio		500—360
WEAP	Mobile Radio Co., Mobile, Ala.		100—360
WEAR	Evening News Publishing Co., Baltimore, Md.		50—261
WEAU	Davidson Bros. Company, Sioux City, Iowa		100—360
WEAY	Will Horwitz, Jr., Houston, Texas		500—360
WEB	Benwood Co., St. Louis, Mo.		500—273
WEBH	Edgewater Beach Hotel Co., Chicago, Ill.		1000—378

Call Letters	Name	Location	Power & Wave Length
WEBP	E. Budd Peddicord,	New Orleans, La.	10—242
WEV	Hurlburt-Still Electrical Co.,	Houston, Texas	50—360
WEW	St. Louis University,	St. Louis, Mo.	100—280
WFAA	The Dallas News, The Dallas Journal,	Dallas, Texas	500—476
WFAB	Carl F. Woese,	Syracuse, N. Y.	100—234
WFAF	H. C. Spratley Radio Co.,	Poughkeepsie, N. Y.	20—360
WFAH	Electric Supply Co.,	Port Arthur, Texas	150—236
WFAJ	Hi-Grade Wireless Instrument Co.,	Asheville, N. C.	100—360
WFAM	Times Publishing Co.,	St. Cloud, Minn.	10—273
WFAN	Hutchinson Electric Service Co.,	Hutchinson, Minn.	100—360
WFAQ	Missouri Wesleyan College,	Cameron, Mo.	10—360
WFAV	University of Nebraska, Dept. E. E.,	Lincoln, Neb.	500—275
WFBW	Ainsworth-Gates Radio Co.,	Cincinnati, Ohio	750—309
WFI	Strawbridge & Clothier,	Philadelphia, Pa.	500—395
WGAL	Lancaster Elec. Supply & Const. Co.,	Lancaster, Pa.	10—248
WGAN	Cecil E. Lloyd,	Pensacola, Fla.	50—360
WGAQ	Glenwood Radio Corp. (W. G. Patterson),	Shreveport, La.	150—252
WGAW	Ernest C. Albright,	Altoona, Pa.	100—261
WGAZ	The South Bend Tribune,	South Bend, Ind.	250—360
WGI	American Radio & Research Corp.,	Medford Hillside, Mass.	100—360
WGL	Thomas F. J. Howlette,	Philadelphia, Pa.	500—360
WGR	Federal Telephone and Telegraph Co.,	Buffalo, N. Y.	750—319
WGV	Interstate Electric Co.,	New Orleans, La.	100—242
WGY	General Electric Co.,	Schenectady, N. Y.	1000—380
WHA	University of Wisconsin,	Madison, Wis.	500—360
WHAA	State University of Iowa,	Iowa City, Iowa	100—484
WHAB	Clark W. Thompson,	Galveston, Texas	200—360
WHAD	Marquette University,	Milwaukee, Wis.	100—280
WHAG	University of Cincinnati,	Cincinnati, Ohio	100—222
WHAH	Hafer Supply Co.,	Joplin, Mo.	250—283
WHAK	Roberts Hdwe. Co.,	Clarksburg, W. Va.	15—258
WHAM	University of Rochester (Eastman School of Music),	Rochester, N. Y.	100—283
WHAR	Seaside House,	Atlantic City, N. J.	10—231
WHAS	Courier-Journal and Louisville Times,	Louisville, Ky.	500—400
WHAV	Wilmington Electrical Specialty Co., Inc.,	Wilmington, Del.	50—360
WHAZ	Rensselaer Polytechnic Institute,	Troy, N. Y.	500—380
WHB	Sweeney School Co.,	Kansas City, Mo.	500—411
WHK	Radiovox Co. (Warren R. Cox),	Cleveland, Ohio	100—360
WHN	George Schubel, Loew's State Theatre Bldg.,	New York, N. Y.	500—360
WHO	Bankers Life Co.,	Des Moines, Iowa	500—526
WIAB	Joslyn Automobile Co.,	Rockford, Ill.	50—252
WIAC	Galveston Tribune,	Galveston, Texas	100—360
WIAD	Howard R. Miller,	Philadelphia, Pa.	100—254
WIAF	Gustav A. DeCortin,	New Orleans, La.	10—234
WIAI	Heer Stores Co.,	Springfield, Mo.	20—252
WIAJ	Fox River Valley Radio Co.,	Neenah, Wis.	20—224
WIAK	Journal-Stockman Co.,	Omaha, Neb.	250—278
WIAO	School of Engineering of Milwaukee,	Milwaukee, Wis.	100—246
WIAQ	Chronicle Publishing Co.,	Marion, Ind.	10—226
WIAS	Home Electric Co.,	Burlington, Iowa	100—283
WIK	K & L Electric Co.,	McKeesport, Pa.	100—234
WIL	Continental Electrical Supply Co.,	Washington, D. C.	5—360
WIP	Gimbel Bros.,	Philadelphia, Pa.	500—509
WIAY	Woodward & Lothrop,	Washington, D. C.	100—273
WJAB	American Electric Co.,	Lincoln, Neb.	100—229
WJAD	Jackson's Radio Engineering Laboratories,	Waco, Texas	150—360
WJAG	The Norfolk Daily News,	Norfolk, Neb.	250—283
WJAK	Clifford L. White,	Greentown, Ind.	30—254
WJAM	D. M. Perham,	Cedar Rapids, Iowa	20—268
WJAN	Peoria Star,	Peoria, Ill.	100—280
WJAQ	Capper Publications,	Topeka, Kan.	100—360

Call Letters	Name	Location	Power & Wave Length
WJAR	The Outlet Co. (J. Samuels & Bro.),	Providence, R. I.	500—360
WJAS	Pittsburgh Radio Supply Co.,	Pittsburgh, Pa.	250—250
WJAT	Kelley-Vawter Jewelry Co.,	Marshall, Mo.	10—360
WJAX	Union Trust Co.,	Cleveland, Ohio	500—390
WJAZ	Chicago Radio Laboratory,	Chicago, Ill.	20—268
WJD	Denison University,	Granville, Ohio	10—229
WJX	De Forest Radio Telephone & Telegraph Co.,	New York, N. Y.	500—360
WJY	R. C. A.,	New York, N. Y.	500—405
WJZ	R. C. A.,	New York, N. Y.	500—455
WKAA	H. F. Paar,	Cedar Rapids, Iowa	50—268
WKAD	Charles Looff (Crescent Park),	East Providence, R. I.	10—240
WKAF	W. S. Radio Supply Co.,	Wichita Falls, Texas	100—360
WKAN	United Battery Service Co.,	Montgomery, Ala.	15—226
WKAP	Dutee W. Flint,	Cranston, R. I.	50—360
WKAQ	Radio Corp. of Porto Rico,	San Juan, Porto Rico	100—360
WKAR	Michigan Agriculture College,	East Lansing, Mich.	500—280
WKAV	Laconia Radio Club,	Laconia, N. H.	50—254
WKY	W. K. Y. Radio Shop,	Oklahoma City, Okla.	100—360
WLAG	Cutting & Washington Radio Corp.,	Minneapolis, Minn.	500—417
WLAH	Samuel Woodworth,	Syracuse, N. Y.	100—234
WLAJ	Waco Electrical Supply Co.,	Waco, Texas	150—360
WLAK	Vermont Farm Machine Corp.,	Bellows Falls, Vt.	500—360
WLAL	Naylor Electrical Co. (Sim Naylor),	Tulsa, Okla.	100—360
WLAP	W. V. Jordan,	Louisville, Ky.	20—360
WLAQ	Arthur E. Schilling,	Kalamazoo, Mich.	20—283
WLAV	Electric Shop,	Pensacola, Fla.	20—254
WLAW	Police Dept.,	New York, N. Y.	500—360
WLAX	Putnm Electric Co.,	Greencastle, Ind.	10—231
WLB	University of Minnesota,	Minneapolis, Minn.	5—360
WLBL	Wisconsin Department of Markets,	Stevens Point, Wis.	500—278
WLS	Sears, Roebuck & Co.,	Chicago, Ill.	345—500
WLW	Crosley Manufacturing Co.,	Cincinnati, Ohio	500—309
WMAB	Radio Supply Co.,	Oklahoma City, Okla.	100—360
WMAC	Clive B. Meredith,	Cazenovia, N. Y.	200—261
WMAF	Round Hills Radio Corp.,	Dartmouth, Mass. 100—	500—360
WMAH	General Supply Co.,	Lincoln, Neb.	100—254
WMAJ	Drovers Telegram Co.,	Kansas City, Mo.	250—275
WMAK	Norton Laboratories,	Lockport, N. Y.	500—273
WMAL	Trenton Hardware Co.,	Trenton, N. J.	50—256
WMAN	First Baptist Church,	Columbus, Ohio	10—286
WMAQ	Chicago Daily News,	Chicago, Ill.	500—448
WMAV	Alabama Polytechnic Inst.,	Auburn, Ala.	500—250
WMAY	Kingshighway Presbyterian Church,	St. Louis, Mo.	100—280
WMAZ	Mercer University,	Macon, Ga.	100—261
WMC	Commercial,	Memphis, Tenn.	500—500
WMU	Doubleday-Hill Electric Co.,	Washington, D. C.	100—261
WNAC	Shepard Stores,	Boston, Mass.	100—278
WNAD	University of Oklahoma,	Norman, Okla.	50—360
WNAL	R. J. Rockwell,	Omaha, Neb.	20—266
WNAN	Syracuse Radio Telephone Co.,	Syracuse, N. Y.	100—286
WNAP	Wittenberg College,	Springfield, Ohio	100—275
WNAQ	Charleston Radio Electric Co.,	Charleston, S. C.	10—360
WNAR	C. C. Rhodes,	Butler, Mo.	20—231
WNAS	Texas Radio Corp. & Austin Statesman,	Austin, Texas.	100—360
WNAT	Lennig Bros. Co. (Fred'k Lennig),	Philadelphia, Pa.	100—360
WNAV	People's Telephone & Telegraph Co.,	Knoxville, Tenn.	500—236
WNAW	Henry Kunzman,	Fort Monroe, Va.	5—360
WNAX	Dakota Radio Apparatus Co.,	Yankton, S. D.	100—244
WNJ	The Shotton Radio Mfg. Co., Inc.,	Albany, N. Y.	55—360
WOAC	Page Organ Co. (H. P. Mouse),	Lima, Ohio	50—266
WOAE	Midland College,	Fremont, Neb.	20—360
WOAF	Tyler Commercial College,	Tyler, Texas	10—360
WOAG	Apollo Theatre (Belvidere Amusement Co.),	Belvidere, Ill.	100—273
WOAH	Palmetto Radio Corp.,	Charleston, S. C.	10—360
WOAI	Southern Equipment Co.,	San Antonio, Texas	500—385

Call Letters	Name	Location	Power & Wave Length
WOAN	Vaughn Conservatory of Music,	Lawrenceburg, Tenn.	200—360
WOAO	Lyradion Mfg. Co.,	Mishawaka, Ind.	50—360
WOAP	Kalamazoo College,	Kalamazoo, Mich.	50—283
WOAR	Henry P. Lundskow,	Kenosha, Wis.	50—229
WOAT	Boyd M. Hamp,	Wilmington, Del.	100—360
WOAV	2nd Battalion, 112th Inf.,	P. N. G., Erie, Pa.	50—242
WOAW	Woodmen of the World,	Omaha, Neb.	500—526
WOAX	Franklyn J. Wolff (Monument Pottery Co.),	Trenton, N. J.	500—240
WOC	The Palmer School of Chiropractic,	Davenport, Iowa	500—484
WOI	Iowa State College,	Ames, Iowa	500—360
WOK	Pine Bluff Co.,	Pine Bluff, Ark.	500—360
WOO	John Wanamaker,	Phila., Pa.	500—509
WOQ	Western Radio Co.,	Kansas City, Mo.	500—360
WOR	L. Bamberger & Co.,	Newark, N. J.	500—405
WOS	Missouri State Marketing Bureau,	Jefferson City, Mo.	500—441
WPAB	Pennsylvania State College,	State College, Pa.	500—283
WPAC	Donaldson Radio Co.,	Okmulgee, Okla.	200—360
WPAJ	Doolittle Radio Corp.,	New Haven, Conn.	100—268
WPAK	North Dakota Agricultural College,	Agricultural College, N. D.	50—360
WPAL	Avery & Loeb Electric Co.,	Columbus, Ohio	500—286
WPAM	Auerbach & Guettel,	Topeka, Kan.	100—360
WPAR	Ward Battery & Radio Co.,	Beloit, Kan.	10—236
WPAT	St. Patricks Cathedral,	El Paso, Texas	20—360
WPAU	Concordia College,	Moorhead, Minn.	10—360
WPAZ	Dr. John R. Koch,	Charleston, W. Va.	10—273
WQAA	Horace A. Beale, Jr.,	Parkesburg, Pa.	500—360
WQAC	E. B. Gish,	Amarillo, Texas	100—234
WQAE	Moore Radio News Station,	Springfield, Vt.	50—275
WQAF	Sandusky Register,	Sandusky, Ohio	5—240
WQAI	Coles County Telephone & Telegraph Co.,	Mattoon, Ill.	10—258
WQAM	Electrical Equipment Co.,	Miami, Fla.	100—283
WQAN	Scranton Times,	Scranton, Pa.	50—280
WQAO	Calvary Baptist Church,	New York, N. Y.	100—360
WQAQ	West Texas Radio Co. (Abilene Daily Reporter),	Abilene, Tex.	100—360
WQAS	Prince-Walter Co.,	Lowell, Mass.	100—266
WQAW	Catholic University,	Washington, D. C.	5—236
WQAX	Radio Equipment Co.,	Peoria, Ill.	100—360
WQJ	Calumet Baking Powder Co.,	Chicago, Ill.	500—448
WRAA	Rice Institute,	Houston, Texas	200—360
WRAF	The Radio Club (Inc.),	Laporte, Ind.	10—224
WRAH	Stanley N. Read,	Providence, R. I.	15—231
WRAL	Northern States Power Co.,	St. Croix Falls, Wis.	100—248
WRAM	Lombard College,	Galesburg, Ill.	100—244
WRAN	Black Hawk Electrical Co.,	Waterloo, Iowa	10—236
WRAO	St. Louis Radio Service Co.,	St. Louis, Mo.	10—360
WRAV	Antioch College,	Yellow Springs, Ohio	100—242
WRAW	Avenue Radio Shop,	Reading, Pa.	10—238
WRAX	Flexons Garage,	Gloucester City, N. J.	100—268
WRAY	Radio Sales Corp.,	Scranton, Pa.	10—280
WRBC	Immanuel Lutheran Church,	Valparaiso, Ind.	500—278
WRC	Radio Corp. of America,	Washington, D. C.	500—469
WRK	Doron Bros. Elec. Co.,	Hamilton, Ohio	200—360
WRL	Union College,	Schenectady, N. Y.	500—360
WRM	University of Illinois,	Urbana, Ill.	500—360
WRR	City of Dallas Police and Fire Signal Dept.,	Dallas, Texas	30—360
WRW	Tarrytown Radio Research Laboratory (Koenig Bros.),	Tarrytown, N. Y.	150—273
WSAB	South East Missouri State Teachers College,	Cape Girardeau, Mo.	100—360
WSAC	Clemson Agricultural College,	Clemson College, S. C.	500—360
WSAD	J. A. Foster Co.,	Providence, R. I.	150—261
WSAG	Loren V. Davis,	St. Petersburg, Fla.	10—244
WSAI	United States Playing Cards Co.,	Cincinnati, Ohio	500—309
WSAJ	Grove Cit College,	Grove City, Pa.	250—360

Call Letters	Name	Location	Power & Wave Length
WSAN	Allentown Radio Club,	Allentown, Pa.	10—229
WSAP	Seventh Day Adventist Church,	New York, N. Y.	250—263
WSAR	Doughty & Welch Elec. Co.,	Fall River, Mass.	100—254
WSAT	Donohoo-ware Hardware Co.,	Plainview, Texas	20—268
WSAU	Camp Marienfeld,	Chesham, N. H.	10—229
WSAV	Clifford W. Vick Radio Construction Co.,	Houston, Texas	100—360
WSAW	John J. Long, Jr.,	Canandaigua, N. Y.	5—275
WSAY	Irving Austin (Port Chester Chamber of Commerce),	Port Chester, N. Y.	100—233
WSAZ	Chase Electric Shop,	Pomeroy, Ohio	50—258
WSB	Atlanta Journal,	Atlanta, Ga.	500—429
WSL	J. & M. Electric Co.,	Utica, N. Y.	100—273
WSY	Alabama Power Co.,	Birmingham, Ala.	500—360
WTAB	Fall River Daily Herald Pub. Co.,	Fall River, Mass.	100—266
WTAC	Penn. Traffic Co.,	Johnstown, Pa.	150—275
WTAF	Louis J. Gallo,	New Orleans, La.	10—268
WTAG	Kern Music Co.,	Providence, R. I.	10—258
WTAJ	The Radio Shop,	Portland, Me.	10—236
WTAL	Toledo Radio & Elec. Co.,	Toledo, Ohio	10—252
WTAM	Willard Storage Battery Co.,	Cleveland, Ohio	1000—390
WTAP	Cambridge Radio & Elec. Co.,	Cambridge, Ill.	50—242
WTAQ	S. H. Van Gorden & Son,	Osseo, Wis.	100—254
WTAR	Reliance Elec. Co.,	Norfolk, Va.	100—280
WTAS	Charles E. Erbstein,	Elgin, Ill. (near)	500—286
WTAT	Edison Electric Illuminating Co.,	Boston, Mass. (portable)	100—244
WTAU	Ruegg Battery and Electric Co.,	Tecumseh, Neb.	10—242
WTAW	Agricultural & Mechanical College,	College Station, Texas	250—280
WTAX	Williams Hardware Co.,	Streator, Ill.	50—231
WTAY	Oak Leaves Broadcasting Station,	Oak Park, Ill.	500—283
WTAZ	Thomas J. McGuire,	Lambertville, N. J.	15—283
WTG	Kansas State Agricultural College,	Manhattan, Kan.	50—273
WWAB	Hoenig, Swern & Co. (John Rasmussen),	Trenton, N. J.	10—226
WWAC	Sanger Bros.,	Waco, Texas	50—360
WWAD	Wright & Wright, Inc.,	Philadelphia, Pa.	100—360
WWAE	L. J. Crowley,	Joliet, Ill.	500—227
WWAF	Galvin Radio Supply Co.,	Camden, N. J.	100—236
WWAO	Michigan College of Mines,	Houghton, Mich.	250—244
WWI	Ford Motor Co.,	Dearborn, Mich.	250—273
WWJ	Detroit News (Evening News),	Detroit, Mich.	500—517
WWL	Loyola University,	New Orleans, La.	100—280

CANADIAN STATIONS

CFAC	The Calgary Herald,	Calgary, Alta.	430
CFCA	Star Publishing & Printing Co.,	Toronto, Ont.	400
CFCF	Marconi Wireless Telegraph Co. of Canada,	Montreal, Que., Canada	440
CFCH	Abitibi Power & Paper Co.,	Iroquois Falls, Ont.	400
CFCJ	La Cie. de L'Evenement,	Quebec, P. Q.	410
CFCK	Radio Supply Co., Ltd.,	Edmonton, Alta.	410
CFCL	Centennial Methodist Church,	Victoria, B. C.	400
CFCN	W. W. Grant Radio, Ltd.,	Calgary, Alta.	440
CFCO	Semmelhaack-Dickson, Ltd.,	Bellevue, Que.	450
CFCQ	Radio Specialties, Ltd.,	Vancouver, B. C.	450
CFCR	Laurentide Air Service, Ltd.,	Sudbury, Ont.	410
CFCW	The Radio Shop,	London, Ont.	420
CFDC	Sparks Co.,	Nanaimo, B. C.	430
CFQC	The Electric Shop, Ltd.,	Saskatoon, Sask.	400
CFRC	Queens University,	Kingston, Ont.	450
CFUC	University of Montreal,	Montreal, Que.	400
CFXC	Westminster Trust Co.,	New Westminster, B. C.	440
CHAC	Radio Engineers,	Halifax, N. S.	400
CHBC	The Alhertan Publishing Co.,	Calgary, Alta.	410
CHCB	Marconi Wireless Telegraph Co. of Canada, Ltd.,	Toronto, Ont.	440
CHCD	Canadian Wireless & Elec. Co.,	Quebec, Que.	410

Call Letters	Name	Location	Power & Wave Length
CHCE	Western Canada Radio Supply,	Victoria, B. C.	400
CHCL	The Vancouver Merchants Exchange, Ltd.,	Vancouver, B. C.	440
CHCM	Riley & McCormack, Ltd.,	Calgary, Alta.	440
CHCS	The Hamilton Spectator,	Hamilton, Ont.	410
CHYC	Northern Electric Co., Ltd.,	Montreal, Que.	341
CJCA	The Edmonton Journal, Ltd.,	Edmonton, Alta.	450
CJCM	J. L. Phillipe Landry,	Monti Joli, Que.	400
CJGC	London Free Press Printing Co.,	London, Ont.	430
CJCD	The T. Eaton Co., Ltd.,	Toronto, Ont.	410
CJCE	Sprott-Shaw Radio Co.,	Vancouver, B. C.	420
CJCI	Maritime Radio Corp., Ltd.,	St. John, N. B.	400
CJCN	Simons Agnew & Co.,	Toronto, Ont.	410
CJCX	Percival W. Shackleton,	Olds, Alta.	400
CJSC	The Evening Telegram,	Toronto, Ont.	430
CKAC	La Presse Publishing Co., Ltd.,	Montreal, P. Q.	425
CKCD	Vancouver Daily Province,	Vancouver, B. C.	410
CKCE	Canadian Indp. Telephone Co.,	Toronto, Ont.	450
CKCH	Canadian National Railways,	Ottawa, Ont.	435
CKCK	Leader Publishing Co., Ltd.,	Regina, Sask.	420
CKCO	Dr. G. M. Geldert (For Ottawa Radio Assn.),	Ottawa, Ont.	400
CKCX	P. Burns & Co., Ltd.,	Calgary, Alta.	440
CKOC	Wentworth Radio Suply Co.,	Hamilton, Ont.	410
CKY	Manitoba Telephone System,	Winnipeg, Man.	450
CKYC	V. W. Odlum,	Vancouver, B. C.	400

BRITISH STATIONS

2LO	London		365
5IT	Birmingham		475
5WA	Cardiff		350
6BM	Bournemouth		385
2ZY	Manchester		375
5NO	Newcastle		400
5SC	Glasgow		420
2BD	Aberdeen		495
6SL	Sheffield (relay station)		303

FRENCH STATIONS

YN	Lyon	740	
FL	Paris (Eiffel Tower)	2600	
8AJ	Paris	1780	
ESP	Paris	450	

CUBAN STATIONS

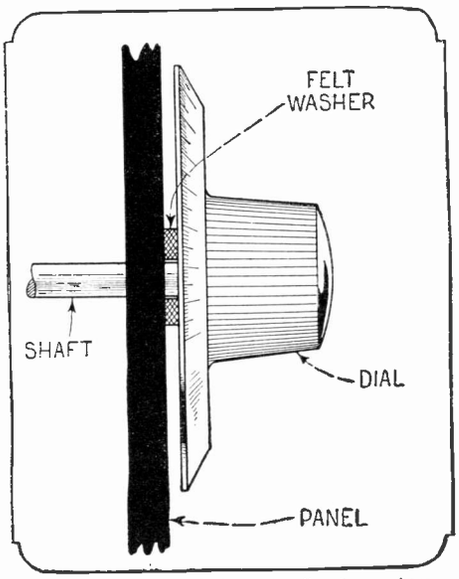
PWX	Cuban Telephone Co.,	Havana	400
2DW	Pedro Zayas,	Havana	300
2AB	Alberto S. de Bustamante,	Havana	240
2OK	Mario Garcia Vélez,	Havana	360
2BY	Frederick W. Borton,	Havana	260
2CX	Frederick W. Borton,	Havana	320
2EV	Westinghouse Elec. Co.,	Havana	220
2TW	Roberto E. Ramírez,	Havana	230
2HC	Heraldo de Cuba,	Havana	275
2LC	Luis Casas,	Havana	250
2KD	E. Sanchez de Fuentes,	Havana	350
2MN	Fausto Simón,	Havana	270
2MG	Manuel G. Salas,	Havana	280
2JQ	Raúl Pérez Falcón,	Havana	150
2KP	Alvaro Daza		200
2HS	Julio Power,	Havana	180
2OL	Oscar Collado,	Havana	290
2WW	Amadeo Sáenz,	Havana	210
5EV	Leopoldo V. Figueroa,	Colón	360
6KW	Frank H. Jones,	Tuinucü	340
6KJ	Frank H. Jones,	Tuinucü	275
6CX	Antonio T. Figueroa,	Cienfuegos	170
6DW	Eduardo Terry,	Cienfuegos	225
6BY	José Ganduxe,	Cienfuegos	300
6AZ	Valentin Ulivarri,	Cienfuegos	200
6EV	Josefa Alvarez,	Caibarién	225
7AZ	Pedro Nogueras,	Camaguey	225
7BY	Salvador Rionda,	Camaguey	350
8AZ	Alfredo Broocks,	Santiago de Cuba	240
8BY	Alberto Ravelo,	Santiago de Cuba	250
8FU	Andrés Vinnet,	Santiago de Cuba	225
8DW	Pedro C. Anduz,	Santiago de Cuba	275
8EV	Edurado Mateos,	Santiago de Cuba	180
8GT	Juan F. Chibas,	Santiago de Cuba	260

RADIO WRINKLES

EDITED BY
LEON L. ADELMAN, 2AFS

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 prizes 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.

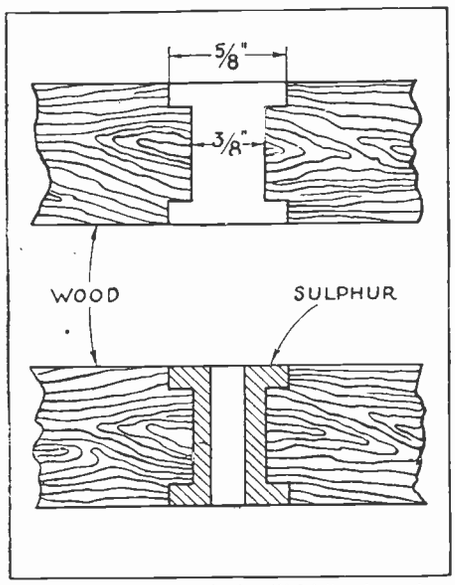
IMPROVISED BEARING



The bearings of radio instruments often become hopelessly loosened so that it is impossible to set the dial at any desired point. This may be overcome by inserting a small felt washer on the shaft between the dial and the panel. The dial is tightened on the shaft with a slight tension on the washer. This will also prevent the dial from scratching the panel.

—B. G. Switzer.

PANEL INSULATION



How to get the benefit of a beautiful full-grain wooden panel and still overcome the disadvantage of leakage in one is readily seen in the illustration. A hole is drilled and filled with melted sulphur, after which a hole is drilled through the sulphur, large enough to accommodate the shaft of the instrument.

—T. B. Marsden.

The Heavens in August

By ISABEL M. LEWIS, M.A.

(*Continued from page 369*)

this takes us only to the center of the Milky Way. If Dr. Shapley's estimates are correct, and there are some excellent reasons for believing that they are, the diameter of the entire Milky Way system of stars, that enormous equatorial belt of the heavens, is something like three hundred thousand light years.

In the little diamond-shaped constellation of Delphinus, popularly called Job's Coffin, which will now be seen in the eastern heavens, there is a small, faint object, shown by the great Mt. Wilson reflector to be a globular star cluster, a ball of brilliant suns and a small universe in itself. It is known merely by the catalogue number, N.G.C. 7006, but it is estimated that its distance from the earth is about 220,000 light years. It was the most distant object known until a few months ago when a still more distant cloud of stars, which resembles a small detached portion of the Milky Way, was found by Dr. Shapley to be of the order of a million light years away. This object known as N.G.C. 6822 was discovered some years ago by the late Prof. E. E. Barnard of the Yerkes Observatory, but it was not examined in detail and found to bear the marks of a universe of suns until recently. It lies in the direction of the constellation of Sagittarius but is far beyond the Milky Way system of stars.

Turning from a consideration of these incomprehensible distances let us find on the chart the little star known as 61 Cygni in the constellation of Cygnus which is one of the very nearest objects in the heavens, less than nine light years away. It is of special interest because it was the first star to yield an estimate of star disances. Its distance from the earth was first measured by the astronomer Bessel about seventy-five years ago. Now, by one way or another, the astronomer is able to estimate the distances of thousands of stars and only two or three have been found to be nearer than the little sixth magnitude star 61 Cygni. Wonderful vistas have been opened up into space with the aid of powerful telescopes since those days, until in our present conception of the universe the entire solar system is like a single atom, in a sea of space.

In the neighborhood of the Northern Cross in Cygnus the possessor of a small telescope will find many treasures. Even the smallest telescope will reveal the exquisite beauty of that finest of all double stars, Albireo, at the foot of the Cross. The two stars of which it consists are of beautifully contrasting shades of blue and gold.

Deneb, at the head of the Cross, is classed as one of the twenty brightest stars in the heavens, as is also the white star, Altair, in Aquila, to the southeast. Altair is one of the nearest stars, only sixteen light-years distant from the earth, but Deneb, in Cygnus, is one of the giants of the universe. If it were no farther away than Altair it would far outshine the planet Venus. It is probably several hundred light years distant from the earth, too far away for direct measurements of its parallax to give reliable estimates of its distance.

Among the planets this month Mars will come in for the lion's share of attention, for this is the year of its close opposition, the closest in over a century. It will surpass all stars and planets in brightness this month with the exception of Venus, which has now passed to the morning sky and is visible only before sunrise. Though not

above the horizon at the time for which our chart is given Mars will appear shortly after. It is now in the constellation of Aquarius, which is just coming into view on the southeastern horizon. Mars is too far south to be seen to the best advantage in our latitudes, but observers in the tropics and in the southern hemisphere will obtain exceptionally fine views. On August 1st the distance of Mars from the earth will be 37,520,000 miles, on August 15th, 35,000,000 miles, on August 22nd, the date of its opposition and nearest approach to the earth, 34,639,000 miles and on August 31st, 35,114,000 miles. It will increase in brightness from the first of August to the twenty-second and will then gradually become less brilliant. During the last two weeks in August it will be about one magnitude or two and a half times brighter than Jupiter, which is now also in fine position for observation, being a short distance to the northeast of Antares in Scorpio and a little to the southwest of the meridian at the time indicated on the chart. Saturn is now close to the southwestern horizon in Virgo and will soon disappear from view.

REGARDING CONTRA-PROPELLERS

With reference to article on the contra-propeller by Dr. Armin Demuth, which appeared in our February, 1924 number, we are requested by the TH. Goldschmidt Corporation of New York City, to state that they have the exclusive sales and exploitation rights to this device in America, Canada and Mexico, and are the only people authorized to make quotations, grant licenses, etc. Dr. Demuth is not connected with that organization.

Book Review

FINDING ONESELF IN THE UNIVERSE. By Jean Berry. Stiff cloth covers, 6" x 8¾", 210 pages. Published by G. P. Putnam's Sons, New York City.

In this interesting little book Mrs. Berry teaches her readers to know themselves, to learn the technique of living in order to make life more joyful. The laws of life are well-known, and it is the purpose of the authoress to present them in a clear and concise way, so that a person with the average understanding will be able to see the points which she strives to bring forth in each of her lessons. The subject is taken from a common viewpoint, and the reader should find many an inspiration therein. The authoress tells us to feel hatred, know its feeling, and then feel it less and less. She further tells us that we all suffer from disorders in the world, and in a measure we are all responsible for it. If each and everyone of us would try to put his own life in order, he would achieve happiness for himself and good for the world. We find out what a spirit is, and to know the spirit, is in her opinion, as important as to know your body and what to do with it. Know thyself to the extent of knowing that your desires sway your body feeling. Learn what health is, and attain health bodily and mental. In one of the chapters, however, Mrs. Berry asserts that every plant, every animal has a soul. To this extent the reviewer does not agree with Mrs. Berry, but that does not mean that the book is not worthy of consideration, or that the reviewer's ideas will be held by others who may read the work.

PHENOMENA OF MATERIALISATION. By Baron Von Schrenck Notzing. Translated by E. E. Fournier d'Albe, D.Sc. Stiff cloth covers, 7" x 10", 340 pages, 225 illustrations. Published by E. P. Dutton & Co., New York City.

As an investigator into the spirit world, Baron Von Schrenck Notzing is very well-known. The author takes us into his confidence, and publishes in this remarkable work the results he has obtained with the medium "Eva C" and the Polish medium "Stanislava P." He does not seek to explain the phenomena or how they were produced, but carefully recites the details of and precautions taken during the séance to prevent fraud. In his introduction he mentions the various investigators who have been completely fooled by various mediums

who for years were thought to be absolutely psychic. Eusapia, although thought to be a medium of remarkable powers and declared free of fraud by some of America's foremost magicians, was caught in many a tight fix and found to be using mechanical or other assistance in order to produce her effects. Baron Van Schrenck Notzing admits that fraud has been practised in many cases, but he does not believe that the element of fraud could have entered into his investigations, because he took great care to see that such would be quite impossible. That the Baron was in earnest in these investigations, but failed in freeing all his records from the element of fraud, in spite of the fact that for eight months detectives followed Mme. Bisson and Eva C. has been repeatedly asserted. Investigations in telekinetic phenomena, that is, the action of some force upon inanimate objects, such as moving tables, levitation, auditory impressions, writing, etc., are not in evidence in this work, but teleplastic phenomena are well illustrated.

Throughout the book a record is made of the settings, the positions of the various individuals in the room, the position of the medium, and the precautions taken against fraud, are also clearly shown. However, in looking through the work one must even doubt that this great scientist was not fooled. Photographs themselves which may have meant a lot to Dr. Notzing, seem to the unbiased investigator to look more like paper cuts, gauze structures, pieces of ribbon and other miscellaneous material. Some of these materializations occur when both hands and feet were held, as the flashlight photographs clearly show. The work is remarkable from beginning to end. Dr. Notzing has done a great deal of work in compiling this volume, and he is impartial and painstakingly thorough. The phenomena which he describes occurred over a period of more than four years with photographs taken hy himself and his collaborators. Some of these include microscopic photographs of hair, etc., and attempts were made to duplicate some of the phenomena by artificial means which fell far short of the mark. The series of photographs in the book are unparalleled and the book itself is a storehouse of knowledge written by an able investigator, and contains a mass of detail which will be found of value in any discussion on spiritistic phenomena.

EINE MONDFAHRT. By Karl Meir-Lemgo. Hard covers, 5¼" x 7¾", 94 pages, with many illustrations. Published by Kosmos, Stuttgart, Germany.

Our German contemporary *Kosmos*, at the head of its first page, shows a picture of a cat of sable hue silhouetted against the rising moon, and this begins the story. It treats in quite a charming and fantastic way of two children who visited our satellite, the Moon, and tells of what they saw there, and of their experiences on a comet. Quite a quantity of nice little illustrations pictures all that happened them, and we are sure that those of our readers who read the German language will be greatly delighted if they peruse the story of the adventures of these little people. Seriously speaking, the illustrations are quite impressive, and the fact that the artist shows our little friends protected by an umbrella looking up at the moon's pinnacles, and the various features of the world of our satellite, does no harm, but makes the presentation more vivid.

DER RADIO-AMATEUR. By Dr. Eugen Nesper. Hard covers, 6" x 9¼", 368 pages, profusely illustrated. Published by Julius Springer, Berlin, Germany.

It is always a satisfaction and pleasure to take up a book by Nesper. The present work, while not reaching the 400 page size, is a wonderfully complete presentation of the subject of radio work. As we turn over the pages very familiar objects and well-known names appear. The German radio-world is quite awake to the wonderful work being done by Langmuir and his co-workers in this country. While the book bears upon its title page and cover the word "Broadcasting," it really is devoted largely to the very much more popular subject of "Receiving." The author realized that he was writing for more than one country, for on his title page we find, that it is a book of instruction and help for radio amateurs of all countries. Radio is a subject advancing, it is fair to say, not only from year to year, but from month to month, and it seems a bold thing for an author and a publisher to produce so extensive a book on this subject, so that the amateur could realize how much has been done for him by Dr. Nesper. There are 337 illustrations outside of what the title page terms "two art pictures." It seems a great pity that conditions would not warrant an early production of this book in the English language. We are pleased to see the Experimenter Publishing Company mentioned in the list of publishers of radio periodicals, and other familiar names appear in the list of the English language books and journals. After these Holland and German books receive some slight notice, but are exceeded by the notes of books and journals of this country and England.

Several new devices have recently been placed on the radio market. Of note among them are filament and plate current supply rectifiers to operate tubes directly from the 110 volt line was to get rid of the annoyance of batteries.

Dr. Hackensaw's Secrets

By CLEMENT FEZANDIÉ

(*Continued from page 349*)

tries to market his inventions, is by no means all rose-color. In fact, I'll bet you a thousand dollars against one dollar that you won't succeed in having a single one of our modern improvements adopted!"

"I'll take you up, doctor," cried the reporter, gaily, and he extended himself on the couch and tried to compose himself to sleep, while Doctor Hackensaw prepared a suitable phonograph record.

Then the record was placed in the machine and as Silas dropped off to sleep he was conscious of these words buzzing slowly into his ear:

"1776"—"Benjamin Franklin"—"Steam engine"—"Railroad"—"Telephone" — "Electric Light"—"Automobile"—"Airplane."

CHAPTER 2

"How is thee feeling now, friend?"

Silas started up in a daze and found that he had been lying on the ground, while a pretty Quaker girl, in the conventional costume, was bathing his temples from a nearby spring.

"Where am I?" he cried, sitting up and gazing in astonishment at the rural landscape about him.

"Thee is here; in the town of Philadelphia," answered the girl soothingly.

"Philadelphia!" echoed Silas, in surprise. "Why, where are the houses? There's not a single building in sight!" Then his brain cleared, and he asked:

"What year are we, pray?"

"We are in the year of our Lord, 1776. The Continental Congress has just met and signed the Declaration of Independence."

"Ah!" cried Silas, springing to his feet. "I haven't any time to lose. I must go to Washington at once, and speak to the congressmen." And he began fumbling in his pockets, but his face fell.

"Not a cent!" he cried. "I don't know what I'm going to do." He forgot that his money would have been worthless, even if he had had any. The current coin consisted of pounds, shillings and pence, when it did not consist of tobacco or some other commodity.

"Congress is in session here," replied the maiden, "but General Washington is not in Philadelphia at present. Yet if thee will follow me, I am sure my father will be glad to have thee as a guest."

Silas followed the young girl rather sheepishly. Here was he, planning to revolutionize the world of 1776; and yet, with all his knowledge, unable to secure a meal, but dependent on others to provide it for him. Still, he could make ample compensation soon.

"What should he turn his hand to, first?" That was the question. Should it be the automobile? No, that was too complicated and required material not easy to obtain in this ancient civilization. And when he looked at the mud and ruts in the road and reflected that this was Philadelphia, he realized at once that even if he had an automobile with him it would be absolutely useless. You can't run an auto in mud a foot deep. An airplane was evidently preferable. It was easier to build and required no roads. The great problem was to find petroleum to run it, but he knew there was plenty of oil in Pennsylvania waiting to be tapped. But to get the oil he would need capital.

(*Continued on page 425*)

COME to MILWAUKEE

INVESTIGATE—compare—write to any big business concern in Milwaukee for information about us—or to any of the big electrical organizations in the United States—and you will surely decide to come to Milwaukee, on old Lake Michigan, for your training, at America's Greatest Institution of Electrical Education.

Built on the Corner-Stone of Personal, Individual Service to every student.

SCHOOL of ENGINEERING of Milwaukee

Learn More in Less Time at Less Cost

The only school advertising in this magazine that is authorized to confer the degree of Bachelor of Science upon graduates of its Electrical Engineering College. Our equipment is the most elaborate, complete and up-to-date of any electrical school in America, and includes wiring, testing, D. C. and A. C. motor generator, armature winding and transformer, starting, lighting and ignition, storage battery and chemical laboratories, drafting and designing rooms. Unique laboratory equipment originally designed and patented by us, housed in our most modern steel and concrete fire-proof structure. Our complete facilities afford to every student ample opportunities for actual practice.

No matter how young or old you are, no matter how little or how much general schooling you have had, no matter whether you want to master every branch of electricity and become an Electrical Engineer or desire only to become a highly skilled and well-paid shop worker at one particular kind of electrical work—there is a place for YOU in one of our many classes of students who are learning to be Electrical Engineers, Commercial Engineers, Electrotechnicians, Practical Electricians. Motor Generator Repairman, Electrical Draftsman, Automotive Electricians, etc., etc.

We do not use our students to make secret profits for ourselves by selling the work they do and the things they produce in the shops.

Don't even think of enrolling with any other school until you have written direct to headquarters for full information about the particular kind of training you are interested in. Choose from the list below. Then mark and mail the coupon TODAY.

S. of E. graduates make big salaries everywhere in the great electrical field. Our Employment Department will help to secure profitable employment with opportunities for advancement.

Our Special Practical SHOP COURSES

These courses are intensely practical and are easily learned by any man who can read and understand common English and simple arithmetic.

Course 1.—Learn in SIX Weeks:
Complete shop course in Electric Light and Motor Wiring.

Course 2.—Learn in SIX Weeks:
Complete shop course in Armature Winding for A. C. and D. C. motors.

Course 3.—Learn in THREE Months:
Complete shop course in Electric Light, A. C. and D. C. Motor Wiring. Armature Winding and Motor Generator Repairs.

The above courses are taught to day classes only—eight hours' training and practice five days each week. We guarantee every student satisfaction.

AUTOMOTIVE ELECTRICIAN—Learn in 3 Months

A complete and thoroughly practical course, including every phase of electric starting, lighting, ignition, storage battery work for automobiles, trucks, tractors, motorcycles, airplanes, etc. An invaluable training for any progressive garage man.

ARMATURE WINDING—Learn in 3 Months

The theory and actual practice of armature winding, giving you a complete mastery of this fascinating subject. One of the best paid branches of work in the electrical industry.

COMMERCIAL ELECTRICAL ENGINEERING Learn in 12 Months

This new profession demands young men with combined technical and commercial training.

ELECTRICAL DRAFTING—Learn in 9 to 12 Months

Easy, interesting, pleasant work that is earning big salaries for our graduates all over the world.

PRACTICAL AND THEORETICAL ELECTRICITY Learn in 6 Months

For the man or youth who cannot spare the time or money to enroll for more intensive and higher training, this course is ideal. We positively guarantee that as a student in one of these classes you will learn Practical Electricity in the shortest possible time—no matter how much you pay for your instruction. This course teaches you everything you need to know to go into business for yourself either as the owner of an electrical shop or as an electrical contractor.

EARN WHILE YOU LEARN

We provide for a limited number of worthy men, half-time jobs at good wages, and permanent positions with unlimited prospects to all duly qualified graduates.

Ask about our Financial Loan Fund Offer

ELECTROTECHNICS—Learn in 1 to 3 Years

This elaborate course prepares the student for entrance to our College Course for Electrical Engineers. Electrotechnicians are a special type of electrical experts qualified to fit electricity to the demands of modern industry and for such positions as superintendent of maintenance, director of construction, superintendent of installation and testing, electrical equipment salesman and automotive electrotechnician.

ELECTRICAL ENGINEERING—Learn in 3 Years (36 Months)

Bachelor of Science degree conferred on graduates. Full provision is made for making up deficient high school credits. It is the Electrical Engineers who have given to the world the thousands of fortune making inventions in the electrical field. No man with this training can fail to realize his highest ambitions in life.

EVERY INSTRUCTOR A SPECIALIST

These are some of the experts whose teaching has supplied thousands of high-salaried men to the electrical industry through this school—many of whom in overalls and jumpers stand at your elbow teaching and explaining while you learn by doing. The only way you can fail to learn is to refuse to learn:

Oscar Werwath, E.E.
Francis A. Vaughn, B.S.
Willard C. Hartman, A.B., A.M.
Chester C. Aiken, B.S.
Asher C. Ball, B.S., LL.B.
W. H. Bieck, B.S.
W. E. Boren, A.B.
E. L. Consoliver, M.E.
J. T. Baker
I. C. Fisher, B.S.
George B. Haverson, A.B.
Elmer A. Ihrke, B.S.
Arthur A. Koch, M.S., Ph.D.
Fred W. Krotzer, A.B.
Charles Nyberg, A.B.
C. E. Pettingill, B.S.
Charles M. Ploetz
F. C. Raeth, B.S.
H. A. Rickeman, A.B.
Charles G. Simpson, M.A., Ph.B.
J. W. Smith
A. L. Sudduth
Peter C. Winther, B.S.

MAIL COUPON NOW

Mail the coupon today for our Free Illustrated catalog. Tell us what course interests you most and we will send you special information. Find out about the great opportunity in Electricity today. Learn how we can help you to a permanent and lasting success. Don't put it off! Mail the coupon now!

SCHOOL OF ENGINEERING OF MILWAUKEE
Dept. X.-1702, 415 Marshall Street, Milwaukee, Wisconsin

Please send me, without cost or obligation, your big free illustrated book and details of the course which I have indicated below. Also details of "Earn While You Learn" and Financial Loan Fund Offer.

Course .....
Name .....
Address .....
City ..... State .....
Age ..... Education .....

SCHOOL of ENGINEERING of Milwaukee

Dept. X.-1702, 415 Marshall Street, Milwaukee, Wisconsin

Chicago Laboratory Branch: **2011 So. Michigan Ave., Chicago, Ill.**

Dr. Hackensaw's Secrets

(*Continued from page* 423)

His first problem, then, was to make money. Surely, with his head full of the countless inventions made during the nineteenth century, he should have no trouble in becoming rich. Many simple inventions had made fortunes for their promoters. But as he questioned Ruth and her father, he found that his task was by no means easy. The main industries seemed to be the fur trade; the lumber trade—that is to say the shipping of masts and other lumber abroad (this trade, of course, now prevented by the war), and the growing of tobacco. How could his boasted knowledge help him with these? And his wealth, even when acquired, would consist mainly in bales of tobacco and packs of furs. Not a very handy capital with which to start a twentieth century factory.

Only two practical ideas occurred to Silas. The first was a percussion-cap, breech-loading magazine-rifle to replace the old flint-lock, muzzle-loaders that missed fire half the time, and that left the owner helpless after each shot, until a new charge could be rammed home.

The second idea was the manufacture of matches, and these he determined to make at once, as they seemed the easiest thing to manufacture with his limited resources.

THE FIRST INVENTION

Accordingly after a dinner of venison and corn-bread at the house of his Quakeress, whose name, by the way, he learned was Ruth Friend, Silas hunted all through the town to find a chemist's shop—with great difficulty he was able to secure a small amount of sulphur and phosphorus and such other chemicals as he judged would be most useful, leaving his watch as a deposit. Then he started in to manufacture some matches. His success was not very great, but he finally produced a dozen large clumsy matches which would answer as samples. These he triumphantly exhibited to Ruth's father.

"There, Mr. Friend, what do you think of those?" he asked, when, after repeated efforts, he had succeeded in lighting one of his matches and starting a fire.

"Friend Silas," answered the Quaker, "that thing looks and smells like an invention of the devil. Moreover, of what use is it?"

"Of what use?" echoed Silas. "Why, it will take the place of your old flint and steel."

"Indeed? Well, friend, I would not trade my trusty flint and steel for many thousand of such 'matches' as thee calls them. I can light a fire more quickly with my flint and steel than thee can with thy matches. And it costs me nothing and requires no work; while to make matches such as thine requires chemicals and labor. They are worse than useless!"

And so it was with all the other inventions with which Silas sought to amaze the good people of Philadelphia. He had a large circle of listeners evenings, for his stories appealed to them like fairy-tales, but when he insisted on being taken seriously, his listeners shook their heads and thought his mind was a trifle deranged.

It was when they talked among themselves about his wild tales that they gave free vent to their minds.

"Just imagine!" said one. "He said he would one day show us how he could catch a man's image on a piece of glass, and the image would not only remain there permanently, but could be printed off on paper many times. He called it 'photography'."

(*Continued on page* 427)

Dr. Hackensaw's Secrets

(*Continued from page* 425)

"He spoke to me of something even more extraordinary than that," chimed in another. "He said he would some day take a sheet of wax and let us talk and sing to it, and that the wax would remember every word, and would repeat the songs and speeches without a mistake, over and over again, and even weeks later if we wished. And he said this 'phonograph'—that's what he called it—would even imitate the very tones of each man's voice. Surely, the fellow must be a fool!"

"And to me," said a third, "he said that he knew how to make a machine that would enable him to look right into a man's body. He said it would be possible to see a bullet, even though hidden in a man's chest."

"That's nothing!" interrupted a fourth. "He told me he was going to try to get capital enough to make some stage-coaches and some boats that would run by steam. He said that, with steam, he could run a dozen heavily loaded wagons at a speed of sixty miles an hour or more! How is that for a wild dream? Not content with that, he said he knew how to build flying-machines that would go *two hundred miles* an hour! No bird can fly that fast, and it stands to reason that even if a flying machine is ever made, it will be so heavy and clumsy that it cannot fly even as fast as the slowest bird!

TALK ABOUT ELECTRICITY

"Then, too, you ought to hear him talk about electricity. Ben Franklin knows a lot about electricity, but you ought to hear this fellow talk. He says you can make electricity out of running water, and that it will do all our work for us. He must have forgotten that he had just said that steam would do it. He said electricity would run our stage-coaches, work our machinery, plough our fields, sweep the floors of our houses, and even furnish us a better light than a good wax candle would give. What do you think of that?"

"He told me something else," spoke up a chemist who happened to be present—obviously the best educated person among them. "He wanted me to trust him for some chemicals, and he told me he knew how to build a machine that would enable him to talk from here in Philadelphia to a man in England. But I tripped him up neatly. I happen to know that sound only travels 1,080 feet per second and as the distance to England is some three thousand miles, it would take the words spoken here over three hours to reach England and three hours to come back—six hours to get an answer to a question. He's such an ignoramus he thought you could get an answer right away!"*

And so the conversation continued. Some thought that Silas might have sold himself to the devil, but the more advanced leaned to the belief that the reporter was crazy.

A VISIT TO FRANKLIN

All Silas's efforts to secure financial help for his schemes failed, and he saw that he must earn his first capital by making and marketing some simple invention. He thought of a toy—the handball with an elastic, which is said to have made its inventor a millionaire; but he had no rubber, and the children of 1776 had no money for toys. Then he thought of the safety-pin and the crimped hair-pin. With great difficulty he managed

*NOTE.—*It may be well to state, for the benefit of some of my younger readers, that, in the telephone, it is not the sound that travels, but the electric current. The speech is therefore transmitted thousands of miles in the fractional part of a Second.*—C. Fezandié.*

to obtain some stiff wire and made a few pins of each kind. But the wire was too soft and the ladies were too unprogressive to use these devices even when given to them free.

His one hope now lay in seeing Benjamin Franklin. That great philosopher and statesman was a scientist and a man of advanced ideas. Franklin was in Philadelphia at the time and received the reporter genially. Silas with some copper sulphate, zinc and acid had managed to make a simple gravity cell, and as this was twenty-four years before Volta invented his famous voltaic cell, Franklin was delighted at thus finding that an electric *"current"* was a possibility. So far, all electricity was of the *"static"* kind produced by an electrical machine. By the use of his cell and a bit of wire, Silas soon demonstrated to the great philosopher the possibility of a simple telegraph with dots and dashes.

Franklin acknowledged the practicability of the invention, but looked upon it as a mere scientific toy.

"The device," said he, "is highly ingenious, but it would be of no real value. What need is there of this "telegraph," as you call it? If the news is good, it will keep, and if bad, we shall hear it soon enough!"

Silas tried to explain the advantage it would afford the Colonials by giving them advance information in regard to the movements of the British troops.

"But," objected Franklin, "what would prevent the enemy from cutting the wires? Besides, think of the cost! And the British would soon learn to make the device themselves."

Then Silas tried to explain about "wireless," but here Franklin could not follow him. So Silas tried another tack and explained the principle of the dynamo. He insulated his wires by dipping them in beeswax and by coiling them to form simple electro-magnets, he showed how it was possible to change mechanical force into electricity. Here, too, Franklin was delighted with the idea, though he failed to see that the invention had any practical value.

"Just think what a waste of power there would be with such a machine," said he. "Here you are using a one-man power to produce a very small current. You say that we could use our water-wheels to produce the electricity; but this would be most wasteful. Why not have the water-wheels do the work directly, themselves, as they do now in our mills, grinding our flour and sawing our lumber?"

"Yes," admitted Silas, "but with electricity you could transport your power anywhere you wanted it, even into your houses, and make it spin your flax, weave your cloth or sweep your floors!"

Franklin's face grew stern. "As for the house-work," said he, "we want nothing that will tend to make our women lazy and shiftless. Work is good for everyone; and spinning and weaving is the women's share."

THE PHILOSOPHER IS SKEPTICAL

Then Silas tried to explain the advantages of the electric light. He explained how, by joining a number of voltaic cells together he could heat a wire red-hot and so produce a substitute for candles. But the great eighteenth century philosopher showed no enthusiasm.

"Of course, electricity will produce light," said he. "We all know that, because lightning is nothing but electricity. I will say nothing of the danger of using a flash of lightning instead of a candle to light up our homes. I will suppose it could be made perfectly safe and that the light would be brighter and cheaper than candles. Even so, I would oppose the innovation. Daylight is better than any artificial light, and the man who rises at dawn and does a good day's work is ready for bed at dusk. The people who want artificial light are the gad-abouts

who lie in bed until noon and then turn night into day with their chandeliers that hold scores of candles!"

Silas returned home completely discouraged, but his visit brought fruit. Franklin introduced him to several prominent people, and Silas at last found means of earning money by giving dancing lessons to some of the ladies and gentlemen of the well-to-do families. Poor Silas! After all his dreams of reigning as a king, to be obliged to teach the minuet! He was now dressed in Colonial costume, for Franklin had advanced him sufficient credit to obtain the necessary wigs, etc.

"If I only had a good live newspaper," thought Silas, "I could make things hum! I could teach the people here something about advertising and wake them up."

Silas had dabbled a little in prestidigitation when young, and resolved to give a few exhibitions to increase his income. Accordingly, with the first money he earned as a dancing teacher, he prepared a few simple conjuring tricks and secured a confederate to help him in giving Robert Houdini's second-sight trick. He hired a hall and advertised the performance by printed notices posted up at the principal cross-roads of what was then Philadelphia.

The hall was well filled, and though the receipts were not wonderful, they were satisfactory. The performance, though very mediocre, had a remarkable success!—too great, in fact. His audience were convinced that he had sold himself to the devil. Otherwise how could he perform such black magic, read what was written in sealed envelopes, or make luminous hands appear in the dark? At the third performance, the hall was filled to overflowing, and there was a hooting crowd outside. In the very middle of the performance, at a given signal, the crowd forced its way to the stage, seized him and carried him off to the nearest horse-pond, where he was repeatedly ducked. In vain, he shrieked for help and tried to break away from his captors. He was gasping for breath and thought his last moment had come, when his eyes opened and he awoke to find Doctor Hackensaw bending anxiously over him.

* * * * * * * *

You seemed to be having a night-mare, Silas, observed the doctor, "so I thought it better to awaken you. I suppose you were having trouble. It must have made many people envious to see you as leading man in the colonies!"

Silas Rockett bit his lip. "I have learned a thing or two, doctor," said he. "I have especially learned that an inventor has no easy time of it, and his troubles only begin after his invention is made and perfected. There was I, master of thousands of valuable inventions such as no man had ever had at command before, and yet I was unable to have a single one adopted—not even the most trifling." And he proceeded to relate his experiences.

"I sympathize with you, Silas," said Doctor Hackensaw. "But don't imagine that an inventor finds it much easier, nowadays, to market a valuable improvement. If he lets another man exploit his invention, he gets practically nothing for it; while he rarely has capital enough to put it on the market himself; and if he does, his lack of business training is apt to result in his losing what little cash he had. Then another man comes in and profits by his failure."

"Well, doctor, you've won the bet," said Silas, "and I owe you a dollar."

"On the contrary, Silas, it is you who have won, and here are your thousand dollars. Didn't you tell me that you taught some of the ladies the fox-trot? And that you got them to humming some of our latest jazz music? If you had remained a little longer you might have had the staid old Colonial dames doing the barefoot Oriental, or dancing the 'shimmy'!"

Opportunity Ad-lets

YOU will find many remarkable opportunities and real bargains in these columns. It will pay you to read and investigate the offerings made every month by reliable firms, dealers and amateurs from all over the country. No matter what you may be seeking, whether supplies, automobile accessories, the opportunity to make money, or anything else, you will find listed here the best and most attractive specials of the month.

Advertisements in this section twelve cents a word for each insertion. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. No advertisement for less than 10 words accepted.

Ten per cent. discount for 6 issues, 20 per cent. discount for 12 issues. Objectionable or misleading advertisements not accepted. Advertisements for the October issue must reach us not later than August 15th.

The Circulation of Science and Invention is over 150,000 and climbing every month

EXPERIMENTER PUBLISHING CO., INC., 53 Park Place, New York City, N. Y.

Agents Wanted

Agents—Best seller; Jem Rubber Repair for tires and tubes; supersedes vulcanization at a saving of over 800 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.

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.

We start you without a dollar. Soaps, Extracts, Perfumes, Toilet Goods. Experience unnecessary. Carnation Co., Dept. 232, St. Louis.

Make $25 to $50 week representing Clows' Famous Philadelphia Hosiery, direct from mill—for men, women, children. Every pair guaranteed. Prices that win. Free book "How to Start" tells the story. George Clows Company, Desk 27, Philadelphia, Pa.

Only one sale a day means $200 per month. Five sales, $1,000 per month. Marvelous new adding machine. Retails $15. Work equals $350 machine. Adds, subtracts, multiplies, divides automatically. Speedy, accurate, durable, handsome. Five-year guarantee. Offices, stores, factories, garages buy one to dozen. A fortune for live agents. Write quick for protected territory and free trial offer. Lightning Calculator Co., Dept. W., Grand Rapids, Mich.

Earn big money fast applying gold initials to autos. Every owner buys—$1.35 profit on $1.50 sale—particulars and samples free. Write quick. Lithogram Co., Dept. 19, East Orange, N. J.

Write and learn how to start profitable business without capital or experience. Silvering mirrors, refinishing auto headlights, tableware plating. Outfit furnished. International Laboratories, Dept. 25, 309 Fifth Ave., New York.

We want Salesmen and Agents, either whole or side line, to sell our low priced radio books to the trade. Excellent proposition for live wires. The E. I. Company, Publishers, 233 Fulton Street, New York City.

Earn $10 daily silvering mirrors, plating and refinishing metalware, chandeliers, bedsteads, headlights. Outfits furnished. N. Decie Laboratories, 1153 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.

Agents—Big returns, fast office seller; particulars and samples free. One Dip Pen Co., 12 Daily Record Bldg., Baltimore, Md.

Make $120 Weekly in Spare Time—Sell what the public wants—long distance radio receiving sets. Two sales weekly pays $120 profit. No big investment, no canvassing. Sharpe of Colorado made $955 in one month. Representatives wanted at once. This plan is sweeping the country—write today giving name of your county. Ozarks, 825 Washington Blvd., Chicago.

Big money and fast sales. Every owner buys gold initials for his auto. You charge $1.50, make $1.44. 10 orders daily easy. Samples and information free. World Monogram Co., Dept. 32, Newark, N. J.

Agents Wanted Full or Part Time to Sell on liberal commission new Thermostatic Automatic Carburetor control Attachment for Ford cars. Increases mileage 100%. No holes to drill. Attached in 2 minutes. Does automatically exactly what Ford Manual instructs driver do by hand. Cadillac now using Thermostatic Carburetor Control under Blancke license. Write at once. A. C. Blancke & Co., Dept. 251-E, 602 W. Lake St., Chicago.

Rummage sales make $50.00 daily. Offer wonderful values. We start you. "Wholesale Distributors." Dept. 32, 609 Division Street, Chicago.

Best proposition in the Specialty Field. Perry Lykoil Paintings, Photo Medallions, and Novelties have no equal. Every interview means a sale. 600% profit. Write for details. Perry Photo Novelty Corporation, Sect. S17, 360 Bowery, New York.

Agents, both sexes, we manufacture and control new household article. Fast seller. Big profits. Exclusive territory. Write now. Connelly, 123 Liberty St., New York.

Wonderful invention eliminates all needles for Phonographs. New, different, lasts for years. Preserves records. 12,000,000 prospects. $15 to $30 daily, easy. Carry days supply in pocket. Everplay Desk 7H, McClurg Bldg., Chicago.

Salesmen: Sell tailoring. It's a great staple that sells the year around. You don't have to look for prospects; every man is a possible customer, and with a good line at the right price you sell him again and again. Our line is a good line. It offers an assortment of more than 100 Virgin Wool fabrics of the finest quality, made up in suit or overcoat to special order, for only $31.75. This price is $25 lower than store prices. It is this that enables our men to make the big money they do. Earnings of from $75 to $125 a week are common with our men and in season many of them make even more. Our selling outfit is a winner; the fabric assortment is powerful and impressive and the advertising helps contained are tremendously effective. Write at once for the full facts about what we believe to be the greatest selling opportunity in the field today. When you write, tell us about yourself. It will help us to give you action. But write at once. Now's the time to get started. Address Dept. 113, Goodwear, Chicago, Inc., 844 West Adams St., Chicago.

Succeed with your own products—Formulas, Processes, Trade-Secrets. Different, dependable, profitable. Catalog free. D. Thaxly Co., Washington, D. C.

Agents Wanted (Continued)

Big Money selling new Household cleaner. Washes and dries windows. Sweeps, scrubs, mops. Complete outfit less than brooms. Over 100% profit. Harper Brush Works, 152 2nd St., Fairfield, Iowa.

Agents Wanted to Advertise our goods and distribute free samples to consumers; 90c an hour; write for full particulars. American Products Co., 1833 American Bldg., Cincinnati, O.

Men's Shirts. Easy to sell. Big demand everywhere. Make $15.00 daily. Undersell stores. Complete lines. Exclusive patterns. Free samples. Chicago Shirt Manufacturers, 229 W. Van Buren, Factory 212, Chicago.

American Made Toys

Opportunity to start Manufacturing Metal Toys and Novelties. No experience necessary. Enormous demand exceeds supply. We furnish, at cost, casting forms for production and buy entire output, also place yearly contract orders. Casting forms made to order. Catalog, advice and information free. Metal Cast Products Co., 1696 Boston Road, New York.

Automobiles

Ignition diagrams for any make car. State make, year and model, 10c postpaid, no stamps. C. M. Labunski, 2640 Hendrie E, Detroit, Mich.

Auto Owners

Auto Owners! Get your tires Free! Be our Factory Agent! Big spare time money-maker! Sample tires furnished. No capital or experience needed. Write today. Armour Tire & Rubber Co., Desk 944-B, Dayton, Ohio.

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. Welsh, 2117 Regent Place, Brooklyn, N. Y.

Books

Perpetual Motion, by Percy Verance. A history of the efforts to discover same from earliest days to the present, together with a scientific discussion regarding the possibility of its ultimate achievement. Profusely illustrated. 357 pages. Price postpaid, $2.00. The Enlightenment Specialty Co., 305 Fourth St., Edwardsville, Ill.

Free—Upon request will send you my literature illustrating the following books. Astrology, Character, Clairvoyance, Concentration, Healing, Hypnotism, Magnetism, Mediumship, Personal Magnetism, Personality, Physiognomy, Salesmanship, Seership, Success, Sex, Will, Yogi Philosophy, Gazing Crystals, etc. A. W. Martens, E. E. 6, Burlington, Iowa.

Hypnotism Astounds, Controls. Wants gratified. 25 easy Lessons $2.75. "Mindreading" (Any distance) Wonderful. Genuine. Guaranteed $2.75. "Book of Wonders, Mysteries and Disclosures" $20.00 worth for $2.00. All three $5.00. Catalogs free. Science Institute, SV 1014 Belmont, Chicago.

Sleep Quickly Produced. Self or others. Infallible. Priceless. Guaranteed $1.10. "How to Live Right" 10c. "Way to Win" 10c. Prof. Deprado, SV357 Oak, Chicago.

25c Each. Success—Happiness, Hypnotism, Clairvoyance, Coue's System, Astrology, Phrenology, Success, Key. Bargain Catalog (stamps), Phipps Library, 1014 Belmont, Chicago.

Magic-goods, cards, books. Catalog free. Clifford Fenner, 2401 Jefferson, Louisville, Ky.

"Nature's Finer Forces," Vibrations; Lights; Colortones; Electromagnetrons; Odicauras; Radio; Coldlights; Inventions; Wonderful Opportunities; Fifty Lessons; Marvelous Cures; Illustrated 270 pages, $2.00. DeLuxe $3.00. Stevens Research Laboratories, 242 Powell, San Francisco.

Business Opportunities

If you have adaptability to selling specialties, exclusive territory is available on the Hush-A-Phone. This device is generally recognized by the largest concerns in the country, as superior to a phone booth for voice privacy, office quiet, and telephoning in noisy places. Over a thousand banks have adopted it. It is without competition. Energetic men can make a life occupation of selling the Hush-A-Phone in their section. Office appliance, and telephone men particularly adapted. Write for proposition. Hush-A-Phone Corp., Room 1311, 19 Madison Avenue, New York City.

Dollars yearly in your backyard. No mushroom dope. Particulars free. Metz, 319 East 89th, 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.

Business Opportunities (Continued)

$10 daily silvering mirrors, plating and refinishing lamps, reflectors, autos, beds, chandeliers by new method. Outfits furnished. Write Gunmetal Co., Ave. D, Decatur, Ill.

Stop Plodding! 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.

Earn $10 to $20 per day. Learn sign painting, auto painting, decorating, paperhanging. Be an expert in a few weeks; low cost; actual work; no books. Catalog Free. Chicago Painting School, 132 West Austin Avenue, Chicago.

Free Advice. How to be Successful in Real Estate, particulars. Macdonald Cooperative Realty, San Diego.

I Made $100,000 as Real Estate Specialist. Free information tell how. American Business Builders, Dept. A-558, 1133 Broadway, New York.

Chemistry

Learn Chemistry at Home. Dr. T. O'Conor Sloane noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our ad on page 396 of this issue. Chemical Institute of New York, 66 W. Broadway, New York City.

Experimenters—We carry a complete supply of chemicals and glassware for your chemical laboratory. Catalogue, 5 cents. Book of interesting experiments with formulas for making colored fires and fireworks, 15 cents. National Scientific Supply Co., 241 Pa. Ave., Washington, D. C.

Correspondence Courses

Used correspondence courses bought and sold. Barcain catalogue 1,000 courses free. Students' Exchange, Dept. 4, 47 West 42d St., New York.

Used correspondence courses of all schools sold, rented and exchanged. New 1921 catalogue free. (Courses bought). Lee Mountain, Pisgah, Alabama.

Duplicating Devices

"Modern" Duplicators save Time, Labor and Money. Gets Business. Reproduces Typewritten or penned letters, Drawings, Lessons, Music, Menus, Bids, Notices, Specifications, Maps or anything in one or more colors. Prints two per minute. Special Sale On. 30 Days' Free Trial. $2.25 up. Booklet Free. B. J. Durkin-Reeves Co., Pittsburgh, Pa.

Films Developed

Amazing Trial Offer! Your Kodak Films developed; 6 fine glossy prints; only 15c. Associated Photo, Box 1165-P, Cincinnati, Ohio.

For Advertisers

24 words—355 Rural Weeklies $14.20. Ad-Meyer, 4112 St, Hartford, St. Louis, Mo.

For Inventors

Cashing In—If you have a practical, useful invention to sell, write us promptly, stating whether patented. American Patents Corporation, Barrister Building, Washington, D. C.

We Develop your ideas into commercial shape for presentation to purchasers making working models, drawings, experiments or tests. Courtesy, efficiency, secrecy and ample equipment; 30 years' experience. Ducorron-Rich Engineering Co., 504 Pacific Mutual Bldg., Los Angeles, Cal.

Unpatented Ideas Can Be Sold. I tell you how and help you make the sale. Free particulars (Copyrighted 1923). Write W. T. Greene, 808 Jenifer Bldg., Washington, D. C.

Your Chemical problem solved and working process furnished for Five Dollars. Write me. W. Stedman Richards, Consulting Chemist, Box 2402, Boston, Mass.

Formulas

Moneymaking Books, Plans, Formulas. Catalogue Free. Ideal Book Shop, 5501-E, North Robey, Chicago.

For Sale

For Sale or Trade. Concrete Culvert. Particulars on request. Smith Caldwell, Castague, Mont.

For Sale—Patent on alarm clock. Variable sound. Jack Moore, 131 Circle Drive, Wichita, Kansas.

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

Tricks, Puzzles, Jokes, Magical Apparatus, Plays. Stage Supplies. Mind-Reading Acts and Sensational Escapes. Send 10c for 160-page illustrated 1922 professional catalogue. Oaks Magical Co., Dept. 549, Oshkosh, Wis.

Health

Free to men—Information of a scientific nature that has brought physical vigor and happiness to thousands. No charge; no obligation. Enclose stamp for reply. C. I. Wood & Co., Colorado Springs, Colorado.

Booklets on healing. Particulars for stamp. Arthur Stevens, Wauseon, O.

Free—Stop using tobacco. We will give free information how to conquer habit easily and permanently. Results guaranteed. Anti-Tobacco League Box M, Omaha, Neb.

Help Wanted

We want Salesmen and Agents, either whole or side line to sell our low priced radio books to the trade. Excellent proposition for live wires. The E. I. Company, Publishers, 233 Fulton Street, New York City.

Detectives Needed Everywhere. Work home or travel. Experience unnecessary. Write, George Wagner, former Government Detective, 1968 Broadway, N. Y.

Silvering Mirrors, French plate. Easily learned, immense profits. Plans free. Wear Mirror Works, Excelsior Springs, Mo.

Earn $25 Weekly, spare time, writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 986 St. Louis, Mo.

All men, women, boys, girls, 17 to 65, willing to accept Government positions, $117-$250, traveling or stationary, 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.

Clerks for Government Postal and other good positions, $1,400-$2,300 yearly. Experience unnecessary. Full particulars free, by writing G. W. Robbins, Civil Service Expert, 764 Burchell Bldg., Washington, D. C.

Firemen, Brakemen, Baggagemen, Sleeping car, train porters (colored). $140-$200. Experience unnecessary. 897 Railway Bureau, East St. Louis, Ill.

Money: Silvering Mirrors, Autolights, Radiators, Tableware, Stoves, Brassbeds. Outfits, Methods Free. Sprinkle, Plater, Dept. 95, Marion, Indiana.

Railway Postal Clerks—Start $133 month. Railroad pass; expenses paid; questions free. Columbus Institute, H-4, Columbus, Ohio.

Earn $1.20 an hour cutting blanks at home; anywhere; spare time. Men only. Send addressed reply envelope. Goodyear Sy., 147 W. 23d St., New York.

U. S. Government wants men 18 up. Railway Mail Clerks—City Mail Carriers. $117-$192 month. Steady. Information free. Write immediately. Franklin Institute, Dept. M-23, Rochester, N. Y.

Be a Detective—Exceptional opportunity; earn big money. Travel. Big rewards. Established 1909. Particulars free. Write C. T. Ludwig, 1417 Westover Bldg., Kansas City, Mo.

Information

Guaranteed information, any subject, strictly confidential, $1.00. Doris Chemical Laboratories, East Cleveland, Box 594, Cleveland, Ohio.

Instruction

Learn Chemistry at Home. Dr. T. O'Conor Sloane, noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our ad on page 396 of this issue. Chemical Institute of New York, 66 W. Broadway, New York City.

Learn Ventriloquism. Book of instruction, 30c. J. Tillberg, Proctor, Vermont.

$ $ Dollars $ $ An opportunity to Earn Big Money at home in your spare time writing Display Cards for us. No experience necessary. Write for particulars. 5118 Sho-Rite Sign System, Inc., Detroit, Michigan.

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., 505 South Third St., St. Louis, Mo.

Manufacturing

Metal-Craft Mfg. Company will manufacture your product complete. Engineers, Designers and Manufacturers of dies, stampings, deep pressing, die-casting, plating, enameling, screw-machine and wire products. Reasonable. Estimates promptly furnished. Box 259-L, Chicago.

To order: Metal articles, simple, or complicated machinery. Models, tools, patterns. Experimenting. Parma Engineering Works, Brooklyn Station, Cleveland, Ohio.

Miscellaneous

Hindu Psychology, Yogi, Personal Magnetism. The Secret Sciences, Books and Courses. Large illustrated Private Catalogue, with "How Realize Any Desire," 25c. Adaros, 116 South Michigan, Chicago.

Consulting Mechanical Designer and Engineer. Clifford H. McClain, 1300 Darby Road, West Brookline, U. D. P. O., Penna.

Motorcycles—Bicycles

Don't buy a Bicycle Motor Attachment until you get our catalogue and prices. Shaw Mfg. Co., Dept. 6, Galesburg, Kansas.

Patent Attorneys

Patents. Send for free booklet. Highest references. Best results. Promptness assured. Send model or drawing for examination and opinion. Watson E. Coleman, Patent Attorney, 644 G Street, Washington, D. C.

Get your own patents. Application blanks, complete instructions $1. Cutting Bros., Campbell, Calif.

Inventors write me about patents. My fees payable monthly. Booklet free. Frank Fuller, Washington, D. C.

Unpatented Ideas Can Be Sold. I tell you how and help you make the sale. Free particulars (Copyrighted 1923). Write W. T. Greene, 809 Jenifer Bldg., Washington, D. C.

Patents Procured, Trade-Marks Registered—A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 130 Owen Bldg., Washington, D. C., or 2278-T Woolworth Bldg., New York.

"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.

Lacey Patent-Sense. "The book the inventor keeps." Free. See page 402.

"Inventors' Guide" free on request; gives valuable information and advice for all who have original ideas or improvements. Frank Ledermann, Registered Attorney and Engineer, 15-E Park Row, New York.

Herbert Jenner, Patent Attorney and Mechanical Expert, 624 F Street, Washington, D. C. I report if patent obtainable and exact cost. Send for circular.

M. P. Laughlin, Patents. Engineer-Attorney, 47 West 42nd Street, New York.

Patents—Write for our Guide Books and "Record of Invention Blank" before disclosing inventions. Send model or sketch of your invention for Examination and Instructions. No charge for the above information. See advertisement on page 405. Victor J. Evans & Co., 191 Ninth, Washington, D. C.

Patents Procured. Send sketch or model today for examination, prompt report and advice. No charge for preliminary advice. Write for free Booklets "How to Obtain a Patent" and "Invention and Industry" and blank form on which to disclose your idea. Highest references. Promptness assured. Clarence A. O'Brien, Registered Patent Lawyer, 924 Security Bank Building, Directly across the street from Patent Office, Washington, D. C.

Monroe Miller, Ouray Bldg., Washington, D. C. Patent Attorney; Mechanical, Electrical Expert, Free Blue Book gives candid advice.

Inventors—Send for form "Evidence of Conception" to be signed and witnessed. Form, fee schedule, information free. Lancaster and Allwine, 242 Ouray Bldg., Washington, D. C.

Millions spent annually for ideas! Hundreds now wanted! Patent yours and profit! Write today for free books—tell how to protect yourself, how to invent, ideas wanted, how we help you sell, etc. American Industries, Inc., 212 Kresge Bldg., Washington, D. C.

The Patentome Impartial advice to Inventors and manufacturers. Mailed on request. Anderson & Son, Patent and Trade Mark Lawyers, Established 1865. 627 F St., Washington, D. C.

Patents

M. P. Laughlin, Patents. Engineer-Attorney, 47 West 42nd Street, New York.

Patent applications filed with drawing $20; deferred $15; strongest claims; priority rights guarded. Inventors' Service, 11 Broadway, New York.

Patents For Sale

For Sale—Patent No. 1494896—Water-circulator cooling system. First class Automobile accessory, no carbon, no mechanical movements, cheap manufacture and a very attractive ornament on radiator cap. Victor G. Forslund, Route 1, Clay Center, Kansas.

Personal

Exchange interesting letters with new friends. Write Dolly Gray Club, Box 186K, Denver, Colorado. Stamp appreciated.

Exchange Cheery Letters with new friends. Write Betty Lee, Inc., Box 820, City Hall Station, New York City. Stamp appreciated.

Phonographic Supplies

Build Your Phonograph. Quality phonoparts. Famous Serenado Motors. Also original Perfection Motors. Electric Motors, tonearms, reproducers, amplifiers, case material, accessories. Free blueprints and building instructions. Big saving. Wonderful results. Prompt delivery. Catalogue mailed for ten cents. Hoosier Mfg. & Supply Company, 321 Baldwin Block, Indianapolis, Indiana.

Photoplays, Stories, Etc.

Big money writing photoplays, stories, poems, song. Send for free copy America's greatest magazine for writers. Tells you how to write and sell. Writer's Digest, 637 Butler Bldg., Cincinnati, Ohio.

$ $ $ For Ideas. Photoplay Plots Accepted any form; revised, criticised, copyrighted, marketed. Advice free. Universal Scenario Corporation, 223 Security Bldg., Santa Monica & Western, Hollywood, California.

Radio

Attention! 50 Vacuum Tube Hook-Ups. The greatest collection of Vacuum Tube Circuits ever brought under two covers at such insignificant cost. These diagrams will be found in the great "Rasco" catalogue which contains raw materials and parts in a greater profusion than any other catalogue. 15c in stamps or coin will bring the catalogue to you. Radio Specialty Company, 100 Park Place, New York City.

Radio (Continued)

Boys, don't overlook this! The "Rasco" Baby Detector. Greatest detector ever brought out with molded base. Fully adjustable. See former advertisements in this publication or our catalogue. Detector with Galena Crystal complete, 50c; the same Detector with Radiocite Crystal, 75c, prepaid. Send for yours today. Radio Specialty Co., 100 Park Place, New York City.

Radio Generators: 500V 100 watt, $28.50 Battery Charging Generators, $8.50. High Speed Motors—Motor Generator Sets. All Sizes. Motor Specialties Co., Crafton, Penna.

Motors—Manufacturer's Surplus Sale—¼ HP., $8.50; ½ HP., $32.50; 1 HP., $54.50. 8 Volt Charging Generators, $8.50. Complete Lighting Plants—Generators, Light Machinery. Write for Catalog. Motor Specialties Co., Crafton, Penna.

Wanted: Light Machinery—Lathes—Drill Presses, Model High Speed Gasoline and Steam Motors. Best Cash Prices Paid. Motor Specialties Co., Crafton, Penna.

Radio Equipment

Lambert's Reach-Out Crystals. The kind I use on my famous DX crystal sets that reach out and bring in concerts 400 to 1000 miles away. Mounted 60c each, two for $1.00. Unmounted, 40c each, three for $1.00. Fixed detector, $1.50. Mailed postpaid the day I get your order. Leon Lambert, 541 South Volutsia, Wichita, Kansas.

Salesmen Wanted

A Salesmen wanted in every town or city within 25 miles of a broadcasting station to sell Radiogem, the complete radio receiving set that retails for $2.50. With Radiogem there is nothing else to buy—the outfit includes the Radiogem receiving apparatus, 1,000-ohm phone, and aerial outfit. The cheapest radio outfit on the market—yet as practical as the most expensive. Big money to the right men. Send $2.00 for sample outfit. The Radiogem Corp., 661 West Broadway, N. Y. City.

Tailoring Salesmen: Oldest established wholesale tailors on earth pay Largest Commission and give Liberal Bonus orders for union made $15.00 all wool suits at $32.50. Big outfit and advertising furnished free. Exclusive territory. Experience unnecessary. Wilson Tailoring Co., 910 W. Jackson, Chicago.

Short Stories, Manuscripts Wanted

Earn $25 Weekly Spare Time writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 987 St. Louis, Mo.

Stories, Poems, Descriptive Articles, Plays, etc., are wanted for publication. Submit Mss. or write Literary Bureau, 165 Hannibal, Mo.

Song Poems Wanted

Write the words for a song. We compose music. Our Chief of Staff wrote many big song-hits. Submit your song-poem to us at once. New York Melody Corp., 412J Romax Bldg., New York.

Stammering

St-Stu-t-t-tering and Stammering cured at home. Instructive booklet free. Walter McDonnell, 105 Potomac Bank Bldg., Washington, D. C.

Stamps and Coins

California Gold, quarter size, 27c; half-dollar size, 53c. Columbian nickel and catalogue, 10c. Norman Shultz, Box 116, Colorado Spring, Colo.

Stamps 100 All Different 3 cents. S. I. Quaker Stamp Company, Toledo, O.

158 Genuine Foreign Stamps. Mexico War Issues. Venezuela, Salvador and India Service, Guatemala, China, etc., only 5c. Finest approval sheets 50 to 60%. Agents Wanted. Big 72-p. Lists Free. We buy stamps. Established 20 years. Hussman Stamp Co., Dept. 156, St. Louis, Mo.

Danzig Free—Nice Set Danzig Stamps with Biggest Catalogues Issued. 2c postage. Midland Stamp Co., Station E 12, Toronto, Canada.

Technical Schools

Chicago Technical College offers short, intensely practical courses in Drafting and Engineering—civil, mechanical, electrical, structural—Architecture, Building Construction, Plan Reading, etc. Courses fitted to your needs. No time wasted. Instructors are experts. Graduates in demand at big salaries. Opportunities for part-time work while studying. Day and evening classes. 21st year. Enter any time. No special preliminary training required. Low tuition—easy terms. Write for 52-page illustrated Blue Book, describing opportunities open to our graduates. Chicago Technical College, 24 Chicago Tech. Building, Chicago.

Typewriters

All standard makes, $10 up. Fully guaranteed. Free trial. Write for complete illustrated lists. Northwestern Exchange, 121 N. Francisco Ave., Chicago.

Wanted

Detectives Earn Big Money. Work home or travel. Experience unnecessary. Particulars free. American Detective System, 1974 Broadway, N. Y.

THE PERIODICAL PRESS, NEW YORK

CARPENTRY SELF TAUGHT!!!

Spare Time Reading Teaches Profitable Trade—Solves Problems

Over a hundred million dollars worth of building is being done every month! The biggest building boom in the history of the country. Men that know carpentry are in great demand. The quickest way to learn carpentry and get your share of the building money is by spare time reading of Audel's Guides. Learn the fundamentals, then keep the volume you need handy as a practical working guide. Carpenters everywhere will tell you that Audel's New Guides are a Good Set.

New Ideas-Modern Methods-Short Cuts

This course "Audel's Guides for Carpenters and Builders" consists of 4 handy volumes of over 1500 pages with thoroughly illustrated charts, diagrams, graphs, pictures with calculations for every job from making the excavation to constructing the entire building. You will find these new Guides most complete and comprehensive in addition to being both timely and practical. There are 3700 actual examples of efficient construction work with new methods, ideas, solutions, plans, systems, short cuts, time and labor saving suggestions, new ways that cover the entire theory and practice of the subject illustrated by sketches and forms all specific and practical. Audel's Guides give you the short cut, professional information you want. No need to guess or take chances. Every day you have before you in this set the exact, practical, useful information that will help you with every job that comes up in your daily work.

Thousands Say Guides Are Carpenter's Best Friend

"Reasonable Price"

I find the Guides very satisfactory. The knowledge in them is much greater than I anticipated. A very convenient size and price is so reasonable that every carpenter should possess a set. —Ralph M. Collemer, Lowell, Mass.

"Valuable for Beginners or Old Timers"

I have looked over my Audel Guides and find a wealth of information. Their size makes them very handy to carry right onto the job. I have put my books in my tool kit and have them for ready reference. The arrangement of subjects and the simple way it is explained make the books very valuable for the beginner. The rules and formulas are mighty handy for the old timers.—Ross Smith, Sommers Point, N. J.

"Good For Professional Carpenters"

It is the most handy reference work that I ever came in contact with. It is the very thing that the building mechanic needs every day for reference. I wish to state further there is not a foreman or superintendent who can afford to be without this valuable work. I wish you unbounded success. —George H. Watson, 136 Munson St., Long Island City, N. Y.

"Guides Save Hard Knocks"

The Guides are truly wonderful and should be in the hands of all young carpenters as well as a lot of the older heads. If I had such information 20 years ago they would have saved me many a hard knock and also sleepless nights trying to figure out the next day's work. —G. M. McJohnston, R. R. 1, Hammond, Ind.

"Save Money"

The Guides have met with my complete satisfaction. Anyone expecting to build a home can well save $150 or more by using the information given in your books. W. E. Frantz, Box 77, Tuscarawas, Ohio.

"Good For Amateurs"

The books are surely worth more than the purchase price; especially as they serve as a guide to the non-professional like myself who is trying to build himself a home at the least expense. —Otto F. Schulze, P. O. Box 143, Westmont, Ill.

Condensed Contents of Audel's New Guides

Guide No. 1—Over 431 pages—1200 illustrations

- How to know the different kinds of wood.
- How to use the different kinds of wood.
- Complete detailed information on nails and screws.
- How circular and band saws are handled.
- How to use the steel square.
- How to sharpen tools.
- How to file and set saws.
- How to make wood joints.
- Complete information regarding joints and joinery.
- How to build furniture.
- How to make a work bench.
- How to make a mitre box.
- How to make a mitre shooting board.
- How to plumb and level work.
- How to use the chalk line.
- How to lay out work.
- How to use rules and scales.
- How to use all of the carpenter's tools, with over 900 illustrations showing specifically how.

Guide No. 2—Over 455 pages—400 illustrations

- How to understand carpenter's arithmetic.
- How to understand geometry.
- How to understand trigonometry.
- How to solve mensuration problems.
- How to estimate the strength of timbers.
- How to proportion beams.
- How to use drawing instruments.
- How to read plans.
- How to survey.
- How to draw up specifications.
- How to estimate cost.
- How to build houses, barns, garages, bungalows, etc.

Guide No. 3—Over 255 pages—400 illustrations

- How to excavate foundations.
- How to build foundations.
- How to make water-proof.
- How to erect post foundations.
- How to build forms for concrete.
- How to proportion foundation footings.
- How to frame houses.
- How to set girders and sills.
- How to frame joists.
- How to construct a well hole.
- How to frame a studding.
- How to frame corner posts.
- How to lay out and cut braces.
- How to attach lath to corner posts.
- How to frame temporary and permanent braces.
- How to frame girts and ribbands.
- How to set window frames.
- How to frame partitions.
- How to distinguish various types of roofs.
- How to use the settings 12, 13 and 17 on the steel square.
- How to lay out mitre cuts.
- How to use tangents, and full detailed information covering sky lights, scaffold and hoisting.

Guide No. 4—Over 448 pages—400 illustrations

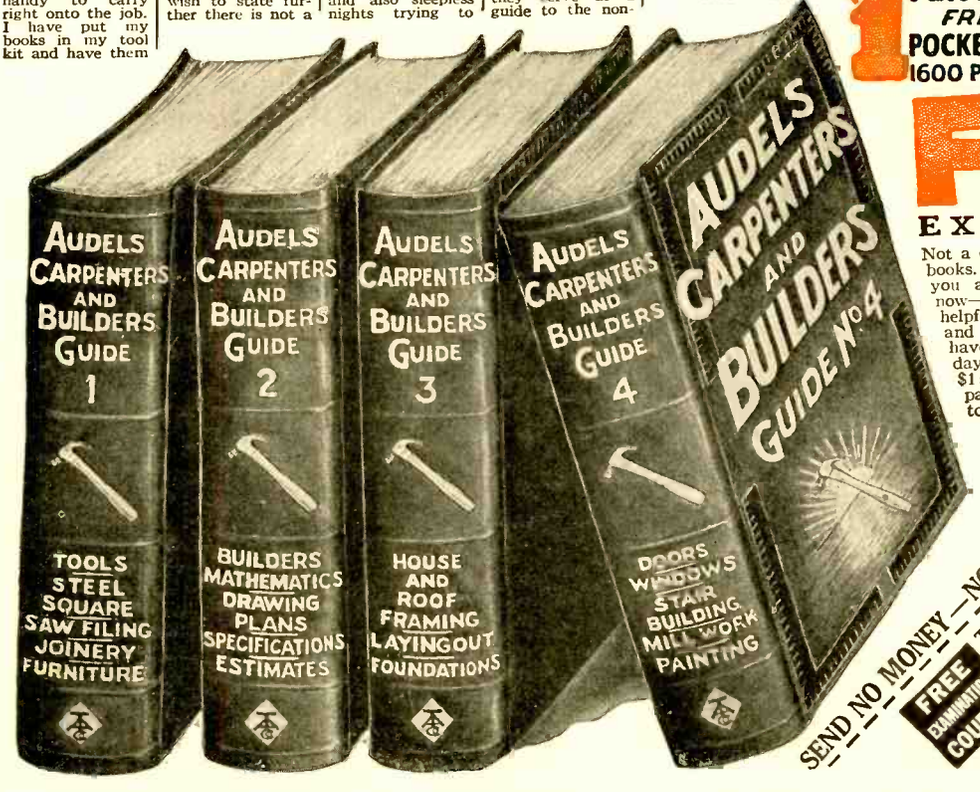
- How to put on wood, fibre and metal shingles.
- How to lay gravel roofs.
- How to lay tin roofs.
- How to hang doors.
- How to frame windows.
- How to put on siding.
- How to put on exterior trim.
- How to do cornice work.
- How to build stairs.
- How to lath.
- How to lay floors.
- How to put on interior trim.
- How to paint.
- How to give first aid to the injured.

$1 PER MONTH-ENTIRE SET $6

FREE EXAMINATION

POCKET SIZE-FLEXIBLE COVERS

1600 PAGES-3700 ILLUSTRATIONS



FREE EXAMINATION

Not a cent to pay until you see the books. No obligation to pay until you are satisfied. Send coupon now—today and get this fine, helpful new set for Carpenters and Builders. After you have looked them over 5 days send only $1, then $1 a month until $6 is paid—if you want to keep them.

SEND NO MONEY—NOTHING TO POSTMAN—MAIL COUPON NOW!

FREE EXAMINATION COUPON

THEO. AUDEL & CO., 72 Fifth Avenue, New York City.
Please submit me for approval and free examination:
AUDEL'S CARPENTERS AND BUILDERS GUIDES. Ship at once, prepaid, the 4 numbers. If satisfactory I agree to send you $1 within five days and to further mail you $1 monthly until $6 is paid.

Name.....

Address.....

Occupation.....

Employed by.....

S-I-AUG

I Tell You

This Free Book Will Show You The Way to Amazing Salary Increases

I only ask that you risk two cents on the strength of my word that the contents of this amazing book will show you the way to a prosperity that you never dreamed possible, in a fascinating field that you never thought of entering. This book is now free for the asking. Read my offer.

By J. E. GREENSLADE

FIRST let me ask you two questions. One: Do you consider that you are as intelligent as the average mail-clerk, farmhand, office clerk, mechanic, or bookkeeper? I ask you this because most of the men whose salaries have jumped are just ordinary, every-day sort of men.

Second: If you suddenly found yourself with all the money you needed to spend, wearing the best clothes, living in the finest neighborhood, driving a good car and belonging to the best clubs—but having to make good in a job that paid $10,000 a year, would it scare you? There are men to whom $10,000 a year is so much that the idea of earning it themselves never occurs to them. They will always be in routine jobs at low pay. Their dreams will never come true. But yours will if you will absorb what I am going to tell you. For my work in life is to take ordinary men from blind-alley jobs and show them how they can quickly make more money than they ever dreamed possible. And if you will give me a chance I'm going to show you how it's done!

Now, in one quick step you can enter the field where opportunities in your favor are ten to one—the Selling field. You know that Salesmen top the list of money-makers—that the salesman is his own boss—that his work is fascinating, interesting and highly profitable? But the thing you doubt is your own ability. All right, but you can become a first-class, money-making salesman in an amazingly easy way.

Proof That Salesmen Are Made —Not "Born"

You might laugh if I told you that in a few weeks or months you could be making good in a big way in the Selling field. Thousands before you have laughed—perhaps bitterly—at the idea, but many of these thousands are now making big money as salesmen.

The story of six men who once thought salesmen were "born," who did not believe they were "cut out for selling," is on this page.

Thousands of men like these six—men who formerly thought salesmen were "born," are now enjoying magnificent earnings in the selling field. They were bookkeepers, mechanics, farmers, clerks—even doctors, lawyers and ministers—but in a few months after writing to the National Salesmen's Training Association they were out in the field selling—and making more money than they had ever hoped to make in their former vocations.

Sounds remarkable, doesn't it? Yet there is nothing remarkable about it. Salesmanship is governed by rules and laws. There is a certain way of saying and doing things, a certain way of approaching a prospect to get his undivided attention, certain ways to overcome objections, batter down prejudice, overcome competition and make the prospect act.

Just as you learned the alphabet, so you can learn salesmanship. And through the NATIONAL DEMONSTRATION METHOD—an exclusive feature of the N. S. T. A. System of Salesmanship Training—you gain actual experience while studying.

The NATIONAL DEMONSTRATION METHOD gives you experience and knowledge that enables you to overcome sales obstacles of all descriptions easily. It is one of the many reasons why N. S. T. A. members make good as salesmen right from the start.

A Lifetime of Selling Experience in a Few Weeks—Then Success

No matter what you are doing now, I can prove to you that you can gain years of selling experience in a few weeks—that you can go out and successfully sell goods—that you can make more money than you ever dreamed possible.

The N. S. T. A. System of Salesmanship Training and Employment Service will enable you to quickly step into the ranks of successful salesmen—will give you a big advantage over those who lack this training. It will enable you to jump from small pay to a real man's income.

Remarkable Book, "Modern Salesmanship," Sent FREE

With my compliments I want to send you a most remarkable book, "Modern Salesmanship."

It will show you how you can easily become a Master Salesman—a big money-maker—how the N. S. T. A. system of Salesmanship training will give you years of selling experience in a few weeks; how our FREE Employment Service will help select and secure a good selling position when you are qualified and ready. And it will give you success stories of former routine workers who are now earning amazing salaries as salesmen. Mail the coupon to-day. It may be the turning point in your life.

NATIONAL SALESMEN'S TRAINING ASSOCIATION
Dept. 42-K
53 W. Jackson Blvd.
Chicago Ill.

WORLD'S OLDEST AND LARGEST SALESMANSHIP TRAINING INSTITUTION
NATIONAL SALESMEN'S TRAINING ASSOCIATION

National Salesmen's Training Association,
53 W. Jackson Blvd., Dept. 42-K, Chicago, Ill.
I simply want to see the facts. Send me free your book "Modern Salesmanship" and Proof that I can become a Master Salesman.

Name .....
Address .....
City ..... State.....
Age ..... Occupation.....

Read What They Say

$9,000 First Year

Ellis Sumner Cook, 58 Superior Street, Oak Park, Ill., left a $25 a week job and last year made $9,000!

$100 a month to $100 a week in only 3 months

H. D. Miller, a Chicago boy, was making $100 a *month* as a stenographer in July, 1922. In September, 3 months later, he was making $100 a *week* as a salesman.

$150 to $500 a month

W. P. Clenny of Kansas City, Mo., stepped from a $150 a month clerkship into a selling job at $500 a month. He is making $850 a month now.

$6,500 a year

M. V. Stephens of Albany, Ky., was making $25 a week. He took up this training and now makes 5 times that much.

Small Pay to Big earnings

J. H. Cash of Atlanta, Ga., exchanged his $75 a month job for one which pays him $500 a month.

Now Sales Manager at $10,000 a year

O. H. Malfroot of Boston, Mass., stepped into a $10,000 position as a SALES MANAGER—so thorough is this training. All these successes are due to this easy, fascinating and rapid way to master certain invincible secrets of selling.

EMPLOYERS

are invited to write to the Employment Dept. of the N. S. T. A. We can put you in touch with just the men you need. No charge for this service to you or our members. Employers are also cordially invited to request details about the N. S. T. A. Group Plan of instruction for entire sales forces. Synopsis and charts sent without obligation.