

January

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If you will mail coupon at once you will be entitled to my remarkable offer of a complete outfit of electrical apparatus, instruments

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W. E. Pence in his working togs

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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.

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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.

L. L. Cooke
Chief Engineer, Chicago Engineering Works,
Dept. 21 2150 Lawrence Ave., Chicago, Ill.

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.

Chehalis, Wash.,

L. L. COOKE, Chief Engineer
CHICAGO ENGINEERING WORKS, Dept. 21
2150 Lawrence Ave., Chicago

Dear Sir: Send 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.

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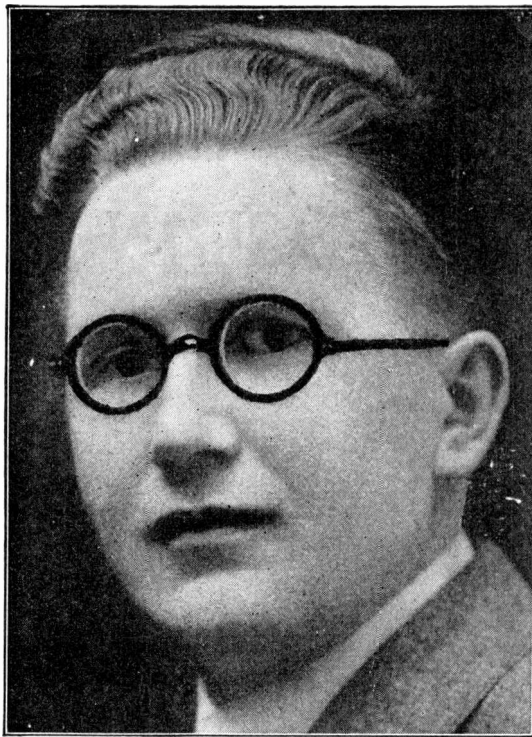
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Discovers Amazing Way to Grow Hair

Alois Merke, Founder of Famous Merke Institutes, Perfects New Method Which Brings Results in a Few Days

WILL baldness soon be a thing of the past? So it would seem—at least if we are to judge by the remarkable results being performed daily at the Merke Institute, Fifth Avenue, New York. For here hundreds of men and women—many of whom were almost completely bald—are rapidly acquiring full growths of wonderfully thick luxuriant hair, without even a trace of bald spots. As for dandruff and falling hair, these ailments are often banished after the first few treatments with this new method.

The discoverer of this new treatment is Alois Merke, a hair specialist of international reputation. His discovery, which for the first time provides a method of penetrating to the hair roots and bringing nourishment direct to them, is the result of a long experience in treating baldness, which included many years at Heidelberg, Paris, Berlin, Cairo, Buenos Ayres and other centers of dermatological research. It works on a plan entirely different from any known or used before.

At the Merke Institute, Alois Merke has treated scores of prominent stage and social celebrities, many gladly paying \$500 or more for the marvelous restoration of hair effected. But, desiring to place his discovery within reach of rich and poor alike, he recently perfected a method

whereby these same results can be secured for only a few cents a day right in your own home. The treatment may be taken in any home in which there is electricity.

Free Booklet About New Home Treatment

Through special arrangement readers of this publication may secure without cost, all details of this new home treatment to make hair grow. A 32-page booklet fully describing the Merke treatment, will be sent postpaid on receipt of the coupon below, properly filled in. No matter how long you have been bald—no matter if you are completely bald—no matter how many different treatments you have taken without results, this booklet will prove of the deepest interest to you. So send for it to-day. Merely mail the coupon and it will be sent you by return mail.

Allied Merke Institutes, Inc.,
512 Fifth Ave.,
Dept. 461.
New York City.

Actual Results

(Dozens of letters like the following are received every day by the Merke Institute)

"In the short time I have used your treatment I have gained remarkable results. Dandruff has disappeared entirely. My scalp is now all full of fine new hair. I would not part with my treatment for 10 times its cost." A. W. B.

"The top of my head is now almost covered with new hair about one-half inch long. I have been trying five years, but could never find anything to make my hair grow until your treatment." T. C.

"Ten years ago my hair started falling. I used hair tonics constantly, but four years ago I displayed a perfect full moon. I tried everything—but without results. Today, however, thanks to your treatment, I am pleased to inform you that I have quite a new crop of hair one inch long. My friends are astonished at the result." F. H. B.

ALLIED MERKE INSTITUTE, Inc.,
512 Fifth Avenue, Dept. 461,
New York City.

Please send me a copy of your free booklet, "The New Way to Make Hair Grow," which describes the Merke Institute home treatment in detail.

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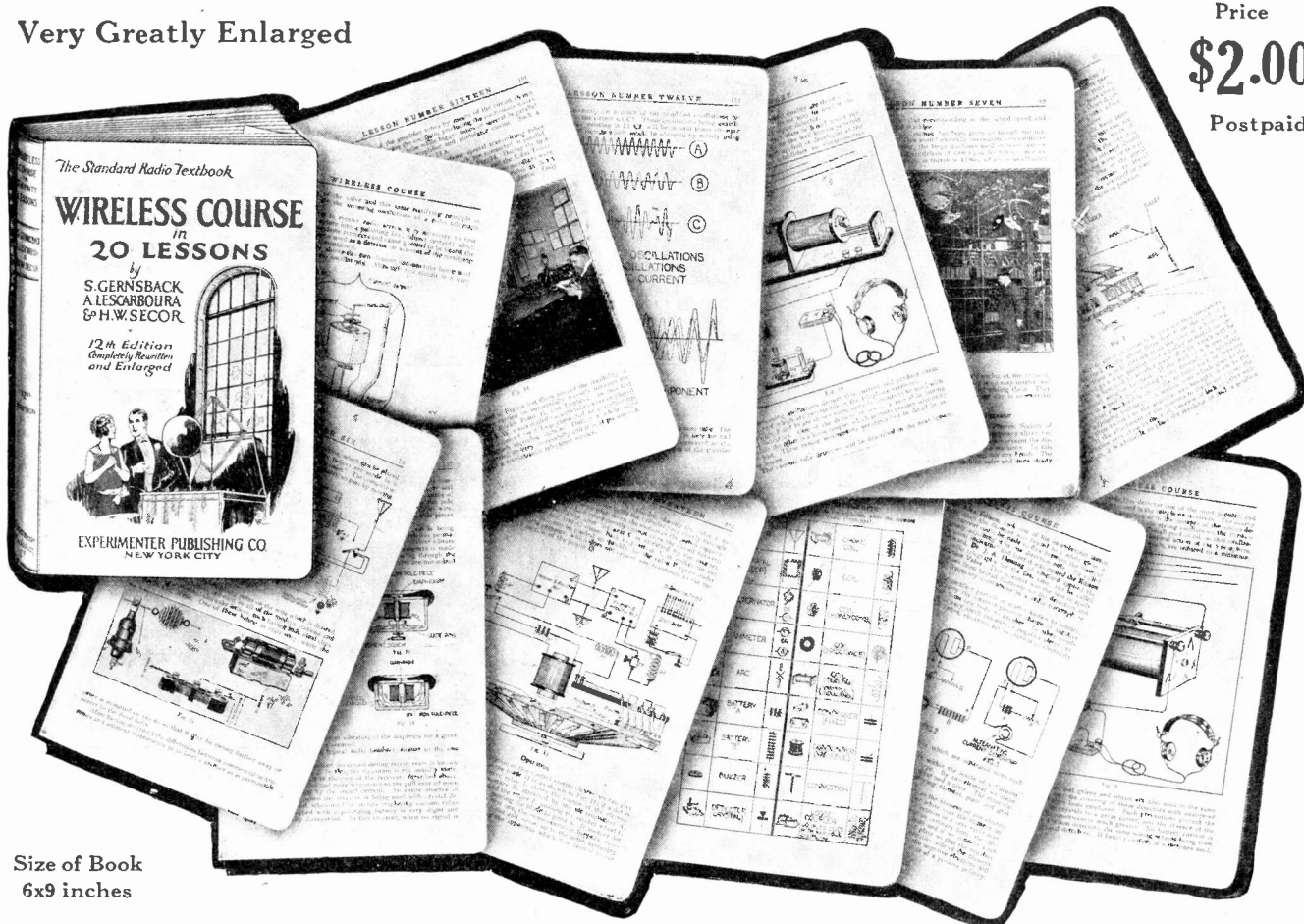
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A Problem in Invention Can You Solve It?

This simple test will show whether or not you have inventive ability; thousands have it and do not know it, or *do not develop it*. Yet invention is the easiest way to earn a fortune. No technical or scientific knowledge necessary. Read below a few instances of how little ideas have made millions of dollars for their inventors.

HOW would you like to get the royalty paid to the inventor of the tin cap used on millions of bottles? How much money would you have now had you thought of the simple idea of putting rubber tips on pencils? Wouldn't you gladly be the inventor of the Gillette Safety Razor, who it is said made as much as **TWO AND ONE-HALF MILLION DOLLARS a year!** The inventor of the tiny snap-fastener recently paid an *income tax* of \$29,000, or be the man who invented the President Suspenders who is now worth \$5,000,000. The inventor of the autographic attachment for cameras sold his patent rights for \$300,000.

Ideas Worth Fortunes

One single idea—as simple as any of these—can make you independently wealthy in a short time. Other inventors have made hundreds of thousands of dollars from such common things as the crimped hair-pin, the metal-tip shoe lace, the paper safety match, the ordinary wire paper clip. These are certainly not complicated inventions—they are so simple, in fact, that probably thousands of people thought of them but only one man DID anything about the idea when it came to him.

You, too, probably have ideas for needed inventions—and the only reason you have not turned your ideas into gold is because, like thousands of other persons, you doubt your own ability to invent. Or, like most persons, you believe that an inventor must be born; that every inventor is a man of genius who invents things as naturally as other people do their work as bookkeepers, mechanics, doctors or farmers.

Invention Can Be Learned

But this is not true. What were our great inventors *before* they invented anything. Bell was a teacher. Edison was a telegrapher. Gillette and Waterman were traveling salesmen. Better proof than this is that you can satisfy yourself that invention is not limited to geniuses or that it is merely guesswork, luck or chance. You can prove to yourself that invention—*any* invention, from the collar button to the colossal railroad engine—is the result of the same kind of thought that you use in adding a row of figures.

Just think, for a moment, what you do in any example in addition. You see a problem—the row of figures. You recognize that a result is wanted—the sum of the figures. From these two facts you go ahead and get the result. And because only one answer can be correct for that particular example, you know you solve your problem when you find that answer.

Proof YOU Can Invent

Exactly the same thing is true in invention. This is the proof. At the top right-hand corner of this page is shown a simple problem in invention. What would you put on a shaft "A" to force members "B B" to move back at the same time. A little thought will show you the correct answer within a few minutes.

This test of your inventive ability, simple as it is, illustrates the thought behind every invention. Like your arithmetic example you see first, a problem to be "fixed." Then you think of something which will "fix it," something which is the only correct answer to your problem. That is all—that is *everything*—to invention. Brought down to its plainest definition, invention is merely the science of "fixing things."

And how many times a day you do "fix things." A leaking faucet, a rattling window, a wobbly table—you fix hundreds of things like these every year. And, though you may never have realized it, every time you "fix things," you use the very definite exact principles which are the basis of Inventive Science!



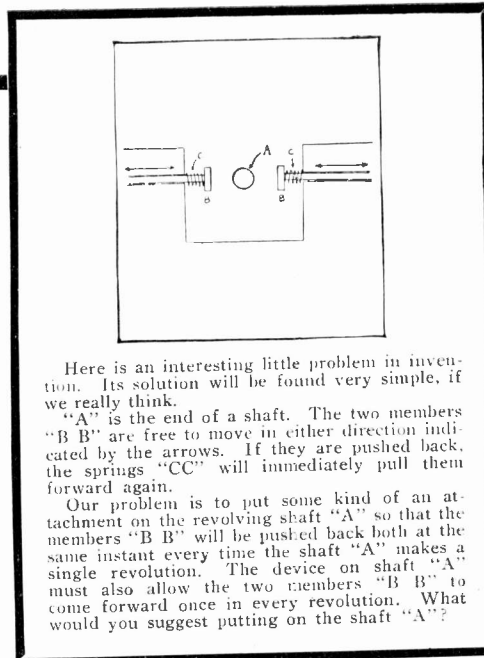
Raymond F. Yates, who with fourteen other famous inventors, now makes it easy for you to learn how to invent in your spare time at home.

What Edison Says

Could you ask the advice of any greater authority than Thomas A. Edison? He says: "Invention is a Science and should be taught as a profession."

And now for the first time, you can profit by Edison's advice. You can actually learn invention as a profession—exactly as other people are learning electricity, mechanics, law, medicine. It doesn't matter who you are, or what your present work is—you have the native ability to invent. No special knowledge of mechanics or science is necessary.

The Bureau of Inventive Science offers you the first course in practical invention ever devised. It has written down the easy-to-learn principles of Inventive Science so that everybody can read them and learn to use them. The ability to invent was *born* in you. You already possess the instinct to fix things. What you need now is to develop this ability, this instinct so you can use it to produce inventions. All you need, to become successful, is this easy, fascinating training which will develop your ability so it will be worth real money. 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.



Here is an interesting little problem in invention. 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 "CC" 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"?

New FREE Book

The most fascinating part of this great new course is that it teaches invention by actual practice, right in your own home. With each lesson you are sent some problem in invention—just like the one you worked out here. This fascinating exercise in solving actual problems in invention sharpens your instinct to fix things. Better than anything else it gives you an unforgettable, instinctive habit of thinking inventively which is worth more than you realize. In fact, the lessons and exercises are so simple, so easy to understand, so interesting, that they seem more like a pleasant game than like instruction which can make you a successful inventor.

A wonderful new book, just printed, tells you more about the Bureau of Inventive Science and its simple new course in invention. It costs nothing, so send the coupon at once. Hundreds of years ago, the world needed only few things, so few inventions were made. But now the world has more needs, more things to be "fixed." Every day you see things which must be improved. Every day you run into problems which a simple idea can solve. It may be a new toy for or your children. The man who invented the Kiddie-Kar, it is reported, made over \$5,000,000. It may be a new kind of soap. E. T. Babbitt is worth millions of dollars today. It can even be a new kind of broom to make housework easier for millions of housewives. But no matter what it is—if your idea is practical, if it solves a problem, if it satisfies a need—a fortune may be waiting for you. This bureau is not connected with patent attorneys or manufacturers. Its only purpose is to teach you the principles of practical invention used by every successful inventor. Write for the FREE BOOK now.

15 great inventors teach you every step in inventive science.

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- How to get the facts you need for inventions
- How to keep legal records of ideas
- How to use scientific principles of mechanics
- How to avoid wasting time on impractical inventions
- How to apply for a patent
- How to organize a company
- How to protect your rights
- How to market a patent

and hundreds of other vitally important facts which EVERY successful inventor knows and uses.

Bureau of Inventive Science

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H524 Each...\$3.68
A wonderful value at our price. Properly designed and constructed. Polished black bakelite rotor and stator forms. Large size. Green silk wire insures greatest efficiency. 1/4 inch shaft. Noiseless pigtail connection. Table or panel mounting.

SUPERIOR VARIOMETER

H525 Each...\$4.45
Forms moulded of red brown bakelite. A neat handsome instrument. Green silk windings calculated for highest efficiency. 1/4 inch shaft. Noiseless pigtail connections. Table or panel mounting. Produces superior results in any type circuit 180 to 650 meters.

RADIO INDUCTANCE COILS

Carefully made—fine looking coils. Highest efficiency. Low distributed capacity effect, low resistance—high self inductance. Very firm impregnation. Range given is in meters when used with .001 variable condenser. Mounted coils have standard plug mountings. Art. Not. Art. Price
Turns Range No. Mtd. No. Mtd.
25 120-250 H301 \$0.39 H320 \$0.80
35 175-450 H302 .42 H322 1.00
50 250-720 H303 .49 H323 1.94
75 390-910 H304 .54 H324 1.16
100 500-1150 H305 .58 H325 1.11
150 600-1200 H306 .63 H326 1.15
200 900-2500 H307 .72 H327 1.24
250 1200-3500 H308 .78 H328 1.33
300 1500-4500 H309 .82 H329 1.34
400 2000-5000 H310 .97 H330 1.55
500 2800-6100 H311 1.12 H331 1.60
600 4000-10000 H312 1.27 H332 1.75
750 5000-12000 H313 1.43 H333 1.90
1000 7900-15000 H314 1.70 H334 2.25
1250 9750-19500 H315 1.92 H335 2.40
1500 14500-26500 H316 2.18 H336 2.55

INDUCTANCE COIL MOUNTINGS

H340-3 Coll. Ea.\$3.40
H341-2 Coll. Ea.2.75
Sturdy, rigid durable construction. Made of polished black bakelite.

Mount on front of panel.
BACK OF PANEL MOUNTING
Mounts back of panel, with knobs or dials on front of panel. Helps make a neat efficient set. H342—Each \$4.45

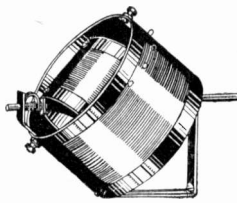
COIL MOUNTING PLUGS

Made of genuine bakelite.
H344 Plug for mounting "honeycomb" inductance coils...39c
H345 Stationary plug to fasten mounted coil stationary to panel...42c
H346 Movable plug to fasten mounted coil to panel so it can be rotated...89c
H343 Fibre strip to hold coils for mounting. Two foot piece...15c

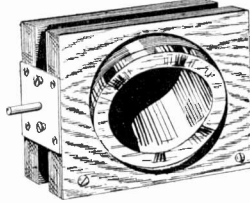
SPIDER WEB COILS

H290—25 turn 39c H292—50 turn 47c
H291—35 turn 42c H293—75 turn 54c
H294—100 turn. Each...68c
A new popular type of inductance of highest efficiency. Lowest distributed capacity and lowest high frequency resistance. Pivm green silk windings with fibre mounting strips.

OUR SPECIAL VARIOMETER AND VARIOCOUPLER



Build into your set reliable instruments. You can depend on this variometer and variocoupler to give you the best results in any circuit working from 180 to 650 meters. In design and construction they are the best. Only the highest grade materials are used. The prices quoted save you 30 to 40 per cent. Why pay more?



H418 Variocoupler. Each...\$2.45
The most efficient type of coupler, insures better tuning and louder signals. Primary and secondary wound on natural uncolored genuine bakelite tubes. Handsome green silk windings. Primary tapped for fine tuning. Can be panel or table mounted. 1/4 inch shaft.

ULTRA AUDION COIL

H297 Each...85c
Spider web wound of green silk covered wire. Four taps. Produces wonderful results. Fibre strings and wooden rod for mounting included. Directions furnished.

STRANDED ANTENNA WIRE
Cabled of fine copper strands. Very flexible. High tensile strength. Best for aerials. H248 100 ft. coil 56c H249 500 ft. coil \$2.75

MAGNET WIRE

Insulated copper wire. Best quality even drawn wire, one piece to a spool. Prices quoted are for 8 oz. spools unless otherwise stated.

Double Cotton Covered	Enameled Insulation	Silk Green Covered
Number H990	Number H992	Number H991
Gauge Price	Gauge Price	Gauge Price
18 .43c	20 .39c	20 .07.78
20 .55c	22 .50c	22 .09.95
22 .70c	24 .55c	24 .11.10
24 .80c	26 .60c	26 .13.38
26 .90c	28 .65c	28 (1 oz.) 1.25
28 \$1.05	30 .70c	30 (1 oz.) 1.65
30 .1.45	36 .90c	36 (1 oz.) 2.20

ANTENNA INSULATORS

H260 Size 1 1/2 x 1/2. Composition, metal eyelets. Two for...17c
H263 Ribbed Porcelain Insulator. 2 1/2 in. long. Ea. 6c Dozen...55c

LEAD-IN INSULATORS

H270 For 4 inch walls or less...42c
H271 For 9 inch walls or less...69c
The only practical lead in insulator for aerial wires. Small, neat, effective, durable. Fits 1/8 inch hole. Securely locked by two adjustable nuts.

OUTDOOR LIGHTNING ARRESTER

H980 Price...\$1.55
Protect your instruments with this lightning arrester. Weatherproof porcelain case. Air gap type. Permanent. Durable. Underwriters approved.

HIGH-GRADE LIGHTNING ARRESTER

H981 Each...79c
A dependable protector, always on guard. Small and compact. Weatherproof porcelain case. Easily fastened and connected. Underwriters approved.

BINDING POSTS

Brass, polished nickel finish. Washer and 6-32 in. screw extending 1/2 in.
H370 Large size—barrel and knob 3/4" long.
H372 Smaller size...H376-8 barrel and knob 9-16" long. Dozen...70c
H374 Large size with composition knob. Dozen...45c
H376 Large size with hole for phone tip or wire. Dozen...80c
H378 Small size with hole for phone tip or wire. Dozen...35c

PANEL MOUNTING VARIABLE CONDENSERS

These are especially high grade condensers and we guarantee them to be mechanically and electrically perfect. Fine polished end plates of heavy bakelite. Shafts 1/4 inch diameter. Sturdy, heavy aluminum alloy plates perfectly spaced to insure smooth, even, reliable capacity. Our low prices save you money. These condensers are of the very best make and are not to be compared with many inferior, cheap condensers offered. We guarantee them to please you or your money back. The vernier style has one separately controlled plate which permits of the finest tuning.

REGULAR STYLE

H815—3 plate...58c
H816—5 plate...97c
H814—11 plate .00025 mfd...\$1.28
H813—21 plate .0005 mfd...1.35
H812—43 plate .001 mfd...1.58

VERNIER STYLE

Including Dial and Knobs
H825—14 plate .00025 mfd...\$2.45
H824—26 plate .0005 mfd...2.75
H826—46 plate .001 mfd...3.15

OUR SPECIAL AUDIO FREQUENCY AMPLIFYING TRANSFORMERS

H550 Each...\$2.25
The result of years of research work and experienced engineering. In quality of tone and volume of sound, the things a transformer is built for, we guarantee it to equal or surpass any other transformer. Neat in appearance. Carefully made. Fully mounted with plainly marked binding post connections. 5 to 1 ratio. Wonderful results on one, two or three steps without distortion or howling. A quality item in every respect. Not to be compared with articles built for price only.

OUR SPECIAL SHIELDED TRANSFORMER

H551—3 1/2 to 1 Ratio. Each...\$2.55
H552—6 to 1 Ratio. Each...2.75
The same high grade style of transformer as above enclosed in a metal case which completely shields it from any outside magnetic influences. Very attractive appearance and sturdy construction. Free from howling and local disturbances.

OTHER STANDARD BRANDS AUDIO FREQUENCY TRANSFORMERS

Fresh, clean stock in original containers.
H232 Thordarson Ratio 3 1/2 to 1 \$3.40
H233 Thordarson Ratio 6 to 1...3.80
H553 Acme. Each...4.45
H554 Acme. Each...4.45
H555 Federal. Each...4.45
H712 Radio Corp. Each...6.40
H234 All American 10 to 1 Shielded 4.15
H239 All American 5 to 1 Shielded 4.10
H236 All American 3 to 1 Shielded 3.95

RADIO FREQUENCY AMPLIFYING TRANSFORMER

H560 For 201A or 301A Tubes...\$1.70
H561 For 199 or 11 or 12 Tubes...\$1.70
Due to its special design this transformer will produce wonderful results in any type of regular or reflex radio frequency circuit. While low in price we believe it equal or superior to higher priced transformers. Perfect for one, two or three stages. Compact, convenient form, easily mounted. Range 175 to 600 meters. Try it. If you are not satisfied return it and get your money back.

OTHER STANDARD BRANDS RADIO FREQUENCY TRANSFORMERS

H568 Our special—as good as any of them...\$4.48
H562 Dubilier. Each...4.45
H563 Acme. Each...4.45
H565 Acme. First stage. Each...4.45
H566 Acme. Second stage. Each...4.45
H567 Acme. Third stage. Each...4.45
H714 Radio Corp. Each...5.95
H995 All American. Each...3.95
H575 Erla. First stage. Each...3.55
H576 Erla. Second stage. Each...3.55
H577 Erla. Third stage. Each...3.55
H578 Erla. Reflex. Each...4.45

NEUTRODYNE TRANSFORMERS

H571 Per set of three...\$4.95
An air core transformer for use in neutrodyne method of reception. Can also be used for tuned radio frequency or as a fixed coupler with condenser across secondary. Proper design for results and efficiency. Green silk windings on bakelite tubes with adjustable mounting brackets to fit most any condenser.

NEUTRALIZING CONDENSERS

H572 Per set of two...40c
Simple, inexpensive, effective precision type. Micrometer adjustment is attainable. Easily mounted in circuit.

SPECIAL

H573 Neutrodyne Jack. Each...89c

LONG NOSE PLIERS

H970 Price...95c
The handiest pliers for radio work. Made of fine hardened steel. Length, 5 in.

DIAGONAL JAW NIPPERS

H972 Price...\$1.05
For fine electrical work, made of hardened steel. Length, 5 inches.

FOUR-IN-ONE

H974 Each...55c
Especially suitable for radio work. Will handle any size screw used. Smaller drivers nest inside larger one and are held in place with screw cap. Made of steel, nickel finished.

TINOL

H969 Per tube...19c
A combined solder and flux in handy form. Put a little on the connection, heat with a match, torch or solder iron and you have a neat electrical and mechanically perfect joint.

WITH BARAWIK STANDARD RADIO GOODS

VACUUM TUBES

Standard Brands—Cunningham, Radiotron. Every one guaranteed new and perfect. We will ship brand in stock unless you specify otherwise.

H105 Detector UV200 C300 Each \$4.38
 H112 Amplifier, UV201A C301A, 5-Watt Transmitter, 7.70
 H107 WD11 C11, Each..... 5.85
 H101 WD12 C12, Each..... 5.85
 H102 UV199 C299, Each..... 5.85

H104 UV199 Adapter fits 199 tube to standard socket 42
 H108 WD11 Socket, Each..... 31
 H109 WD11 Adapter, Each..... 45

STANDARD TUBE SOCKET

H140 Each 39c

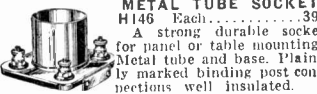
Moulded of genuine red brown bakelite. Binding post connections. For table or panel mounting. Neat and strong.



METAL TUBE SOCKET

H146 Each 39c

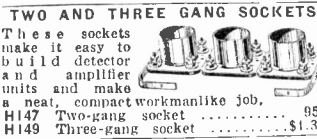
A strong durable socket for panel or table mounting. Metal tube and base. Plainly marked binding post connections well insulated.



TWO AND THREE GANG SOCKETS

These sockets make it easy to build detector and amplifier units and make a neat, compact workmanlike job.

H147 Two-gang socket 95c
 H149 Three-gang socket \$1.39



199 SOCKET

H145 Each 40c

Moulded of high insulating material. Sponge rubber base prevents ringing in tube. Plainly marked binding post connections. Neat and compact.

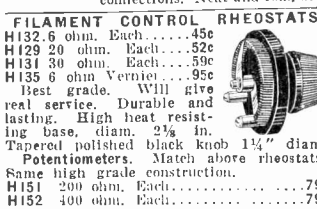


FILAMENT CONTROL RHEOSTATS

H132 6 ohm, Each..... 45c
 H129 20 ohm, Each..... 52c
 H131 30 ohm, Each..... 59c
 H135 6 ohm Vernier..... 95c

Best grade. Will give real service. Durable and lasting. High heat resisting base, diam. 2 1/4 in. Tapered polished black knob 1 1/4" diam. Potentiometers. Match above rheostats. Same high grade construction.

H151 200 ohm, Each..... 79c
 H152 400 ohm, Each..... 79c



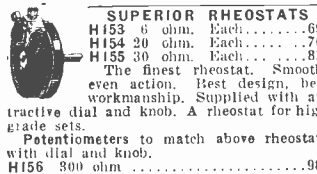
SUPERIOR RHEOSTATS

H153 6 ohm, Each..... 69c
 H154 20 ohm, Each..... 76c
 H155 30 ohm, Each..... 83c

The finest rheostat. Smooth, even action. Best design, best workmanship. Supplied with attractive dial and knob. A rheostat for high grade sets.

Potentiometers to match above rheostats with dial and knob.

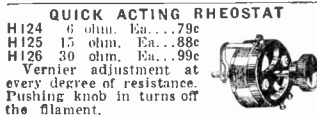
H156 300 ohm, Each..... 98c



QUICK ACTING RHEOSTAT

H124 6 ohm, Ea..... 79c
 H125 15 ohm, Ea..... 88c
 H126 30 ohm, Ea..... 99c

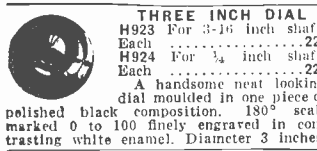
Vernier adjustment at every degree of resistance. Pushing knob in turns off the filament.



THREE INCH DIAL

H923 For 3-16 inch shaft, Each 22c
 H924 For 1/4 inch shaft, Each 22c

A handsome neat looking dial moulded in one piece of polished black composition. 180° scale marked 0 to 100 finely engraved in contrasting white enamel. Diameter 3 inches.



TWO INCH DIAL

H921 For 3-16 inch shaft, Each 16c
 H922 For 1/4 inch shaft, Each 16c

A handsome dial moulded in one piece of polished black composition. 270° scale marked 0 to 100 finely engraved in contrasting white enamel. Fine for rheostat or switch control. Diam. 2 in.



VERNIER DIAL ADJUSTER

H941 Each 19c


Easily installed at edge of dial, gives finest vernier adjustment of condenser or inductance. A great value. Polished black knob.



BAKELITE DIALS

H931—2 in. Diam. for 3-16 in. shaft, Each 35c
 H932—2 in. Diam. for 1/4 in. shaft, Each..... 35c
 H933—3 in. Diam. for 3-16 in. shaft, Each..... 39c
 H934—3 in. Diam. for 1/4 in. shaft, Each..... 39c
 H935—4 in. Diam. for 1/4 in. shaft, Ea. 48c

Moulded in one piece of genuine bakelite in polished black finish. Finely engraved scale in contrasting white enamel. Sure grip knob that fits the fingers. Higher grade dials for good sets. Sizes match perfectly.



WE PAY TRANSPORTATION CHARGES EAST OF THE ROCKIES PRESERVE THESE PAGES—ORDER FROM THEM AND SAVE MONEY FAST SERVICE—TRY US AND BE CONVINCED THE PRICES QUOTED DELIVER THE GOODS TO YOUR DOOR

OUR GUARANTEE PROTECTS YOU—We handle only the best goods, carefully tested and checked by expert radio engineers. You are assured of getting guaranteed apparatus that will give superior results. And while our goods are best, our prices are lowest. Our goods equal or surpass the claims we make for them. We do not attempt to deceive or mislead. Our reputation for fair dealing is our most valued asset.

HOW TO ORDER—Write your Order plainly, state Article Number, Description and Price of items wanted. Send Postoffice or Express Money Order, Certified Check or Bank Draft for Total of Order. Prompt Shipment is assured when these directions are followed.

ENCLOSED DETECTOR

One of the finest crystal detectors on the market, supersensitive galena crystal enclosed in heavy glass shield. Quick, positive adjustment. Brass parts polished nickel finish.

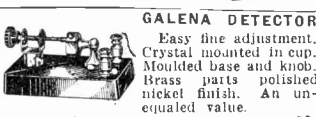
H730 Each 89c



GALENA DETECTOR

Easy fine adjustment. Crystal mounted in cup. Moulded base and knob. Brass parts polished nickel finish. An unequalled value.

H732 Each 59c



GREWOL CRYSTAL DETECTOR

H742 Each \$1.69

DETECTOR CRYSTALS

H736 Galena, Arlington tested piece 19c
 H738 Silicon, Arlington tested, piece 19c
 H735 Tested, Galena, Mounted, piece 9c
 H737 Tested, Silicon, per piece..... 9c
 H739 Genuine million point crystal, Ea. 29c

SUPERIOR VARIABLE GRID RESISTANCE

H167 Each 80c
 H168 With .00025 Condenser 95c

Eliminates hissing, clarifies signals. Capacity smoothly varied from 0 to 6 megohms by half turn of knob. Easily mounted on any panel.

H171 Freshman panel mounting variable grid leak with .00025 condenser, Each 69c
 H172 Durham variable grid leak with mounting, Each 89c
 H173 "RL" Variable grid leak, Each \$1.19

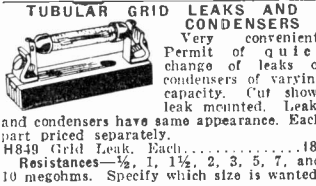


TUBULAR GRID LEAKS AND CONDENSERS

Very convenient. Permit of quick change of leaks or condensers of varying capacity. Cut shows leak mounted. Leaks and condensers have same appearance. Each part priced separately.

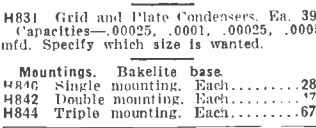
H849 Grid Leak, Each..... 18c
 Resistances—1/2, 1, 1 1/2, 2, 3, 5, 7, and 10 megohms. Specify which size is wanted.

H831 Grid and Plate Condensers, Ea. 39c
 Capacities—.00025, .0001, .00025, .0005 mfd. Specify which size is wanted.



Mountings, Bakelite base


H846 Single mounting, Each..... 28c
 H842 Double mounting, Each..... 47c
 H844 Triple mounting, Each..... 67c



SUPERIOR INDUCTANCE SWITCH

H288 Each 74c

Quickly and securely mounted by drilling one hole. Only knob and pointer show in front of panel. Connections can be soldered before fastening switch, making assembly much easier. Metal parts nicked. Bakelite knob and supporting base.



STANDARD BRAND LOUD SPEAKERS AND UNITS

H610 Murdock \$4.38
 H611 Rico 4.85
 H613 Barawik with Baldwin unit, 11.25
 H615 Pathé 19.50
 H616 Atlas 21.50
 H612 Magnavox 103 32.50
 H614 Magnavox 111 32.50
 H617 Music Master 27.00
 H755 Genuine Baldwin type C unit 5.35
 H619 Murdock Special Unit 2.60
 H618 Brandes Table Talker 8.75
 H620 Baldwin Loud Speaker 22.50

BARAWIK QUALITY HEADSETS

H770 Per Set, 2000 ohms..... \$3.25

These headsets have proven on rigid tests to be one of the very best on the market. The tone quality is excellent with an unusual volume. Skilled workmen make them from only the best selected materials. The receiver cases are fine polished finish with polished black ear pieces. Fabric covered head band comfortably and quickly fitted to the head. Supplied with 5-foot cord. These sets were designed to sell for much higher prices than we ask, and at our price are a wonderful bargain. We guarantee that you will be pleased with them and agree that they are the best value by far yet offered. If they don't suit you we will cheerfully return your money.



STANDARD BRAND HEADSETS

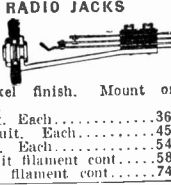
H754 Baldwin type C with universal jack plug \$10.95
 H756 Red-Head, 3000 ohm 5.78
 H768 Brandes, 2000 ohm 4.90
 H769 Brandes, 3000 ohm 6.75

H751 Murdock 56, 2000 ohm \$3.59
 H752 Murdock 56, 8000 ohm 3.95
 H764 Frost, 2000 ohm 3.59
 H766 Frost, 3000 ohm 4.15
 H758 Western Electric 9.50

SUPERIOR RADIO JACKS

Finest grade jacks. Improved design. Best materials. Phosphor bronze springs. Silver contact points. Nickel finish. Mount on panels 3/8 to 3/4 in.

H390 Open circuit, Each..... 36c
 H391 Closed circuit, Each..... 45c
 H392 Two circuit, Each..... 54c
 H393 Single circuit filament cont..... 58c
 H394 Two circuit filament cont..... 74c



COMPETITOR JACKS

H387 Open circuit, Each..... 27c
 H388 Two circuit, Each..... 35c

Well made, durable, smooth working, nickel finished frame. Well insulated.

SUPERIOR RADIO PLUGS

H395 With set screws for fastening cord, Each 35c
 H397 Two-way 45c
 H398 Head 3-16" diam., 1-16" high style cords, Each 59c

High grade plugs. Fit any standard jacks. Polished round barrels.



SWITCH CONTACT POINTS

Brass polished nickel finish. All have 3/8 in. long size 6-32 screws and two nuts. All prices the same.

Dozen 15c Hundred \$1.00

Order by Article Number.

H360 Head, 3/8" diam., 1/2" high
 H362 Head, 3-16" diam., 1/2" high
 H363 Head, 3-16" diam., 1-16" high

Solder Lugs to Fit Contact Points

Also for connecting wires to binding posts, etc.

H365 Dozen 8c Hundred 30c



SWITCH LEVER STDP

Brass polished nickel finish.

H386 Dozen 18c Hundred \$1.05



SWITCH LEVERS

Very neat polished black composition knob. Exposed metal parts polished nickel finish. Fitted with panel bushing and two set nuts. A high grade switch.

H381 1 1/2" Radius, Each 15c



INDUCTANCE SWITCH

H285 Price including knob and dial, \$1.28
 Mounts switch points and contact lever behind panel. Only one hole needed to mount. 15 switch points, any number of which may be used. Smooth wiping contacts. Attractive tapered knob.



CABINETS

Fine looking cabinets solidly built. Elegant hand rubbed dark mahogany finish. You will be proud of your set mounted in one of these cabinets. Hinged tops. Front rabbeted to take panels. Panels not included. Prices are transportation paid.



Panel Size	Inside High	Dimensions Wide	Deep	Art. No.	Price Each
6x7"	5 1/2"	6 1/2"	7"	H420	\$2.15
6x10 1/2"	5 1/2"	10"	7"	H422	2.65
7x10"	6 1/2"	9 1/2"	7"	H421	2.90
7x12"	6 1/2"	11 1/2"	7"	H424	3.65
7x14"	6 1/2"	13 1/2"	7"	H423	3.20
7x18"	6 1/2"	17 1/2"	7"	H426	3.45
7x21"	6 1/2"	20 1/2"	7"	H425	3.85
7x24"	6 1/2"	23 1/2"	7"	H429	4.65
9x14"	8 1/2"	13 1/2"	10"	H428	3.55
12x14"	11 1/2"	13 1/2"	10"	H430	4.6*
12x21"	11 1/2"	20 1/2"	10"	H432	5.45

PLATE CIRCUIT "B" BATTERIES

You can make real savings on these batteries. Don't pay more. We guarantee them to equal any on the market regardless of price. Absolutely uniform. Extra long life.


H180 Signal Corps type, small size, 15 cells, 22 1/2 volts, Each \$1.10
 H182 Large size, 5 taps 16 1/2, 18, 19 1/2, 21 and 22 volts, Each..... \$1.59
 H184 Variable Large Navy size, 16 1/2x4x3 inches 5 taps, giving range from 16 1/2 to 22 1/2 volts in 1 1/2 volt steps, Each..... \$1.95
 H188 Combination Tapped 45 volts, 30 cell, 13x4x3 battery. Tapped to give 45, 22 1/2, 21, 19 1/2, 18 and 16 1/2 volts. Handles both detector and amplifier tubes, Ea. \$3.65



"B" BATTERY METER

H189 Each 98c


Reads 0 to 50 volts. Accurately tells you the exact condition of your B Battery. Convenient watch size. Polished nickel case with wire lead.



STORAGE "A" BATTERY

A very high grade battery made especially for radio service. Guaranteed for three years. Properly cared for will give many more years of service for filament lighting. Made of best new materials. Full capacity. The best battery buy on the market. Try one of these batteries on your set for 10 days. If at the end of that time you are not fully satisfied with the battery return it and we will refund the purchase price.

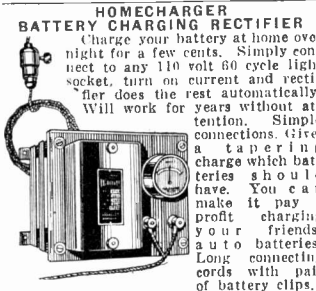
H194 6 volt, 40 ampere size, Each \$10.75
 H196 6 volt, 80 ampere size, Each \$13.25



HOMECHARGER BATTERY CHARGING RECTIFIER

Charge your battery at home overnight for a few cents. Simply connect to any 110 volt 60 cycle light socket, turn on current and rectifier does the rest automatically. Will work for years without attention. Simple connections. Gives a tapering charge which batteries should have. You can make it pay a profit charging your friends' auto batteries. Long connecting cords with pair of battery clips.

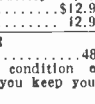
H201 For 6 volt battery..... \$12.95
 H203 For 12 volt battery..... 12.95



HYDROMETER

H190 Each 48c


Accurately tells you the condition of your storage battery. Helps you keep your battery in better condition.



BATTERY CLIPS

H198 Two for 28c

Clip onto storage battery terminals, lead coated. Make positive non-corrosive contact at all times.



WIRE CONNECTING CLIPS

H199 Per dozen 30c

Small connecting clips for quickly fastening leads on to binding posts, etc. Handy and useful. Every radioist should have at least a dozen.



RADIO "BAKELITE" PANELS

Notice our very low prices on this fine quality material. Other bakelite for hard rubber panels which are worth much less. We supply genuine Bakelite. Condensers Celoron or Formica, all of which are materials with practically identical mechanical, chemical and electrical properties. Machines well without chipping. Won't warp. Waterproof. Highest mechanical and dielectric strength. Attractive natural polished black finish which can be sanded and oiled.

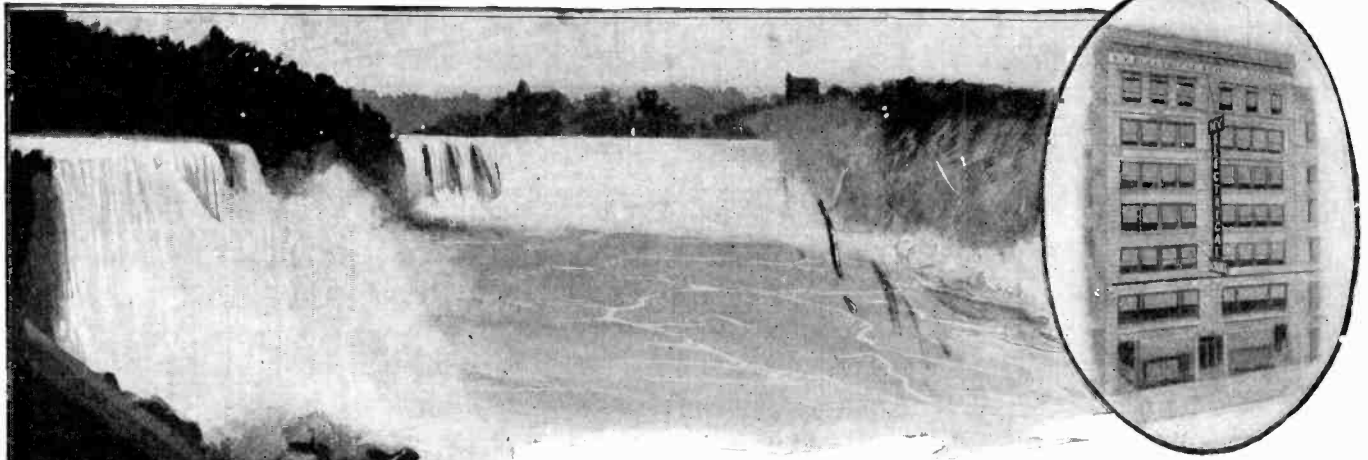
Panel Size Inches	1/2" thick	3-16" thick	1/4" thick	Art. No.	Price
6x7	H450 \$0.57	H460 \$0.87	H470 \$1.15		
6x10 1/2	H451 1.80	H461 1.27	H471 1.73		
7x14	H458 1.38	H468 2.07	H478 2.76		
7x18	H453 1.78	H463 2.65	H473 3.50		
7x21	H457 2.05	H467 3.05	H477 4.10		
7x24	H459 2.42	H469 3.56			
9x14	H454 1.85	H464 2.65	H474 3.56		
12x14	H455 2.42	H465 3.56	H475 4.78		
12x21	H456 3.62	H466 5.35	H476 7.13		

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Made of a special compound having a rubber base. Equal in appearance and in all essential points to any other class of panels. Fine smooth polished finish. Can be drilled or cut without chipping. Guaranteed not to warp and to be a perfect insulator for radio use. Smooth, clean edges. Thickness 3/16 inch. Size given in inches.

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 H482 7x12..... 1.05
 H483 7x14..... 1.22

H484 7x18..... \$1.60
 H485 7x21..... 1.85
 H486 7x24..... 2.10



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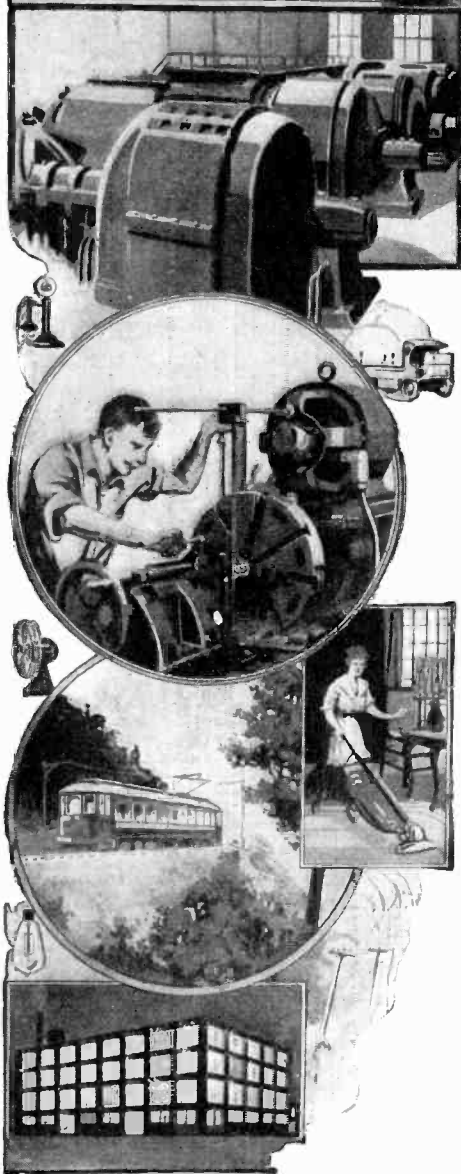
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Volume XI
Whole No. 129

Science and Invention

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

JANUARY
1924
No. 9

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

Evolution

By H. GERNSBACK

R. H. GERNSBACK,
New York City.

M

Dear Sir:

The pleasure which I derive from your editorials can never be determined. They are the best I have ever read, yet there is one thing which I have often wondered about, and which I have never seen treated on your editorial page of SCIENCE AND INVENTION. It is man's evolution. Many of the science magazines have completely over-stressed the question.

I am sure your readers are earnestly looking for your opinion concerning this subject. It would be very much appreciated if we could read your views of the

above in the next issue of SCIENCE AND INVENTION.

Thanking you I am

Very truly yours,

(S) FRANCIS L. WADSWORTH, JR.

Radio Editor of Macon County School Review,
Tuskegee, Alabama.

The writer must thank the sender of the above for his letter. The writer had no idea that so much attention was paid to his editorials. He has been writing them for years as a sort of hobby, which was hard to abandon, but it is gratifying to see that there are really people who read them.

The reason the writer has never written an editorial on man's evolution is, that the subject is so vast, that it is almost impossible to treat it successfully in a short editorial. One of the best works on man's evolution that the writer ever came across is H. G. Wells' "Outline of History," with which the writer is very much in sympathy. In the main, it expresses the writer's ideas. The following, however, will give a few of his own observations on man's evolution at random.

Life began on this planet the minute the earth had formed a solid crust and had cooled off so that water would not boil on its surface. At that time evolution on this planet commenced. Just how life actually began at first it is impossible to tell now. The reason is that we do not know now what life really is. But it seems probable that the first living creatures came from the muck and slime collected by sea waters on beaches. In other words, life first came out of the depths of the ocean. This seems pretty well established today. Man is a descendant of fish. Man's spine and the spine of a fish are in principle the same. Even man's hair can be directly traced to fish scales.

Of course, all this evolution is extremely slow. From the first fish to the first prehistoric man, you will find that the time must be measured in millions, if not billions of years. Evolution on this planet in general is very slow and very gradual. It takes tens of thousands of years before a change can even be detected. The Egyptian mummies that we find today, although perhaps five or six thousand years old, are practically the same anatomically as ourselves. In other words, a span of 5,000 years in man's evolution means nothing at all. How could it be otherwise when only 58 generations have elapsed since Christ was

born nineteen hundred and twenty-three years ago, and only 178 generations have elapsed since the earliest Biblical times, figuring the average life at one-third of a century. Every breeder of horses and dogs knows that the process of evolution is extremely slow. Many generations must be passed before even the slightest change is possible.

Before man had acquired speech, it is very probable that he roamed the primeval forests much as wild animals do today. He probably was entirely covered with hair and there is no question that in many respects he resembled a large monkey. This does not mean that man has descended from monkey or that monkey has descended from man. During the process of evolution there probably came a time when a so-called "split" arrived, of which the human race is one branch and of which the monkeys are another branch; but that both descended from the same common ancestors there is no reason for doubt. All of our ancestors originally came from the sea.

Our abode then was probably the primeval forests. That the earliest man dwelt in trees, there is today no doubt. Down to our present day, the instincts still lead back to the forests. Nearly every human being still dreams of falling through space. This can be traced directly back to the time when we were still living in trees and when one of the greatest dangers to the race was the falling from a tree into the fangs of some prowling beast.

Nearly every man, particularly those who go hunting, know the strange feeling that comes to them when followed in the dark. The hair of the back of the neck begins to bristle in a disagreeable manner. This, even today, is common in many animals such as monkeys, dogs, etc.

Even the panic-stampede of human beings can be traced directly to the forests. A man when alone has an entirely different psychology than a man in a crowd. The collective stampede of the human race is an exact counterpart of the animal stampede as it exists with many animals.

One surprising thing that the writer has always been concerned with is: How many times has a "human" race been evolved during the past millions of years. By that is meant animals—not necessarily resembling man—that could talk and REASON as human beings do. But there is a possibility that such a race lived on this planet, having long been supplanted by other species under Nature's own law of the "survival of the fittest."

Of course, it might be said that under this classification, such highly developed insects, as for instance the ants and the bees, would come. Many entomologists are of the opinion that both of these insect classes really do reason, which the writer does not deny. But it might be said that there can be several classes of reasoning. For instance, it may be doubted if either the ant or the bee knows anything of astronomy, of scientific research work, of chemistry, etc. In any event, both of these classes of insects are much older than the human race, but neither of them seem to have made use of the planet's treasures. So far, only the human race seems to have had this "gift."

I BELIEVE

¶ THAT you can't believe everything you see with your own eyes.

I BELIEVE

¶ THAT most successful inventors are made — not born.

I BELIEVE

¶ THAT there is nothing more mind ennobling in the whole world than astronomy.

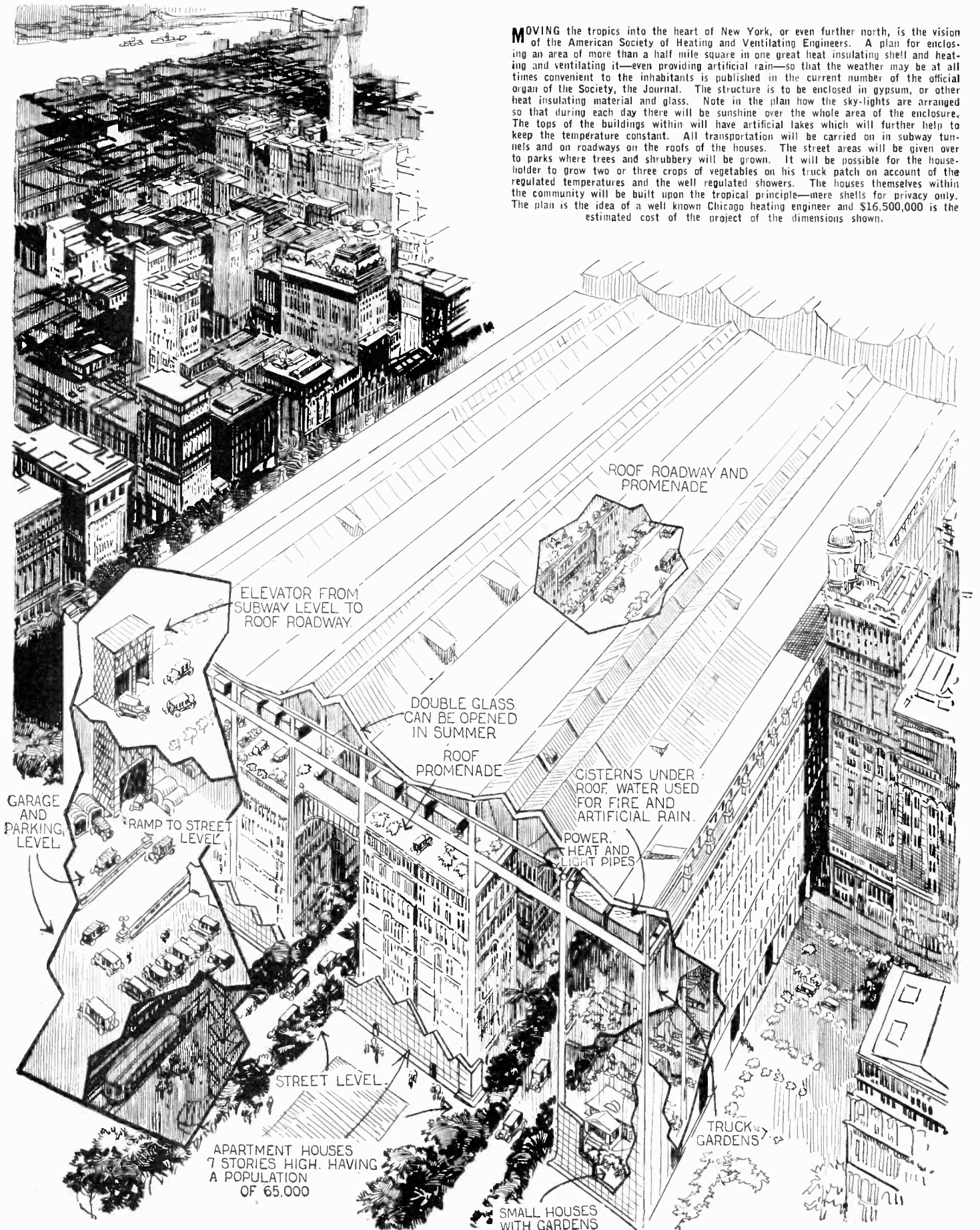
THE GOLDEN AGE OF SCIENCE

is now symbolized by the golden cover of SCIENCE & INVENTION. LOOK FOR THE GOLD COVER every month!

A Glass Enclosed City

Glass Enclosed Community to Have Artificial Heat and Rain.

MOVING the tropics into the heart of New York, or even further north, is the vision of the American Society of Heating and Ventilating Engineers. A plan for enclosing an area of more than a half mile square in one great heat insulating shell and heating and ventilating it—even providing artificial rain—so that the weather may be at all times convenient to the inhabitants is published in the current number of the official organ of the Society, the Journal. The structure is to be enclosed in gypsum, or other heat insulating material and glass. Note in the plan how the sky-lights are arranged so that during each day there will be sunshine over the whole area of the enclosure. The tops of the buildings within will have artificial lakes which will further help to keep the temperature constant. All transportation will be carried on in subway tunnels and on roadways on the roofs of the houses. The street areas will be given over to parks where trees and shrubbery will be grown. It will be possible for the householder to grow two or three crops of vegetables on his truck patch on account of the regulated temperatures and the well regulated showers. The houses themselves within the community will be built upon the tropical principle—mere shells for privacy only. The plan is the idea of a well known Chicago heating engineer and \$16,500,000 is the estimated cost of the project of the dimensions shown.



APARTMENT HOUSES
7 STORIES HIGH. HAVING
A POPULATION
OF 65,000

Movies Manufacture Own Lightning

Machine Shoots Two-Foot Flame Twenty Feet In Air.

Here is shown the machine devised by the Metro Studios, for producing artificial lightning effects. It shoots a flame two feet in diameter twenty feet in the air. The flash is made by a mixture of pyro-aluminum powder, acetylene, oxygen and compressed air.

Above is shown the machine in operation with the truck and built-in air compressor. Only two men are required to operate the device. At the top right is shown the large powder tank, oxygen and acetylene containers and controls.

In the diagram: A-Acetylene tank, B-Oxygen tank, N-Small acetylene tank for pilot light. E-Compressed air tube. D-Pyro powder container. O, P, Q and R-Gas and powder mixers. Powder is forced up tube.

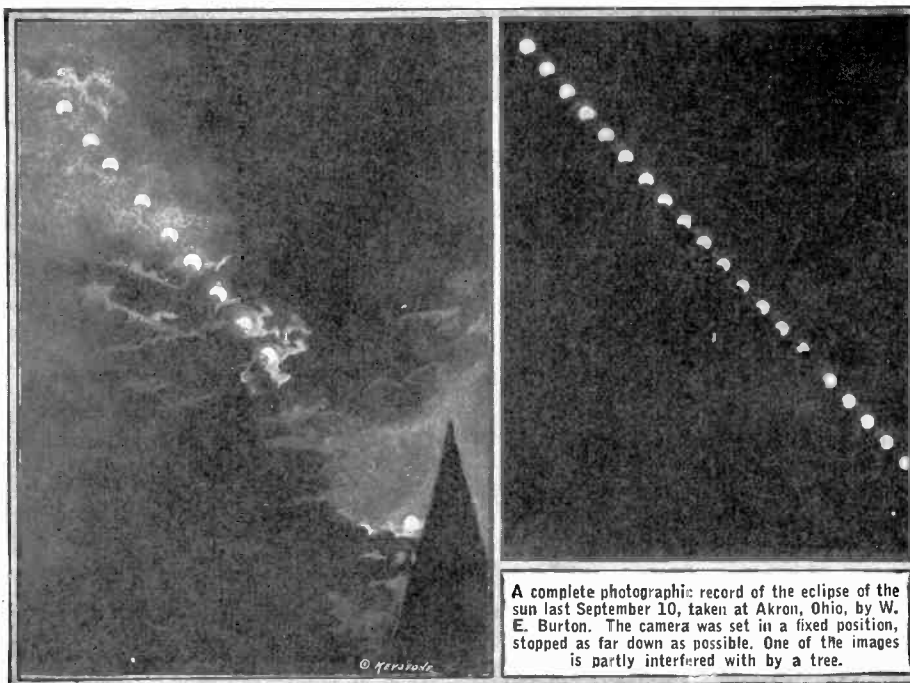
Control for the powder is at the bottom of the funnel tank. Gases are released around the spray of powder at the nozzle opening. Phil Gersdorf.

Black Lightning



In spite of the fact that practically no explanation which really explains the nature of the so-called black lightning has been brought forward there seems to be no end of evidence as to its actual existence. Above is a photo of the phenomenon taken recently at Spokane, Washington, by T. L. Walker. The original photo was taken on a five by nine plate and in a perfectly ordinary way. It was taken at night with a small exposure and the lightning furnished the only illumination for the plate. The smaller reproduction shown here is a reduction from the original plate. Some scientists have gone to great length to prove that this phenomenon is the work of some defect in the photographic process or due to some peculiarity in the plate or in the camera

Photographs of Eclipse

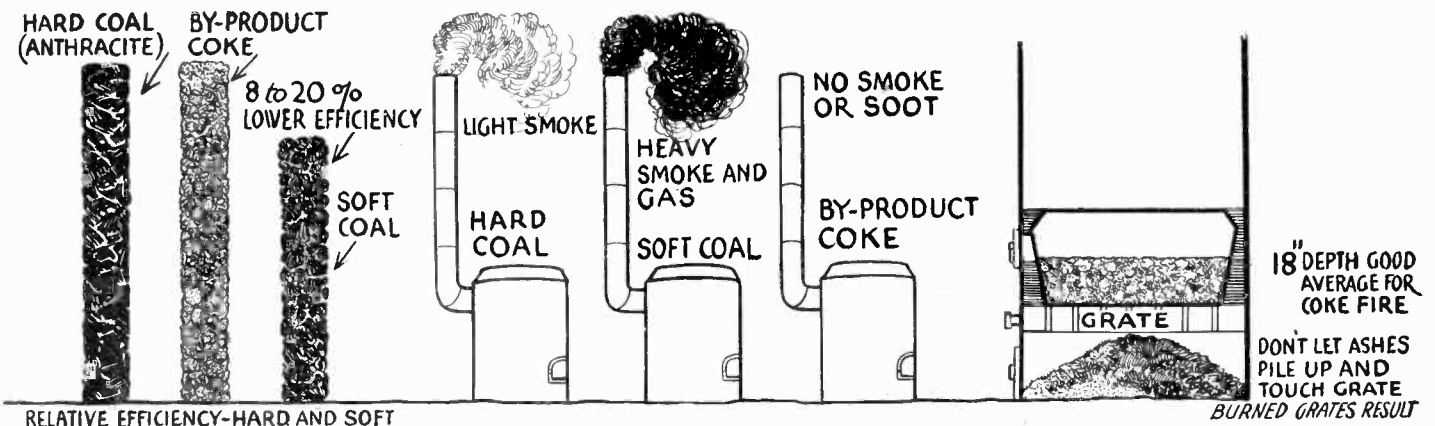


A complete photographic record of the eclipse of the sun last September 10, taken at Akron, Ohio, by W. E. Burton. The camera was set in a fixed position, stopped as far down as possible. One of the images is partly interfered with by a tree.

At the left above is shown another composite photograph of the eclipse that was obscured for a period of thirty minutes by a passing cloud. This series was made at Scranton, Penn. The cloud moved in the way after nine, five-minute exposures had been made. The exposures began at 4:10 P. M. The last one was made at 5:25 P. M.

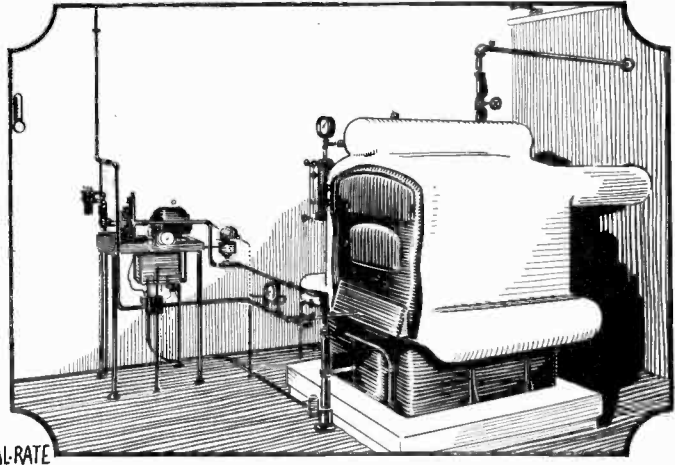
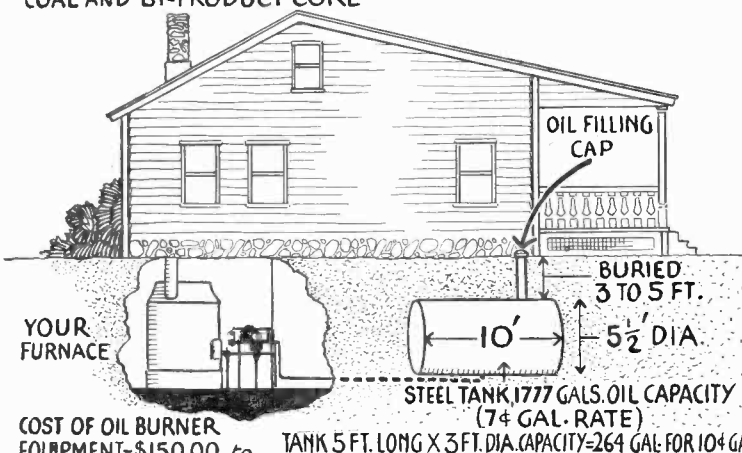
Coke and Oil As Coal Substitutes

By-Product Coke and Oil More Efficient Than Coal.



RELATIVE EFFICIENCY-HARD AND SOFT COAL AND BY-PRODUCT COKE

BURNED GRATES RESULT



COST OF OIL BURNER EQUIPMENT-\$150.00 to \$350.00

TANK 5 FT. LONG X 3 FT. DIA. CAPACITY-264 GAL. FOR 10 1/4 GAL. RATE
 130 GALS. OIL=1 TON COAL @ 7 1/2 GAL.=\$9.10 TON COAL EQUIVALENT
 @ 10 1/4 GAL.=\$13.00 TON COAL EQUIVALENT

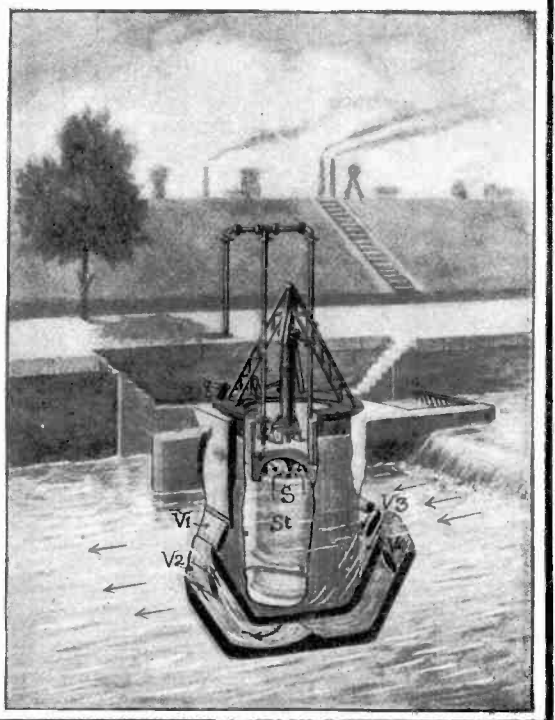
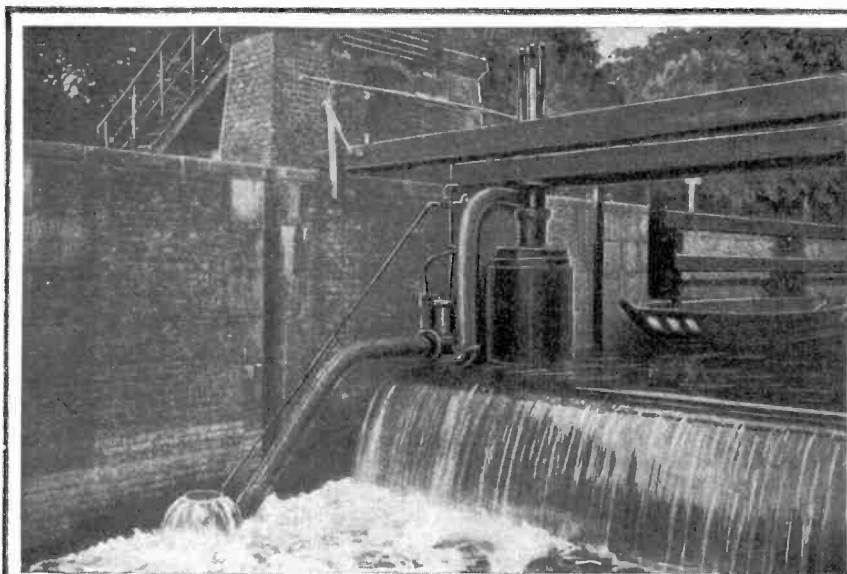
OIL BURNER ATTACHED TO FURNACE

With the ever-increasing difficulties connected with burning coal and the attendant dirtiness, the U. S. Bureau of Mines, after a full investigation state that it is not only more economical but cleaner and easier to fire coke and oil in homes and small buildings than coal. Their tests show that coke burns with the efficiency of anthracite coal

(between 10 and 20 per cent more than bituminous). Their method suggested to burn the by-product coke is shown in the upper right corner. Careful regulation of the draft is necessary. In burning oil, the main problem is that of securing a tank large enough to get the cheapest rate on the fuel delivered. Details are shown above.

TURBINE-LIKE MACHINE FOR TIDE POWER

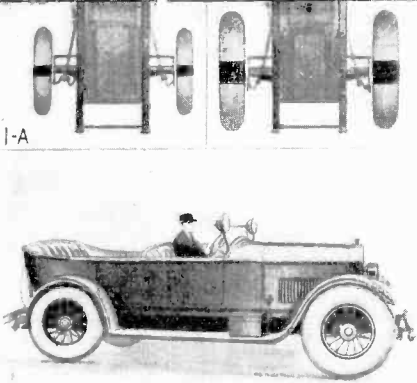
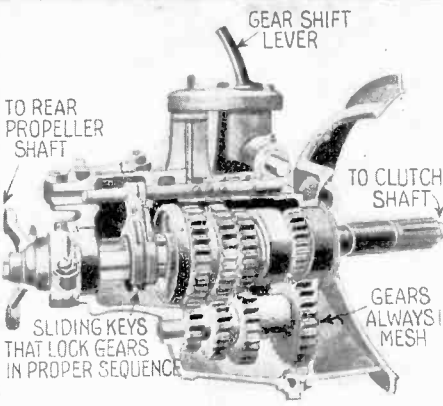
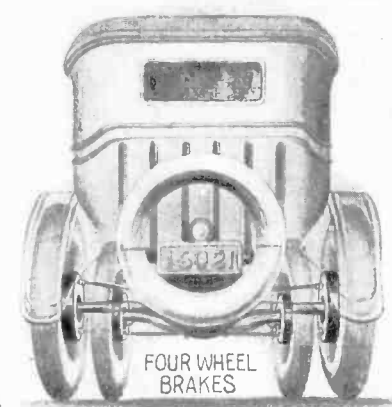
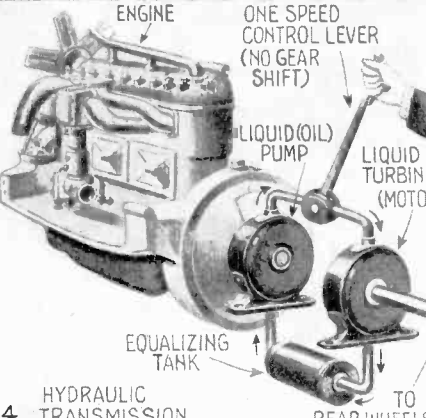
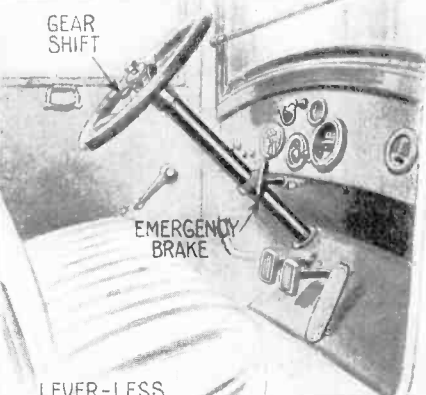
BY DR. H. BECHER.



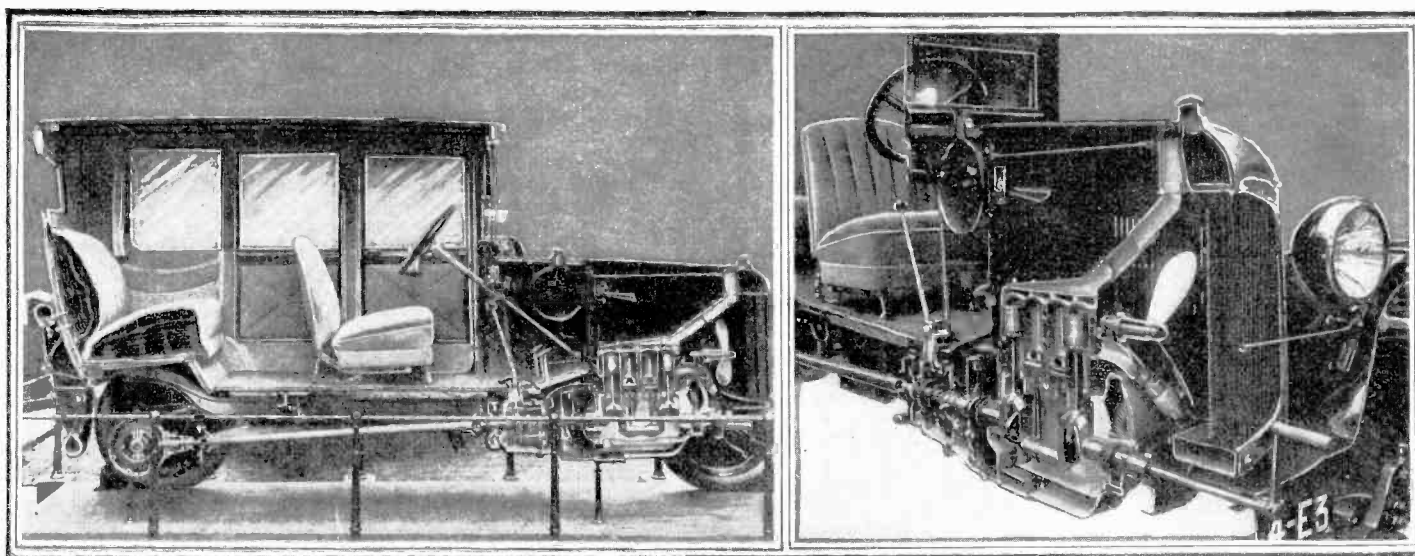
By housing a common design tidal turbine within a case arranged with a system of valves, German engineers have completed a machine for the utilization of the power of the sea that works as the tide flows in both directions. When the tide is incoming the water flows through the valve V1, through the cylinder, into the turbine and out at valve V4. When the tide changes direction the other two valves of the appliance come into use and the water follows the path from V3, through the cylinder, over the turbine and out at V2. Thus the direction of operation of the turbine is the same at all times. Above is shown a view of the complete arrangement as it looks installed. At the right is a diagrammatic arrangement showing the path of the water as it passes through the machine. The device shown in the illustration is used for pumping water.

Automotive Improvements of the Year

Recent Advances Shown at New York Auto Show.

 <p>1-A</p> <p>1 BALLOON TIRES</p>	 <p>GEAR SHIFT LEVER</p> <p>TO REAR PROPELLER SHAFT</p> <p>TO CLUTCH SHAFT</p> <p>SLIDING KEYS THAT LOCK GEARS IN PROPER SEQUENCE</p> <p>GEARS ALWAYS IN MESH</p> <p>2 NEW GEAR SHIFT</p>	 <p>3</p> <p>FOUR WHEEL BRAKES</p>
 <p>ENGINE</p> <p>ONE SPEED CONTROL LEVER (NO GEAR SHIFT)</p> <p>LIQUID (OIL) PUMP</p> <p>LIQUID TURBINE (MOTOR)</p> <p>EQUALIZING TANK</p> <p>4 HYDRAULIC TRANSMISSION</p> <p>TO REAR WHEELS</p>	<p>Most of the radical changes in the design of motor cars and their equipment, during the past year, have been in connection with braking and gear transmission. At 1 are shown the new "Balloon" tires, seven and one-half inches in diameter for the ordinary touring or closed car and inflated to only 25 pounds pressure. The manufacturers claim that cars equipped with these tires have more braking surface than the new four-wheel-brake cars. A comparison of the braking surface of the balloon tires and the ordinary type is shown in the illustration at 1A. The four-wheel-brake type car is shown at 3. At 2 we have the new constant mesh gear. They are shifted in the regular way by the driver, but in operation, instead of actually shifting the relative position of the gears in the gear box he merely shifts the keys fastening the gears to their shafts. This allows a perfect shift on hills since the gears are always in mesh. At 4 we have the new hydraulic transmission. At 5 is shown a new gear shift mounted on the steering wheel. The emergency brake terminates on the dash. Note the ample space.—H. W. Secor.</p>	 <p>GEAR SHIFT</p> <p>EMERGENCY BRAKE</p> <p>5 LEVER-LESS CONTROL</p> <p>(C) 1923 SCIENCE & INVENTION</p>

DEMONSTRATION CAR "CUT IN HALF"



At the recent Paris Automobile Show an enterprising manufacturer, in order to show his clients exactly how his wares are made and what they are made of, exhibited to view a full sized car cut completely in half. The car is shown above. Note that every part can be plainly seen. A good hint to American car exhibitors.

THE FIRST PRIZE WINNERS IN OUR \$1,000 CONTEST

are announced in this issue! Do not fail to read the list on page 856. Each month for the coming year this series of prizes will be given for the best articles appearing in SCIENCE AND INVENTION. And nearly every article published will receive one of them. The competition is open to everyone. It is only necessary for contestants to submit their ideas with a short description accompanied by pencil sketches. Be sure to rush YOUR ARTICLE so you may win YOUR PART OF THE \$1,000.

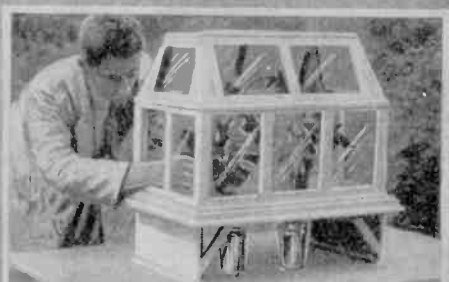
Making Butterfly Trays



One of the simplest ways in which to obtain butterflies for experimental purposes is to lure them with the aid of dried apples and valeric ether. It is only necessary to hang the fruit, on which a little of the ether has been sprinkled, on a convenient fence or twig. It will only be a short time until the collector will have as many of the insects as he can use.



In raising butterflies and moths from the eggs laid by the mother it is only necessary to find the twigs and leaves upon which the eggs are laid and then surround them with gauze or netting to protect them from their natural enemies, and to keep them from falling to the ground as soon as they are hatched. Any variety of light netting may be used.



In case it is found desirable to watch the development of the larva more closely, a small glass housing such as shown in the above photo may be constructed at a small cost by the investigator in which the development of the eggs may take place. The housing should be constructed so that the stems of the plant food supplied the insects may protrude into water.



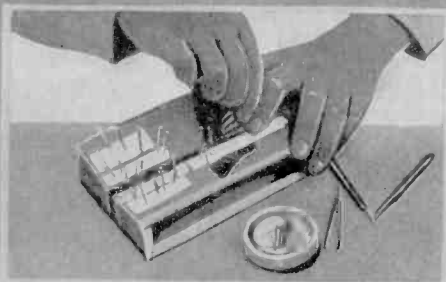
After the butterflies have reached their full development and are ready for the final mounting, they sometimes become too dry for ease in handling. If such is the case it is only necessary to put the dried insect on a small plate covered with sand as shown above and then to moisten the sand with a bit of water. It might be noted that when dry they become extremely brittle.



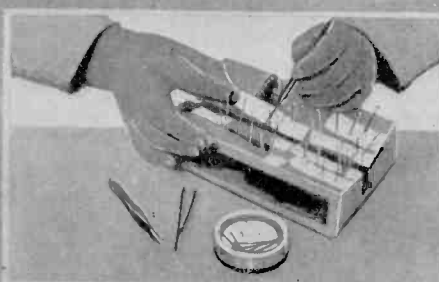
After the insects have been placed on the sand and it has been moistened the whole is covered with a glass container and allowed to set for a few hours. It is a dangerous practice to handle the dried butterflies since they become so brittle that the slightest touch will shatter them. For this reason if there is any sign of dryness it is safest to dampen them.



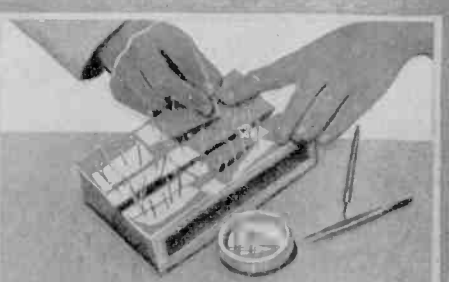
The drying board for the final process is shown in the above photo. It is made of two pieces of thin board mounted so that they take the shape of a flattened "V" with a small crack between them. The separation between the two boards should be large enough to accommodate the abdomen of the insects to be mounted. These boards may be made in any length desired.



For final drying, place the abdomen of the insect in the space between the two boards and with the aid of pins and strips of paper flatten the wings as shown above. For ease in handling the specimen it is best to thrust a pin through its abdomen, being careful not to disrupt the legs or the form of the body. By using this pin as a handle there will be many less mishaps.



After the bits of paper have brought the wings into place pin them thoroughly to the board. A very convenient tool to use in this process is made by fixing a fine needle into a wooden handle. This will help the operator to move the fragile subjects with a great deal less danger to them. A fine pair of tweezers will also be found to lend ease to many operations.



After the process of fixing the specimens to the drying boards is complete and all the pins and papers are found to be tightly fixed to the board so that they will not be removed by vibrations the whole is set away in a dry, cool place for about three weeks. At the end of this period it will be found that the specimens are thoroughly dried and are in perfect shape for display.



When making decorative backgrounds with the aid of the insects for such articles as serving trays or novelty decoration designs the well dried insects are placed on a foundation of evenly spread absorbent cotton. In order to heighten the effect the cotton may be covered with silk or other soft material. If the article to be decorated is a serving tray, the back is removed and the cotton and silk spread evenly over it.



After the foundation has been prepared, the dried specimens are removed directly from the box and with the aid of the tools described above are placed on the background in the preconceived design. If the effect is to be heightened milk-weed seeds and dried grasses and in some cases dried flowers may be used in connection with the insects. It is best to mark out the location where the specimens are to appear on the completed design so as to do away with as much handling as possible.



Here is shown the completed design after the insects, the flowers and the seeds have been put in place on the background and the whole is placed under the glass of the serving tray. An infinite variety of designs may be put into effect through this method and the complete product will have colors and a purity of design that any painter might well envy since it is made of the natural product of Nature.—Dr. Ernest Bade.

Radio Power Assured

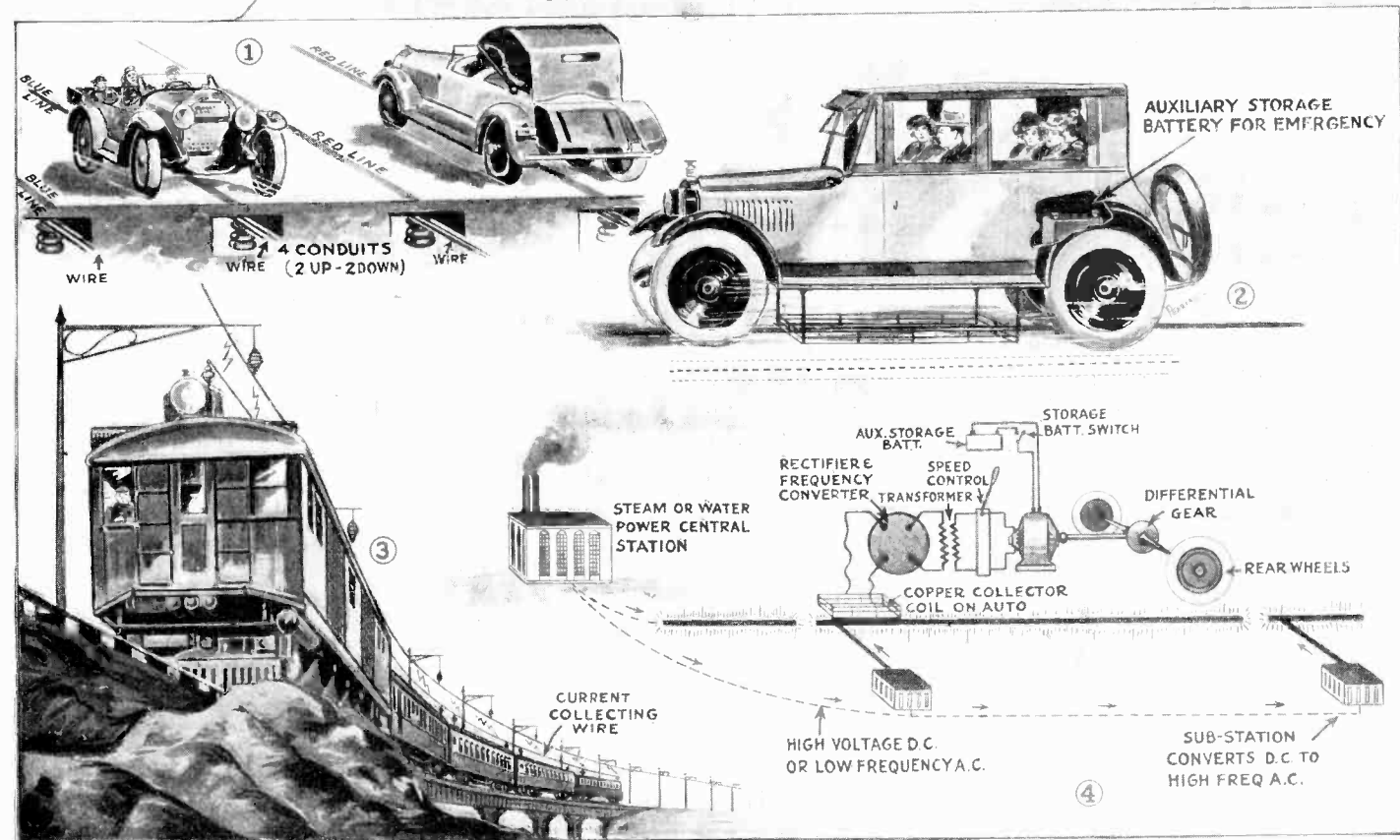
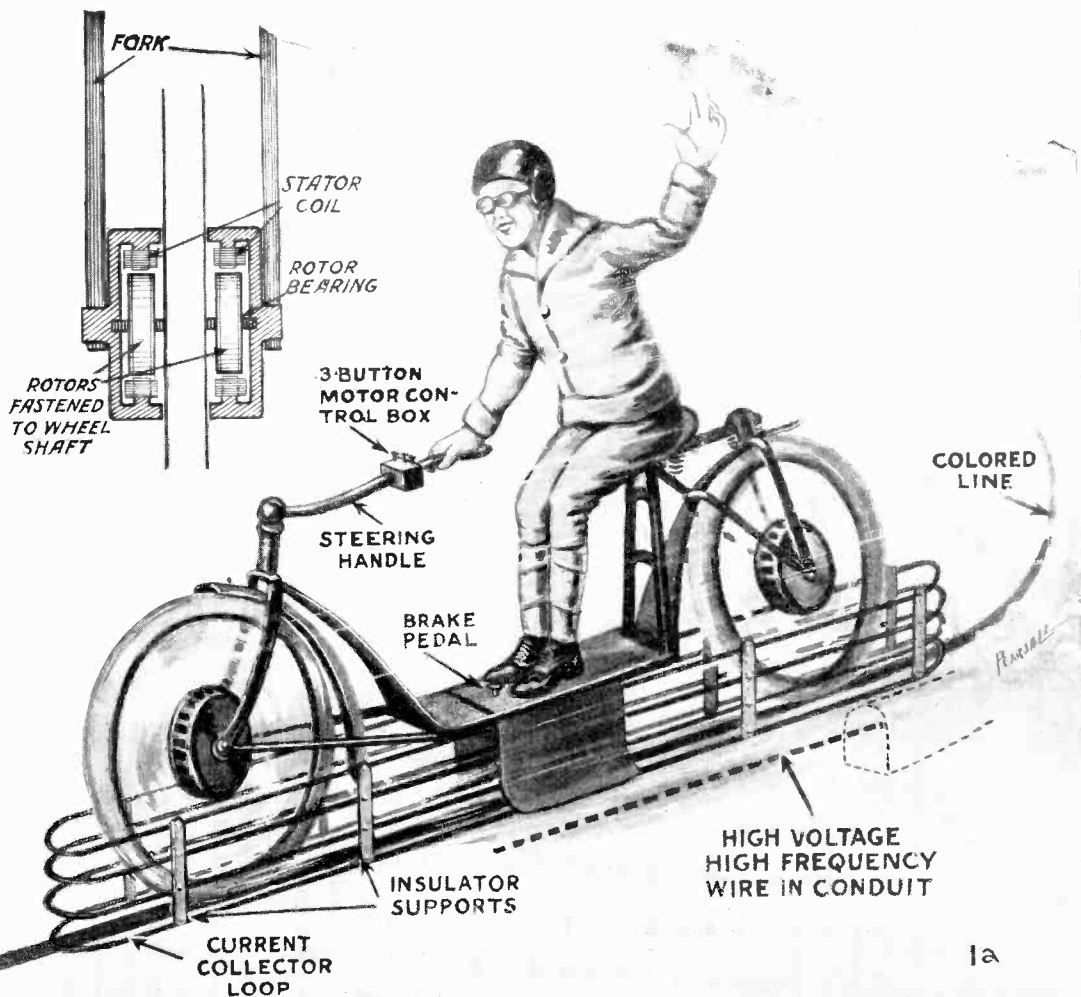
High Frequency Induction Assures Radio Power Transmission.

By H. GERNSBACK

FRENCH radio engineers have recently experimented with a new sort of radio power. Our diagram 4 shows how a sub-station would convert the direct current into high frequency alternating current which, in turn, would be led to an underground conductor resembling a third rail, located three or four inches below the level of the street or road. Automobiles. (Figs. 1 and 2), or a car as illustrated on our cover and Fig. 1A, would carry a number of wire convolutions in which the energy from the underground conductor would be induced. The electric motors to drive the wheels would derive their energy from these stationary loops mounted underneath the car. On the train shown in Fig. 3, the energy is taken from the overhead wire without a trolley being used. The energy is induced into a stationary wire on top of the train.

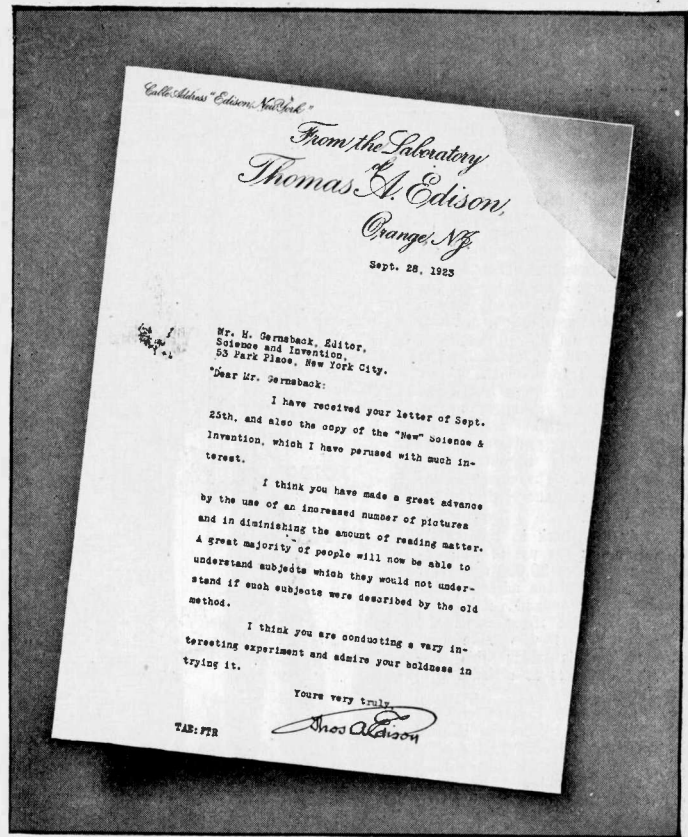
The only draw-back to the scheme heretofore was the use of tremendous frequencies of 20,000 cycles per second but with the advent of the vacuum tube (audion), it is now possible to solve the problem and French engineers who have constructed models along this line express themselves as satisfied with the tests.

The next step is to transform the high frequency current as induced in the automobile coil to the order of 15 to 50 periods per second. This result is obtained by means of mercury vapor rectifiers. Regulation of the speed of the vehicle is accomplished very simply by means of a little self-induction coil of several turns of copper wire wound into a helix. This coil acts upon the current as a faucet on water, passing more or less current. Future automobiles or cars of the type shown will carry auxiliary storage batteries for traveling away from the electrified roads. We understand that this system is to be tried out in France very shortly.



Awards of \$1000 Monthly Prizes.

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John W. Wells	868
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Dr. Armin Demuth	864
Dr. Armin Demuth	867
Ismar Ginsberg	869
Dr. Alfred Gradenwitz	870
Raymond Francis Yates	871
Raymond B. Wailes	881
Jack Kay	893
W. L. Pearce	895
Armstrong Perry	896
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Dr. H. Becher	852
Edwin Haynes	874
Dr. Ernest Bade	883
Ernest K. Chapin	884
TEN PRIZES OF \$15.00 EACH	
W. E. Burton	851
T. L. Walker	851
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L. B. Robbins	882
C. R. Mullin	882
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Chas. Vivier	931
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William Williams	933
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Jack Kay	938
Warren Fleenor	938



THOMAS A. EDISON'S OPINION

Above is a letter received by SCIENCE AND INVENTION from the great inventor, giving his opinion on the new picturized magazine. It speaks for itself.

Jason Crain	941
H. N. Loeb	941
Stephen Goff	942
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Kenneth Kesterson	943
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Author Article, Variocoupler Bases	945
Author Article, Increasing Capacities	945

\$12,000 or More in Gold

Beginning with the January issue, SCIENCE AND INVENTION will pay \$1,000.00 or more each month of the year in prizes. Every article published in the regular news section will receive one of them.

(The departments have awards of their own which they will continue to give.)

Ideas are what the editors want. They must be told simply—so your mother or sister can understand them—in pictures and sketches. Be sure they are NEW and have something to do with science or invention. The editors want pictures and

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

sketches—must have them—but ideas are wanted most of all.—And they will be handsomely paid for. The rules of the contest will be found on page 534 of the October issue. If you haven't a copy, one will be mailed you free on receipt of your name and address. It will give full details of the rules and hints on submitting articles. The closing date for all prize contributions will be the 15th of the month preceding date of issue, i.e., 15th of December for the February number; the 15th of January for the March number, etc.

WILL YOU BE OUR REPORTER?

IN Connection with our \$12,000.00 prize contest announced last month, it goes without saying that you will have to hustle to win a prize. The Editors do not wish to make it hard for you; quite the contrary. We want the pictures and want them badly. Herewith is reproduced our reporter's card. We shall be glad to send it to anyone who makes an application. By means of this card you will be able to secure entre into industrial plants, business houses, motion picture studios, steamships, mines, etc. This card will prove an open sesame to you in many instances. Each 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 for obtaining one. It will be sent you by return mail. Address Field Editor, SCIENCE AND INVENTION, 53 Park Place, New York City.

REPORTER

Science and Invention

CORRESPONDENT REPORTER'S IDENTIFICATION

NO. 999

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

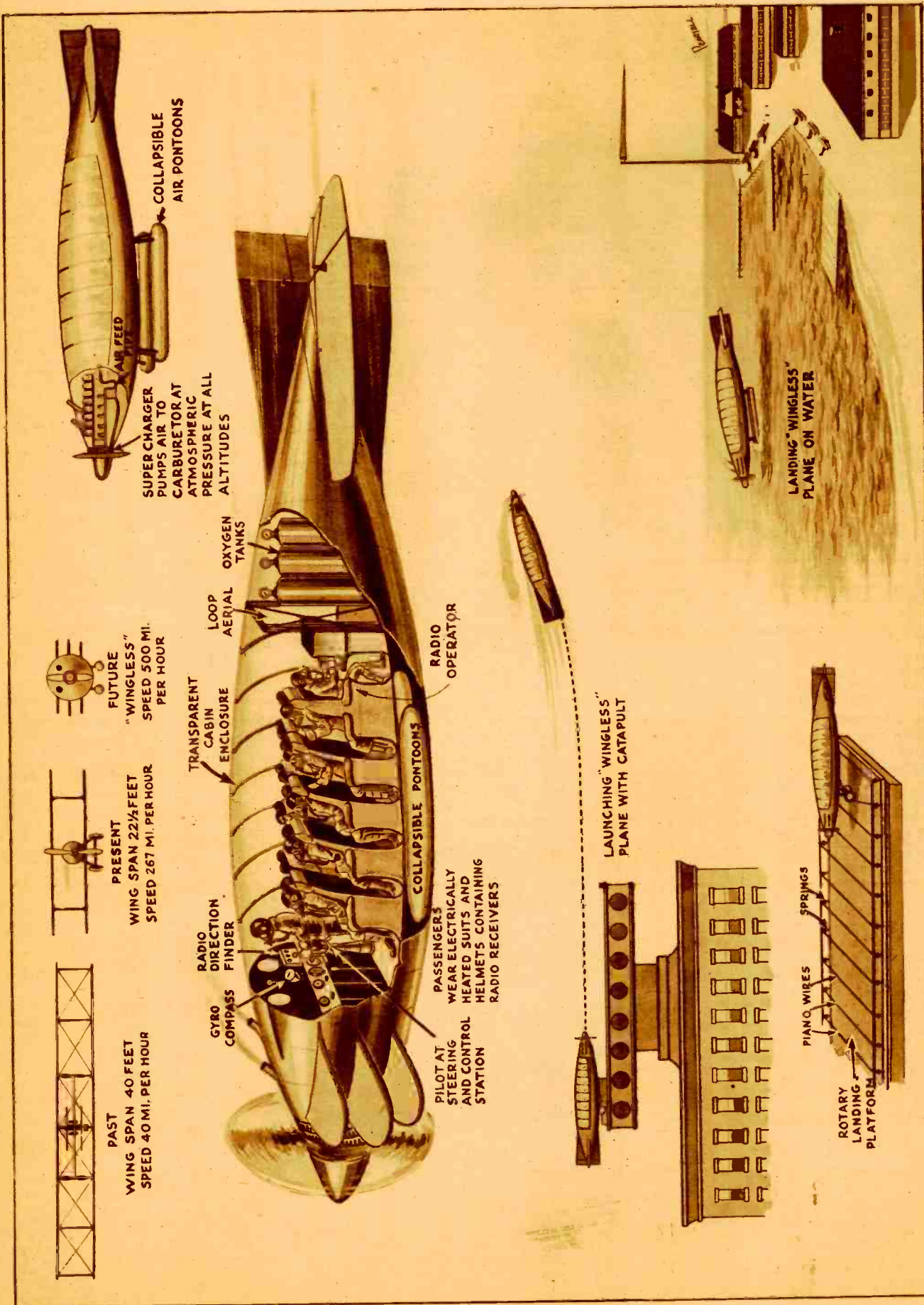
EXPERIMENTER PUBLISHING CO.
John Doe
PRESIDENT

(over)

The Airplane of the Future

Will Look Like Projectile and Go 500 Miles per Hour.

BY H. WINFIELD SECOR.



a wing spread of forty feet and an engine weighing almost 15 pounds per horse-power. At the present day the planes making the speed records have a wing spread of only twenty-two and one-half feet and an engine producing one horse-power to every one and one-half pounds of weight. This would lead us to believe the wing spread is to be reduced with the rise in speed. The chief problem here is to design a plane that can alight with so short a wing spread. One solution to this problem is to use pontoons for water landing. Another is the piano wire and spring method as recommended by the U. S. Navy. The wires break the plane's speed effectively. As for taking off, that may be done with the Navy type pneumatic catapult now in actual use.

With the making of recent records nearing 300 miles per hour in sustained flight the masters of aviation are looking ahead to see what the ultimate in air speed and construction will be. By going back into the history of the plane from its first appearance in the world's science and following the history of its design down to the present time it seems probable that the plane of the future will be very much on the order of a projectile with fins. Such authorities as Prof. E. P. Warner, of the Massachusetts Institute of Technology, hold this view and state that the only limit on the speed of aeronautics is the power of endurance of the human pilot. By examining the history of the plane we see that the first Wright Brothers' plane, capable of forty miles per hour, had

The Man on the Meteor

By RAY CUMMINGS

I

I do not know where I was born. I am ignorant of the country—I do not even know on which world it was. They are trying to tell me now that I was born here on Earth. That is absurd. And when you read what I have done, the

The night was calm without a breath of air stirring—Lucky for me for I would have blown away had there been any wind! I sat there puzzling over my very existence. I knew nothing, not even my own name. I have since named myself Nemo. They tell

It was indeed, as though I were clinging to the top of a ball, whirling through Space. The stars were swinging across the sky with visible movement.

I had been conscious no more than a minute when a moon swung up into view. Then another. And then, without warning, a million tiny worlds flashing silver with reflected sunlight, burst up from below the horizon and swarmed the heavens. Behind them I saw a tremendous, glowing silver sphere, with dark bands upon it—a sphere so large that as it rose it almost filled the sky.

I want no mystery in my narrative; I have no desire to puzzle you. I was on a tiny meteor—one of the myriad that swarm in circular orbits about the planet Saturn and form its rings.

No doubt you are ignorant. Most Earth-people are, I find. Let me enlighten you further.

Saturn, in position outward from the Sun, is the sixth major planet of the Solar System. Its mean distance from the Sun is 887,098,000 miles. It is a globe almost as large as Jupiter—74,163 miles in diameter, to be exact. It has, however, a trifle less than half Jupiter's density and only one-ninth the density of the Earth.

With Saturn's rings you are perhaps familiar in a general way. They are concentric, and encircle the planet like a flat hat-brim—a brim more than 37,000 miles broad. These rings are composed of billions upon billions of tiny meteors revolving about Saturn all in almost the same plane and each maintaining its separate orbit—each a tiny satellite, each glowing silver from its reflected sunlight.

And it was upon one of these tiny meteors that I found myself. Do not imagine that I knew all these facts at the moment. Far from it. I had no knowledge of any kind. My body was developed to manhood but I was ignorant of everything with only instinct and a dawning reason to guide me.

I had tossed away my transparent helmet. It left my hand and went through the air like a stone from a catapult. The last I saw of it it was sailing out over a line of trees.

My brain was still confused but I knew



Nona was in midair. Then, like a wasp she darted at that thing on the rock. The lizard—I shall call it that—saw her coming. It leaped, and sailed across the cave. I saw that it had webbed membrane connecting its six outstretched legs. Nona turned in the air after it, her slim body as sinuous as her waving hair.

extraordinary experiences I have undergone, you will realize that I am the product of some greater civilization than any you have on this Earth. I doubt even that I was born on any planet of the Solar System.

I must be at least eighty years of age now—as you on Earth measure time. I am an old man and my memory is full of strange lapses. There are blank periods in my life for which I cannot account. But you will bear with me, I am sure.

I shall tell you my history exactly as I remember it.

THE FIRST RECOLLECTION

II

The first recollection that I have was when I was a young man at the full height of my physical strength. Let us say, I was twenty, with dark hair and eyes, a slender body, but muscular and powerful. The day I have in mind is clear to my memory now—but everything that happened to me before it is a blank. I found myself lying on the ground. It was dark and there was a sky full of stars and strange flashing lights.

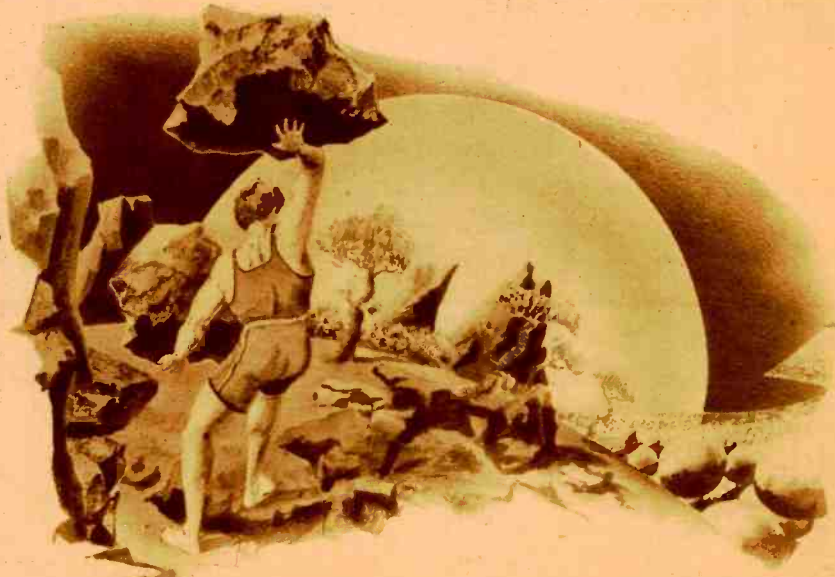
I sat up, stiff and sore, and bruised all over. I was encased in some sort of a rubber suit, with a pack on my back; my head was enclosed in a helmet of transparent, rigid material.

I felt as though I were smothering; and I tore off the helmet and flung it from me. I drank in a deep breath of the night air. It was pure and sweet, but heady. It made my senses reel like some potent wine.

I say that I sat up. That is not strictly true. I pushed my elbow against the ground, and my whole body went into the air. I floated back to a sitting posture. I was light as a feather!

me there was once a famous sea captain by that name here on Earth. I assure you that is coincidence merely, for I have no connection with your Earth other than that I am at this moment unfortunately imprisoned upon it.

This place where I found myself that starry night showed a barren landscape with only a few queerly-shaped, stunted trees. The horizon was very close to me—almost at hand, in fact—for the ground was curved with an enormous convexity.



I saw her eyes upon the muscles of my arms and shoulders, and her admiration pleased me. I stretched my arms for her, showed her the muscles of my legs; and looked about for some way of displaying my prowess. There were many boulders around that could be loosened. One by one I flung them into the air, sent them into Space never to return.

that my body was over-warm. I took off the rubber garment and pack, finding myself in a white knitted affair like a bathing suit—sleeveless shirt and trunks.

THE FIRST GLIMPSE

I stood up unsteadily, and found that I had just enough weight to maintain my footing. My head was reeling, I suppose, largely because of the quality of the air.

Air, you say! Air on a meteor like that! Do you call yourself an astronomer? If so, you show your ignorance by such questioning. Air, or at least something that served my purposes of breathing, was there and that I am here alive to tell it must be your proof.

I could see perhaps a quarter of a mile. The land curved away, dropping down in every direction so that the sky at the horizon showed seemingly below the level of my feet. I was visibly on the top of the world.

Overhead those billions of tiny worlds were swarming. Sometimes fragments of star-dust would enter my atmosphere—flaming red shooting stars, burning themselves out in an instant. And behind everything hung that gigantic silver ball that was Saturn.

The whole firmament was swinging sideways. In a few moments half of Saturn was below my horizon. The Sun rose behind me—a smaller Sun than appears to you here on Earth, but still the same yellow-red color.

It was daylight, with the Sun mounting toward the zenith so quickly in less than an hour it would be there, and my day would be half over.

I saw myself now to be standing on a slight rise of black, sandy ground. There were metallic rocks lying about, a low, scanty vegetation in patches on the ground—vegetation of a bluish color; and flimsy, stunted trees. These had broad, angular blue-white trunks with spreading tops ten feet up, and foliage that was bluish-white. Behind me was a jagged, metallic peak perhaps a hundred feet in height.

There was no water in sight, no sign of life of any kind. Quite suddenly I discovered that I was both hungry and thirsty.

What was I to do? This world was so

small I could have started walking in any direction and come back to my starting point in a very short time. Walking! It was impossible to walk! I weighed almost nothing. I stood teetering on tip-toe, straining

dred feet away and behind them, over that dizzying curve downward of the world, was the azure of cloudless Space.

I was frightened, and now I know it was with good reason. Had I leaped recklessly



The girl took flight. Her arms struck out, and like a swimmer mounting through water she floated up to the ceiling, landing upon a ledge of rock. Through a tangle of her hair her face peered down at me. And though her eyes were frightened, there seemed an impish, mocking expression to her tremulous smile.

every muscle to maintain my balance, feeling like a balloon poised ready to sail away.

I make these speculations now. At that time I had not the reasoning ability to speculate. All I knew was that I was hungry and thirsty—with a hunger and thirst that was maddening. But I was young and strong, and youth fights.

I took a step forward. Under the impulse of my gentle leg-thrust, my body rose into the air in a broad arc. I suppose I went up a hundred feet, sailing forward toward the line of trees at the horizon. I lost my balance; my arms and legs were flying. I floated gently down and landed on my face near the base of a tree!

You smile! I assure you it was not humorous to me. I stood up again, trembling with surprise and alarm. A new vista of land beyond the former horizon had opened. I saw other little jagged peaks a few hun-

into the air I might have left my tiny world entirely—escaped from its slight gravitation sufficiently to become its satellite, or perhaps even completely to depart its vicinity and become a satellite of Saturn!

AN INHOSPITABLE WORLD

This tiny world upon which I found myself was inhospitable to the extreme; and yet if I had been conscious of the choice, I would not have wanted to abandon it for empty Space. Out there, worse than suffering hunger and thirst, I would not even be able to breathe. Thus, if you are of philosophical mind, you may find consolation in any unhappy plight. There is, indeed, always something worse to contemplate.

Whatever my life before this day may have been walking evidently was part of it. I know that because my instinct was to walk. I decided to weigh myself down with rocks and thus be able to maintain a footing. Futile conception! I seized a huge rock of black metallic quartz in each hand—only to find that the rocks themselves were mere feathers in my grasp! Angered I flung them into the air. They sailed away, out over the horizon. Undoubtedly they left my world never to return.

The Sun was now past the zenith. It was mid-afternoon. Shortly it would be night again.

I was clinging to the tree-trunk for support, when quite near me I saw what seemed to be the mouth of a cave. I was staring at it when a figure appeared from below. I did not move, and this thing evidently did not see me.

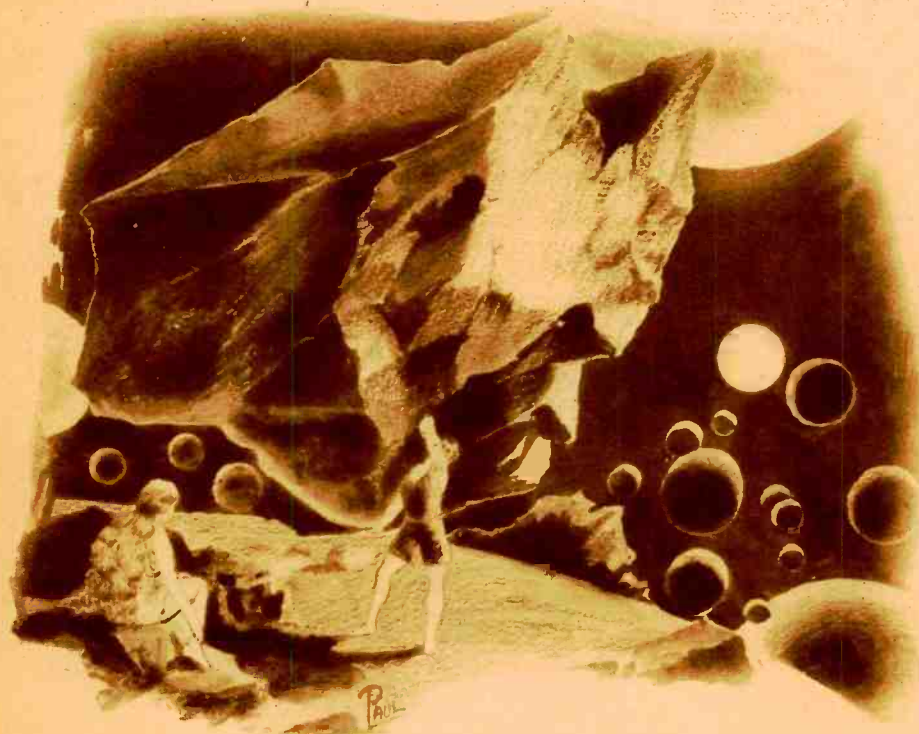
It was a girl, fashioned in human form like myself. She stood there cloaked in the long waving masses of her golden hair. I must have made some slight sound for after a moment she looked my way. I caught a glimpse of a beautiful oval face framed in the golden tresses, lips full and red, eyes blue, wide now with fear.

Without warning, she left the ground. She went swiftly past me, lying in the air gracefully on one side, her arms moving rhythmically. She was swimming in the air with all the grace and skill of a mermaid!

I stood spellbound. In a moment she had passed over the curve of the world and disappeared.

III

Can I say that the sight of this girl in-
(Continued on page 904)



Nona watched me with awe, encouraging me with little syllables of pleasure as I selected larger and larger rocks. Some I dug up and tore loose, until at last I ripped off the top and side of a hill. It was a mountain of rock. I staggered like Atlas.

Doctor Hackensaw's Secrets

By CLEMENT FEZANDIÉ

No. 25

The Secret of the Submarine City

this submerged land is more than I can fathom. The only thing I see that might be made useful are the fish."

SUBMARINE FARMS

"Yes, domestic herds. I hatch fish from the spawn and keep them penned in suitable places. Then, too, I have my submarine farms. You probably know that many submarine animal and vegetable growths have a real commercial value. Iodine and bromine exist in quantities in certain sea weeds and can be extracted with profit. Then I have whole acres planted with sponges of the finest quality—my oyster farms cover miles of surface and I even raise the pearl oysters and can produce pearls of the largest size and most wonderful lustre. You see, I have scoured the world to secure the best stock."

"But who attends to these submarine farms?"

"I have no lack of help. My submarine cities have a large population—not only self-supporting but every member certain of becoming wealthy in the course of a very few years."

"Submarine cities?" cried Silas, more and more perplexed. Am I to understand that you have found means of enabling men to live and work in the ocean depths, and that you have found men willing to so live?"

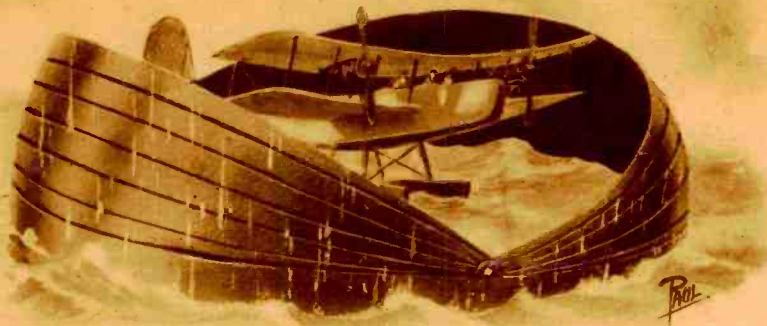
"Yes to both questions. Silas. Yes, I have found means of enabling men to live indefinitely under water in perfect comfort, and I have had no trouble in finding men and women willing to work for me. Unfortunately there is still a great deal of misery in the world, and men and women gladly come to me to escape from it. Then there are enthusiastic young people in search of adventure, and they form the elite of my workers. The inducements I offer are great—for I guarantee to all my workers who remain a few years with me, a comfortable pension for the rest of their lives. But, if you are to understand the matter, I would better begin my story at the beginning—What first gave me my idea of a submarine city, was the study of the gasoline problem."

HOW THE DOCTOR STARTED

"Gasoline?" echoed Silas Rockett.

"Yes. With the increasing use of gasoline fuel—oil for automobiles, aeroplanes and ships—the supply of petroleum is certain very soon to become inadequate. The conse-

MAN has conquered the earth and the air. There still remains, however, the vast unexplored regions at the bottom of the ocean, that have so far eluded his dominion. Yet they must contain untold treasures in mineral wealth, coal and petroleum. This story of a submarine city, which seems a wild fantasy today will be a cold fact in the not distant future.



Five minutes later the hydroplane had alighted on the surface of the ocean. Then it came to a complete stop, and a large yawning metal mouth came up out of the depths of the water and closed over it. Then it was dragged down into the ocean by means of a cable. Again there was a halt, followed by a click. "We are now in one of the receiving compartments," explained Doctor Hackensaw.

"**S**ILAS," said Doctor Hackensaw, impressively, "I'm going to initiate you today into one of my greatest secrets—one that I have so far revealed only to those whose co-operation was necessary to carry out my plans. Silas, I am a king!"

"What!" cried the reporter, gazing at the doctor in amazement, and wondering if he had suddenly gone mad. "What did you say?"

"I said I was a king, and it is true. I am the supreme ruler of a large country—in fact I am really monarch of a domain larger than all the other kingdoms on earth put together."

"What in the name of the Seven Wonders do you mean?" asked Silas, perplexed. "Have you discovered a new continent in the Polar regions?"

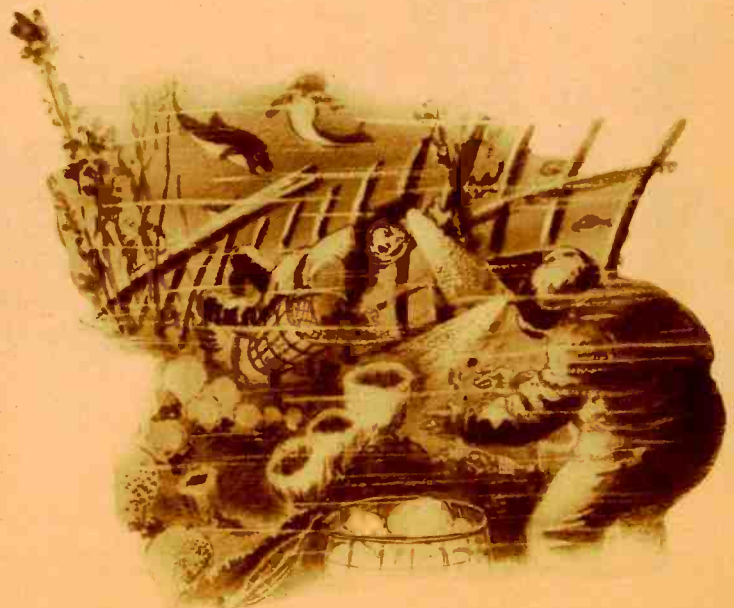
"No," replied the doctor, "but I have found the means of conquering and bringing under my dominion immense unexplored regions in the ocean's depths. For years it has seemed to me foolish that man, overcrowded as he is on land, should allow the enormous tracts under water to remain unused. Do you realize, Silas, that the ocean covers far more land than all our four continents put together? It is this land that I have sought to make use of—these submerged tracts that so far have been allowed to remain idle, and that are yet capable of producing immense wealth, and of supporting a population greater than that now in existence. I have no competitors. My secret has been well kept, and I am absolute monarch of my own dominions. I make my own laws and I enforce them myself."

Silas Rockett looked puzzled. "Please explain yourself, doctor," said he. "I gather your idea in a vague way; but not very clearly. I suppose you have explored a portion of the ocean's depths with submarines, but how you can make any real use of

"The fish, of course," returned Doctor Hackensaw, "are of great importance—I have my submarine fisheries and my submarine flocks if I may so call the immense schools of fish and marine animals that I keep penned up. The returns are highly profitable. I learn the fishes' habit and their habitats. I place immense traps at the proper places, bait them carefully and secure thousands of tons of fish with very little trouble. My canning factories run night and day. The fish are cleaned, cooked and packed by machinery, while absolutely fresh, and so have a flavor unequalled by the ordinary commercial grades."

"You have flocks of fish, too?"

"Here are perfect specimens of all kinds of marine plants and animals, specimens such as you will not find in any museum on earth, for my men go out in diving suits and select only the finest specimens. My workers are free to move about as they use my artificial gills to furnish them air for breathing. Then here are relics from sunken ships. These coins and jewels came from a Roman galley that sank here hundreds of years ago, and was deeply imbedded in the silt. We come across very curious things here."



quence will be a great rise in the price of gasoline and the need of some substitute. During the World War a number of substitutes were tried with more or less success. Alcohol gives good results and can be made in large quantities. Hydrogen gas was tried, the automobile carrying a balloon of this gas. But the scheme was not found very practical. Liquified hydrogen in tanks might answer better. Electricity will some day supersede gasoline, but not for some time yet. I resolved to turn my attention first to increasing the available supply of gasoline. Gasoline, as you know, is made from petroleum, and the petroleum is found deep under ground. In fact, petroleum is a by-product in the natural formation of coal. The liquid sinks from the coal-beds deep into the ground, forming underground pools. These are often under pressure, and when tapped will spout up above ground like artesian wells.

"Such being the case, and England possessing very rich coal mines, how was it that England had no oil wells? Petroleum must exist in Great Britain in large quantities—why was it not made use of? I found the answer in a London Museum, where I was shown samples of petroleum obtained by borings made in different parts of England. But this petroleum, probably owing to the chalky nature of the soil, was deep under ground, and could not be profitably utilized at present.

OIL BENEATH THE SEA

"I consulted several distinguished geologists, carefully studied the geological maps, and became convinced that there must exist large deposits of petroleum below the bottom of the North Sea. The question then arose as to how to dig an oil well under water. The answer was obvious. We must sink one or more caissons and work from these. There was nothing new in the method—it is used daily in building bridges.

"I began by sinking two caissons and joined these together by a tunnel which I excavated deep under the sea bottom. This tunnel was gradually enlarged in spots to form large chambers. One of these served for the drilling operations and the others formed store-rooms and sleeping rooms.

"The great trouble was to keep matters secret. To achieve this, I bought an Eng-

lish power plant. Conducted the electrical power to the work by cables. The air supply is obtained from above by means of extensible conduits. A ship of my own on watch informs me of the approach of strange vessels and my air-pipes are then pulled

saw in England, about to embark in one of the doctor's hydro-aeroplanes for a visit to the secret under-water city.

The aeroplane was in good condition, and a thirty-minute flight brought the two men out over the North Sea.



While Silas and the doctor were waiting for their turn to pass through the door, the doctor showed the reporter an iron grating through which the ocean water was descending into an unused mine-shaft.

down below the surface, and compressed air, stored in reservoirs, is used until the stranger has passed. I obtained my water supply, as on shipboard, by distilling the sea-water. I expect soon, however, to obtain an ample supply of fresh water by means of artesian wells. But what's the use of talking! You have a month's vacation. I am sailing for England tomorrow. Come along with me for a visit to my submarine city, and I promise you that you will be well repaid for your trouble."

And that is how, some days later, Silas Rockett found himself with Doctor Hackensaw

"We are now somewhere near Submarina, as I call the city," said the doctor, "so I will wireless the radio station to notify them of our arrival." Sitting down to his machine, he sent off a brief message and received the answer.

"All right," said he. "They say they will pilot us to our destination. See. The compass is turning to point the way."

Silas looked at the instrument indicated. It was different from any compass he had ever seen. It was a needle suspended on a universal joint, and it was surrounded by a number of electro-magnets, each designed to be rendered active only by a radio-wave of a special length. The operator in Submarina could thus turn the compass needle on the aeroplane in any direction he desired. The needle had now assumed a sloping direction, and the pilot of the aeroplane turned the machine in the same direction.

"We shall soon be in port, now," remarked Doctor Hackensaw.

"But what's the use of this guiding instrument?" asked Silas.

TO SUBMARINA

"This arrangement is absolutely necessary at present," replied the doctor, "because, as I told you, I am keeping the existence of this submarine city a complete secret. I myself could scarcely hope to find it, in this waste of water, without some guide."

Five minutes later the hydroplane had alighted on the surface of the ocean. Then it came to a complete stop, and a large yawning metal mouth came up out of the depths of the water and closed over it. Then it was dragged down into the ocean by means of a cable. Again there was a halt, followed by a click.

"We are now in one of the receiving compartments," explained Doctor Hackensaw. "This receiving chamber has closed over us, and we must wait until the water has been pumped out before we can emerge."

The pumping out did not take long. The metal mouth that enclosed them opened, and

(Continued on page 910)

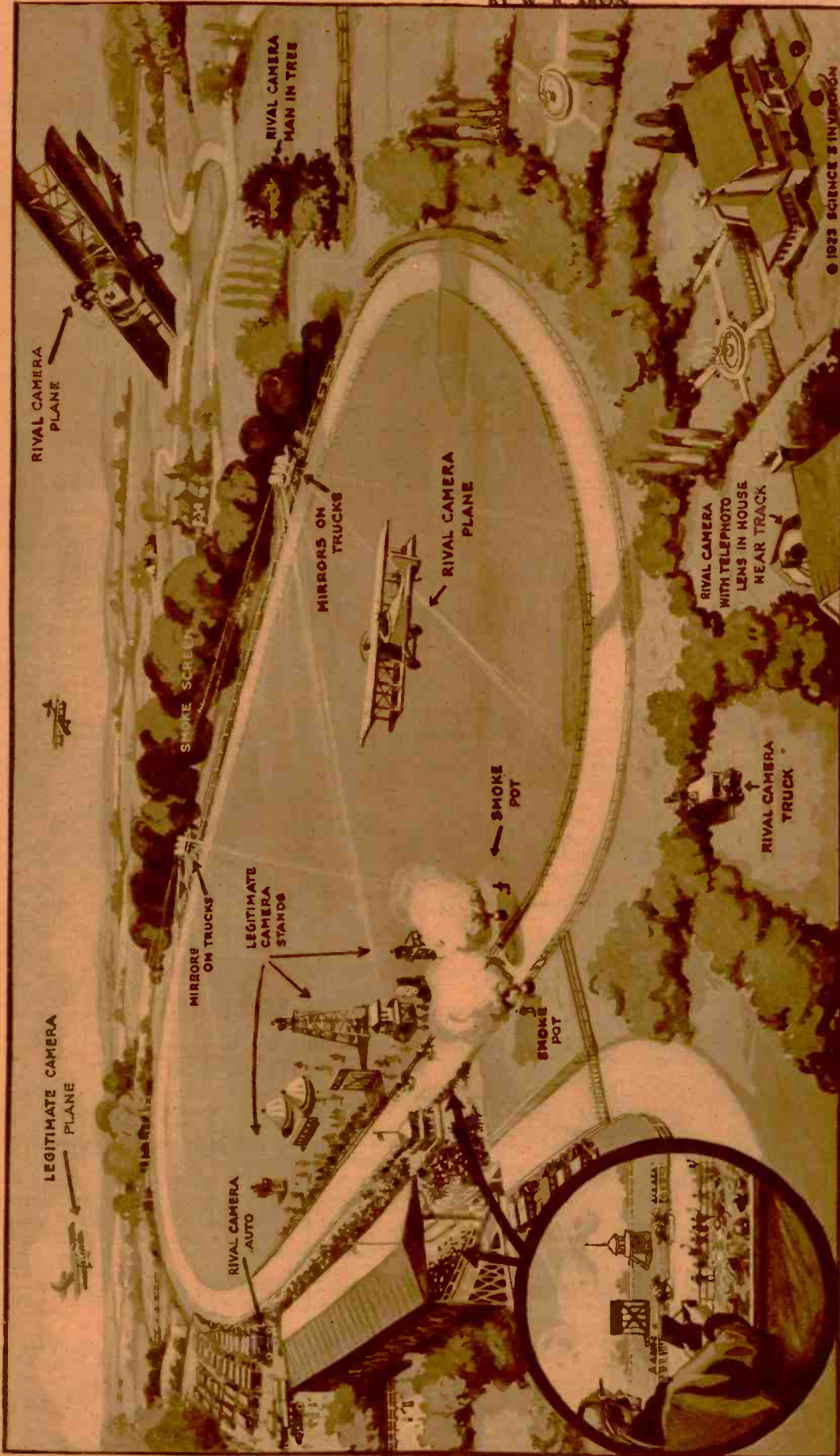


At this moment a shriek from the woman with the baby called their attention to the fact that the mother burdened with the child had been unable to provide herself with life preservers or helmets. It was only with the greatest difficulty that Silas and the doctor managed to secure helmets for the two, and get the pair safely protected.

Zev-Papyrus Race, Camera War

How Rival Camera Men Tried to Get Exclusive Pictures of Zev-Papyrus Race.

BY W. B. ARVIN



© 1923 SCIENCE & INVENTION

The outlawed cameramen—those who didn't pay any of the \$50,000 to buy the privilege to take pictures—at the Zev-Papyrus race, showed their wits in defeating their rivals. One disguised himself as an expressman and set his camera up in a delivery van and got into the field, taking his pictures practically under the noses of the legitimate operators stationed on the stands at the finish line. Above is shown graphically how the two opposing sides fought to take their pictures. The company that paid for the privilege did everything to keep the others out and the others prepared for every emergency. The legitimate company fairly surrounded the track with a smoke screen seventy feet high. But they left one gap which happened to leave clear the line of vision of one cameraman perched in a tree. The men, however, upheld the ethics dictating that they wear caps. None appeared without them.

No General in the Great War took more precautions or laid his plans with more care than did the rival movie interests in their preparations for getting pictures of the great international turf event held at the Westchester Racing Association, in New York, when Zev and Papyrus met in the mile and one-half grueling test recently. It is said that one movie firm paid \$50,000 for the exclusive rights to pictures of the meet; and that the same offer was made to no less than four other firms before the offer was taken. The movie men maintained that it just wasn't being done but the management maintained just as stoutly that it was. So the \$50,000 was paid.

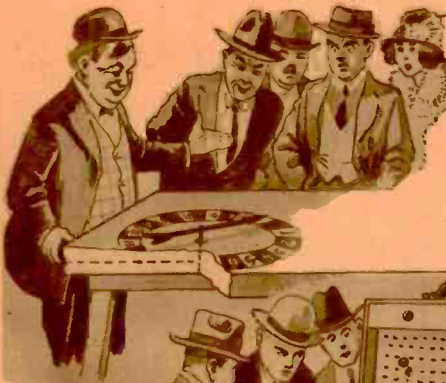
sive. They hired a veritable army of spies to weed out the cameramen who might slip in at the gate. They rented all the houses around the course where their rivals might set up cameras with long distance lenses and even hired a couple of airplanes to patrol over the race course. Then they sent a pair of mirrors around the rear of the course and flashed light beams along the rail of the grandstand in order to blind any disguised picture-takers' cameras. They even protected the course with smoke pots, giving off great clouds of opaque smoke. But they were outwitted. The interlopers appeared in delivery vans, in crows-nests in trees adjacent to the course and even hired a few houses and two airplanes themselves. One company hired two movie actresses with cameras hid in vanity cases.

Then the firm that purchased the rights proceeded to make their rights exclu-

"Sure Things" At the County Fair

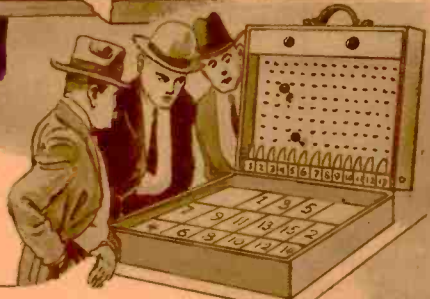
Methods of the "Con Men" for Parting the Yokel and His Money

BY W. C. KELLY.



The little game played with the arrow spinning around over a list of numbers is known to every one who ever attended a street fair. It looks honest—and so do a lot of hold-up men. The trick is simple. By pressing an inconspicuous nail head at the end of the table the operator works a brake on the whirling arrow stopping it approximately where he wants it. These games are often worked with a confederate.

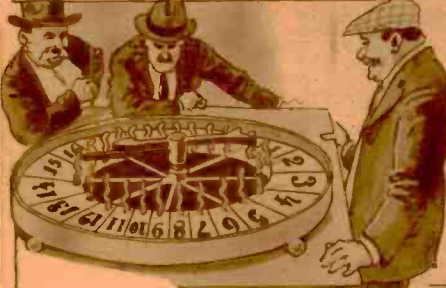
This one is on the same order but slightly more refined. The crook must know his business a little better to operate it. The arrow sets on a spindle that can be moved about over the table top, giving the thing a quite innocent air. The secret is in setting the arrow. There are two small bumps, one on the arrow and one on the spindle that stops the arrow at the right place.



Almost identical with the first arrow game is this one supported on three legs and standing above the table. The brake on the wheel's motion is supplied by a rod running up through one of the legs of the support. A lever connecting this rod runs through the table in the same manner as the arrow brake, so that the operator only presses the nail.



Here the fish puts the marble in one of the two holes at the top of the case and it falls down through a set of pins finally falling into one of the holes at the base of the contraption. The operator moves the baseboard slightly, making the marble fall into one of the slots bearing a useless prize.



This gambling device is one of those in which the arrow flips against a number of bent wires. The wires are about a quarter of an inch thick and can be turned in their sockets. The operator can turn the wires and tell you long before the wheel spins if it will stop on odd or even.

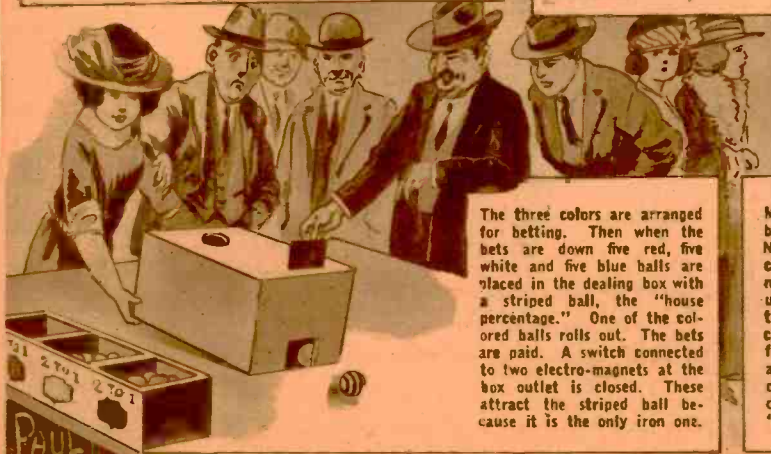
How many dollars have gone the way of all the earth through this clever piece of palming! It is all very simple and now most everyone knows it. But what a history it has had in the annals of the "sure thing" man! The trick is simple. The operator simply palms the pea after showing you that it is under one of the shells. He then, by the same method, puts it under another and takes your money.



The bottle pool game isn't so well known. It takes some bit of dexterity for operation and is very easily detected. Two white balls and a black one are placed in the bottle. All are numbered. The suckers bet on which of the three balls will roll out of the bottle. The little hold-out arrangement in the side of the bottle, which is made of leather, is very easily operated by a slight pressure on the side of the bottle.

This arrow game is practically the same one as described above. It has the bent wires against which the arrow runs. The player is allowed to spin the indicator and the indicator will stop in the correct position no matter which way the spin is made.

"Take any Jack, King and Queen," the barker says—but he doesn't. He takes a Queen and Jack and another card with a Jack on one end and a King on the other. He turns them face down, shuffles them, and asks you to indicate the King. You do. But his thumb covers the King mark and the Jack shows.

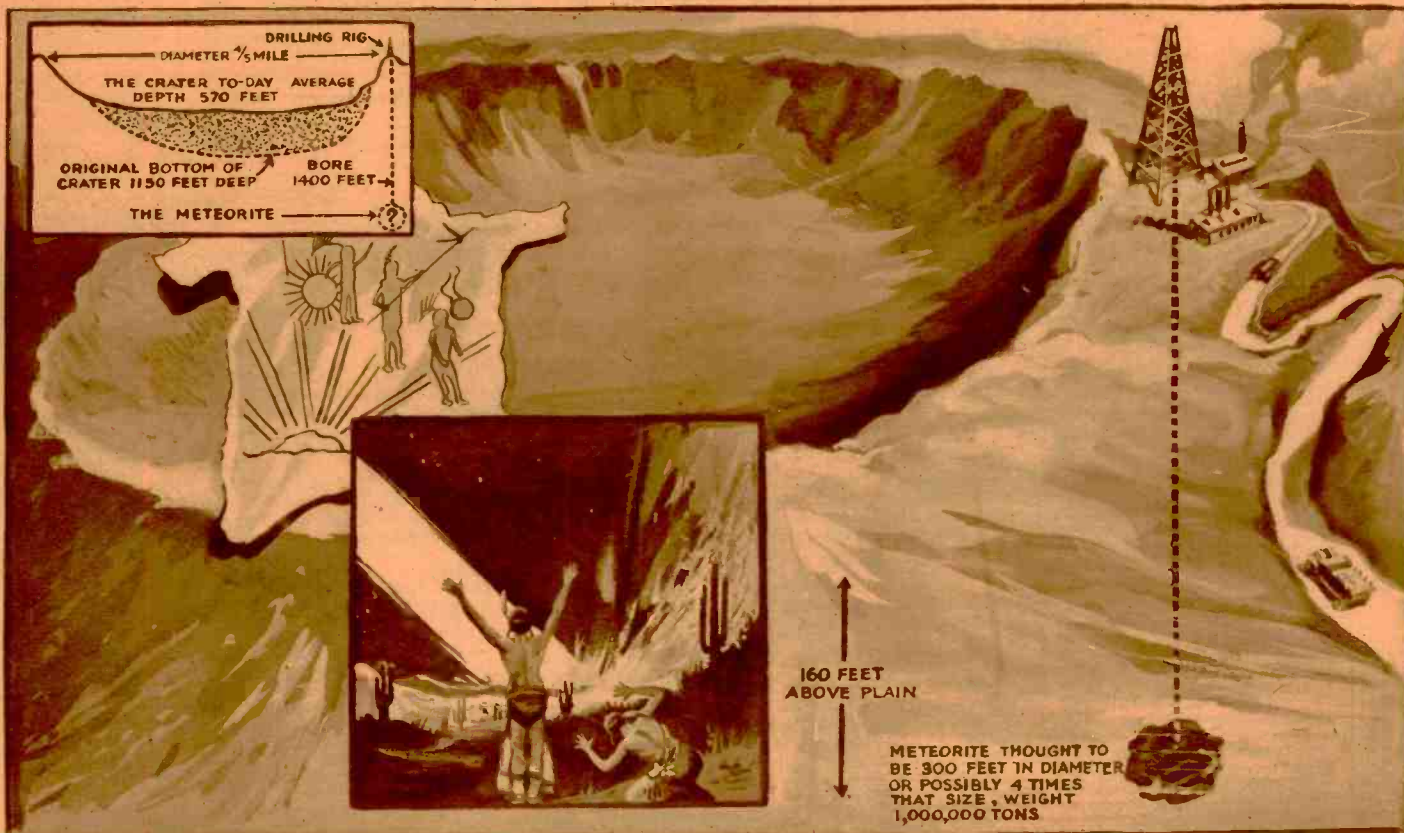


The three colors are arranged for betting. Then when the bets are down five red, five white and five blue balls are placed in the dealing box with a striped ball, the "house percentage." One of the colored balls rolls out. The bets are paid. A switch connected to two electro-magnets at the box outlet is closed. These attract the striped ball because it is the only iron one.

Many cigar stores and pool rooms have a board where dice are thrown for cigars. Notice that beneath the glass of the showcase there is what appears to be an innocent humidifier. Usually six dice are used. The winnings are figured on the total number of points thrown. The secret is that the humidifier contains a powerful magnet and that one side of the dice are loaded. Thus if the total shows signs of becoming too high the operator has only to connect the magnet, taking the "chance" out of the game.



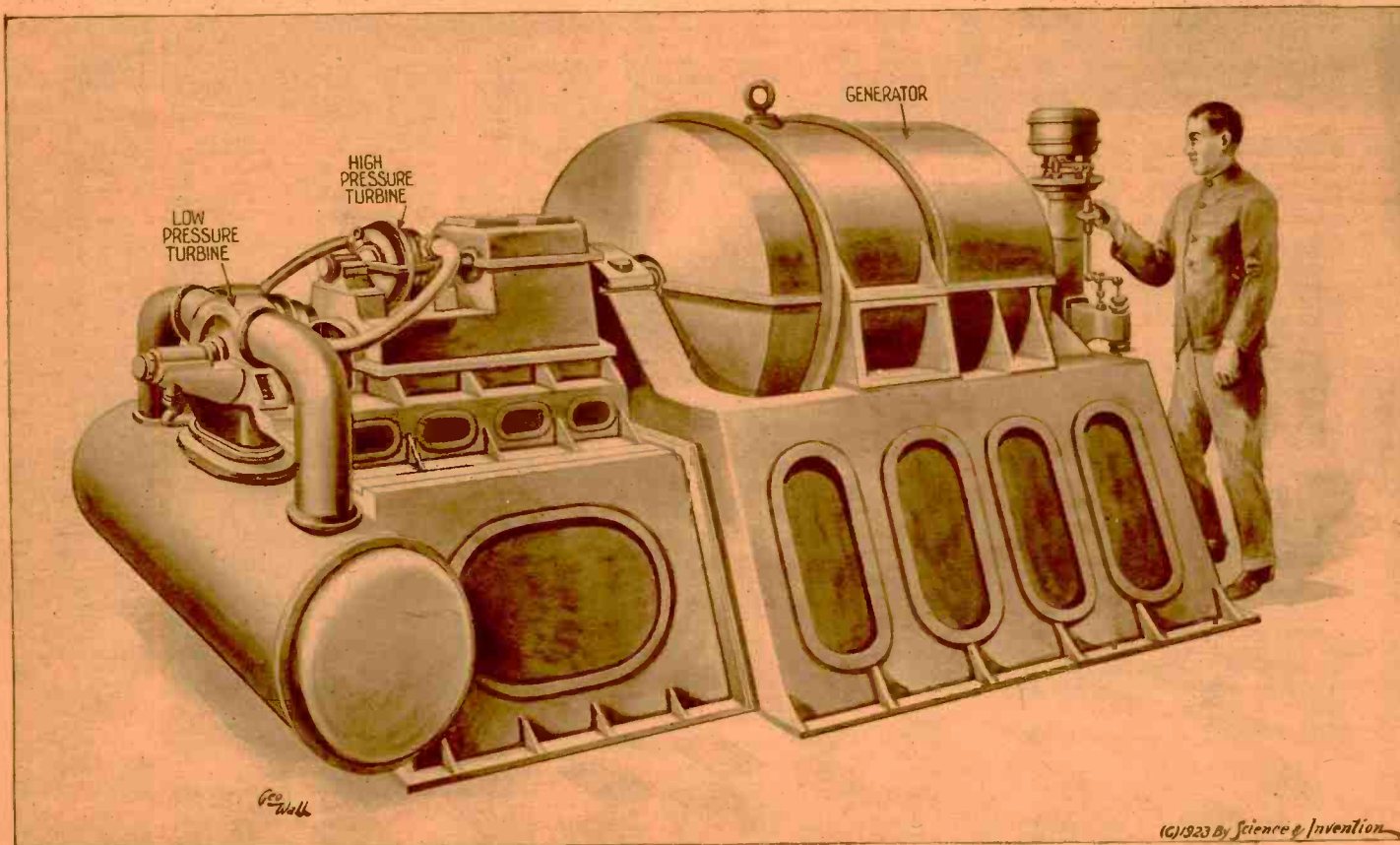
Million Ton Meteorite Found



A mining company has just started prospect drilling in Canyon Diablo, Arizona, in an attempt to discover the dimensions of a meteorite buried 1,400 feet underground which contains 90 per cent pure iron, 8 per cent nickel and quantities of platinum. The force

with which it fell from the sky made the crater shown in the sketch. It is four-fifths of a mile in diameter and originally went to the depth of 1,150 feet. The Navajo Indians deify the meteorite. Its value is estimated at \$15,000,000.

Small Turbine Drives Huge Generator



At first the small engine driving the electrical generator seems ridiculously inadequate. But the engine actually develops one thousand horse-power. The new high pressure (1,000

lb. per sq. in. steam pressure) turbine is coupled to the low pressure turbine, which latter makes use of the exhaust steam. Both are connected through gears.—Dr. A. Demuth.

Chart of the Development of Man

Graphic Depiction of the Rise of Man from the Anthropoid Ape

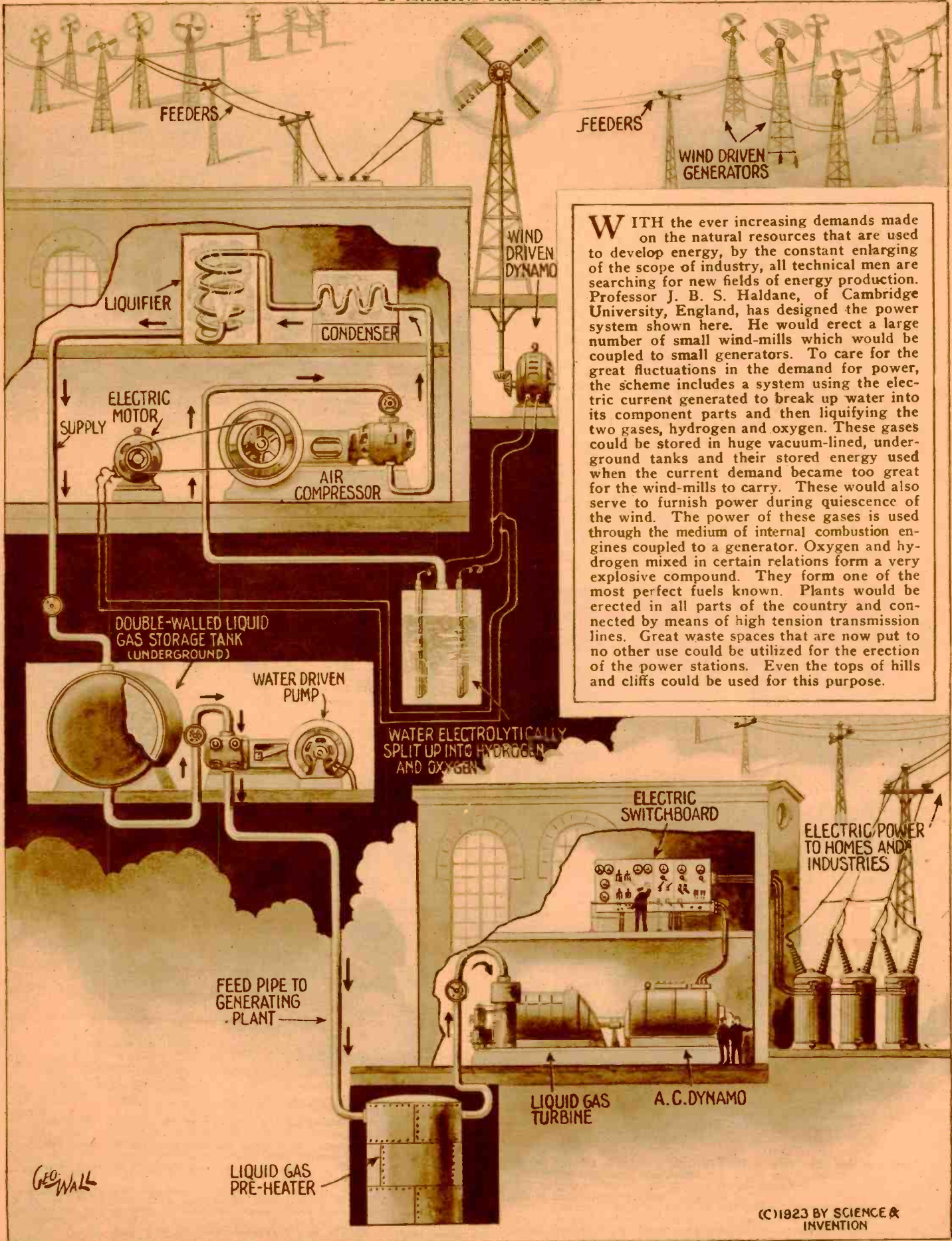
BY DR. O. HAUSER



Huge Wind Power System

Cambridge University Professor Submits Plan to Harness Wind.

BY RAYMOND FRANCIS YATES



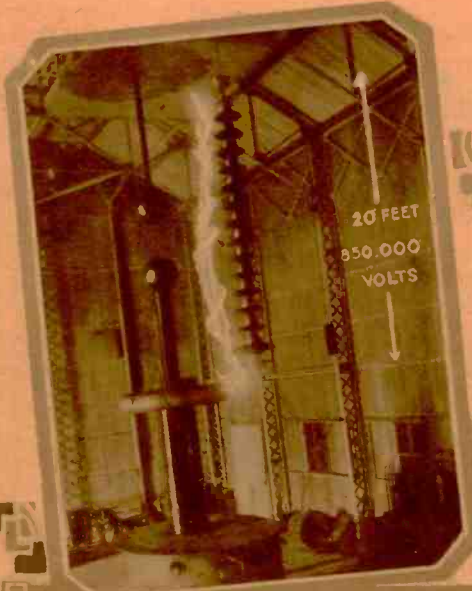
WITH the ever increasing demands made on the natural resources that are used to develop energy, by the constant enlarging of the scope of industry, all technical men are searching for new fields of energy production. Professor J. B. S. Haldane, of Cambridge University, England, has designed the power system shown here. He would erect a large number of small wind-mills which would be coupled to small generators. To care for the great fluctuations in the demand for power, the scheme includes a system using the electric current generated to break up water into its component parts and then liquifying the two gases, hydrogen and oxygen. These gases could be stored in huge vacuum-lined, underground tanks and their stored energy used when the current demand became too great for the wind-mills to carry. These would also serve to furnish power during quiescence of the wind. The power of these gases is used through the medium of internal combustion engines coupled to a generator. Oxygen and hydrogen mixed in certain relations form a very explosive compound. They form one of the most perfect fuels known. Plants would be erected in all parts of the country and connected by means of high tension transmission lines. Great waste spaces that are now put to no other use could be utilized for the erection of the power stations. Even the tops of hills and cliffs could be used for this purpose.

GEO. WALL

(C)1923 BY SCIENCE & INVENTION

A Million Volts Under Control!

Experiments In Home-made Lightning Flashes



It is hard to visualize the actual size of the spark shown in the above picture, made in one of the experiments at the high potential laboratory of the Westinghouse Electric and Manufacturing Co. The spark here liberated is more than twenty feet in length and represents 850,000 volts. This spark, representing literally thousands of horse-power, was used in testing the dielectric value of an insulator. The insulator was placed in the transmission line from the high potential transformer and the voltage gradually raised until the current became more than the insulator could stand, which was indicated by the spark jumping across the terminals to the conductor at the other end of the insulator.



Interior of the high-voltage laboratory of the Westinghouse Electric and Manufacturing Co., at Trafford City, Pa. The huge million-volt transformer can be seen in the right of the photo. This is the only transformer of the kind in the world. A good idea of the size of the apparatus used in the experiments with the so-called artificial lightning can be gained by comparing the size of the man standing by the huge spark gap shown in the extreme right of the picture. A traveling crane has to be used in the building for moving the various pieces of apparatus from one part of the laboratory to another. An even larger gap can be seen just beyond the smaller one. One point of the gap is supported from the ceiling by the huge steel frame-work of the building while the other is mounted on a great insulating pillar. The noise of the sparks released by the high potential currents is deafening.



A forty-two foot controlled arc! It hardly seems necessary to add that this is the longest controlled arc ever made. One million volts transmitted to the ends of the conductors between which the arc occurred was necessary to produce this arc. It was drawn in tests for "Wet Flashover," which is a test applied to the conditions under which high tension lines must operate in rainy weather. Accurate comparison of the hugeness of this discharge may be gained by comparing the thickness of the flash as well as its length with the size of two men shown standing in the photograph. The arc was held under perfect control.



This photograph is another flashover test made in the laboratory. It reveals 800,000 volts gone on the rampage. In taking this photograph a series of quartz lenses were used, thus bringing into prominence the ultra-violet rays which would not be recorded using the common method of making the photograph. By this method the flare-out at the top of the spark column is shown that would otherwise be invisible. The spark here, as in the first picture, is breaking over the capacity of an insulator. With the use of the ultra-high voltages used in the laboratory the engineers of the company are able to ascertain with almost exact certainty just how any piece of high tension apparatus is going to work when it is put into actual operation and just what its limit of strength is. Experiments are constantly being carried on looking toward ultra-long distance transmission of power service.

\$100 Toy Contest Prize Winners

Results of Contest Announced in October Issue.

1 **MERCURY**
 First prize, \$25, goes to W. C. Michel, for Golf Game. Numbered cork disks are to be placed on numbered circles with a drop of mercury.
 Labels: DEPRESSION, NUMBERED SPOTS, NUMBERED CORK DISCS

2 **ARMS PIVOTED TO BODY**
 Second prize, \$20 to W. S. Hendren for foot ball kicker as shown.
 Labels: BODY PIVOTED TO LEFT LEG WHICH IS STATIONARY AND SECURED AT FOOT TO BASE, FOOT BALL, SLOT, LEVER, RUBBER BAND, BOX, TWINE STRING

3 **CONCEALED WIRING**
 Third prize, \$15, taken by A. Melvin Skellett, Solenoid and iron plunger in doll shift weight so doll swings when key is pressed.
 Labels: COIL OF WIRE WOUND AROUND GLASS TUBE #24 B+S, GLASS TUBE, IRON PLUNGER, COTTON FOR PLUNGER TO FALL ON, SEAT, CONNECTING WIRES, DOTTED LINE SHOWING POSITION OF COIL, KEY, DRY CELL

4 **TIN WHEEL CORK PULLEY**
 Fourth prize, \$10, is paid to Jerry Sehnontka, for the automatic see-saw shown at the left above. Magnet pole-pieces make contact.
 Labels: TIN SUPPORTS, STEAM SCREW TOP, SOFT IRON ARMATURE, PIVOT CIGAR BOX, CONTACT, ELECTRO MAGNETS

5 **TIN WHEEL CORK PULLEY**
 Fifth prize, \$5, goes to Walter Markowski, for the paddle wheel oil can steam engine shown center above. The oil can acts as a boiler; spout directs steam against tin paddles.
 Labels: TIN WHEEL CORK PULLEY, 10-D WIRE NAIL, SOLDER TO NAIL

6 **TURN TABLE**
 Sixth prize, \$5 to Franklin Cathell for the miniature steam shovel (right, above), constructed of scrap tin and wood. The shovel is operated by the wire windlasses seen protruding from the sides.
 Labels: TURN TABLE, BUCKET

7 **SOLENOID**
 Seventh prize, \$5, is awarded to Alfred Clark for the electric engine shown at the left. It is motivated by an iron core running in a solenoid which is magnetized by the contact of the fly-wheel axle against a brush wire.
 Labels: IRON CORE, REVERSE LEVER, CRANK SHAFT, BRUSH

8 **PROPELLER**
 Eighth prize, also \$5, goes for the submarine diver, (center, above), which is actuated by rubber bands. Diving planes, propeller and rudder are of tin.
 Labels: PROPELLER, RUDDER, DIVING PLANES, RUBBER BANDS

9 **PASTE BOARD DOLL**
 Ninth prize, of \$2, is given to Mrs. Erwin, for the roach-operated toy shown at the right. A small card-board box, three inches in diameter, is covered with a piece of card-board on which short paper extensions have been glued as shown. The doll is fastened with a pin to the top. The roaches moving in the box cause the doll to spin.
 Labels: PASTE BOARD DOLL, PIN, PASTE BOARD STRIPS, ROUND PIECE OF PASTE BOARD GLUED TO LID, ROACHES

10 **RUBBER BAND**
 The tenth prize, \$2, is awarded to Lawrence Benson for the rubber band gun.
 Labels: RUBBER BAND, RUBBER BAND, NAIL

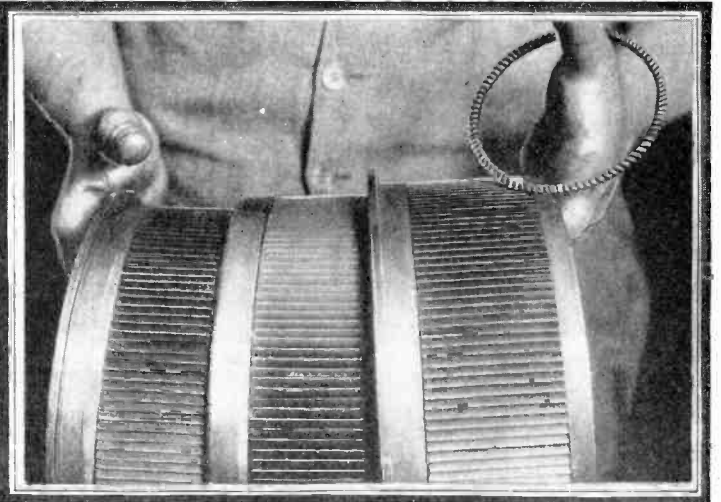
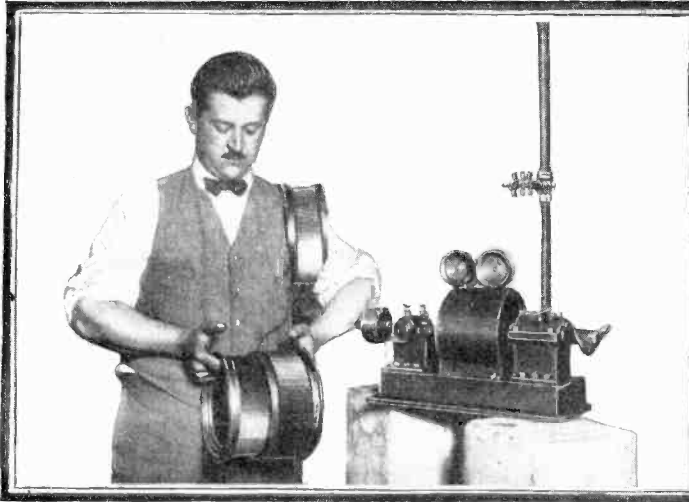
11 **METAL STRIPS**
 The eleventh prize, \$2 goes to Roy Hale, for the alarm-clock tractor.
 Labels: METAL STRIPS, SMALL ERECTOR WHEELS

12 **SAND CONTAINER**
 The twelfth prize, \$2, is given to Casimir Mazur for the sand-operated fan mill as shown.
 Labels: SAND CONTAINER, CLOTH, WIRE OR THIN BOARD, CUPS, RECEIVER, SAND SLIDE

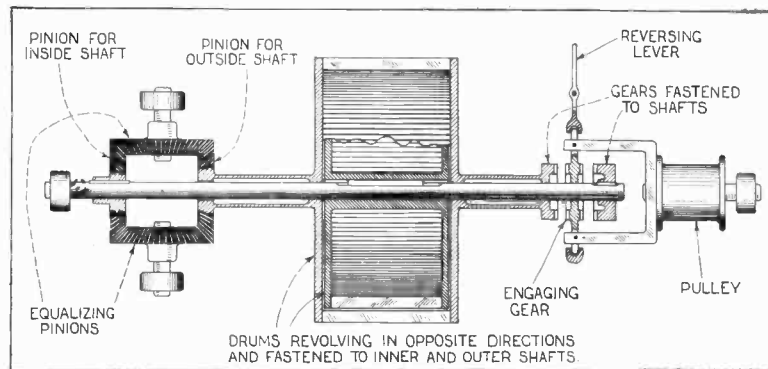
13 **CLIP**
 The thirteenth prize, \$2 is awarded to Adolph F. Lonk, for the swinging "Kiddie Horse" (right, above). The horses' heads are cut out and set on wire pivots. The counterweighted wires cause the horses to swing.
 Labels: CLIP, WIRE PIVOT, WEIGHT

New Design of Reversible Turbine

Rotors Running in Opposite Directions Are Gearing to Shaft.

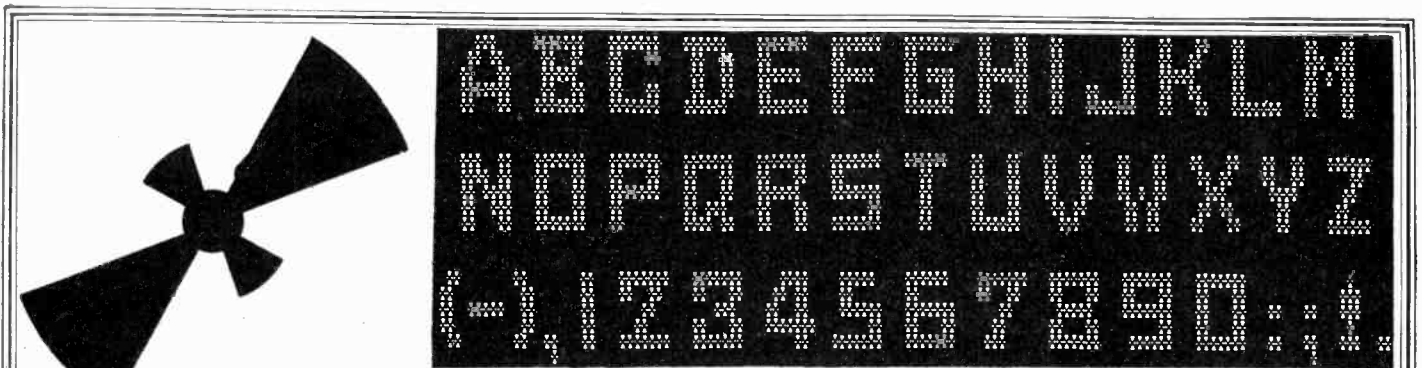


ABOVE at the left will be seen a completed model of the reversible steam turbine invented by Mr. Bonom. The gentleman in the photograph is holding two of the rotors and one of the separating rings. It will be noticed that the two rotors have their blades set at different angles so that with steam passing through them in the same direction, the two rotors are revolving in opposite directions. This is what takes place continuously in the turbine, the compensating gears transmitting the power to the shaft so that it revolves in the same direction, even though the rotors are revolving in different ways.



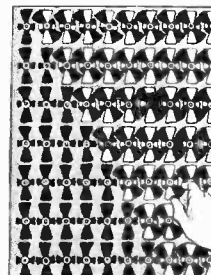
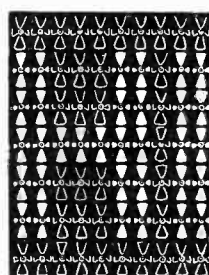
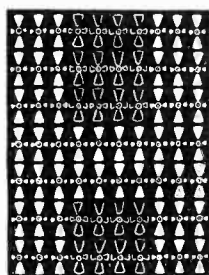
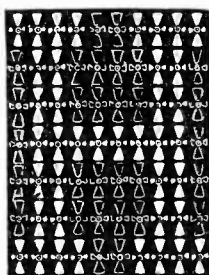
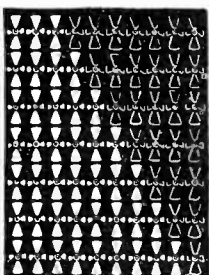
THE above photograph is a close-up view of the two rotors used in the reversible steam turbine. Note the angles of the blades. At the left is a simplified view of the different parts of this reversible turbine. Note how the two rotors revolve in opposite directions and how they are geared to the main shaft by means of beveled gears and a hollow and a solid shaft. By means of one sliding gear connected to a handle at the extreme right, the direction of the rotation of the pulley may be changed at will without stopping the turbine or changing the direction of the rotation of the blades. This is similar to an ordinary reversing device, the novelty lying in the rotors traveling in opposite directions.

Unique Universal Letter Sign



By slotting a solid background and fitting it with shutters to cover the slots the unique universal sign, shown above, is made. The shutters and the background being of the same color, when the shutters are closed the sign face presents a solid appearance. The letters are made by turning the

shutters one-eighth turn on their pivots which permits light to shine through the slots making the letters. Any design may be executed on the board. The shutters are light and require only a touch of the finger to move them, making the changing of the sign a very small bit of work.

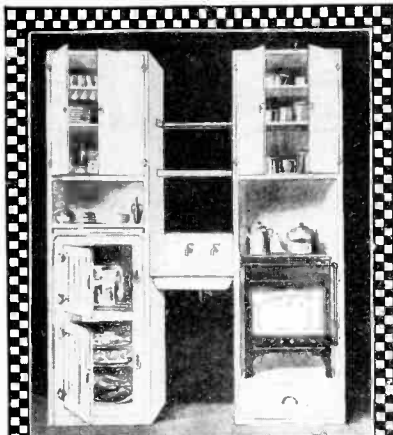


Above are shown samples of the same letter which may be made with the new advertising device. At the extreme right is shown the method of moving the shutters. The whole thing is made of a light grade of sheet steel and when once in place is little trouble to the advertiser. The inventor,

Roland N. Chubb, of Los Angeles, made the original model of cardboard carving all the parts with the aid of a pocket knife and a pair of scissors. The shutters are fitted with a small wing on one side which is used to open them.

—Edwin Haynes.

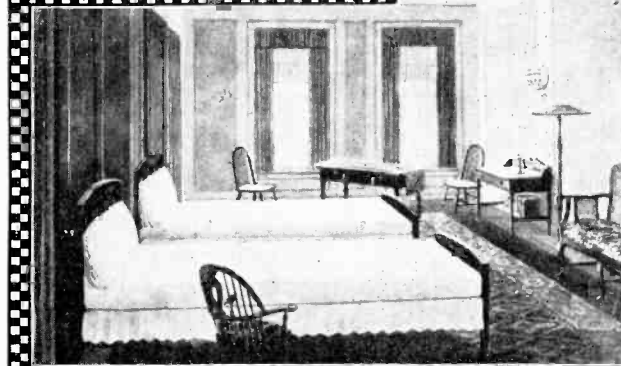
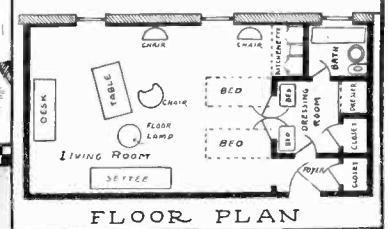
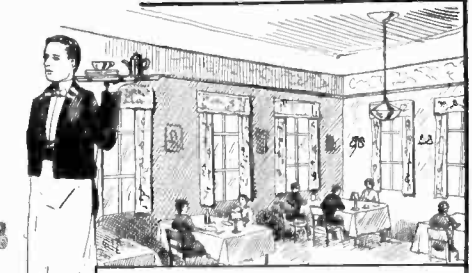
Parlor, Bedroom and Kitchenette



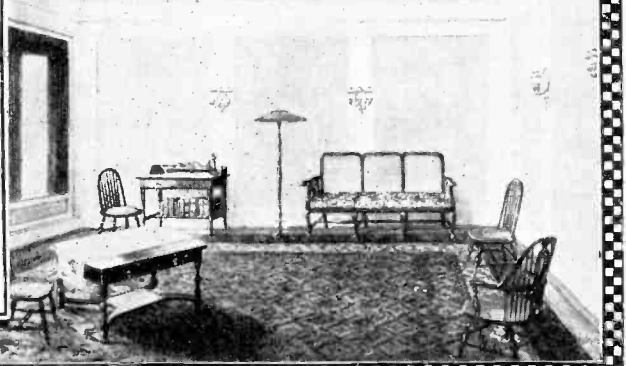
The kitchen in the apartment. Curtains are drawn in front of it when it isn't in use. It has stove, ice-box and sink with hot and cold water.



A new complex apartment recently opened in Newark, N. J. The apartments consist of one large room, a small foyer, dressing alcove and bath. The large room becomes living room, bedroom, kitchen and dining room with a few twists of the wrist. The beds fold from doors, at night.



Both the rooms shown here are the same. To the left is the living room when the tenants are ready to retire. In the morning it becomes again the charming living room seen at the right. The library table, by simply pulling a lever concealed beneath it, becomes a dining table. The telephone connects through a baseboard plug.



Horizontal Indicator for Planes

BY STANLEY Y. BEACH

TO WIND DRIVEN DYNAMO

ELECTRIC LAMP LENS

GROUND GLASS DIAL

BRIGHT SPOT OF LIGHT

GEAR

PIVOT RELEASE SCREW

WIND DRIVEN DYNAMO

SWITCH

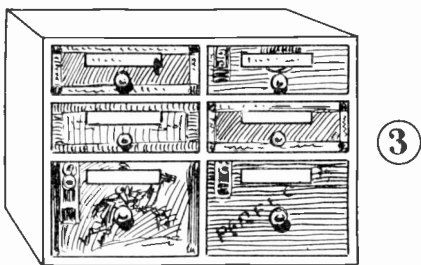
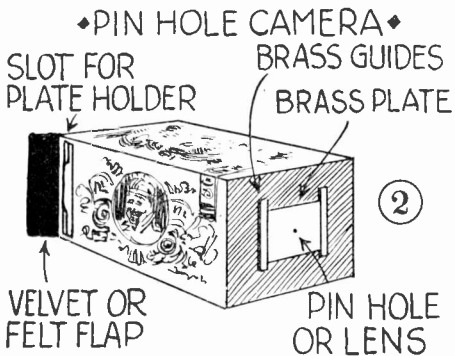
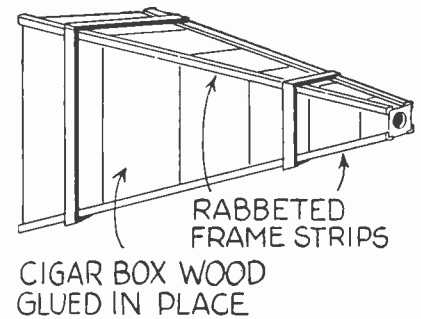
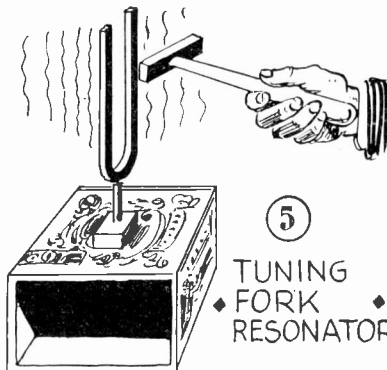
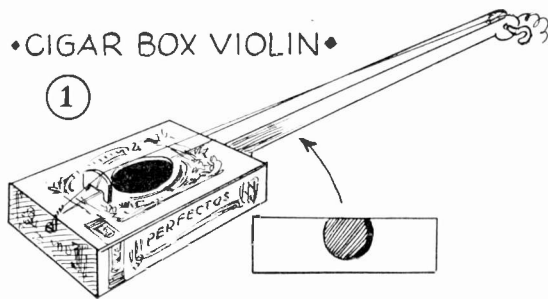
VALVES

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One of the greatest dangers to aeroplane pilots is the total loss of sense of direction. A ray of light from a wind driven dynamo strikes the surface of the mirror which forms the top of a miniature gyroscope. The beam reflected on the ground glass shield tells the aviator of his angle with regard to the horizontal. The gyroscope is started by means of a small tube conducting air from the edge of the fuselage against small notches cut into the periphery of the gyroscope wheel.

"Cigar Box" Contest--\$100.00 in Prizes

Think of All the Devices You Ever Saw Made from Cigar Boxes.



CIGAR boxes are cheap. As a matter of fact in most towns they are thrown away by storekeepers. Why not make good use of these? The wood may be used for various purposes, and the cigar box, either cut or whole, finds numerous uses. On this page we are showing examples of various devices in which cigar box wood is used entirely in their construction. We want more ideas and will pay for these suggestions. Of course, none of the uses for cigar boxes or cigar box wood depicted upon this page, will be awarded prizes.

It will be seen that you may construct anything using cigar box wood exclusively in the building of the device. It can be a toy, a table, a piano or a watch charm. Fig. 8 on this page is a cigar box telephone. A hole has been cut in one side of the cigar box, and the string passes from the other side to a duplicate box at a neighbor's house. The string must be tightly held. Fig. 9 is a simple stereoscope constructed as illustrated. Fig. 10 is a method of using a cigar box so as to permit the entire family to enjoy the radio concerts from a receiving set of relatively low power amplification.

The conditions of this contest are:
Contest closes in New York on March 10th at 12:00 o'clock midnight.

All material must be in our hands at this time.

Participants are not limited as to the number of entries.
Everybody, man, woman and child, is eligible.

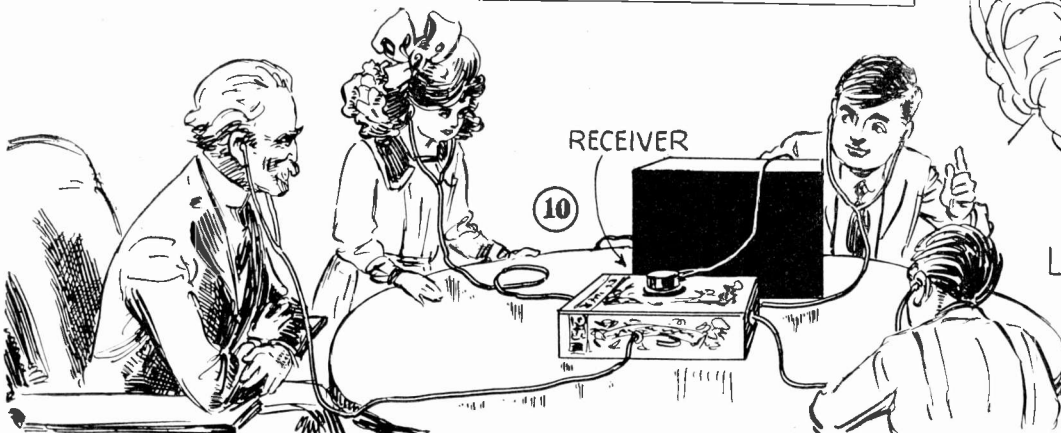
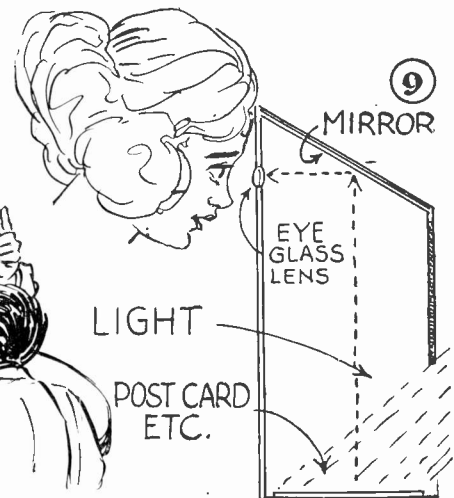
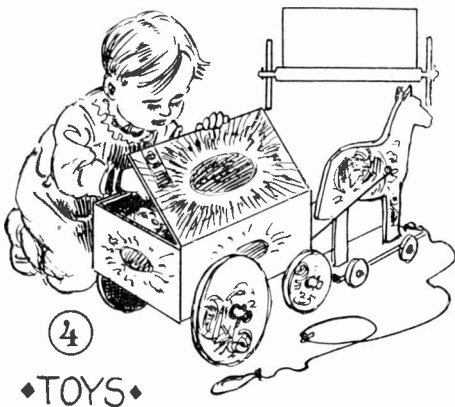
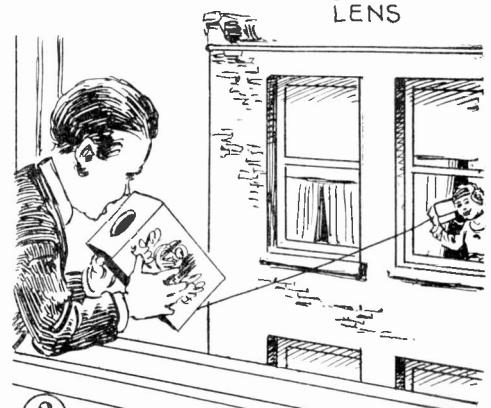
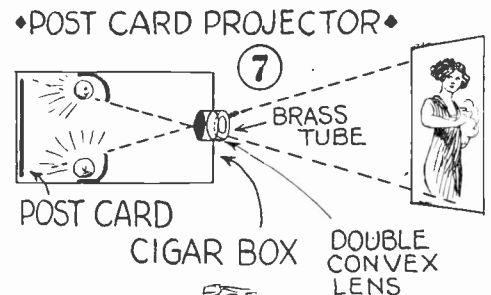
A sketch and a 100-word article are all that is necessary, although models should preferably be submitted.

In event of a tie for any of the awards, participants so tying will be given prizes identical to those tied for.

\$100.00 will be awarded

THERE ARE TWELVE PRIZES AS FOLLOWS:

- First prize \$25.00
- Second prize 20.00
- Third prize 15.00
- Fourth prize 10.00
- Four prizes, each of 5.00
- Four prizes, each of 2.50



Magic for Everybody

BY PROF. JOSEPH DUNNINGER.

NO. 10 OF A SERIES.



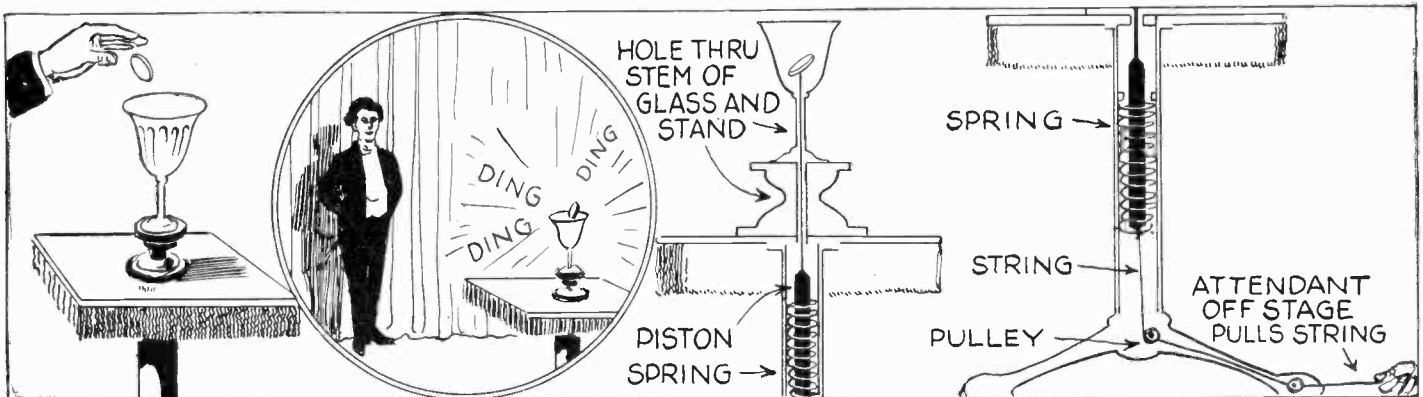
A sheet of paper is held up and then torn longitudinally in three pieces. These are placed in front of each other and then folded in thirds. Some one is requested to initial the paper, and when it is opened, the paper will be found whole again. Two

papers of identical size are pasted together. One of them, however, has been folded up as shown in the illustration. When the paper is torn, the performer is careful not to show the folded piece. These torn parts are folded up. The whole sheet is opened.



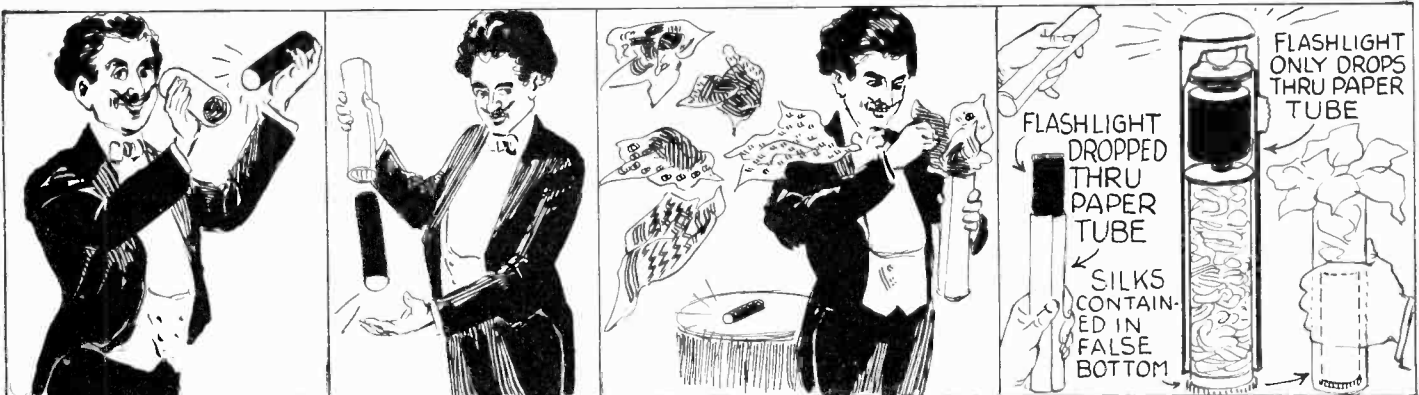
A box of matches is removed from the pocket and the trickster lights his own cigarette. His friend is waiting for a light and asks for it. The book of matches is closed and handed to the waiting guest, so that he can light his own cigarette. When he opens the match book he finds it empty. This stunt is easily performed, it being necessary

to tear two match books so that one will be complete, except for the cover, and the other will contain no matches. The group of matches is then placed within the cover, and after a light has been obtained, the matches are slipped out of the cover and the cover is closed.



A glass may be seen resting on a small magician's table. Into this is thrown a borrowed coin. The glass will now answer any questions because of the fact that the coin

jumps up and down in it. Two leaps signify "yes" and one "no." A knitting needle passes through a hole in a glass. An assistant off-stage, operates the mechanism.

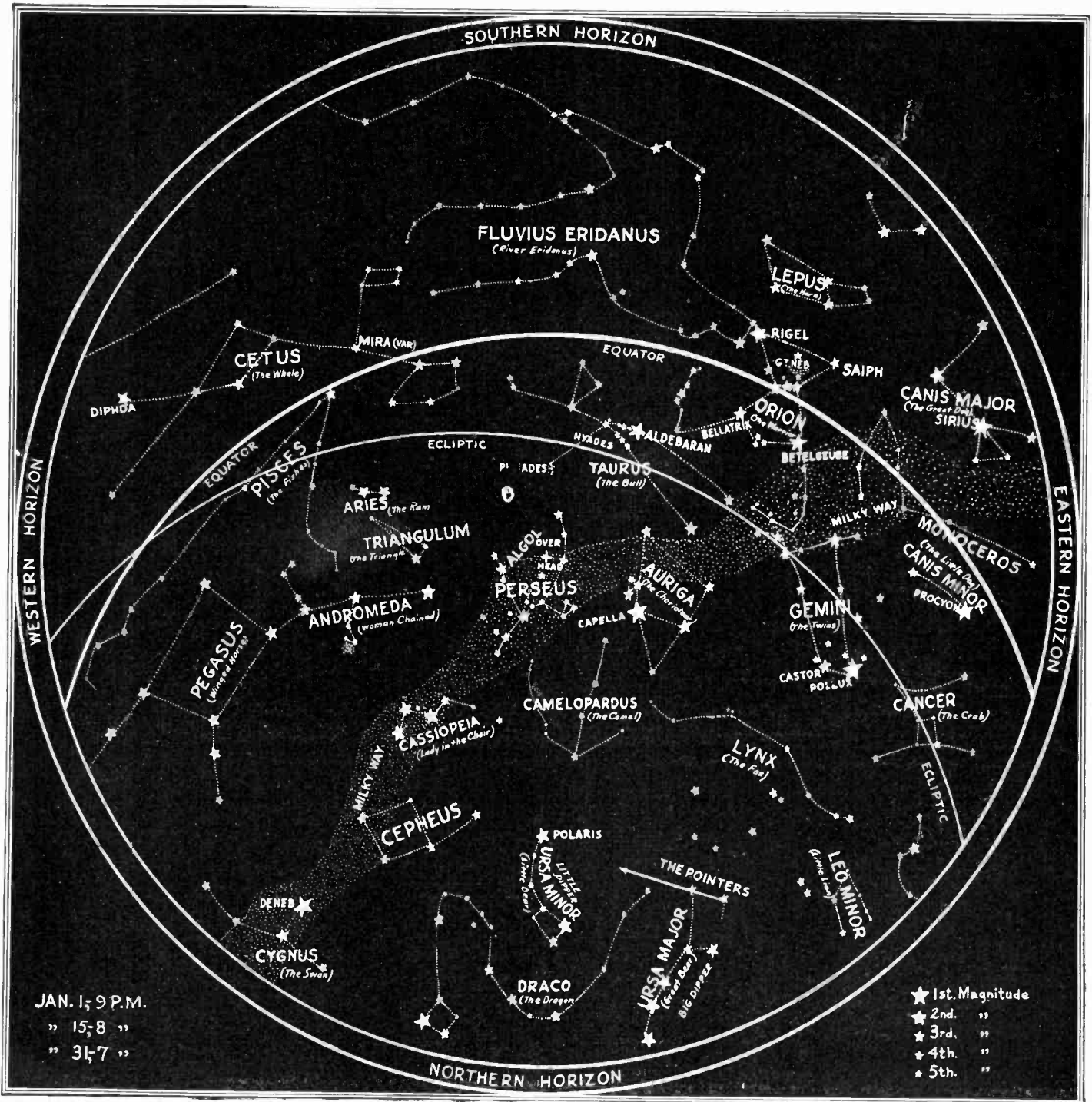


The performer takes a sheet of paper and rolls it up to form a tube. To demonstrate that it is empty, he holds a flashlight at one end, and permits the beams of light to pass through the tube. He drops the flashlight through it, and removes flags and ribbons from

this empty tube in vast quantities. The flashlight is fitted with but one section of the usual battery. When the flashlight is dropped through the paper tube, the handkerchief container remains within it.

The Heavens in January

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



If this map is held over the head with the "Northern Horizon," north, the position of the stars in the heavens will coincide with their position on the map. It may be used any time during the month between 7 and 9 P. M., though at other hours and days than indicated the stars will have slightly different locations.

WINTER evening skies are the most brilliant of all the year. Seven stars of the first magnitude and more than twice as many of the second magnitude will now be found in the eastern sky. Ruddy Aldebaran in Taurus and golden Capella in Auriga are close to the meridian. The far-famed cluster of the Pleiades is due south of Perseus which is directly overhead at this time. The Hyades, another noted group in Taurus, lie a little to the southeast of the Pleiades. They are easily distinguished by their distinctive V-shape and by Aldebaran, marking one point of the V and the eye of the Bull. Just to the south of Auriga will be found the two stars, one

of the second magnitude the other of the third. They mark the tips of the horns of Taurus.

Orion is now high in the southeast and no constellation in the heavens can rival the magnificence of this mighty celestial hunter. All of the principal stars in Orion, with the exception of the red giant star, Betelgeuse, of which we have heard so much in the past few years, are members of an associated group of stars that are involved more or less in a vast nebula that is probably about six hundred light years from the solar system. This great nebula is most strongly concentrated around the star Theta in the Sword of Orion which is a sextuple star, that is,

it is made up of six stars in a connected system. Four of these—considerably brighter than the other two—form the well-known trapezium of stars in the heart of the Great Nebula. It is generally granted that there is no finer object in the heavens than this Great Nebula in Orion which can be seen to advantage even in a small telescope. It takes a powerful telescope, however, to reveal the branches and ramifications of the nebula that envelope the entire constellation in its folds.

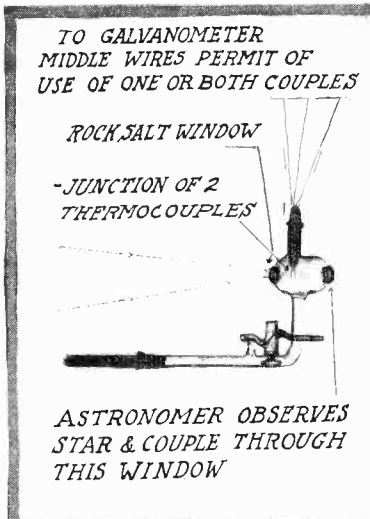
Diagonally opposite to Betelgeuse is Rigel, a true diamond of the stars, and probably one of the super-giants of creation. It is an excessively hot and massive star of the us-
(Continued on page 916)

Measuring the Stars' Heat

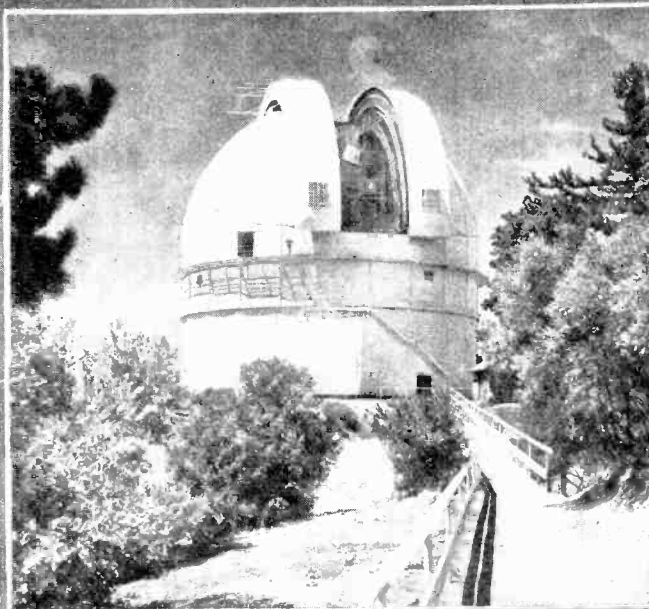
Sensitive Thermocouple Creates Infinitesimal Current From Their Light.

BY EDISON PETTIT,

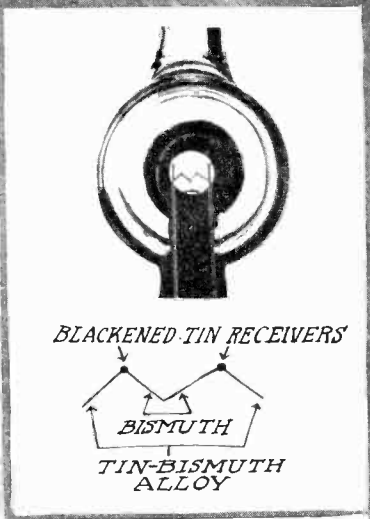
Astronomer, Mt. Wilson Observatory



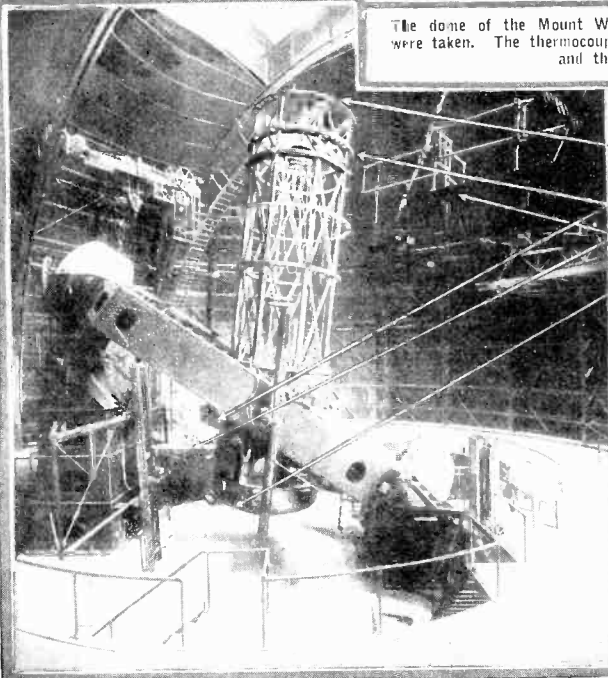
Above is the double thermocouple on which the star image falls for heat measurement.



The dome of the Mount Wilson Observatory where the present measurements were taken. The thermocouple was inserted at the focal plane of the telescope and the wires run to galvanometers.



Top: Telescope eyepiece showing the thermocouple in place. Bottom: Wiring of double couple.



LIGHT FROM
STARS ENTERS
SKELETON TUBE
HERE

FOCAL POINTS
PLATFORMS FOR
OBSERVER

MIRROR 100' IN
DIAMETER

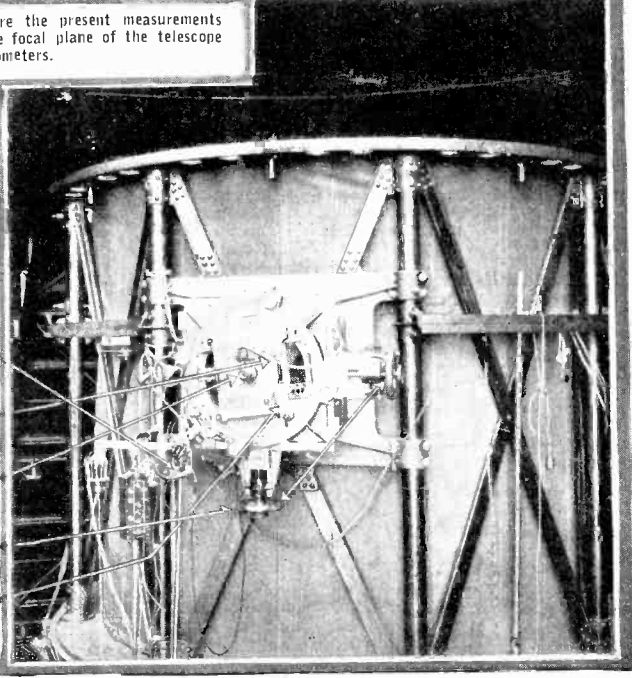
TELEPHONE
TO COMMUNICATE
WITH OBSERVER
AT GALVANOMETER
IN BASEMENT

THERMOCOUPLE
CABLE

EYE PIECE -
THERMOCOUPLE
ATTACHED BEHIND
THIS.

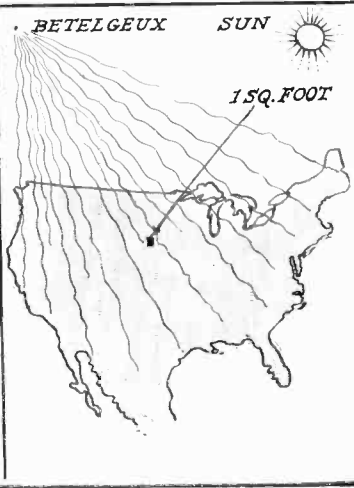
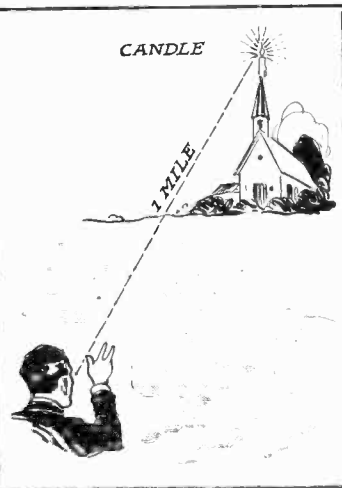
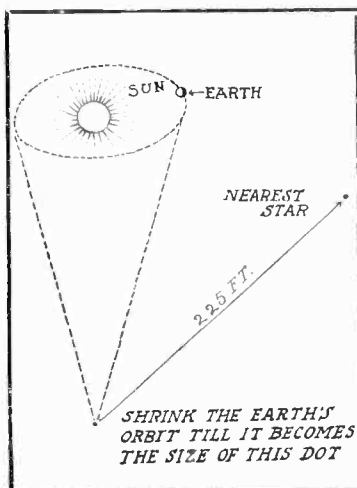
LEVER FOR
SHIFTING SCREEN
FOR SPECTRUM

GUIDING HANDLE
FOR THERMOCOUPLE



At the left below is shown the Hooker 100-inch reflecting telescope with which the present measurements were taken. The reflecting mirror is at the bottom of the skeleton tube. It is concave and focuses the beam of light to a point. The thermocouple is in-

serted at this point on movable supports. The couple is made in two parts and each part may be used separately, each deflecting the galvanometer in the opposite direction. Thus checking the results.



COMPARISONS

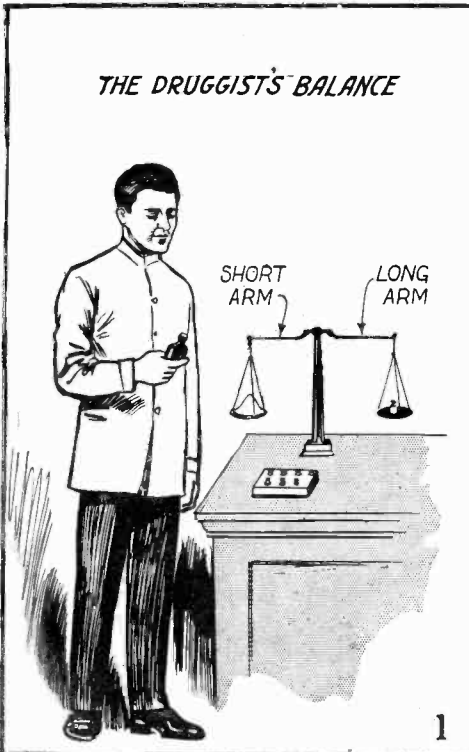
THE observer can see the thermocouple at all times. He focuses the point of light first on one junction of the couple and then on the other, the deflection in each case being in the opposite direction. Thus he checks each measurement. Above is shown the eye-piece of the telescope. The couple is placed directly behind it. The telescope is also equipped with a spectroscope, used with the couple, so the heat emitted by each color of the star's light may be measured.

AT the left are shown comparisons of the heat from the stars that falls on the earth. If the whole orbit of the earth around the sun were shrunk to the size of a pin head, Alpha Centauri, the nearest star, would still be 225 feet away. Its heat has the same effect as the heat from a candle at the distance of a mile. If the heat from the star Betelgeux, absorbed by the United States were concentrated it would hardly equal the heat of the sun on one square foot of its surface.

Can You Answer These Problems?

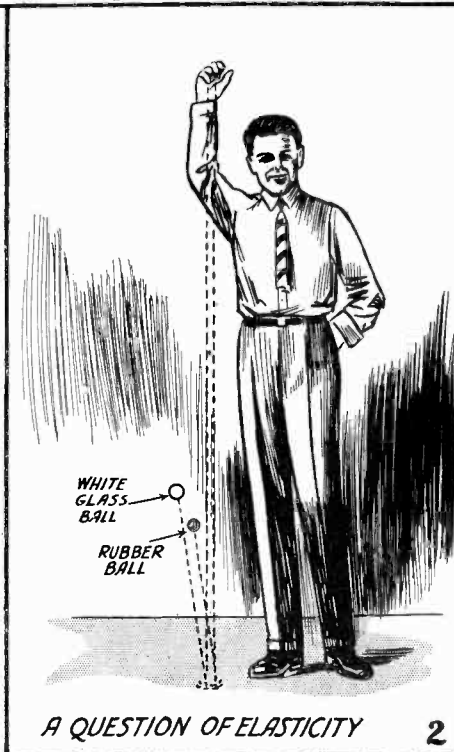
Everyday Scientific Problems Involving General Laws.

BY ERNEST K. CHAPIN, M. S.



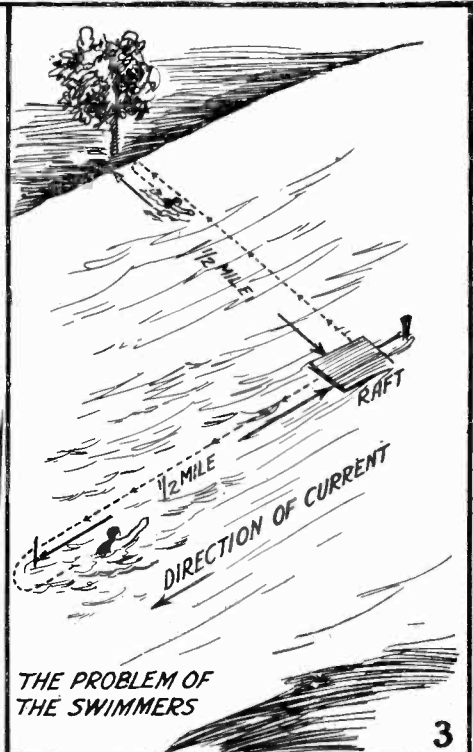
THE DRUGGIST'S BALANCE

1



A QUESTION OF ELASTICITY

2



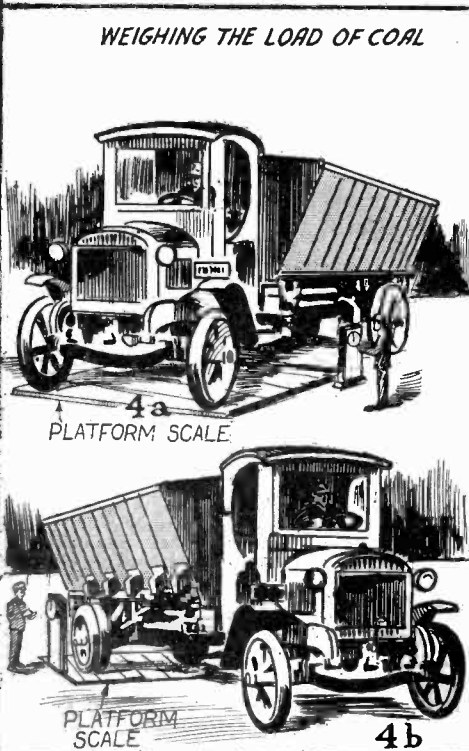
THE PROBLEM OF THE SWIMMERS

3

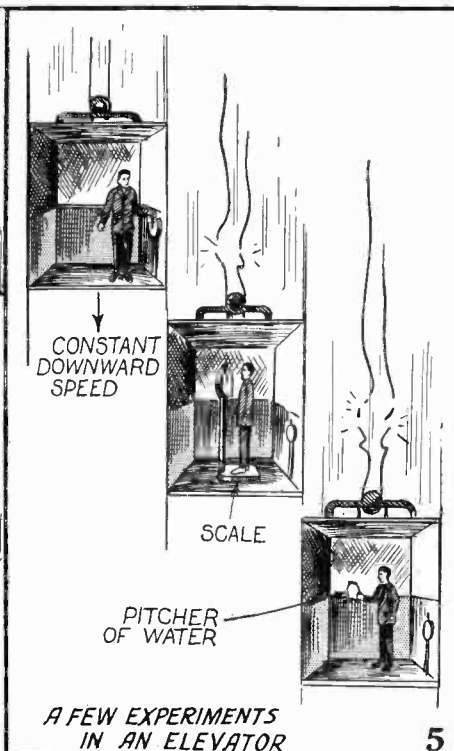
A certain druggist is accustomed to weigh his powders on a beam balance one arm of which is slightly longer than the other. Of this defect he is ignorant since the short arm is properly loaded by a set screw to make the beam balance. Suppose he places his weights just as frequently on one pan as on the other will he gain or lose on account of the defect?

Take two balls, one of rubber and the other of solid glass. Release them from the same height and let them fall to a cement sidewalk, or better yet to a flat piece of sheet iron or other metal with an absolutely flat surface. Let them be of the same size. Which will bounce higher, the glass ball or the rubber one?

Two swimmers of equal strength and ability race across a river. One swims half a mile and returns across the river and the other swims half a mile down stream and returns. They start and finish from a raft in mid stream. If they are of equal power and of equal skill as swimmers which should win the race. Both are forced to combat the current of the stream.



WEIGHING THE LOAD OF COAL



A FEW EXPERIMENTS IN AN ELEVATOR

5



WHY PUT BOILED EGGS IN COLD WATER

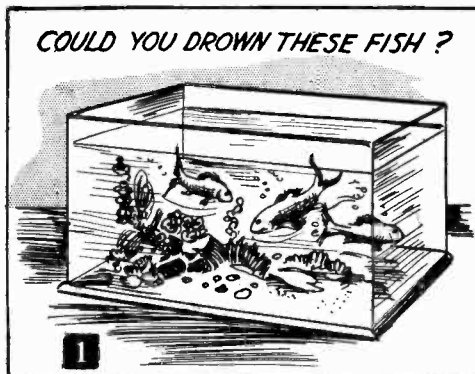
A man wishes to weigh a load of coal but finds that the platform of the scales is too short to accommodate the whole wagon. He decides to obtain the weight with the front wheels on the platform and then with the rear wheels on the platform. The sum of the weights thus obtained, he figures, should be the total weight. Is he correct in this assumption?

Suppose an elevator drops quietly and at constant speed, could an individual tell if it were in motion? Suppose a man in the elevator stood on a weighing scale when it started to drop, what would be the result? Suppose the elevator were dropping at the speed due to the action of gravity, what would happen if a pitcher of water were inverted in the cage?

It is said that if hard boiled eggs are immersed in a bath of cold water immediately after they come out of the boiling kettle they will be much easier to peel. Is there any scientific foundation for this fact? Is it actually the case? ANSWERS TO THESE QUESTIONS AND THEIR EXPLANATIONS WILL BE FOUND ON PAGE 929.

Scientific Misconceptions

BY RAYMOND B. WAILES.



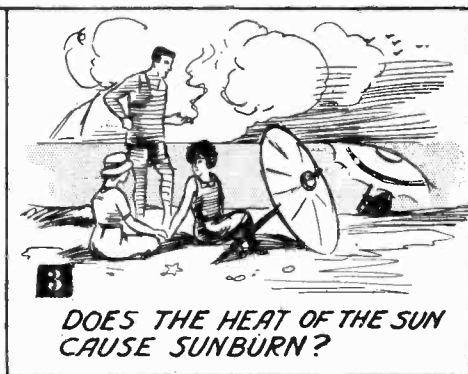
COULD YOU DROWN THESE FISH ?

Strange as it may seem, fish may be drowned by simply taking the dissolved air out of their aquarium. This can be done by boiling the water and then cooling it. It is because of the necessity of dissolved air in the water that a stream of fresh water or a jet of air is forced into artificial fish ponds where there are numbers of fish.



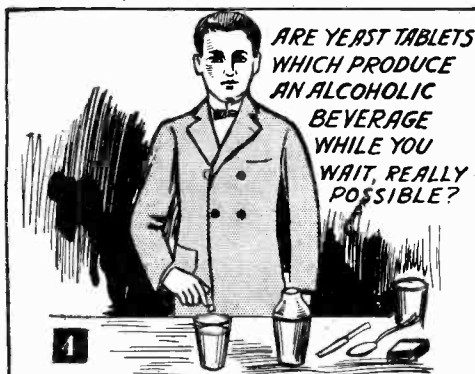
ARE THE BROWN STAINS ON THE SMOKER'S FINGERS REALLY NICOTINE ?

Very little, if any, of the rich brown stain that appears on smokers' fingers is nicotine. The stain is composed chiefly of tar as formed by the burning of the carbon in the cigarette. Nicotine is a deep brown oily substance but there is little of it that is not volatilized with the extreme heat at the end of the cigarette.



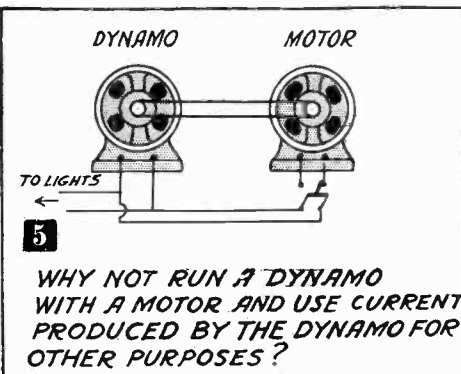
DOES THE HEAT OF THE SUN CAUSE SUNBURN ?

Most people who sit long on the beaches in the hot sun think that it is the solar heat that causes the tan, or sun-burn, as it is called. The effect is caused by the ultra-violet rays in the sunshine and not by the extreme heat. This is proved by the fact that if these rays are filtered out there is no tan even in the hottest sun.



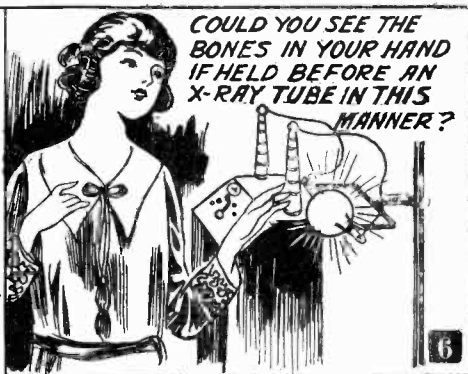
ARE YEAST TABLETS WHICH PRODUCE AN ALCOHOLIC BEVERAGE WHILE YOU WAIT, REALLY POSSIBLE ?

With the advent of prohibition there were many firms who claimed to manufacture yeast tablets that could be dropped in a drink and would produce alcohol content "while you wait." This is impossible as it takes some time for the live yeast organism to perform its work of making alcohol from the sugar in the drink.



WHY NOT RUN A DYNAMO WITH A MOTOR AND USE CURRENT PRODUCED BY THE DYNAMO FOR OTHER PURPOSES ?

The scheme shown above would work if it were possible to manufacture a dynamo and a motor that were mechanically and electrically perfect. The loss in friction takes between ten and twenty per cent of the power of the two machines. Aside from this loss, the machines cannot be made electrically perfect.



COULD YOU SEE THE BONES IN YOUR HAND IF HELD BEFORE AN X-RAY TUBE IN THIS MANNER ?

X-rays affect a photographic plate but are invisible to the naked eye. In order to get their penetrating effect, i.e., to see the bones in the hand with the aid of an X-ray tube, it would be necessary to use a fluorescence screen between the eyes and the hand. This screen would show the effect of the rays.



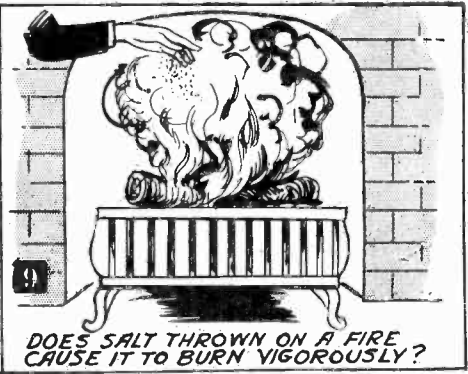
IS A "BRASS" PIN POISONOUS IN REMOVING SPLINTERS ?

A brass pin or needle is no more poisonous to the body than a steel one. The danger in both cases arises from the use of an unsterilized pin which may have micro-organisms on the point which is used to prick the splinter or to open the blister. These organisms cause the infection, not the nature of the metal used.



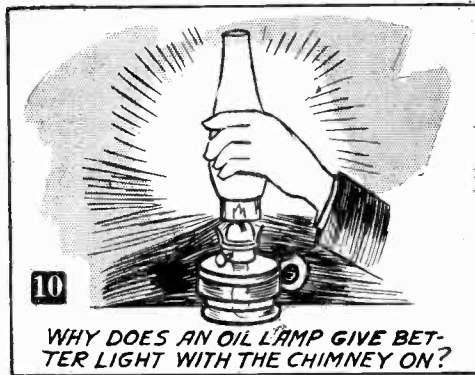
YELLOW SOAPS ARE CALLED ROSIN SOAPS - DOES IT MEAN THAT ROSIN IS USED AS AN ADULTERANT ?

Many of the heavy yellow soaps have a comparatively high resin content. This element used in the manufacture of the soap is not, as is sometimes thought, used as an adulterant. Its addition causes the soap to produce a rich, highly detergent lather that is very useful in dissolving greases and oils.



DOES SALT THROWN ON A FIRE CAUSE IT TO BURN VIGOROUSLY ?

When it is wished to make a fire blaze up freely, salt is sometimes thrown into the flames to cause the effect. The Bureau of Mines, in a recent series of tests, has conclusively proven that the flare-up following the dosage of salt is simply a result of the sodium flame and not because of a better burning fire.



WHY DOES AN OIL LAMP GIVE BETTER LIGHT WITH THE CHIMNEY ON ?

The lamp burns much brighter with the chimney because the chimney causes a draft which allows the carbon to be more highly heated giving a brighter flame.



WHAT MAKES A COLD GLASS CRACK IF HOT WATER IS POURED INTO IT ?

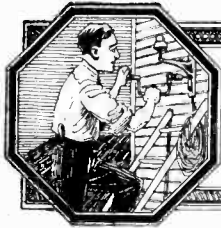
A glass breaks when hot water is poured into it because of the difference of expansion between the outside and the inside due to the higher heat on the inside.



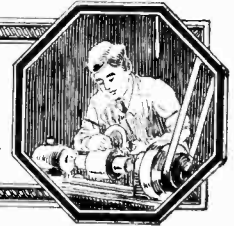
WHAT CAUSES THE SOUND WHEN A SEA-SHELL IS HELD TO THE EAR ?

IS IT AN ECHO OF THE WAVES OF THE SEA ?

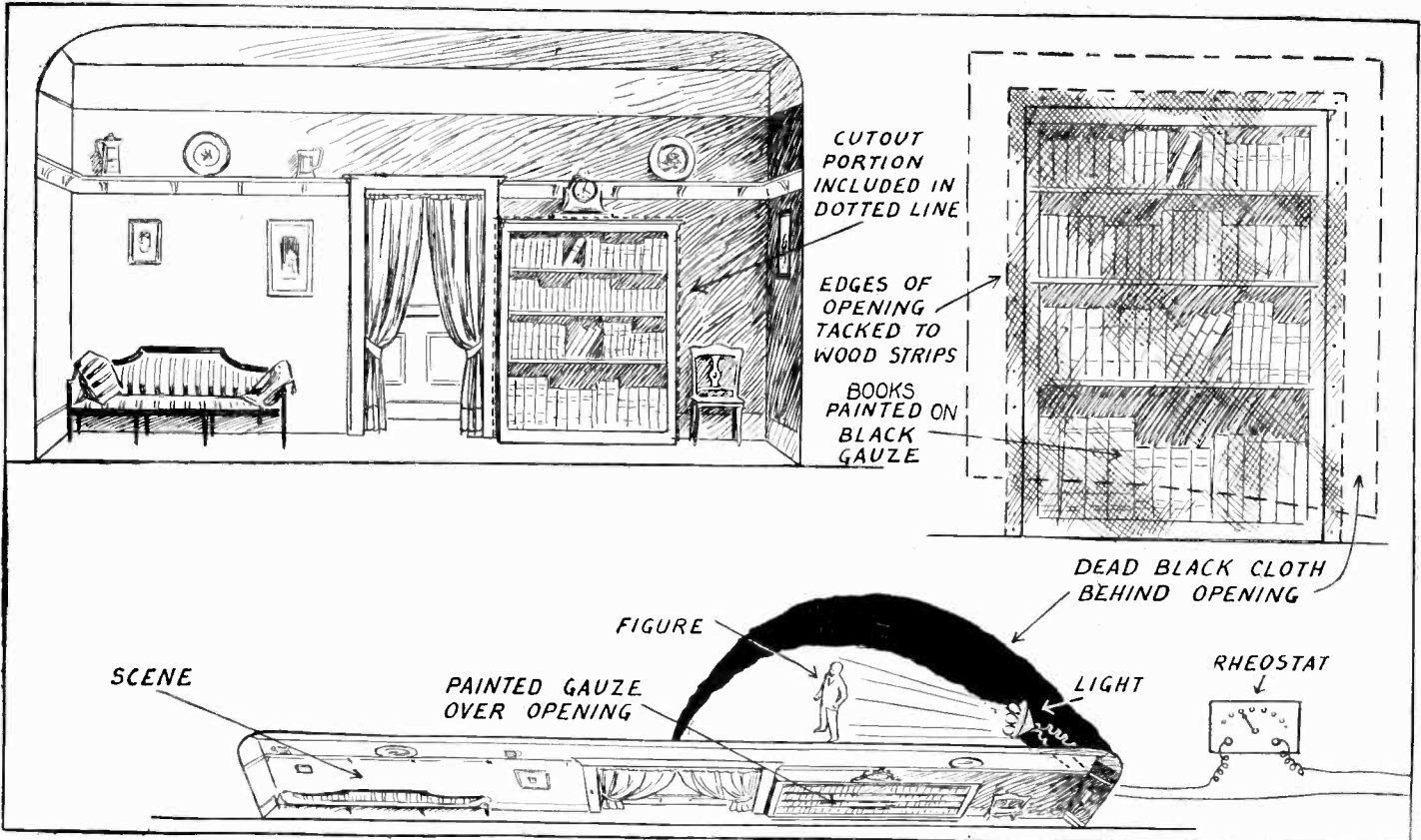
A sea shell sounds when held to the ear simply because its form magnifies the sounds of the room and pulses in the head. The least vibration causes an "echo."



THE CONSTRUCTOR



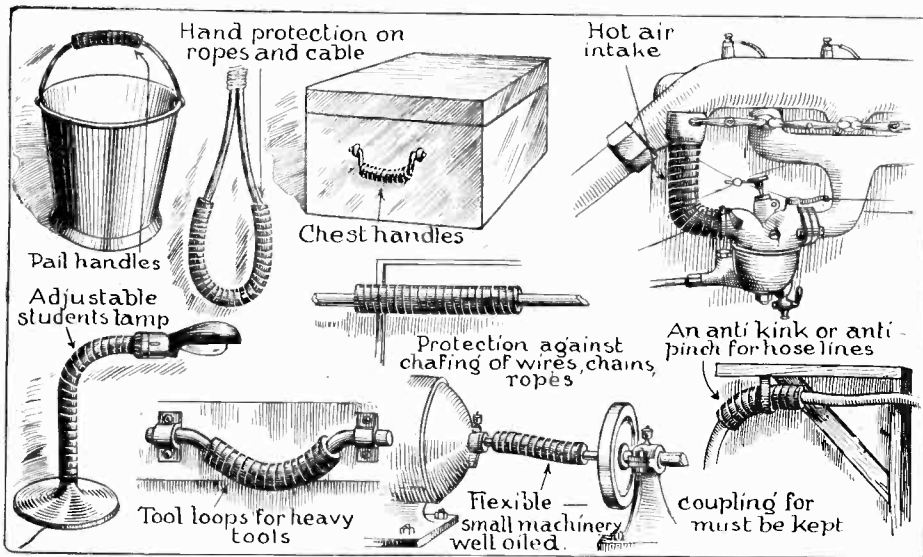
Ghost Spectacle for Amateur Stage



Many times amateur productions on the stage are put to it to show a ghost or apparition. A simple method of creating the illusion is to take a spot in the back drop, say a book case, cut out the regular canvas upon which it is painted and substitute theatrical gauze. Paint the same piece of furniture on the gauze and drop a solid black drop be-

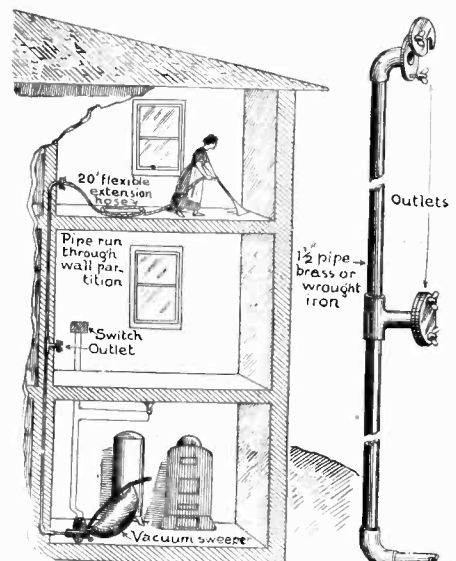
hind it. When the apparition is supposed to appear it is only necessary to place the figure behind the gauze, darken the stage lights and throw light on the figure. Thus the figure is seen through the piece of furniture. He disappears when the lights are turned up, and the light is taken off the figure.—L. B. Robbins.

USES FOR SCRAP CONDUIT



All amateur electricians are confronted with the problem of disposing of scrap bits of conduit. Amateurs do not like to throw away anything—that's why they are amateurs. Above is shown some of the many ways scraps of flexible conduit, too short to use in regular wiring, may be put to use. Any number of handles may be made by placing short strips of the flexible metal over stiff wire or cord. If there is a piece of larger diameter available it will be found very handy in constructing a hot air lead for the carburetor of the car. If a couple of the end fittings are handy, a very presentable study lamp can be made, as shown.—C. R. Mullin.

CLEANER KINK

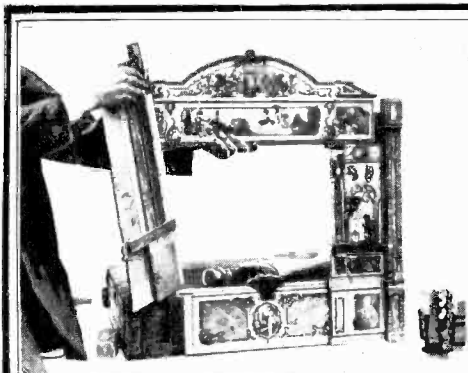


By passing a pipe line up through the partitions of a house and fitting it with plugs on each floor and attaching it to the vacuum cleaner in the basement and using a hose with a nozzle time can be saved.—G. A. Luers.

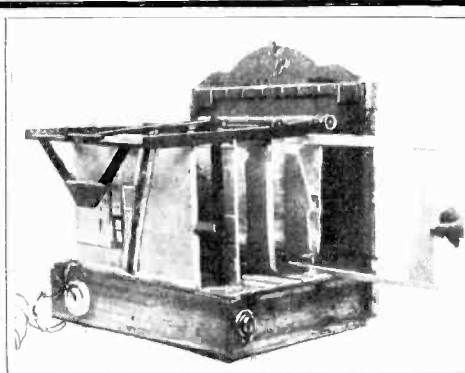
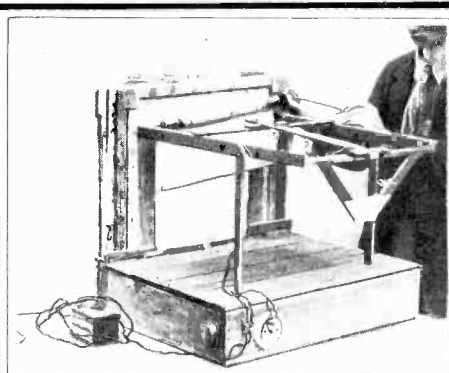
Stage Effects for Miniature Theatre

Miniature Theatre in Which Wonderful Effects Can Be Worked.

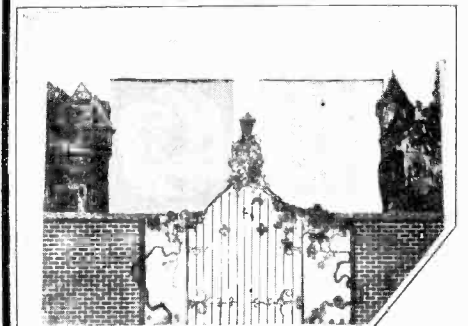
BY DR. ERNEST BADE.



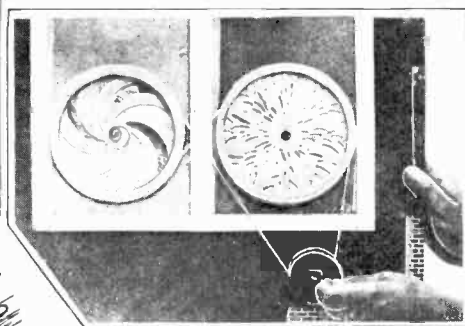
All of the parts of the electrically operated toy stage shown above are found in the box. This is hinged at one end and grooved on top, so that the various scenes can be slid in and out. The proscenium consists of four separate pieces.



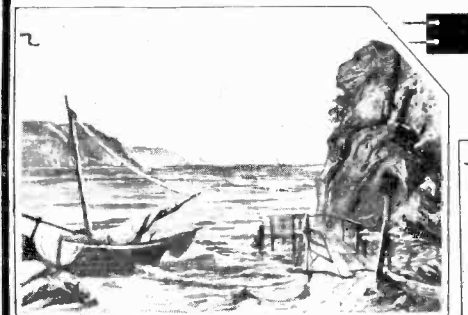
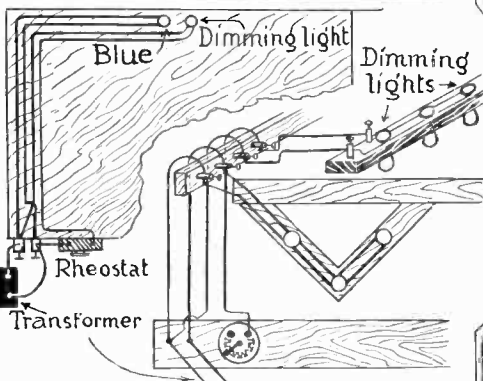
Back stage two T-shaped pieces of wood containing four deep grooves are erected. At the rear a V-shaped piece of wood, having several miniature incandescent lights mounted upon it, may be seen. The back drop is the most important part of the scene.



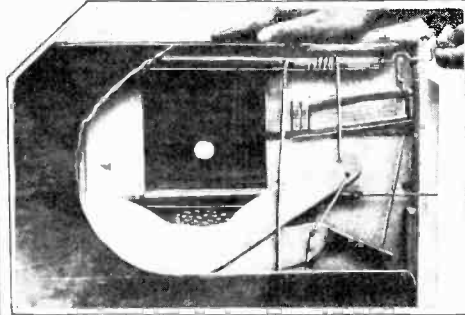
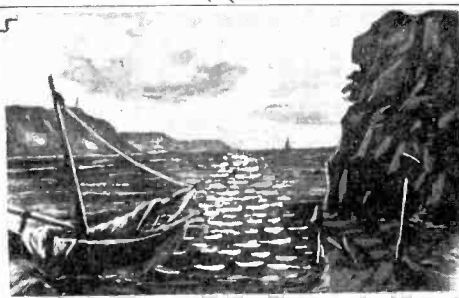
One of the scenes as it appears from the front of the stage with the footlight turned on fully. These scenes can be made from paper cut-outs. Sunday supplements or other art pictures. The dimming light is then turned low by means of the rheostat, which causes the front stage illumination to be produced entirely by the blue light. A beautiful firework scene is now in evidence, and the surprising feature is that it moves and is colored.



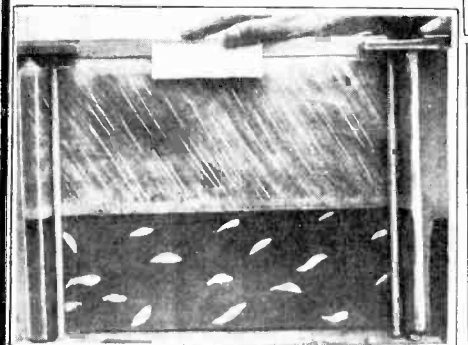
Two cardboard wheels are cut out as illustrated above, and covered by tissue paper which has been colored with crayon pencils, are rotated by means of the small driving wheel also made of cardboard. A cord belt connects the three wheels as shown. When illuminated from behind, the effect is startling. The circuit diagram is shown at the left.



Even the picture shown above can be employed in this miniature theatre, in which the curtain rolls up and down for each change of scenery. The night effect of the picture is shown at the right and is easily attained.



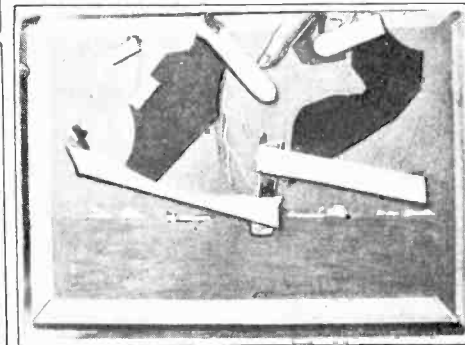
The manner in which the effect is produced is here illustrated. The rising moon is merely a hole cut in a roller curtain. The waves are cut into black cardboard which rocks back and forth.



Those portions of the scene which are to be illuminated from behind, are generally made of thin paper. Above is a night ocean effect. As the roller curtain is moved from one end to the other, the waves move and the rain pours down.

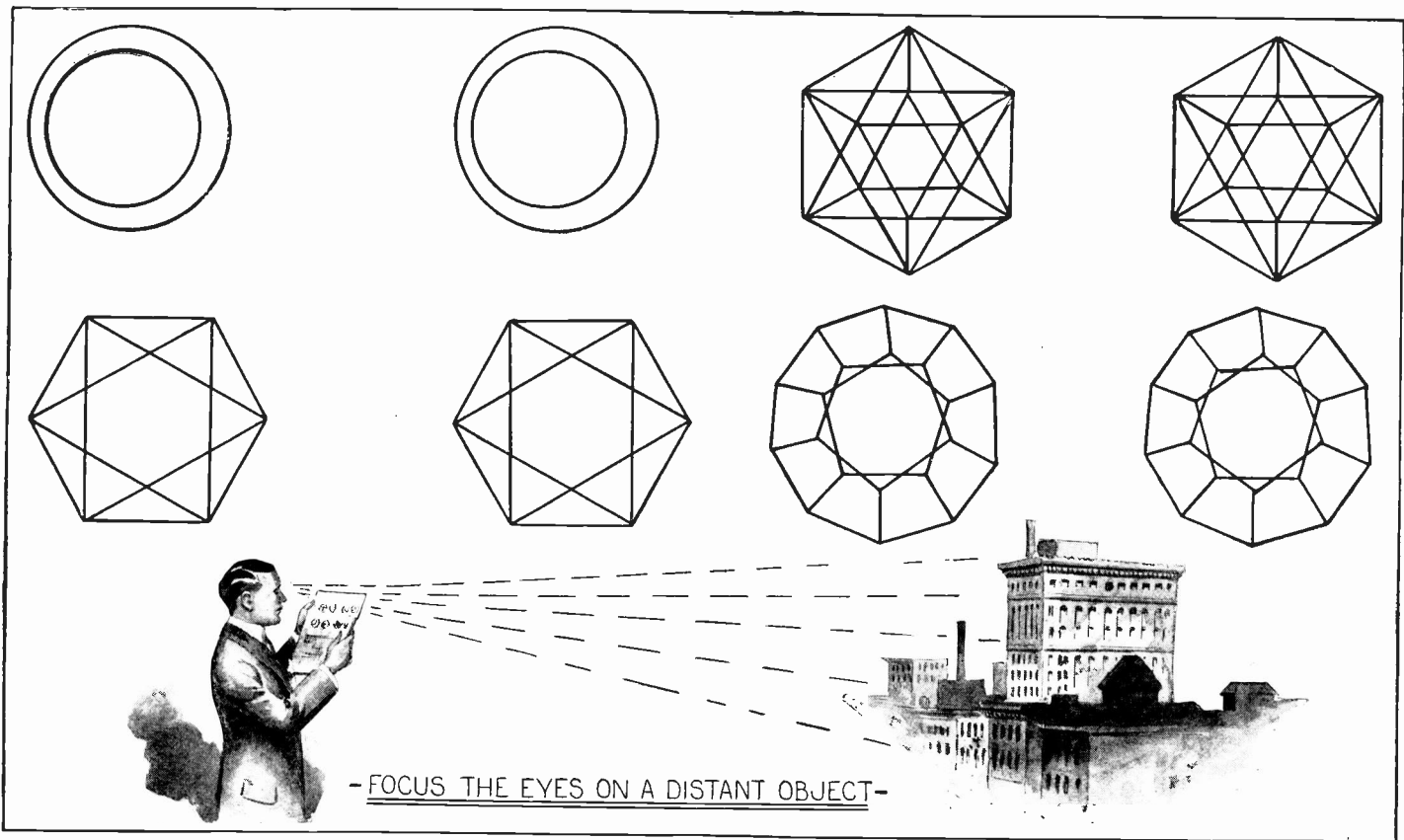


Another back view in which the tissue paper part of the scene is clearly shown. This is a rising sun effect over a lake. The method of producing wave ripples simulating reflection upon water is effected by rocking the wave device back and forth.



In the back scene effect illustrated above, lightning flashes through a dense forest. The lightning flash cut into the picture, is clearly illustrated. The shutter merely cuts off the rays of light.

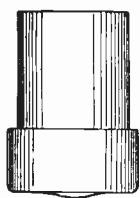
Stereoscopic Drawing Method



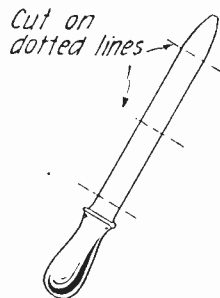
The making of relief drawings is a comparatively simple matter. As shown above, it is only necessary to make duplicates of the drawings, offsetting that part of the image that is to appear on the left side of the completed drawing a little to the left and that part of it

which is to appear in the right side a little to the right. If the above drawings are then focused in the plane of the eyes at the regular reading distance and the eyes are then focused at some distant point they will stand out in stereoscopic relief.—Ernest K. Chapin.

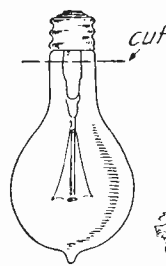
Home-Made Laboratory Equipment



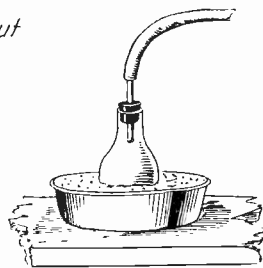
Iron Crucible



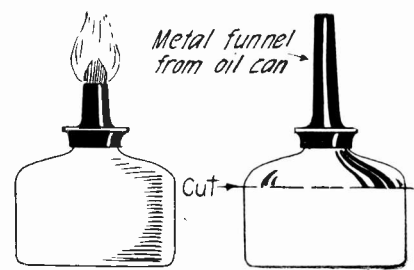
Glass tubes from medicine dropper



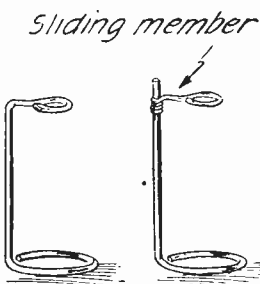
Flask from light bulb



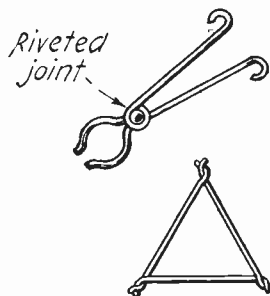
Sand bath for heating flask



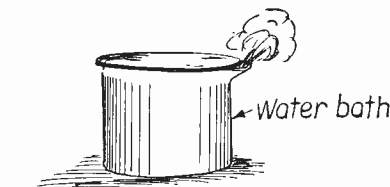
Alcohol lamp from oil can



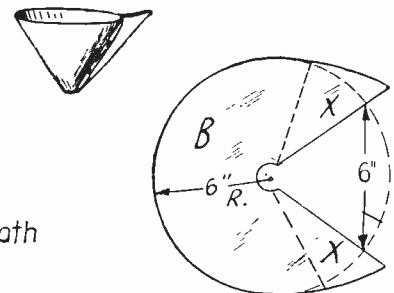
Ring stands bent from wire



Tongs and triangle bent from wire



Watch crystal evaporator

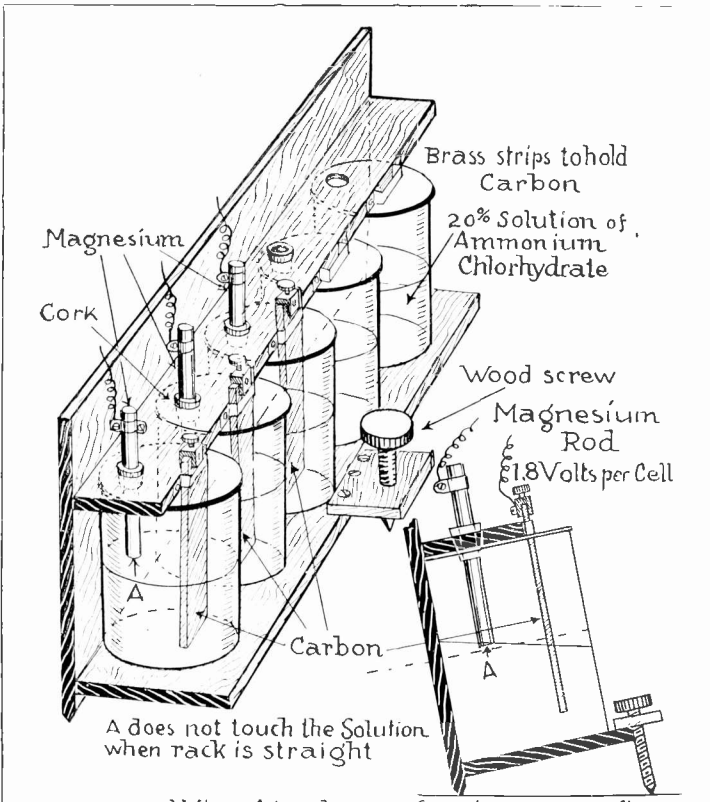


Oil paper filter-paper holder or funnel

Many experimenters living away from the larger cities encounter much trouble in getting the kind of apparatus necessary for their experiments at a reasonable cost. Above are shown some of the ways the experimenter may manufacture his own apparatus from materials found at home. An iron crucible is made from a short length of pipe and a pipe

cap. Short lengths of glass tubing may be made from ink droppers. A serviceable flask is made from a large light globe. An alcohol lamp and funnel is made from an oil can. Ring stands, triangles and tongs are made from stiff wire. Filter paper holder is made from waxed paper.—Charles D. Tenney.

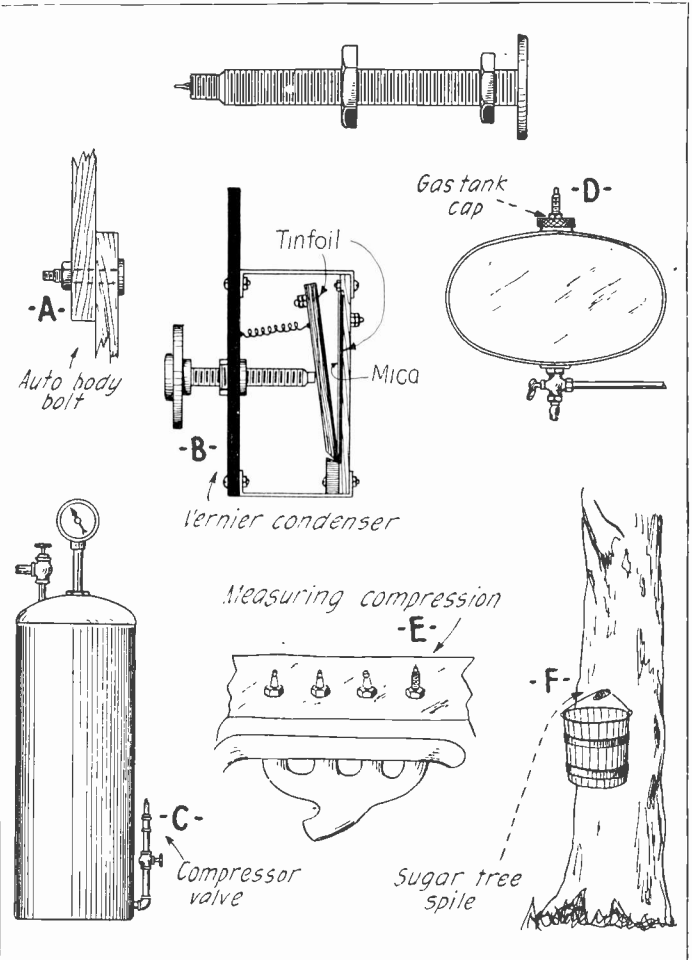
Novel Wet Cell



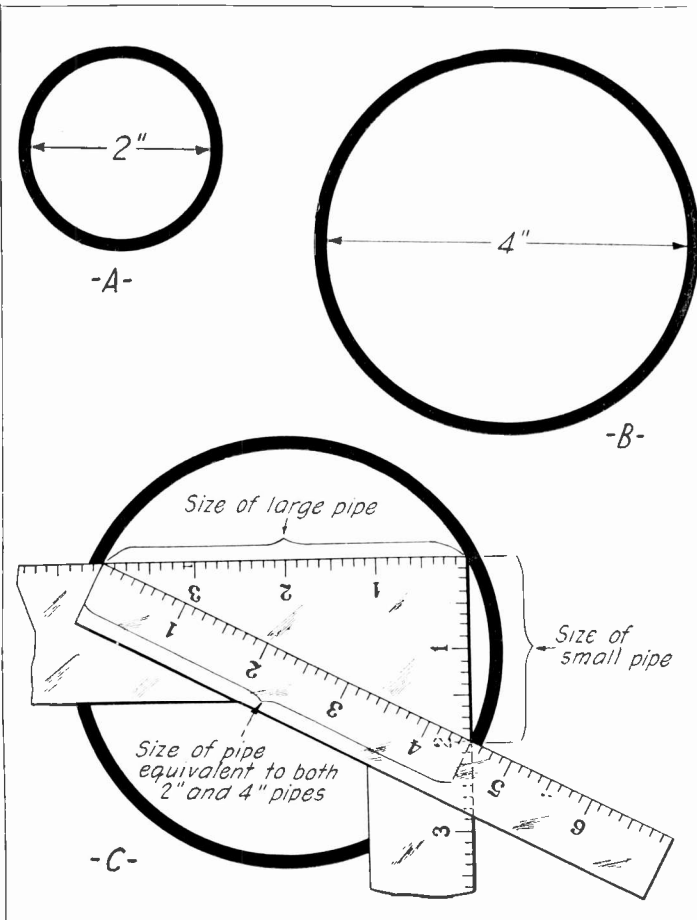
When A touches the Solution—Current flows

A simply constructed battery that will deliver 1.8 volts per cell. It is constructed of carbon and magnesium rods in Ammonium Chloride. The thumb-screw takes the magnesium out of the solution when the cell is not in use.—Chas. Mohr. At the right are shown several uses for discarded valve stems. A—As a bolt. B—As an adjustment screw for hook-type variable condenser. C—As an intake valve for a compressed air tank. D—As an air valve in the top of the fuel tank. A few strokes of the pump helps the car over the hill. E—Compression tester. F—Sugar tree spile.—J. T. Garver.

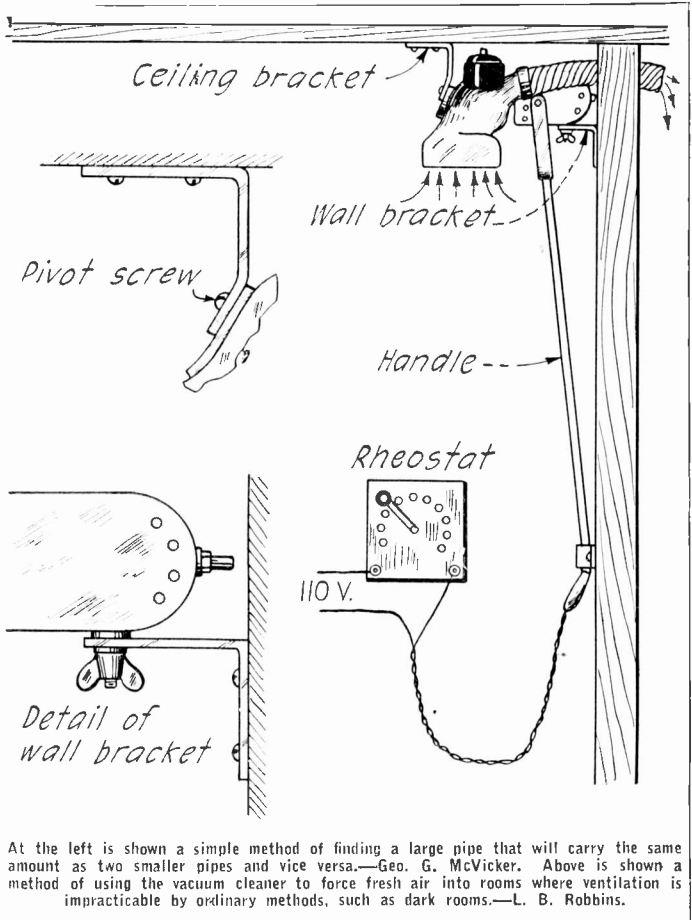
Uses for Valve Cores



Pipe Size Changes



Vacuum Cleaner Use



At the left is shown a simple method of finding a large pipe that will carry the same amount as two smaller pipes and vice versa.—Geo. G. McVicker. Above is shown a method of using the vacuum cleaner to force fresh air into rooms where ventilation is impracticable by ordinary methods, such as dark rooms.—L. B. Robbins.



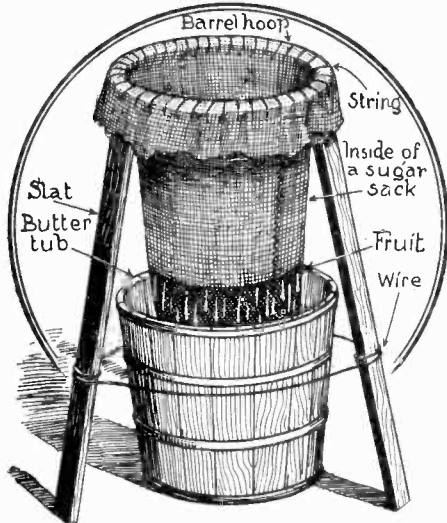
WRINKLES RECIPES & FORMULAS



Edited by S. GERNSBACK

FOR PRIZES PAID SEE PAGE 856.

Fruit Strainer



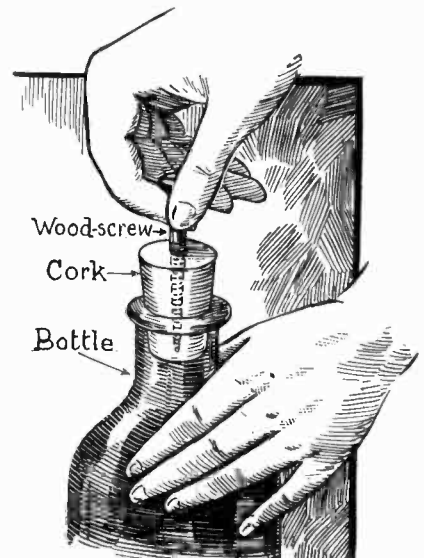
A very cheap strainer for fruit juices is made by stitching a sugar sack to a barrel hoop and supporting it on three slats over a butter tub, as shown in the sketch above. Wires hold the slats in place. —Mrs. Florence Swallow.

Coffee Grinder



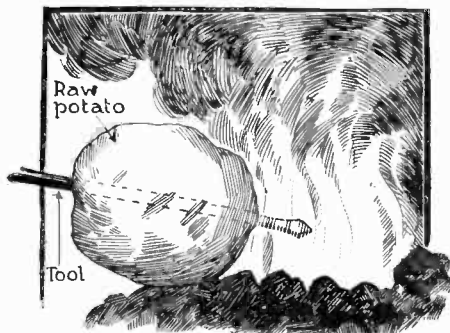
When in camp or away from home, a convenient coffee grinder is made with a beer bottle and a large can, as shown in the above sketch. —I. D. Burkett.

Cork Screw



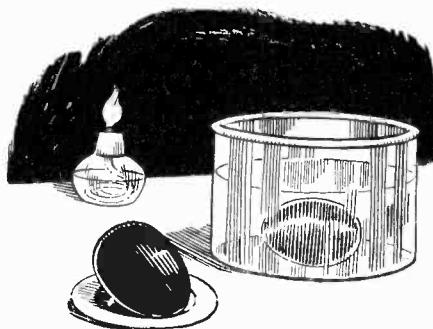
When the cork screw is lost or misplaced try using a large sized wood screw in its place. If the screw is passed through a wooden handle it works better. —B. Willard.

Tempering Tools



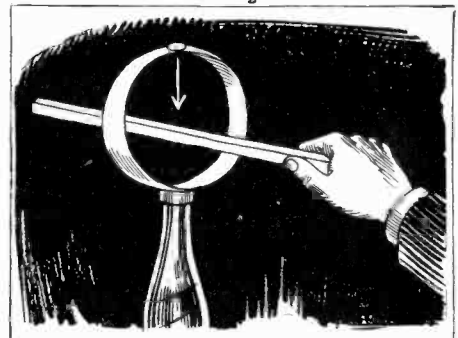
To keep the heat from running too far up a small tool when tempering it, insert it in a raw potato. —W. A. Kyle.

"Silvered Egg"



If an egg is thoroughly blackened in a flame and dropped in water it takes an iridescence like silver.—Ethel Amine.

Inertia Experiment



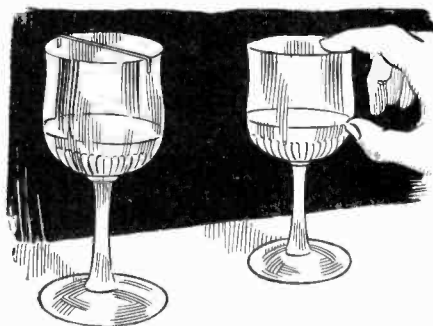
If a dime is placed on top of a stiff hoop of paper which rests on a bottle top as shown, and the hoop removed by a quick sidewise blow the dime falls in the bottle.—B. Zyl.

Pin Hole Vision



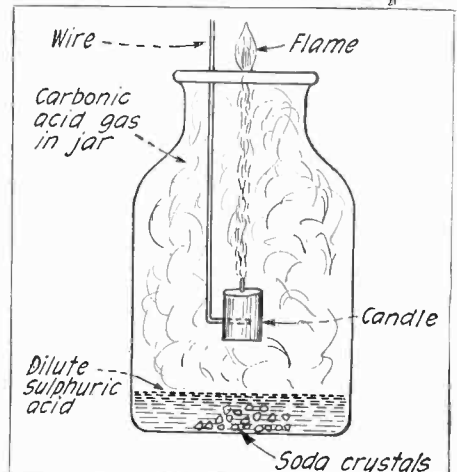
With a pencil point punch a small hole in a bit of paper. Small print may be read through it easily.—J. N. Morrison.

Dancing Wire



If two glasses are filled with water so that they emit the same musical note and a short bit of wire is placed atop one of the glasses and the other is caused to sound the musical note by rubbing its top with resined fingers the wire on the other glass will be found to dance. This is due to the fact that both glasses vibrate in unison to the musical note sounded. If a violin is handy and the same note is struck on the violin and wires are placed on top of both glasses they will both vibrate. —P. Rolatom.

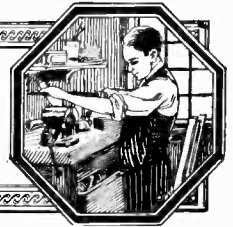
Will-o'-the-Wisp



If a lighted candle is placed in a bottle containing solution as shown above, a flame will burn on top of the bottle as long as the candle remains hot. —C. A. Oldroyd.



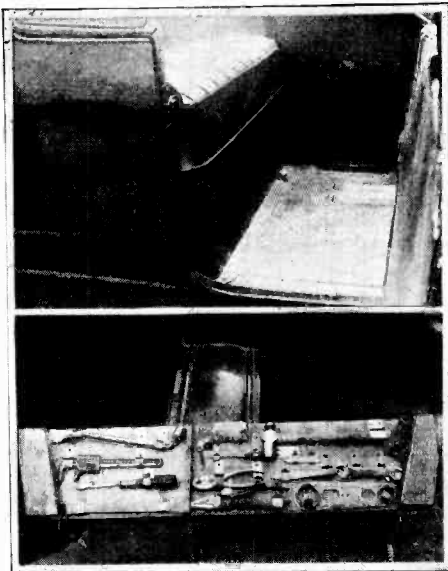
HOW-TO-MAKE-IT



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.

Auto Tool Kit

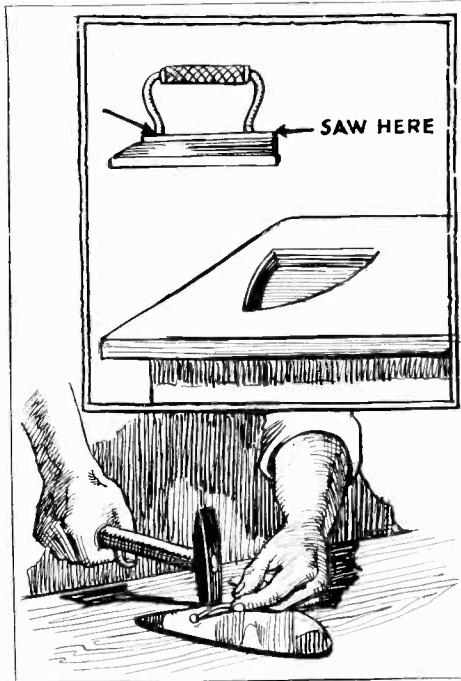
FIRST PRIZE \$15



A few strokes of the hammer and saw will save the trouble of digging the hammer and the rim wrench out from under the back seat and untangling them from the skid chains if the above shown idea is put into practice. A short length of board is sawed to fit the space under the front seat cushion. It is then equipped with metal clips to hold the tools. —John Blank
[If author will send address, prize will be forwarded.—EDITOR.]

Bench Anvil

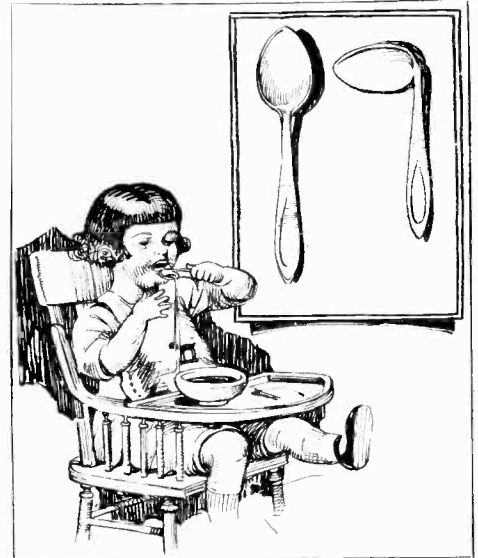
SECOND PRIZE \$10



By sawing the handles off an old flat-iron and cutting a receptacle to fit the body of the iron on the work bench a very useful bench anvil is made. —Chas. T. Allen.

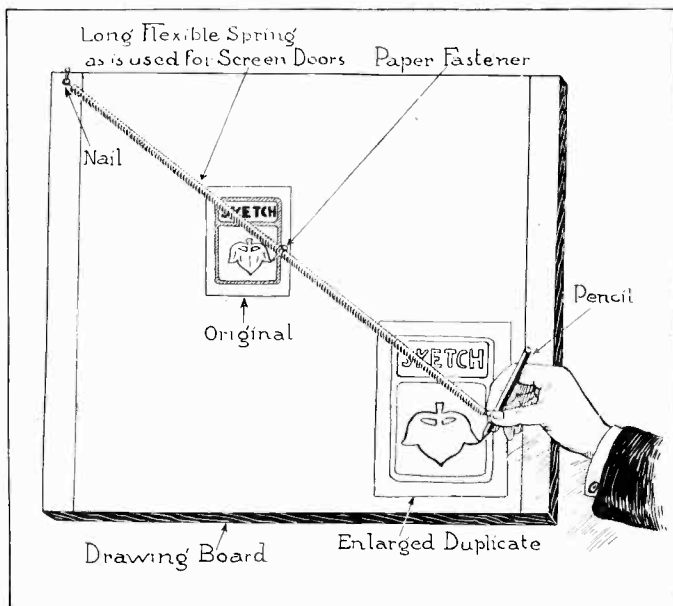
Spoon Teacher

THIRD PRIZE \$5



For those children who seem prone to use the left hand in spite of the daily admonitions of mother and father the little device shown in the above sketch will do more to teach them the correct usage than all the scoldings the parents can hope to give. It is only necessary for the father to bend one of the old teaspoons in the shape shown above. The shape makes it impossible of use except with the right hand. The small part of the spoon handle is heated over a gas jet and the bowl of the spoon bent at right angles and to the left. —Otto A. Koehler.

Coil Spring Used for Enlarging



A long, flexible spring, such as the type used to hold screen doors in check, may be used to make enlargements of drawings by the process shown in the sketch above. A stout nail is fixed in one corner of the drawing board and a pencil stub or paper fastener is placed in the center of the spring as an indicator. The drawing pencil is then attached to the other end and used as shown. —G. A. Luers.

Universal Indicator for Poison Bottles



The young lady to the right is putting the sandpaper on the bottles. Note that most of the body of the bottle is covered, so that the warning is certain.

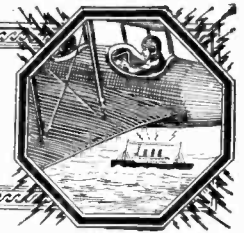
Any number of schemes for marking poison bottles have been suggested to this department in times past. This scheme seems, however, to be one of the best submitted since it is easily installed and will lead to no discomfort to the person grasping the bottle as is the case with some of the ideas submitted. It is also obvious that it is practically impossible to touch the bottle without receiving the warning as to its contents.



By the simple means of pasting a strip of sand paper over the face of bottles containing poisons the danger of getting the bottle by mistake on account of darkness is eliminated. The flint paper is pasted clear around the bottle. —Nelson Edwards.

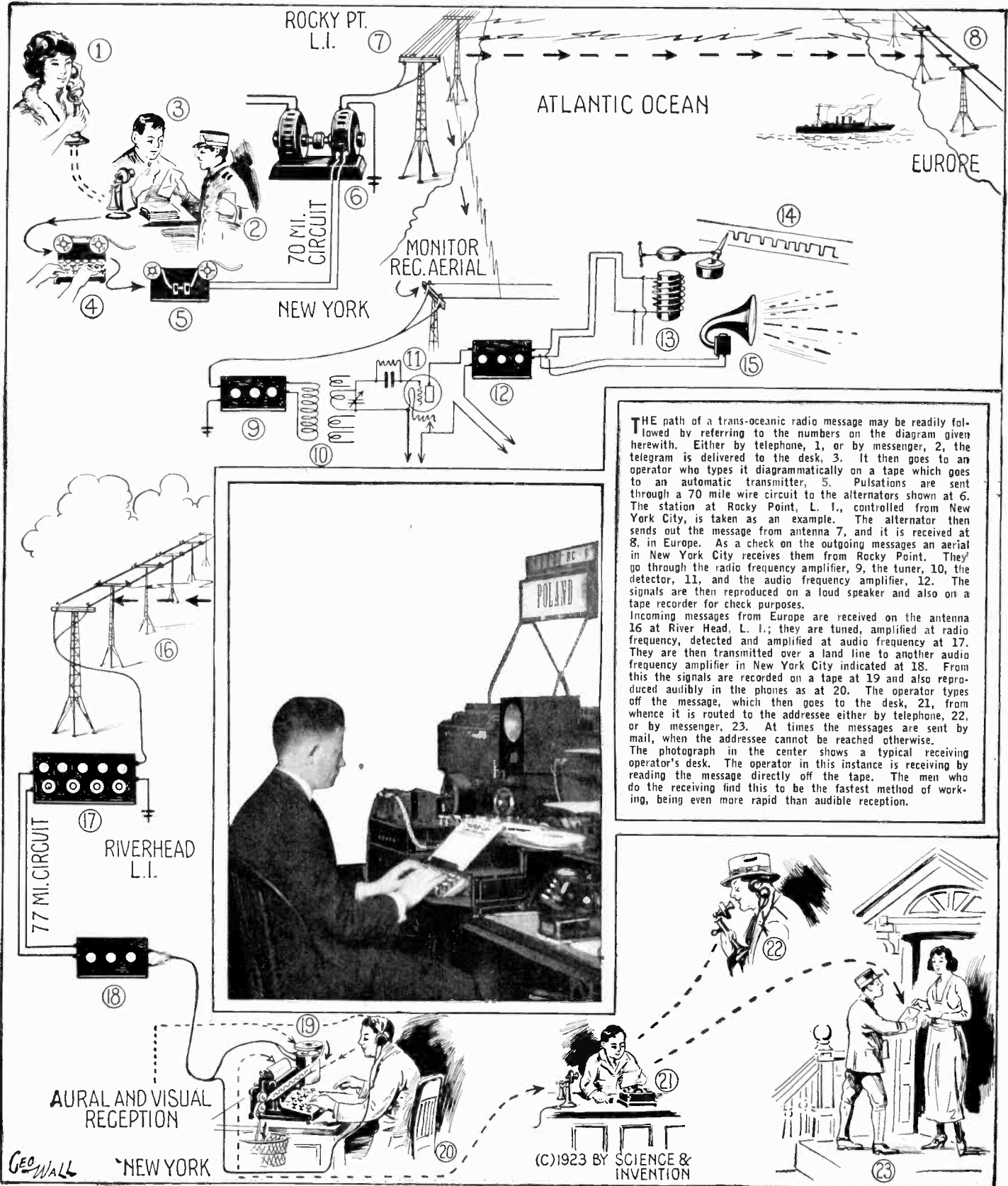


RADIO



Path of Trans-Atlantic Radio Message

How Messages Are Handled by World's Largest Radio Stations.



THE path of a trans-oceanic radio message may be readily followed by referring to the numbers on the diagram given herewith. Either by telephone, 1, or by messenger, 2, the telegram is delivered to the desk, 3. It then goes to an operator who types it diagrammatically on a tape which goes to an automatic transmitter, 5. Pulsations are sent through a 70 mile wire circuit to the alternators shown at 6. The station at Rocky Point, L. I., controlled from New York City, is taken as an example. The alternator then sends out the message from antenna 7, and it is received at 8, in Europe. As a check on the outgoing messages an aerial in New York City receives them from Rocky Point. They go through the radio frequency amplifier, 9, the tuner, 10, the detector, 11, and the audio frequency amplifier, 12. The signals are then reproduced on a loud speaker and also on a tape recorder for check purposes.

Incoming messages from Europe are received on the antenna 16 at River Head, L. I.; they are tuned, amplified at radio frequency, detected and amplified at audio frequency at 17. They are then transmitted over a land line to another audio frequency amplifier in New York City indicated at 18. From this the signals are recorded on a tape at 19 and also reproduced audibly in the phones as at 20. The operator types off the message, which then goes to the desk, 21, from whence it is routed to the addressee either by telephone, 22, or by messenger, 23. At times the messages are sent by mail, when the addressee cannot be reached otherwise.

The photograph in the center shows a typical receiving operator's desk. The operator in this instance is receiving by reading the message directly off the tape. The men who do the receiving find this to be the fastest method of working, being even more rapid than audible reception.



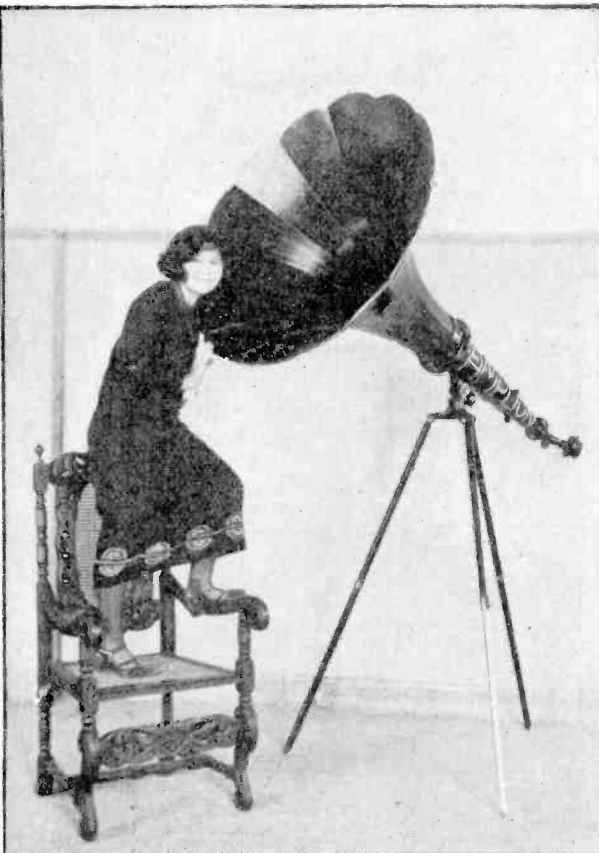
Geo. Wall

NEW YORK

(C)1923 BY SCIENCE & INVENTION

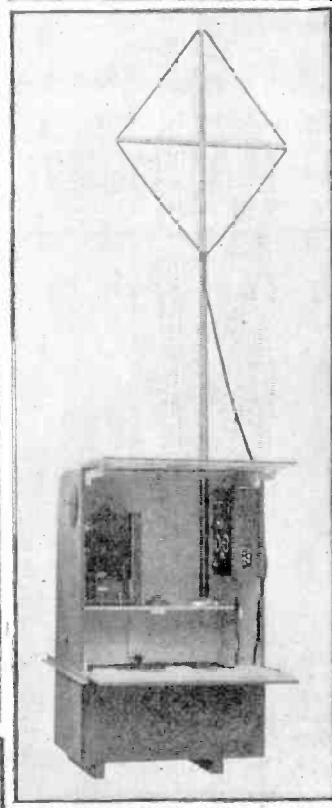
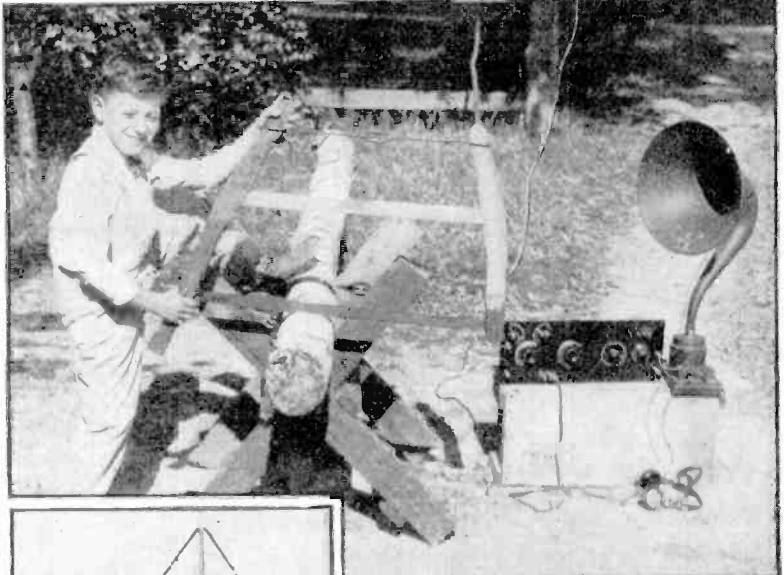
The Radio Invasion Continues

Its Entertainment Goes Everywhere.
New Equipment for Life Boats.



RADIO has become so much a part of the life of the United States that a few weeks ago there was held at Grand Central Palace, New York, the American Radio Exposition, showing every kind of equipment and the latest advances made in the craft. It promises to be a yearly affair. Above is shown one of the most interesting pieces of apparatus exhibited at the show. It is the new English invasion of the American loud-speaker market, the Amphion. Going back to the old principle of the long air column and equipping it with a very hardy diaphragm the horn produces voice and music with surprisingly little distortion and the device is capable of taking a very strong current.

The young lady shown below is taking the boredom out of gray squirrel hunting by carrying her radio set on her Nimrodian adventures. The gray squirrel is most easily seen just at dawn and dusk and the wait for him to put in his appearance sometimes becomes tedious. With the simple aid of a small dry battery set and a loop antenna the Maryland girl in the photograph is whiling away the last half hour before her quarry comes to play. She was one of a large hunting party that took the set with them into the woods so as to while away spare moments.



THE World's Series was a serious time for this youngster (above) for he lived a long way from the village score board and the wood pile needed attention. But he took the disaster out of his position by moving the radio set from upstairs so that the two great events—the Series and the wood pile both were attended to.

By installing small one-quarter kilowatt radio sets (left)—and a small gasoline motor with alternator to furnish power—aboard life boats, an English chandlery firm hopes to reduce the loss of life caused by the loss of open life boats in heavy storms. The aerial is directional.

In the Amateur Built radio set contest at the recent Radio Show in New York, one of the most popular entries was the set of Miss G. Alexander, whose set (below) was built as a replica of Eiffel Tower. All the apparatus is concealed within the tower with the exception of the honeycomb coils.



Last Minute Radio News

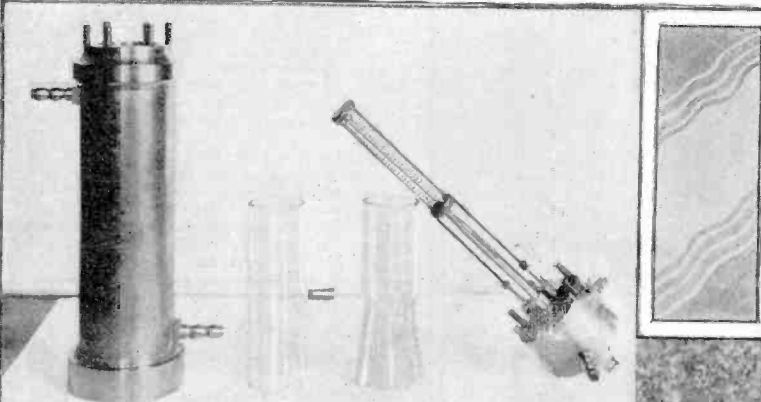
Novel Designs; New French Power Tube.



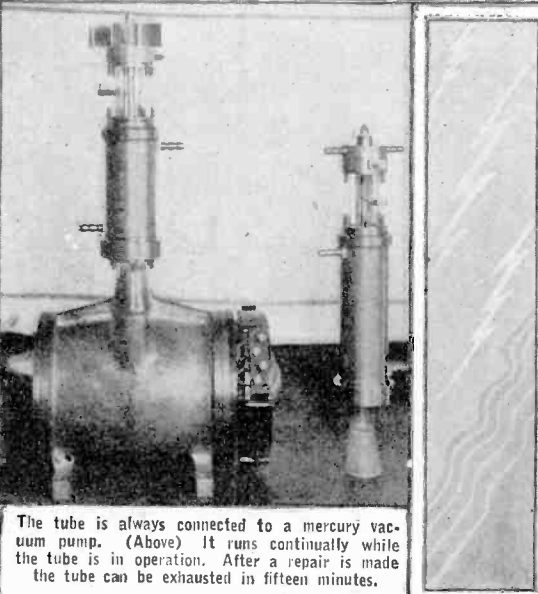
ANOTHER exhibit that created a great deal of attention at the Radio Show was a set in a plate glass cabinet. It is shown above. The loud speaker accompanying it is also of noteworthy design. Below is a step forward in the manufacture of power tubes brought out by a Paris scientist and put into use in the famous Eiffel Tower station. It is built up of a number of parts and can be instantly taken apart for repair. With the constant increase in the price of the larger power tubes it has become necessary to repair old tubes.



One of the most noteworthy features in examining the apparatus shown at the Radio Show was the tendency of the manufacturers to work their sets into some form in which they could be put into the well furnished home, without impairing the aspect of the rooms in which they are placed. The careful householder demands that the furnishings of his home be ornamental as well as useful. Above is one of the radical departures in cabinet design. The set, designed primarily for the use of the broadcast listener is housed in a lamp-like case. It consists of three stages of radio and two of audio amplification. The loop aerial appears at the side of the cabinet. Batteries are in case below.



Above is a view of the demountable tube with the fixed elements under the cap and the glass case. The metal cylinder is air-tight and acts as the water-cooling shield. It is also the plate element.

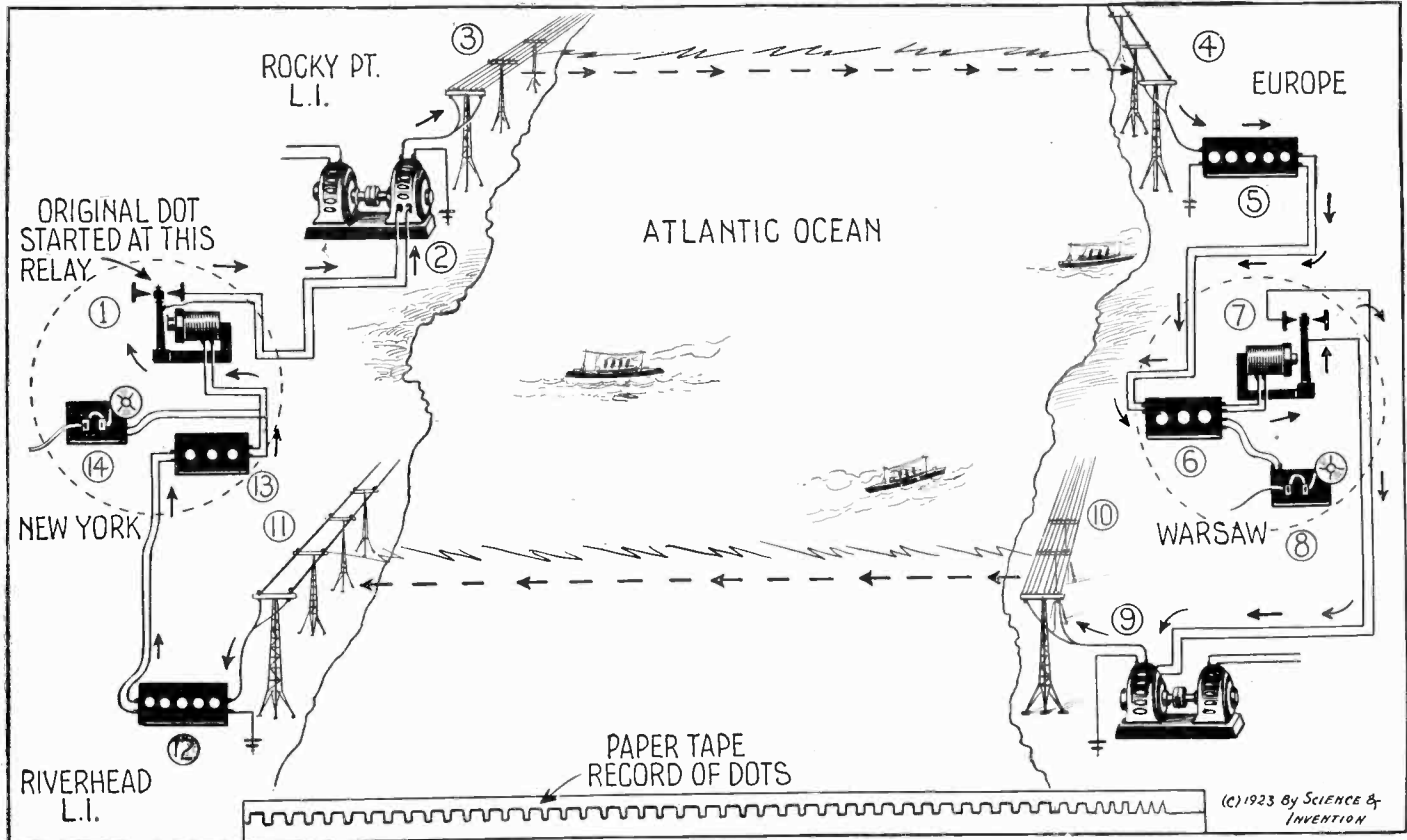


The tube is always connected to a mercury vacuum pump. (Above) It runs continually while the tube is in operation. After a repair is made the tube can be exhausted in fifteen minutes.



Distance fiends (or DX hounds, as they are called in the parlance), please note. Above is the new and enlarged transmitter of the amateur station 2CTQ, known to many amateurs throughout the country. Mr. Leo Johnson, owner of the station, is shown sitting at the microphone of his new outfit. The improvement in the transmitter is the installation of a new 20-watt C.W. outfit using four five-watt tubes. Many amateurs outside of the first, second and third districts (the East Coast) will now be able to hear 2CTQ, although he already has an enviable record for long distance work and has taken part actively in the work of the Amateur Radio Relay League. Note the accessible arrangement of the instruments.

Radio Makes Transoceanic Circle



Recent experiments started a radio dot from the United States sent it to Europe and return many times, covering an actual distance of 4,500,000 miles, without the assistance of an operator. The signal originated in New York City on relay 1. It traveled to 2 and 3 and then across the ocean to 4, through instruments 5 and 6 and actuated relay 7.

It was recorded on 8. Then it went through 9 and 10, came back to the United States to 11, through 12 to 13 and then actuated relay 1, starting itself all over again. At the foot of the diagram is the tape record of dots showing how they varied in duration because of the mechanical lag of the relays, becoming shorter until they died out.

Latest Designs In Radio Cabinets

The radio set illustrated at the left could well grace any living room. By lifting up the front shelf, the set sinks down out of sight and the cabinet folds up and makes a very nice decorative table. Right: A hand carved antique model cabinet which houses an up-to-date radio set with power amplifier and loud speaker. It is entirely self-contained.

In the above illustration is shown a suggestion for amateur constructors who desire to put their radio set into the best possible form. The loud-talker is located directly above the set, which latter is covered by cloth. A drawer is provided for tools and spare parts and at the bottom is a space for the storage "A" battery and the "B" batteries.

Above is a combined side table and radio set. As will be noted the right end drops down exposing a complete receiving set. The loud talker is also included in this cabinet.

Above is a hand carved antique model cabinet which houses an up-to-date radio set with power amplifier and loud speaker. It is entirely self-contained.

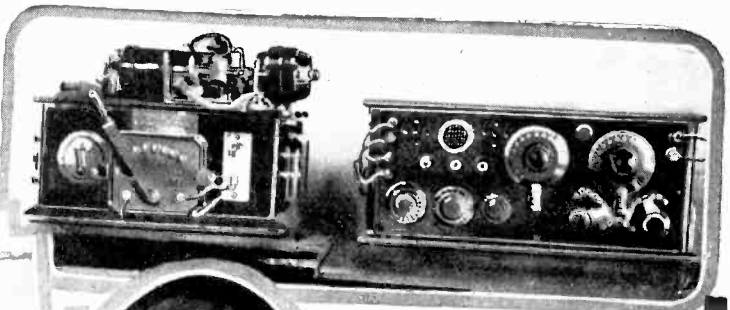
Above: A sturdy, serviceable model of a radio receiving set cabinet. A novel system of dial control is used in which the figures may be seen through slots in the face of the cabinet.

Radio Transmission of Photographs

A Recently Developed and Simplified, Yet Accurate Method of Transmission.

BY A. P. PECK

Below and to the right will be seen the transmitting apparatus used for sending photographs by radio. As will be noted, the apparatus takes up little more space than the average receiving set. A cylinder is rotated by means of an electric phonograph motor, a governor being used to maintain a constant predetermined speed. The photograph, made into a half tone on copper or zinc with a one-line screen is placed on the cylinder with a stylus in contact with it. The stylus moves in a spiral course at a rate of 175 turns to the inch. The stylus, working over the indented surface of the half-tone causes fluctuations in the current.



Above: The receiving apparatus used by Mr. Ferree in the reproduction of photographs transmitted by radio. At the right in the above photograph is a standard radio receiving set and at the left will be seen the apparatus for reproducing the transmitted photograph. Mr. Ferree has perfected his apparatus to a very great extent and claims that it will be extremely useful in newspaper work for transmitting photographs of current events. With this apparatus, it is possible to carry on communication over the same lines on which the photograph is being transmitted, both transmissions taking place simultaneously.

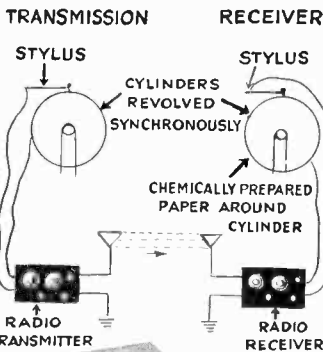
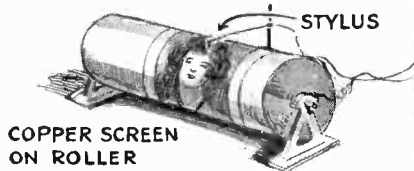


Above: The inventor of the system of radio and wire transmission of photographs, Marvyn Ferree.

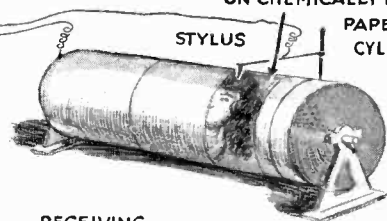
Below at left: A diagram of the transmitting cylinder and stylus contact. The half-tone is prepared on either a copper or zinc plate and then formed on the cylinder so as to fit the latter perfectly. The cylinder turns at the same speed as the receiving cylinder pictured below at right. The receiving stylus acts on a chemically prepared paper which turns black or gray, forming the picture.



COPPER SCREEN CUT OF PICTURE PREPARED FOR TRANSMISSION



REPRODUCING PHOTO ON CHEMICALLY PREPARED PAPER ON CYLINDER



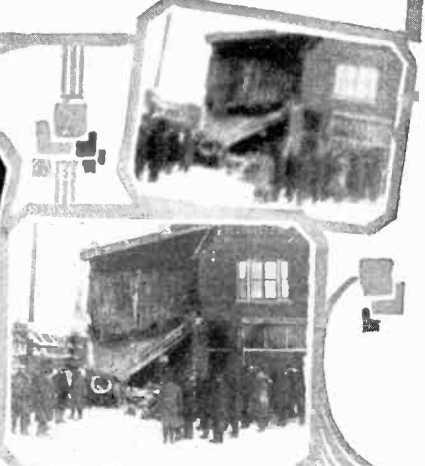
RECEIVING PHOTO BY RADIO



Above: The original photograph and reproduction after being transmitted by radio. The top photograph is the original and the bottom one the reproduction. At the receiving end, no trace of the screen used in making the half-tone is visible, the only effect being a few vertical lines.



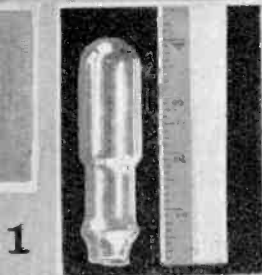
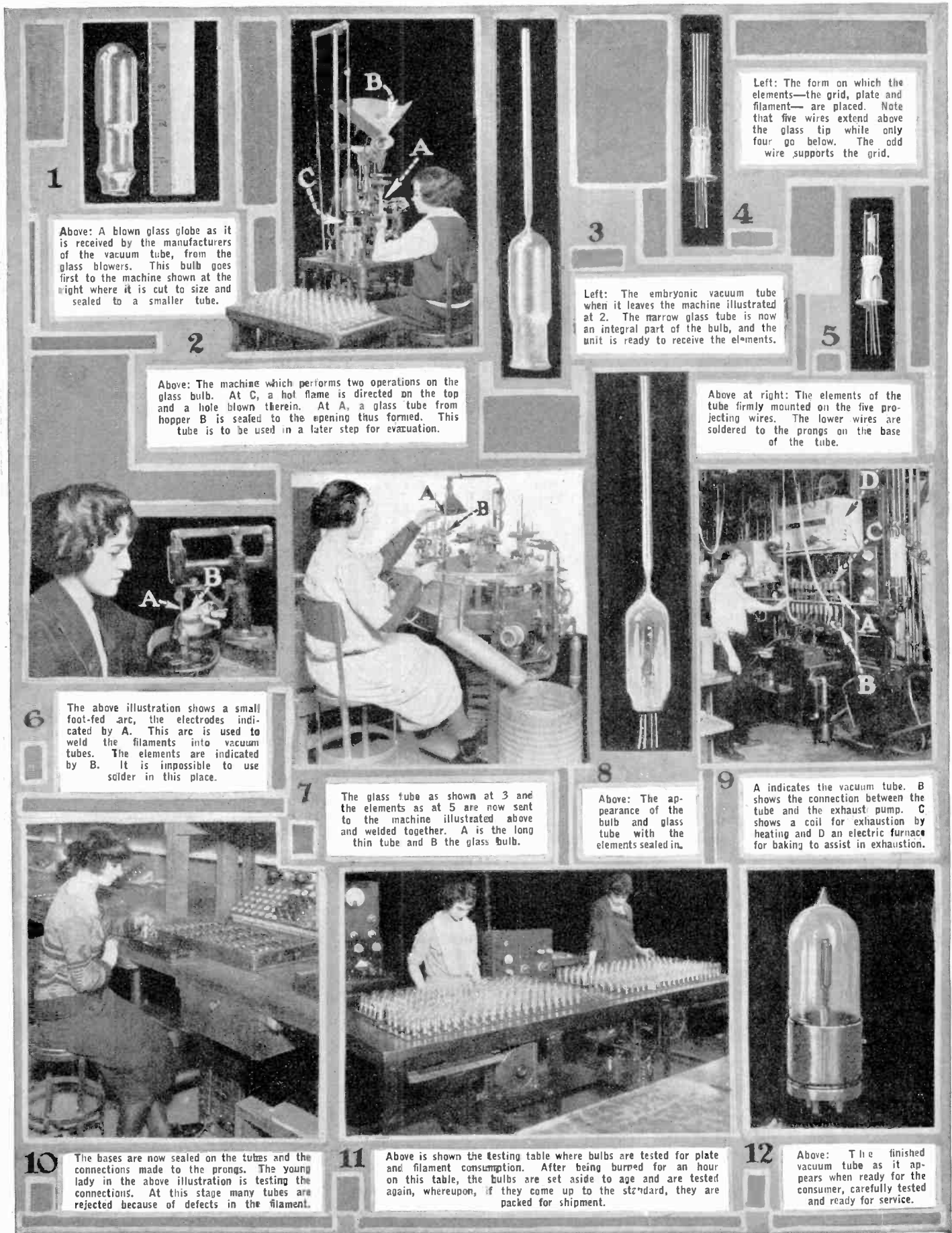
Above will be seen two untouched photographs of America's most beautiful girl, Miss Catherine Campbell. The original is at the left. The reproduction at the right was telegraphed over a 400 mile line. The entire time of transmission is in all cases less than five minutes.



The scene of an automobile accident transmitted 900 miles by radio. The original is the lower photograph and the transmitted copy is at the top. With later developments along this line better transmission will undoubtedly be accomplished and practically perfect photographs will be reproduced.

The Biography of a Vacuum Tube

A Pictorial Review of the Manufacture of a Dry Cell Vacuum Tube.



1 Above: A blown glass globe as it is received by the manufacturers of the vacuum tube, from the glass blowers. This bulb goes first to the machine shown at the right where it is cut to size and sealed to a smaller tube.



2

Above: The machine which performs two operations on the glass bulb. At C, a hot flame is directed on the top and a hole blown therein. At A, a glass tube from hopper B is sealed to the opening thus formed. This tube is to be used in a later step for evacuation.



3

Left: The embryonic vacuum tube when it leaves the machine illustrated at 2. The narrow glass tube is now an integral part of the bulb, and the unit is ready to receive the elements.



Left: The form on which the elements—the grid, plate and filament—are placed. Note that five wires extend above the glass tip while only four go below. The odd wire supports the grid.

4



5

Above at right: The elements of the tube firmly mounted on the five projecting wires. The lower wires are soldered to the prongs on the base of the tube.



6

The above illustration shows a small foot-fed arc, the electrodes indicated by A. This arc is used to weld the filaments into vacuum tubes. The elements are indicated by B. It is impossible to use solder in this place.



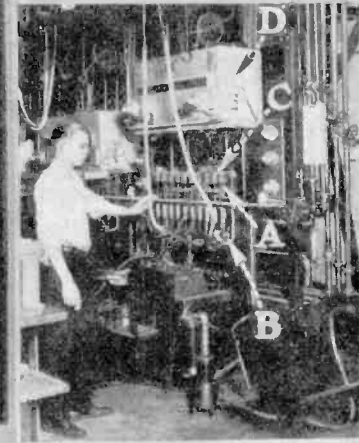
7

The glass tube as shown at 3 and the elements as at 5 are now sent to the machine illustrated above and welded together. A is the long thin tube and B the glass bulb.



8

Above: The appearance of the bulb and glass tube with the elements sealed in.



9

A indicates the vacuum tube. B shows the connection between the tube and the exhaust pump. C shows a coil for exhaustion by heating and D an electric furnace for baking to assist in exhaustion.



10

The bases are now sealed on the tubes and the connections made to the prongs. The young lady in the above illustration is testing the connections. At this stage many tubes are rejected because of defects in the filament.



11

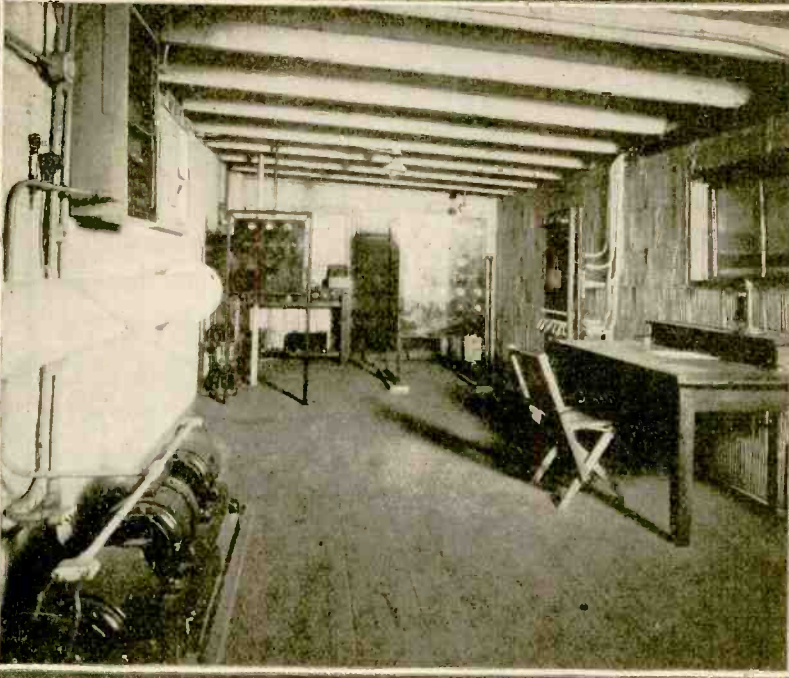
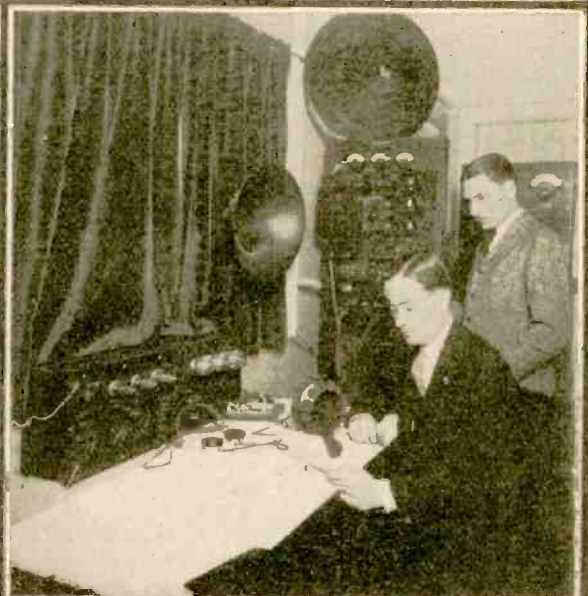
Above is shown the testing table where bulbs are tested for plate and filament consumption. After being burned for an hour on this table, the bulbs are set aside to age and are tested again, whereupon, if they come up to the standard, they are packed for shipment.



12

Above: The finished vacuum tube as it appears when ready for the consumer, carefully tested and ready for service.

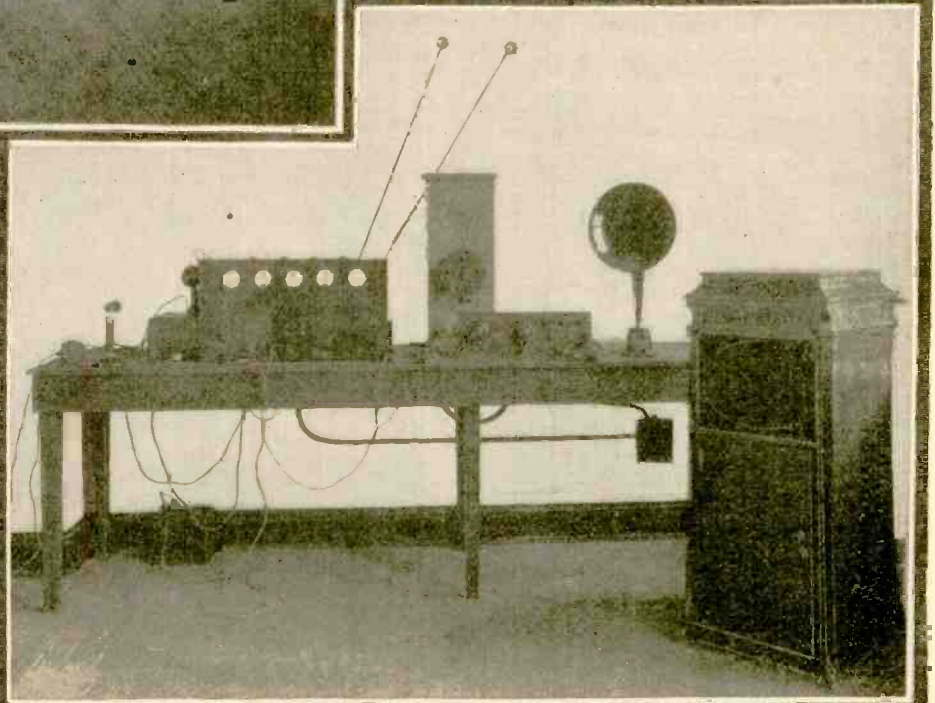
BROADCAST — STATIONS



THE two photos directly above show the interior of the operating room and the studio of station WSY, Birmingham, Ala. The studio follows the regular lines of construction with the exception that the main microphone leading to the modulators is suspended with elastic from the ceiling of the studio. There is a special small microphone that is used to pick up the piano and the Victrola when they are used in connection with programs. The operating room seen in the lower of the two photos shows the neatness and the skill that has been used in assembling the station. All controls for the set as well as the motor-generators are gathered together in order to make for ideal operating conditions.

The top photo at the right shows the operating end of station WOS, the State Marketing Bureau of Missouri, located at the capitol of the state, Jefferson City. Sitting in the photo is J. M. Wittem, announcer and program director. Standing, is R. J. Engler, the engineer in charge of the operation of the station. Although the broadcasting of the station has principally to do with the announcing of prices on farm products and general market conditions, programs are broadcast under much the same schedule as obtains in other Middle-Western stations.

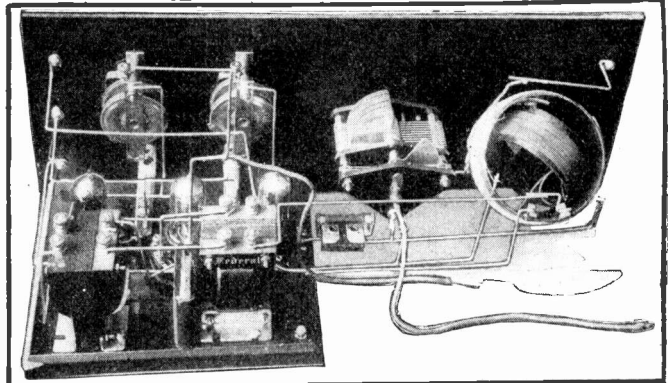
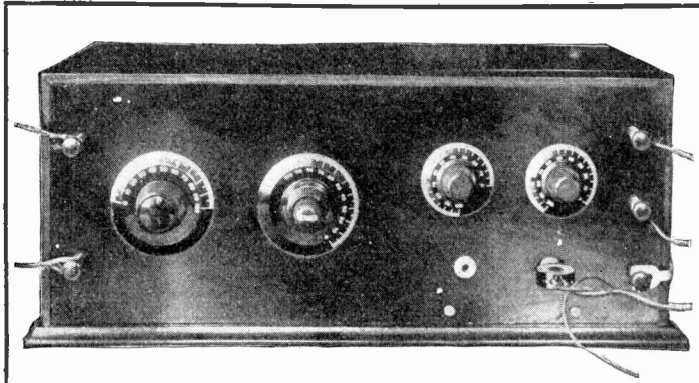
At the bottom of the page may be seen the Peoria Star Company's station (WJAN) located at Peoria, Ill. The photo shows the interior of the operating station and the talking machine with microphone attached which is used in some of the programs. Note the neat arrangement of the apparatus.



An Untuned Primary Receiver

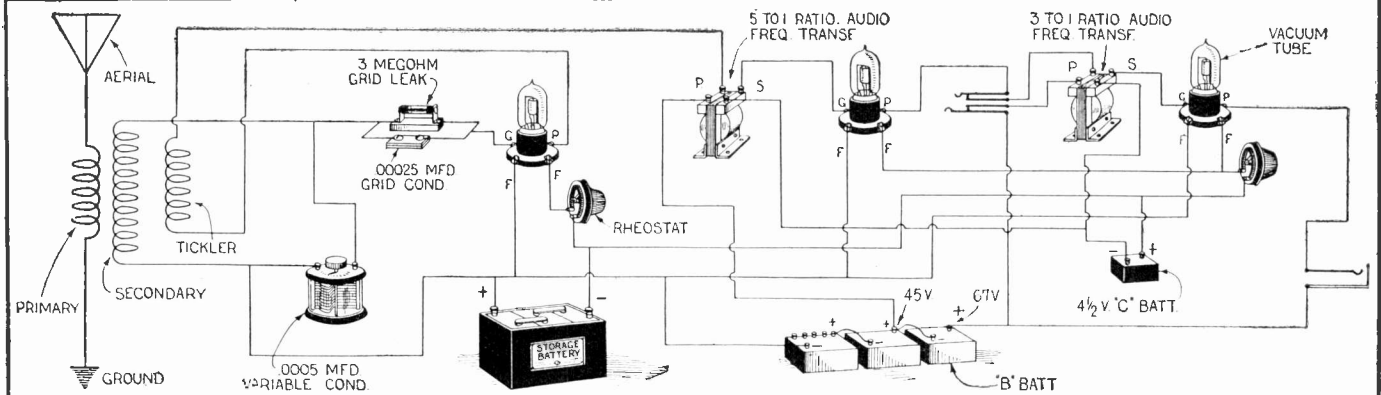
A Two Control Set With Extreme Selectivity

BY W. L. PEARCE.



The above photograph shows a front view of the assembled set which is fully described and illustrated below. There is one tuning control, the second dial from the left. The first dial on the left controls regeneration. Only two rheostats are used, one for the detector and the other for controlling both amplifier tubes.

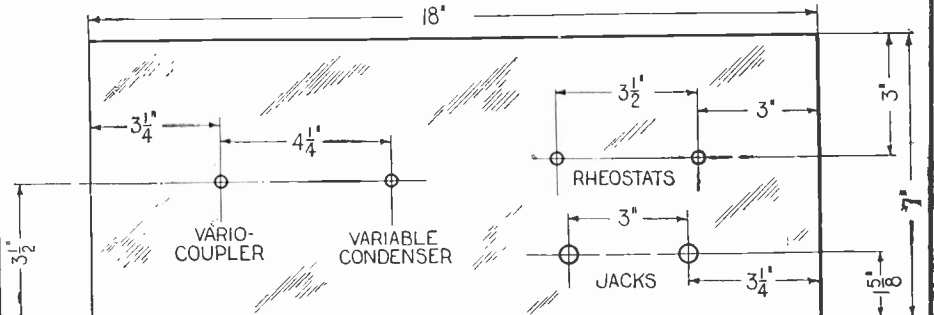
The above photograph is a rear view of the untuned primary receiving set, taken at a slight top angle. Notice the relative positions of the two audio frequency transformers and how the cores are turned at right angles to each other so as to avoid inter-action. The three tubes are placed just behind the two transformers.



The above circuit diagram shows all the connections for this very selective yet simply tuned radio receiving set. The primary is "aperiodic," or so designed that it will respond to practically all wave-lengths over a certain band. The secondary is then sharply tuned to the incoming signal. It has been found in tuning this set that

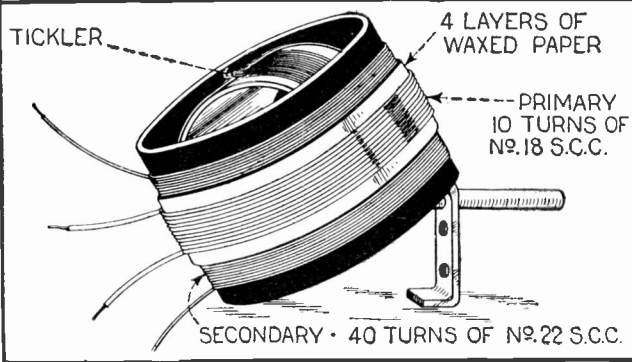
three degrees on either side of a certain point on the condenser scale will tune out a station. This allows quite good selectivity. Note that a single rheostat and 4 1/2 volt "C" battery are used on the amplifier tubes. With U. V.-199s, or C-299s, the "C" battery is very necessary in order to cut down tube noises.

At the right is given the panel lay-out for the set, photographs of which are shown above. The extreme simplicity of the panel should appeal to everyone; only six holes aside from those for the binding posts being necessary. The posts for connections can be mounted either on the ends of the panel as illustrated in the above photographs or on the cabinet as desired. If the latter method is used, it will be found that it will do away with unsightly wires on the front of the set. The two jacks take care of the phone connections and are so placed that either the first or second stage of audio frequency amplification may be used as desired. Rheostats with a resistance of 30 ohms should be used in this circuit if vacuum tubes drawing only .06 amperes are used.



Sometimes when a set of the type described herewith is hooked up, and the set placed in operation, a loud noise like the sounding of a deep toned bell will be heard when the set is tapped or even touched. This is due to the vibration of the elements of the tubes and can usually be eliminated by trying different tubes in different

positions. It is sometimes found that by placing an amplifier tube in the detector socket and the detector tube in place of the amplifier, this difficulty will be remedied. Mount sockets on felt. The above applies to the dry cell tubes, which have very small elements, and which are recommended for use in this set.



At the left are shown all the constructional details of the variocoupler used in connection with this very selective receiving set. It is of the 180 degree type and any well made instrument will answer. The primary winding must be removed and 40 turns of No. 22 S. C. C. wire wound on the stator. This acts as the secondary of the tuner. In most cases the rotor, which is to be used as the tickler coil, need not be changed. Directly over the secondary winding, place four layers of waxed paper or oiled linen. Over this wind 10 turns of No. 18 S. C. C. wire, fastening the ends of the winding with sealing wax. It is quite essential that large wire be used on this latter winding so that the distributed capacity will be kept down as much as possible and so that the tuning of the set will be sharper. In connecting the set, the movable plates of the variable condenser are connected to the filament side of the secondary. This method of connecting eliminates capacity effects when tuning. It is sometimes advantageous to ground the metal frame of the variocoupler for the same reason. When the rotor is horizontal, the plate lead should be taken from the bottom of the coil wound on the rotor, and the grid lead should be taken from the top end of the secondary. If care is taken to keep this connection correct, it will not be found necessary to reverse the leads to the tickler coil as usually must be done when first hooking up a circuit using feedback regeneration.

Radio for the Beginner

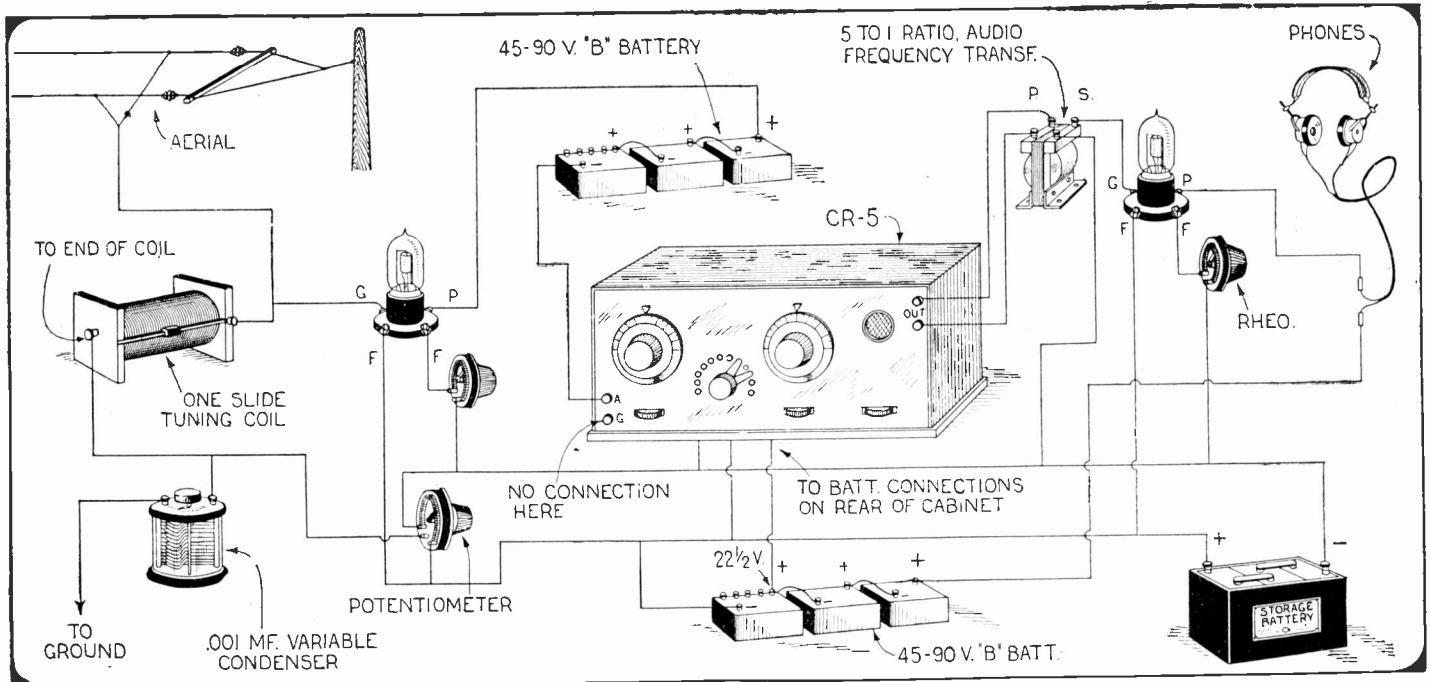
By ARMSTRONG PERRY

No. 23—INDUCTION.

<p>LINES OF FORCE</p> <p>WIRE CONDUCTING ELECTRICITY</p>	<p>LINES OF FORCE OF INDIVIDUAL WIRES AFFECT ADJACENT TURNS</p> <p>WIRE</p> <p>INSULATING FORM</p>	<p>SAME LENGTH OF WIRE AS 'A' BUT IN COIL, PRODUCING GREATER SELF-INDUCTION AND LARGER SPARK</p> <p>WEAK SPARK</p> <p>STRONG SPARK</p>
<p>Upon the magnetic lines of force depend induction. These lines of force if visible would take the form of circles surrounding the wire as an axis.</p>	<p>When wire is wound in a coil form, the lines of force intersect adjacent wires as shown above and induce currents into each other. This is self-induction.</p>	<p>The difference between the two sparks produced as illustrated above is caused by the lines of force from the turns in the coil acting on the next.</p>
<p>TO DETECTOR</p> <p>REPRESENTS SECONDARY AT MAXIMUM COUPLING</p> <p>REPRESENTS PRIMARY</p> <p>SECONDARY WINDING AT MAXIMUM COUPLING INTO WHICH CURRENT IS INDUCED BY LINES OF FORCE</p> <p>LINES OF FORCE</p> <p>PRIMARY WINDING</p> <p>AIR UNDER PRESSURE</p>	<p>TO DETECTOR</p> <p>REPRESENTS SECONDARY AT MINIMUM COUPLING</p> <p>LINES OF FORCE</p> <p>TO DETECTOR</p> <p>REPRESENTS PRIMARY</p> <p>VERY LITTLE CURRENT INDUCED INTO SECONDARY OR ROTOR WHEN AT RIGHT ANGLES TO STATOR.</p> <p>PRIMARY WINDING</p> <p>AIR UNDER PRESSURE</p>	
<p>In practical radio work, induction is made use of in the variocoupler. The lines of force having the property of inducing a current into conductors which they intersect make a transference of energy from the stator or primary to the secondary or rotor. An analogy is shown for this at the right.</p>	<p>In the above illustration the rotor is shown at right angles to the stator of a variocoupler and the amount of current in the secondary circuit is very small. In the analogy at the right the piston is removed from the cylinder and suspended above it at right angles. The current of air striking the curved surface exerts little pressure.</p>	
<p>TO GROUND</p> <p>PRIMARY</p> <p>SECONDARY</p> <p>TO GRID & FILAMENT</p> <p>TICKLER</p> <p>TO PLATE CIRCUIT</p>	<p>SLIDER</p> <p>ONE SLIDE TUNING COIL</p> <p>SWITCHES</p> <p>UNITS AND TENS TAPPED COIL</p>	
<p>The current in the primary honeycomb coil sets up lines of forces. These emanate from the coil, cutting the secondary coil and inducing a current therein. The tickler coil sends out its own lines of force which again effect the secondary and set up what is known as regeneration.</p>	<p>Two methods of varying inductance are shown above. A slider moves over a path of bare wire and makes contact thereto. At the right taps are taken off at various sections along the coil of wire and connected to switch points. Arms make contact with the switch points.</p>	
<p>LARGE HONEYCOMB COIL</p> <p>TAPS</p> <p>LONG SINGLE-LAYER COIL</p> <p>BOTH COILS HAVE SAME INDUCTANCE AND WAVE-LENGTH</p>	<p>VIEW OF EDGE</p> <p>HOW HONEYCOMB COILS ARE WOUND</p> <p>HOW TO WIND SPIDERWEB COILS</p>	
<p>Large inductance coils used to be necessary to receive long wave stations, which then did most of the transmission. Today their form has changed considerably. The long coil illustrated above is the old form and at the left is shown a honeycomb coil of the same inductance, but only an inch or so thick.</p>	<p>Both honeycomb and spider-web coils are very efficient. The distributed capacity of the coils is low, an advantage in radio work, and the inductance is high. A great amount of the latter can be obtained in a small space. At the right is shown a flat view and an edge view of a spider-web coil.</p>	

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.



No. 208. To increase the receiving radius of a standard signal circuit tuner of practically any type, radio frequency amplification may be added by following the circuit diagram given above. The remarks relative to the series antenna condenser which are given in the text should be carefully noted, as inattention to points given there will result in the

set's failure to operate. If desired, a honeycomb coil may be substituted for the one slide tuner indicated in the diagram. Various coils will have to be substituted to cover the band of wave-lengths desired. The inductance used in the antenna circuit should be such that its wave-length will tune in the incoming signals.

R. F. AND A. F. WITH STANDARD RECEIVER

(208) George Siedel, Pittsburgh, Pa., writes to the Radio Oracle:

Q. 1. How can I connect one stage of radio frequency amplification with my type CR-5 receiver and place after the same one stage of audio frequency amplification?

A. 1. The diagram given in these columns shows all the necessary connections. It is imperative that the variable condenser which is connected in series with the antenna binding post on your set be short circuited or else removed from the circuit so that the aerial binding post will be connected to the grid end of the stator. If this is not done, the set will not function. It is advisable to connect this variable condenser in parallel with the stator so as to give sharper tuning although in some cases it will be found that such a procedure will raise the wave-length to a point where broadcasting stations cannot be received. Thereupon the condenser should be removed from the circuit.

STORAGE "B" BATTERY QUERY

(209) Joseph Karl, Pittsburgh, Pa., asks:

Q. 1. In making a storage "B" battery should the plates be pasted in the same manner as those in a large storage battery such as used in automobiles?

A. 1. Yes.

Q. 2. What kind of wood should be used for separators?

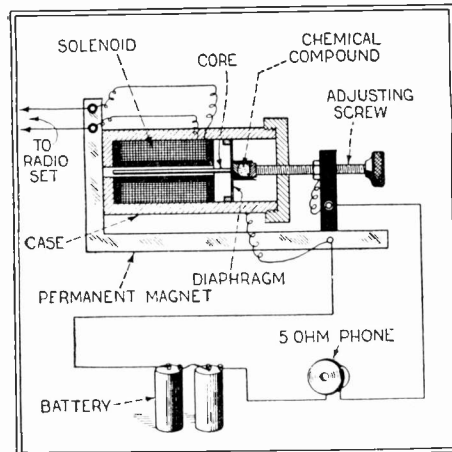
A. 2. Practically any kind of wood could be used, but white pine or spruce is best. Even better than wood are perforated sheets of thin hard rubber.

MULTI-AUDI-PHONE

(210) James McCarthy, Bayonne, N. J., asks:

Q. 1. Is the apparatus known as the multi-audi-phon still on the market?

A. 1. To the best of our knowledge this apparatus is no longer manufactured.



One of the first successful types of microphone amplifiers is shown above. This is the cross section view so that the solenoid and the location of the compound may be readily seen.—No. 210.

Q. 2. What is the principle of the multi-audi-phon and how is it constructed?

A. 2. You will find in these columns a cross sectional diagram of the microphonic amplifier known as the multi-audi-phon. As will be seen, it consists of a solenoid within which is a movable core, which in turn is connected to a diaphragm. On the

opposite side of the diaphragm is a projection, the end of which is cup shaped. Close to this is another cup shaped projection which can be moved closer to and further away from the former by means of a screw. Between these two surfaces and held in place by an insulating tube is found a compound which we believe is carbon in a granular form. The action of this instrument is similar to that of the microphone and becomes obvious upon studying the accompanying diagram.

A. F. AMPLIFICATION WITH A REINARTZ TUNER

(211) T. L. Jacoby, Detroit, Mich., wants to know:

Q. 1. Can I add four stages of audio frequency amplification to a Reinartz tuner?

A. 1. We would not advise you to use four stages of audio frequency amplification on a Reinartz or any other type of tuner. Furthermore, if you desire to use amplification with this circuit, it may be added in the standard way, no change being necessary for this particular type of set. Two, or at the most only three, stages of A. F. amplification should be used.

RADIOPHONE TRANSMITTER TUBE

(212) Gilbert Joyce, Kansas City, Mo., asks:

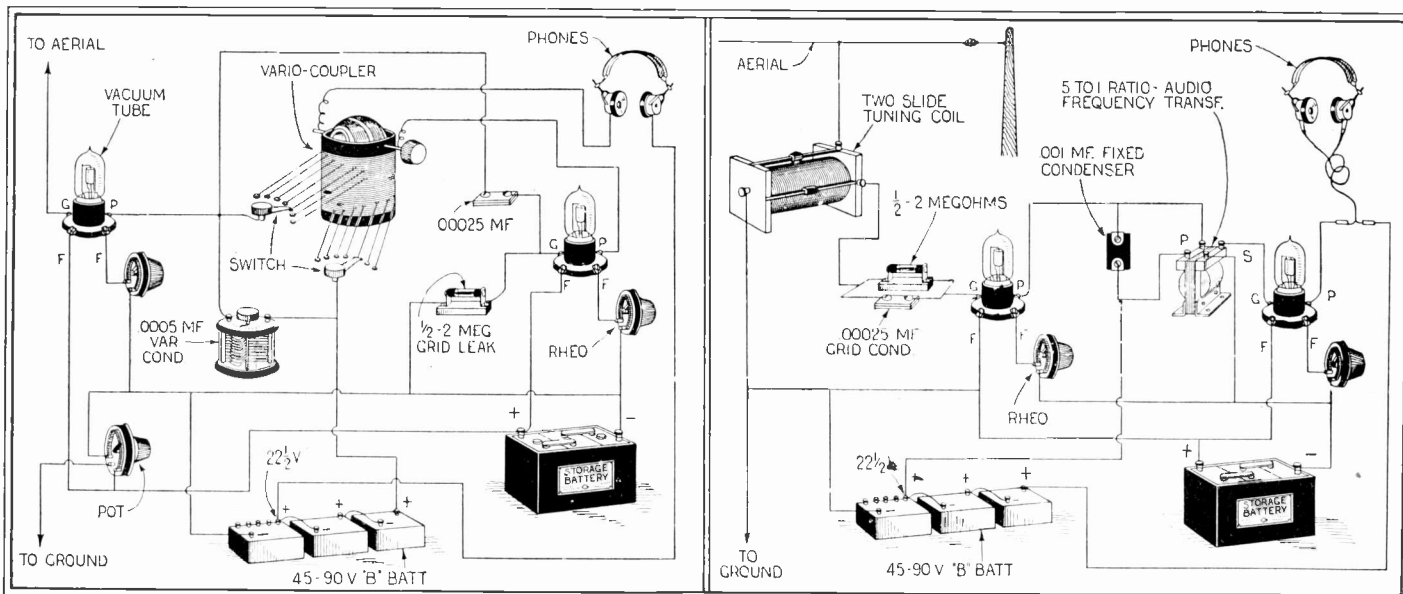
Q. 1. Can a U.V.201 vacuum tube be used as a radiophone transmitter?

A. 1. A U.V.201 vacuum tube with 100 to 150 volts on the plates will act as a transmitter over very short distances. Any one of the 5-watt tubes will give good results.

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 want articles on the latest single tube receptors which require a minimum current from the filament battery.—Editor.



In some cases it is possible to use radio frequency amplification without any tuning arrangement between the R. F. amplifier tube and the antenna. Such a circuit diagram is shown above. At times it will be necessary, however, to place a one slide tuning coil in series with the antenna.—No. 213.

In districts where there is not much radio congestion and very little interference from nearby broadcasting stations, louder signals will be obtained by using a two slide tuning coil as shown in the above diagram instead of more complicated and expensive apparatus. For broadcasting the wave-lengths a small coil may be used.—No. 216.

UNTUNED ANTENNA CIRCUIT

(213) Charles Burg, Riverside, Cal., asks:

Q. 1. How can I place one stage of radio frequency amplification in front of my single circuit tuner without an apparatus for tuning the antenna circuit?

A. 1. The diagram in these columns shows all the necessary connections for such a circuit. It is advisable to place the grid leak in the position shown rather than in the conventional place in parallel with the grid condenser. An amplifying tube is used at the extreme left and a detector tube in the other socket. The potentiometer may or may not be used as is found best by experiment.

SQUEALING

(214) Elmer Kayler, Dayton, Ohio, says that his set howls and squeals continuously when his hand is brought near any of the controls. He asks:

Q. 1. How can I eliminate this and will a vernier condenser be of any assistance?

A. 1. You can probably eliminate the trouble you mention by shielding the back of your panel with aluminum and grounding the shield. The trouble is due to the capacity of your body and can be eliminated as mentioned above. If this work is done a vernier condenser shunted across your antenna condenser will be of assistance in accurate tuning.

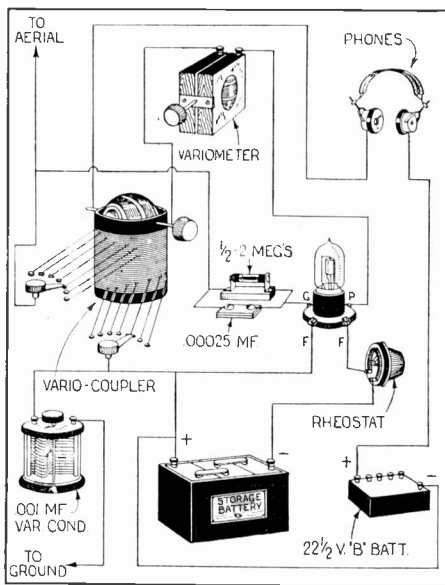
VARIOMETER WITH SINGLE CIRCUIT TUNER

(215) Robert Fitch, Lakewood, Ohio, asks:

Q. 1. How can a variometer be added to

my present standard type of single circuit tuner?

A. 1. The circuit diagram herewith shows how a variometer may be connected in series with the plate of a standard single circuit tuner. Recent experiments have shown that such an addition to a standard single circuit set makes it more selective under almost all conditions.



If a variometer is placed in series with the plate of a vacuum tube in a standard single circuit tuner, much greater selectivity will result as a combination of the feed-back and tuned plate system.—No. 215.

TWO SLIDE TUNER WITH DETECTOR AND AMPLIFIER

(216) C. Saracool, New Hudson, Mich., requests:

Q. 1. Can you show me how to connect a two slide tuner with a vacuum tube detector and one stage of audio frequency amplification?

A. 1. The diagram will be found in these columns.

AMPLIFIER TROUBLE

(217) Frank Prell, Osceola, Nebraska, sends diagram of his detector and two-stage amplifier and says that he has placed his transformers quite a distance apart, but that he still gets whistling noises during reception. He asks:

Q. 1. Can you tell me what is the trouble with my circuit?

A. 1. The whistling noise is probably caused by the way you placed your transformers in an endeavor to cut it down. The long leads necessary between your transformers have a capacity effect on the circuit, thereby causing the howling. In connecting up your set, do not have the grid and plate circuits cross each other. Also try reversing the leads on the transformers, grounding the filament, and shielding all the apparatus.

Your circuit diagram is O. K., but would suggest that you connect the fixed phone condenser directly across the primary of the first amplifying transformer.

Variable grid leaks and condensers are always preferable in any type of set, and we would advise you to try various resistances and capacities until the correct value is obtained.

FIRST!

RADIO NEWS is the FIRST radio magazine in the world today. It is FIRST in circulation, printing over 250,000 copies a month. It is FIRST in advertising patronage, carrying a larger amount of advertising than any other Radio magazine in the world. It is FIRST in size, printing more matter than any other radio magazine. And last but not least, it is FIRST in quality. The greatest radio writers invariably write for RADIO NEWS first.

And before we forget it, RADIO NEWS prints radio news FIRST. Important news can always be found in RADIO NEWS ahead of all other publications.

SOME OF THE INTERESTING ARTICLES APPEARING IN JANUARY, 1924, ISSUE OF RADIO NEWS:

Pioneer Pathfinders of Radio,
By Jesse Marsten.

The Radio Police Car,
By Armstrong Perry.

Some Suggestions for Radio Beginners,
By Bernard Steinmetz.

Break-In Radio Relay Communication,
By Lieut. Col. J. D. Mauborgne.

A Balanced C.W. Circuit for Quick Wave-
Length Changes,
By John L. Reinartz.

A Well Designed Short-Wave Receiver,
By James Wood, Jr.

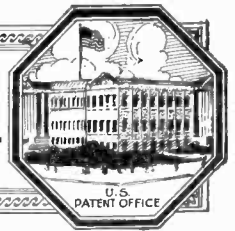
Some Suggestions in the Design and Construc-
tion of Aerials,
By L. W. Hatry.

C.W. and Radiophone Transmitters—Part IV
By L. R. Felden.

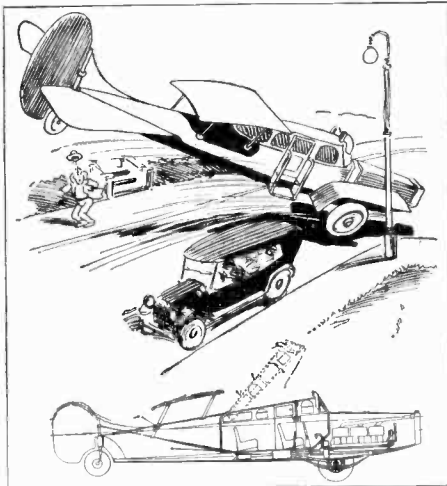
A Practical Neutrodyne Receiver,
By Allan L. Hanscom.



LATEST PATENTS

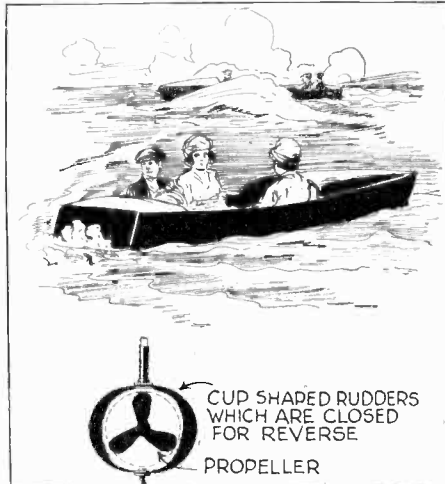


Auto-Airplane



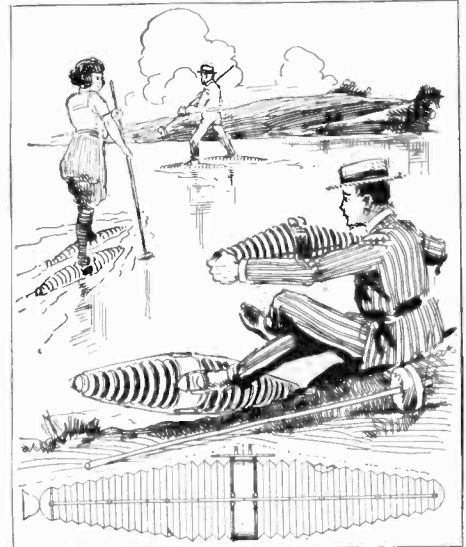
(Pat. No. 1,445,953, issued to Rudolph B. Ilgen.) By equipping an automobile with wings and an air rudder as shown above, the bulk of the car's weight is removed from the wheels and very sharp turns are possible.

Reverse Rudder



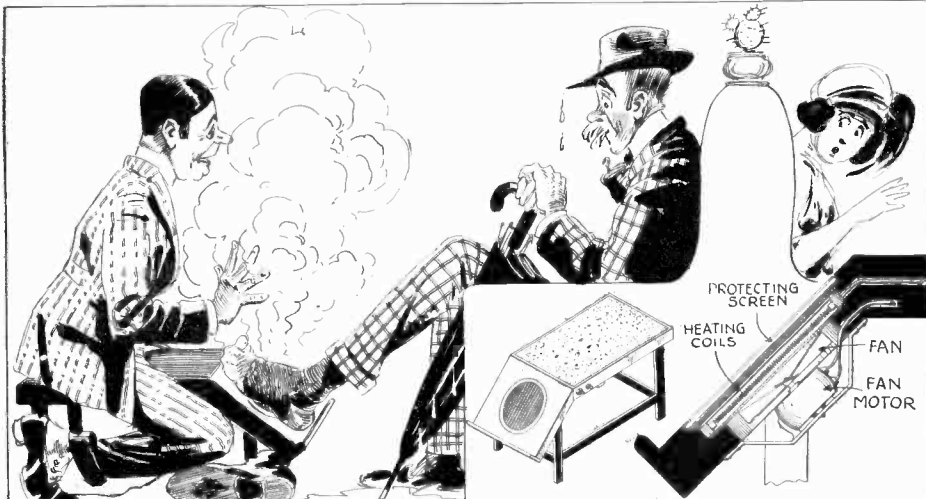
(Pat. No. 1,449,803, issued to Johnston Robertson Alexander.) When the cup shaped rudders are closed behind the propeller the force of the water reacts against them and the boat goes backward. The rudders are also used for steering.

Water Shoes



(Pat. No. 1,463,330, issued to Henry Meyer.) Small pontoons made of a collapsible substance treated so as to be water-tight are furnished with foot rests. When not in use they may be folded on their steel frames so as to fit into a small box for transportation. The pontoons may be inflated and are provided with rudders for maintaining a straight course.

Shoe Salesman's Ventilated Stool



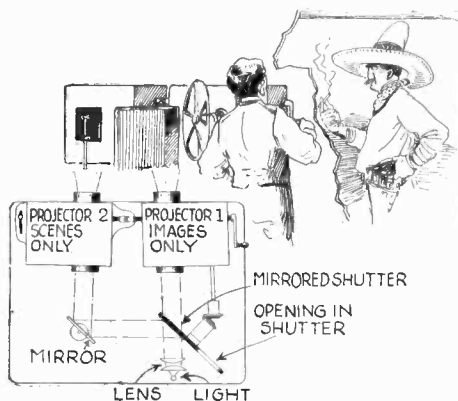
(Pat. No. 1,460,915, issued to Smith L. Luton.) To do away with the unpleasantness connected with the shoe salesman's profession, this invention places a fan under the foot rest of the salesman's stool. A current of air is forced over hot coils and against the perspiring foot. The hot coils and the fan are both electrically operated.

Amphibious Toy



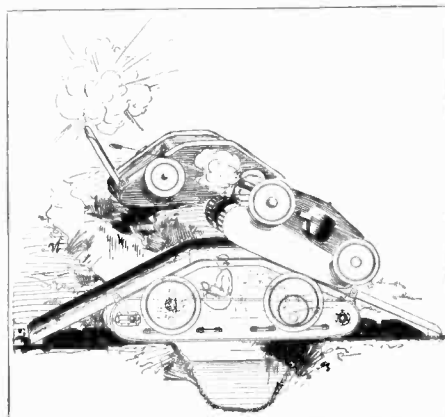
(Pat. No. 1,456,429, granted to Joseph L. Duggan.) The body of this toy is made of light metal. It is fitted with wheels, although it is built in the form of a boat. The spring motor it contains is connected to the wheels through a chain of gears and to an upright piece fastened to the figure in the boat holding the oars. When on land the boat is driven by the wheels; when it is in water the oars move it. Both the wheels and the oars move continuously. The figure holding the oars is pivoted where it is attached to the seat in the boat. The oars are also pivoted.

Perspective Movies



(Pat. No. 1,461,133, issued to Thomas Henry Marten.) Two projectors, operated alternately, both using the same film, are claimed to produce movies in perspective.

Bridge Tank



(Pat. No. 1,447,893, issued to Irene Leroy.) This tank, constructed with collapsible ends, forms a bridge over large gulches for whippet tanks, as shown.

Scientific Humor

Maybe He Will Meter There.—The announcer at Broadcasting Station XYZ had had a hard day. Besides his duties as announcer, he operates a Radio Supply Store. He had many things on his mind.

He was reading the news bulletin: "John Doe, who was arrested here last month on a charge of robbing the mails, was today transferred to the Federal Potentiometer."—*Leslie J. Smith.*

While Hydrogen Tans Hide.—BOBBY: "Is oxygen what the oxen breathe all day?" PAPA: "Of course, and what most everything else breathes."

BOBBY: "And is nitrogen what everyone breathes at night?"—*Edward Fleegy.*



The Missing Link. — BILL: "Why the gloomy look, Joe?" JOE: "I'm in trouble. My wife overheard me telling Steve Jackson that I had had two misses in my car the evening before."

BILL: "But that is no excuse for a row. Why everybody has engine trouble."

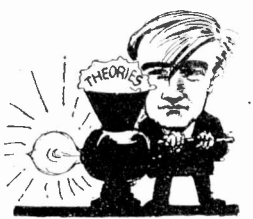
JOE: "But she found out that only one of them was in the engine."—*W. A. Loveridge.*

The Mechanics of It. —CRAWFORD: "There's an old fellow with a lot of jack."

CRAWSHAW: "No wonder. He's a landlord and makes it jacking up rents."—*J. J. O'Connell.*

And We Must Pay \$1.00 For These Jokes.—MR. BROWN: "What's the idea of these china dishes on my radio?"

MRS. BROWN: "You ought to be glad I put them there because you can tell Mr. Jones that you got China on your radio."—*Jessie Walters.*



A Delightful Joke. — Inventors are never taken seriously. No, even Edison made light of his theories. *Bradford Smith.*

And the Arch of the Foot Is Never Built.—WISE ONE: "It's funny that the pupil of the eye never learns anything."

WISE TWO: "Yes, and it's curious that the bridge of the nose is never crossed, and the roof of the mouth never repaired."—*J. Neuss.*

Nutley, N. J., Papers Please Copy.—BILL: "That new automobile manufactured by Jones and Company should prove quite popular."

TOM: "How so?"
BILL: "It requires only one nut."
TOM: "How wonderful! But why not eliminate all of them?"
BILL: "Well, you see, one must sit behind the steering wheel."—*Rev. D. C. MacLeod.*

A Ringer.—"It asks no questions, but you have to answer it frequently."
"What is it?"
"A door bell."—*Julia Gross.*

First Prize \$3.00



Most of Ours Is.—

LUNATIC: "I've invented a coal that will last forever."

KEEPER: "How did you do it?"

LUNATIC: "I made it

fireproof."—*Sidney Rochelson.*

Ought to Be Sold by Stationery Stores.

No 1: "They make engine wheels out of paper now."

No. 2: "That so? Use them for stationery engines I suppose."—*Everett Pardell.*

A New Tune.—WIFE (to husband operating new radio set): "Henry, what are you turning all them black wheels for?"

HUSBAND: "Why, it needs tuning."
WIFE: "Well that set can't be new if it needs tuning already."—*Karl L. Martin.*

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. No letters acknowledged unless postage is included.

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.

En-light-ened.—"Law is the oldest subject matter in the college," said the law student, "because Adam was evicted from Paradise for non-payment of rent."

"You are wrong," said the future doctor, "before that happened he was operated on."

"You are both wrong said the electrical engineer, "before all of that happened, the Lord pressed the button and said 'let there be light.'"—*Peter P. Udre.*



They are now translucent, and if they are not washed pretty soon, they will be opaque."—*Sadye Kauffman.*

Seeing It Through.

PROFESSOR (to Soph.): "Explain the difference between transparent, translucent and opaque."

SOPH: "The windows in this building were once transparent."

They are now translucent, and if they are not washed pretty soon, they will be opaque."—*Sadye Kauffman.*

Why, of Course.—"With all due deference my boy, I really think our English custom at the telephone is better than saying 'Hello!' as you do."

"What do you say in England?"
"We say: 'Are you there?' Then, of course, if you are not there, there is no use in going on with the conversation."—*The Continent (Chicago).*

The Saturday Evening Ghost.—FATHER: "At last I've found a way to make that young scamp of ours stop winking his eyes."

MOTHER: "How?"
FATHER: "I'll show him the article in this Science Magazine where it says that every time we wink we give the eye a bath."—*Mrs. R. Rowe.*

Turtle.

Wrecked motorist at phone: "Send assistance at once. I've turned turtle."

Voice (from the other end): "My dear sir, this is a garage. What



you want is an aquarium."—*Julia Gross.*

Eclipsed.—During the recent solar eclipse so much publicity was attached with the proposed flight of Army aviators in California to ascend 20,000 feet and take pictures in the path of totality, that around many newspaper offices the eclipse was usually thought of in connection with this flight.

About a week before the eclipse was due, a young newspaper reporter in Washington whose education had been more literary than scientific, telephoned the War Department and asked:

"Can I interview some one there who will give me the details of this eclipse that the Army Air Service is putting on out in California?"—*Lieut. C. P. McDarment.*

A Case in the Short-Circuit Court.

—A chap was arrested for assault and battery and brought before the judge.

JUDGE (to prisoner): "What is your name, your occupation and what are you charged with?"

PRISONER: "My name is Sparks, I am an electrician, and I am charged with battery."

JUDGE: "Officer, put this guy in a dry cell."—*The Inland Merchant.*



Easing Up the Jar.—As Rastus was led to the electric chair, an attendant asked him if he had a request to make.

"Well, boss," replied Rastus sadly, "Ah knows I'se goin' on a tough ride, and maybe I could use one of dese here shock absorbers!"—*Chas. Vivier.*

And Seasickness.—TEACHER (to class in chemistry): "What does sea water contain besides the sodium chloride we have mentioned?"

SMART BOY: "Fish, sir."—*James Rogers.*



THE ORACLE



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

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

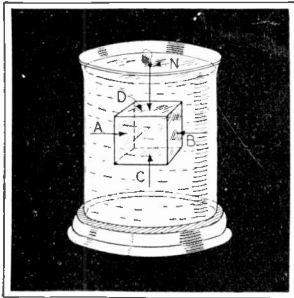
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to the department cannot be answered by mail free of charge.

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.

ARCHIMEDES PRINCIPLE

(1599) Jesse Phillips, Philadelphia, Pa., asks:
Q. 1. If a cube of metal is suspended in a liquid, is the pressure exerted upon it by the liquid equal in all directions?

A. 1. Referring to the illustration herewith, faces A and B will be equally pressed upon in



The perpendicular faces of a block of any material suspended in a liquid have exerted thereon equal pressure. The pressure on the upper face depends on the distance to "N" and that on the lower face on the distance and the thickness of the block.

opposite directions. It will also be found that the other pair of lateral faces will have the same pressure exerted thereon. On D, there will be a downward pressure equal to the weight of a column of water whose base is the same size as face D and whose height is equal to the distance from D to N. On the bottom of the cube, C, there will be a pressure equal to the weight of a column of water whose base is of the area of C and whose height is the distance of C to N. This is one of the principles of the mechanics of fluids discovered by Archimedes and from it is deduced the fact that upward pressure on the immersed body at any particular point is the same as that on the fluid which it replaces.

TREATMENT OF CANCER WITH X-RAYS

(1600) John W. Arnold, Urbana, Ill., asks:
Q. 1. Is a patient undergoing the X-ray treatment for the cure of cancer likely to develop other cancers from the use of the rays?

A. 1. With ordinary care a person subjected to cancer treatment by X-ray does not develop X-ray cancer. It is only those who work with the rays continuously that are likely to become so afflicted, but with modern machines this possibility has been reduced to a negligible degree. In the olden days, when tubes were not shielded, such cases were rather frequent.

Radium rays can likewise cause a sort of cancerous growth but the action of radium on an X-ray cancer case is very slight. The best method of treatment of cancer today is excision combined with both radium emanation and X-ray treatment.

SOMETHING NEW

CAN you build a telephone receiver less than 3/4 of an inch big, or a loose coupler, or a vario-coupler, or a variometer, or a radio outfit of this size? \$200 in prizes will be paid for actual working models of the smallest electric and radio apparatus and appliances. The most novel contest staged in a long time. For full particulars, see page 951 of this issue.

This is only one of the big features of the new and enlarged PRACTICAL ELECTRICITIES for January. Other features are: MEASURING CELESTIAL TEMPERATURES, RADIUM, AERIAL RAILROAD, ANALOGIES AND OTHERS, ELECTRIC TIMING OF HORSE RACES.

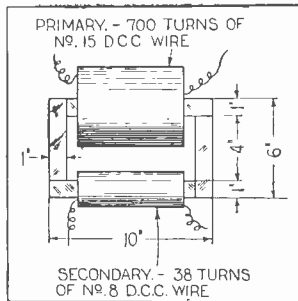
By Raymond F. Yates
By T. O'Conor Sloane, Ph.D.
By Jacques Boyer, Paris Correspondent

100-WATT STEP-DOWN TRANSFORMER

(1601) Jos. P. Rodriguez, New York City, asks:

Q. 1. Can you give me the necessary data for building a step-down transformer giving 6 volts at approximately 16 amperes on the secondary, to be operated on 110 volts A.C.?

A. 1. The illustration herewith gives all the



At the left will be seen constructional details for a 100 watt step-down transformer delivering six volts at approximately sixteen amperes on the secondary. The two coils should be thoroughly insulated from the core.

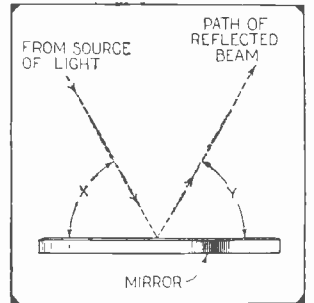
necessary data for such a transformer. The core should be built up of laminated silicon steel and the legs should be 1 inch square in cross-section.

REFLECTION OF LIGHT

(1602) John Harvey, Boston, Mass., wants to know:

Q. 1. In speaking of the reflection of light what is meant by the saying that "The angle of incidence equals the angle of reflection?"

A. 1. The diagram herewith illustrates this rule very clearly. The angle X is the angle of



Whenever a beam of light strikes a reflecting surface, such as a mirror, at a certain angle, it is always reflected away from that surface at an angle exactly equivalent to the first. At the right, angles X and Y are equal.

incidence and the angle Y is the angle of reflection. These two angles are equal in all cases of the reflection of light from a plain surface.

MOTH BALLS

(1603) Mr. Norman Atkinson, Jordan, Minn., requests:

Q. 1. Can you give me a formula for making a preparation similar to that used in making moth balls?

A. 1. If you will melt together four ounces of naphthaline and eight ounces of paraffine wax you will have a production very similar to the ordinary moth balls.

TROUBLE WITH FREEZING MIXTURES

(1604) Anthony Azzopardi, New York City, says that he used the freezing mixture mentioned in this department of this magazine some time ago which consists of ammonium chloride and potassium nitrate. He says that with this he has had no results. He asks:

Q. 1. Can you tell me why the freezing mixture does not work and give me some pointers for using the same?

A. 1. It may be that your chemicals were insufficient in amount and for this reason your freezing mixture will not work. However, if the initial temperature of the water used is about 32° C it will not freeze because the temperature depression of the mixture you mention is only 30° C. Would advise you to try this mixture again using water with a temperature of about 25° C, or even lower. If your chemicals are correct you should have no trouble in obtaining the results you desire.

OUR \$12,000 PRIZE CONTEST

YOU will note from this issue, our prize contest has gone over big. Over \$1,000 has been paid this month for worth-while contributions to this magazine, either in pictures, suggestions, ideas or articles. There is something doing all the time, no matter where you live, that can be written up for SCIENCE AND

INVENTION. All you need to do is to keep your eyes open. Even if you were totally deaf or blind, there would still be a way for you to win a prize simply by using your head and sending us ideas and suggestions of a scientific nature, or of a nature directly or indirectly touching on new inventions.

ARTICLES FOR FEBRUARY SCIENCE AND INVENTION

- Taking Photos of the Earth with a Sky-rocket Camera By Raymond Francis Yates
- The Secret of Perpetual Youth By Clement Fezandie
- Why the Elevation of Our Naval Guns Should Be Increased By Graser Schornstheimer, Naval Expert
- Science Serves in New York's Newest Hotel By W. B. Arvin

- Electricity and Science in Stock Exchange Operations
- A Day with America's Master Model Makers By Joseph H. Kraus
- A Gigantic Scheme for Utilizing Power of the Tides
- Choosing a Vocation by Machine Methods

- Announcement of Winners in the "Single Tube" Radio Receiving Set Contest
- The Story of Lime By Ismar Ginsberg
- Does a Ship Sailing East Weigh Less Than When Sailing West?
- Burning Coal Twice By Ismar Ginsberg
- Match Tricks—Second Article By Walter B. Gibson

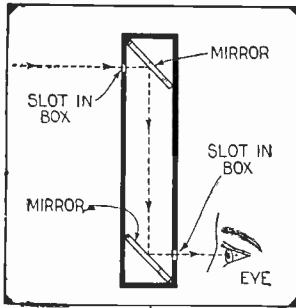
FREE INFORMATION

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.

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

PERISCOPE PRINCIPLE

(1605) John Blake, Wenthams Mass., asks:
 Q. 1. Can you show, in simple form, the principle of the reflecting periscope?
 A. 1. The illustration in these columns shows the principle of the periscope and also how a very simple type may be constructed. A long



A simple periscope may be made by using two mirrors placed in an oblong box at the angles illustrated. They can be held by means of adhesive tape or glue. Slots are to be cut in the box on opposite sides as illustrated.

narrow box of square cross-section is obtained and two mirrors fitted therein at the ends as illustrated. The surfaces of these mirrors must be parallel and the angles at which they are placed will depend upon the location of the slots in opposite sides of the box. This can best be determined by experiment. By looking in the slot at the bottom of the box, objects can be seen over other objects higher than the level of the eye by turning the periscope in the desired direction.

TRANSFERRING OF PICTURES

(1606) Paul Redman, Kansas City, Mo., says that he has seen a liquid which is supposed to transfer pictures from newspapers or magazines merely by coating the photograph with the liquid and placing over it a clean sheet of paper. The illustration is then supposed to be transferred to the clean sheet. He asks:

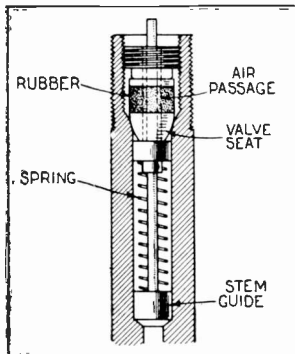
Q. 1. Can you give me any information on such a liquid?
 A. 1. There have been various liquid solutions exploited on the market which the makers claimed would transfer newspaper and magazine print to plain paper. However, none of these have been found to give satisfactory results, and as an added drawback, the reproduced printing was reversed. If you have any clippings or other material which you desire to have reproduced, we would advise you to use the photostat method.

2 M. F. CONDENSERS

(1607) Richard Romaine, Iowa Falls, Iowa, asks:
 Q. 1. Kindly give me the directions for making a 2 mf. condenser?
 A. 1. A 2mf. paraffin paper condenser would be of too large a size for the average amateur to construct. This construction requires about 35 feet of paraffin paper 4 or 5 inches wide, three of these sheets being necessary. Two sheets of tin foil, two inches shorter and 1/2 inch narrower than the paper, are also required. However, trouble will almost always be experienced in rolling this condenser up unless it is done by machinery. These condensers can be purchased very cheaply from any electrical supply store.

PNEUMATIC TIRE VALVES

(1608) Robert Mellons, Canton, Ohio, wants to know:
 Q. 1. What is the principle of the valve such as used in the stems of ordinary pneumatic tires?
 A. 1. The illustration puts forth the construction of the standard type of tire valve. It will be noticed that the valve proper is placed on a central rod and held against its seat by a light spring. Incoming air passes through the openings indicated. The entire mechanism is so placed that the pressure of the air from the inside of the tire



The valve used in the ordinary pneumatic tire is very simple yet positive in operation. The pressure of the air within forces the valve up against the seat thereby sealing the air passage and preventing the escape of air. The spring is used to hold the valve in place.

forces the valve against the seat, thereby retaining the air in the tire. The spring used is of such a tension that it will allow the incoming air from the pump or compressor to force the valve open. The valve has its cap with rubber packing. This cap is screwed on by hand.

POTASSIUM PERMANGANATE

(1609) Lewis Baldwin, Croton, N. Y., wants to know:
 Q. 1. How may potassium permanganate be made?
 A. 1. To make potassium permanganate, you should fuse together equal parts of manganese dioxide, caustic potash, and potassium chlorate. Dissolve the resultant in water and pass carbonic acid gas through the liquid. Filter, and the bright purple solution will be potassium permanganate.
 Q. 2. What is formed when hydrochloric acid acts on copper?
 A. 2. Hydrochloric acid will act slowly on copper in the presence of air, forming cupric chloride.
 Q. 3. Will iron pyrites treated with sulphuric acid form hydrogen sulphide?
 A. 3. No.

REDUCTION IN WEIGHT

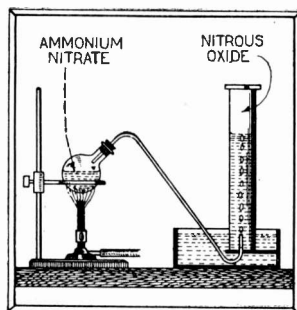
(1610) O. Shimeton, Oakland, Cal., asks:
 Q. 1. If a piece of iron weighing three pounds is placed in a vessel and the air exhausted therefrom, will the vessel weigh three pounds heavier than it would without the iron?
 A. 1. If a piece of iron weighing three pounds is placed in a receptacle and the air exhausted from the latter the entire weight will still be three pounds more than the weight of the receptacle alone. This is speaking approximately, for the weight will be slightly less due to the weight of the air which was drawn out of the jar. This would very slightly reduce the total weight.

IMPORTANT

TO NEWSSTAND READERS

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Nitrous oxide may be prepared very easily for experimental purposes by setting up the apparatus as shown. Nitrous oxide is given off by the application of heat and collected.

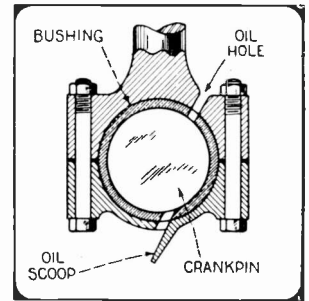
NITROUS OXIDE

(1611) Ralph Stevens, Brooklyn, N. Y., asks:
 Q. 1. How can nitrous oxide or laughing gas be produced in small quantities in the chemical laboratory?
 A. 1. The apparatus should be set up as illustrated in the diagram herewith and a small quantity of nitrate of ammonium placed in a flask. Upon heating, it will be found that a gas is given off which gas will replace the water in the tall glass cylinder. Some will be lost by solution in the water. This is nitrous oxide.
 The nitrate of ammonium necessary for use in this experiment can be bought; it is a regular commercial product.

MOTOR LUBRICATION

(1612) J. Simpson, Springdale, Pa., asks:
 Q. 1. How are the various parts of the average gasoline engine lubricated? That is, the wrist pins, the crank pins and the cylinder walls and pistons?
 A. 1. In the majority of internal combustion engines there are small channels in the crank case at right angles to the line of the crank shaft. Into

these dip small oil scoops, one of which is located on the end of each connecting rod as illustrated herewith. These scoops throw the oil around inside the crank case and, together with heat, form an oil vapor and spray which penetrates to every part of the engine. The oil also enters the small



The oil scoop illustrated at the bottom of the connecting rod, shown in part at the right, throws oil around inside the crank case of a gasoline engine and lubricates the various moving parts by what is known as the "splash system."

oil hole shown in the illustration herewith, lubricating the crank pin. This pin is also partially lubricated by the hole placed by the oil scoop as shown. The vapor and spray are continuously forming and keep in circulation throughout the various parts and lubricate all the sections of the engine mentioned in your question. It is termed splash feed.

CHARGING STORAGE "B" BATTERIES

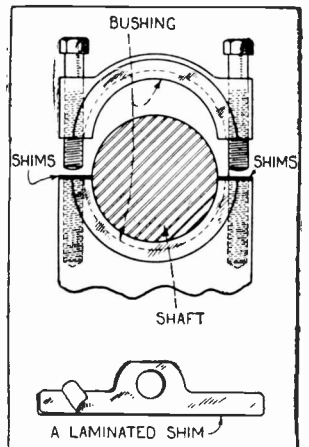
(1613) Edward Reynolds, Cazenovia, N. Y., says that he has an airplane generator which will deliver 13 volts at 33 amperes and wants to know:
 Q. 1. Can I charge a 22 1/2 volt storage "B" battery with this generator?
 A. 1. We would not advise the use of the airplane generator you have for charging 22 1/2 volt "B" batteries. Its voltage is too low for this work unless you desire to charge your battery in three different sections, which would of course, consume considerable time.
 Q. 2. What is the proper speed for running such a generator?
 A. 2. Regarding the correct speed for running your generator, we would have to refer you to the manufacturers.

GENERATOR QUERY

(1614) E. V. Porter, Henniker, N. H., says that he has a D. C. generator rated at 13 volts and 33 amperes and desires to operate the same from a water power plant located 1,300 feet from his house. He asks:
 Q. 1. What size wire should I use for conducting the current from the generator which will be located near the water power plant to the building?
 A. 1. If you will use No. 6 rubber covered wire for conducting the current from your generators to the house we believe you will have no trouble in lighting the buildings with the resulting current. Of course, in order to insure stable operation of the installation you should use a storage battery, to be charged by the generator and which will deliver current to the house when the generator is not running.

SHIMS

(1615) Jack Bartlett, Chicago, Ill., wants to know:
 Q. 1. What are "shims" and of what use are they in automobile engines?
 A. 1. A shim is usually made in a form such as shown here and consists of many sheets of very thin copper lightly soldered together so that the leaves can be peeled off leaving a shim of the desired thickness. The leaves are usually one one-thousandth of an inch thick. They are very useful in adjusting bearings to shafts if they are



Very thin sheets of copper, soldered lightly together and cut as shown at the bottom of the illustration at the left come in very handy when adjusting connecting rod bearings on automobile engines. They are known as shims and one or more are placed as shown, so that the bushing and the connecting rod may be made to fit snugly.

placed in a manner such as illustrated herewith. As can be readily seen, the shims can be removed and peeled down to the required thickness so that the two halves of the bearing will fit snugly on the shaft.

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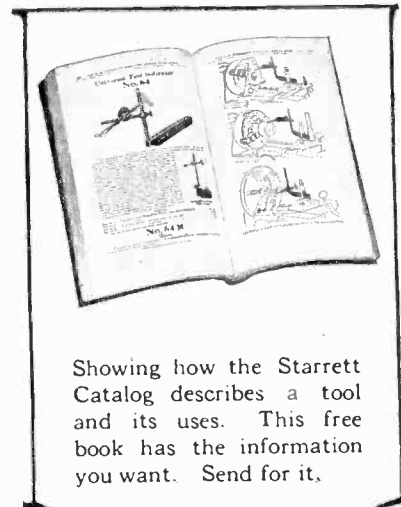
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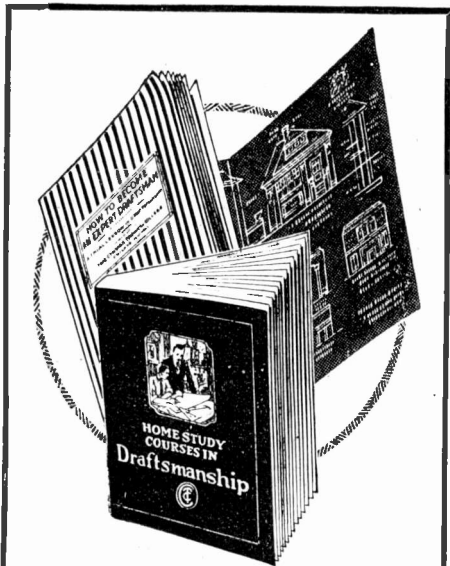
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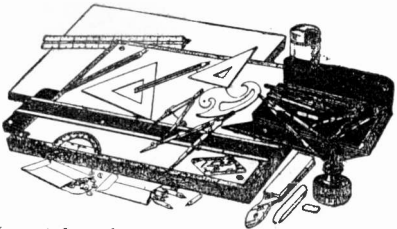
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The Man On the Meteor

By RAY CUMMINGS

(Continued from page 859)

spired in me any emotion stronger than my passions of hunger and thirst? Not so. I was in the full bloom of my manhood, yet the sight of this beautiful woman thrilled me because now I knew instinctively I might find food and water.

I scrambled forward, holding myself to the ground with difficulty, and entered the mouth of her cave like some marauding animal seeking the sustenance I craved.

The cave-mouth gave into a tunnel leading at an angle downward. The walls were smooth. I forced myself down, half sliding, half gently falling. For an instant the thought came to me that I would encounter other living creatures—things to keep me from the food and drink I wanted. Had I met them—humans or beasts—I know I should have fought desperately.

It was dark in the tunnel; but soon I saw that the rocks were glowing with a phosphorescence. This grew brighter as I advanced.

EXPLORATION

I went down perhaps two hundred feet; then the tunnel opened. I was in a subterranean chamber of indeterminate size, possibly five hundred feet square, with a black rocky ceiling some fifty feet above me. The whole place was dimly lighted by the red-silver glow which came from the rocks. The air was denser, with a pungent, aromatic odor. It seemed to strengthen me and clear my head.

The sides of the cave were rough and broken with overhanging rocks like shelves. Here and there were other small tunnel-mouths. Most important of all, a small subterranean stream crossed the cave, opening up into a little lagoon near the center. It was a thin-looking, milk-white fluid. I flung myself down to it with a splash.

It tasted, not like milk, but like pure, cold water, though very thin and light. I drank my fill. The joy of it!

There was a pile of blue fabric—woven grass—on the bank beside the stream. The girl's couch, it proved to be. The robes were very soft, gossamer in weight. I started to dry myself upon one of them. But the water—I shall call it that—evaporated like alcohol, and I was dry in a moment.

There was food here. A patch of black soil had queer, fungus-like growths in it. I had no doubt it was the girl's food. There were the remains of a fire, though I did not know what it was at the time. On a stone was some of the fungus which had been cooked. Of this I ate.

Upon the couch I lay at ease. The blue robes lay around me like swan's down. My slight weight made me seem floating in them. It was my first conscious moment of physical peace.

With hunger and thirst appeased my thoughts turned to the girl. She was not only the first woman, but, to my memory, the first living thing I had ever seen. Where was she now? Could I capture her?

Across the cave I saw something move. The mouth of a passage-way was there beyond the stream; and in the dim glow of light I could make out the girl standing there. She was watching me as I lay in possession of her couch.

I held myself motionless. After a moment she began coming forward, timidly, yet curiously to inspect me. She stopped at the edge of the stream no more than fifty feet

away. Her hair fell in waves to her knees. She stood hesitating, frightened, yet drawn by a power greater than her fear. I could see the muscles of her limbs tensed for instant flight.

I had intended to leap suddenly across the stream but a strange shyness came over me. Instead, I called to her. Words? I had no spoken language. I called some syllable. It startled her; but she answered—a soft little call of shy friendliness.

I wanted her to come to my side of the stream, but she would not. I beckoned to her; but she moved backward on fairy-like tip-toed steps. It angered me. I waved my arm vehemently and tried to climb to my feet, struggling with the airy, half-floating robes of the couch.

The girl took flight. Her arms struck out, and like a swimmer mounting through water she floated up to the ceiling, landing upon a ledge of rock. Through a tangle of her hair her face peered down at me. And though her eyes were frightened, there seemed an impish, mocking expression to her tremulous smile.

Shyness dropped from me. She would obey me; I would make her. I kicked myself into the air and swam as I had seen her swim. But it was not as easy as it looked. I turned over in the air, losing my balance in spite of myself.

THE CHASE

I reached the ledge, striking my shoulder violently upon it as I landed in a heap. But she was not there. Across the cave, down by the couch she stood poised on tip-toe, looking at me. And this time her red mouth and dancing eyes were openly mocking.

For half an hour I pursued her about the cave; but she eluded me as easily as though she had been a butterfly and I one of your Earth-children in eager chase. She could have escaped from the cave, but she had no fear of me now. At last, bruised and exhausted by my futile efforts, I sank upon her couch; and again she stood nearby, regarding me.

I was angry and sulky. I pretended to disregard her. At last, utterly worn out, I fell asleep.

IV

When I awoke, the girl was sitting beside me. Her soft fingers had been stroking my hair; it was their touch which awakened me. As I moved and opened my eyes, she instantly withdrew beyond my reach.

I was hungry again and when I motioned to her and indicated the food, she seemed to understand. I sat quite still, and within a few minutes she was deftly preparing a meal. But I was aware that she watched me narrowly and seldom came within my reach.

The fire she produced by rubbing two stones together. It seemed to ignite the stones, with a tiny flickering flame like the burning of sulphur. She had gathered a pile of dried vegetation from the surface above the cave; and when that was blazing she added rocks that glowed like coal. The fire interested me tremendously. It alarmed me; but only at first, for I saw that the girl had no fear of it.

I need not go into details. Her manner was proud when presently she indicated the hot food ready to eat and she watched me expectantly while I tasted it. I smiled my approval and beckoned her to take some of it with me. At which she curled up on the

(Continued on page 906)



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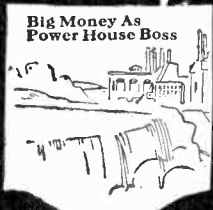
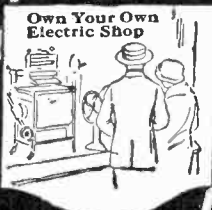
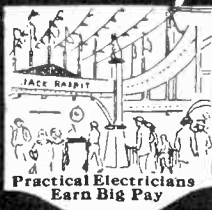
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The Man on the Meteor

(Continued from page 904)

robe beside me, eating the food I pushed toward her.

We were friends. Like myself, she had no spoken language. But when we tried to talk it came fast. I indicated myself and told her I was Nemo. The word seemed to spring readily to my mind; I have no doubt it was some part of my earlier life. She had no name. I called her Nona. It seemed to please her. She repeated it after me half a dozen times, and clapped her hands delightedly.

LEARNING TO TRAVEL

A little later we went up to the surface of our tiny world. It chanced to be daylight; and Nona taught me how to swim through the air, how to handle myself against this lack of gravity.

The art came to me quickly. I was soon able to swim about with swift, powerful strokes. My stronger muscles gave me an advantage over her. I could swim more quickly; but I could never attain her deftness, her agility. She would swoop about, dive head downward in a graceful arc, right herself and land on tip-toe.

We circled our little globe, swimming at an altitude of a hundred feet, and following the Sun; and within half an hour were back at our starting point. Everywhere I saw the same bleak landscape. It was night when we returned, for we had overtaken the Sun and passed it. But in a few moments daylight came again.

Then Nona showed me how to jump. With arms folded, she leaped vertically into the air. Straight up her body shot, her hair

brushed flat against her by the downward rush of wind. She held herself upright by throwing out a hand occasionally. Like an arrow she mounted; until standing on the ground I could see her only as a tiny dark speck against the blue of the sky.

She came swimming down a few moments later, her hair waving like a cloak behind her, spun gold with the sunlight on it. She was laughing and flushed from the exertion.

Then at arms length with fingers clasped, we leaped upward together. The tiny world dropped away. Looking down, it showed itself as a ball. I could see far around it.

We seemed to mount endlessly. The air grew so rare I gasped for breath. My head was roaring. I was cold. Below, I could see the spherical meteor turning under us. We were in Space, no longer a part of our world. And we had almost reached the limit of its atmosphere.

Nona's fingers clutched mine tightly. Suddenly she twisted me downward and dropped me. A strong side wind had sprung up. We swam down against it, fighting our way until at last we were back to the meteor's surface.

I was tired, for through my clumsiness I had used far more energy than Nona; but I would not let her see it. I saw her look upon the muscles of my arms and shoulders, and her admiration pleased me. I stretched my arms for her, showed her the muscles of my legs; and looked about for some way of displaying my prowess. There were many boulders around that could be loosened. One by one I flung them into the air, sent them into Space never to return.

MOVING MOUNTAINS

Nona watched me with awe, encouraging me with little syllables of pleasure as I selected larger and larger rocks. Some I dug up and tore loose, until at last I ripped off the top and side of a hill. It was a mountain of rock. I staggered like Atlas, with it over my head, and then launched it into the air. It rose a short distance, and fell back to form another hill.

Nona gazed at me with new respect and with a look in her eyes that made my heart pound. I was casting about for some larger burden, but she drew me away.

I was pleased. A sense of my own power filled me. I was master here on this world of mine. I could have taken it apart bit by bit and tossed it into Space. I could tear down mountains, build others in their stead.

Facts and figures? I am in a position now to give them to you. My meteor had a diameter of five miles, a circumference of some fifteen. Its density relative to Earth was .67. Its surface gravity—again relative to your Earth—was .00039 placing Earth as 1.00. My weight at the surface of my meteor—neglecting other factors which I shall name in a moment—was slightly over one ounce.

Without undue exertion I could leap upward nearly ten thousand feet—that is to say, almost two miles. And the mountain of rock I tossed into the air on your Earth would have weighed some 320,000 pounds!

I have said that the boulders I tossed upward left the surface of the meteor never to return. At an initial velocity of 13 feet a second, all objects became satellites of the meteor, revolving about it comparatively close to the surface in perfect circles. The velocity of escape was but 18½ feet a second, i.e., that velocity which would cause an object to pass into outer Space, moving onward until it found some larger body to encircle.

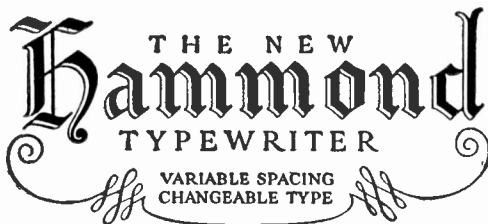
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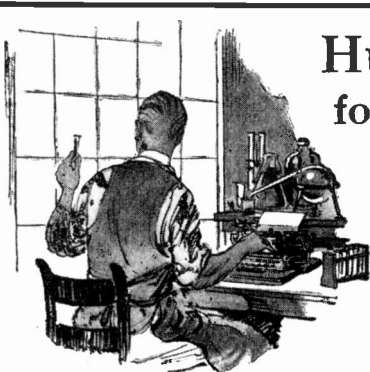


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The Man on the Meteor

(Continued from page 906)

I give these figures without corrections for atmosphere, axial rotation of the meteor, or the attraction of other bodies. Theoretically they are accurate, though in practice they were altered somewhat. During our brief days we weighed more than I have stated; while at night, less. Indeed, had we essayed to jump into the air at night, we should doubtless have been unable to struggle our way back.

How can that be, you ask? Our proximity to Saturn! Around this great planet we were revolving at a distance of no more than thirty-five thousand miles. Saturn's surface gravity is a trifle greater than that of your Earth—1.07 to be exact. Saturn's density is only one-ninth that of the Earth; but the difference is made up because of its tremendous size. Saturn's gravity—to us on the meteor—was an appreciable pull, even though diminished by the distance between us, and further offset by the meteor's rapid rotation.

Thus, you see, when Saturn was below us—in daytime—its gravity was added to ours. But at night, when it was in the sky above, it was subtracted.

These conditions applied to the days I am describing. Our meteor was then between Saturn and the Sun. Later in our year, when we had passed around Saturn, the Sun was blotted out. There was then no daylight—merely alternate periods of a sky filled with Saturn's silver disk and the azure, star-filled outer Space.

I have not mentioned the time of our meteor's axial rotation. It was, as you on Earth measure time, 2 hours, 58 minutes. A complete day and night in less than three hours!

GLORIOUS NIGHT

When I had finished showing Nona my strength, it was night again. And such a night! Saturn no more than thirty-five thousand miles away! The darkened bands were plainly visible. When fully overhead, the circular limb of the planet came down in all directions almost to our horizon. The silver light from it was dazzling. And everywhere in the sky, meteors like ourselves were whirling past—silver in Space, flaming red when fragments of them struck our atmosphere.

Occasionally a meteorite would strike our surface, but we had no fear of them. For an hour perhaps, we stood together, silent, gazing with awe at these mysteries of the sky. Until at last Nona gently drew me back to her cave.

V

Within the cave the air seemed warmer than before perhaps because I was flushed and tired from my exertion. The radiant light from the rocks was soft. Here all was quiet and peace.

At once I threw myself upon Nona's couch, stretching my limbs, head pillowed upon my crooked arm. For a time, as before she stood regarding me. There was in her gaze now no fear, but a curious softness. I sensed it. With sudden thought she smiled, and swam across the cave. She got a stone, hollowed out like a cup. She filled it at the stream and offered it to me. I drank gratefully.

Again I was conscious of hunger. The fungus-like food was unsatisfying. I made Nona understand, and she seemed distressed. I could see she wanted to feed me but had no other food.

Finally she motioned me to lie quiet. I watched her as she stretched herself prone

on the ground near me. Her head was raised; she was looking keenly, carefully about the cave. Then she began swimming, slowly, stealthily no more than a foot or two above the cave floor circling about, up along the walls, back overhead following the line of the ceiling.

Once, when she was hovering over by the side wall, I saw her grow suddenly alert. I followed her steady gaze; and on a rock fifty feet from her I made out the outlines of something lying motionless. It was the exact color of the rock itself. It looked like a lizard some three feet long, with white eyes standing out from its forehead. It was because of the eyes that I first saw it.

Nona was in midair. Then, like a wasp she darted at that thing on the rock.

MEAT FOR FOOD

The lizard—I shall call it that—saw her coming. It leaped, and sailed across the cave. I saw that it had webbed membranes connecting its six outstretched legs.

Nona turned in the air after it, her slim body as sinuous as her waving hair itself. She was faster than the lizard, but again, on the opposite side of the cave, it eluded her.

Back and forth across the cave they went. Often the reptile would dash for one of the passageways but Nona with her greater intelligence, always anticipated it and was there to bar its way.

The lizard seemed jointed all over, and it could turn in the air with extraordinary swiftness. But not so swift as Nona. Once the reptile whirled back and forth on a sustained flight. Nona followed its every twist and turn as one bird follows another.

At last she had it in her arms, in midair at the center of the cave. Calling to me in triumph, she struggled with it, fighting her way down to the ground.

I started toward her, but her voice and gesture waved me away. The lizard was screaming—a shrill, hideous scream. But she had its back bent across her knee. Its spine broke with a crack. It lay still.

By one foreleg she held its quivering body up to me; she was laughing with happiness as she sought my applause.

We ate the meat of its tail and legs; and satiated, I lay somnolent on the robes and watched Nona moving about the cave. She extinguished the fire, and at last approached me timidly. I did not notice her. My eyes were half closed. I was vaguely planning my own hunting for food—wondering if there would be other reptiles larger, for me to capture.

A twitch at the coverings on which I was lying aroused me. Nona was pulling a robe out from under me for herself. I pushed it toward her.

I did not move. It was very soundless in the cave with only the murmuring of the stream. Nona curled up on her robe near me. Thus we lay silent; but I felt her shy gaze always upon me and suddenly I came back to complete wakefulness.

We stared wordlessly at each other until her gaze timidly dropped. With heart racing, I moved myself slowly toward her. I was afraid to frighten her; but she moved, not away, but to me. Abruptly my arms were around her.

Thus I found my habitable world and my mate—beyond which the legitimate needs of man do not go.

(Continued on page 910)

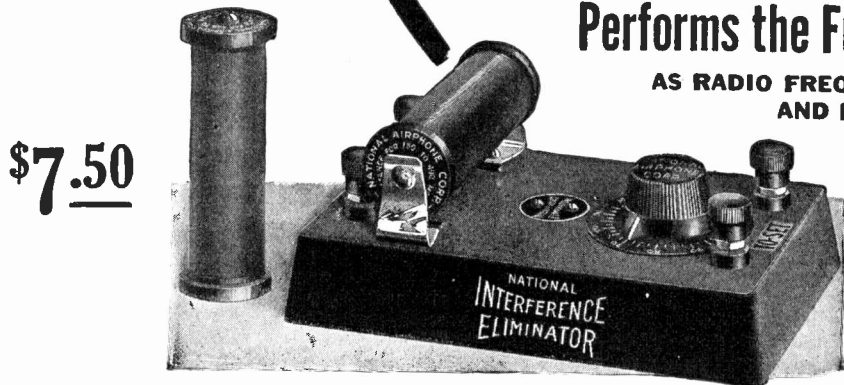
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The Man on the Meteor

(Continued from page 908)

VI

NOTE TO READER

The foregoing manuscript was written by an old man—known only as Nemo—who is at present an inmate of one of our State Homes for the Aged. His case is a curious one. The Institute authorities inform me that two years ago he was found wandering on the streets of Chicago, the victim, apparently, of amnesia. He had no idea who he was, nor could he give any details of his past life. No papers of identification were found upon him.

I talked with the old man personally for some hours. He is undoubtedly cultured, and with a wide, though eccentric scientific knowledge. He speaks English with an extraordinary indefinable foreign accent—an accent which leaves one wholly in doubt as to his possible nationality.

His memory has never returned. No trace of friends or relatives has been found. At the Institution, because of his pleading, he is known simply as Nemo.

Though the events of his later life are

still a blank, Nemo insists that he can remember, with a clarity which increases daily, the events of his youth. The authorities scoff; they tell me he was doubtless at one time some obscure scientist, possibly of Europe. Efforts are being made to identify him.

You have read Nemo's written narrative of his first conscious memories. He gave it to me at my request; and with a cynicism for which I cannot blame him, assured me that no one would credit it. I have made almost no changes; you have it practically as he wrote it.

For myself, I liked the old man. His personality is distinctly likable, and his manner convincing. I can testify that his sole appearance of irrationality lies in the extraordinary things he has to tell. And in these present days of science when nothing seems wholly impossible—and when, as always through history, the thoughtless find it easiest to scoff—I can offer no opinion. I leave you to be his judge.

RAY CUMMINGS.

Dr. Hackensaw's Secrets

By CLEMENT FEZANDIÉ

(Continued from page 861)

they found themselves in a small closed chamber. A door in this chamber immediately opened and gave access into a street of Submarina.

"You see, Silas," remarked Doctor Hackensaw, "we're pretty safe here. Even if an enemy discovered our hiding place, he would find it difficult to injure us. We could easily protect ourselves against attacks from submarines, and I doubt if even depth bombs could do us much damage. In fact the whole city, like a ship, is built in air-tight compartments. If one is damaged we can take refuge in another. The central city is some distance away. In fact we must take the electric trolley car to get there."

"What!" cried the reporter, amazed. "A trolley car here, under the ocean?"

"Of course. You don't suppose I am going to give my men any more work than is necessary. Every labor-saving device I can think of is installed here."

THE SUB-SEA CITY

It did not take Silas long to realize that he had come to a real city. The streets, lighted by diffused electric light, were as bright as if the sun were shining overhead. They bore names and numbers, and were kept spotlessly clean. The air was pure and sweet—a regular ocean breeze pervading.

"How is it the air here is not under pressure?" asked Silas. "I understood that the air pressure on the earth is about 15 pounds to the square inch. Every thirty-two feet depth of water adds 15 pounds more. Hence half a mile under water the pressure should be 1,252½ pounds per square inch."

"You are right about the water pressure, Silas, but my air taken from the sea level has barely little more weight than normal air. Half a mile more of air in the column does not greatly increase the weight."

"But how do your receiving chambers and the roof of your city stand the enormous water pressure?"

"My receiving chambers and my entrance wells have thick walls of the strongest metals I can obtain. The city itself is excavated so far under ground that there is little dan-

ger. You will notice that the car is going down a rather steep incline."

To say that Silas was amazed would be to put the matter mildly. He could scarcely believe his eyes as he went from one surprise to another. The streets were filled, not only with laborers, but with clerks, stenographers and other professional people, and even with children. Theatres, moving-picture shows, restaurants and ball rooms advertised their various attractions. There was a bank, and there were even stores, but, as the doctor explained to Silas, all the stores and recreation centers were under his own management and were run at cost. The stores would furnish anything wanted, sending to England for it if necessary. Only two things were noticeably different from the ordinary city—here there were no automobiles and no horses.

BOTH WERE TABOOED

Silas was deeply impressed. "I wondered how it was," said he, "that you were able to get help in your submarine city, but now that I have seen it, I am not surprised. Your workmen have all the comforts of home here."

"Yes, we receive all the principal books, newspapers and magazines, and we even publish a journal of our own. 'The Submarine Daily Swash.' We have telephones and electric lights and all modern conveniences in every house, even including radio receiving sets to receive the 'broadcasts' from England. But here we are at the oil wells. Let's get out and visit them."

THE OIL WELLS

"How do you dispose of your crude oil?" "I have a secret pipe line which carries it to an English refinery I have started. We also refine oil from Europe, though our greatest supply comes from here. I furnish gasoline to England and France cheaper than any one else can supply it. My only doubt is whether or not I am benefitting the world by so doing."

"I don't understand you."

"What I mean to say is that I am a firm
(Continued on page 912)

Radio Catalogue Free—

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a post card—**

Address Dept. 40-R

and we will send you free this 52 page catalogue of radio sets and parts. It also contains explanation of radio terms, map and list of broadcasting stations and much radio information, including an explanation of successful hook-ups and circuits.

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Violet Rays work quickly, it's scientific, goes after the cause. That's why results are quick, permanent. Dr. Duncan, Kewanee, Ill. writes, "Violet Rays is the finest thing I ever used to relieve pain, treatments are so pleasant all my patients like it." Use it yourself at home, you save Doctor's bills.

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Please send me without cost or obligation your free book describing your VI-REX Violet Ray outfits, and details of your \$1.00 offer.

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City _____ State _____

Dr. Hackensaw's Secrets

(Continued from page 910)

believer in the conservation of natural resources. It has taken Nature millions of years to store up her supplies of coal and petroleum, and there is no hope of them being renewed. It seems a wanton waste to use these up for pleasure trips in automobiles. We ought to make use of alcohol or air or water-power or some other such inexhaustible source of energy, instead of consuming these invaluable natural hydrocarbons. My only consolation is that chemistry is making such rapid strides at the present day, that the time is bound to come when we can make the petroleum products synthetically, 'from carbon dioxide and water.'

Have you had a coal mine here?"

"Yes, and a very rich one. We are working it now. As soon as I perfect my devices for burning the coal without smoke, I shall generate all my own power here and shall then send electrical power by cable to England. 'Turn about is fair play.' Up to date, I have placed the coal, as mined, in large buoyant steel vessels, hermetically closed, allowed them to float to the surface and then towed them to some convenient spot where the water is smooth where the coal can be transferred to ships."

"Your city ought to be useful as a submarine base in war time," suggested Silas.

"Yes, indeed, especially as its existence is not suspected."

"I don't see how you can keep it secret."

"All my help are under contract to remain here five years. Only those I know I can trust are allowed to attend getting supplies and provisions. Of course, Submarina could, in a pinch, furnish all her own food; as fish, oysters and seaweeds of many kinds abound. But I find it easier to import meat, flour, and vegetables rather than attempt to raise them here."

"How could you raise wheat here, without sunlight?"

THE MUSEUM

"I think it could be done by means of artificial light, but until I manufacture my own electricity I shall not do any experimenting in this line. But here we are at the Museum. Come in with me and I'll show you some of the curiosities we have discovered in the ocean's depths. Here are perfect specimens of all kinds of marine plants and animals, specimens such as you will not find in any museum on earth, for my men go out in diving suits and select only the finest specimens. My workers are free to move about as they use my artificial gills to furnish them air for breathing. Then here are relics from sunken ships. These coins and jewels came from a Roman galley that sank here hundreds of years ago, and was deeply imbedded in the silt. We come across very curious things here."

The journey was continued and Silas was shown one new marvel after another. Nothing that might lend to comfort or recreation of the inhabitant was neglected.

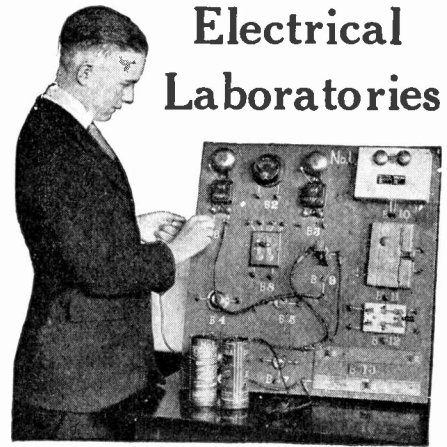
The pair stopped at a restaurant and had an excellent dinner, and then took rooms in the hotel—for a hotel had been found a convenience for many, especially those engaged in the transportation of supplies. But, in the middle of the night, Silas Rockett was awakened by the loud ringing of an alarm. An instant later, Doctor Hackensaw, in his nightshirt, was at the door.

"Grab your clothes, quick!" he cried, "and come with me! Submarina has sprung a leak!"

(Continued on page 914)

FREE \$500.00

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9 Laboratories Sent to Your Home

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HOW I SAVED MY HAIR!

THE TRAGEDY OF BALDNESS

By ALBERT WOODRUFF

WHEN the barber told me my hair was getting thin I merely smiled and let it go at that. When my wife said, "Bert, I do believe you are becoming bald," I gave a little laugh and passed it off with a jesting remark. I took the gibes of my friends in the same spirit—and I laughed when the comedian at the theatre made his "cracks" about candidates for the "bald-headed row."

But it wasn't until my business associates commenced to notice that I was rapidly becoming bald and gray that I worried. For while I was just as full of pep and vim as I had ever been—while my business judgment was just as keen as ever, yet I worried for fear my associates might think of me as heading toward the "has been" class. I decided to try to save my hair—if it could be saved.

Then I became a slave to hair tonics. If a tonic was new I bought it on sight. I tried every kind of shampoo that I heard of. I was a victim of the barber's wiles. The money I spent—and all to no purpose. My hair continued to come out just as fast as it ever did before I had tried to stop it. Every time I combed my hair it told the story.

How I Prevented Baldness

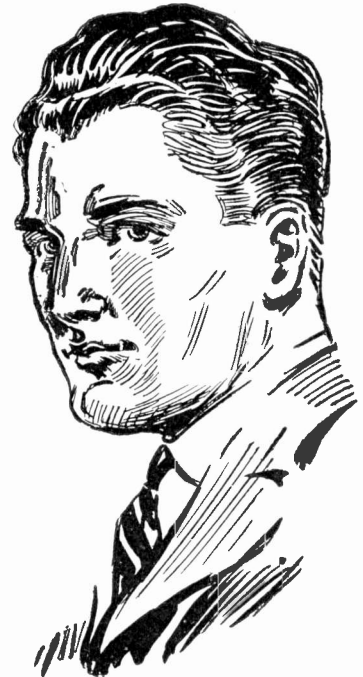
One day I read a very interesting advertisement by the celebrated Physical Culturist, Bernarr Macfadden. Now, it so happened that I had seen Mr. Macfadden several times and I knew that he himself had wonderful thick hair. Naturally I was interested—although it was news to me that Mr. Macfadden had made a study of the hair and had written a book on the subject, entitled, "Hair Culture."

In the advertisement Mr. Macfadden said he was amazed to learn how little really authoritative information had been

written about the proper care of the hair and scalp. He said that one need not let the hair grow thin and gray. He said that if the hair is falling out or getting gray a reasonable amount of proper care will restore it, unless one is completely bald. And this same care will keep the hair strong and healthy throughout life. He spoke of simple, natural and effective methods for treating the hair and scalp by following a few laws of nature. Then he casually mentioned that he was startled at the tremendous demand that existed for his comprehensive work. In fact, the first edition of his treatise was very quickly sold and a new edition had to be printed to take care of the orders that were flooding in on each mail.

I made up my mind right then that since Mr. Macfadden had written the book it was sure to be very practical—and the fact that so many had been sold clearly proved to me that the treatise must be filling a popular demand.

So I just jotted my name and address down on the coupon and returned it.



"Only a short while ago my hair was falling out by combfuls, yet today I have fine, thick hair, with not the slightest trace of baldness or dandruff."

one of the most valuable—if not the most valuable—and instructive books ever written on Hair Culture.

Albert Woodruff.



Women! Keep Your Hair Youthful

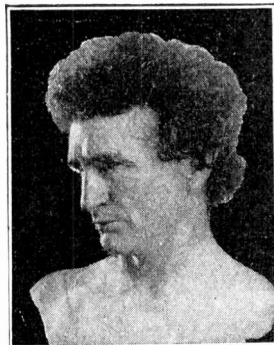
If your hair is graying prematurely you have every reason to hope that it can be stopped and that much can be done toward restoring it to its original youthful and becoming color.

If it is losing its luxuriant quality and glossy sheen the few simple rules taught by Bernarr Macfadden in his new book HAIR CULTURE will enable you to bring about an almost unbelievable improvement. Why spend time and money at the hair dresser's when you can give your hair a better home treatment in only a few minutes a day by this new method? You can easily have hair that is wonderfully silky in texture and your scalp be cleansed of every trace of dandruff or scurf.

When I received the book on five days' free examination I immediately read it very carefully and that very same night I started to follow the few simple rules. I must confess that within a very short time I noticed a decided improvement in the growth of my hair—it became thicker and more glossy. Then dandruff disappeared. Today, after following the rules laid down in this new method, I have just as fine a head of thick hair as you would see on any man—even a young man of eighteen or twenty has no thicker or glossier hair than mine. In fact, many haven't anywhere near such fine hair. The grayness has all disappeared and my hair has the glowing color of youth. My wife and children also adopted the rules which we discovered in Mr. Macfadden's treatise entitled "Hair Culture" and their hair is the admiration of all their friends. If you will examine the book I am quite sure that you will agree with me that it is

Bernarr Macfadden's Secrets of Hair Culture

These chapter titles will give you an idea of the scope and value of this remarkable book:



BERNARR MACFADDEN. Note his thick, luxuriant, healthy hair.

Superfuous hair. Hair Tonics.

Eyebrows and Eyelashes.

- Hair as an attribute to beauty.
- Facts everyone should know about hair.
- Care of healthy hair.
- How to care for baby's scalp.
- Facts about soaps and shampoos.
- The cause of hair troubles.
- Dandruff.
- Dry Hair, Oily Hair, Split Hair.
- Falling hair.
- Baldness.
- Gray hair.
- Hair Dressing.

Send No Money

If you would like to take Mr. Woodruff's advice we will gladly let you examine "Hair Culture" for yourself, without obligation, and see how easily you can follow the methods that should bring new life, new lustre and luxuriance to your hair. Don't send one cent in advance—just fill in and return the coupon and the book will come to you by return mail. When the postman hands it to you, deposit only \$2.00 with him. Then after you have kept "Hair Culture" for 5 days—after you have tested the methods—if you are not absolutely satisfied return the book to us and your money will be promptly refunded. If, however, you decide to keep this remarkable book, as you surely will, there are no further payments of any kind to be made—the book becomes your property for the one sum of \$2.00 which you deposited with the postman.

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Without obligation on my part, please send me a copy of Bernarr Macfadden's Book giving me all of Nature's simple methods for preserving and beautifying the hair. I will pay the postman \$2.00 on arrival, but I also have the privilege of returning the book if I desire and you will refund my deposit.

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Dr. Hackensaw's Secrets

(Continued from page 912)

Silas Rockett lost no time. He made one grab for his clothing and then followed the doctor out into the street where they found numbers of lightly clad men, women and children splashing through a small stream of water that had suddenly made its appearance. Among the number was a woman with a baby in her arms—the first child born in Submarina.

"Follow the water!" cried the doctor, and Silas obeyed. He realized only too well what had happened. The enormous pressure exerted by the ocean above, had caused the earth, that formed the roof of the city, to cave in at some spot, and it was evidently but a matter of minutes before the flying people would all be drowned like rats in a trap.

"Good bye, doctor," cried Silas, but the doctor did not hear him. Meanwhile the stream had rapidly risen and the water now reached their knees.

"Grab a life preserver!" cried the doctor. Silas now noticed that life preservers in large numbers were hanging within reach, on the sides of the houses. Evidently an emergency like the present one had been foreseen and prepared for, and the reporter's spirits rose. The fleeing crowd were all busily engaged in putting on their life preservers, and Silas and the doctor were not a moment too soon in adjusting theirs. Evidently a new portion of the roof had given way, for the water came pouring in, and the stream became so rapid, they were borne along at a terrific pace.

TO SAFETY

"Put on your helmet!" commanded the doctor.

To each life preserver a helmet containing a reservoir of compressed air was fastened. Provision had of course been made so that the air would be reduced to normal atmospheric pressure before being inhaled.

Silas lost no time in adjusting his head-piece, and, before he got it on, he realized the need of this protection, for the air in the street, compressed by the inflowing water, attained a pressure which made breathing difficult. It is a sudden change of pressure like this, that in under-water caissons, gives workmen attacks of "the bends."

At this moment a shriek from the woman with the baby called their attention to the fact that the mother burdened with the child had been unable to provide herself with life preservers or helmets. It was only with the greatest difficulty that Silas and the doctor managed to secure helmets for the two, and get the pair safely protected.

By this time the water was so high that everyone was afloat, borne rapidly forward by the swift current. Luckily their journey was nearly finished, for they came suddenly to the end of the passage where about a thousand persons were floating about, awaiting their turn to pass through a revolving door somewhat similar to those used in department stores.

The purpose of these doors was soon evident. Doctor Hackensaw, in planning Submarina, had foreseen the possibility of a catastrophe like the present one, and had built his city in water-tight compartments, like our modern trans-Atlantic liners. The ocean might burst its way into one of these compartments, but the inhabitants could take refuge in the others.

Communication between the compartments was made by means of revolving doors. On each side of the door was a completely en-

(Continued on page 916)

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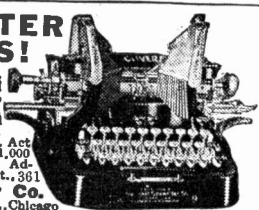
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The apparatus furnished are all of the best obtainable make and of standard laboratory size and shape.

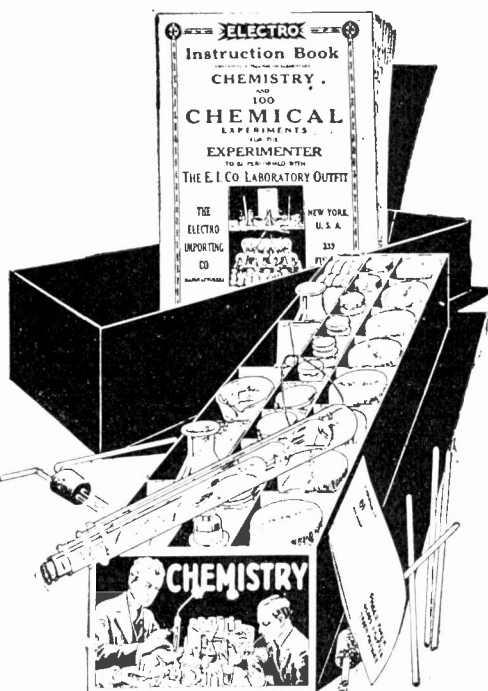
The Instruction Book is a real Chemistry Course for the Beginner. Some of the Contents are: Division of Matter: This is a Treatise on Elementary Chemistry and deals with the theory of the Elements, Molecules and Atoms, etc. Chemical Nomenclature: This explains in simple language the derivation of the chemical names of the elements and their compounds. There is a chapter on Laboratory Operations; Glass Working; First Aid; Fire Extinguishers; Experimenters' Aphorisms, etc.

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The following tables are furnished: Symbols and Atomic weights of the Elements; Measures of Weights, Volume, Capacity and Length; per cent solutions; Conversion of Measure expressed in parts; poisons and their antidotes; technical and common name of chemical substances; formulas for cleaning various substances, etc., etc.

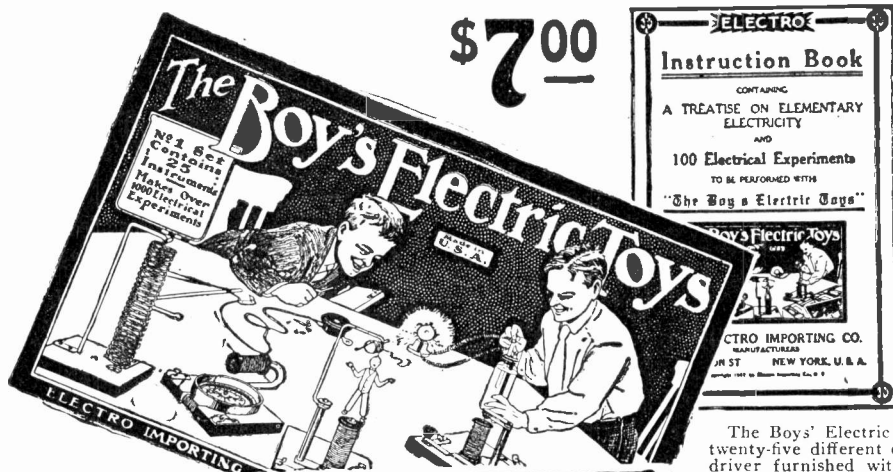
Among the 100 Experiments are:

How to make chemical tricks; How to make invisible and magic inks; How to test flour; How to test soil; How to make chlorine gas and smoke (German War Gas); How to bleach cloth and flowers. How to produce Oxygen and Hydrogen; How to make chemical colors; How to test Acids and Alkalies and hundreds of interesting hints and formulas.



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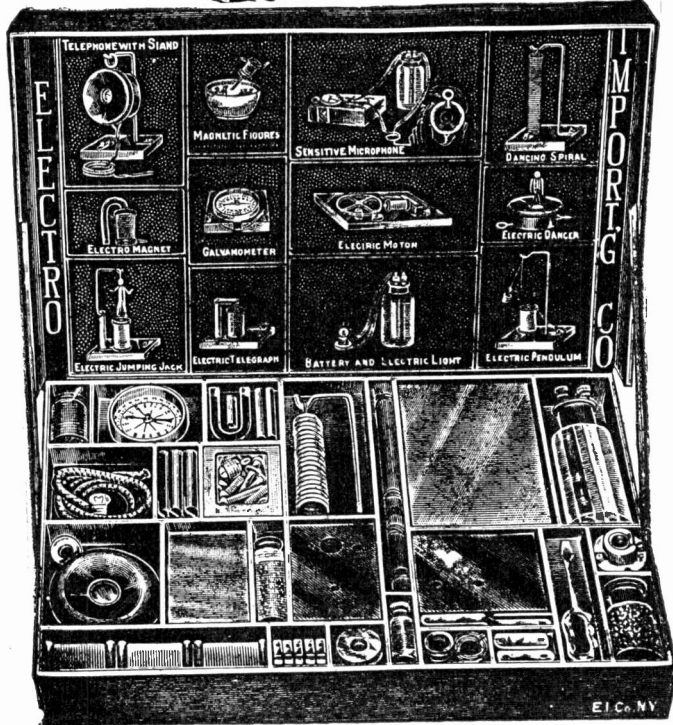
The size over all of the outfit is 14 x 9 x 2 3/4. Shipping weight, 8 pounds.

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We have so much confidence in these sets that we desire to ship either one to you by express C.O.D. with the privilege of inspection. In other words, we ship on approval. It does not cost you one cent to take a good look at whichever outfit you want, and see if it comes up to your expectations. If it does, pay the express man \$7.00, plus express charges. If not, you need not accept it, and we will pay the return charges as well.

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S. & I. -1-24

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Dr. Hackensaw's Secrets

(Continued from page 914)

closed platform hermetically tight, which held one hundred persons. Revolving this platform half way, brought it safely to the next unflooded portion of the city—the small amount of water in which the persons floated was of course carried with them, but was of no consequence.

While Silas and the doctor were waiting for their turn to pass through the door, the doctor showed the reporter an iron grating through which the ocean water was descending into an unused mine-shaft.

"You see," he explained, "I constructed my door here, in order that the current of water, flowing down into this shaft, should carry all refugees safely to this spot—the only place where safety lies."

Silas admired the ingenuity of the scheme, but he was shivering with the cold and glad to get somewhere where he could obtain dry clothing. But he had had enough of submarine cities, and when the doctor suggested returning to London, he acquiesced with alacrity.

"Submarine cities are very interesting," said he, "and they offer some novel experiences, but as for me, give me the sunlight and the open air!"

Correct Postures for Various Workers



The ill effects caused by the strain on workers who are forced to hold one position for hour on hour on account of the nature of their work or of the machine they operate has long been known. The U. S. Department of Health is conducting a campaign for the relief of this condition. In their circular letter "DBF," some of the most harmful of the positions are illustrated and remedies suggested. At the left is shown one of the most harmful. The woman at the machine is forced to stand with one side of her body contracted and the other expanded.



When workers are forced to sit on chairs too high to admit the feet touching the floor, a foot-rest on the order of the one shown above should be provided. If it is not, fatigue will result.

(Continued on page 928)

The Heavens in January

BY ISABEL M. LEWIS, M. A.

(Continued from page 878)

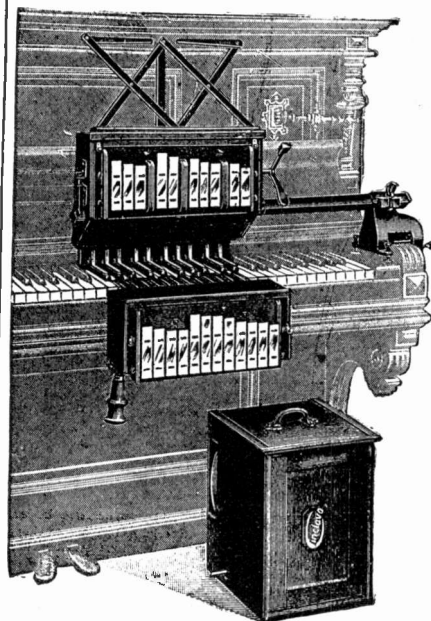
ual Orion or "helium" type as its bluish-white light indicates. The three evenly spaced stars that mark the Belt of Orion and the two stars Saiph and Bellatrix that form, with Betelgeuse and Rigel, the huge quadrilateral that outline the body of Orion are all second-magnitude stars. No other constellation contains so many brilliant stars or so many objects of exceptional interest. Most of the brightest stars in the group are either double or multiple stars and the possessor of a small telescope will find this a rich field to explore. The line of faint stars to the west of the quadrilateral represents the lion's skin that is flung over the left shoulder of Orion while the line of faint stars running northward from Betelgeuse and then turning sharply to the westward represents the uplifted arm of Orion and the club that he is brandishing. Its tip lies close to the horns of Taurus. Betelgeuse which is Arabic for armpit, is the star in the right shoulder of Orion.

It was the first star to be measured with the Michelson interferometer and its diameter is about two hundred and seventy-five times that of the sun. As to its distance from the earth there is some uncertainty but it is probably between one hundred and fifty and two hundred light years. In addition to its interest as a giant star, Betelgeuse is an irregularly variable star by as much as half a magnitude. The cause of its light variations are so far unexplained.

Close at the heels of Orion follow the two dogs, Canis Major and Canis Minor. Sirius, the brightest star in the heavens and one of the nearest stars—only eight and three-fourths light years away—is the principal star in Canis Major.

Venus is now a beautiful object in the west at sunset but sets about two hours after the sun. It is gradually approaching the earth and is slowly increasing in brightness. Mars, Jupiter and Saturn will all be found in the eastern sky before sunrise. It will be spring before they will be seen in the evening hours.

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The Month's Books

A digest of the general scientific publications issued during that period, with brief criticism.

THE OUTLINE OF SCIENCE. In four volumes. By J. Arthur Thompson. 1220 pages, profusely illustrated. Board. G. P. Putman's Sons, New York.

It would be one of the most profitable steps ever taken in education if the plan of the book—and the book itself, for that matter—were made a compulsory study in every college course. The first chapters of the work are given over to a brief survey of the universe and how the earth came into existence. Then follows a discussion of the theory of evolution and the ascent of man over the mammals and reptiles. Being written in the paragraphed form, it is very easily understood and the continuity of the discussion and the presentation of facts is clear and concise.

The process of evolution is thoroughly discussed; all phases of it are covered in a very understandable way. The first volume closes with a chapter on "The Foundation of the Universe," which opens with the story and theories of the atom. This chapter sets out the latest accepted ideas concerning the atom and the nucleus and electron theory of its construction.

The second volume takes up the body in its anatomical evolution.

Natural history under the headings of birds, mammals and insects is then discussed in outline. The outline form of the treatise gives the reader a clear understanding of the relations of the various forms of life to one another.

The second volume closes with a discussion of the workings of the mind—psychology. Its completeness is indicated by the fact that the Freudian theory is discussed.

Following this, at the beginning of the third volume, comes a chapter under the name of Sir Oliver Lodge on "Psychic Science," in which the famous Englishman presents his views. The facts are merely presented, the reader is asked to take nothing for granted. He may take it or leave it, according to his own opinion.

Then follows Botany and a very interesting discussion on the inter-relation of living creatures, biology, and a brief discussion of chemistry and electricity.

The fourth volume is more specialized in its scope, taking up the domestication of animals, the seasons, and the causes and signs of "weather." There is also a chapter on the Einstein Theory.

The work is printed in large type and its profuse illustrations lead to ease of assimilation of ideas, some of which may be new to the reader. The fact that it takes up the science of the world in its logical order and inter-relates all branches of it, makes it very valuable. Everyone interested in science should read it, if, for no other reason, than because it will help greatly to classify the maze of information he may collect on scientific subjects. It will organize his knowledge.

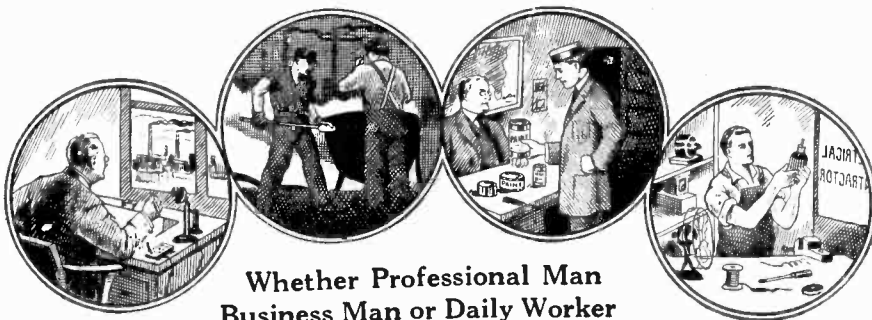
THE GLANDS REGULATING PERSONALITY. By Louis Berman, M. D., Associate in Biological Chemistry, Columbia University. Cloth. 300 pages. The MacMillan Co., N. Y.

Although a great deal that is bizarre and a lot more that is idiotic has been said about the glands of internal secretion, lately, in connection with the so-called youth restoring operations, there is nothing but close scientific discussion in this book. There is a short introduction on the general attitude toward human nature leading to a discussion of how the glands affect it. A short history of the discovery of the ductless glands follows and the research finally leading to the discovery of their important relation to the formation of character is described.

The thyroid and pituitary glands (the two most important of the ductless glands) are discussed. Here the situation, fluid of secretion, and their place in the scheme of evolution are commented upon. In each case, data, experiments and theory concerning them are set down in the manner of a scientist. There is nothing of the florid journalistic craze about the treatment of the subject.

Finally, toward the latter part of the book, a great many of the characters of history are discussed in relation to their glandular equipment—a new light in which to analyze the brilliant men of the world, possibly, but one that explains them quite thoroughly and accounts for many of their shortcomings and failures that otherwise have to be credited to "human nature."

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Chemistry should be as much a part of your mental equipment as the ability to calculate or to write correct English. The world is paying a thousandfold more for ideas than for actual labor. The big rewards go to the man who can show how to turn out a little better product at a little lower cost. And Chemistry will give you the ideas that will save money for yourself or your firm in the very fundamentals of your business. There is nothing remarkable about this; it is going on every day. If you have not heard of it before, it is because the general public has been slow to recognize the tremendous value of chemical training. People have been content to leave Chemistry in the hands of a few trained chemists who could not possibly develop the subject to anywhere near its greatest extent.

Now we are on the eve of a great awakening. Our heritage from the World War has been an intense development of the chemical industries in the United States and a tremendous interest in all the applications of Chemistry. People are taking up the subject merely for the good it will do them in their own line of business.

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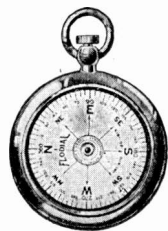
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FUNDAMENTALS OF RADIO. By J. L. Thomas. 207 pages, illustrated. Board. D. Van Nostrand Co., New York.

Beginning with a chapter that is called "Review of the Principles of Radio," the author explains very tersely, but in terms perfectly understandable to those who have the amateur's knowledge of electricity, the primary laws of radio. Following this, instruments and methods of measurement are taken up. The style of the book is concise and clear throughout, giving the reader the facts unadorned. There is no trouble in understanding the principles set out. Following the chapter on measurements he goes on through the theory of capacity and inductance and then into the principles of transmission and reception of signals. The book is very complete with tables and glossary, making it exceptionally valuable for the young amateur.

RELATIVITY AND MODERN PHYSICS. By George David Birkhoff and Rudolph Ernest Langer. Cloth, 283 pages. Harvard University Press, Cambridge, Mass.

Here we have a mathematical treatise on the relations of the Einstein theory to modern and classical physics. Although the two college professors who are its authors definitely assert in the preface that the minimum of technical matter is used in its presentation, the book, nevertheless, is composed by building one formula on another. The chief work of the book is a postulation of time and space in such a manner as to be a working basis for both the Einsteinian and classical theories.

The latter part of the book is given up to a discussion of various points of the two theories in connection with the problems of gravitation.

FUEL OIL IN INDUSTRY. By Stephen O. Andros. Cloth, 198 pages. Petroleum Extension University, Fort Wyane, Ind.

With the ever increasing vicissitudes that are besetting the coal industry and making the fuel supply for industries, as well as for householders, more and more hazardous, oil as a fuel is coming very much to the fore.

This little book discusses the problems of combustion and shows how commercial needs may be satisfied with oil fuel. Beginning with a sort of elementary treatise on combustion—inserted so the problems treated later in the book may be more thoroughly understood—the author passes on into the field of heavy oil as a fuel. There are chapters on the heat content of oil, the making of tests to ascertain the correct amount of air to be used with it and the correct design of fire-box in which the oil is to be burned.

There are also individual chapters dealing with the specific problems of combustion on railways and in steamships. The most important chapter, by far, to the most of us, is one dealing with the installation of oil burners in the home. This phase of the problem is treated fully and with great care. The ordinances of many cities regarding the storage of fuel oil are almost cruel in some localities. This question is also submitted to discussion.

This is the second edition of the book, rewritten and revised on account of the new factors added to the problem by constant fluctuation and almost ever-present instability of the coal market.

THE TYRANNY OF GOD. By Joseph Lewis. Board, 122 pages. Published by the Truth Publishing Co., New York.

This little volume directed against God and Nature is quite the silliest, inane thing that has come to the attention of this department in months. Not that the reviewer is not open minded to any system of proof. Quite the contrary. Whether the department believes in the statements and conclusions drawn by an author or not, it always respects straight thinking, and that is precisely what this book lacks. There's no thinking in it, at all; it's simply a collection of blind spleen.

For example, this Lewis says (in effect) that if there is a God, as most people say there is, and if this God is like what they say He is, He would not have made the human machine imperfect. Ergo, there is no God. Further, he says that the human race is only slightly removed from the stage of cannibalism because they still eat the flesh of animals.

That is as far as the reviewer read; he then threw the book into the waste-basket and went into the park across the street to let the sunshine and this same nature that Lewis deplores so, keep him from doing murder.

THE EARNING POWER OF RAILROADS. By Floyd W. Mundy. Leather. 442 pages. Jas. H. Oliphant and Co., New York.

This little book of statistics and notes deals with the financial engineering side of the railroad problem. In the financial statements, set out

at the opening of the book, is given the total capitalization, bonded indebtedness, and the yearly earnings, gross and net, of the roads of the United States and Canada. In the notes following the text, there is a large fund of information as to the present organizations, changes that have taken place during the last year, and comments on the general financial condition of the roads. This volume is the seventeenth annual edition.

BY WIRELESS FROM VENUS, or THE PRIMAL ELEMENTS. By Charles Henry Taylor. Board, 391 pages. The Planet Book Distributors, Los Angeles, Calif.

It is all settled, this question of Spiritualism. "By Wireless from Venus" settles it. In the introduction, the author states that the book is written in fictional form so it can more easily reach the minds of the readers. Why take it as fiction? It settles everything.

The author divides all life into two forces, namely electricity and viticity. The first is well known, the second is the author's great contribution to science. It's the vibration of life, he says, and the motive power of all life. All material things are electricity, all animate things are motivated by viticity, the author's discoveries. Simple, isn't it? He says the alleged phenomena of spiritualism, the work of mediums, spirit writings, and all such, are not miracles at all; says there is nothing mysterious about them, that they are simply the natural workings of the viticity.

But he not only settles the problems of the mind but also the problems of astronomy. The universe, we are told by him, is built around one central star about which all the suns revolve in their orbits and around which, in turn all the planets and their satellites revolve. Quite simple, the universe.

INSECTICIDES AND FUNGICIDES; SPRAYING AND DUSTING EQUIPMENT. A Laboratory Manual with Supplementary Text Material. By O. G. Anderson, Professor of Horticulture, Purdue University and F. C. Roth, Instructor in Horticulture, Purdue University. Cloth, 337 pages, illustrated.

This manual offers instruction in preparing insecticides and fungicides as applied to horticultural crops. A detailed study of spraying and dusting equipment is also included, and this subject is treated from the standpoint of those who must use these appliances. Aside from its value as a general reference, that portion of the book which deals with appliances, and their efficient operation, will be of special interest to park superintendents, nurserymen, and county agents. A new treatment of the subject is also offered to those engaged in the manufacture and distribution of spray and dust materials and machinery.

Special ingredients, methods and equipment are discussed, and reasons for a rise or decline in their usefulness are given.

In the interest of the reader, whose knowledge of chemistry is limited, the authors have presented the subject in simple form, using few technical terms.

A series of exercises, requiring the student to work with his hands, as well as with his head, adds to the usefulness of the manual.

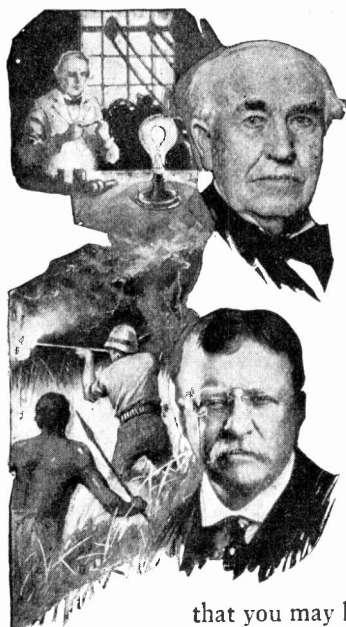
HANDBOOK OF CHEMISTRY AND PHYSICS. By Charles D. Hodgman, M. S., and Norbert A. Lange, Ph.D., size 6 3/4"x4 1/4". Flexible cloth covers, 803 pages. Published by Chemical Rubber Publishing Co., Cleveland, Ohio.

This book, now in its ninth edition, has been compiled from the most authentic sources of chemistry and physics and is getting better and better with each successive edition. It gives promise of extending through many more editions, each one being better than the last.

The scope of work which this book covers is so great that no one interested in chemistry, physics, electricity, or in fact science of any kind, can afford to be without it. It covers such topics as mathematical tables, tables of general information, including international atomic weights and various different kinds of solutions. It enters into the various properties of matter giving boiling points, constants of elasticity, co-efficients of friction and all other properties of the various materials used in everyday life and scientific pursuits.

Expansion and contraction due to heat and cold is also dealt with in the form of tables listing almost every substance which the scientist would have to work with, hygrometric and barometric tables are given which become very useful in the study of weather conditions.

Under the chapter entitled "Electricity and Magnetism," tables of all kinds will be found giving sizes of wire with resistances and other characteristics too numerous to mention.



Miracle Men of Science

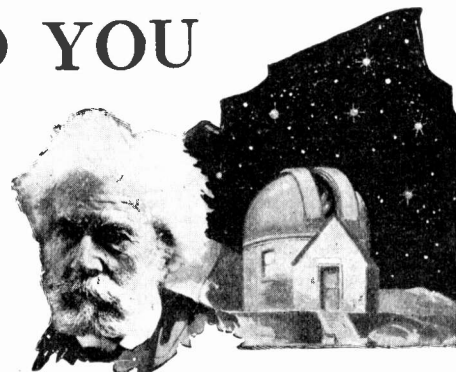
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Light is also dealt with in a very comprehensive manner and under the chapter on Miscellaneous Tables are found such things as Röntgen Rays, Meteorological Data, Acceleration of Falling Bodies, etc. Two chapters are devoted to Formulas, one to Laboratory Receipts and the other to Photographic Formulae.

By means of a very complete table of contents and index it is possible to locate very quickly any desired subject in the book.

THE FACE OF THE EARTH AS SEEN FROM THE AIR. By Willis T. Lee. Illustrated, 110 pages. Hard cloth covers, size 10"x7". Published by American Geographical Society, New York City.

Within the covers of this book is found one of the most complete collections of aerial photographs ever gathered together in one volume. The book is printed on coated stock which lends itself very well to the reproduction of the various photographs. The pictures are by far the outstanding feature of the work and as an introduction, the first photograph in the book is one of the National Capitol, at Washington, D. C., taken from the air. The details in the photographs are marvelous and the methods of taking the various ones used for illustrations are thoroughly covered. Composite photographs are also dealt with and the relationship between landscape-gardening and aerial photography is well put forth. A further chapter deals with the making of maps from aerial photographs and the value of such pictures is well put forth. Maps of portions of mud flats inaccessible to surveyors are shown.

To anyone interested in photography of any kind or in map making and general geology work, this volume is of inestimable value.

500 QUESTIONS AND ANSWERS TO STEAM HEATING. By Alfred G. King. Illustrated, 253 pages. Hard cloth covers, size 9"x6". Published by The Norman W. Henley Publishing Company, New York City.

This book in a thoroughly revised and enlarged second edition has been arranged for the use of all engaged in the business of steam, hot water heating and ventilation. It is well illustrated throughout and the text is arranged in a question and answer form, making reference to various parts exceedingly easy. A table of contents and an index records everything contained in the book and assists in locating various subjects. "Tricks of the Trade" for shop use and of general usefulness to anyone engaged in this business are given in a simple and concise form and the reader is informed on various other subjects such as how to get heating contracts, how to install heating and ventilating apparatus and the best possible methods to be used in connection with such work.

The book also describes all the principal heating systems using hot water and steam and includes chapters on up-to-date methods of ventilation and the application of the fan to both heating and ventilating.

PROBLEMS OF MODERN SCIENCE. Edited by Arthur Dendy, D.Sc. F.R.S. Size 8½"x5½". Hard cloth covers, 236 pages. Published by Henry Holt & Co., New York City.

In this work the editor has brought together a series of papers presented before the Kings College of London, England, by authorities on various subjects. They are presented in a concise form and in a manner meant for the advanced student and scientist. The subjects covered are mathematics, astronomy, physics, organic chemistry, biology, botany, physiology and anatomy.

Each one of the above subjects is covered in a manner meant to bring forth the most important points in each particular subject and the various authors of the papers have succeeded admirably. The only fault which we find with this book is that it contains no index. The only hint which one gets as to the contents of the book is a list of the subjects as given above. To find any particular part, one must go through the entire chapter on the particular subject.

PRACTICAL PRINTING PROCESSES. By Frank R. Fraprie, S.M., F.R.P.S. Size 7½"x4¾". Hard cloth covers, 56 pages. Published by American Photographic Publishing Company, Boston, Mass.

This book, No. 10 of the Practical Photography series, has already run over 18,000 copies and in this latest edition has been completely revised and enlarged.

Various photographic printing processes are dealt with in the order of their importance and the reader is led through various processes up to the



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most complicated. The book opens with several pages on general instructions, cautioning the photographer on the importance of cleanliness in photographic work. Blue prints and printing-out papers are then dealt with and formulas given for the making of blue print paper and transparencies. This method of presentation is continued throughout the book and it is replete with formulas setting forth the methods for preparing various printing papers as well as other formulas for the preparation of developers and fixing baths. Directions for sepia toning processes are also given as are directions for applying the same to all kinds of paper.

Throughout the whole each page is full of hints for the photographer and the book should be in the possession of anyone interested in this work. Its one drawback is a complete lack of any table of contents or index but as each page is headed with a description of the information given on that page, the reader will not find much trouble in locating the particular part which he desires.

DISCOVERIES AND INVENTIONS OF THE TWENTIETH CENTURY.
By Edward Cressey. Illustrated, 453 pages. Hard cloth covers. Size 8 1/4" x 5 1/4". Published by E. P. Dutton & Co., New York City

This book dealing with the various inventions and discoveries of the past twenty-three years is very well compiled and illustrated. Some of the subjects touched on are the development of steam, gas and oil for power, the various developments of gasoline engines, the latest advances in generation and transmission of electricity, improved electric lighting and heating systems, new developments in artificial refrigeration, the latest discoveries in chemistry, the motor car up-to-date, aeronautics, wireless telegraphy and telephony and high speed photography. The chapter on aeronautics is well worth special mention as not only the theory of transportation through the air is dealt with, but photographs of the various latest types of airplanes and dirigibles are shown. The chapter on wireless telegraphy and telephony is practically the same as found in the first chapter of any standard radio hand-book, dealing as it does with the early days of radio history and touching lightly upon some of the newer developments.

Taken as a whole, the book is one which should interest any student of general science.

THE BOOK OF WIRELESS TELEGRAPH & TELEPHONE. By A. Frederick Collins. Illustrated, 227 pages. Hard cloth covers. Published by D. Appleton and Company, New York.

This book is one which should appeal to every student of radio telegraphy and telephony as well as to the broadcast listener. It begins with a short explanation of the simplest types of radio telegraph transmitters and receivers explaining carefully how each piece of apparatus is to be constructed. The text goes on to deal with the construction of an antenna and the learning of the code. A complete chapter is devoted to the subject of how wireless works and analogies are used to illustrate the various points. The drawings used in connection with this book are exceedingly plain and easily understood. Commercial transmitters and receivers are dealt with in a comprehensive manner and certain parts of the chapter on receiving instruments will interest the how-to-make-it fan very greatly. Several instruments are thoroughly described in detail and all the necessary information for their construction is given. The theory of tuning is dealt with in very concise and plain manner and the subject of continuous wave transmission and reception is thoroughly covered.

The design and construction of vacuum tube transmitters as well as the theory of their operation is set forth in separate chapters and the book ends with a chapter of useful information giving rules and regulations for the operation of radio apparatus. An appendix of terms used in radio work makes the book quite valuable to all those interested in the subject. A complete index also adds to the usefulness of the book.

THE MEANING OF RELATIVITY.
By Albert Einstein. 119 pages. Hard cloth covers, size 7 1/4" x 5". Published by Princeton University Press, Princeton, N. J.

This is a book written as only Professor Albert Einstein can write. To anyone interested enough in the subject of relativity to go into the necessary calculus, this book will be a veritable gold mine. It consists of four chapters, namely Space and Time in Pre-Relativity Physics, The Theory of Special Relativity, The General Theory of Relativity and The General Theory of Relativity, continued. The book is entirely filled with pages of abstruse mathematical calculations which render it very valuable in the understanding of the more complicated parts of the meaning of relativity. If it is true, and it has been

(Continued on page 927)



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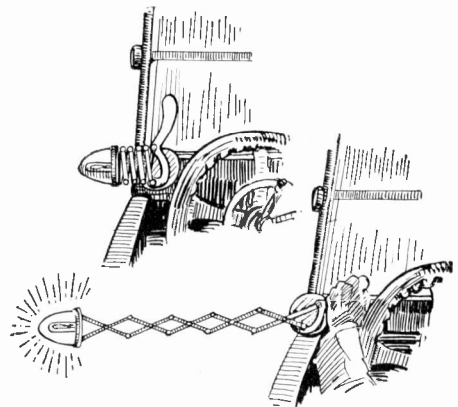
Should advice be desired by mail a nominal charge of \$1.00 is made for each question. Sketches and descriptions must be clear and explicit. Only one side of sheet should be written on.

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.

TURN INDICATOR

(759) A. Levine, Los Angeles, Cal., requests our opinion of an automobile right and left turn indicator made as shown.

A. We do not advise applying for a patent upon your automobile extension light, for indicating right and left turns, for the simple reason that such extension arms have not met with very great favor. Here in New York signaling devices of this nature, entirely automatic, and operating from the clutch for the stop signal, and from the wheel for the right and left turn, are being sold very cheaply. Indicators of the nature you describe have not met with very favorable markets. Attempting to place this device upon the market is a gambling venture which we do not advise you to undertake.



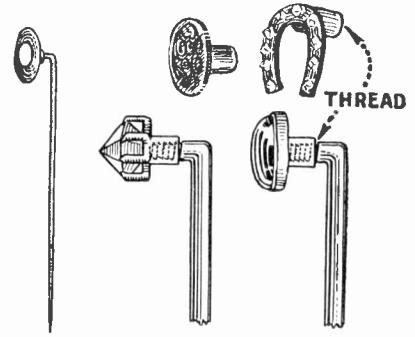
Some auto turn indicators similar to the above are manufactured at present and haven't found a healthy market.

DOUBLE PHONOGRAPH RECORD

(760) Samuel H. Landis, Lane, Pa., asks why phonographic records are not made so that one song can be played with a hill and dale producer and another with a lateral cut producer, both on the same face of the same record.

A. We can answer your question very simply. Take a hill and dale record, place it upon your phonograph, and set your needle to play laterally cut records. You will find that, regardless of what you do, you will get a sound. Reverse the process, and use laterally cut record with a hill and dale reproducer, and again you will reproduce music

with a great many distortions and scratching noises. Consequently, your device, although of interest, could not very well be perfected, because of the fact that both records would be heard simultaneously, one a little weaker than the other.

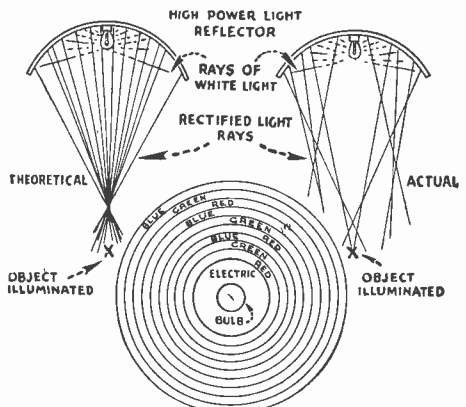


Tie-pins with removable heads like the above could hardly be sold "by the millions" as the inventor asserts.

REMOVABLE TIE PIN STONES

(761) William King, Womessen, Pa., asks us what we think of the idea of making tie pins so that the stones or fronts can be removed.

A. We have recently advised four individuals against trying to patent either removable stones for tie pins, or removable tie pin fronts. We do not agree with you when you state that the pins could be sold by the millions.



For portraying articles in their day-light colors the above device is good if it will work, actually.

NATURAL LIGHT REFLECTOR

(762) Don Lowery, Moundsville, Fla., asks whether a lamp for interior decorating made as shown, would give objects their true lustre.

A. We do not believe that the reflector which you have designed will have any effect whatever, and it is our opinion that instead of giving objects their true lustre, the reflector will throw a series of concentric colored bands upon the object toward which it is turned.

The experiment is nevertheless, not too costly to try and we would suggest that you build a model before proceeding further. An absolutely perfect parabolic reflector and pure white light are necessary in this test.

(Continued on page 924)

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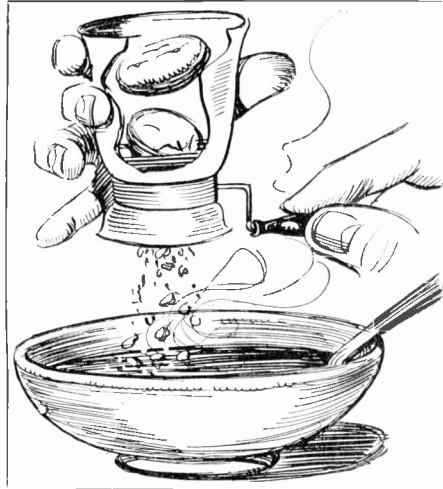
(Continued from page 922)

INDIVIDUAL CRACKER CRUSHER

(763) John Lisinski, Mt. Carmel, Pa., asks our opinion of an individual cracker crusher for restaurants.

A. Modern restaurants have regular cracker crushers. Some of the smaller restaurants are using a small ringer for this purpose. In neither case are these cracker crushers put to any great use because crushed crackers are not being served in restaurants, it being considered more refined to serve the whole cracker, and except in cakes or stuffings, the crushed material is not of value. If crushed crackers are desired, restaurants can purchase them in cartons all ready in a crushed and sifted form, so that all the granules are uniform in size.

We would not suggest applying for patent on the invention here described.



Since whole crackers are served in restaurants and since very few people crush them when eating, the above idea is hardly valuable.

VACUUM WINDOW GLASS

(764) S. A. Lind, Alameda, Cal., asks us for our opinion on a window glass made of two panes sealed at the edges and the air exhausted.

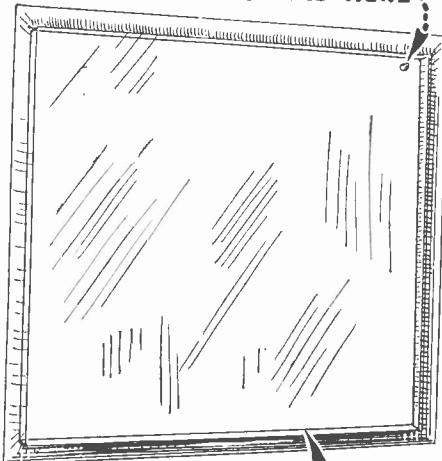
A. Our opinion of a double sheet pane of glass with a vacuum between the individual sheets is very poor indeed.

In the first place such glass could not be cut and made to fit various sized window frames. Consequently, an immense amount of glass would have to be kept in stock.

In the second place, this glass is liable to breakage to a greater extent than ordinary window glass, due to the fact that the point at which the glass is exhausted must be much thinner than other portions of the glass. Furthermore, glass of this nature cannot be made to fit ordinary frames, because of the exhausting projection; the sheets of glass, unless very thin indeed, would have different amounts of expansion, due to the fact that one side is being heated while the other is kept cool. Last but not least, the expense of manufacture is prohibitive. Atmospheric pressure would tend to break the panes.

The idea is, as stated before, not practical, and we would not advise applying for a patent.

AIR EVACUATED HERE



VACUUM

A window pane made of two glass sheets sealed and the air exhausted is not practical for a number of reasons.

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A THEORY BASED ON MISTAKEN IMPRESSIONS

(765) M. Knickerbocker, Mokena, Ill., has evolved a theory in which radio waves are to be focussed to one spot. He assimilates radio waves to light waves and sound waves and asserts that wireless waves are reflected by a convex mirror.

A. Radio waves transmitted through the ether cannot be focussed the same as light or heat waves. The waves pass through glass very readily. The vibrations differ from sound in wave-length, medium of transmission and speed of travel. Sound waves travel at a rate of roughly 1,190 ft. per second through the air, with an additional speed of 2 ft. more per second for every degree rise in temperature of the surrounding atmosphere over zero C. Electricity on the other hand, travels at 186,500 miles per second. Temperature has no effect upon its speed of travel; at least normal temperature variations do not effect it. The ether is the medium of its transmission.

Sound travels better in denser mediums, traveling 1,315 ft. per second in water at 0° C, whereas radio does not change its speed, as it always has the same medium of transmission.

CLOTHES HANGER AND REMOVABLE STONES FOR TIE PINS

(766) William E. King, Monesseu, Pa., asks for advice on two ideas. The first is a hanger for garments; the second is a suggestion for removable stones for tie pins.

A. In our opinion, the suggestions advanced by you are about half good. Coat hangers such as you have designed, may without a doubt, be very easily constructed, but the grip arrangement which you intend to use for holding light clothes, is a very undesirable feature. A slight tug at the flimsy garment, if held on one of these coat hangers, would tear it, thus destroying the garment's further usefulness. A far better suggestion would be to employ a rubber pad, fitted with a steel spring, under which the garment could be held. Needless to say, the garment hangers of your particular design and construction, are rather expensive, even though you have worked out the manufacturing details to a very great extent.

Less favorable is your idea of inter-changeable tie pins. It is much easier to retain a tie pin which is a complete unit, than it is to hold on to a separable device. The cost of the shank alone in these tie pins is practically negligible, and it is the stone or the finer design or figure which is the most valuable part of pins. Therefore, your inter-changeable mechanism, will not reduce the cost of the tie pins to a very great extent, and the undesirable feature is that each change has to conform to the same general tie pin shape. Open-work tie pins could not be employed or attached to your device.

You see, therefore, that we do not have very much faith in either of your two ideas, and would be skeptical toward advising you to apply for a patent on either.

CLOCK-WORK OPERATED MECHANISM

(767) Everett A. Manning, Decatur, Ill., asks if he can patent a device depending on a clock mechanism for its operation.

A. Of course, a device using the works of an alarm clock for its functioning, and depending solely upon the running of the clock for its operation could be patented if otherwise conforming to statute.

If it depends upon one particular style of clock, then it is an entirely different matter, but inasmuch as nearly all clocks run and most are equipped with alarms, and inasmuch as the patents on clocks or clock mechanisms are so old that they have long become public property, we see absolutely no reason for your not placing your device upon the market, if it is worth while.

IGNITION CUT-OFF

(768) L. L. Meyer, Lead, So. Dakota, has designed a thermostatically controlled device for automobiles which will cut off the ignition as soon as the temperature of the water of the cooling system reaches a predetermined point.

A. In your communication, requesting patent advice, you have given a design of rather ingenious principle, but upon which we cannot favorably comment. There are many reasons for this, a few of which may suffice.

It would be very undesirable, for instance, to install one of these systems upon a car, and after driving in low gear, as through country towns, so as to heat up the motor considerably, and after finally reaching a ferry pier or railroad crossing, or an intersection in a busy street, to have this automatic device turn off the ignition and stop the car dead. It may be that the driver had attempted to cross the railroad tracks before the gates were lowered, and an approaching train was bearing down upon him, enabling him to cross the track ordinarily in safety, but because the ignition went dead, to stall, and perhaps send the car's occupants into the region of the Great Beyond. This is not a very satisfactory outlook, we can assure you. If your device is merely to sound an alarm, then it will have no value either. The system is far more expensive than the motometer, both to install and to operate, the latter requiring no energy of any sort, while your system consumes current constantly.

In our opinion such a system would never find a favorable market.

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PERPETUAL MOTION

(769) Joseph McDonal, Providence, R. I., asks to whom he could apply for bona-fide advice on perpetual motion.

A. You may feel free to discuss your perpetual motion plan with us, and we will give you the best advice possible. We do not hold the inventor of a perpetual motion machine up to ridicule and scorn, and neither do we deride an inventor for his opinion. We try to explain the matter as clearly as possible, although at times we find it rather difficult to convince perpetual motion inventors that the machine they have designed is impossible of operation.

If you will make your sketch clear, and give us your own reasoning on the subject, we will attempt to point out your error, if such exists.

PATENT ATTORNEY VS. INVENTOR

(770) R. J. Mark, Lincoln, Neb., asks if a questionnaire which he has received from a patent attorney, should be filled out and if the attorney intends to steal the idea if it should be filled out.

A. We do not believe the patent firm means anything in sending you the questionnaire. All questionnaires of this nature are required by certain firms to be executed merely for convenience, not because of any attempt to steal the idea. The main point at issue is that they desire to determine whether or not you have fully protected yourself, so we would advise you to make a truthful reply to the questions, and if the device originated fourteen or eighteen years ago, state so. Be sure, however, that you claim the day of the making of the first sketch, etc., and also the date when the model was built.

HOTEL LOCK AND TIE PINS

(771) A. Lippert, Toronto, Canada, asks us for advice on a duplex lock for hotels which can be opened from the outside even though the key is in the lock, and if he should patent two safety tie-pin shanks.

A. We do not believe that your idea of a hotel lock will have any value for the simple reason that if the hotel lock can be opened from the outside, regardless of whether patron's key is in the lock or not, thieves with pass-keys could easily open the lock. If electric circuits were placed upon the lock so that any attempt to tamper with it while there is a patron sleeping inside the room would alarm the sleeper, then those circuits, or the bell could be destroyed. Besides there are about fourteen different attachments made for ten cents each to be slipped between the door jams and the door, which permit the placing of a small catch across the back of the door, securely locking the door and preventing intrusion. Consequently, your dual lock would be worthless.

With reference to your wavy pins, and your other stick pins, we would state that the former style is not new at all, having been in use a great many years. It is now practically obsolete. The pin with the small V may be of some value, but we doubt very much if it will meet with any degree of favor, in that the structure of the pin is such as to tear ties in an attempt to extract the pin. It would require considerable fussing to loosen a good quality silk tie from the pin, and even more fussing if the user were wearing a heavy crocheted neck tie.

ROTARY GAS ENGINE.

(772) A. H. Phillips, Hulberton, N. Y., submitted a model of a rotary gas engine, the details of which are omitted for the protection of the inventor. The blades of the turbine revolve and form their own explosion chambers, but the manner in which they did so, was very unique.

A. Of the thousands of patent advice inquiries which we receive, regarding rotary gasoline motors, the one submitted by you is better than any which have thus far been called to our attention. We do not doubt that if this patent is properly handled, a very clever motor would be developed, which is bound to "take" but it will require considerable money to do this. We would suggest that you have a full-size model built after you have secured the proper patents. There are several details which will have to be worked out, namely, the method of making the vents tight and the control of the gears. Your descriptions are extremely clear, and for the crude model you have designed and built, its working principles are clearly explained. We wish you the best of success in your venture.

STATIC ELIMINATOR.

(773) Leonard Peulter, Fort William, Ont., Canada, has designed a static eliminator for radio sets made in the form of ebonite and wax rods. He states that these substances conduct static electricity and are used as insulators in radio sets. He then illustrates his theory by a physical experiment.

A. The static eliminator which you have devised may suggest a possibility to you, but is a complete absurdity to any one who knows what static electricity is. Static electricity is not conducted by hard rubber, bakelite, glass or resin. It is, nevertheless, charged upon the surfaces of these materials when they are rubbed with proper substances, and metal is used to lead the charge off. Consequently, metal combs and brushes are used in static machines to collect electricity formed on the plates.

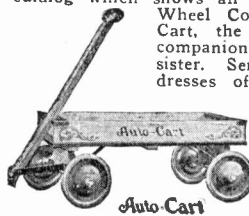


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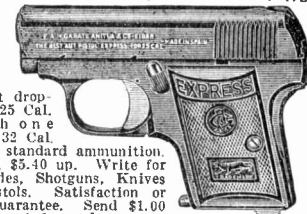
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Book Review

(Continued from page 921)

said many times, that there are only twelve men in this world that understand relativity, here is each one's chance to learn of this subject if they are willing to go through the deep calculus computations given in this book. A complete index gives ready references to the various calculations and other rules set forth in the book.

LABORATORY MANUAL OF PHYSICAL CHEMISTRY. By Davison and Van Klooster. 182 pages, hard cloth covers, size 9 1/4"x6". Published by John Wiley & Sons, New York City.

This book is one which is used in the physical chemistry laboratory of the Rensselaer Polytechnic Institute and other colleges of this country. It outlines twenty-four useful experiments in physical chemistry, many of the exercises being those which are not found in other works of the same nature. The book will make a valuable addition to the library of any chemical student as each experiment is thoroughly described and the necessary information for the completion of the same is given.

The last few pages of the book are devoted to tables which will be of constant use to the performer of the experiments outlined in the volume, and following these tables will be found blank pages of graph paper for the construction of curves plotted from the experiments performed. For easy reference, each experiment is listed with its page number in the table of contents. In order that the experimenter may have full information on the work, a list of reference books is given from which he can obtain further information on the work at hand.

RADIO-PHONE RECEIVING. By Erich Hausmann, Sc.D., Alfred N. Goldsmith, Ph.D., Louis A. Hazeltine, M. E., John V. L. Hogan, John H. Morecroft, E. E., Frank E. Canavaciol, E. E., Robert D. Gibson, E. E., Paul C. Hoernel, E. E., and Michael I. Pupin, Ph.D., Sc.D., L.L. D. Illustrated, 183 pages, hard cloth covers, size 7 1/2"x4 3/4". Published by D. Van Nostrand Co., New York City.

This book, written by nine experts in the radio field is a clear and concise explanation of the phenomena and theory of radio. Each expert has written on a subject for which he is most noted and, therefore, the cream of radio knowledge is presented to the reader. The tuning of the radio receiving circuit is very clearly explained as is also the theory and practice of reception with the use of crystal detectors.

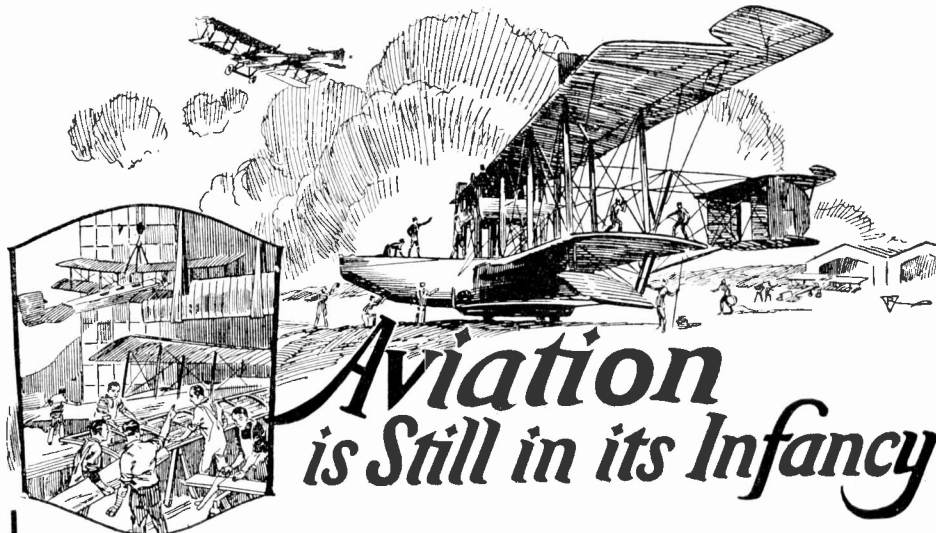
The vacuum tube detector and amplifier is dealt with in a manner which presents it in the easiest manner to the amateur. Amplification is put forth in theory and practice and the regenerative and heterodyne circuits are fully explained.

The growth of radio phone broadcasting and its value to the public is mentioned and a complete chapter is devoted to this work. In this latter chapter an insight is given into the workings of a radio phone broadcasting station.

Taken all in all the book is one which would be well worth reading by the amateur as well as the broadcast listener as it will give a better knowledge of the workings of all types of radio apparatus.

WRINKLES WANTED

HAVE you solved a knotty problem in your radio set in an extremely simple way? Have you found a short-cut in construction that saves times and worry? If you have, why not give the host of amateurs the benefit of your idea and at the same time benefit yourself? In the **RADIO WRINKLES** columns of **SCIENCE AND INVENTION** there are numbers of these ideas published every month. The ideas must be furnished by the amateurs and experimenters actually engaged in the work of constructing and experimenting with radio sets. **AND DON'T FORGET.** The regular \$1,000 in prizes given monthly by this magazine is available to contributors to this department.



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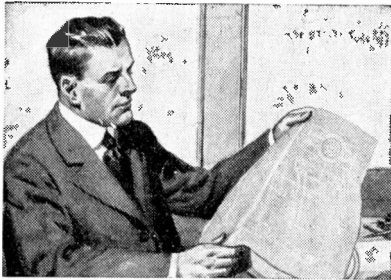
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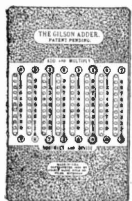
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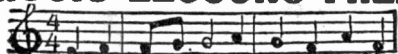


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Correct Postures for Various Workers

(Continued from page 916)



Aside from foot rests, one of the most important things to the worker who is forced to sit in one place in more or less the same position for a whole day at a time, is a back support of some kind. Where there is no back rest and the feet are forced to hang without touching the floor more fatigue may result from sitting all day than from standing. Aside from the tiring effect of the position it has a tendency to form a curvature in the body that causes cramping of the upper organs on the diaphragm and the digestive tract.



One of the most advisable arrangements that can be made for the health of the workers is to arrange the benches or work tables so that they may be used either in the sitting or the standing position. Above is shown such a desk fitted to the proper height and supplied with the proper foot rest. The stool, it will be noticed, also has a convenient back rest. This is the best design for certain office and laboratory or shop furniture. It will cause the minimum of fatigue.



When workers are forced to sit in cramped positions it is best to change the nature of their work at short intervals and to change it in such a way that each succeeding position will tend to rectify the effects of the previous one. For instance, if the worker is required to lean forward on one piece of work, it should be arranged so that she may stand more or less straight at the next one. Also there should be frequent rest periods in the day's routine.

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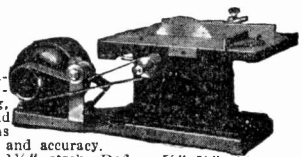
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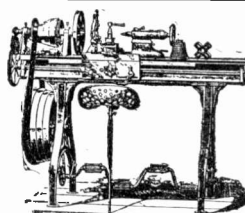
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Answers to Scientific Puzzles
(Continued from page 880)

THE DRUGGIST'S BALANCE

A NUMERICAL example will perhaps illustrate most clearly the effect of inequality in length of the arms of a beam or platform balance. Suppose for simplicity that one arm is 12 inches long and the other only 6 and that the druggist wants to weigh out 10 oz. of material. If he places a ten ounce weight on the long arm of the balance he will have to counter-balance it with 20 oz. of material which he will sell for the price of 10 oz. But if he places the weight on the short arm he will have to balance it with only 5 oz. of material which again he will sell for the price of 10 oz. On the average, then, he will dispense 25 oz. of material at the price of 20 oz. which means a constant loss on account of the imperfection in the balance.

A QUESTION OF ELASTICITY

In general a glass ball will bound much better than a rubber ball provided of course that the former does not chip or break in the process. This is because glass, contrary to common opinion, is far more elastic than rubber. By elasticity, it should be remembered, we do not mean stretchableness, for in that sense taffy would be very elastic indeed. To be elastic a body must have a tendency to recover its original shape quickly after being distorted, in which sense glass is surprisingly elastic notwithstanding its great brittleness which sometimes gives us a contrary impression.

THE PROBLEM OF THE SWIMMERS

Let V be the speed of swimmers in still water,

V_1 the speed of the stream,

and D the distance to the turning point.

Then the speed of the swimmer going downstream is $V + V_1$ and his speed upstream $V - V_1$. The time required to make the complete trip downstream and back will

$$\text{be } t_1 = \frac{D}{V + V_1} + \frac{D}{V - V_1} = \frac{DV - DV_1 + DV + DV_1}{V^2 - V_1^2} = \frac{2DV}{V^2 - V_1^2}$$

The other swimmer, who swims across the stream, makes the same speed both ways, but his net speed is not equal to that in still water, for he must constantly swim upstream a little to avoid being carried down by the current. Adopting the notation used above, the speed of the swimmer going across the current will be $V_2 = \sqrt{V^2 - V_1^2}$, and the time required to make the complete

trip will be $t_2 = \frac{2D}{\sqrt{V^2 - V_1^2}}$

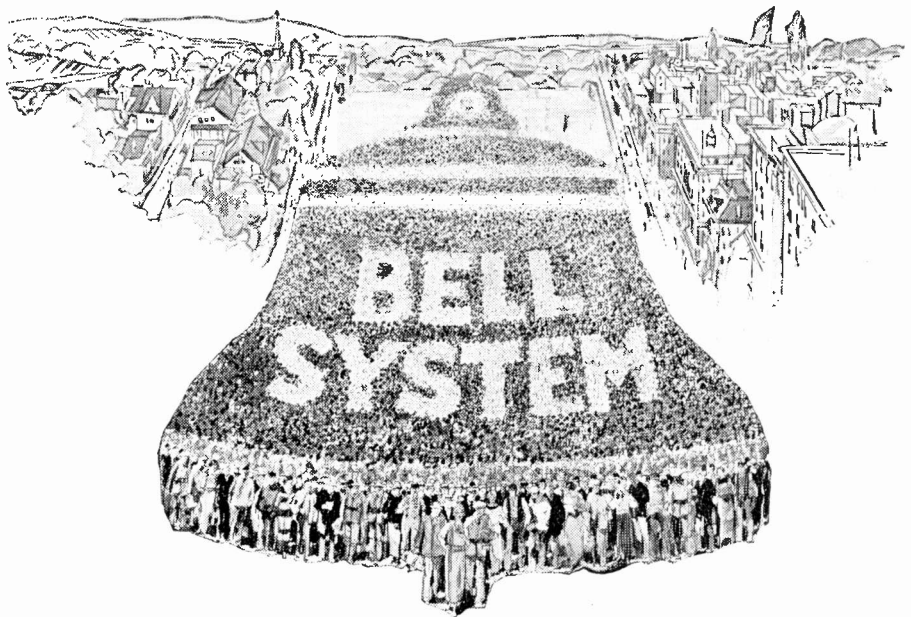
On dividing the expression for t_1 by the expression for t_2 we see that

$$\frac{t_1}{t_2} = \frac{\frac{2DV}{V^2 - V_1^2}}{\frac{2D}{\sqrt{V^2 - V_1^2}}} = \frac{V}{\sqrt{V^2 - V_1^2}}$$

From an inspection of this last equation it is apparent that the denominator of the right hand number is less than the numerator for any positive value of V_1 , the velocity of the stream. Hence t_2 is less than t_1 which indicates that the swimmer going across the stream should win the race.

WEIGHING THE COAL

The answer to this problem depends upon whether the platform of the scales was above the level of the ground, on the level of the ground, or below the level of the ground when two of the wheels of the wagon were



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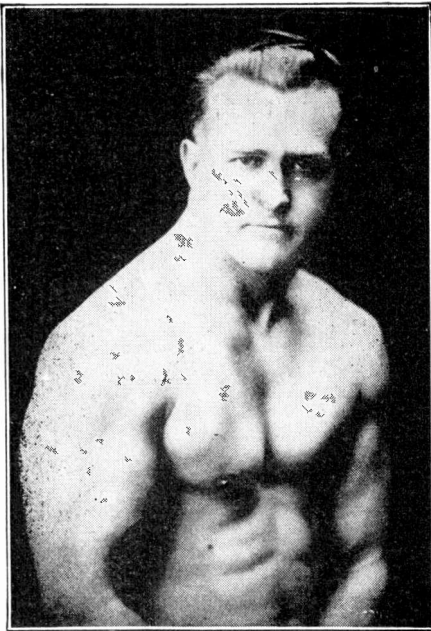
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If a man stood on the house-tops and shouted to the people that he was the strongest man on earth, it would avail him nothing. Someone would make him come down and prove it. But records speak for themselves. I will gladly show anyone personal letters from the leading strong men in the world today that my course is absolutely the best and the quickest to acquire physical perfection. Come on then and make me prove it—I like it. I have the means of making you a perfect physical specimen of manhood, of making you a successful leader of men. You will be a credit to your community. I have done this for thousands of others. What I have done for them I will do for you. I don't care what your present condition is. The weaker you are, the more noticeable the results. Come on then, start the New Year right.

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on the platform. The man's method of weighing would be all right provided the platform were even with the ground when the weighing was being done, otherwise a preponderance of the weight of the wagon and load would be thrown either upon the scales or upon the ground, in one case making the apparent weight too great and in the other too low.

A FEW EXPERIMENTS IN AN ELEVATOR

(a) According to the theory of relativity a person moving with a constant velocity in a straight line cannot possibly detect his motion without performing an experiment on some other system. For example, though the solar system is in motion toward a certain star in the constellation of Hercules not only are we not in the least conscious of this fact, but no apparent departure from the laws of mechanics can be noted on account of this motion. The only knowledge we have of this velocity comes from observations of the light from various stars, that is, from an experiment on another system. So unless the man in the elevator has some means of getting information from outside his cage, he might be travelling with a terrific speed without suspecting it.

(b) If a man were standing on weighing scales when the cables supporting the elevator broke, the cage would at once fall by the acceleration due to gravitation (32.2 ft. per sec.). All objects in the cage would have a tendency to fall at the same rate and hence for the time they would lose all weight. The springs of the scales would then recoil and probably drive the man from the platform to the top of the elevator where he might remain for the rest of the trip.

(c) If the man in the elevator tried to pour out a pitcher of water while the elevator was falling it is evident that the pitcher and water would both fall at the same rate and so no water would flow out. He might, of course, invert the pitcher and then raise it suddenly, thereby leaving a sheet of water apparently suspended from the mouth of the receptacle.

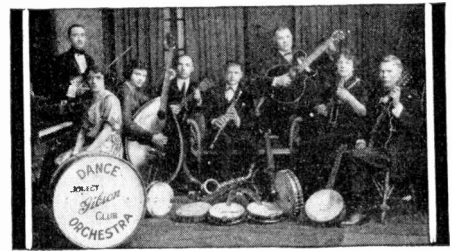
WHY PUT BOILED EGGS IN COLD WATER?

All objects have a tendency to contract on being cooled. The contents of an egg, however, will contract more than the shell and hence will pull loose from the latter when the hot egg is placed in cold water. This, obviously enough, makes the egg easier to peel.

A CAUTION TO RADIOPHONE FANS

The radio signals which are obtained with telephone and telegraph line aerials are usually very inferior and great interference is often encountered from the currents which are carried by these wires. Even condensers cannot always cut out this interference.

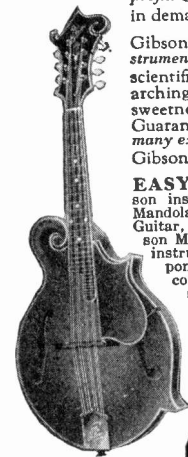
The use of electric light lines is, of course, permissible providing that condensers are used as protective devices because about the only trouble that can come about through the use of such a line, even if something goes wrong, is the blowing out of fuses. This causes inconvenience to the amateur himself and usually to no one else. Several methods of using condensers for this work were described in a recent past issue of this magazine. However, use discretion in all such acts and do not rely upon any make-shift antenna composed of wires which were never intended to be used for this purpose. Always erect a standard antenna if possible, or, if not, employ an indoor aerial or a loop with sufficient radio frequency amplification to build up your signal strength. By so doing you will avoid all appearances of tampering with other persons' property and will get much better results and greater satisfaction from your receiving set.



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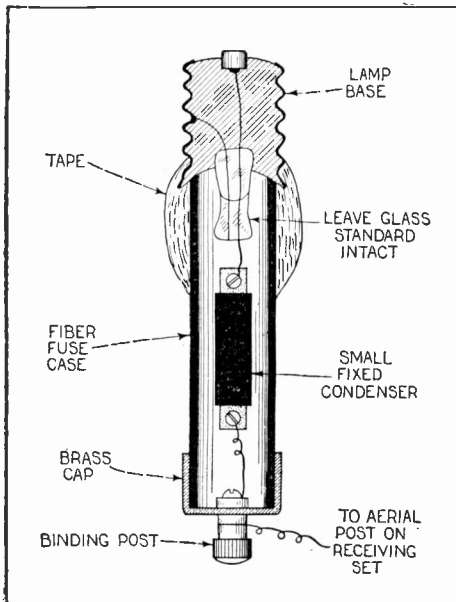
RADIO WRINKLES

EDITED BY
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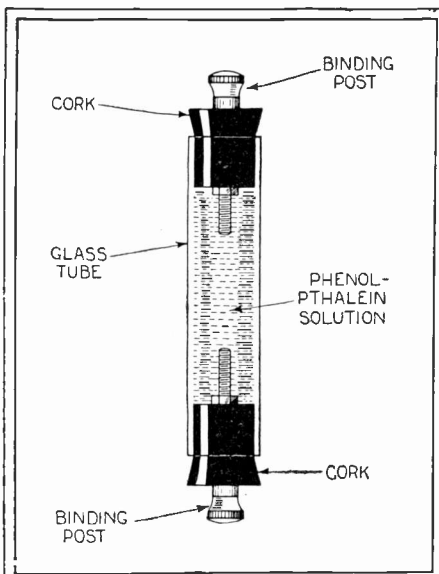
UNDER this heading we are going to publish items of interest to everyone who likes to build radio instruments. In order to continue this department it is necessary for our readers to tell us about their latest experiments. Write us a short description of some time- or money-saving kink you have discovered and send it to us along with a few sketches. Our regular 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.

Lamp Socket Aerial



By constructing a device as shown above and plugging it into an ordinary electric light socket, a fairly efficient substitute antenna will be obtained. The fixed condenser used should have mica as a dielectric. In some cases it will be found best to connect the shell of the lamp base to the fixed condenser. This must be determined by experiment.—Charles Vivier.

Polarity Indicator



The little instrument indicated above should be kept on hand at all times. By connecting it to a battery a red spot will be noticed near the negative terminal. By shaking the tube, this spot will disappear and the indicator may be used again.—Harry Cooper.

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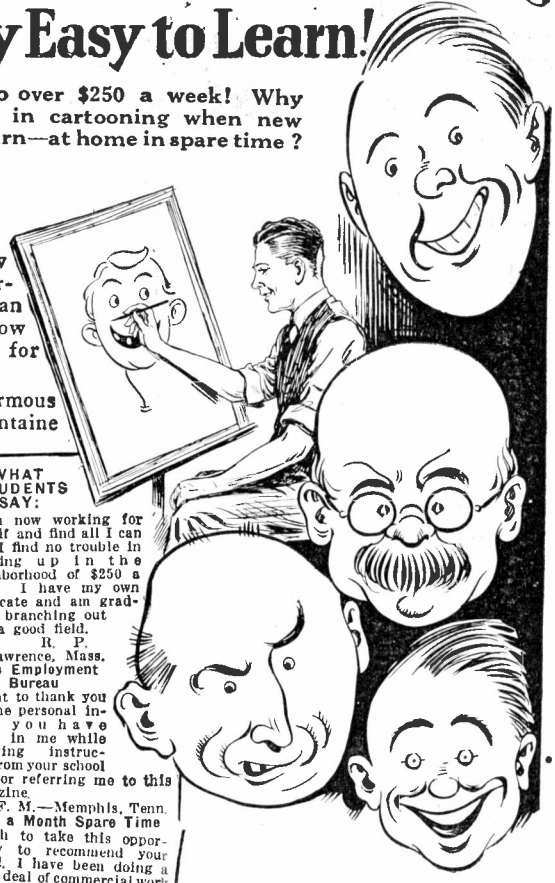
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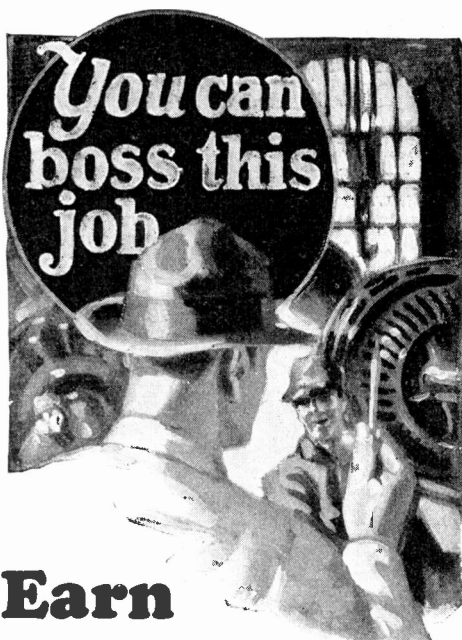
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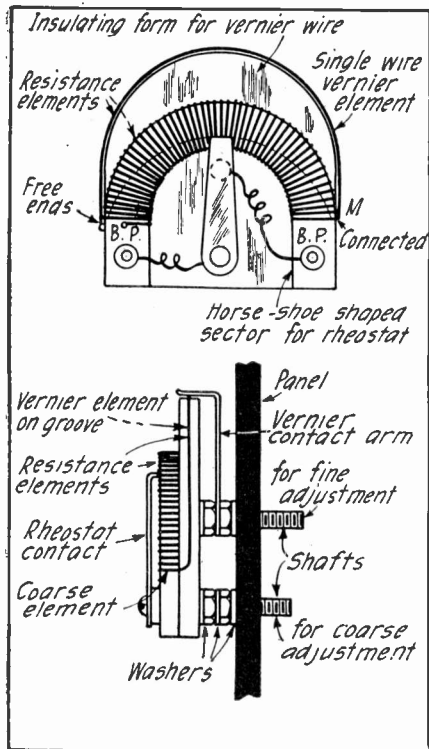
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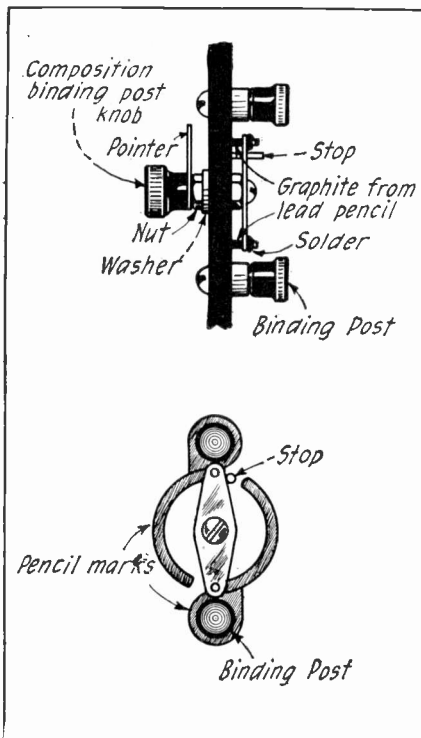
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—P. T. Replade.

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—Carl Webb.

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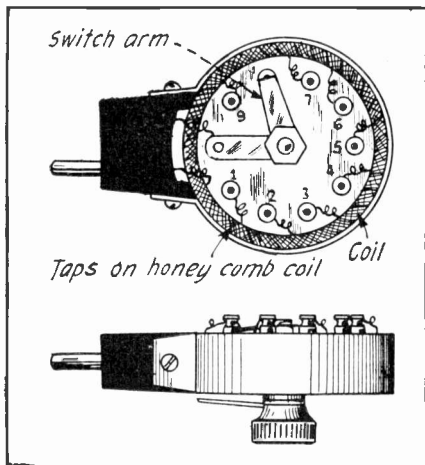
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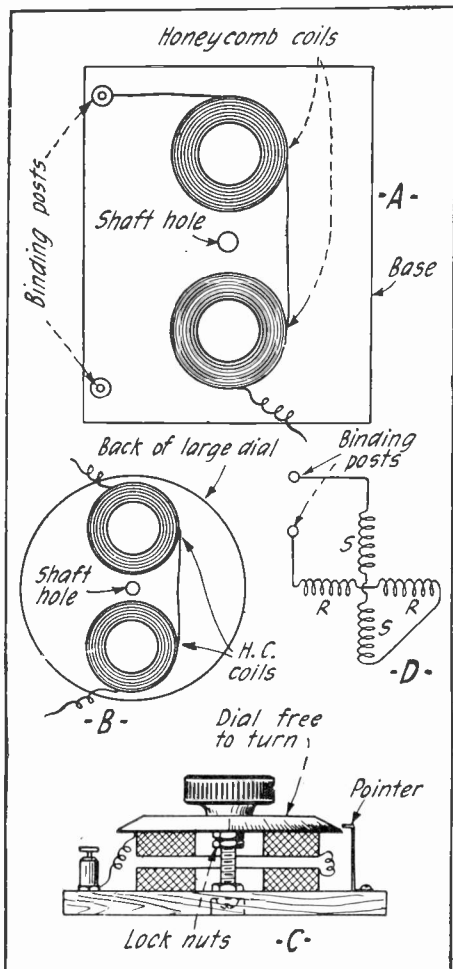
Tapped Honeycomb Coil



For efficient work it is sometimes necessary to have a tapped inductance coil with a low distributive capacity. This can be made very readily from a honey-comb coil, in the center of which is mounted any one of the many standard back-panel mounting switches. If a switch of a larger circumference than the hole in the center of the honeycomb coil is obtained, a wooden plug may be placed in the hole and the switch mounted thereon. Taps can be taken off from the edge of the coil and connected to the switch points. The tapping can readily be done by scraping the insulation from a single turn and tinning the exposed surface with a light soldering iron. A thin, fairly flexible wire can then be placed along the tinned portion and soldered thereto. As little solder as possible should be used to avoid short-circuiting other adjacent turns.

—W. W. Johnson.

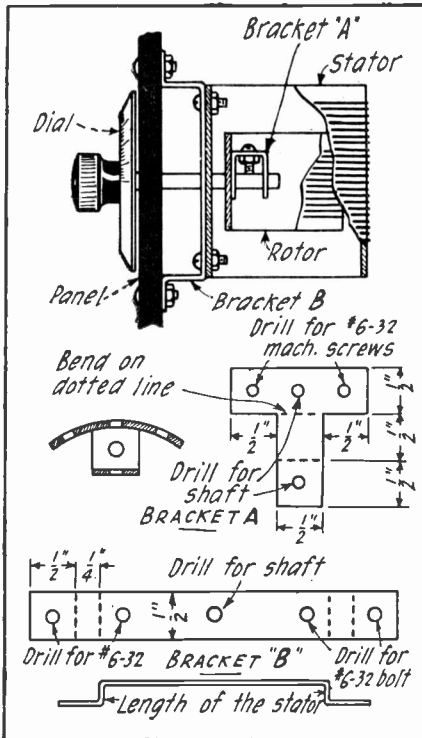
Honeycomb Coil Variometer



Four honeycomb coils mounted as shown above and connected as a standard variometer as shown at D make a very efficient variometer. Two of the coils are mounted on the base as at A, in which is drilled a hole for the shaft. Two other coils are then fastened to a large dial as at B, and the two units assembled as at C. The shaft is locked to the base as shown, and the dial is free to turn on the other end. The distance between the two sets of honeycomb coils may be regulated by the two lock nuts.

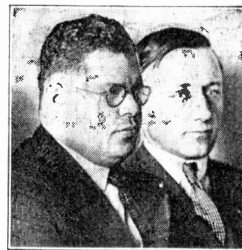
—William Williams.

Mounting of Varico-Coupler



When a varico-coupler is to be mounted on a panel at a point where the base cannot rest on the base board, quite a problem is presented. However, by making up two brackets from strip brass as shown at A and B above, the problem is readily solved. Bracket A is bent to the shape shown in the upper part of the illustration and clamped to the rotor and the shaft. Bracket B is bolted to the stator and also to the panel, thereby making a rigid mounting. The shaft bearings are the panel and the center hole in bracket B.

—Guy Simmons, Jr.



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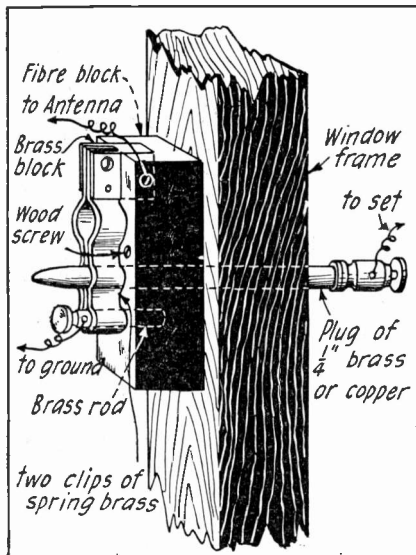
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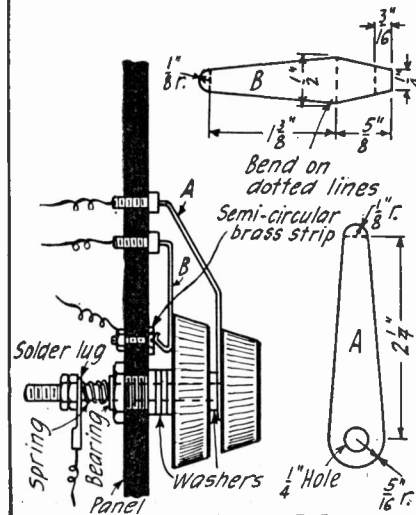
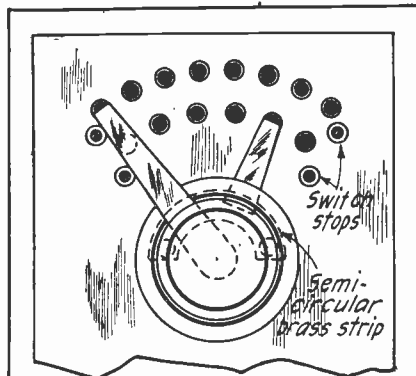
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Unique Lightning Switch



If a hole is drilled in a window frame and through a fibre block screwed to the outside of the frame, and other material arranged as shown above, an efficient lightning protection device will be formed. Two heavy spring brass clips are so bent that they may be mounted as shown. A plug is then made which can be passed through the hole in the frame and the fibre block and which will separate the two clips so that they will not touch the binding post which is connected to the ground. When the plug is withdrawn the clips close and clasp the binding post and the antenna is grounded. With the plug inserted, the antenna is connected directly to the receiving set.—David Kennedy.

Compact Double Switch



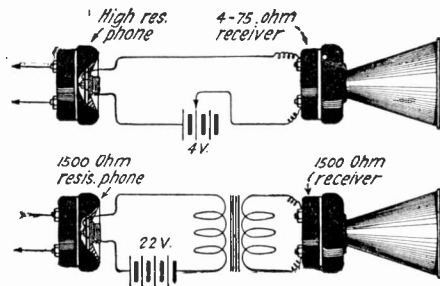
The units and tens switch on a variocoupler can be combined into one unit by following the data given above. The details of the two switch arms are given at A and B and the assembly is made as shown. A front view of the completed switch will be seen at the top of the above illustration. The short arm makes contact both with a row of switch points and with a semi-circular brass strip which completes the circuit. The circuit of the long arm is completed through the mounting. Arm B is fastened to the large knob so that it is insulated from the shaft.—Einar I. Rand.

How to Hook - Up A Transmitter Button to Make an Efficient Loud Talker

A Transmitter button with a few dry cells and a telephone receiver will make a remarkably simple and efficient loud talker. A Microphonic amplifier of this type is just the thing for use with a radio set. The weak music and signals may be amplified many times their original value. It is possible to entertain a large audience with a simple radio equipment if a transmitter button is used in the circuit as explained in diagram A.

The cost is extremely low and the results are comparable with those produced by highest grade of expensive loud talkers.

As may be seen in the diagram, two dry cells or a small storage battery are connected in series with the transmitter button and a 4 to 75 ohm telephone receiver. The transmitter button is secured to the diaphragm of the telephone in the radio receiving set. To accomplish this properly, scrape off the enamel (if diaphragm is enameled) on the face of the diaphragm and solder the small hexagon nut supplied with the button to the exact center. Care should be taken that the thin diaphragm is not bent or otherwise



harmful. The transmitter button is then screwed into place. Connections, as shown in the diagram, are made with flexible wire. A horn may be placed over the low resistance receiver if desired. When the radio set is properly tuned and signals are being received, the transmitter button is operated by the vibration of the diaphragm of the receiver. As the receiver diaphragm vibrates, the mica diaphragm on the transmitter button also vibrates. The carbon grains are compressed at varying pressure; the current flowing through the local battery circuit is thus varied and results in an amplification of the sounds in the low resistance telephone loud-talker.

Diagram B, which includes a step-up transformer, is to be used with loud talking receivers of high resistance. The primary of the transformers should have a resistance of about 75 ohms. An ordinary telephone induction coil will serve as the transformer in this circuit.

You can get the above-described transmitter button FREE in subscribing to "Practical Electrics Magazine" at \$2.00 per year (12 months). Send your subscriptions today.

Make all remittances payable to Practical Electrics Co., 53 Park Place, New York City.

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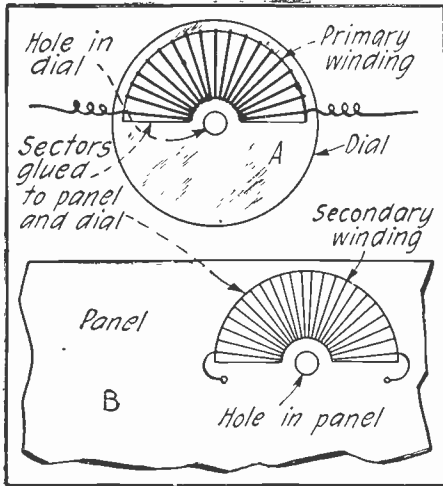
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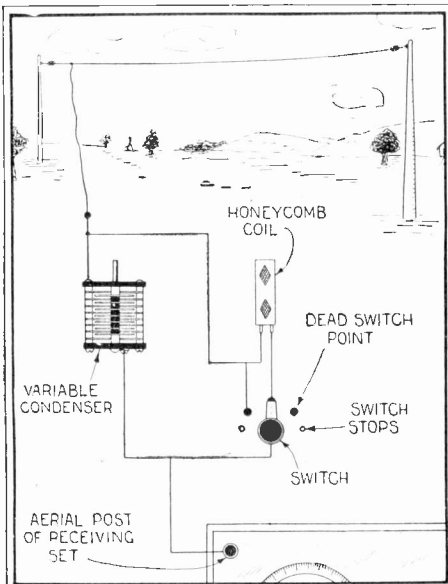
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A Novel Tuner



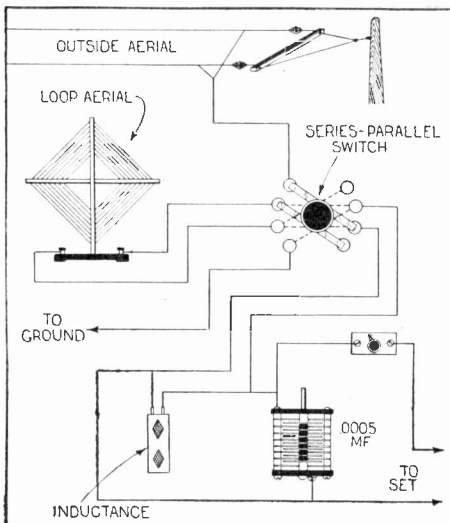
By winding two coils on cardboard sectors and mounting as illustrated above, a serviceable and compact tuner will result. It may be connected either as a variometer or variocoupler as desired.—Walter Ridgwell.

Wave-Trap or Series Condenser



By connecting a variable condenser and a honey-comb coil with a three point switch as illustrated above, either a series variable condenser or a wave-trap may be used in series with the antenna or the latter may be connected directly to the set.—Philip M. Zimmerman.

Switch for Flewelling Circuit



On a Flewelling set it is often desirable to change from aerial to loop or to ground alone. This may be accomplished by means of a series parallel switch. All the connections are shown above.—Arthur Landman.



Generations of travelers in Europe have seen women washing clothes, like the woman in this illustration, on the banks of rivers.

**Shall the river work—
or shall you?**

Too many women, abroad, are still washing clothes like this.



Back of every great step in woman's progress from a drudge to a free citizen has been some labor-saving invention. Back of most inventions in electricity's progress from a mystery to a utility has been the research of General Electric Company scientists and engineers.

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Radiogem received, which we assembled and were very much astonished at results obtained and the clearness and volume of tone produced.

The greatest distance I heard on one of your sets is 1000 miles, having heard WGY at Schenectady, N. Y. I think your set is the best I have ever sold at any price.

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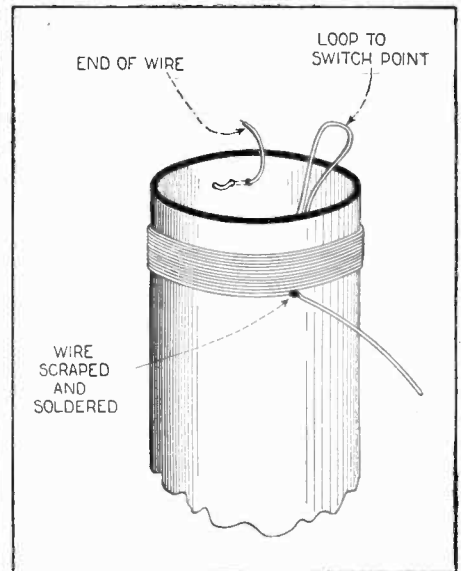
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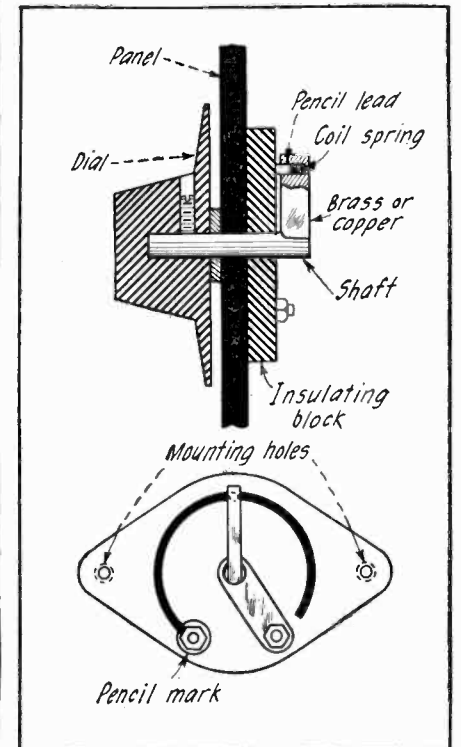
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Tapping Coils



In tapping a coil it is usually common practice to make a small loop in the wire and twist it slightly and continue with the winding. However, when coils are used which do not have any parts within them, a much neater job will result if the taps are taken off as illustrated above. Holes should be drilled in the tube at the points where taps are to be taken off. The wire is then wound and when a hole is reached, a loop about five or more inches long is made in the wire and pushed through the hole. At the point where the wires enter the hole, the insulation should be scraped and the two points soldered. The end of the loop is then freed from insulation and soldered to the switch point. A kink for fastening the end of the wire is also given above. Three holes are drilled in the tube and the wire laced in and out through them so that it will hold itself. —Maynard J. Columbe.

An Efficient Grid Leak



An efficient variable grid leak is one of the most elusive of instruments and very seldom can be made to function properly. However, by following the constructional details given above, a variable grid leak will result which will have very few of the drawbacks of the average type and many advantages. One of the greatest advantages is that it renews itself by placing carbon on the line which forms the high resistance instead of scraping it away, as is done by the usual type of contact. —T. L. Stalker.

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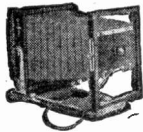
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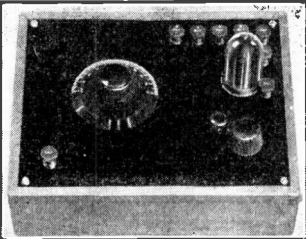
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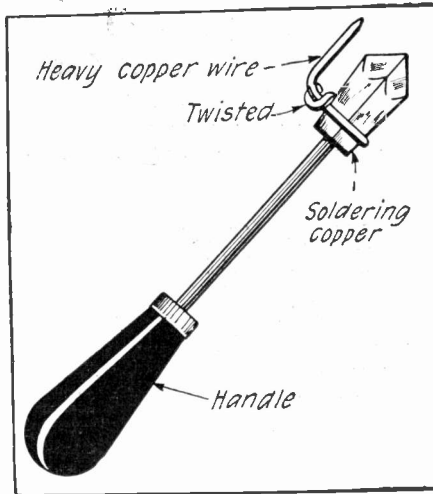
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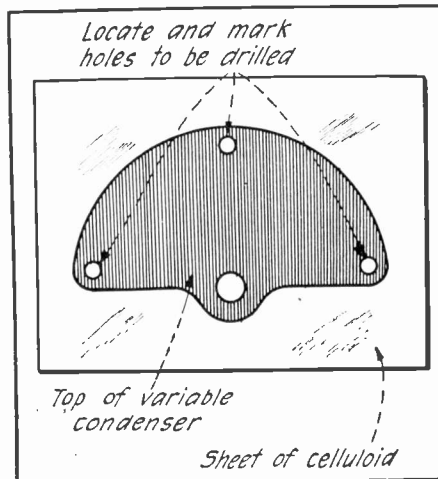
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Useful Soldering Kink



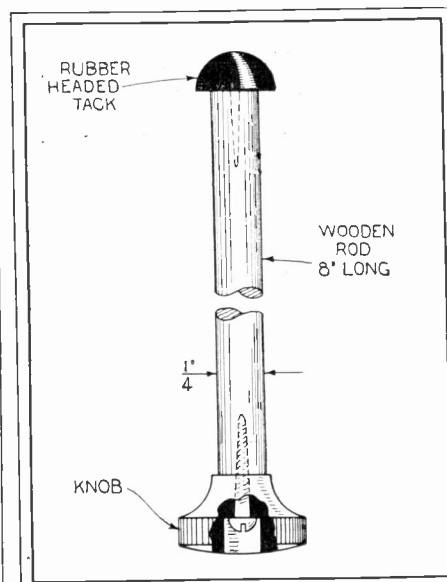
The average soldering iron used by the amateur is much too heavy for fine work. If a piece of copper wire is twisted around the iron and pointed at one end a useful appliance for small work will be formed. The wire may be of any length necessary to do the work on hand and the heavy soldering copper will keep it hot.—E. Rosewater.

Easily Made Template



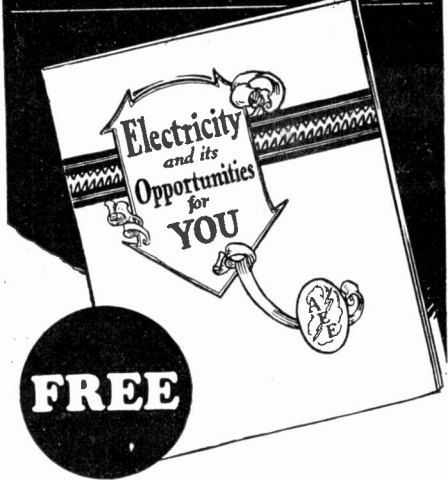
A sheet of celluloid may be laid over the top of a variable condenser and the locations of the various holes to be drilled marked thereon. The holes are then drilled in the celluloid and a template will result which will give very good results for locating the mounting holes for the condenser on the panel. —E. M. Abbot.

Vernier Rod



A rod constructed as shown above may be used for turning the dials on a receiving set by placing a rubber headed tack on the panel in frictional contact with the edge of the dial. —Edward L. Foote.

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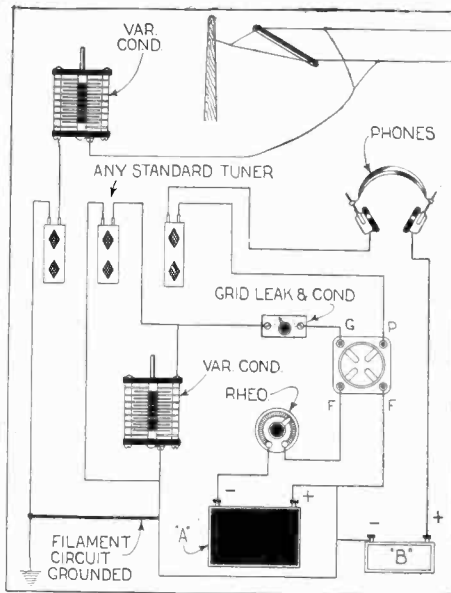


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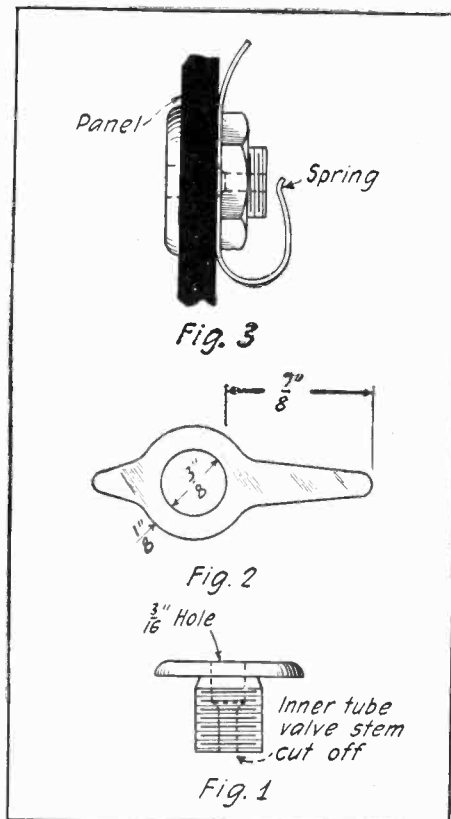


Reducing Body Capacity



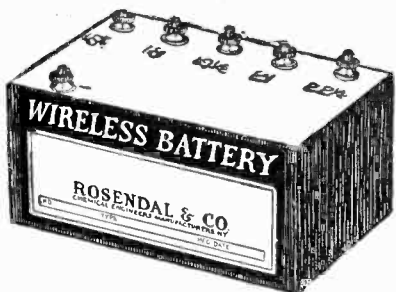
One of the greatest annoyances to the average amateur is the effects of body capacity which are found when the hand is brought near the tuning controls. This is particularly annoying in tuning in DX stations. Sometimes even shielding of the panel will not eliminate the trouble. Under such conditions it is advisable to try the kink illustrated above wherein the filament circuit is grounded. This will very often eliminate trouble caused by body capacity, and make the set easier to tune. —Jack Kay.

Phone Tip Jacks



Phone tip jacks are rather expensive to purchase, but can readily be made by following the instructions given above. All the material required is the valve stem from an old automobile inner tube and a sheet of spring brass cut to the shape shown in Fig. 2. The valve stem is first cut off as shown in Fig. 1 and the hole enlarged for a distance of about one-quarter of an inch as shown. The strip of brass is then bent as illustrated in Fig. 3. The two parts are then mounted with a nut as illustrated. It will be found that the phone tip can be plugged into the hole and will make excellent contact with the spring brass strip. —Warren Fleenor.

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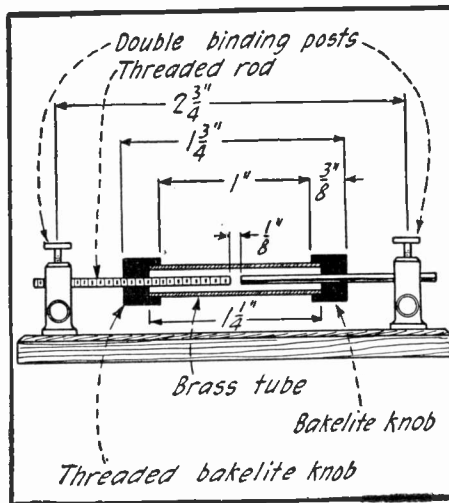
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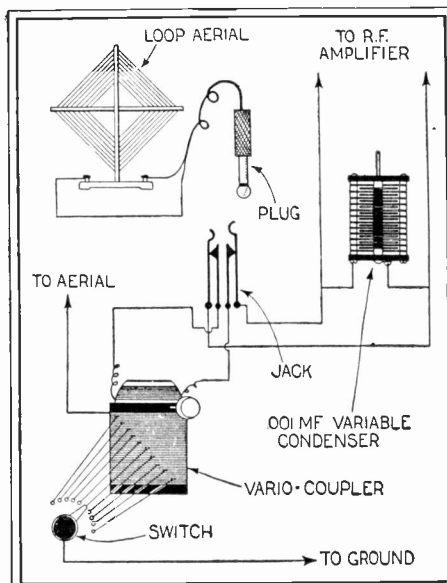
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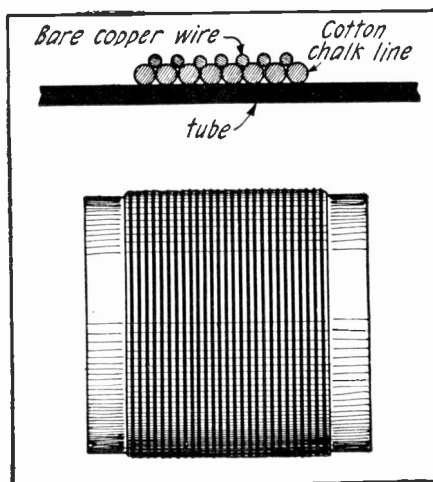
In the Neurodyne circuit, very small capacities which can be critically adjusted must be used. By following the above diagram, a condenser results which will give good results and at the same time susceptible to close manipulation.
—L. Kranzli.

Loop Connection



By connecting a loop to an ordinary phone plug and connecting a two-circuit jack as shown, either a loop or an outdoor antenna may be used as desired. Inserting the plug in the jack disconnects the antenna, ground and coupler and connects the loop in the circuit.
—J. Phillyss.

Bare Wire Coils



Coils wound with bare wire are found to be very efficient in radio receiving sets, but spacing the turns is a rather tedious job. However, by first winding the coil with a layer of ordinary cotton cord and then winding the wire, an efficient coil will result in which the turns will be spaced very evenly.
—A. Ferrand.

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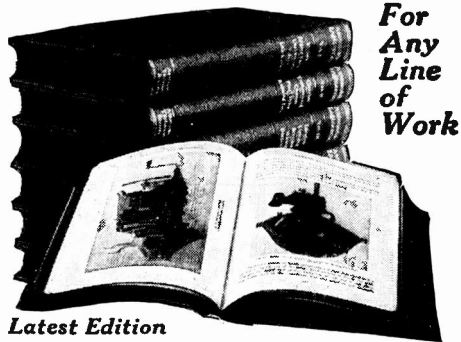
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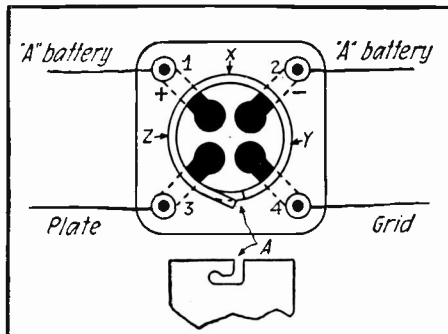
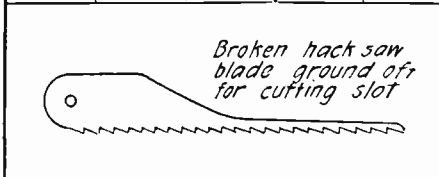


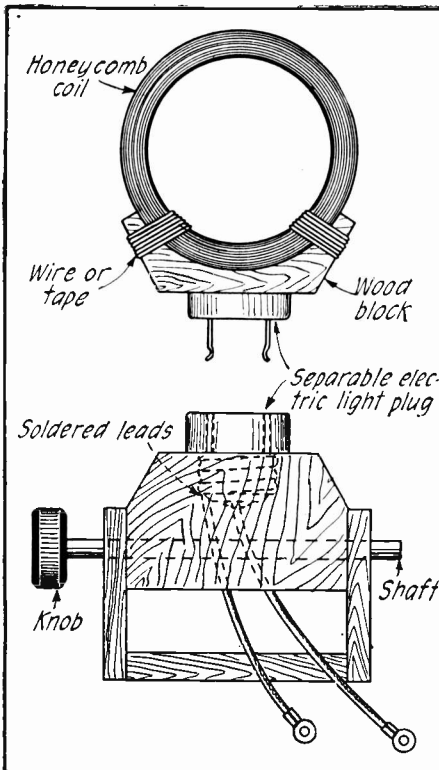
Chart for marking posts after change of slot

New slot cut at	+ A 1	- A 2	Plate 3	Grid 4
X	G	P	-A	+A
Y	-A	G	+A	P
Z	P	+A	G	-A



Where moulded sockets are used it is often found that the slot into which the prong fits bends outward, and no longer holds the tube securely. When this happens, new slots may be cut at points X, Y or Z and the binding posts changed to the designations shown in the chart. A hacksaw blade ground as shown will give excellent results for cutting the slots. —J. Arthur Calkins.

Mounting Honey Comb Coils



A separable electric lighting plate may be mounted as shown, one half on a honey comb coil and the other half in a wooden block. An efficient variable honey comb coil mounting will result. The base of the plug may be cemented into the hole in the wooden block if a tight fit cannot be made. The wooden support should be keyed solidly to the shaft. —C. W. Fancher.

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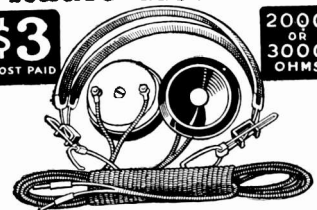


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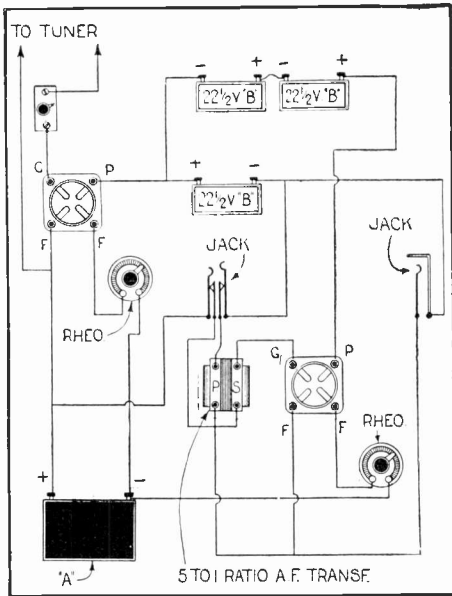
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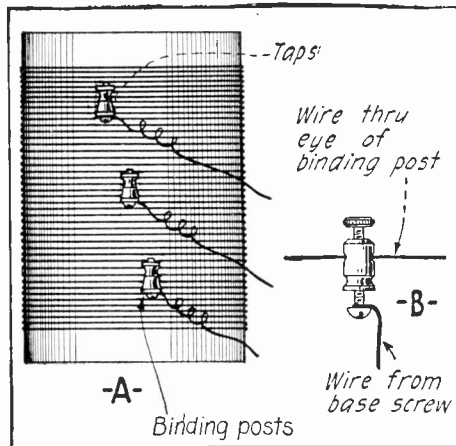
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Filament Control Circuit



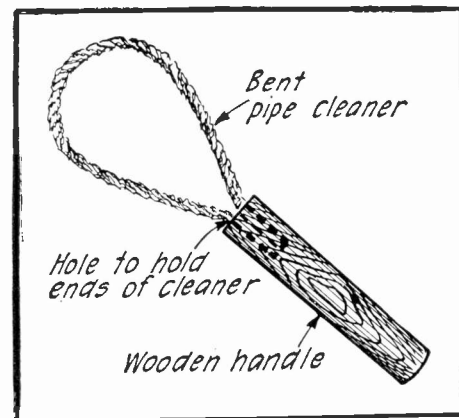
The standard filament control jacks are very difficult to connect, as many leads are necessary. If a double circuit jack and a single circuit jack are used and connected as illustrated, they will function as filament control jacks very efficiently. With the plug in the two circuit jack, the detector will light when the rheostat is turned on. With the plug out, or in the other jack, both filaments will light. —Jason Crain.

Solderless Connections



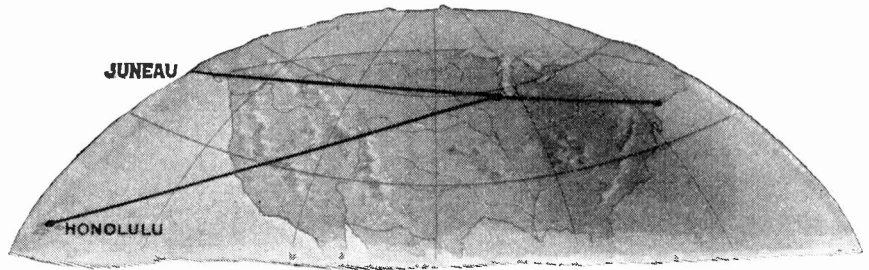
Small binding posts may be fastened to ordinary taps taken from inductance coils and connections made thereto, thereby eliminating the necessity of soldering. At B is shown how two wires may be connected together by means of a binding post. —H. N. Loeb.

Variable Condenser Cleaner



By bending a pipe cleaner and inserting the ends into a wooden handle as illustrated a cleaner will be made which will remove any dust or any foreign material which might cause trouble by short-circuiting the plates. This cleaner should be used frequently to keep the condensers at maximum efficiency. —Charles L. Higgins.

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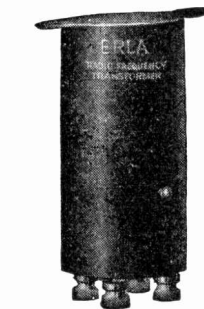
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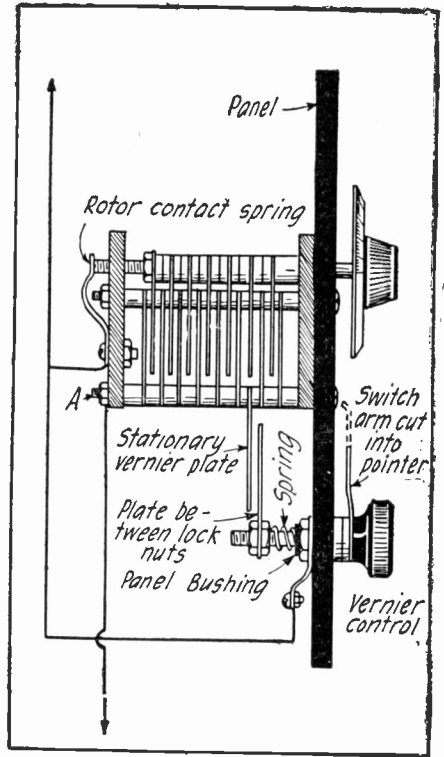
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Vernier Condenser



A vernier variable condenser is one of the handiest instruments to place on a receiving set and an exceedingly simple, yet efficient type may be constructed as shown above. The variable condenser is partially dismantled and one of the stationary plate separators removed. Two thinner washers are then put in place of the separator, the total thickness of the two washers and the vernier stationary plate to equal that of the separator. A rotary plate is clamped between two nuts on a shaft and mounted as shown. The regular condenser dial is then used for coarse tuning and the small vernier control when fine tuning results are desired.

—Harry F. Gammeter.

A New RICO Product

CAPACITY EQUALS 43 PLATE CONDENSER
REQUIRES 1/4 THE SPACE



THE "RICO" STRAIGHT LINE CONDENSER

This condenser marks a revolution in condenser building. It is the simplest and most practical type of condenser as yet developed for broadcast and amateur work. This condenser has been developed by our engineers after considerable research work and has been pronounced perfect by experts.

15 Outstanding Features

- 1—Large capacity (.001 Mf.).
- 2—Replaces a 43-plate condenser.
- 3—Uses a minimum of space, size 3 1/4" x 2 1/4" x 1 3/4".
- 4—For panel mounting or for table mounting—universal in its scope.
- 5—One complete revolution of dial adjusts condenser from minimum to maximum.
- 6—Vernier effect.
- 7—Absolute straight line curve.
- 8—Accumulates no dust between plates as is the case with air condensers entirely enclosed.
- 9—Light weight. Condenser only weighs 3 oz.
- 10—Less than 1-30th amount of parts as used in old style mesh plate condenser.
- 11—Can never get out of order.
- 12—Impossible to short circuit. Finest India Mica dielectric used.
- 13—Works in any position, vertical or horizontal.
- 14—Lowest in price for high class condenser.
- 15—Compactness. Size only 3 1/4" x 2 1/4" x 1 3/4" over all. The Rico Straight Line Condenser must be seen to be appreciated. Made of the best materials that money can buy. Stands in a class by itself. All metal parts finished in nickel plate. Money refunded if this condenser is not all we claim for it. No. 450 "Rico" Straight Line Condenser complete with molded dial, \$1.75. No. 451, same condenser but without dial (shaft is for 1/4 inch), \$1.50.

(Patents Pending)

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Gentlemen: Please send me by Parcel Post No.

..... "Rico" Condenser for which I will pay the postman the amount of

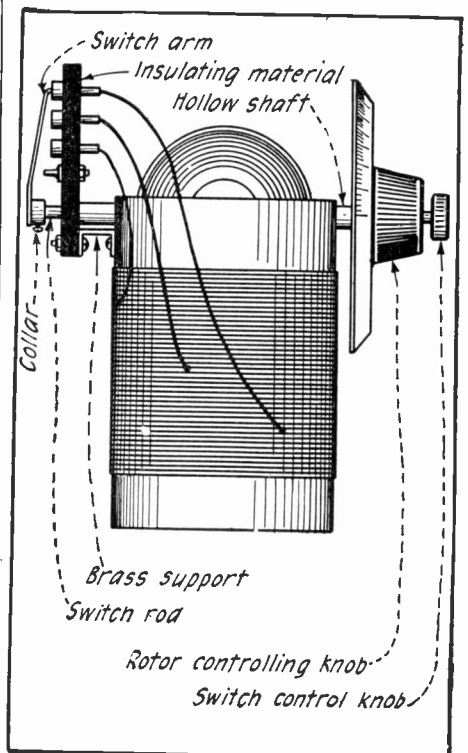
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131 DUANE STREET, NEW YORK CITY
Cable Address: Ricotrade, New York

Mounting Switches



In order to eliminate the number of parts on a dial of a radio receiving set and at the same time centralize the controls, the switch points for controlling the inductance in the primary circuit may be mounted on a panel and fastened to the variocoupler as shown. The shaft on which the coupler secondary rotates must be hollow. Through its center passes a rod which controls the switch arm. This rod is rotated by means of the small knob.

—Stephen Goff, Jr.

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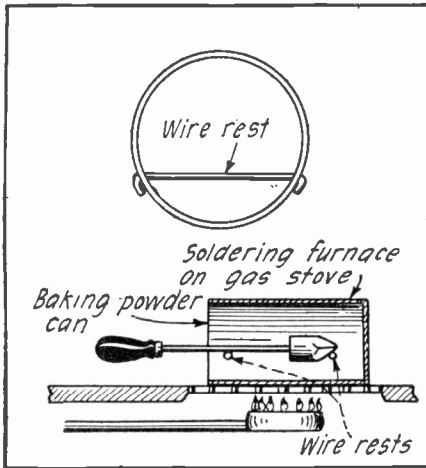
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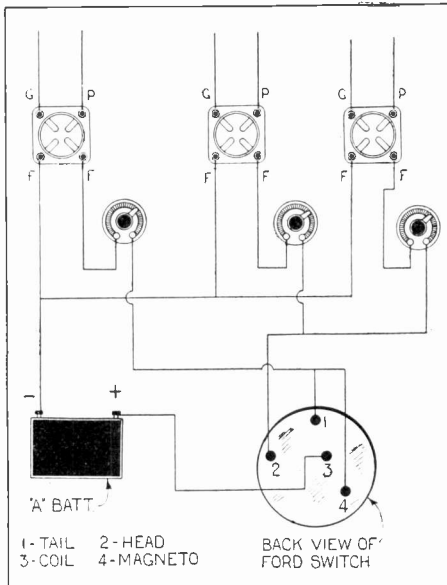
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Soldering Furnace



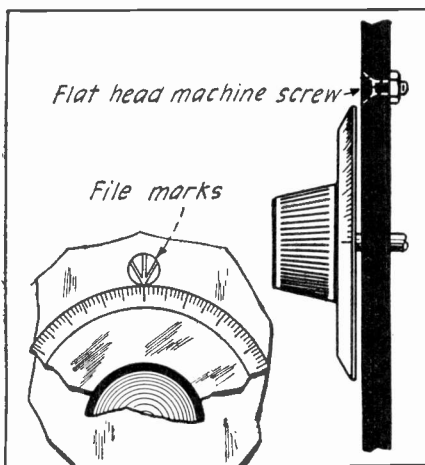
When an ordinary soldering iron is exposed to a gas or alcohol flame it usually becomes sooty and the tin is sometimes burned off. This is done away with by making a small soldering furnace as shown above. Place over a gas flame. —John L. Kenickell.

Lock Filament Circuit



It is very annoying when, at times, it is found that in the absence of the operator, the filaments of the tubes in a radio set have been turned on and left burning. It is possible to overcome this annoyance by connecting up a Ford switch as shown above. By turning off the switch when leaving, it can be locked in position and one who has no key cannot move it. —Kenneth Kesterson.

Dial Indicators



Neat and effective indicators of dial settings may be made from flat head machine screws by filing two slots in their heads and mounting as shown above. If the heads are painted black and the slots filled with engravers' white, a much better looking job will result. —Edward W. Lens.

(Continued on page 945)



The Improved
MIRACO

Gets 'em From Coast to Coast

Model K
(SHOWN ABOVE)
\$29.50

It is a two-tube outfit consisting of one stage of tuned impedance radio-frequency amplification with a tuner and vacuum tube detector. This radio-frequency receiver amplifies before it detects, eliminates interference to a marked degree and has much more volume than most one-tube sets.

Model MW
(SHOWN BELOW)
\$54.50

The Model MW consists of the same high-grade units as our Model K, with the addition of a two step audio-frequency amplifier in a single beautifully finished solid mahogany cabinet. It is a four-tube set, comprising one stage of tuned impedance radio-frequency amplification, detector and two stages of audio-frequency.

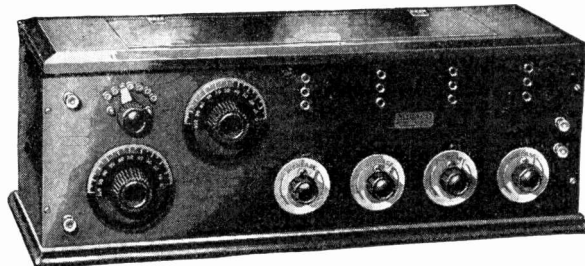
Just like the sweet, mellow tones of a flute or violin floating in from afar out on a lake—that's the way concerts come in through MIRACO receivers—and—

Not only from the nearby stations either. For our users tell us that Cincinnati hears Frisco, Denver hears Schenectady, New York hears Havana! Scores of long-distance records were made on these instruments last year so, with the many new refinements incorporated, the results obtainable will be far better now than ever.

HIGHEST QUALITY AT LOWEST PRICE

When the radio craze swept the country like a storm late in 1921, MIRACO was one of the first real successful sets to be placed on the market. Highest quality at the lowest price has always been our keynote, and the thousands of sets now in use all over the world are a fitting tribute to Miraco's excellent performance. Many new improvements have just been made in the MIRACO Models K and MW, such as new sockets resting on shock absorbing pads is a refinement found only in the most expensive and elaborate sets. Improved rheostats with multiple resistance windings makes it possible to use any type of tubes and a new aluminum shield prevents annoying body capacity effects.

The cabinet is of solid mahogany, workmanship throughout is the finest while its operation is extremely simple yet always dependable.



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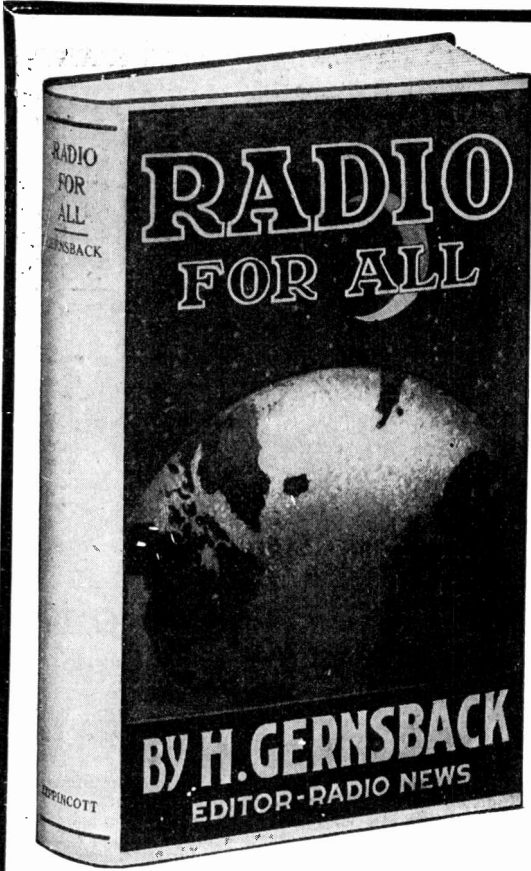
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a little instrument, fits in the mouth out of sight, used with above for Bird Calls, etc. Anyone can use it. NEVER FAILS. Also a 32 PAGE BOOK which gives full instructions on Ventriloquism. Formula for Secret Writing (Invisible Ink), 12 Money Making Secrets and 10 BIG TRICKS ON MAGIC all for 10¢

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For the More Experienced Amateur.

- How to make a practical vacuum tube detector, two stage amplifier set costing less than \$50.00 that will work.
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- All about underground aeriels, loop aeriels and directional aeriels.
- Formulae for finding wave length; miscellaneous formulae for finding capacity of condenser and other instruments. Tables of wire resistances, wave lengths and their corresponding frequencies, approximate wave lengths for different aeriels, tuning coil data, and much more invaluable information.

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- Collection of miscellaneous radio information for the amateur.

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The information that you ordinarily have to dig out of government publications, text-books, pamphlets, etc., is handily combined in this one book.

The Complete Book of All Radio Information

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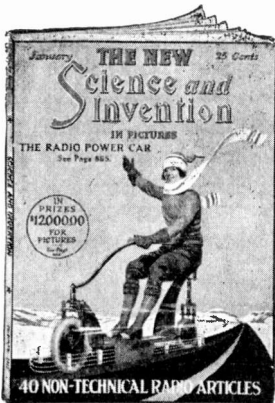
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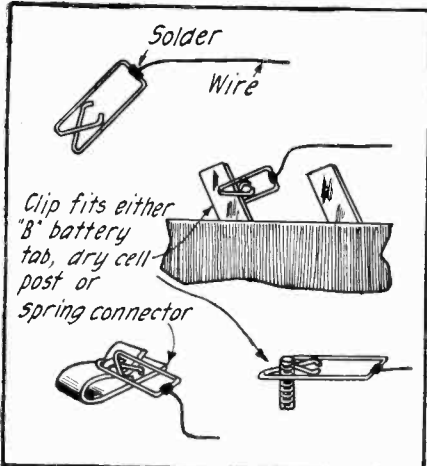
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Radio Wrinkles

(Continued from page 943)

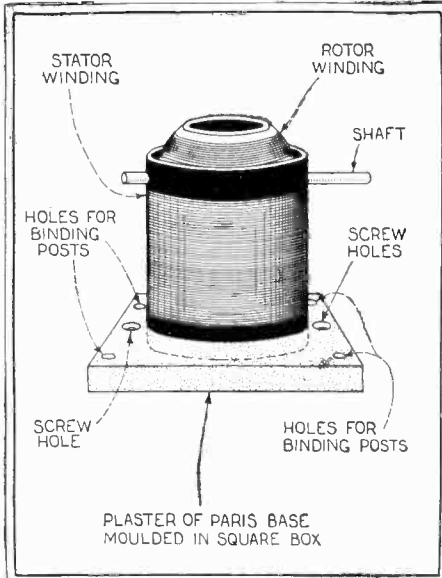
Simple Connectors



Ordinary paper clips of the type illustrated above make very good connectors for use on different radio apparatus. The illustration shows how they can be used for clipping on to "B" batteries, machine screws, or spring connectors.

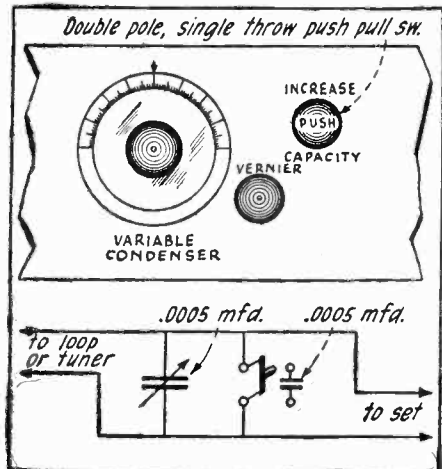
—L. B. Robbins.

VarioCoupler Bases

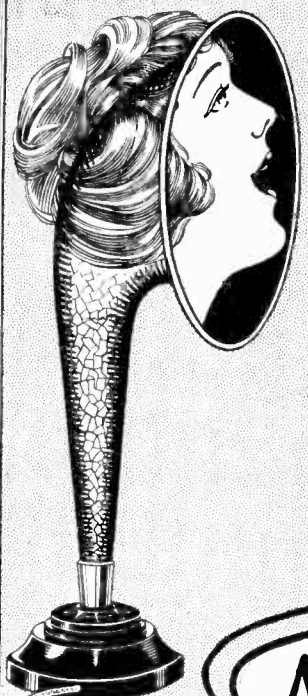


Plaster of Paris makes a very good base for mounting variocouplers and it may be made as shown above. The holes for the binding posts and mounting screws should be moulded directly into the base. The stator of the coupler should be put into place before the plaster of Paris sets.

Increasing Capacity



The capacity of a variable condenser may be increased by placing in parallel with it a small fixed condenser of the same capacity. This is connected with double-pole single-throw switch which should preferably be of the push-pull type. By closing the switch, the total capacity will be variable from .0005 to .001 mf.



Atlas

LOUD SPEAKER

Natural Re-Production

Multiple Elec. Products Co. Inc.
124 J. Harvey St.,
San Francisco, Calif.

October 20, 1923.

Dear Sir:

It will probably interest you to hear of a record we have obtained with the Atlas Loud Speaker for which you are the agent. We manufactured a set of which we mount the Loud Speaker in the cabinet and prepared to give a radio date of 1923. We had a set on the shelf of the set and of the set's content above the note of the ocean.

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Yours very truly,
FARKIN MFG. CO.
John Parkin

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How to Make a Short Wave Regenerative Receiver

This set was designed by a foremost radio engineer to fulfil the wants of an all-round broadcast receiver. It covers wave-lengths up to 800 meters. 50c.

How to Make Detector and Amplifier Units

This pattern was designed for detector and amplifying units especially adapted for use with our regenerative receiver. It is strongly recommended when the attachment of a loud speaker to that set is desired. 50c.

How to Make a Cockaday Receiver

The Cockaday four-circuit tuner is one of the latest advancements in radio. Its main advantage lies in the fact that the set can be adjusted to the highest point of regeneration and tuning accomplished over wide band of wave-lengths without the necessity for readjusting the regeneration control. All dimensions, size of wire, number of turns, etc., are given leaving nothing to the imagination. 50c.

How to Make the S. T. 100

This is a two tube and crystal dual amplifier brought out by an Englishman, John Scott-Tiggart. This is a very stable circuit and above all, very easy for the amateur to construct. Complete blue prints for drilling and wiring 50c.

14 Radio Formulae and Diagrams

With this packet you need never worry about schematic wiring diagrams, measurements and radio tables. All formulas and diagrams are printed on heavy paper. 50c.

20 Radiophone Diagrams and Hook-Ups

These diagrams show how to get the best possible efficiency from the instruments you make or purchase. They cover hook-ups from the simplest to the most complicated, in a way that any amateur can understand and follow without difficulty. Printed on heavy paper, 8 1/2 x 11 1/2 inches, and together with KEY CHART OF SYMBOLS and pamphlet "How to Read Diagrams" are contained 50c.

How to Make a Reinartz Receiver

The original Reinartz Receiver is the most popular type of set in existence today due to its simplicity of operation and capability of long-distance reception. Full directions for building this receiver are given in this folder. Two blue prints and instruction pamphlet in two-color manilla envelope. The connections of the set are shown plainly. 50c.

All About Aerials and their Construction

These blue prints were made after practical erection of each aerial, and point out how simple it is to erect not only the proper aerial for your particular need, but how to erect this aerial in the most practical manner and at the least expense. Consists of 12 blue prints 8 1/2 x 11 inches and one four-page instruction pamphlet 50c.

How to Make A Radiophone Crystal Set

Designed for those without technical knowledge. This set has a range of 20 miles. Packet consists of 4 pages illustrated direction pamphlet and full size blue print 50c.

How to Make an Autoplex Receiver

The long expected one tube set that will work a loud speaker. Will operate wherever placed and requires but a ground connection. Every station within its range is amplified sufficiently for a loud speaker. Tuning is very simple, there being but two controls. Any tubes from the "peanuts" up to the "big ones" can be used. This receiver knows no such thing as "critical filament adjustment". The complete plans consist of full sized blue print for wiring and drilling and also a four-page instruction pamphlet giving complete details even as to tuning. 50c.

How to Make a Neutrodyne Receiver

This pattern gives the complete assembly, wiring, adjusting and tuning of a five-tube Neutrodyne receiver. This type of receiving outfit was brought out after extensive experimenting and is noted for its very efficient radio frequency amplification. All the disadvantages of ordinary radio receivers, such as distortion and re-radiation are eliminated. The circuit is also noted for keeping the tubes from oscillating. Put up in packet, with full size blue prints for drilling and wiring and four-page instruction pamphlet. 50c.

How to Make a Reflex Receiver

The plans for the reflex receiver were gotten out only after considerable research work by our engineers. Most people have trouble with reflex receivers. It takes an expert to build one that will work satisfactorily. The trouble lies in the values of condensers, etc., in the circuits. If they are incorrect, the set is a dismal failure. The construction details of a reflex receiver, contained in this folder, are the results of their successful efforts. 50c.

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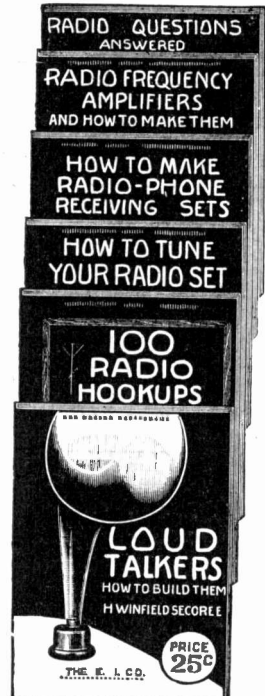
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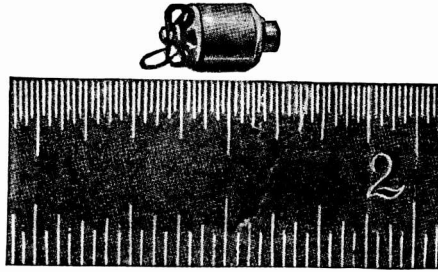
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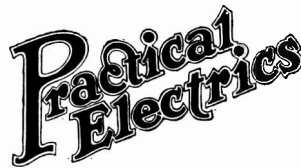


Full particulars, for entering the miniature models in this contest, closing date, rules and restrictions, etc., will be found in full in the January issue of PRACTICAL ELECTRICS.

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The January issue now on the news-stands contains 64 pages, over 100 different articles and over 150 illustrations, with an artistic cover in three colors. Professor T. O'Connor Sloane, Ph.D., is associate editor of the magazine.

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"PRACTICAL ELECTRICS"
The Wonders of Radium
Measuring Celestial Temperatures
Aerial Railroad by Raymond F. Yates.
Analogies and Others, by T. O'Connor Sloane, Ph.D.
Electric Timing of Horse Races, by Jacques Boyer, Paris Correspondent
Commercial Applications of Photoelectric Cells, by Raymond B. Wailes.
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A new contest offering \$200 in prizes for best miniature working models of electrical apparatus.
Also a new prize contest giving four prizes amounting to \$7.50 for the best account of an odd electrical experience.
\$3.00 for the best article on Elec-Tricks, the new department.
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In addition to this, the magazine pays high prizes for all electrical experiments, electrical articles, etc. See current issue for full details.

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- "Motor Electrics"
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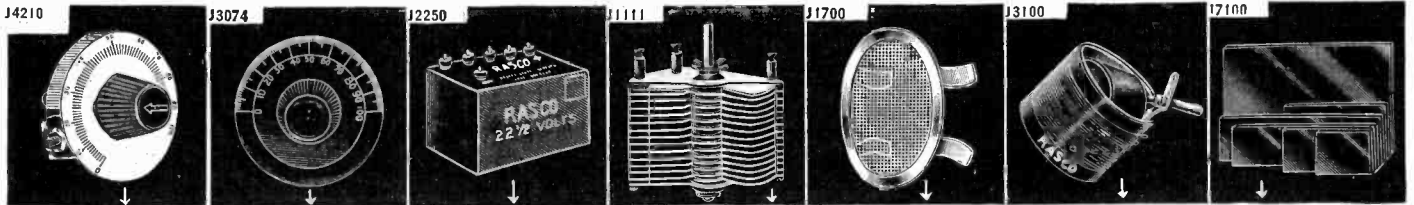
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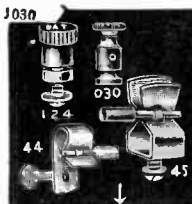
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J2250 Small 22 1/2 V. \$.85
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Positively no better condenser on the market. Shafts 1/4". Save from 40 to 60% by assembling condenser yourself.
J1111 11 plate,\$1.10
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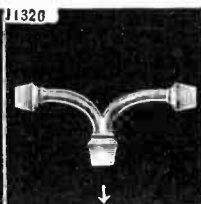
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Highest dielectric strength as per Bureau of Standards.
J7100 7x10x3-16" ..\$.90
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J7210 7x21x3-16" .. 1.85
J7240 7x24x3-16" .. 2.10



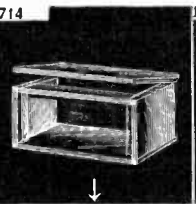
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J030 Small size, 1/2" high, nickel finish, each . \$.04
J124 Initialed Binding Posts: Antenna; B Bat.; A Bat.; Ground; Phone; each12
J45 Spring Posts, ea. .04
J44 Spring Posts, ea. .07



Double Phonodapter
Fits all phonographs and will take any standard double head set, thus making your phonograph a loud talker. Made of cast metal, nickel plated and highly polished.
J1320 Double Phonodapter \$.65



Cardboard Tubing
Only seamless tubing made (I.—Inside Diameter. O. cabinets made. Top 1/4" Outside Diameter. L. hinged. Made of 1/2" stock.—Length). J6600 3" I. J714 Panel, 7x14" ..\$3.35
3 1/2" O. 7" L. \$.30 J6601 J724 Panel, 7x24" .. 3.60
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\$.35. J6604 4" I. 4 1/2" L. J710 Panel, 7x10" .. 2.60
O. 5" L. \$.35. J6605 J712 Panel, 7x12" .. 3.00
2 3/4" I. 3" O. 2 3/4" L. \$.15 J721 Panel, 7x21" .. 3.90



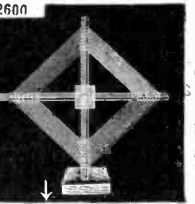
Wood Cabinets
Highest grade mahogany
J1430 Panel, 7x14" ..\$3.35
J1431 Panel, 7x18" .. 3.60
J1432 Panel, 7x21" .. 3.90
J1433 Panel, 7x24" .. 4.20
J1434 Panel, 7x27" .. 4.50
J1435 Panel, 7x30" .. 4.80
J1436 Panel, 7x33" .. 5.10
J1437 Panel, 7x36" .. 5.40
J1438 Panel, 7x39" .. 5.70
J1439 Panel, 7x42" .. 6.00



Phonodapter
Will fit any phone. Make your phonograph a loud talker. Fits all phonographs. Made entirely of pure soft rubber with brass tube insert.
J1310 Phonodapter... \$.40



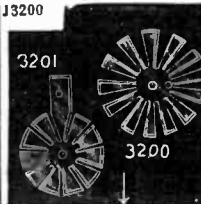
Melotone Loud Speaker
Best popular loud speaker. Fibre horn, heavy metal base, five foot cord. Nickel goose neck. Greatest tone (adjustable) talker. Horn length 11 1/2", bell 6 3/4", total height 9".
J255 Melotone Speaker\$4.90



Loop Aerial
Made entirely of well seasoned hard wood. Complete with all parts and base. Total height of loop 36". Can be put together by anyone in less than 5 minutes.
J2600 Two ft. loop aerial, complete\$1.15



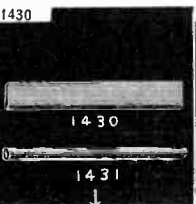
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Used practically in all audio-frequency transformers. Better than iron. Extremely soft. 3/8" wide and .007" thick.
J4900 Silicon steel per foot\$.60



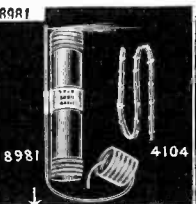
Spider Web Forms
Fine forms to wind your spider webs. Made from hard, well seasoned fibre, 1-16" thick, center and side holes for wiring. Both 5/8" diameter.
J3200 Spider form, \$.25
J3201 Spider form \$.25



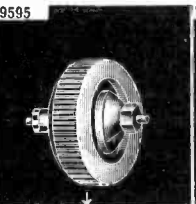
Universal Bearing
to hold rotors. Length of bearing 2 3/4", shaft 1 1/4", thread 1 1/4" long, thread sleeve 3/4" long, each\$.25
J1550 Sockettes. Four of these take one vacuum tube. Grasp tube firmly. Best by test. Set of 4 \$2.25



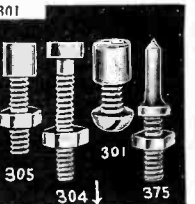
Brass Strip and Tubing
Brass strip 1/2" wide; 1-16" thick; 6" long. J1430 Per length...\$.10
J1431 Brass tubing, dia. 3/4", 6" long; length, \$.15
J1432 Threaded Brass Rods 1/4", 6" length only. Sold in 8" lengths only. J8032 8-32" thread \$.08
J6032 6-32" thread ..\$.06



Alcohol Blow Torches
Best made. Give intense hot flame. Great for fine work.
J1891 5" Torch.....\$.85
J8982 3" Torch..... .50
J4104 Rosin Core Solder. A non-corrosive solder with flux inside. 18" length\$.10



Skinderviken Button
Famous Micro-Phone for Transmitters. Sold all over for \$1. This is the genuine article. No imitation. Smallest and most sensitive microphone made.
J9595 Microphone ...\$.75



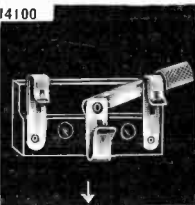
"Rasco" Switch Points
Nickel and polished. J301, 1/4"x1/4", 6/32" doz.\$.18
J304, 3/8" dia., 7/8" thick; 6/32" doz.\$.18
J305, 1/2" dia., 3/16" thick, 4/32" doz.\$.18
J375, 3/8" long, 4/32" with nut, doz.\$.18



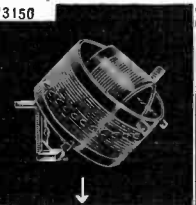
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The simplest radio outfit made. Includes all parts for tuning: coil, tapped switch, crystal, catwhisker.
J5353 Radiogram, no aerial or phone\$.75
J5354 Radiogram, with 1000 ohm phone and 3 ft. cord\$3.75



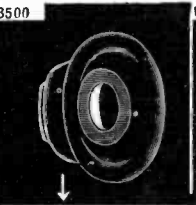
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Mounted on composition block. Small enough for all radio purposes.
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J4101 Double Throw Single Pole\$.35



Bakelite 180° Coupler De Luxe Style
Tubes of natural color bakelite, wound with green silk. Aluminum bracket, 1/4" shaft. Primary 13 taps. 180 to 550 meters.
J1310 Coupler\$2.45



(Adjustable) Loud-Speaker Phone
Has rubber gasket underneath diaphragm, making phone fully adjustable. Gives amazing results as loud-talker on 1 and 2 stages of amplification.
J2525 Speaker with 5 ft. cord\$3.70



Soft Rubber Ear Cap
At last! Ear caps that will relieve headaches, earaches, and undue pressure on the ears. Fit all receivers.
J3500 Ear caps, pair \$.50



Series Parallel Switch
Quick change from one circuit to another. Black composition knob, nickel plated fittings. Blade radius 1 1/4".
J2550 Series parallel switch\$.25

Short Wave Regenerative Receiver
1—J710 Mahogany Cabinet\$2.60
1—J7100 Dilectryte Panel 7"x10"90
1—J3150 DeLuxe Variocoupler 2.45
1—J433 43 Plate Condenser 1.60
2—J3075 3" Dials50
1—J200 Switch Lever25
1—Doz. J305 Switch Points. .18

2—J375 Switch Stops04
1—J6500 Vacuum Tube Socket35
1—J5060 Grid-Leak Condenser .30
1—J4311 30 ohm Rheostat. .65
1—J1000 Double Circuit Jack .65
8—J201 Binding Posts, no aerial or phone80
8—J6000-B Binding Post Name Plates24
24 Ft. J6400 Bus Bar Wire60
Blue Prints and directions for assembling50
Total \$12.61
Our Price \$12.00

Reinartz Circuit
1—J710 Mahogany Cabinet\$2.60
1—J7100 Dilectryte Panel 7"x10"x3-16"90
1—J2660 Reinartz Inductance (225 to 600 meters) 1.90
1—J6500 Vacuum Tube Socket .35
1—J4311 30 ohm Rheostat. .65
2—J2121 21 Plate Variable Condensers 2.50
1—J5059 Grid Leak Condenser80
8—J201 Rasco Binding Posts80
2 Doz. J305 Switch Points... .36

3—J200 Rasco Switch Levers75
2—J3075 3" Dials50
2—J1450 Vernier Attachments60
24 Ft. J6400 Bus Bar Wire60
1—J1000 Double Circuit Jack .65
1—J1003 Rasco Plug55
8—J6003 Binding Post Name Plates24
1—J1430 Brass Strip, 6"x1/2"x1-16"10
1—Consrad Assembling Pattern50
Total \$14.85
Our Price \$14.25

2 Stage Amplifier
1—J710 Mahogany Cabinet\$2.60
1—J7100 Dilectryte Panel90
1—J1100 A.F. Transformers. 4.00
2—J1000 Double Circuit Jacks 1.30
1—J1003 Rasco Plug55
2—J6500 Tube Sockets70
2—J4311 30 ohm Rheostats. 1.30
10—J6060 Post Name Plates .30
10—J201 Rasco Binding Posts 1.00
30 Ft.—J6400 Bus Bar Wire .75
Blue Prints and directions... .50
Total \$13.90
Our Price \$13.50

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- Radio Mechanic, \$1,500 to \$4,000 a year.
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