

Dec.

RADIO PHONE  
**WRNY**  
STATION

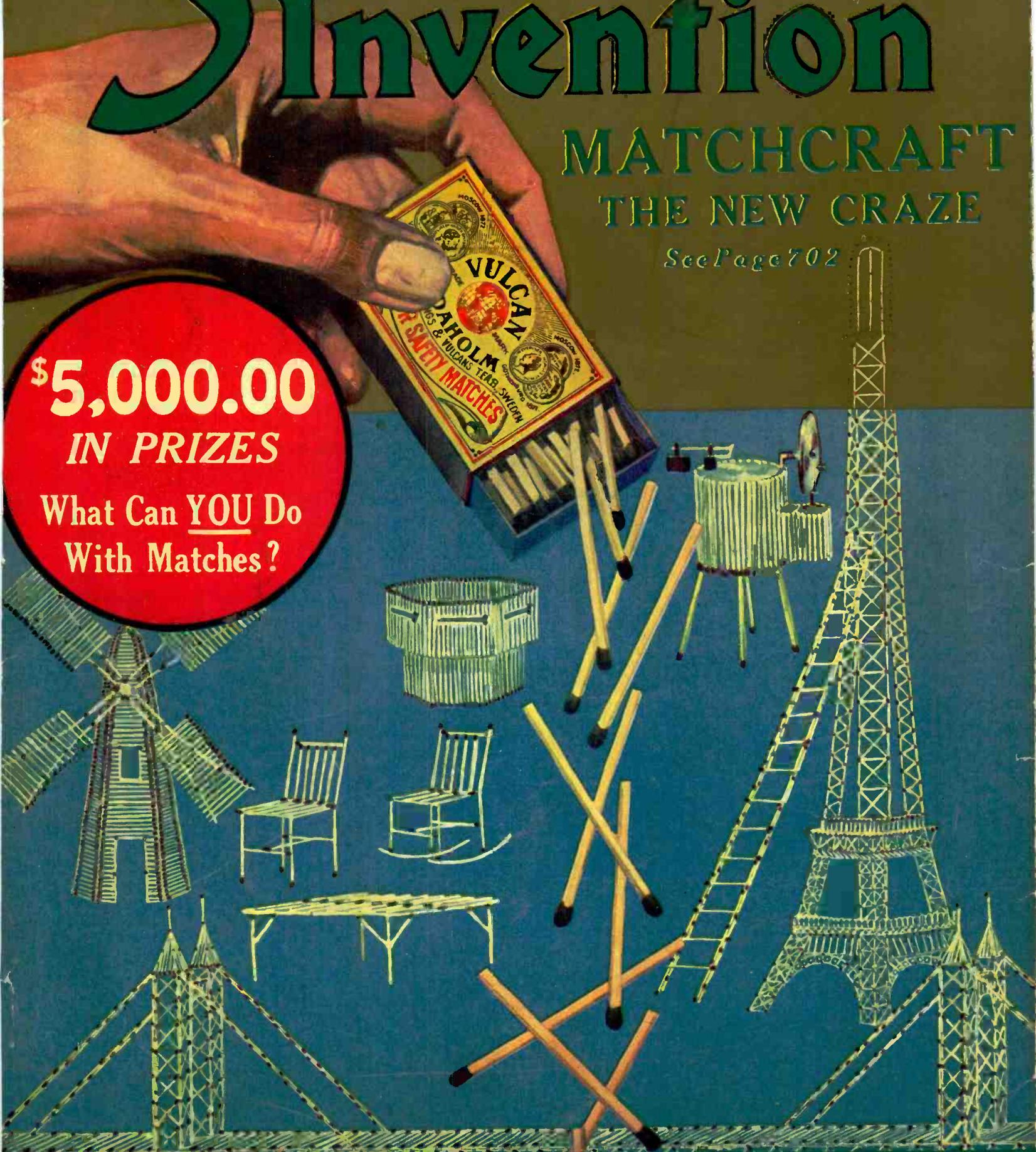
25 Cents

# Science and Invention

## MATCHCRAFT THE NEW CRAZE

See Page 702

**\$5,000.00**  
IN PRIZES  
What Can YOU Do  
With Matches?



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

# Send for this RADIO BOOK FREE

**The World's  
Largest Exclusive  
Radio Mail Order House  
Will Send You This Wonderful Book FREE**

64 illustrated pages containing thousands of bargains in radio sets, semi-finished sets and radio kits of all styles, sizes and approved circuits. **5 tube complete sets as low as \$29.50.** Beautiful models of the very latest designs and types. Elaborate console models with **loud speakers built right into cabinets** of genuine mahogany and walnut. **ALL SETS GUARANTEED.** Coast to coast receiving range. Catalogue also contains everything in radio supplies, including batteries, chargers, loud speakers, transformers, condensers, rheostats and any other parts you may want for improving your set or building a new one. **Guaranteed saving to you of 1/3 to 1/2.**



# 1926 Catalog of RADIO BARGAINS Save 1/3 to 1/2

## AMERICAN RADYNOLA 5 TUBE SET

# \$29.50



### The Biggest 5-Tube Value on the Market

Positively the world's greatest 5 tube radio bargain. REGULAR \$75.00 VALUE. Our large quantity production enables us to sell this set for **ONLY \$29.50**, fully built and wired in beautiful mahogany cabinet of latest design with sloping Bakelite panel of Satin finish, handsomely etched and engraved as illustrated. Constructed of the finest low-loss condensers, coils and sockets, bakelite baseboard, panel and dials. **PRICE FOR SET ONLY. \$29.50**

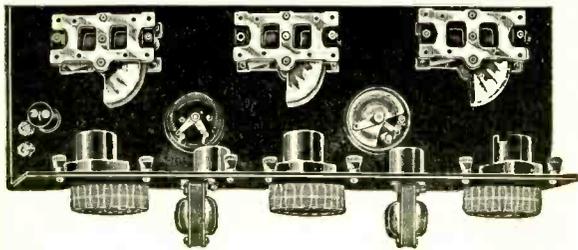
Transportation charges extra, shipping weight 25 pounds.

### This Set with All Accessories, Including The Famous American Bell Loud Speaker

with adjustable unit, 2-45 volt "B" batteries, one guaranteed 100 Ampere Hour storage "A" battery, cable for battery connection, 5-201A tubes, Aerial and ground equipment, and everything complete ready to set up and operate. Nothing else to buy. **PRICE \$59.75** Transportation charges extra. Shipping weight 100 pounds. Complete instructions with set.

**Order Direct From This Page!** Save 1/3 to 1/2. Our guarantee protects you. Money cheerfully refunded if you are not satisfied. Write your order and prices plainly. Send post office money order or bank draft for full amount to insure safety. Refer to any bank or commercial agency regarding our reliability.

### Semi-Finished 5-Tube RADIO FREQUENCY RECEIVING SET

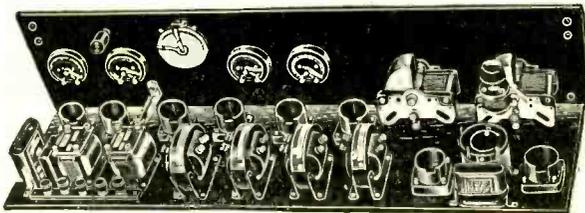


This special offer is astounding the radio world. Coast to coast reception on loud speaker. Low-loss condensers and sockets. Highest quality transformers. Bakelite rheostats. All wiring concealed under Bakelite baseboard. 7 x 18 panel fits into any standard 7 x 18 cabinet. Complete instructions for operating. **GUARANTEED SAVING TO YOU OF \$60.00.** Price of set all mounted. Not wired. Cabinet of same model as American Radynola **\$18.75** pictured above **\$5.55** extra

You must have our catalog no matter what set or kit you want. Our line is complete and includes all popular sets, such as Super-Heterodyne, Neutrodyne, Ultra-dyne, Reinartz, Regenerative, Radio Frequency, Browning-Drake, Reflex and all other latest circuits. Kits, sets and parts manufactured by all well known manufacturers such as Frost, Howard, Baldwin, Brandes, Western Electric, Columbia and others.

Our semi-finished sets come with all parts mounted on panel and baseboard ready for wiring. Do not fail to send for our catalog. Remember—we are the largest exclusive radio mail order dealers in the world and carry the best of everything in radio. We save you 1-3 to 1-2 on the following kits. Detailed description appear in our catalog.

### Semi-Finished 8-Tube Super-Heterodyne



#### World's famous 8-tube Super-Heterodyne

Fully mounted on panel and baseboard. These pictures show interior set and how it looks when enclosed in cabinet. Comes completely assembled ready to wire and operate. We have testimonials from thousands of builders of this set. **Some Have Received Foreign Stations on Loop Aerial.** Unsurpassed in volume and tone quality. Low-loss straight line frequency condensers, vernier dials, finest quality rheostats. Matched or Columbia long wave transformers. Requires only three screws for attaching panel and baseboard and set is ready to operate. 7x30 panel. Price of set only.

Requires following accessories to complete this set. 7x30 cabinet, 5-201A tubes for storage battery operation or 100 tub's for dry cell operation. 100 Ampere hour storage battery, 2-45 volts "B" batteries, loud speaker, center tapped loop aerial. All these items are listed in our catalog at a tremendous saving. **\$43.75**

Complete Parts for Best 45 Kilocycle Super-Heterodyne Genie Remler Parts **\$49.50**

**NEUTRODYNE**  
Genuine Licensed Neutrodyne kit of parts come fully assembled on the panel and baseboard with complete instructions ready to wire **\$29.75**

**OUR GUARANTEE**  
Every article exactly as represented. Every article is tested before shipping. Complete satisfaction or money cheerfully refunded.

**COCKADAY**  
3-tube Cockaday kit of parts, fully assembled on panel and baseboard, ready to wire **\$15.85**

**BREMER TULLY**  
Complete Parts 5 Tube "Nameless" Kit. No additional parts necessary. **\$42.50**

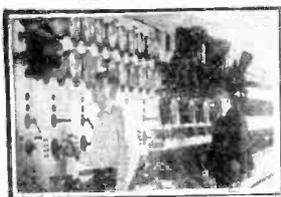
**ROBERTS KNOCKOUT**  
Complete Parts 3 Tube Set **\$27.95**  
4 Tube Set **\$33.75**

**BROWNING-DRAKE**  
4-Tube Kit **COMPLETE \$32.40**

**OUR CATALOG**  
includes complete list of broadcasting stations and general information and facts about our free service division. Our radio engineers will help you solve all your radio problems. Send your name and address on a card or in a letter. We will send catalog FREE.

**RANDOLPH RADIO CORPORATION**  
159 N. Union Ave. Dept. 183 Chicago, Illinois

# Get a Job Like These

	<p><b>\$20 a Day for Schreck</b>          "Use my name as a reference and depend on me as a booster. The biggest thing I ever did was answer your advertisement. I am averaging better than \$500 a month from my own business now. I used to make \$18 a week."          A. Schreck,          Phoenix, Arizona.</p>		<p><b>Makes \$700 in 24 Days in Radio</b>          "Thanks to your interesting Course I made over \$700 in 21 days in Radio. Of course, this is a little above the average but I run from \$10 to \$10 clear profit every day, so you can see what your training has done for me."          Fred G. McNabb,          848 Spring St., Atlanta, Ga.</p>	
<p><b>PLANT ENGINEER—Pay Raise—150%</b>          "I was a dumbbell in electricity until I got in touch with you Mr. Cooke, but now I have charge of a big plant, including 600 motors and direct a force of 34 men—electricians, helpers, etc. My salary has gone up more than 150%."          George Illingworth,          63 Calumet Road, Holyoke, Mass.</p>		<p><b>\$70 to \$80 a Week for Jacquot</b>          "Now I am specializing in Auto Electricity and battery work and make from \$70 to \$80 a week and I am just getting started. I don't believe there is another school in the world like yours. Your lessons are a real joy to study."          Robert Jacquot,          2005 W Colorado Avenue,          Colorado Springs, Colorado.</p>		<p><b>\$1000 a Month for Jirinec</b>          "You will be glad to know that my business is now rounding into shape—I am making now from \$800 to \$1000 every month myself. But I've got you to thank for what I've done."          John Jirinec,          1133 Fourth Ave.,          Astoria, N. Y.</p>

Learn to Earn **\$3,500** to

**\$10,000** a Year

## ELECTRICITY ~The Big-Pay Field~ NEEDS YOU NOW



**I Will Train You  
 at Home—Spare  
 time Only Needed**

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

### Electrical Experts Are In Big Demand

Even ordinary electricians—"the screw driver" kind—are making big money, but trained men—Electrical Experts who get the top salaries—are needed more now than ever before. Thousands of Cooke Trained Men easily earn \$3500 to \$10,000 a year. That's the kind of job you want—where you can plan, and boss and supervise the work of others or go in business for yourself. Get started towards one of these big-pay jobs now. Learn to earn \$70 to \$200 a week—you can do it with Cooke Training—recommended by more than ten thousand successful graduates. Just mail the coupon below.

### Employment Service and Help—No Extra Charge

I will train you for a big pay job and help you get it without extra charge. Hundreds of Employers look to me for the electrical men they hire. Last year I placed over one thousand men at big raises in pay. Hundreds of others were promoted by their employers through the help of my Vocational Service and other hundreds went into business for themselves with the help of my special Business Training. Mail Coupon for big free book which explains this service and fourteen other features, many of which can't be had anywhere else.

### Age or Lack of Experience Bars No One

You don't need experience. You don't have to be a College man. You don't have to be even a high school graduate. As Chief Engineer of this big two million dollar institution which does a general Consulting Engineering Business besides operating one of the world's greatest Training

Schools, I know just what training you need to make a big success in electricity. Let me give you that training with my simplified, complete home course,—the world's famous "Cooke Training"—built on my own 20 years of engineering experience with the help of nearly 50 other engineers. Learn to earn \$70 to \$200 a week—Only spare time needed.

### My Training Pays For Itself

You can start earning extra money a few weeks after you start my training. I give you special instruction for doing simple electrical jobs in your spare time—show you how to get these jobs and tell you what to charge. Many of my students make as high as \$25 a week extra this way while studying. My course more than pays its own way.

### Your Satisfaction Guaranteed

I am so sure I can make you a big success in Electricity, just like I have done for the men whose pictures you see here and thousands of others who now boost my training that I will guarantee your satisfaction with a signed, money-back guarantee bond. If my training doesn't satisfy you after you have finished, you get back every penny you pay me. A two million dollar institution stands back of this guarantee.

### Get Started Now—Mail Coupon

Get my big free book—"The Vital Facts about Electricity." Read about the success of hundreds of other men—who recommend this training and whose names and addresses are being given in my book. Get the real dope about your opportunities in Electricity. See how easy it is to get started on the road to jobs that pay \$70 to \$200 a week.

Don't deny yourself this chance to make big money. Get the facts—Mail Coupon at once for facts and my guarantee.

**5 Wonderful Working Outfits Free to Students**

1. LABORATORY AND EXPERIMENTAL OUTFIT. Complete material for interesting experiments.
2. BELL AND ALARM OUTFIT. Electrical apparatus material and tools—a complete installation kit.
3. ELECTRIC LIGHTING OUTFIT. Wire, Switches, Lights, etc. Everything needed to make up all complicated electric lighting circuits.
4. ELECTRIC POWER OUTFIT. The Famous "Cooke" Motor and other apparatus. Not a toy—but a real, honest-to-goodness, workable machine.
5. TRANSFORMER OUTFIT. Complete parts for building and winding this widely used equipment.

Get this Big Book Now!



**L. L. COOKE, Chief Engineer,  
 Chicago Engineering Works, Inc.  
 Dept. 29, 2150 Lawrence Ave.,  
 CHICAGO, ILLINOIS**

**L. L. COOKE, The Man  
 Dept. 29 Who Makes  
 2150 Lawrence "Big-Pay"  
 Ave., Chicago Men**

**MAIL COUPON FOR MY FREE BOOK**

Send me at once without obligation your big illustrated book and complete details of your Home Study Course in Electricity, including your outfit and employment service offers.

Name.....

Address.....

Occupation.....

**5 big outfits given to you—no extra charge**



*The "Cooke" Trained Man is the "Big Pay" Man*

Vol. XIII.  
Whole No. 152

December, 1925  
No. 8

# Science and Invention

FORMERLY  
**ELECTRICAL EXPERIMENTER**

Member Audit Bureau of Circulations

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

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

Published by Experimenter Publishing Company, Inc.

(H. Gernsback, Pres.; S. Gernsback, Treas.; R. W. DeMott, Sec'y.)

Publishers of **SCIENCE & INVENTION, RADIO NEWS, THE EXPERIMENTER**  
and **MOTOR CAMPER & TOURIST.**

## EDITORIAL STAFF

HUGO GERNSBACK, *Editor-in-Chief.*  
H. WINFIELD SECOR, E. E.,  
*Managing Editor.*  
DR. T. O'CONNOR SLOANE, Ph.D., M. A.,  
*Associate Editor.*  
JOSEPH H. KRAUS, *Field Editor.*  
A. P. PECK, Assoc. I. R. E.,  
*Radio Editor.*  
S. GERNSBACK, *Wrinkles Editor.*  
M. ESSMAN, *Art Director.*

## CONTRIBUTING EDITORS

*Astronomy—*  
Dr. Donald H. Menzel, Ph.D., Ohio  
State University.  
Isabel M. Lewis, M.A., of the U. S.  
Naval Observatory.  
*Entomology and Allied Subjects—*  
Dr. Ernest Bade, Ph.D.  
*Physics—*  
Dr. Harold F. Richards, Ph.D.  
Ernest K. Chapin, M. A.  
Dr. Donald H. Menzel, Ph.D., Ohio  
State University.  
*Automotive Subjects—*  
Tom C. Plumridge.  
George A. Luers.  
*Chemistry—*  
Raymond B. Wailes.  
*Radio—*  
Dr. Ernest Bade, Ph.D.  
Sylvan Harris.  
Leon L. Adelman.  
*Magic and Psychic Phenomena—*  
Joseph Dunninger.  
Joseph F. Rinn.  
Edward Merlin.  
*Foreign Correspondents—*  
Dr. Alfred Gradenwitz, Germany.  
Dr. H. Becher, Germany.  
C. A. Oldroyd, England.  
S. Leonard Bastin, England.  
A. N. Mirzaoff, France.  
Hubert Slouka, Czecho-Slovakia.  
P. C. van Petegem, Holland.  
Richard Neumann, Austria.

## IN OUR NEXT ISSUE

### King Winter Foiled By Science

Every winter, traffic in the harbors of temperate and northern countries is usually tied up for some length of time by ice blockades. An article will show how science can be applied to eliminate this great loss of time.

### How Air-Ports of the Future May Look

A full page futuristic drawing will clearly show how the self-contained air-ship terminals may appear.

### Where Do You Weigh Most?

Some interesting disclosures, based on the laws of gravity, will show differences in weight of an object in various places.

### An Entirely New Brain Teaser

Everyone is more or less interested in problems of all kinds. We are going to present a new type that is as interesting and absorbing as it is novel.

### Can Radio Sets Be Used on Alternating Currents?

Yes, if a properly designed and constructed rectifying and filter system is used. A manufactured set operating entirely from A.C. will be described.

## Contents for December

Editorial . . . . .	701	Window Control . . . . .	729
By Hugo Gernsback.		By Edward L. Salmon.	
Matchcraft . . . . .	702	A Pocket Metronome . . . . .	729
By Hugo Gernsback.		By Dr. Russell G. Harris.	
Bridge Is Great Engineering Feat. . . . .	706	Sound Gauge . . . . .	729
Science in Prison Escapes . . . . .	707	Finding the Center of Gravity by Experiment . . . . .	730
By Joseph Fulving Fishman.		By C. A. Oldroyd, Rep. No. 4433.	
New Light on Human Reactions . . . . .	708	Shadow Pictures . . . . .	731
By Dr. Buttersack.		How-to-Make-It Department . . . . .	732
Electric Fountains Float in the River Seine . . . . .	709	Readers' Forum . . . . .	733
By A. N. Mirzaoff.		Wrinkles, Recipes and Formulas . . . . .	734
Photo-Electric Eye Sorts Cigars . . . . .	710	Edited by S. Gernsback.	
New Labor-Saving Devices . . . . .	711	Power Speaker and Super-Hetero- dyne on A.C. . . . .	735
Refrigerated Theatres . . . . .	712	By L. Port.	
By H. Winfield Secor.		"WRNY" Plan Expands . . . . .	736
Trick Photography in "The Gold Rush" . . . . .	714	By Charles D. Isaacson.	
By Edwin Schallert.		The One-Tube Regenerative Inter- flex . . . . .	738
Astounding Strength of Insects . . . . .	716	By Hugo Gernsback.	
By Dr. Ernest Bade.		The Radio Constructor . . . . .	739
New Rescue Methods for Subma- rinists . . . . .	718	By A. P. Peck, Assoc. I. R. E.	
By F. W. Horton.		Novel Audio Frequency Amplifier . . . . .	743
Scientific Santa Delights Children . . . . .	720	By R. L. Young.	
By Joseph H. Kraus.		The Radio Oracle . . . . .	744
Mineral and Oil Finder . . . . .	722	Non-Sci(ence) . . . . .	745
How Movie Railroad Wrecks Are Made . . . . .	723	Latest Patents . . . . .	746
By Frank George Kerk.		Scientific Humor . . . . .	747
Tarrano, the Conqueror . . . . .	724	The Oracle . . . . .	748
By Ray Cummings.		Awards in Our \$1,000.00 Monthly Contest . . . . .	750
Scientific Problems and Puzzles . . . . .	726	Patent Advice . . . . .	760
By Ernest K. Chapin.		Edited by A. P. Peck.	
Magic . . . . .	727	Book Review . . . . .	771
By Dunninger.		Radio Wrinkles . . . . .	775
Mathematical Cross-Number Puzzles . . . . .	728	Motor Hints . . . . .	779
By Richard H. Tingley.		By Tom C. Plumridge.	

HOW TO SUBSCRIBE FOR "SCIENCE AND INVENTION." Send your name, address and remittance to Experimenter Publishing Co., 53 Park Place, New York City. Checks and money orders should be made payable to Experimenter Publishing Co., Inc. Mention the name of the magazine you are ordering inasmuch as we also publish RADIO NEWS, THE EXPERIMENTER and MOTOR

CAMPER & TOURIST. Subscriptions may be made in combination with the other publications just mentioned at special reduced club rates. Send postal for club rate card. Subscriptions start with the current issue unless otherwise ordered. ON EXPIRATION of your subscription we enclose a renewal blank in our last number to you, and notify you by mail. Then unless we receive your

order and remittance for a renewal, delivery of the magazine is stopped. CHANGE OF ADDRESS: Notify us as far in advance as possible, giving your old address as well as the new one to which future magazines are to go. It takes several weeks to make an address change on our records.

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

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

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

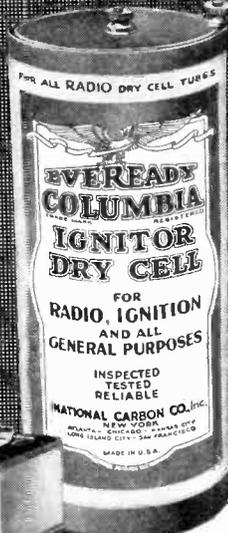
San Francisco, Calif. Title Registered at the Patent Office. Copyright, 1925, by E. P. Co., Inc., New York. The Contents of this Magazine are copyrighted and must not be reproduced without giving full credit to the publication. SCIENCE AND INVENTION is for sale at all newsstands in the United States and Canada. European Agents, S. J. Wise Et Cie, 40 Place Verte, Antwerp, Belgium.

New England Advertising Representative Western Advertising Representatives Pacific Coast Advertising Representatives Kansas City Advertising Representatives  
T. F. Magrane Finucan & McClure A. J. Norris Hill Co. Davies & Dillon  
Park Square Bldg., Boston, Mass. 720 Cass St., Chicago, Ill. Hearst Bldg., San Francisco, Cal. 15 W. 10th St., Kansas City, Mo.

**EVEREADY HOUR**  
**EVERY TUESDAY AT 9 P. M.**  
*Eastern Standard Time*

For real radio enjoyment, tune in the "Eveready Group," broadcast through stations—

- |                  |                  |
|------------------|------------------|
| WEAF New York    | WCAE Pittsburgh  |
| WJAR Providence  | WSAI Cincinnati  |
| WEEL Boston      | WJL Detroit      |
| WCTS Worcester   | WCCO Minneapolis |
| WFI Philadelphia | WOC St. Paul     |
| WGR Buffalo      |                  |



No. 764  
 Portable  
 22½-volt  
 Vertical  
 Price  
 \$1.75



Eveready  
 Columbia  
 Ignitor  
 "A"  
 Battery,  
 the proven  
 dry cell  
 for all  
 radio  
 dry cell  
 tubes  
 1½ volts

No. 779  
 22½-volt  
 Large  
 Vertical  
 Price  
 \$2.00



No. 771  
 4½-volt  
 "C"  
 Battery  
 Price  
 60 cents

## For radio economy

EVEREADY Radio Batteries are noted for their long service and economical operation. They are made in different sizes and types so that every radio user can enjoy the economy and convenience to be had by fitting exactly the right Eveready to his receiver. The five dry cell types of Eveready Radio Batteries are here illustrated and described to make it easy for you to decide just which will give the longest and most economical service on your set. A dealer near you sells Evereadys.

*Eveready Heavy-duty "B" Battery for four or more tubes*

No. 486. *Extra-large Layerbilt.* 45 volts. Vertical. Eveready's latest contribution to radio. The new Layerbilt construction which gives much greater service. Same size as No. 770. Price \$5.50.

*Eveready "B" Battery for one to three tube sets*

No. 779. *Large.* 22½ volts. Vertical. Especially adapted for Radiola 25, DeForest D-17 and Operadio receivers. Same capacity as No. 766, and suitable wherever variable taps are not required. Price \$2.00.

*Eveready "B" Battery for portable sets*

No. 764. *Portable.* 22½ volts. Vertical. For portable sets where medium weight and size are permissible. Price \$1.75.

*Eveready "A" Battery*

Eveready Columbia Ignitor Dry Cell Radio "A" Battery for all dry-cell tubes. 1½ volts. The dry battery used by vacuum-tube engineers in developing the dry-cell tube.

*Eveready "C" Battery*

No. 771. 4½ volts. Saves "B" Batteries, improves tone. Price 60 cents.

*Manufactured and guaranteed by*

**NATIONAL CARBON COMPANY, INC.**  
 New York San Francisco

Canadian National Carbon Co., Limited, Toronto, Ontario

# EVEREADY Radio Batteries

*- they last longer*



No. 486  
 45-volt  
 Layerbilt  
 Extra-  
 large  
 Vertical  
 Price  
 \$5.50

# SCIENCE and INVENTION READERS' BUREAU

## Time and Postage Saver

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

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

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

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

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

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

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

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

TEAR ALONG THIS LINE

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

S. & I. 12-25

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

**THIS FORM SHOULD NOT BE USED FOR TECHNICAL QUESTIONS**

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

**THIS FORM SHOULD NOT BE USED FOR TECHNICAL QUESTIONS**

Use this space if you desire information from a manufacturer whose advertisement does not appear in this month's issue.

NAME	ADDRESS (Street — City — State)
.....	.....
.....	.....
.....	.....

Your name.....	Dealer's name.....
Your address.....	His address.....
<input type="checkbox"/> If you are dealer check here. City..... State.....	City..... State.....

**This Book  
FREE!**



# There may be a fortune for you in this **FREE** book about Inventions

Invention is the easiest way to earn a fortune. Little ideas have made millions of dollars for their inventors. This wonderful book explains how fifteen famous inventors now teach you the secrets of successful invention—in your own home.

**H**OW would you like to be the inventor of the Gillette Safety Razor, who made MILLIONS OF DOLLARS IN ROYALTIES? Wouldn't you gladly be the inventor of the snap fastener whose profits were so big that he paid an income tax of \$29,000? Wouldn't you willingly change places with the inventor of the President Suspenders who is now worth millions, or the inventor of the Auto-graphic attachment for cameras who sold his patents for \$300,000?

One single idea—as simple as any of these—can make you independently wealthy in a short time. Other inventors have made thousands of dollars from such common things as the crimped hair-pin, the metal tip shoe-laces, 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.

### Ideas Worth Fortunes

Every day you find ideas for new inventions. It may be a new toy for 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—B. T. Babbitt made millions of dollars. 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.

Perhaps even now you have splendid ideas for inventions but the only reason you have not developed them is because you doubt your own ability to invent. Or, like most persons, you believe that you were not born to be an inventor; that inventors are men who invent things as naturally as other people work as bookkeepers, mechanics, doctors or farmers.

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

### Proof YOU Can Invent

Invention is not guesswork or blind luck—it is not a God-given faculty possessed by a few favored mortals. As a matter of fact inventors themselves say that invention is based upon exact laws which anyone can learn. It is merely a matter of first seeing something to be fixed and then of thinking of some principle which will fix it. 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 "fix things." A leaky 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!

### 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 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. With no special knowledge of mechanics or science you can learn how to invent!

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. What you need now is to develop this ability, so that you can use it to produce profitable inventions. All you need to become successful is this easy, fascinating training which will develop your ability so it will

be worth real money. No special technical or mechanical knowledge or experience is required. Fifteen famous inventors 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.

### New FREE Book

The most interesting part of this wonderful course is that it teaches invention by actual practice right in your own home. With each lesson you are sent at least one practical problem in invention. This absorbing exercise in solving actual inventive problems 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. 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. It may show you the way to make a fortune!

## BUREAU OF INVENTIVE SCIENCE

Dept. 712

Wisner Bldg.,  
Rochester,  
N. Y.

BUREAU OF  
INVENTIVE  
SCIENCE,  
Dept. 712

Wisner Building,  
Rochester, N. Y.

Please send me your  
free book, "The Science of  
Invention."

Name ..... Age.....

Address .....

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

# Men! Here's a Contract



## NEW HAIR in 30 Days Or Absolutely No Cost

Save Yourself From Baldness. Stop Falling Hair. Here is Your Contract—Grow New Hair in 30 Days Or This Trial Won't Cost You One Cent.

By ALOIS MERKE

Founder of Famous Merke Institute, Fifth Avenue, New York

**T**HAT'S clear, isn't it? I make no conditions. No matter how fast your hair is falling out, no matter how much of it is gone—this offer stands. I don't care what treatments you've tried without results. Scalp foods, massages, tonics—here is a new scientific system that will give you a new head of hair—or I pay the whole cost of the treatment myself.

How am I able to make this amazing offer? The answer is simple. The Merke System of hair growth is founded upon a very recent scientific discovery. I have found during many years of research and experience in the Merke Institute, Fifth Avenue, New York, that in most cases of baldness, the hair roots are NOT dead. They are merely dormant—asleep!

It is an absolute waste of time—a shameful waste of money—to try to penetrate to these dormant roots with oils, massages and common ordinary tonics, which merely treat the surface skin. You wouldn't expect to make a tree grow by rubbing "grow-

ing fluid" on the bark—you'd get at the roots.

And that is just what my scientific system does. It penetrates *below* the surface of the scalp. It stimulates the dormant *roots*. It wakens them. The tiny capillaries begin to pump nature's own nourishment into them. Hair begins to grow again. It takes on body and color. No artificial hairfoods—no rubbing. And here's the wonderful thing about this system. It is *simple*. You can use it at home—in any home that has electricity—easily—without the slightest discomfort.

women write in daily about the wonderful results that I gladly make this offer. Here is your contract—try this remarkable treatment for 30 days. Then if you're not simply delighted with the new growth of hair—write me at once. Say that my system hasn't done all I claimed for it—and I'll see that the 30 day trial doesn't cost you one cent.

### Free Booklet Tells All

There's no room here to tell you all about your hair—and about the amazing contract I offer you. But I will be glad to tell you all if you are interested. It's free—absolutely without any obligations. Just mail the coupon and I will send you, without cost, a wonderfully interesting booklet that describes in detail the system that is proving a boon to thousands in this and other countries. Mail this coupon and the booklet will reach you by return mail. Allied Merke Institutes, Inc., Dept. 4612, 512 Fifth Ave., N. Y. C.

### Here's Proof!

"The condition of my hair was very bad. After six weeks' treatment with the Thermocap my head was covered with short hair and it was no longer dull and lifeless. I kept up the treatment and in return I have as good a head of hair as any one could wish."  
CLARENCE TERPENING  
158 South Cedar St., Galesburg, Ill.

"I used the Cap for 30 days when to my great surprise I could see a new coat of hair coming and now my hair is very near as good as it was when it first started to come out."  
J. C. REGAN  
176 West Street, Englewood, N. J.

"Your Thermocap has done a wonderful thing in bringing back my hair where all other things had failed. The top of my head is now entirely covered with hair after using the Thermocap for about two months, and new hair seems to be coming in all the time."  
HARRY A. BROWN  
21 Hampton Place, Utica, N. Y.

### This Is Your Bona-Fide Contract

Thousands of men and women have been treated successfully at the Merke Institute. Hundreds daily are getting amazing results with this easier, less expensive "at home" system of hair growth. Now, I do not say that all cases of baldness are curable. There are some that nothing in the world can help. Yet so many men and

ALLIED MERKE INSTITUTES, INC.,  
Dept. 4612, 512 Fifth Ave., New York City

Please send me—without cost or obligation—a copy of your book, "The New Way to Grow Hair," describing the Merke System.

Name .....

Address .....

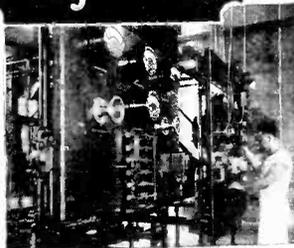
City..... State.....

# Be a RADIO EXPERT

They **EARN \$50. to \$250.** a week in Radio—most fascinating work on earth



**Learn Quickly And Easily At Home This Practical Way ~ ~ ~ ~**



### Government Spending Millions on Radio

U. S. Government now spends millions developing, using Radio. Ex-postmaster General Hays said: "Probably the biggest part in the future of the postal service will be played by Radio." Photo above—sending out time signals at Arlington, great Government Radio station at Washington—Radio is fitting new uses, filling new needs never dreamed of before. Radio Experts are in greater demand than ever.

### Send Coupon Now

Get out of the low-pay rut, get into the most fascinating, easiest big-pay profession on earth. Free Book tells you how. **ACT AT ONCE—SEND FOR BOOK TODAY.**

## Train At Home For A Big-Pay RADIO JOB

Radio today is urgently in need of trained men—Radio Experts. Astonishing opportunities—thousands of them—have been opened up by enormous strides of the Radio Industry. That's why it's easy to make big money in Radio—\$50 to \$250 a week. Here's a field that is teeming with opportunities and room for expansion—a brand-new, wide-awake, and uncrowded industry. If you're earning a penny less than \$50 a week, **clip coupon now for Free Book and proof.**

### Your Satisfaction Guaranteed

Master Radio Engineers will show you how to qualify, quickly and easily at home, for Radio's fine jobs. We guarantee to train you successfully. You don't risk a penny, for we will gladly return every cent paid in tuition if upon completion of course you aren't absolutely satisfied. Back of this guarantee stands all the resources of National Radio Institute, U. S. Government-recognized and the oldest and largest Radio home-study school in the world.

### Age or Lack of Experience No Drawback

You don't need experience before taking this course, and common schooling is enough. Our tested, practical methods make learning clear and easy—the most natural thing on earth.

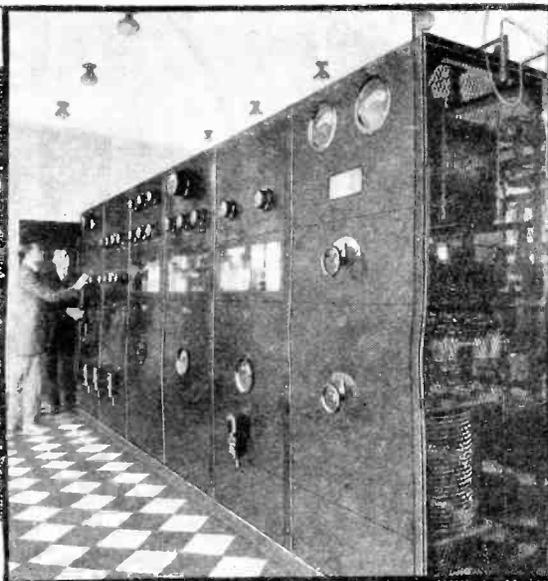
### Famous Course That "Pays For Itself"

Spare time earnings are easiest in Radio-receiving sets everywhere nowadays. In every neighborhood there are scores of jobs you can turn your hand to in an hour or so after supper. Right at the start of your course we give you practical money-making lessons which teach you how to do this work, then how to get it—so by our practical plan you can make your course pay its own way while you're studying.

### Get All The Facts At Once

Astonishing facts on the marvelous new industry of golden rewards—Radio—the fastest-moving, live-wire line. Free Book puts all the facts before you. No obligation. Send coupon for it now.

**NATIONAL RADIO INSTITUTE**  
Dept. 14-OB, Washington, D. C.



### Instruments Given With Course

Receiving sets, from simplest kind to thousand mile receiver, included without extra charge in your course. Other apparatus given to help you learn. An **UNEQUALED OFFER.** Many other big features for limited time only.

### Get This Book

"Rich Rewards in Radio"—most amazing book concerning Radio ever written, will be sent to you promptly when you send the coupon. **ACT NOW.**



### You Can Do What Others Have Done

Why go along at \$15 or \$25 or \$35 a week, when thoroughly-trained Radio Experts earn a hundred or more in the same six days? What this training has done for hundreds of others, it can do for you. Send coupon at once.

**Radio Needs Trained Men**

## N.R.I. TRAINED MEN ARE SUCCEEDING BIG



### Operates WMAQ

"Accepted a position with Chicago Daily News—Station WMAQ. My income practically doubled, thanks to your fine course." Keith Kimball, Chicago, Ill.



### Gets Big Job

"Just been made Sales Manager of this Radio concern—a big raise in pay. Regret I did not take course sooner." R. E. Jones, Bay City, Mich.

"Your course so completely covers Radio it is worth \$40 a week more to anyone in the electrical line. Since graduation have averaged \$50 to \$80 a week more." Preston Fowler, Gordon, Neb.



"The N.R.I. Course has been worth \$2500 a year to me, \$3500 in another year. Thanks a million times to your training." Andrew Shurle, Latrobe, Pa.



"My charges for consultation now \$2.50 per hour. The course is worth to me at least \$50,000." R. W. Blackhill, Brooklyn, N. Y.



"Your course worth \$2500 a year to me—Radio a gold mine. All my success due to your splendid course." A. R. Herke, Winnipeg, Canada.



## MAIL THIS COUPON

**NATIONAL RADIO INSTITUTE,**  
Dept. 14-OB, Washington, D. C.

Without obligating me in any way, send your Free Book "Rich Rewards in Radio"—also full information on your practical, home-study Radio course.

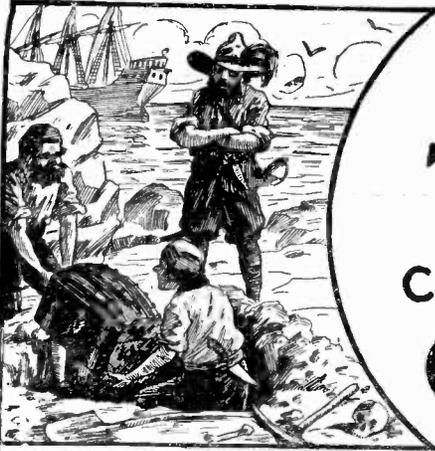
Name .....

Address .....

Town ..... State .....

## LARGEST RADIO SCHOOL IN THE WORLD

ORIGINATORS OF RADIO HOME-STUDY TRAINING



# BURIED TREASURE can still be found in CHEMISTRY



## Good Chemists Command High Salaries

and you can make yourself independent for life by unearthing one of chemistry's yet undiscovered secrets.



**T. O'CONNOR SLOANE,**  
A.B., A.M., LL.D., Ph.D.

Noted Instructor, Lecturer and Author. Formerly Treasurer American Chemical Society and a practical chemist with many well known achievements to his credit. Not only has Dr. Sloane taught chemistry for years but he was for many years engaged in commercial chemistry work.

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

### What Some of Our Students Say of This Course:

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

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

So far I've been more than pleased with your course and am still doing nicely. I hope to be your honor graduate this year.—J. M. NORKUS, JR.

I find your course excellent and your instruction, truthfully, the clearest and best assembled I have ever taken, and yours is the fifth one I've studied.—JAMES J. KELLY.

From the time I was having Chemistry it has never been thus explained to me as it is now. I am recommending you highly to my friends, and urging them to become members of such an organization.—CHARLES BENJAMIN.

I shall always recommend your school to my friends and let them know how simple your lessons are.—C. J. AMPAHL.

I am more than pleased. You dig right in from the start. I am going to get somewhere with this course. I am so glad that I found you.—A. A. CAMERON.

I use your lessons constantly as I find it more thorough than most text books I can secure.—WM. H. TIBBS.

Thanking you for your lessons, which I find not only clear and concise, but wonderfully interesting. I am—ROBT. H. TRAYLOR.

I received employment in the Consolidated Gas. Co. I appreciate very much the good service of the school when a recommendation was asked for.—JOS. DECKER.

## Now Is the Time to Study Chemistry

Not only are there boundless opportunities for amassing wealth in Chemistry, but the profession affords congenial employment at good salaries to hundreds of thousands who merely follow out its present applications. These applications are innumerable, touching intimately every business and every product in the world. The work of the chemist can hardly be called work at all. It is the keenest and most enjoyable kind of pleasure. The days in a chemical laboratory are filled with thrilling and delightful experimentation, with the alluring prospect of a discovery that may spell Fortune always at hand to spur your enthusiasm.

### You Can Learn at Home

To qualify for this remarkable calling requires elaborate specialized training. Formerly it was necessary to attend a university for several years to acquire that training, but thanks to our highly perfected and thorough system of instruction, you can now stay at home, keep your position, and let us educate you in Chemistry during your spare time. Even with only common schooling you can take our course and equip yourself for immediate practical work in a chemical laboratory. Dr. Sloane gives every one of his students the same careful, personal supervision that made him celebrated throughout his long career as a college professor. Your instruction from the very beginning is made interesting and practical, and we supply you with apparatus and chemicals for performing the fascinating analyses and experimental work that plays such a large part in our method of teaching, and you are awarded the Institute's official diploma after you have satisfactorily completed the course.

### Easy Monthly Payments

You don't have to have even the small price of the course to start. You can pay for it in small monthly amounts—so small that you won't feel them. The cost of our course is very low, and includes everything, even the chemistry outfit—there are no extras to buy with our course. Our plan of monthly payments places a chemical education within the reach of everyone. Write us and let us explain our plan in full—give us the opportunity of showing you how you can qualify for a highly trained technical position without even giving up your present employment.

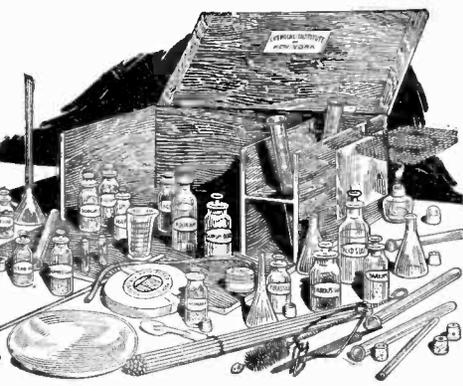
### Special 30 Day Offer

Besides furnishing the student with his Experimental Equipment, we are making an additional special offer for a short while only. You owe it to yourself to find out about it. Write today for full information and free book "Opportunities for Chemists." Send the coupon right now while it is fresh in your mind. Or just write your name and address on a postal and mail it to us. But whatever you do, act today before this offer is withdrawn.

**DON'T WAIT—MAIL COUPON NOW!**

**CHEMICAL INSTITUTE OF NEW YORK**  
Home Extension Division 12  
66-S—West Broadway  
New York City

Please send me at once, without any obligation on my part, your free Book "Opportunities for Chemists," and full particulars about the Experimental Equipment given to every student. Also please tell me about your plan of payment and your special 30 day offer.



### Experimental Equipment Furnished to Every Student

We give to every student without additional charge this chemical equipment, including forty-nine pieces of laboratory apparatus and supplies, and forty different chemicals and reagents. These comprise the apparatus and chemicals used for the experimental work of the course. The fitted heavy wooden box serves not only as a case for the outfit but also as a useful laboratory accessory for performing countless experiments.

## CHEMICAL INSTITUTE OF NEW YORK, Inc.

Home Extension Division 12

66-S—WEST BROADWAY NEW YORK CITY

NAME .....

ADDRESS .....

CITY..... STATE.....  
S.I., Dec. '25

# WIN WEALTH & HONOR

Come to Milwaukee

**I** NVESTIGATE—compare—write to any big business concern in Milwaukee for information about us—or to any of the big electrical organizations in the United States—and you will surely decide to come to Milwaukee, on beautiful Lake Michigan, for your training, at America's Greatest Institution of Practical Electrical Education.

*Built on the Cornerstone of Personal, Individual Service to every student.*



*The only school advertising in this magazine that is authorized to confer the degree of Bachelor of Science upon graduates of its Electrical Engineering College.*

## SCHOOL of ENGINEERING of Milwaukee

### Short-Cut Your Training for Big Pay and High Position

Our equipment is the most elaborate, complete and up-to-date of any electrical school in America, and includes Wiring, Testing, D.C. and A.C. Motor Generator, Armature Winding and Transformer, Starting, Lighting and Ignition, Storage Battery and Chemical Laboratories, Drafting and Designing Rooms and fully equipped Radiocast station right on the grounds of the school. Unique laboratory equipment originally designed and patented by us, housed in concrete four-story building. Our complete facilities afford to every student ample opportunities for actual practice.

No matter how young or old you are, no matter how little or how much general schooling you have had, no matter whether you want to master every branch of electricity and become an Electrical Engineer or want to become a highly skilled and well-paid specialist at one particular kind of

electrical work—there is a place at S. O. E. for YOU. In one of our many classes you can learn to be an Electrical Engineer, Commercial Electrical Engineer, Electrotechnician, Junior Electrical Engineer, Practical Electrician, Motor Generator Repairman, Electrical Draftsman, Automotive Electrician, Radio Salesman and Service-man.

We do not use our students to make secret profits for ourselves by selling the work they do and the things they produce in the shops.

Don't even think of enrolling with any other school until you have written direct to S. O. E. Headquarters for full information about the particular kind of training you are interested in. Choose from the list below. Then mark and mail the coupon TODAY.

S. O. E. graduates make *Big Salaries* everywhere in the great electrical field. Our Employment Department will help you secure profitable employment with opportunities for advancement.

#### Electrical Drafting—Learn in 9 to 12 Months

Easy, interesting, pleasant work that is earning big salaries for our graduates all over the world.

#### Earn While You Learn

We provide for a limited number of worthy men, half-time jobs at good wages, and permanent positions with unlimited prospects to all duly qualified graduates.

#### Electrical Engineering—B. S. Degree in 3 Years

Bachelor of Science degree conferred on graduates. Full provision is made for making up deficient high school credits. It is the Electrical Engineers who have given to the world the thousands of fortune making inventions in the electrical field. No man with this training can fail to realize his highest ambitions in life.

#### Home Electrical Laboratory Training

For those who do not see their way clear to come to Milwaukee now, we offer a very thorough and complete Home Laboratory Course. Ask for details on how you can begin your electrical training at home under our patented Home Laboratory Plan with full size commercial electrical power and equipment valued at \$500 —LOANED without extra charge.

#### Every Instructor a Specialist

These are some of the experts whose teaching has supplied thousands of high-salaried men to the electrical industry through this school—many of whom in overalls and jumpers stand at your elbow teaching and explaining while you learn by doing. The only way you can fail to learn is to refuse to learn: O. Werwath, E.E. Francis A. Vaughn, B.S. Willard C. Hartman, A.B., A.M. Chester C. Aiken, B.S. Asher C. Balt, B.S., LL.B. W. H. Heckman, A.B., E. M. Boren, A.B. Ben. A. Dowe, B.S. E. L. Consover, M.E. J. T. Baker, B.S. W. E. Fisher, B.S. George B. Haverson, A.B. Elmer A. Ihrke, B.S. Arthur A. Koch, M.S., Ph.D. Fred W. Kratzer, A.B. Charles Nyberg, A.B. C. E. Pettingill, B.S. Charles M. Plotz, F. C. Raeth, B.S. H. A. Rickeman, A.B. Chas. G. Simpson, M.A., Ph.B. V. M. Murray, B.S. J. W. Smith, A. L. Sudduth, E. L. Wiedner.

New Class Starts November Ninth. Enroll today and tomorrow you will be doing actual electrical work in our big shops and laboratories.

### MAIL COUPON NOW

Mail the coupon today for our Free Illustrated Catalog just off the press. Tell us what course interests you most and we will send you special information. Find out about the great opportunity in Electricity today. Learn how we can help you short-cut your training for RANK, HONOR and WEALTH. Don't put it off! MAIL THE COUPON NOW!

Men of Action

## SCHOOL of ENGINEERING of Milwaukee

Dept. S. I.-1225, 415 Marshall Street, Milwaukee, Wisconsin

#### WSOE

RADIOCAST STATION

owned and operated by the SCHOOL OF ENGINEERING OF MILWAUKEE

#### Our Special Three Months Practical Vocational Courses

These courses are intensely practical and are easily learned by any man who can read and understand common English and simple arithmetic.

- Course 1: Learn in THREE Months: Complete practical course in Electric Light, Heat and Power Wiring and Testing.
- Course 2: Learn in THREE Months: Complete practical course in D.C. and A.C. Motors and Generators, Armature Winding.
- Course 3: Learn in THREE Months: Complete practical course in Automotive Electricity—Starting, Lighting, and Ignition, and Storage Batteries.
- Course 4: Learn in THREE Months: Complete practical course in Radio Sales, Service and Broadcasting.

#### Junior Electrical Engineering

Learn in 12 to 30 Months

This elaborate course prepares the student for entrance to our College Course for Electrical Engineers. Junior Electrical Engineers are a special type of electrical experts qualified to fit electricity to the demands of modern industry and for such positions as superintendent of maintenance, director of construction, superintendent of installation and testing, electrical equipment salesman and automotive electrician and radio sales and service work.

#### Electrotechnician—Learn in 1 Year

This course is especially adapted to meet the needs of those young men who wish to become a Commercial Electrical Engineer but do not possess the necessary entrance requirements. In addition to the Practical Commercial Electrical Engineering studies, you will receive academic subjects.

#### Commercial Electrical Engineering—Learn in 1 Year

This new profession demands young men with combined electrotechnical and commercial training. Course unexcelled—most complete, practical electrical training.

#### Practical and Theoretical Electricity—Learn in 6 Months

For the man or youth who cannot spare the time or money to enroll for more intensive and higher training, this course is ideal. We positively guarantee that as a student of one of these classes you will learn Practical Electricity in the shortest possible time—no matter how much you pay for your instruction. This course teaches you everything you need to know to go into business for yourself either as the owner of an electrical shop or as an electrical contractor.

SCHOOL OF ENGINEERING OF MILWAUKEE, S. I.-1225, 415 Marshall St., Milwaukee, Wis.

Please send me, without cost or obligation, your free illustrated book just off the press, and details of the course I have indicated below. (Be sure to mention age, education and course of interest.)

Course .....  
 Name .....  
 Address .....  
 City ..... State .....  
 Age ..... Education .....

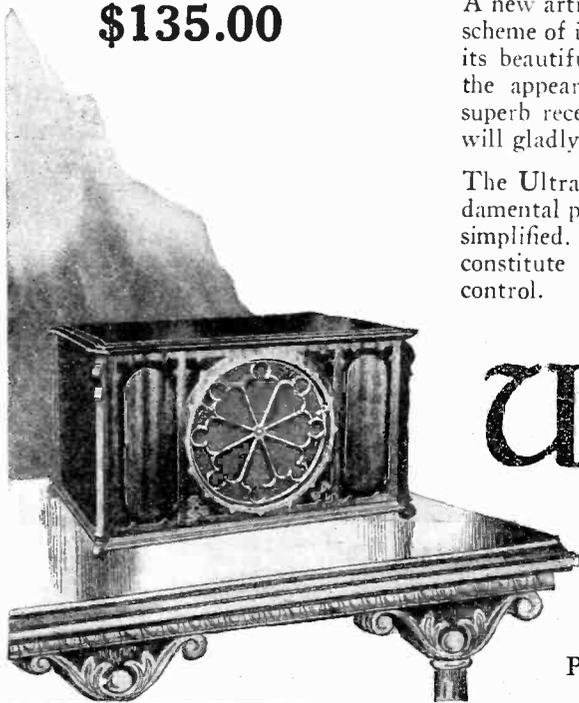
## *No Dials, No Panel, Built-in Loudspeaker*



Designed by R. E. Lacault, E.E., Chief Engineer of this Company, and formerly Radio Research Engineer with the French Signal Corps, Radio Research Laboratories.

To protect the public, Mr. Lacault's personal monogram seal (R.E.L.) is placed on the assembly lock bolts of all genuine ULTRADYNE Model L-3 Receivers. All Ultradyne Receivers are guaranteed as long as these seals remain unbroken.

**\$135.00**



## *The Quiet Manner and The Eloquent Tone*

UNOBSTRUSIVENESS with sufficiency—the rule of good taste—is the distinguishing grace of the ULTRADYNE Model L-3 Radio Receiver. Ushers in a new era of radio reception—a new, casier command of the air's treasures.

A new artistic form of a radio receiver that blends happily with every scheme of interior decoration. Pleases the eye with its charming lines, its beautiful two-tone mahogany cabinet, its fine proportions. Has the appearance of a decorative tablepiece. Utter simplicity with superb receptive and reproductive qualities. Your local radio dealer will gladly give you a demonstration of this new modern receiver.

The Ultradyne Model L-3 is a six-tube receiver employing the fundamental principles of the best circuits greatly refined and marvelously simplified. No dials—no panel; just two inconspicuous levers, which constitute a station-selector. Volume adjustment, the only other control.

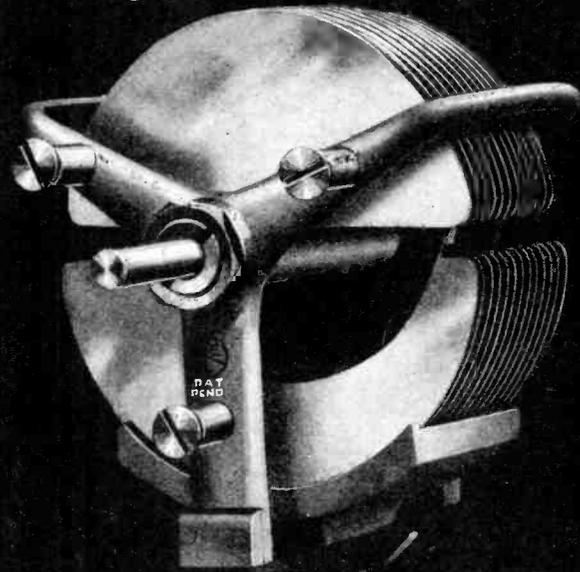
*Write for descriptive folder*

# ULTRADYNE

MODEL L-3

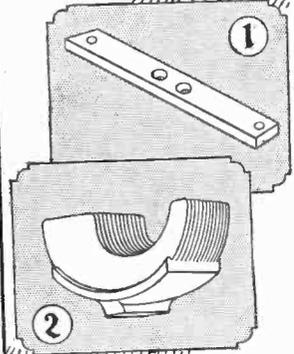
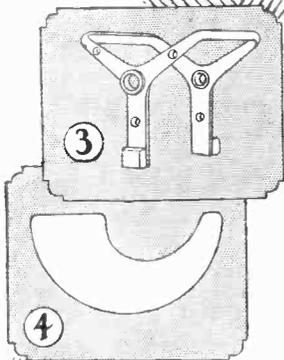
PHENIX RADIO CORPORATION, 114G E. 25th St., N. Y.

# ULTRA-LOWLOSS CONDENSER



CAP. .0005 mfd.

\$5.00



## Unusual Features Increase Receiving Efficiency

IN less than six months the Ultra-Lowloss Condenser has proved its right to leadership by greatly simplified design, greater tuning efficiency, and radically different operating results—not only in the eyes of scientific and engineering men, but with the buying public as well.

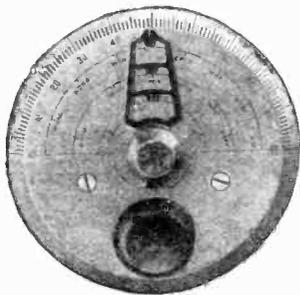
These are the predominating Ultra-Lowloss features: (1) Single insulation strip reduces leakage losses materially, (2) Monoblock mounting with plates cast into block reduces series resistance and assures positive contact, (3) Minimum of metal of high resistance material in the field and frame reduces eddy current losses, (4) Cutlass Stator Plates produce a straight line wavelength curve—separating stations evenly over the dial. Each degree on a 100 degree scale dial represents approximately  $3\frac{1}{2}$  meters over the broadcast wavelength range.

This even separation applies to both high and low wavelengths! Simplifies tuning materially!

The Ultra-Lowloss Condenser is a recent development of R. E. Lacault, E.E., originator of the famous Ultradyne Receiver.

Design of Lowloss Coils furnished free with each Condenser for amateur and broadcast wavelengths showing which will function most efficiently with the Condenser.

At your Dealer's. Otherwise, send purchase price and you will be supplied postpaid.



Simplifies radio tuning. Pencil record a station on the dial—thereafter simply turn the finder to your pencil mark to get that instantly. Easy—quick to mount. Eliminates fumbling, guessing. Furnished clockwise or anti-clockwise in gold or silver finish. Gear ratio 20 to 1. Silver \$2.50. In gold finish, \$3.50.

**ULTRA-VERNIER  
TUNING CONTROL**



*R. E. Lacault*

To manufacturers who wish to improve their sets

I will gladly consult with any manufacturer regarding the application of this condenser to his circuit for obtaining best possible efficiency.

# ULTRA-LOWLOSS CONDENSER



Write for Descriptive Folder.

PHENIX RADIO CORP., 114 East 25th St., New York



# Master Electricity By Actual Practice

The only way you can become an expert is by doing the very work under competent instructors, which you will be called upon to do later on. In other words, *learn by doing*. That is the method of the New York Electrical School.

Five minutes of actual practice properly directed is worth more to a man than years and years of book study. Indeed, Actual Practice is the only training of value, and graduates of New York Electrical School have proved themselves to be the only men that are fully qualified to satisfy EVERY demand of the Electrical Profession.

## The Only Institution of the Kind in America

At this "Learn by Doing" School a man acquires the art of Electrical Drafting; the best business methods and experience in Electrical Contracting, together with the skill to install, operate and maintain all systems for producing, transmitting and using electricity. A school for Old and Young. Individual instruction.

## Over 9,500 Graduates are Successful Men in the Electrical World

No previous knowledge of electricity, mechanics or mathematics is necessary to take this electrical course. You can begin the course now and by steady application prepare yourself in a short time. You will be taught by practical electrical experts with actual apparatus, under actual conditions.

The N. Y. E. S. gives a special Automobile Ignition Course as an advanced training for Auto Mechanics, Garage Men and Car Owners. The course covers completely all Systems of Ignition, Starters, Lighting and other electrical equipment on automobiles, motor boats, airplanes, etc.

*Let us explain our complete courses to you in person. If you can't call, send now for 64-page book—it's FREE to you.*

New York Electrical School  
29 W. 17th St., New York, N. Y.

Please send FREE and without obligation to me your 64-page book.

..... NAME  
..... STREET  
.....CITY .....STATE

# New York Electrical School

29 West 17th Street, New York

# Science and Invention

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

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

## How Science Affects Our Lives

By HUGO GERNSBACK

**I**F you stand with your face close up to a painting, it is impossible to get a good view of it, as you have no perspective of the painting. A fish swimming in water is not aware of the fact that there is water surrounding him. A young child is not conscious that it is surrounded by air on all sides.

These trite remarks lead up to the fact that we of today are immersed in an age of science to such an extent that we no longer are conscious that science affects us at every hand and in a myriad of different ways; all of which we do not observe any longer, because we have become so thoroughly accustomed to them.

During the last 150 years the world has seen more progress due to science than it saw practically for the entire time that went before—that is to say, as far as human beings are concerned, a stretch of some 150,000 or more years.

Picture the astonishment, if you can, of your great-great-grandfather suddenly brought into our present-day civilization. It probably would be impossible for him to live the same life as we do today, because he was not brought up in the atmosphere of the science of our era.

When we speak of science, we refer to anything and everything that has to do with scientific advance,—Electricity and its millions of uses and adaptations, mechanics and its millions of different ramifications, throughout the world.

The strangest part, and the one which few of us realize at any time is that our present civilization, built upon the science platform, is of great frailty. Take such a comparatively simple thing as transportation. Suppose all railroads, steam and electric, as well as all automobiles, should suddenly cease to function for as short a period as six months. The whole world would immediately be thrown into turmoil and life could no longer go on. People

in large cities would either starve to death or have to walk back to the country, because there would be no way to bring the food to them; even going back to horse-and-wagon would not help—quite the contrary, it would make it worse.

Our cities and population have grown to such tremendous sizes that the horse-and-wagon would never be adequate to furnish food and other commodities quickly enough. Witness the fact today of any highway, which is mostly choked with the tremendous truck traffic moving at the rate of from 25 miles an hour upwards. Then take a horse-drawn vehicle, going at five miles an hour, and figure out what would happen.

Take our communication systems—the telegraph, the telephone, and radio. Wipe these out also for a six-month, and see what would happen. Commerce would be at a standstill, and there would be general chaos. The suppression of the telephone would not be all—the new condition would then mean that we would either have to walk or ride in horse-drawn carriages—a condition which you can readily imagine in your mind as being impossible, as far as our present-day lives are concerned. Take away electricity and steam, and our present buildings and houses would become untenable.

These are only a few random selections, leaving out thousands of other scientific accomplishments that have come into vogue during the last 150 years. But even with the few mentioned, it will be seen that we would retrograde immediately several centuries, and after most of our population had died of starvation, plague or what not, the world would go back to where it was centuries ago, and remain in a much worse condition than it was at that time, because our ancestors of that period had become used to existing conditions and had accommodated themselves to these. They would be lost in our environment.

### I BELIEVE THAT:

our present civilization is upheld only by thin gossamer threads of science.

### I BELIEVE THAT:

science is the cure-all for most of our everyday ills.

### I BELIEVE THAT:

while science speeds up our lives, it also brings us untold advantages.

### THE GOLDEN AGE OF SCIENCE

is symbolized by the golden cover OF SCIENCE & INVENTION, LOOK FOR THE GOLD COVER every month!

# MATCHCRAFT

the Latest Craze

By HUGO GERNSBACK

Member American Physical Society.

HERE is a new and intensely interesting craze originated by the writer, which bids fair to become famous over-night, from all present indications. Here is a brand new craft that can be easily mastered by the youngest, as well as the oldest, of our readers. It is one of the most fascinating pastimes that has appeared within recent years, and is exceedingly simple.

The new craze is best explained in the question: "What can You Do With Matches?" The idea is to fashion or make from matches, various models in miniature or in life size. You can build the simplest things with matches, from a doll's chair to a skyscraper five feet high. You can build bridges, towers, houses, and a myriad of other things, some of which we have tried to show in the accompanying illustrations, all of which were built by the staff of SCIENCE AND INVENTION Magazine.

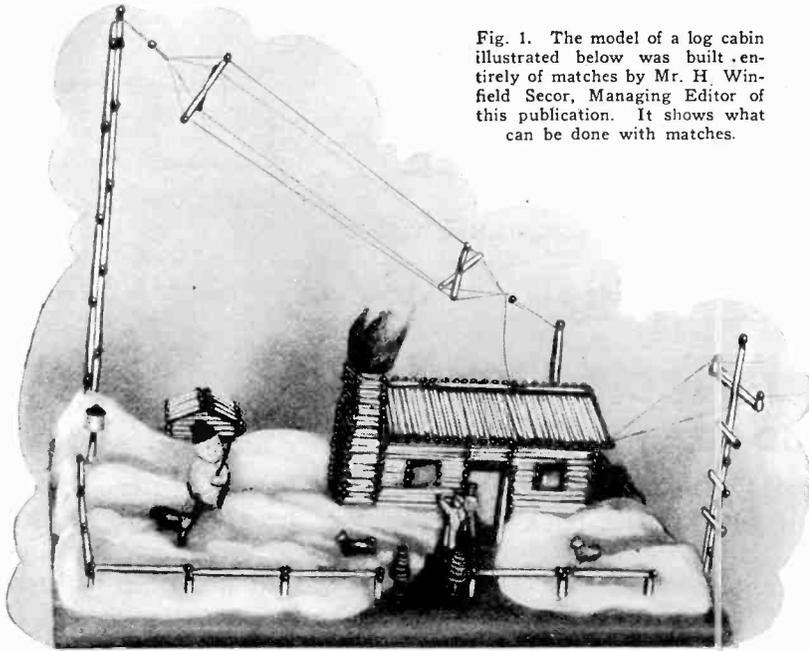


Fig. 1. The model of a log cabin illustrated below was built entirely of matches by Mr. H. Winfield Secor, Managing Editor of this publication. It shows what can be done with matches.

## \$5,000.00 Prize Contest

FOR the next twelve months, SCIENCE AND INVENTION magazine will award a total of \$5,000 in prizes, in a new contest. You are asked to make models, fashioning the same entirely from safety matches. Please read the text of the Matchcraft article carefully and observe the following simple rules:

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

AND INVENTION Magazine will be promptly returned to the builder, who will prepay all charges.

### 16 Monthly Prizes

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

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

for inspection, paying transportation charges both ways.

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

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

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

(13) When photographs are submitted, it is necessary that they be at least 5" x 7", not smaller, and that your name and address appear on the back of each photograph.

(14) In this contest, manuscripts or description of the models are not required, unless the model contains something unusual requiring explanation. Keep all descriptions short.

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

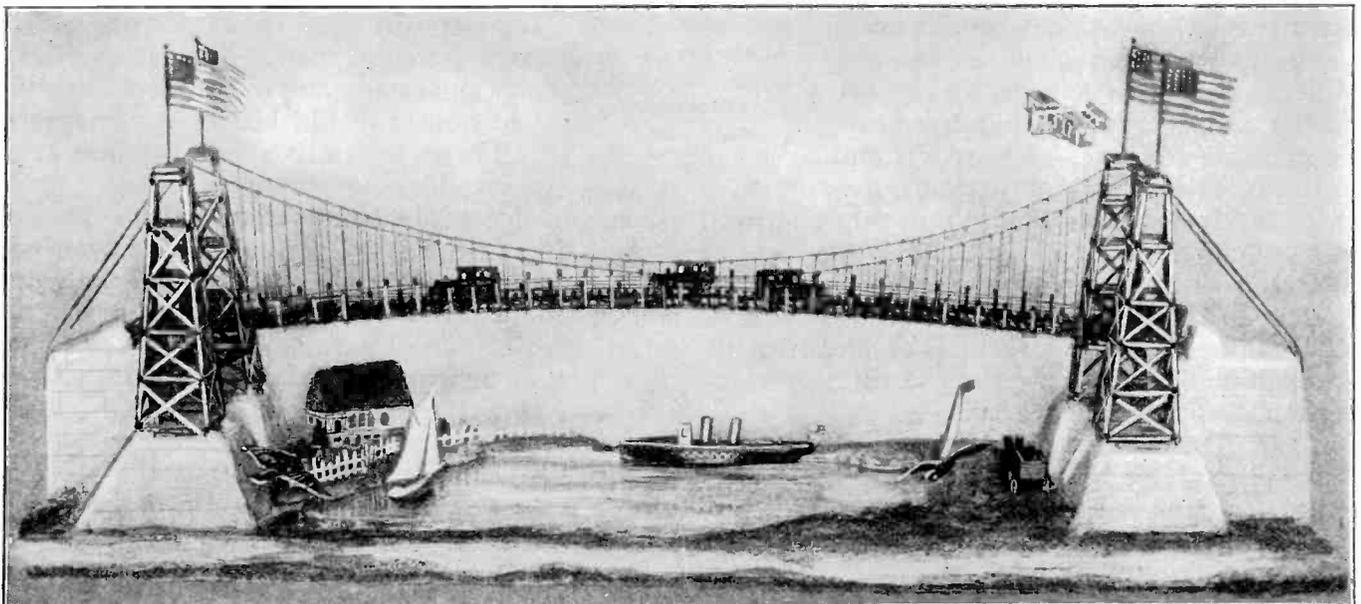


Fig. 2. The model illustrated above was also built entirely of matches and it is typical of the type of material which we expect of the contestants competing in the \$5,000.00 matchcraft contest. Notice how the birds and

the airplane seem to be flying. We are not, however, interested in all the superfluous decorations, but desire models made entirely of match sticks. This particular one was built by Joseph H. Kraus, Field Editor.

The technique of Matchcraft is exceedingly simple, but certain rules must be observed. In the first place, only the so-called safety matches should be used, for obvious reasons. Matches that strike on ordinary surfaces should never be used in any Matchcraft models on account of the fire hazard. Nor can paper matches be used. The only things required in building Matchcraft models are a razor blade with holder—or a sharp knife—a good, quick drying glue, such as Ambroid or thick Sure Grip, which two have been found best from experience, although shellac and ordinary glue can be used, but may take much longer to harden; also a few strips of adhesive tape, which is used as shown further on. The razor blade or sharp knife is used to cut off the heads of the matches if necessary, or to otherwise trim the matches to size as required.

One of the most important considerations of Matchcraft is that at least 90 per cent. of each model must be made out of matches. When building a house, or other object, it is never permissible to use a cardboard box or a wooden box, or other supports, as the background, and simply glue the matches against it. This would defeat the aims and purpose of Matchcraft. The requirement of the new art—if we may call it such—is that whatever is fashioned from matches should carry itself, *using matches only*.

For instance, the house shown in Fig. 1 was made entirely out of matches; nothing else having been used, the entire house being self-supporting. Of course, the surrounding objects, such as, for instance, the snow, which was cotton, have nothing to do with the Matchcraft, and were used simply to give a little scenic effect. The radio mast and power-line pole are fashioned entirely from matches.

The same is the case with the bridge shown in Fig. 2. Here we have a bridge span actually more than two feet long. Only matches, nothing else, were used for the towers and span, while the cables supporting the arch were made of threads and thin strings. From this it will be seen that over 90 per cent. of the bridge consists of nothing but matches, despite its great size. The supporting piers, as well as the lake (which is nothing but a mirror), and the boats, etc., are simply contributing scenery, but the

Fig. 3. This illustration shows how matches may be steamed and bent, and also indicates how a lattice structure may be quickly built. Note the nails driven in the boards for holding the matches in place while drying.

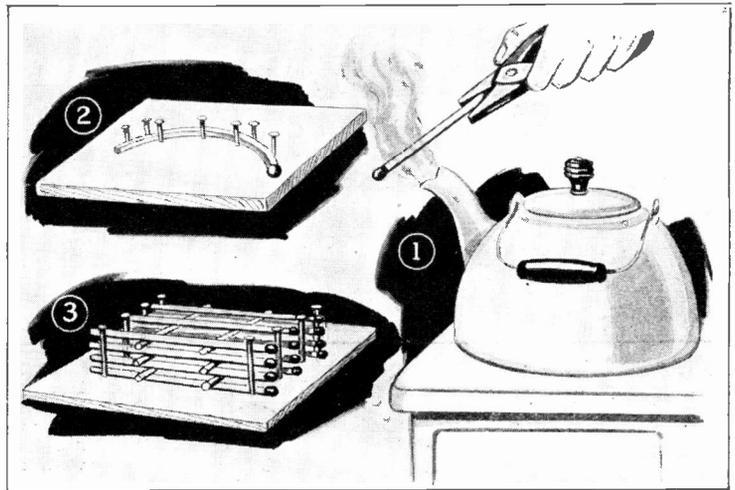
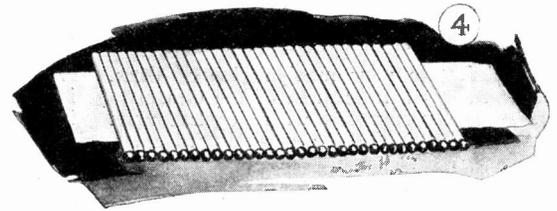


Fig. 4. Matches may be fastened to a strip of adhesive tape and the glue may be applied while they are held in this position. When dry the adhesive tape may be removed.



main article—namely, the bridge itself—is made of matches.

The automobiles on the bridge were small toy models of tin. The same holds true of all the other models, such as Fig. 11, a radio tower and the small power house, made entirely of matches. The towers in this case were 16½ inches high.

Fig. 12, the radio outfit, was also made of fully 90 per cent. matches, the dials being ordinary buttons. These buttons could, of course, have been fashioned out of wood and made to appear more like dials, and we are showing this only as an example of what can be done.

The windmill, Fig. 13, on the other hand, again was fashioned entirely out of matches, including the vanes. In this case a long needle was used as a pivot, and the windmill actually is a working model—the vanes rotate when blown against by a fan.

The same is the case with Fig. 14, showing a floating derrick, which is also movable, the house on the float actually turning around, and the shovel being movable as well. With the exception of the string, the entire model is made out of matches. The supporting background—namely, the water and the land—was made out of plaster of Paris, the land being of plaster of Paris as well, but before it hardened, some bird gravel was sprinkled over it, giving a dark color.

Match puzzles are not eligible.

There is a certain technique which the staff of SCIENCE AND INVENTION has found to work best when trying to build models of this kind, and this technique is given herewith. If it is carefully followed, it will be found that we have here a most entrancing and remunerative new hobby.

## “Matchcraft” Technique

By the Editorial Staff of Science and Invention

THE technique for building models entirely of matches is rather simple, particularly after a few fundamental details have been learned. If a large structure is to be built, it is advisable to glue matches together in groups of twos, threes or fours to serve as the main girders. The procedure was to apply a small amount of Ambroid, an especially quick-drying glue,

to one side of the match. Another match was then picked up and pressed against the glued portion, but care was taken to see to it that the heads of the matches were staggered. This procedure is illustrated in the photograph in Fig. 6, where the reader can see the glue being applied. Notice that in the foreground there is a double row of matches. These have all been cemented to-

gether and the match to which the glue is just being applied will be laid down and pressed to the already existing row, increasing the length of the column. The completed structure is more clearly brought out in Fig. 1, where the photograph shows the radio mast built in this manner. Notice how the matches are staggered. Staggering them in this fashion permits of a perfectly straight, solid girder, or mast, which will not bend or buckle. The heads of the matches do not have to be cut off in order to permit of a straight girder, inasmuch as the slight bulge produced by the head in one group of matches is compensated for by the second group. This particular type of beam was used as the corner brace for each of the towers in the bridge, was used as the foundation for the houses and was used as the main support of the span of the bridge. Beams thus formed were also used as the main uprights of the radio tower and the foundation for the sea-going derrick and its arms. The main idea then is to build the girders upon which the rest of your structure is to be assembled. While one of these beams is drying you can be building the other. In about fifteen minutes the entire group will be ready for use.

When using Ambroid as a cement, it will be found that even though the matches do not apparently hold together because of

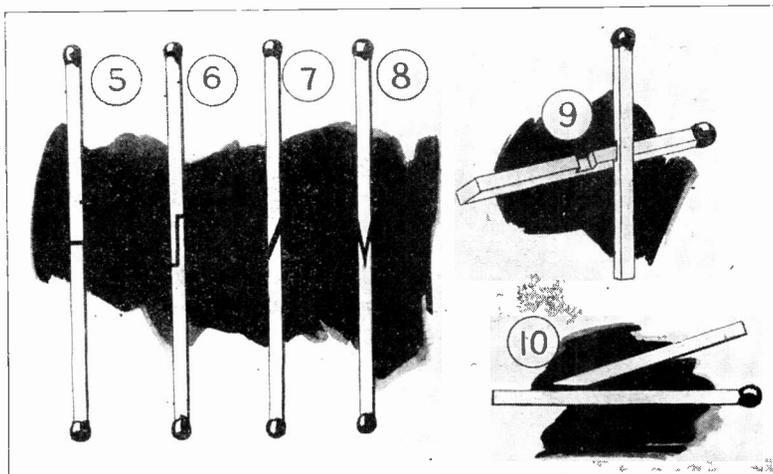


Fig. 5. Here a number of match joints are illustrated. The contestant will find that it is a rather simple matter to make any of these joints and with the exception of the joint shown in 5, all of the other joints are quite sturdy.

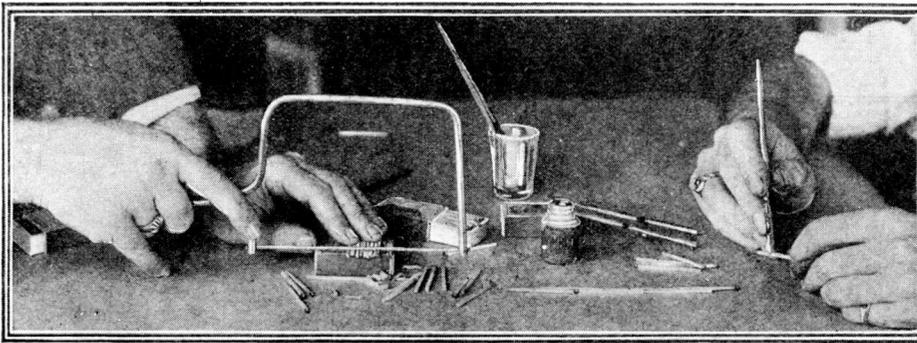


Fig. 6. This illustration shows how matches may be glued together to form beams or girders and also how a group of matches when cemented together may easily be cut to size.

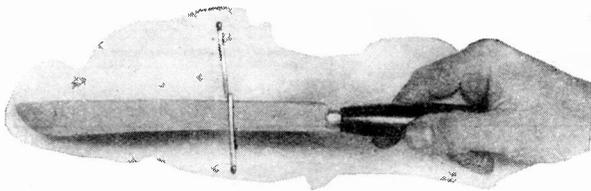


Fig. 7. The interesting match novelty at the left walks along the knife. Build one and try it.

some defect in your manipulation of them, you can apply a little more of the cement to the spreading surfaces, which cement upon drying, will pull those surfaces together. So strong is a simple girder constructed of these matches that under actual test a load of twelve pounds was applied across a simple girder before it broke. Undoubtedly a hundred pounds or more could be applied to a structure without breaking it down if the load were supported from the end of the girder rather than on the line of least resistance.

When joining a great many matches together to form the wall of a house or the side of any particular object, the simplest procedure is to place all these matches on a strip of adhesive tape, which holds them in place. A thin coat of Ambroid, shellac, varnish or any hot or cold glue is then applied over the entire surface of the matches held by the adhesive tape. Cross-braces may then be put on top of the soft cement, but unless the heads of the cross-braces are cut off, the union will be imperfect, due to the slight bulge produced by the match heads. When this object dries, it may be removed from the adhesive tape in one unit and easily put in place on the structure which is being built. This, of course, is merely a suggestion. The procedure is shown in Fig. 4.

Several other kinks may be interesting to note before proceeding with regular construction details. Matches may be bent, particularly if care be taken to select straight-grained matches, of which several will be found in every box, by holding the match in a jet of steam issuing from an ordinary kettle placed on the stove. When the match

is well steamed, as illustrated in Fig. 3, it is put between nails, which are hammered into a board conforming with the desired curvature. This is shown in illustration 2 of Fig. 3. Illustration 3 shows a simple method of constructing a lattice structure, nails holding the matches in place while they are drying. This greatly expedites the building of a structure.

Let us now look at Fig. 5. Here are shown various methods for making joints. The matches may be cut and cemented together, as illustrated in Numbers 5, 6, 7 or 8, of Fig. 5. No. 9 of Fig. 5 shows a method of making a dove-tailed joint, and 10 a

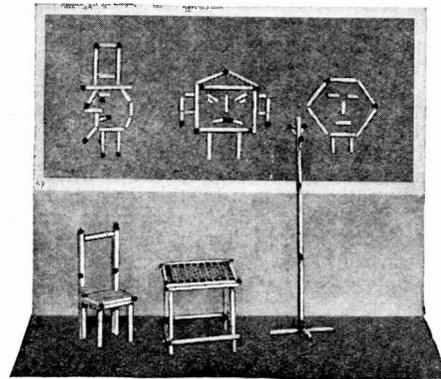


Fig. 8. The furniture illustrated above was made by Mr. Peck. The blackboard was decorated by Mr. Secor. These two groups of devices are very interesting toys for your daughter's doll house.

Fig. 10. The photograph below shows Mr. Kraus busy on the bridge model. Note particularly the size of the bridge. Models in this contest can be of any size desired. In shipping models to the editors it is advisable to tie them fast in their crates to prevent damage.

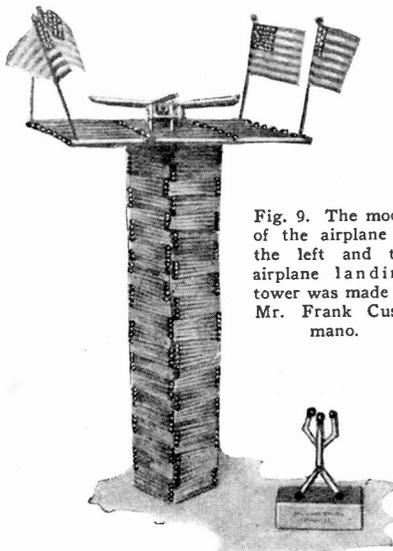
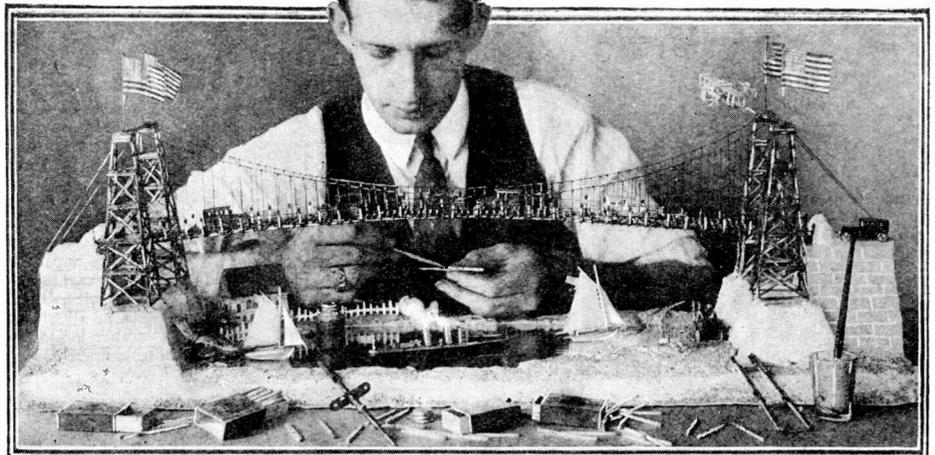


Fig. 9. The model of the airplane at the left and the airplane landing tower was made by Mr. Frank Cusumano.



method of making an angular joint. This latter joint is used particularly in the construction of the larger girders. Only for thin masts or poles are the joints in 5, 6, 7 or 8 employed.

After a number of matches have been cemented together and it is desired to use them for the roof of a building, it may be found that these matches will be too long for the purpose. They may, nevertheless, be cemented into place, and after the object has dried, a small coping saw, a fine-toothed keyhole saw, a scroll saw or hack-saw may be used to cut off the projecting parts of the matches. The edges may then be sandpapered, giving a fine finish to the structure. It is advisable to shellac or varnish all completed models to prevent match heads from loosening, due to dampness. This should be done after the model has been completed. Matches may be cut to size by means of a sharp knife, a safety razor blade held in a suitable holder, a sharp chisel, a photographic print trimmer or a pair of scissors.

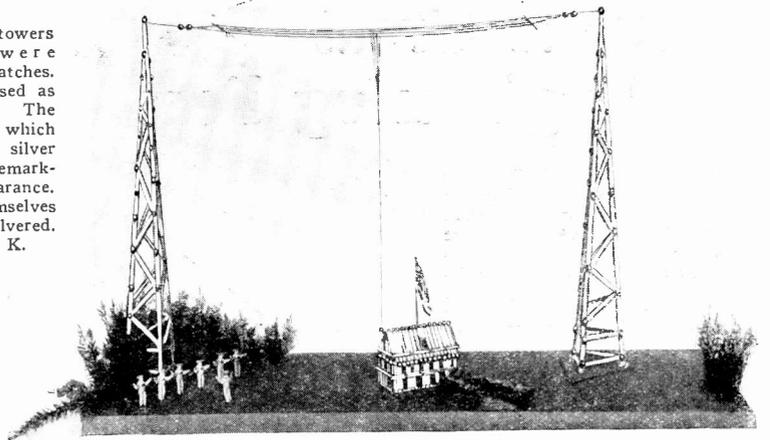
Let us now proceed to outline the method used in the construction of the various objects illustrated on these pages. The model Fig. 1 was built entirely by Mr. H. Winfield Secor, Managing Editor of SCIENCE AND INVENTION Magazine. After a suitable foundation and after the struts were all put in place, a quantity of cement was applied to two of the struts, and the matches were laid in place one after the other in rapid succession. Some cement was then added to two adjacent struts and so layer upon layer of matches were built up. When the windows were reached the matches were cut to shape by a pair of scissors and the heads of alternate matches were turned inward to outline the frame of the windows and doors. The roof of the house was then laid in place, as the photograph shows, and then the chimney was built. Here upright structures were cemented over the already completed side, and the matches were then glued to the uprights. The smoke issuing from the chimney is ordinary cotton which has been blackened by brushing it with a tooth brush dipped in India ink. A door was then built, also entirely of matches, and suitably cross-braced to add strength, which was pivoted at the top and bottom by means of small wire hinges. The antenna mast was then constructed and was set into the base. The current supply pole was also built of matches. Note that the insulators on the poles are merely short pieces of matches, and the heads of these matches make good-looking insulators. Two crosses were then made for the cage-type antenna, which, in this particular case, is made of fine magnet wire. The heads of matches act as insulators for the antenna. The model has a miniature incandescent light installed, which illuminates the interior of the cabin and

sends its rays out through the windows and doors. A flashlight battery connected with the bulb within the model completes the arrangement. Of course, the lamp is not a part of the model. That is merely a dressing added to lend realism, as is the snow in the foreground, the snow man in the yard and the evergreens near the entrance of the house. The house itself, the mast, cross-braces on the antenna, the smokehouse in the back yard, the high-tension line pole and the fence surrounding the entire lot were made entirely of matches.

**THE "MATCH"-LESS BRIDGE**

In the construction of the bridge, two long girders, each 30 inches long, were first made. These were permitted to dry while 16 short girders, each 7½ inches long, were laid down. The procedure in the construction of these girders was the same as that in the construction of the antenna mast in Fig. 1. While the upright girders for the corners of the towers of the bridge were drying, two 30-inch girders were laid on the table and held in place by suitable weights at both ends. Matches were then cemented across these girders, forming the walk or roadway of the bridge. These were spaced one-eighth of an inch apart. While this was drying the towers were started. On each pair, the top and bottom cross-braces were first put in place, and several other cross braces were then added. The diagonals were then cemented in place and the builder thus completed eight tower sections, two for each tower. Two wooden blocks were now cut to the desired size and held between two of the tower sections by means of rubber bands, while the cross-braces to complete the tower were added. When two towers had been finished they were joined together at the top and 2½ inches from the bottom to rest the roadway of the bridge upon and to act as the supports for the cables. Half-lengths of matches were then glued in place to serve as guards or fences. Upon these, thread was wound back and forth in a zig-zag fashion, making a very serviceable looking fence. The roadway was turned upside down and cross-braced by means of matches and then rested upon the structure between the two supporting towers. Two pieces of fishline were then tied to the top of the tower, and the center of the bridge was raised by spreading the towers apart. When the proper curve had been obtained, the roadway was fastened with thread to the supporting structure. A great number of threads were then tied to the fishline cable. They hung about six inches below the roadway. A tiny globule of glue was then put upon the roadway at the exact point where these threads intersected the roadway, and the thread was held in place long enough for the glue to dry. This procedure was resolved upon after it was found impractical to tie the thread to one cable, permit it to

Fig. 11. The radio towers and the barracks were built entirely of matches. Match heads are used as antenna insulators. The aerial is of thread which was painted with silver paint giving it a remarkable sparkling appearance. The towers themselves were likewise silvered. Model by J. H. K.



come around under the bridge and tie it to the corresponding cable on the opposite side, because when such a method was started and the slack was taken up in one part of the thread, another thread loosened. By employing the glue fixation method each thread was taut. When the entire bridge was completed the supporting structure of plaster of Paris was built.

Discarded match boxes were used under the plaster of Paris to serve as a foundation for the laying on of this plaster, and

bird gravel was sprinkled before it dried. The ships are set on a looking glass which serves as the lake, and pins fastened to the very end of the wings of the paper birds, as well as from the end of the paper airplane, suspend the birds and airplane in the air. Using this method of mounting, it appears as though the plane is supported by no visible means. This model was built by Joseph H. Kraus, Field Editor of SCIENCE AND INVENTION Magazine. Fig. 10 shows the author at work upon the device.

Two cross matches and one upright match glued together form the straddling image held upon the knife in Fig. 7. Ask your friends to hold the knife steadily so that the legs of the figure just barely touch the table, and you will find that the match actually

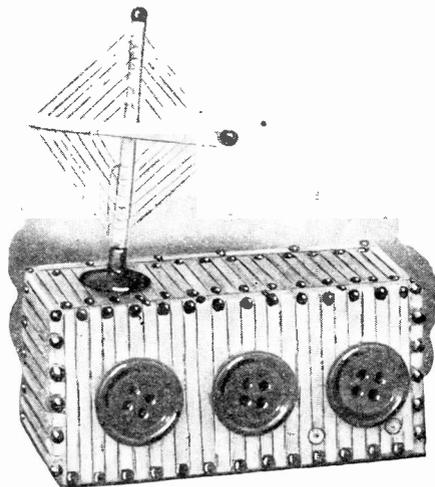


Fig. 12. Above we find a small radio set built of matches. Of course, it is merely a model and doesn't work. The loop is wound with green silk thread and stands on a button. More than ninety per cent. of the model is of matches.

first a very rough outline of the foundation was built which was finished up by a later application of the plaster. The lake or river was outlined by plaster of Paris upon which



Fig. 13. The interesting windmill illustrated here was built by Mr. Joseph F. Odenbach. The vanes are mounted in a cork into which a knitting needle has been pushed. The vanes rotate freely when the wind catches them.

walks along the edge of the knife. If the match is reversed, it will start to walk toward the hand. The walking is due to the impossibility of holding the knife absolutely steady.

The furniture in Fig. 8 was built by Mr. A. P. Peck, Radio Editor of SCIENCE AND INVENTION Magazine, and Mr. H. Winfield Secor decorated the blackboard in the background by means of match figures. These are interesting little adjuncts to any doll house. The airplane and airplane landing stage in Fig. 9 were built entirely of matches by Mr. Frank Cusumano.

The radio towers and the barracks were built by Mr. Kraus. These are shown in Fig. 11. The breaking strain of these towers, when the weight is applied across the structure, is 12 pounds. The antenna in this case is made of thread, although wire (Continued on page 770)

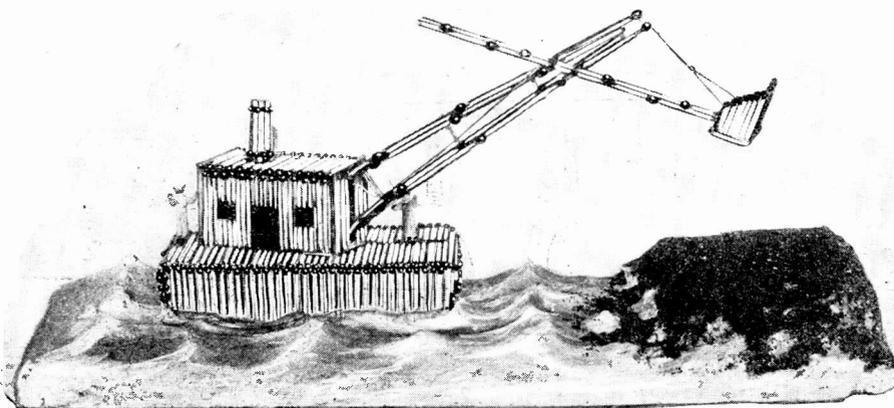
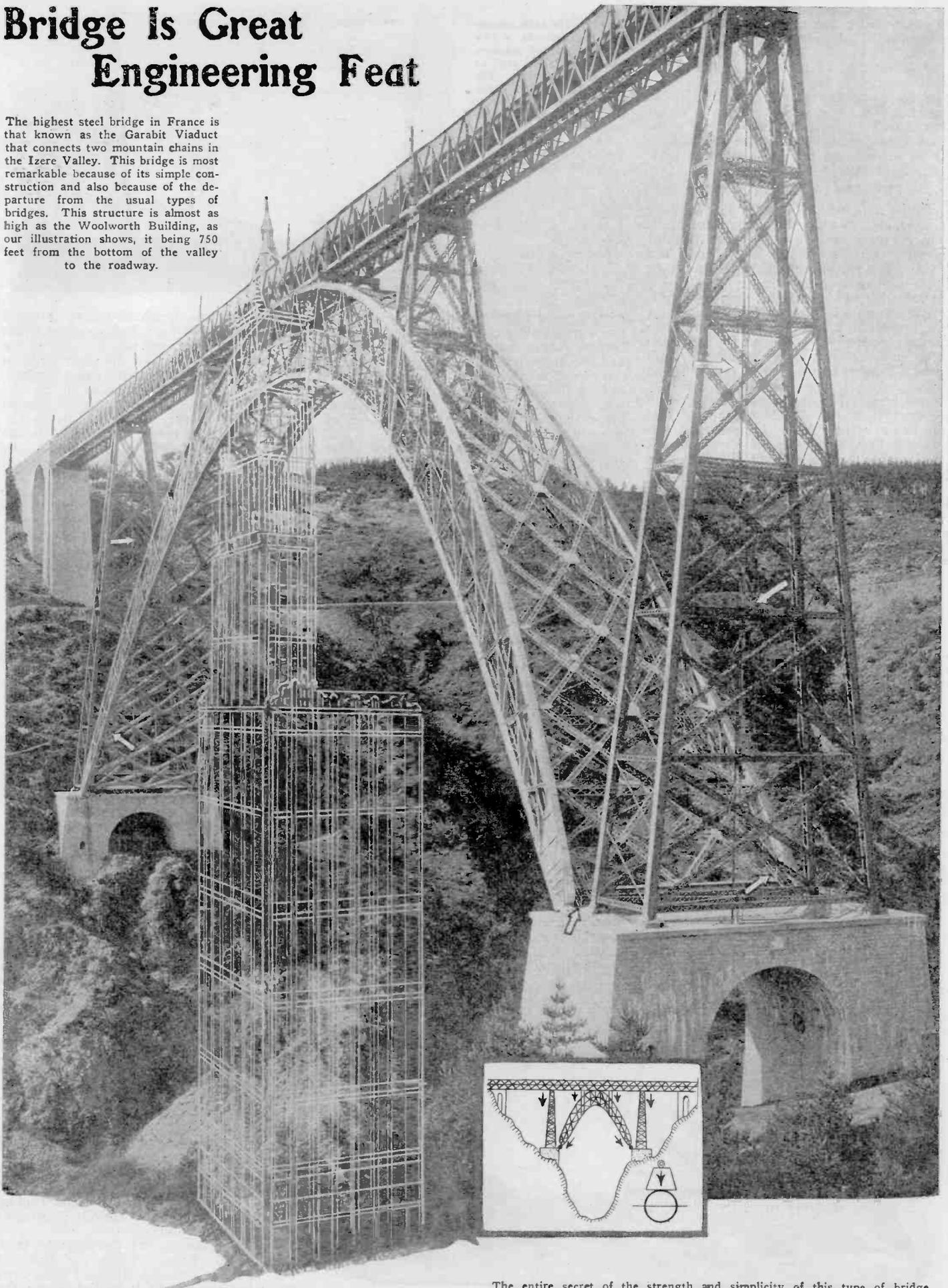


Fig. 14. The model illustrated above was built by Mr. A. P. Peck. The bucket of the derrick is movable, and the engine house on the boat also moves. The foreground and the water are made of plaster of Paris suitably colored.

## Bridge Is Great Engineering Feat

The highest steel bridge in France is that known as the Garabit Viaduct that connects two mountain chains in the Izere Valley. This bridge is most remarkable because of its simple construction and also because of the departure from the usual types of bridges. This structure is almost as high as the Woolworth Building, as our illustration shows, it being 750 feet from the bottom of the valley to the roadway.

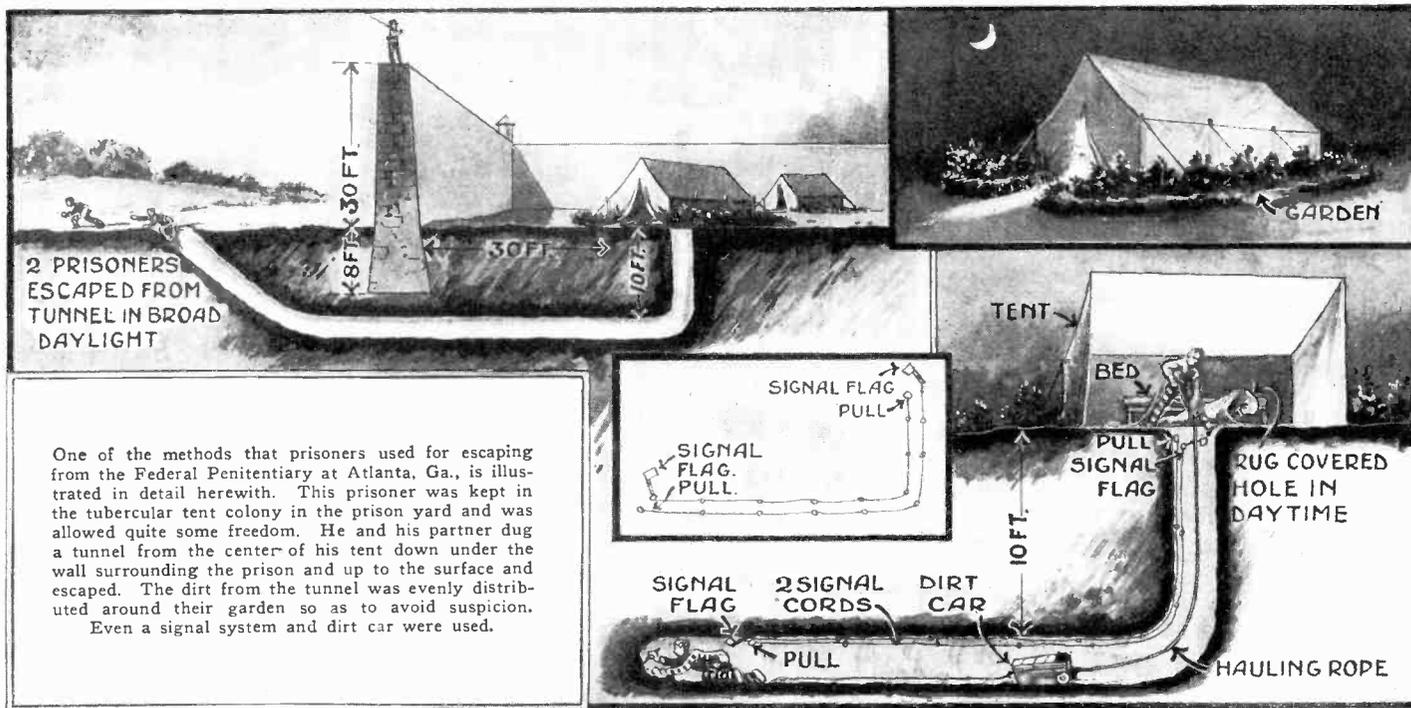


The arrows in the illustration above indicate stairways and ladders that make every part of the framework of this remarkable bridge easily accessible for inspection, painting and repairing. The entire span rests on four concrete abutments.

The entire secret of the strength and simplicity of this type of bridge construction inheres in the fact that a cylinder is the strongest mechanical structure that can be made. Therefore, of course, a semi-cylinder is also very strong. The small diagram of the bridge that is shown in the insert indicates by the arrows the various points of strain. Note how the central strain is distributed.

# Science in Prison Escapes

By JOSEPH FULLING FISHMAN, Prison Investigator



**T**HE interior of every prison is a seething battle of wits between the convicts and their keepers. The prisoners are constantly scheming to outwit the officers and escape, and the officers are scheming with equal intensity to keep from being outwitted. In spite, however, of the utmost vigilance, a prisoner will now and then get away. He who said "There is nothing new under the sun" had never been in a penitentiary. Something "new" is always being "pulled off" by both officers and prisoners, and it is very often the ending of the last act before one can tell how a particular "play" is going to come out.

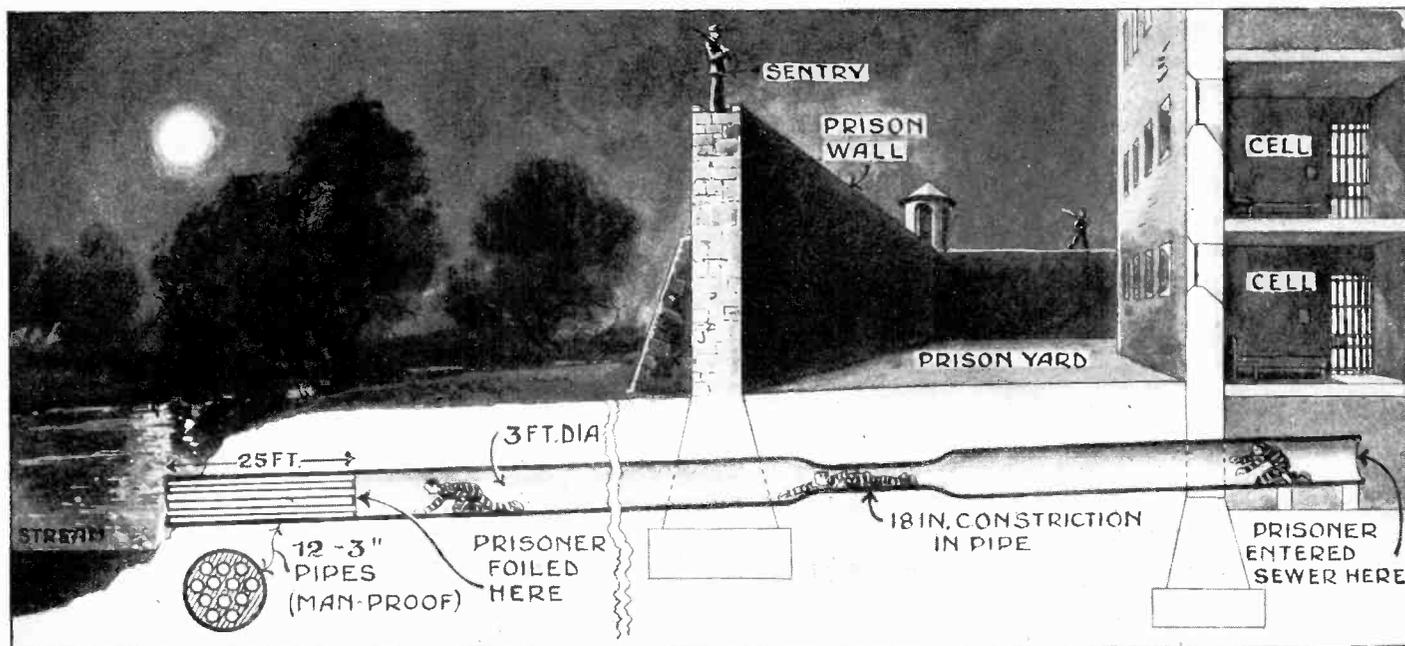
The prison conduit system may well be called the first aid to the convict, because

when contemplating an escape the possibility of going out through the underground pipes is always carefully studied. Under every large prison is a veritable maze of piping of every description through which water and wires are carried to the institution and the sewage is taken away. When therefore a prisoner at the Federal Penitentiary at Leavenworth decided upon a getaway his first thought was of "doing a mole," as the prisoner calls burrowing out underground. He worked in the office of the prison superintendent of construction, so it was comparatively easy for him to steal a blueprint, which showed where one of the big disposal pipes was located in the new wing which was being built. Being constantly employed in

carrying messages to the new wing he found it equally easy to drop below the temporary flooring into the cellar and begin his search for the pipe. He found it within a few moments, notwithstanding the fact that the officials had tried to conceal it by covering the end with dirt until such time as it was ready to be connected on the inside. The prisoner scraped the dirt away with a sharp piece of wood and crawled into the pipe head first.

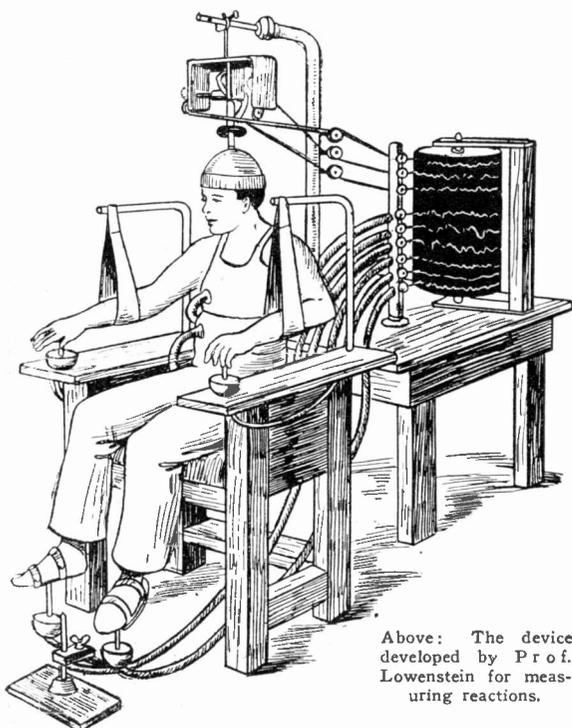
It was easy enough at first, as the pipe had a diameter of about three feet. But suddenly a joint appeared and the conduit was reduced in size to a diameter of about eighteen inches. The prisoner gave a wry

*(Continued on page 764)*

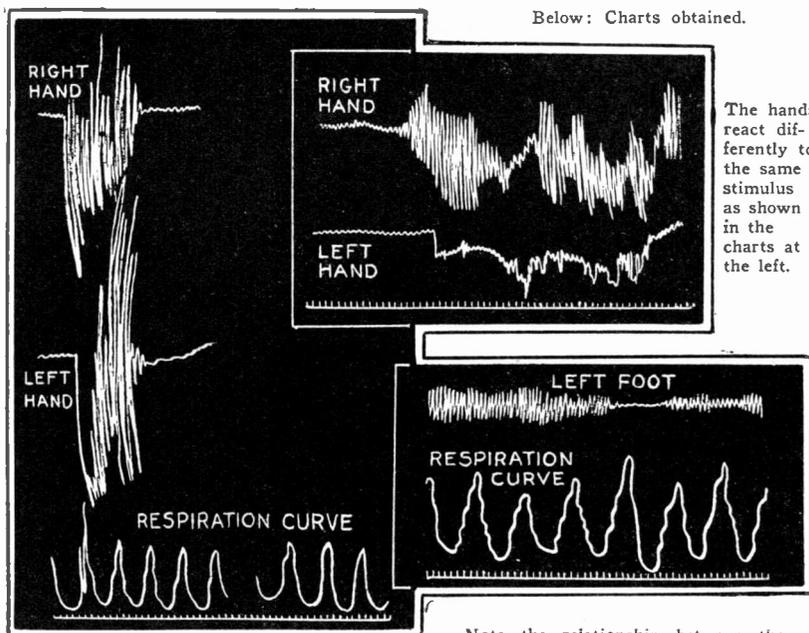


At the Federal Penitentiary at Leavenworth, Kansas, a prisoner tried to escape by crawling through a sewer pipe, which in his opinion led to freedom.

However, the end of the pipe was constricted by a series of 3-inch pipes and so escape was rendered impossible. Imagine the prisoner's consternation.



Above: The device developed by Prof. Loewenstein for measuring reactions.



Below: Charts obtained.

The hands react differently to the same stimulus as shown in the charts at the left.

Another chart showing the different hand-reactions and the respiration-curve.

Note the relationship between the soul-reaction of the left foot and the respiration-curve as shown in the diagram directly above.

## New Light on Human Reactions

By DR. BUTTERSACK

THE whole world is united in the belief that the human body as well as the systems of animals and plants are seemingly sensitive reflex apparatus, that is to say, that they react to the smallest excitations in some way. In general, former experimenters were satisfied with the coarser manifestations and stopped at blushing, paleness, trembling, shuddering, chattering of the teeth, the fixed eyes of fright, the sweat of fear, the influence on the secretions of the body such as milk, etc. One could very well follow the links of these reflex chains into a region where they would show visibly the processes of the soul now invisible and unknown. The suspected murderer could be brought to the corpse of his victim and made to gaze at the remains, but that of course is a very crude and unreliable method.

Now, Tarchanoff as far back as 1890, carried peculiar electric currents through the skins so as to show potential variations under the influence of bodily and mental excitation, and George Sticker in 1897 showed by using this same exciting current how words, pictures, smells, musical notes and the like, which with other currents gave no reaction, with this one would give a strong reaction, or "beat," under the incitement of this or that excitation which would "go to the heart." This too would happen when the essential word was spoken with perfect equanimity along with other indifferent words.

Unfortunately, these observations have been forgotten in the depths of the past, but we will be reminded of them by parallel observations from Brunzlow in Muenster and Loewenstein in Bonn. They not only reveal the electric actions in the skin, but the most delicate changes in the muscular system; these have a definite interlaced system of their own and develop changes in potential through the entire mass starting from the smallest area. The above named investigators express themselves thus: Every excitement of the soul is accompanied by changes of the innervation (or nerve action) affecting the muscles. If such changes are

observed, then the excitation of the soul is revealed quite independently, as to whether the subject under examination knew about it or even wishes to deny it.

An apparatus which appears more complicated than its theory would indicate, inscribes upon a revolving drum the curve of hand, feet, head, chest and abdominal regions. If the subject is acted upon by any excitation such as shock or the prick of a needle, then the movement of the subject gives a characteristic change in the curve which curve-change is visible to the naked eye. But not only do bodily excitations operate thus; those of the soul have the same effect. The simple mention of a name, the bare announcement of the explosion or of the needle prick before either has occurred is enough to change the normal curve. These reactions are so delicate and act so completely without the knowledge or control of the patient that it is impossible by the greatest exertion of the will for him to overcome them. It is as impossible to suppress them as to prevent the shrinkage of the pupils of the eyes in strong light or to overcome the knee reflex phenomenon.

The amplitude of the curve naturally depends upon the susceptibility to excitement of the particular nerve band, but whether great or small, the change in the curve is always to be seen. It follows from this that the excitement reaches the very soul and is woven into its everlastingly moving fabric. If it does not do this then the soul is unaffected, and the curves of the potential of the muscles go along without being affected.

But these investigations are by no means so very simple. The physician and psychologist must find out the psychic excitations to which the specific curves under investigation correspond. This has its characteristic difficulties in such physically unbalanced subjects, who for any motive are profane in their sickness. The best known in this regard are the so-called hysterical subjects and the shell-shock subjects related to the first. The Loewenstein method has detected

at once such subjects who would claim to be deaf to a pretended shell explosion. On the one side it excites grave doubts that soldiers with injuries to the ears of unequal severity, but actually existing, were not at all or only temporarily made hard of hearing and such observations occasioned doubts as to the propounded or suggested causes of the trouble. On the other hand, the infirmities due to such changes in the hearing process lead to no conclusion as reliable as the above to enable us to say that the simulation existed or that imagination was acting.

But at last the medical profession has a relatively simple method to determine quite objectively whether the subject hears or does not hear. It even enables the degree of the affected hearing to be estimated. Not only can the presumably deaf be made to hear, but the presumably blind can be made to see. The man without sensation of touch can be made to feel and the same for those who think they have something the matter with their bodily system, because everything is present in the soul. It is simple to see how rich in results this method is: it frees not only the public from the great expenditures for all kinds of pensions, but it returns to the community those really capable of work.

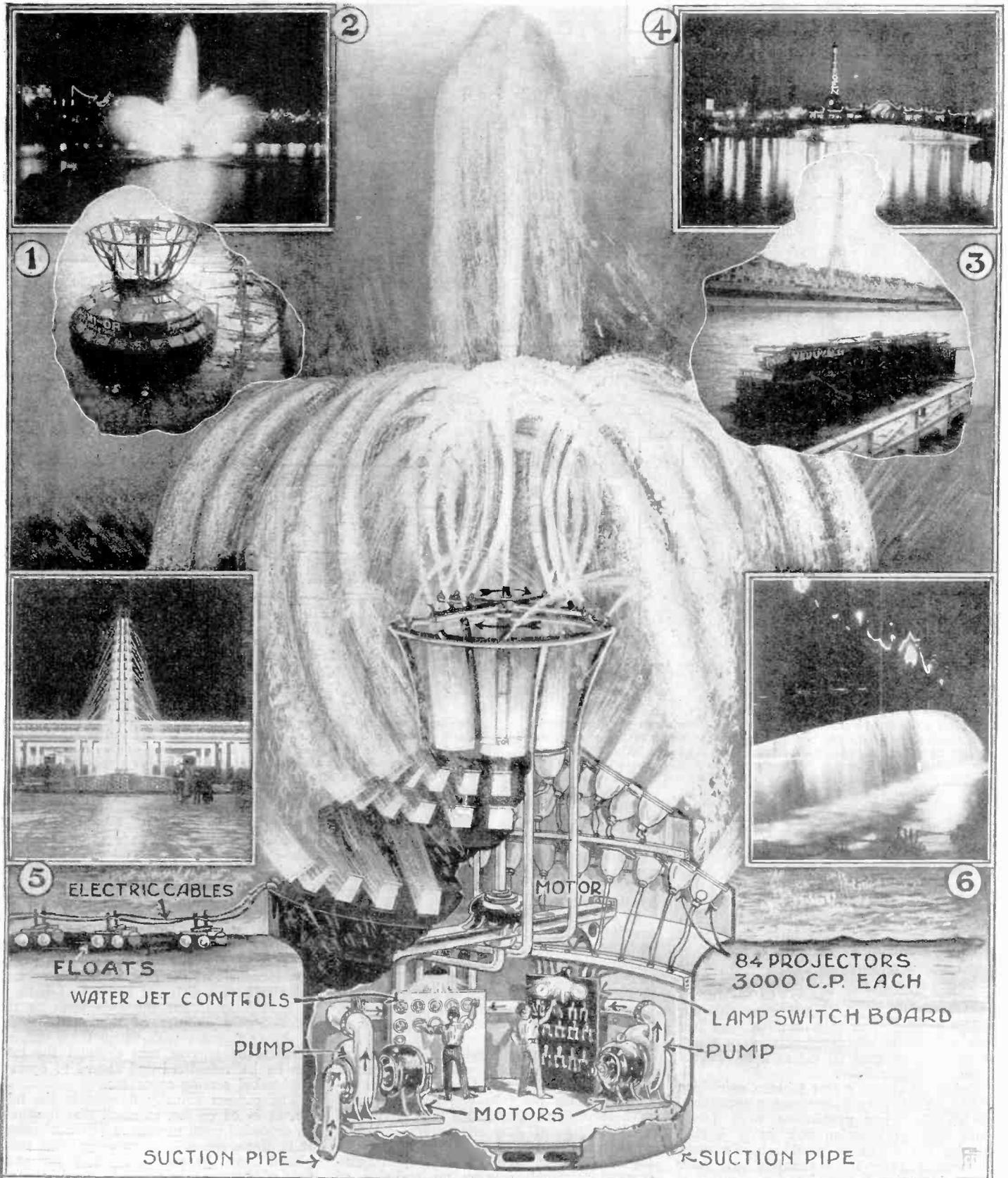
Freud psycho-analysis stands side by side with this physiological method. The two will give, in the course of time, many surprising insights into the intricacies of the life of the soul.

### "Life After Death"

Prof. Charles Henry of Paris, France, recently issued a statement to the effect that he has proof, backed by mathematics, that "nobody dies entirely." He said in part . . . "that little something which gives you a distinctive personality among the millions of your fellow beings is immortal. You hand your soul on to others, that's all." This decision is based upon calculations which have yet defied all attempts toward accurate solution.

# Electric Fountains Float In the River Seine

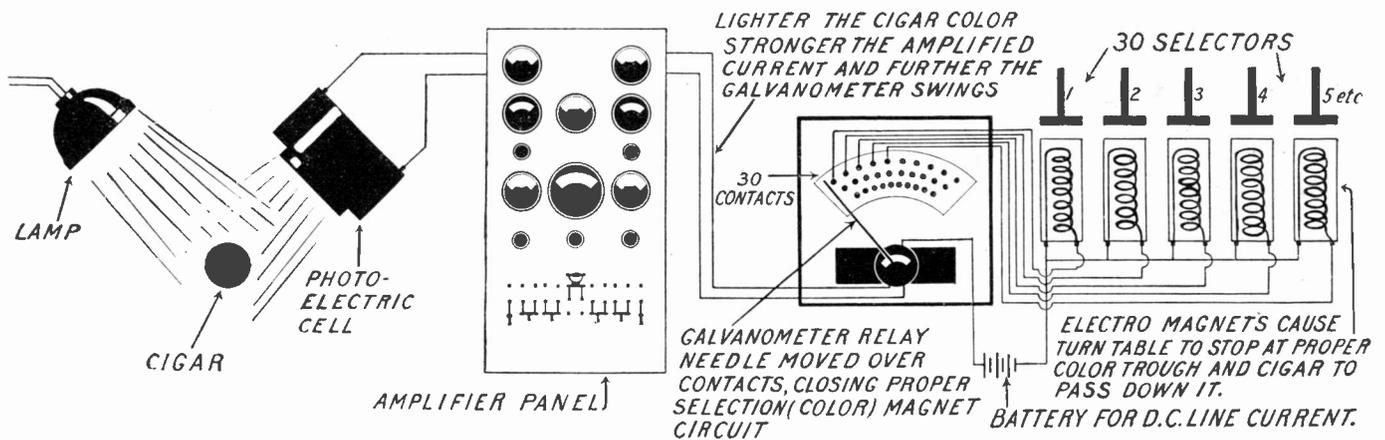
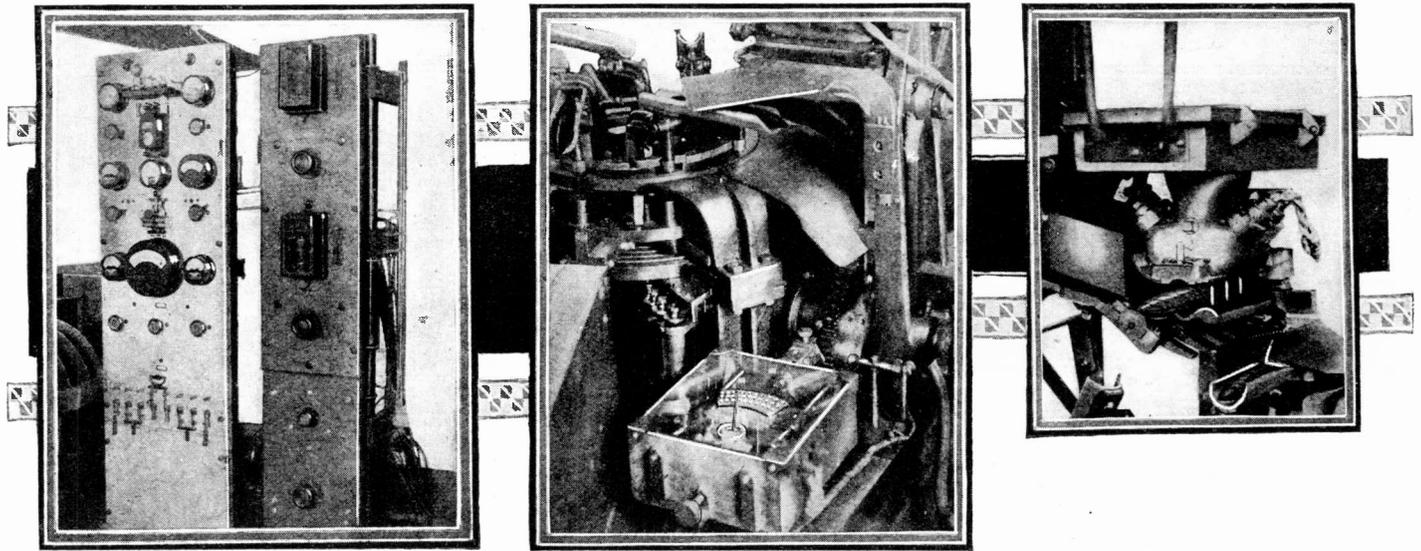
By A. N. MIRZAOFF



THE photograph in Fig. 1 shows a floating fountain moored to the bank of the Seine during the daytime, while Fig. 2 shows the effect of the same when in action and illuminated by colored lights at night. Fig. 3 shows the Eiffel Tower and surrounding territory in daylight and Fig. 4, at night. Photos 5 and 6 show novel forms of illuminated fountains. The central part of this

page depicts the actual construction of an electrically illuminated fountain that floats on the surface of a river. In use in Paris, the fountains can be transported from place to place as needed for display purposes. Note how some of the jets can be revolved while keeping up a continuous play of water. Colored lights complete the effect. The fountains are propelled by water jets.

# Photo-Electric Eye Sorts Cigars



The three photographs at the top of this page show views of the automatic cigar sorting machinery which depends upon the action of a photo-electric cell for its operation. The diagram shows, in simplified form, the various instruments that make this form of sorting machine possible. Light is reflected from the cigar and acts upon the photo-electric cell to a greater

or lesser extent, depending upon the color of the cigar. The photo-electric cell current is then amplified and actuates a combination galvanometer and relay. This instrument closes a circuit through one or another electro-magnet, depending on shade of cigar, which operates a selector that drops the cigar down into a trough of other cigars of the same color.

**A** REMARKABLE machine has been perfected after five years of experimenting, which will sort objects according to their color far more swiftly and unerringly than the most carefully trained human eye.

In its present form, this machine automatically separates cigars into 30 different groups depending on the shade of its wrapper. Imagine picking out 30 different shades of brown as represented in the familiar range of cigar colors from "claro" to "maduro"! That alone is a task almost impossible for human beings. But this machine does just that without the slightest hesitation or error, at the rate of over 60 cigars a minute, or 3,600 cigars per hour.

Exhibited at the recent tobacco exhibition in New York City it attracted a great deal of attention, and predictions were freely made that an adaption now being worked out by the designers would shortly make possible a real standardization of color values in hundreds of industries.

## HOW THE MACHINE WORKS

As made for the sorting of cigars this machine consists of a finger which picks up each individual cigar, a photo-electric eye which measures the color, an amplifying panel which boosts the infinitesimal current

generated in the eye, a switching galvanometer which actuates the mechanical sorting mechanism, and a set of 30 compartments arranged around a common center, into which the cigars are accurately distributed by the sorter.

In detail the operation is this: The cigars are fed, either by hand or from a conveyor belt, into a hopper slightly wider than the length of the cigars, and mounted above and to one side of the photo-electric cell. From the bottom of this hopper an ingenious split finger picks out the cigars one by one with meticulous care and carries each to the bottom of the eye.

The eye is a vacuum tube similar in shape to a small X-ray tube, with two terminals connected to a battery. One terminal is enlarged within the tube and heavily coated with potassium. The entire tube is covered by a light-proof case and in the darkness no current flows between the two terminals. Light, however, activates the potassium-covered terminal, causing an emission of electrons, which emission constitutes a current flow. In a few words, therefore, this eye is simply an electric switch, opened and shut by light and darkness.

Below the eye is another chamber containing four small electric light bulbs, shielded from the tube above. When the finger

places the cigar in position within the lighted chamber, a shutter opens a slit in the covered tube-chamber above it, and only the light which is reflected from the wrapper of the cigar is permitted to act upon the tube.

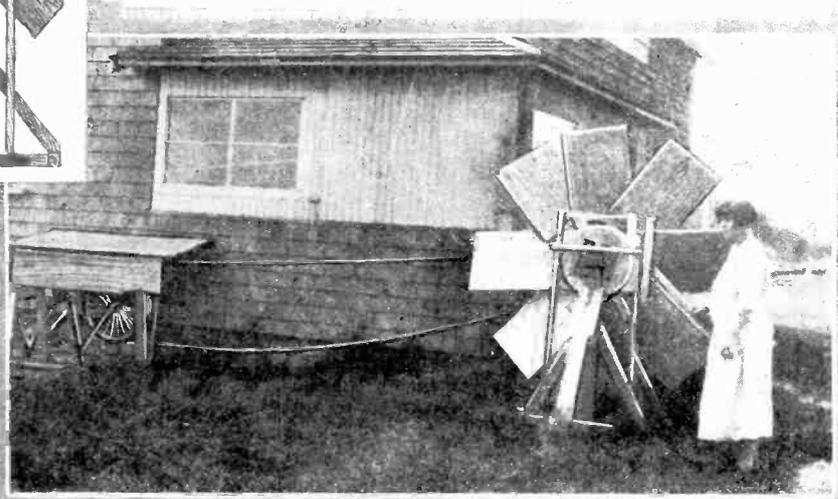
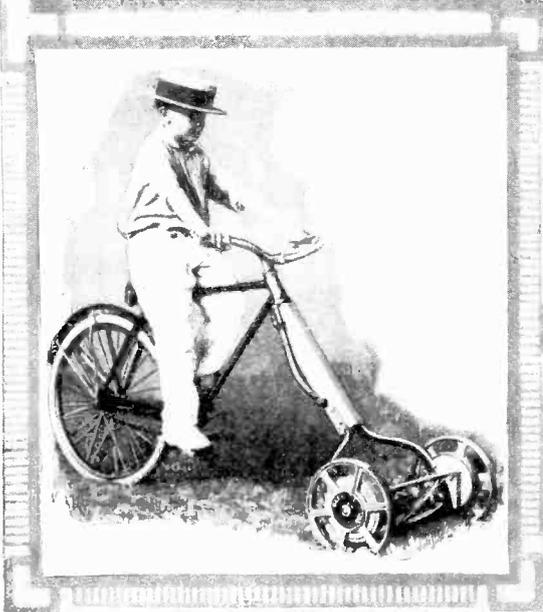
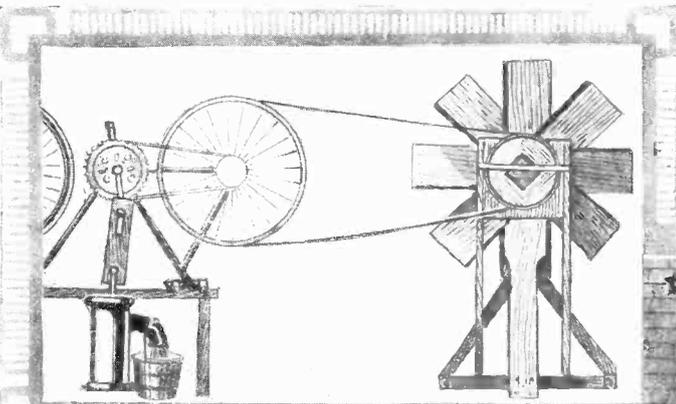
Obviously, the darker the color of the cigar, the less light will be reflected upon the tube, and *vice versa*. The actual color of the cigar, then, determines the amount of current permitted to flow between the two terminals of the tube. And since every color reflects a different amount of light, it is readily seen that the only limit to the color-sorting abilities of this machine lies in the minuteness with which these varying amounts of current sent through the tube can be individualized and caused to operate mechanical sorting apparatus.

The current actually flowing in the tube circuit is, of course, so small that it cannot be depended upon to actuate any mechanism. It is, therefore, sent to an amplifying panel placed near the machine, where the same type of vacuum tube apparatus used in trans-continental telephony is used to boost the current to usable proportions.

From the amplifying panel the electric current, still so small that it will not make a tiny motor work, in spite of this boosting, is led to an extremely sensitive switching

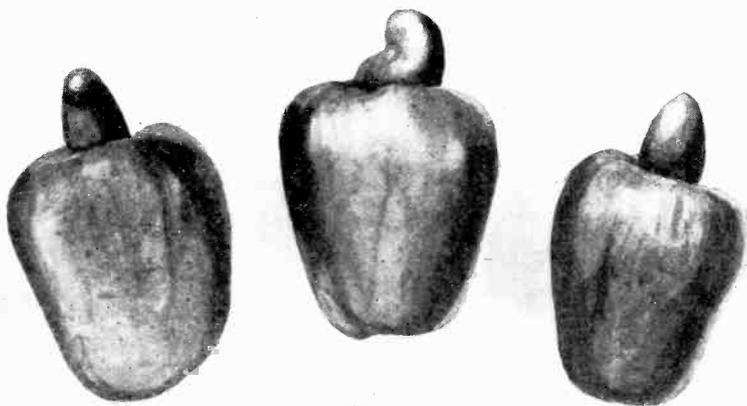
(Continued on page 763)

# New Labor Saving Devices



↑ An ingenious mechanic of Brewster, Mass., has succeeded in harnessing wind power to pump water for his country home. He made up a very simple wind mill that is shown in the photograph and drawing above, and hitched to the mechanism of a bicycle by means of a belt. The crank of the latter actuates a pump and it is said that 20 minutes' work by this device will pump enough water to last for two weeks. In a high wind, a buzz saw can be operated by the wind mill.

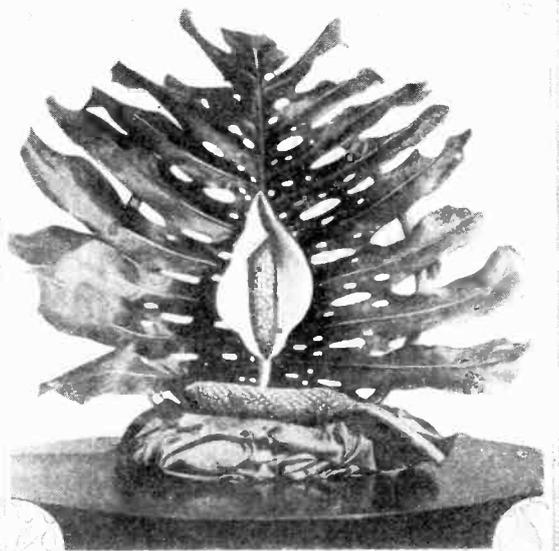
← From New Jersey we receive word of a novel grass cutting device invented by two young boys. They attached their bicycle to a lawn mower as shown in the photograph at the left and now combine pleasure with work. By pedaling the bicycle around the lawn, the grass is neatly clipped.



↑ The three photographs directly above illustrate a relative of the cucumber and squash family which has been imported into this country from Mexico and Central America. Grown in Florida, it is an enormous producer, single fruits weighing from 8 ounces to a pound.

← The photo at the left shows an example of the Dasheen, a richly flavored fruit sometimes known as the Chinese Paro. A single cone often weighs nearly five pounds.

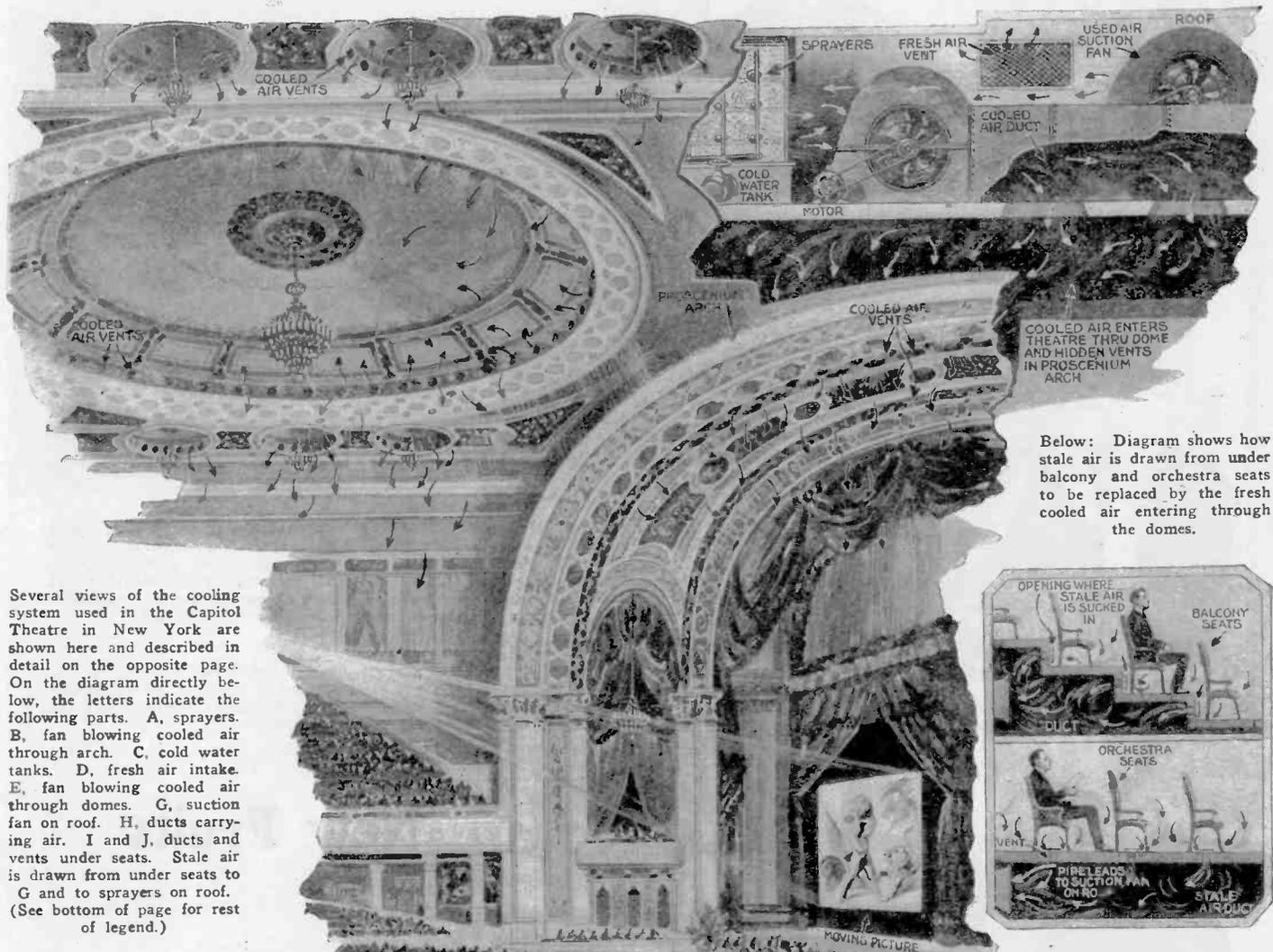
# New Fruits



The "Monistera deliciosa" of Trinidad looks like an ear of corn but its taste resembles that of a combination of fruits, such as strawberries, pineapples and bananas. This new food takes 18 months to ripen after the plant blossoms and has been successfully raised in southern California.

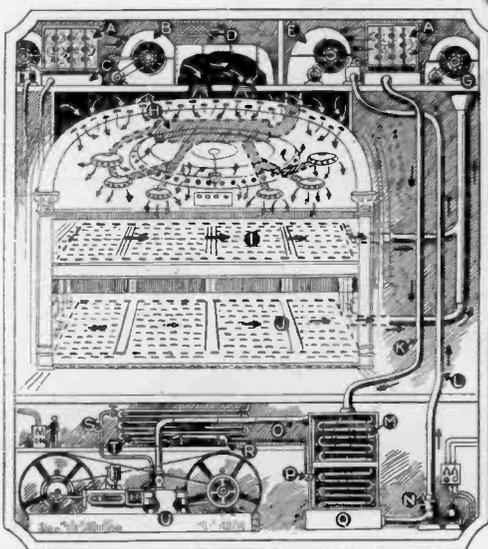
# How New York Theatre's Air Is Cooled

A Complete Cross-Sectional Diagram of the Efficient Cooling System Used in a Large Movie House.

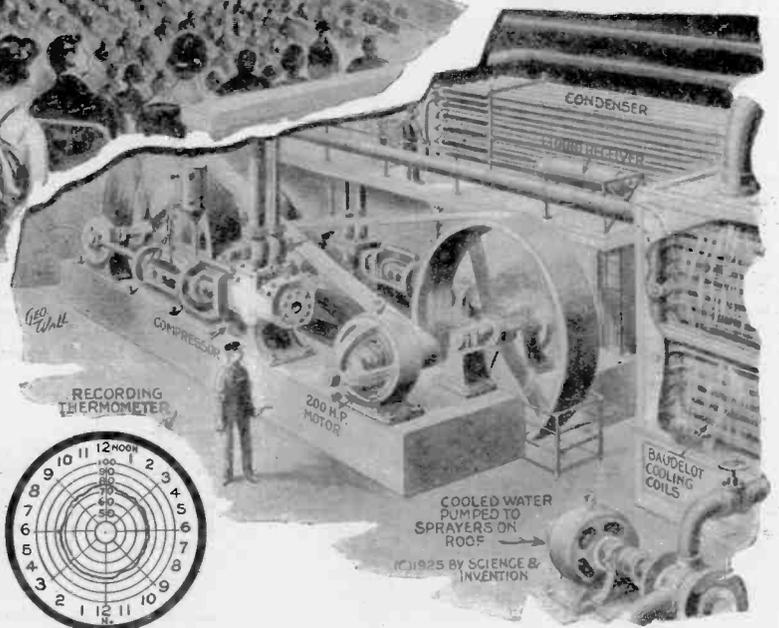


Below: Diagram shows how stale air is drawn from under balcony and orchestra seats to be replaced by the fresh cooled air entering through the domes.

Several views of the cooling system used in the Capitol Theatre in New York are shown here and described in detail on the opposite page. On the diagram directly below, the letters indicate the following parts. A, sprayers. B, fan blowing cooled air through arch. C, cold water tanks. D, fresh air intake. E, fan blowing cooled air through domes. G, suction fan on roof. H, ducts carrying air. I and J, ducts and vents under seats. Stale air is drawn from under seats to G and to sprayers on roof. (See bottom of page for rest of legend.)



K, water returned by gravity from spray chamber and recooled. L, cooled water pumped to sprayers on roof. M, cooling coils. N, pump. O, carbon dioxide suction line to compressor. P, expansion valve. Q, cold water tank. R, carbon dioxide high pressure liquid receiver. S, discharge line to condenser for high pressure carbon dioxide. Typical daily temperature chart appears at right.

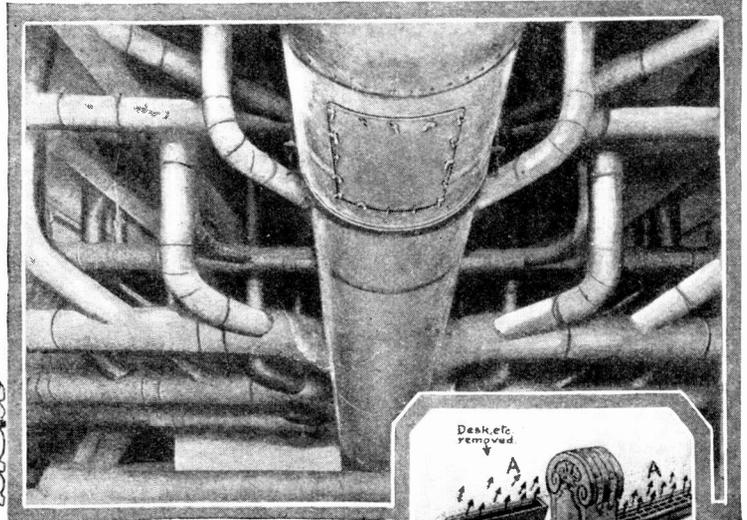
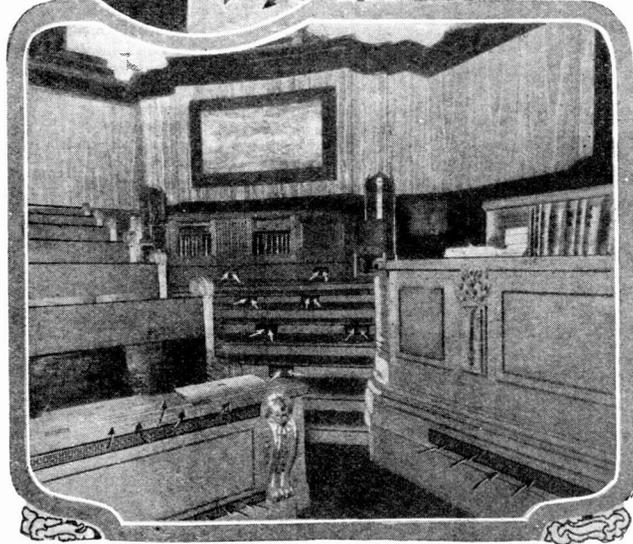


Below: A cross-sectional view of the compressors and other parts of the cooling system located in the basement of the theatre.

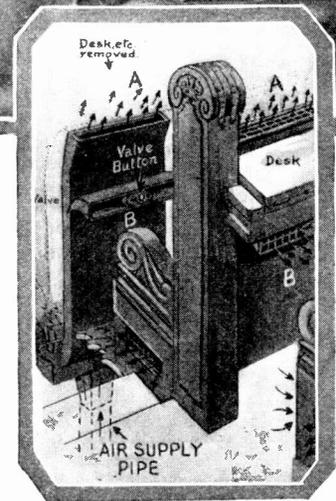




In the London County Council Hall, in England, each individual member can control the condition of the air at his own particular desk, regardless of the desires of others. The photographs and diagram herewith show how this is accomplished.



The maze of distributing pipes under the Council Hall may be seen in the photograph above. By pressing the valve button indicated in the diagram at the right, the occupant of the seat can direct the flow of air toward his body or upward, as may be desired. The upper left-hand photo shows this being done, and the one at the right gives a more general idea of the incoming and outgoing air ducts. The air used is heated and humidified in winter and cooled and dehumidified in summer. The average humidity and temperature are automatically controlled.



## Refrigerated Theaters

By H. WINFIELD SECOR

THE writer remembers about fifteen years ago of walking down a Philadelphia street and noting with surprise and interest a large placard placed in front of a new motion picture theatre and bearing the legend, "twenty degrees cooler than the street." It sounded like hokum, and it must be admitted that upon visiting the theatre the management had endeavored to carry out his proclamation with a goodly number of electric fans placed all along the side walls and in the rear of the theatre. But the twenty degrees cooler than the street never materialized to an engineer's way of thinking, although the general public may have kidded themselves into believing that such a reduction in temperature was being effected.

Now, however, there is at least one theatre in New York City which can produce an auditorium temperature of twenty degrees cooler than the street, and more if desired. This is the famous Capitol Theatre, the world's largest motion picture house, and very elaborate and newly designed ventilating dehumidifying and cooling machinery has been installed in this beautiful theatre to not only provide a constantly changing air content in the auditorium of the theatre, but a cool air from which excess moisture has been removed. It is not sufficient to simply cool the air and blow it out in the auditorium as some theatres have attempted to do in the past, by blowing a draught of air over ice or by employing similar means; the air must have the humidity at the proper point, and one of the greatest problems in any undertaking such as this, is to properly inject the air into the auditorium and remove the vitiated air without causing any draught whatever which will be noticeable to those in the audience.

As the accompanying wash drawing by our

able artist, Mr. George Wall, who inspected the whole lay-out personally for this purpose, clearly demonstrates, the cooled and revitalized air is blown down into the auditorium through a series of openings in the arched ceiling of the auditorium, and also through openings placed around the proscenium or stage arch.

In this way the air circulates through the theatre in ever expanding air currents or whirls, with the consequence that the expansion and circulation of the air currents is so well distributed that no draught or semblance of a draught is noticeable to the audience. The vitiated air is sucked out from the auditorium through registers placed under the seats and other appropriate places. As the illustration on the opposite page shows, a huge cooling plant is installed in the basement of the theatre, and this utilizes electric motor-driven compressors which compress carbon dioxide gas in order to liquefy it and create cold in the pipe coils, over which the water used for dehumidifying and washing the air circulates, and in turn becomes cool. The two carbon dioxide compressors have a combined refrigerating capacity of 400 tons, and represent a form of cooling plant which is new in this country, but which has been extensively employed in Europe and on board ships. Each of the carbon dioxide gas compressors are driven by a 200 horse-power electric motor of the variable speed type. The compressors are charged as required with carbon dioxide gas from tanks resembling those used in charging soda fountains. Under the extreme pressure created by the huge pistons moving back and forth in the cylinders of the compressors, the gas is liquefied.

Next we come to the Baudelot cooler through which the water from the roof circulates over 12,000 feet of pipe coils, and

the frigid expanding gas here opens its attack on the heated water, causing it to be greatly lowered in temperature as it leaves the pipe coil chamber. The cooled water then goes into a centrifugal motor-driven pump, and is repumped to the roof, where it passes into the spray jets inside one of the air chambers, and starts in its work of dehumidifying and washing the passing currents of air as they are drawn past the spray jets, by the powerful blower fans shown in the picture on the opposite page. The circulating system delivers 1,000 gallons of water per minute to the cooler in the basement, and its temperature is reduced to forty degrees Fahrenheit, after it has passed over the cooling coils.

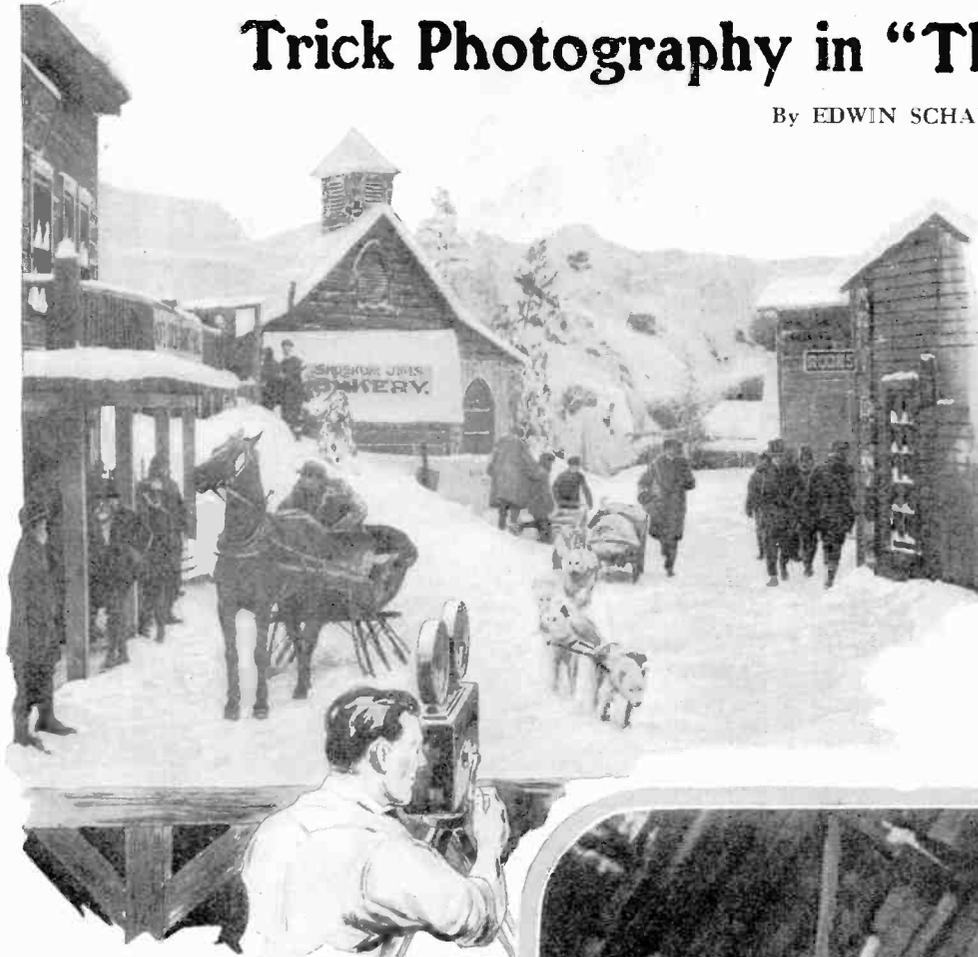
The cooled water is pumped to the roof through insulated ducts, where as aforementioned the chilled water is spread through special jets which discharge it as a curtain of heavy mist. Going back to the roof once more, we find that a number of powerful ventilating fans have been put into action, in order to draw 150,000 cubic feet of air per minute through the curtain of cooled water. This air, thus brought to a proper temperature, is sufficiently cooled and freed from humidity as to be fit for blowing into the theatre auditorium.

It should be mentioned in passing that the stale air from the auditorium is drawn out through registers under the seats and under the floor by means of special suction pumps, and this air is returned to the roof air conditioning plant, or exhausted into the atmosphere, as may be desired. Every six to seven minutes during summer afternoons and evenings a complete change of air is thus brought about in this theatre. This complete change of air helps to bring about a more healthy condition for everyone in the audi-

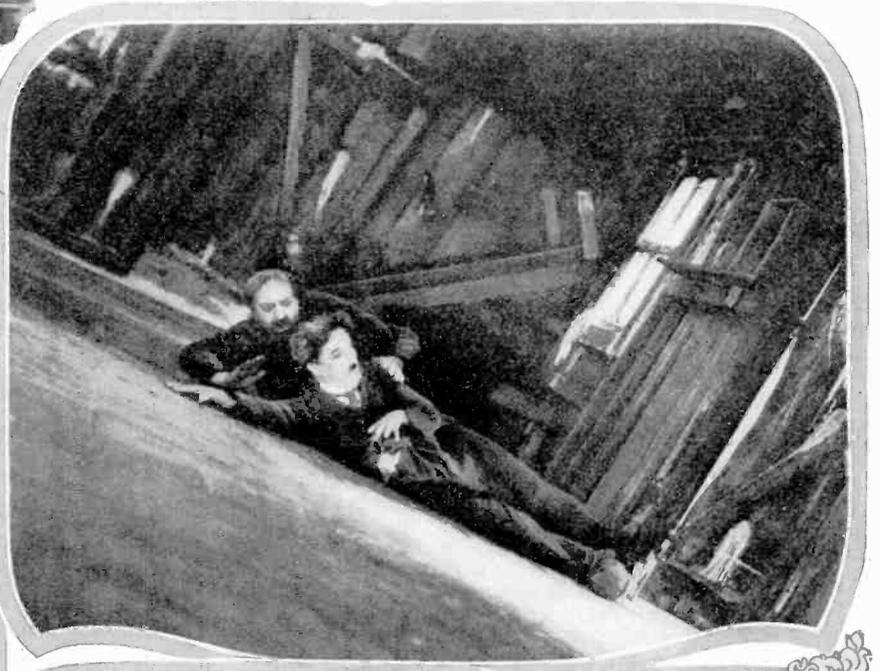
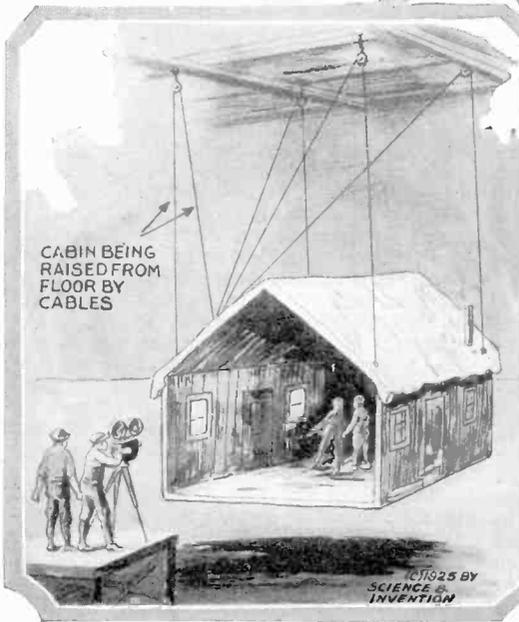
(Continued on page 752)

# Trick Photography in "The Gold Rush"

By EDWIN SCHALLERT



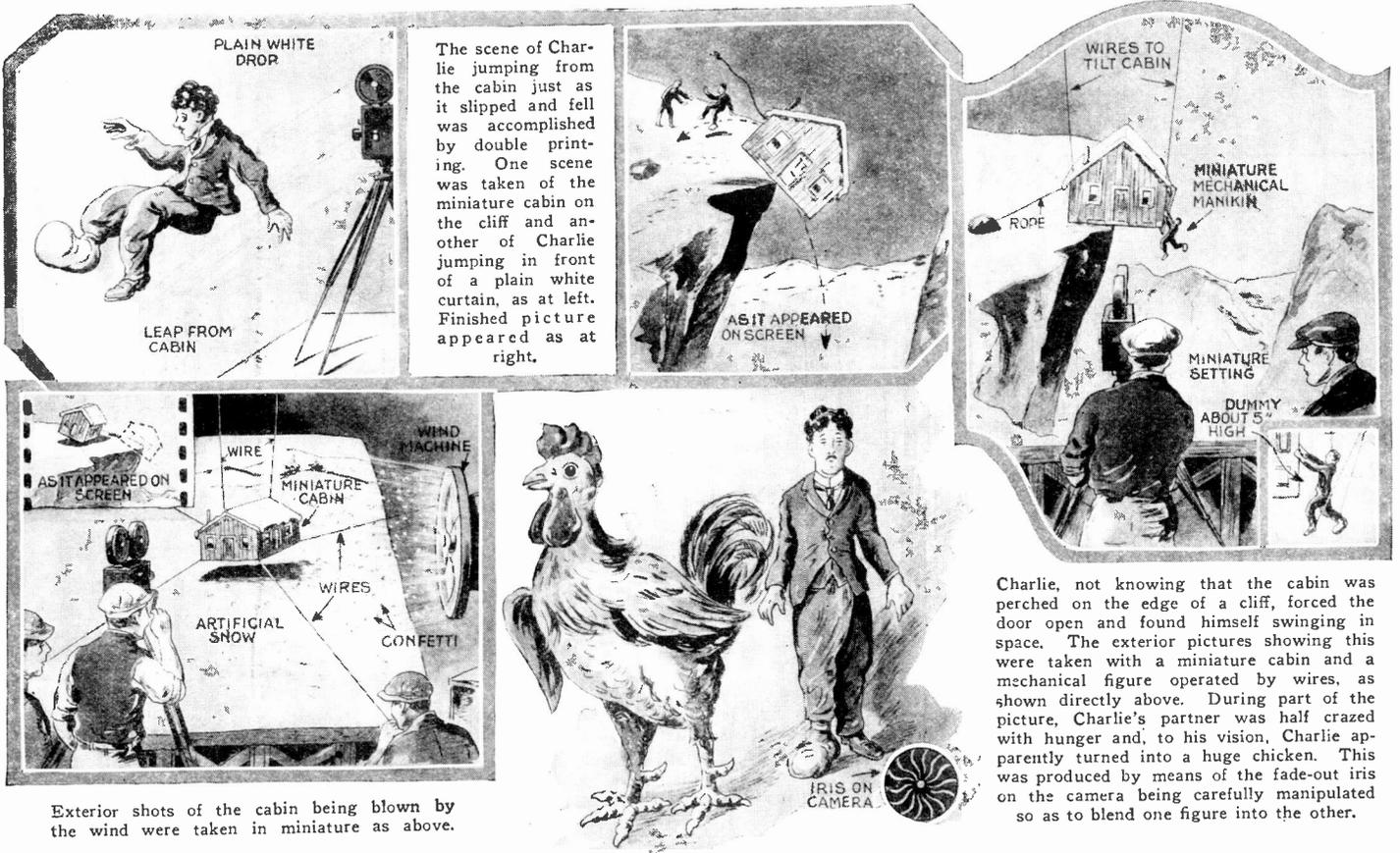
One of the main scenes in Charlie Chaplin's latest comedy was the main street of a small mining town in Alaska. Realistic though the scene appeared, it was all photographed entirely within the studio. This is clearly shown in the illustration directly at the left. The horse and dogs were driven up on the stage from the wings and off to the left and right, respectively, out of the field of the camera. In viewing the picture, it was almost impossible to detect the fact that the mountainous country visible in the background was in reality only property scenery. In fact, practically the entire picture was taken within the four walls of the studio, and thus the necessity of waiting for favorable weather was eliminated.



In the scenes where a small log cabin was blown across the country by a terrific wind storm and finally lodged on the edge of a precipice, various clever mechanical arrangements were resorted to in order to produce the required effect. Several views showing the interior of the cabin through the windows of which the landscape could be seen flying past were taken in the manner shown at the right. The hinged cabin walls were rocked by stage assistance and a cyclorama run past back of the cabin gave the effect of motion. The cyclorama is nothing more or less than a wide sheet of canvas arranged on rollers and upon which various scenes are painted. Revolving the rollers causes the scenes to be unfolded in front of the camera. When the cabin was perched on the precipice, it slipped several times. This effect was produced by jolting the cabin as it hung on cables as above.



Many of the most laughable moments in "The Gold Rush" were afforded by scenes taken inside of the cabin while it was resting insecurely on the edge of the cliff. The floor was tilted at a sharp angle and Charlie and his pal were having all kinds of trouble trying to save themselves from falling out over the cliff. The photograph directly above shows their predicament. Several times one or the other of them started to climb up the floor, slip and slid part way out of the open door below which there were supposedly hundreds of feet of space. The problem of getting out was finally solved by Charlie's pal climbing up Chaplin's body and reaching the doorsill on the opposite side of the cabin, thus pulling himself out and rescuing Charlie with a rope. At the moment of rescue, the cabin slides from its precarious position and crashes to the foot of the cliff.



Exterior shots of the cabin being blown by the wind were taken in miniature as above.

Charlie, not knowing that the cabin was perched on the edge of a cliff, forced the door open and found himself swinging in space. The exterior pictures showing this were taken with a miniature cabin and a mechanical figure operated by wires, as shown directly above. During part of the picture, Charlie's partner was half crazed with hunger and, to his vision, Charlie apparently turned into a huge chicken. This was produced by means of the fade-out iris on the camera being carefully manipulated so as to blend one figure into the other.

**CHARLIE CHAPLIN'S** latest film success, entitled *The Gold Rush*, was a most interesting picture from all viewpoints. It contained comedy, human interest, pathos and enough trick photography to make it unusual. In briefly told form, the picture ran as follows:

Charlie, with his inevitable derby, cane and enormous shoes, was prospecting for gold in the Chilcoot Pass region of Alaska. He and his partner, an old-time prospector, are caught in a severe storm that lasts for days. They take refuge in a lonely cabin and finally their food supply is exhausted. They endure all manner of hardships, due to hunger, and finally cook and eat one of the comedian's famous shoes. The shoe itself is served on a large platter and the laces take the form of a side dish of spaghetti.

The old-timer's reason finally gives way temporarily, due to hunger, and his imagination causes him to see Charlie gradually take the form of a huge chicken. Under the comedian's care, however, he soon recovers. Finally the storm abates and Charlie and the prospector part company. The latter continues his prospecting and finally locates an enormously rich mine. Here he has a battle with another prospector who tries to claim the location. Chaplin's former partner is injured and becomes crazed. He wanders aimlessly about, having totally forgotten the location of the mine, and finally drifts into the mining town in which Chaplin is staying, acting as a caretaker for the cabin of another prospector who is out in the hills.

Charlie, in the meanwhile, has adventures of his own, not the least of them being that of falling in love with one of the dancehall girls. Finally he and the old prospector meet and the latter, still unable to remember the exact location of his mine, knows that if he can find the cabin in which he and Charlie stayed, he can find the mine by the bearings so obtained. He, therefore, rushes Charlie away and, arriving at the cabin, they spend the night, after having imbibed rather freely of a canteen of liquor. They fall soundly asleep and, during the night, a terrific storm carries their cabin away and lands it on the edge of a cliff, it being held

### To What Uses Can You Put Old Celluloid Sheets?

SCIENCE AND INVENTION wants to know what kind of useful articles can be made out of old photographic films or other sheets of celluloid. In order to present the best uses for this material to our readers, we are offering \$100.00 in prizes for suggestions for the best uses of old films. Dig out some of your old camera films that did not turn out as well as they might and see if you can make something out of them that will be useful, interesting and novel. Note the large number of worth-while prizes that we are offering and follow the contest rules carefully.

#### \$100.00 IN PRIZES

First Prize .....	\$25.00
Second Prize .....	15.00
Third Prize .....	10.00
Four Prizes of \$5.00 each .....	20.00
Six Prizes of \$3.00 each .....	18.00
Six Prizes of \$2.00 each .....	12.00

\$100.00

#### CONTEST CONDITIONS

- 1—The article must be made from old photographic films of any size or similar celluloid sheets.
- 2—The number of entries per contestant is not limited.
- 3—In event of ties the full amount of the prize tied for will be awarded to each tying contestant.
- 4—Films may be cemented, cut, steamed or pressed to form objects.
- 5—No prizes will be awarded for articles described on these pages.
- 6—A rough sketch and a description of fifty words or less per object are required. Models are not required but may be entered.  
(CAUTION: Do not send inflammable celluloid articles through the mails.)
- 7—Contest closes in New York on Wednesday, Dec. 30th at noon. All contributions must be in our hands at that time. Address entries to Editor, Old Film Contest, c/o SCIENCE & INVENTION, 53 Park Place, New York City.

there by the providential catching of a rope attached to the cabin on a projecting rock. Awaking in the morning, unaware of their plight, the two men attribute the unsteadiness of the cabin and the way in which it rocks to the over-indulgence in liquor the night before. Soon Chaplin tries to open one of the doors and, after throwing his whole weight against it, it suddenly opens and he finds himself clinging to the door-knob with nothing but empty space beneath. After a struggle he regains the interior. The cabin then shifts so that its floor is at a precarious angle and, after some scrambling, Charlie's partner finally gets out of the door on the opposite side of the cabin. He tosses a rope to the comedian and gets him out, the last part of the rescue being performed by a huge jump on Charlie's part. This was necessary, because at this moment the rope holding the cabin gave way and the house crashed over the cliff. They find themselves on the location of the lost mine and so become rich and sail back to the United States. On the boat, Charlie meets his old love and they live happily ever afterward.

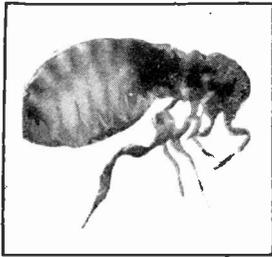
The way in which most of the effects shown in this picture were produced are outlined on this and the preceding page. All of the interior views of the cabin were taken with a full-sized reproduction arranged in various ways as shown.

This model of the cabin was used in the studio for all of the "shots." Artificial snow was blown through cracks in the doors to lend reality to the picture. This gave the impression of a storm raging outside.

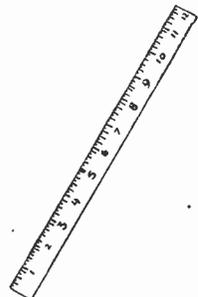
The jostling effects produced at the cliff's edge were given by raising and lowering the cabin quickly on a set of cables. The swaying of the cabin in the storm was produced with the cabin placed on a rotatable mounting. The walls and roof of the cabin were hinged so that they could be swayed. The changing of Chaplin into a chicken and *vice versa* was accomplished by a very cleverly manipulated fade-out iris. It is interesting to note that Chaplin also played the part of the chicken, encased in the huge disguise shaped as shown above.

# The Strength of Insects

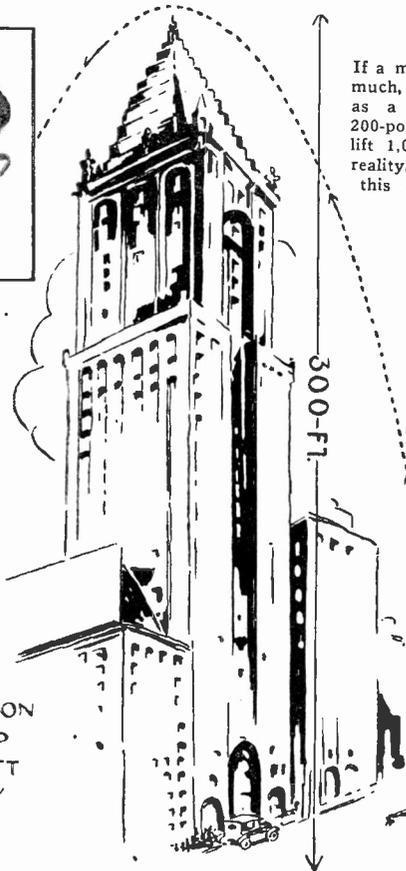
By DR. ERNEST BADE



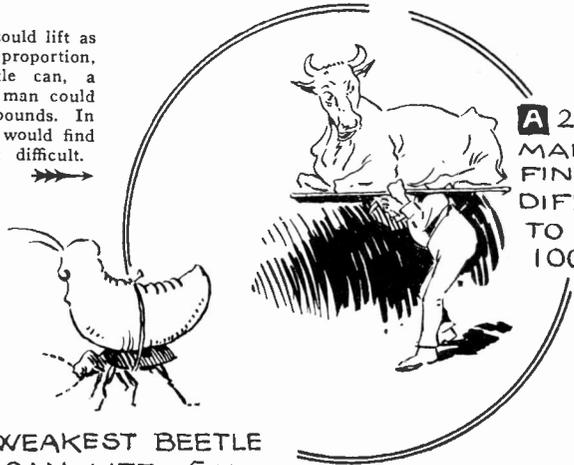
A FLEA CAN JUMP 12" HIGH



IF A MAN COULD JUMP IN PROPORTION HE WOULD LEAP OVER A 300 FT TOWER EASILY



If a man could lift as much, in proportion, as a beetle can, a 200-pound man could lift 1,000 pounds. In reality, he would find this most difficult.



A 200 Lb. MAN WOULD FIND IT DIFFICULT TO LIFT 1000 Lb.

WEAKEST BEETLE CAN LIFT 5X ITS OWN WEIGHT

A flea can jump 12 inches high. If jumping were proportional to size, a man could jump 300 feet.



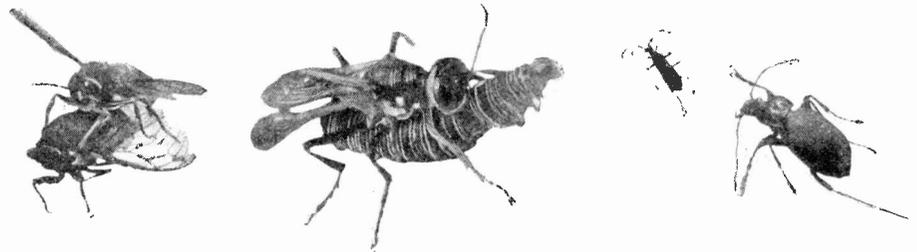
A Hercules beetle weighing only 1/5th of an ounce can carry a load on its back that weighs 5 1/2 pounds. This figure was determined by the English entomologist, Weir, who has made many interesting experiments as to the strength of insects. Directly below a Calosoma beetle is shown hunting another species of beetle.

HERCULES BEETLE WGT. = 1/5 OZ.

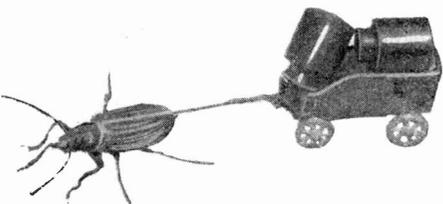
As below, a honey bee can carry a weight equal to 23 times its own weight.



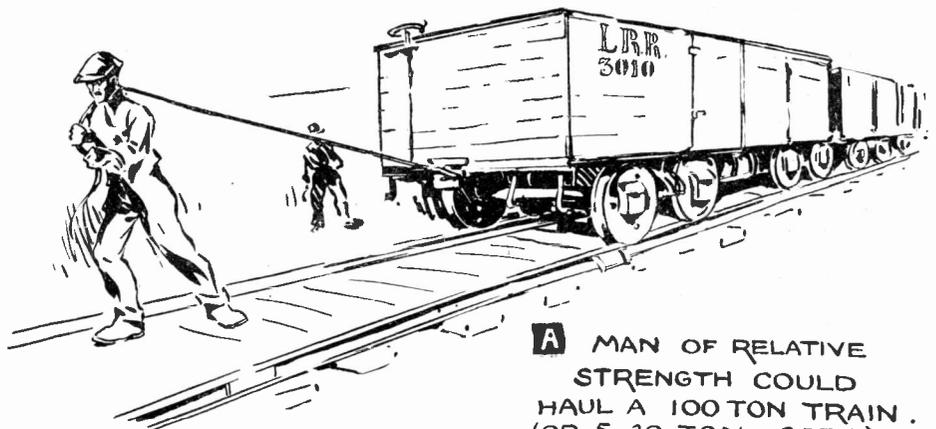
THE HONEY BEE CAN CARRY 23 X ITS OWN WEIGHT



In the left-hand photograph directly above, a digger wasp is shown carrying a harvest fly. In the center photograph above a thread-waisted wasp is easily carrying a large caterpillar. As in the illustration directly below, if a man could pull as many times his own weight as an ant can, that man would be able to haul a 100-ton train.



The author conducted some interesting experiments with beetles. One was hitched to a small wagon weighing 1 1/2 grams and this was easily pulled along by the beetle weighing 1/2 gram. Even 13 additional grams added made little difference. But when two 10-gram weights were added to the wagon, the beetle moved the vehicle in jerks.



A MAN OF RELATIVE STRENGTH COULD HAUL A 100 TON TRAIN. (OR 5 20 TON CARS)

# Astounding Strength of Insects

By DR. ERNEST BADE

**T**HE director of all movements in the insect is the brain, the muscles being put in motion through the stimulation of the nerves. In this way the animal is enabled to perform those functions which we call life.

The muscles consist, primarily, of cross-grained muscle fibres, and these are responsible for the movements. They are attached directly to the inner part of the outer skeleton or they are joined to it with a tendon. The longitudinal muscles of the body are four in number, and two of these are dorsal and two are ventral to it. Every individual part of the body, the appendages, etc., as well as every part of the body has its own muscles, and the muscular strength of the insects, in comparison to their sizes, is far greater than the strength of warm blooded creatures.

Some peculiar and exceptionally interesting experiments have been carried out with various insects to test their strength, and, it was found, that an ant could pull a tiny wagon, to which it was hitched, up an incline. The wagon was 1,300 to 1,400 times as heavy as the ant, but still it was able to pull it along. This would be comparable to the strength of a man who could pull a railroad train of a 100 tons.

An English ornithologist, Weir, hitched a large stag beetle weighing 1.86 grams before a tiny toy wagon made of tin weighing 56 grams. The beetle pulled this load with ease. The experimenter then placed small pieces of lead in the wagon until the total load was 84 grams. This was pulled a distance of three centimeters but then the beetle was exhausted and refused to move. This animal therefore pulled 45 times its own weight. Other experiments led Weir to the conclusion that this insect, in comparison to its weight, was just as strong as a man who could lift 2,200 pounds with one hand. A hercules beetle (*Dynastes tityrus*) which Weir used in one of his experiments, weighed  $6\frac{1}{2}$  grams or about one-fifth of an ounce and this creature was able to carry a brick weighing  $5\frac{1}{2}$  pounds on its back.

Even the weakest of beetles are able to lift five times their own weight without undue exertion. A honey bee is able to move 23 times its own weight, while some can carry as much as 40 to 50 times their own weight. These experiments have shown, as they could be shown in no other way, the extraordinary muscular power of these tiny creatures.

Just consider the energy expended by a flea while jumping, then increase his size, and one arrives at the startling conclusion that if a man had the relative muscular power in his legs, he would be able to jump over the spire of a church towering 300 feet into the air, and he would be able to do this with ease.

Such strength stands the insects in good stead, for they are able to prey on their fellows and they often attack and destroy those which are much larger and stronger than themselves. Here in the insect world, as every where else, it is a battle for existence, and life is fought without regard to rules. The stronger falls a victim to the weaker through thousands of artifices and ingenious devices.

The obese caterpillar which sedately eats one leaf after the other, is frightened by a comparatively small thread-waisted wasp, its hereditary enemy. The wasp walks nervously about the leaf the caterpillar was eating, suddenly it hurls itself upon the caterpillar, grasps it tightly by the neck. Paralyzed by the sting, the caterpillar falls to the ground with the wasp. Then the paralyzed prey is carried by the wasp to a cavity and an egg deposited on it. Here the caterpillar serves as a source of food supply for the young larva of the wasp and

is destroyed by it. But the caterpillar was carried by a creature much lighter than itself, an illustration of how nature utilizes the strength of insects. The digger wasp has such powerful wings that it can carry its prey through the air even though the victim be many times heavier than itself.

All these accounts of the prodigious strength of the insects, when compared, in size, to that of man, are extremely interesting. From a mechanical point of view these comparisons are by no means so extraordinary for they are based on false assumptions, a form of what has been called the conflict of squares and cubes, for volume decreases more rapidly in ratio than surface. The force that a muscle can exert depends upon its section or surface although its capacity for doing work depends upon its volume. It is for this reason that the insects are so powerful; increase their size and their strength is taken from them.

When comparing the muscles of man and insects, the latter will be 100 times shorter while at the same time it will be 1,000,000 times lighter, this is the third power, while the force that it can exert will be the square of 100 or 10,000 which is the second power. Therefore the muscle of the insect, supposed to be one hundredth of man's linear dimensions, furnishes, when it contracts, a force 10,000 times less than the human muscle exerted through a space which is only 100 times smaller.

Take the jump of the flea. Increase his size. Then the relative muscular power in his legs is such that, if it were a man, he could jump over a 300 foot steeple, which would be true if size only were considered. But the muscular contraction of the flea can raise it only twelve inches. Man can raise his own weight about five feet by leaping. For equal weight, the human muscle thus furnishes five times more work than the flea in a single jump.

## Novel Sun-Clock



A novel sun dial which tells time by means of two hands located on a conventional clock face has recently been invented by Prof. W. E. Cooke, a Sidney, N. S. W., astronomer. The appearance of the device is shown in the photograph above.

**T**HIS sun dial not only tells the time of day quite accurately, but also the day and month of the year. There is no clockwork mechanism to it, as the hands on the dial are geared to a revolving ring which is pierced with a tiny hole and fitted with a scale opposite that hole. The ring is revolved so that the beam of light admitted through the hole falls directly on the scale, and when in this position, the hands of the dial will indicate the exact time. The illuminated point on the scale shows the date. The pivots of the revolving ring must lie in a north and south line and the angle of the tilt of the ring must correspond to the latitude of the place where the clock is used. No calculations are necessary to determine the time. — Ernest Brennecke, Jr.

## Polishing Shoes in Comfort



A shoe polishing device that folds up against the wall when not in use is illustrated above. When in use, the footrest can be locked rigidly at either of two heights. Under the footrest are two rollers upon which the polishing cloth moves back and forth, thus imparting a brilliant shine to the shoes. Space is provided for the polishing cloth and such accessories as cleaning liquid and paste.

# RESCUE METHODS FOR SUBMARINISTS

By F. W. HORTON

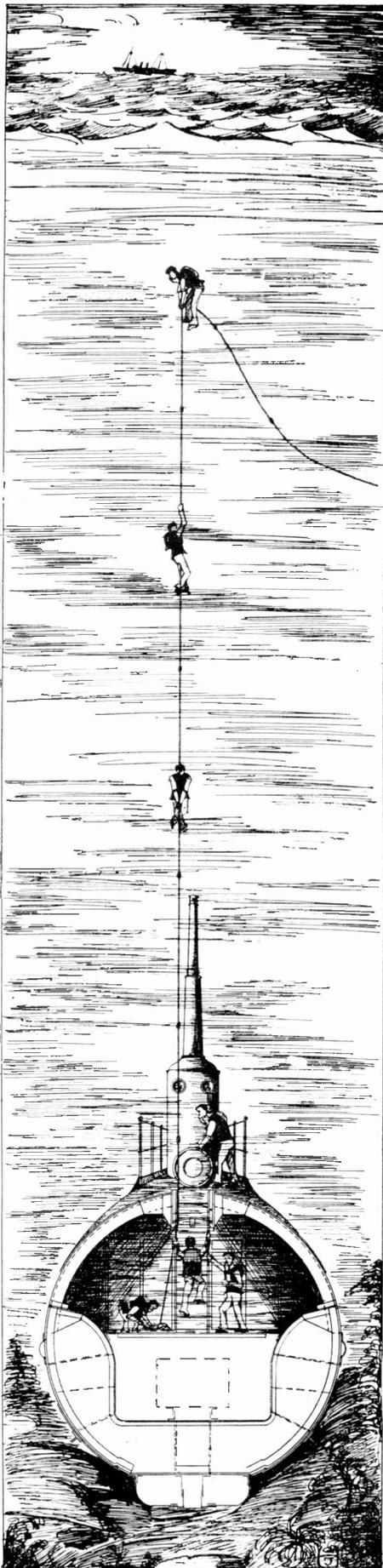
## A Lesson From the Sinking of the S-51

United States Navy Far Behind in Rescue Apparatus for Sailors Trapped in Submarines. Read This Article Describing a Successful Apparatus of Foreign Design Which Enables Imprisoned Submarinists to Rise to the Surface. New and Untried? No! Was Used During World War!

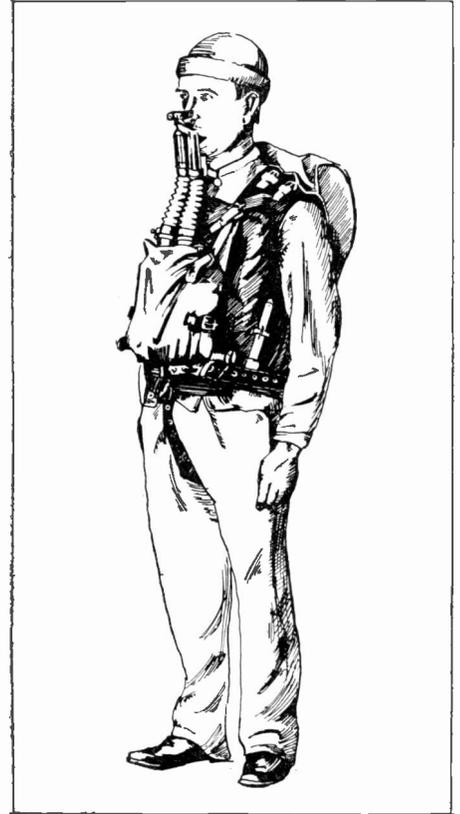
ON the night of Sept. 25th, the U. S. Submarine "S-51" was sunk in collision with the "City of Rome" off Block Island. Only three of the crew who were able to gain the deck before the boat sank, were saved. Thirty-three men were drowned. For nearly a week the attention of the nation was focussed on the heroic work of the divers who attempted to raise the sunken boat in the hope, which later proved vain, that some of the men might have succeeded in shutting themselves in one or more of the water-tight compartments of the submarine that were not smashed by the collision.

This last disaster, following the many accidents to our Navy submarines during the past few years, notably, the sinking of the S-48 off Bridgeport, Conn., in December, 1921, the S-5 off the Delaware Capes in September, 1920, the G-1 at League Island, and the F-4 in Hawaiian waters, emphasizes afresh the many dangers inherent in the operation of submarines and leads to the natural question: Is there not some means of self-rescue that can be used by submarinists in the same way that parachutes are used by aviators or life preservers by the ocean traveler? The answer is "Yes." German submarines and those of several other European navies have been equipped for many years with individual rescue apparatus for every member of their crews. That the device is effective was demonstrated over ten years ago when the German submarine U-18 was sunk in the North Sea in June, 1915. The loss of the entire crew was reported to the British Admiralty, but within 10 days many of the men were safely back in Germany. Since this first rescue the de-

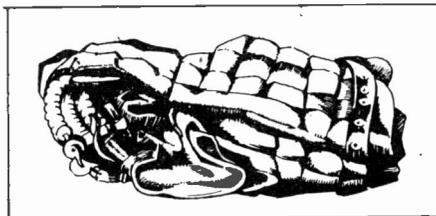
vice has proved its entire practicability by saving scores of lives. The accompanying illustration shows how the men escaped from the wrecked submarine with the aid of their individual life-saving apparatus.



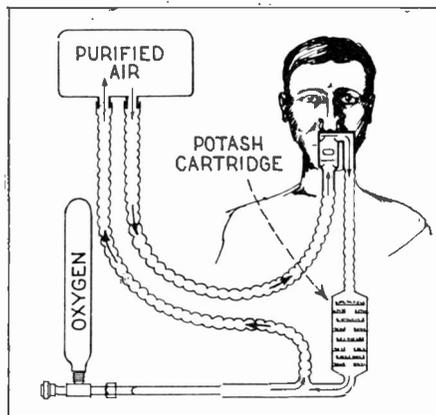
The above illustration shows the crew of a submarine leaving the disabled vessel by means of the life-saving suits and knotted rope mentioned in this article. By means of the rope, the men can ascend slowly and thus avoid the disastrous results of coming quickly to the surface of the water from great depths.



A sailor wearing the rescue suit consisting of swimming vest and self-contained breathing apparatus.



The self-rescue suits fold into a very small space and weigh only 13 pounds.



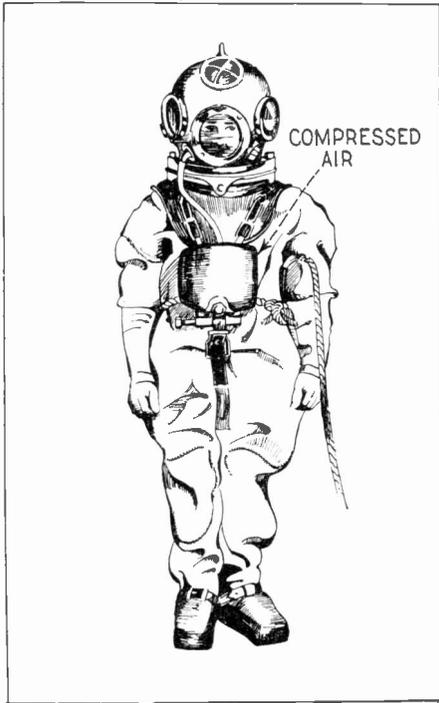
This simplified diagram shows the action that takes place in the breathing apparatus of the under-water rescue suit. See text for full explanation.

The rescue device itself consists of a very buoyant swimming vest combined with an oxygen supply apparatus, which automatically regenerates an air supply sufficient for a half-hour's stay under water, if the wearer is working actively and for an hour's stay if he is not working. The whole apparatus weighs only 13 pounds and can be folded into a small parcel. It can be put on as quickly as a coat and does not hinder motion in any way. A clip prevents water entering the nose and breathing is done through the mouth. The exhaled air flows through the potash cartridge which absorbs the carbon dioxide given off by the lungs. The air is now breathable again and collects in the breathing bag after having been previously revived with a fixed amount of oxygen automatically supplied from the oxygen cylinder. From the breathing bag the regenerated air is reinhaled. An auxiliary valve enables the wearer to pass supplementary oxygen directly from the oxygen cylinder into the breathing bag, if he is very active and is consuming more oxygen than is furnished automatically.

A small cylinder containing compressed air is used to fill the breathing bag in case there is not sufficient time to fill it with outside air when the apparatus is put on. This com-

pressed air supply is also used to dilute the contents of the breathing bag, i.e., lessen its percentage of oxygen, when at depths of more than 60 feet.

There is a safety valve on the feed pipe of the breathing bag which allows air to escape automatically in case the bag gets too full, thus preventing a disagreeable pressure on the lungs. This valve can also be



A front view of a modern European diving suit. It has no cumbersome air-hose, the air supply being regenerated by apparatus worn on the back. The life line carries a telephone cable.

operated by hand. Diving goggles to protect the eyes may be worn with the device.

In case a damaged submarine is lying at a depth of 50 feet or less it is safe for the crew to float to the surface at once, but at greater depths the ascent should be made slowly, the men holding themselves down by means of a knotted rope tied to the boat, and stopping at intervals which should be prolonged on nearing the surface. This slow ascent is of course necessary to prevent the "bends," the illness so much dreaded by the diver, which is caused by the formation of bubbles in the blood on the too rapid release from heavy pressure.

Every member of a submarine crew should be as thoroughly acquainted with diving tables as regular divers. These tables give

the rates for hoisting the diver from any depth after various periods of submersion. They are illustrated by the accompanying chart which shows the procedure to be followed in ascending from a depth of 200 feet after being down a half-hour and after a two-hour's stay, at a depth of 100 feet. It will be noted that in both cases the diver is raised more than half way to the surface in the first lift and that the wait at varying depths is more and more prolonged as the surface is approached. These two facts hold as general rules for ascent from any depth greater than 50 feet. From depths of less than 50 feet it is safe to come to the surface immediately if the diver has not been down for more than two hours.

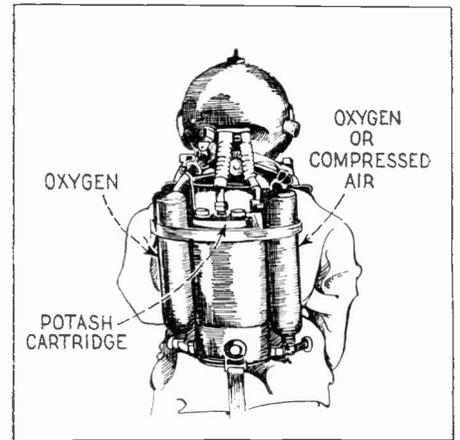
Once at the surface the wearer of the rescue device is in no way dependent on the buoyancy of the breathing bag as the swimming vest alone will support him together with the apparatus for hours or days as may be required. In fact, if the breathing apparatus proves cumbersome it may be detached from the vest and thrown away. This will allow the man to float much higher in the water which is a great advantage particularly if the sea is rough.

Inasmuch as individual rescue apparatus in a form substantially as described has been adopted for submarines by several European countries, it seems strange that our navy does not provide the crews of our submarines with similar equipment. The European countries, however, are apparently far ahead of us in the development of diving apparatus in general. For example, the ordinary diving suit as used in this country, in which the diver is supplied with air pumped from the surface through a hose, was discarded in Europe years ago, and it has been entirely replaced with the self-contained diving suit in which the air is automatically purified by passage through a potash cartridge and revived by oxygen in the same way as in the rescue apparatus already described. A front and back view of the suit are shown in the accompanying illustrations. This type of diving apparatus makes the diver independent of long and dangerous air hose and relieves him of the very considerable drag of the same which even in moderate currents is often sufficient to pull him off his feet. The helmet of the suit is fitted with a sound amplifier for telephonic connection with an attendant at the surface. The microphone is placed at one side of the mouth and the receiver opposite one ear. The telephone cable is made strong enough to be used as a safety line. A watch in the helmet shows the diver just how long he has been down. He has absolute control of his own air supply and can stay down from two to three hours, depending on how

hard he works and his corresponding consumption of oxygen. In case of emergency he can come to the surface at any time by inflating his suit.

Diving operations with this type of apparatus are economical as no air-pump, pump-men, or air-line tender are required.

For work in swift currents where the drag on the telephone cable is considerable, the



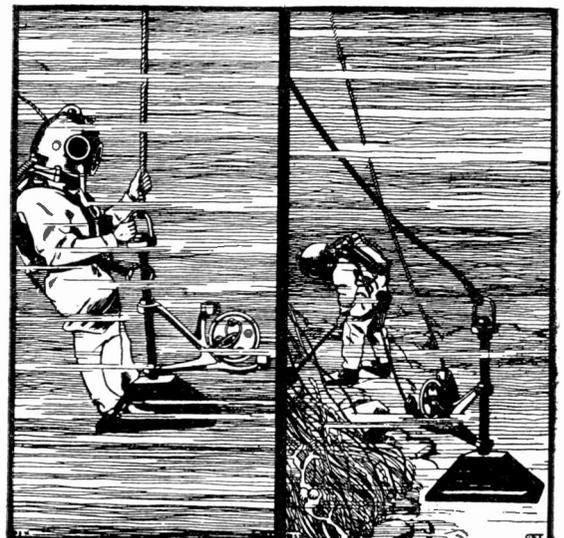
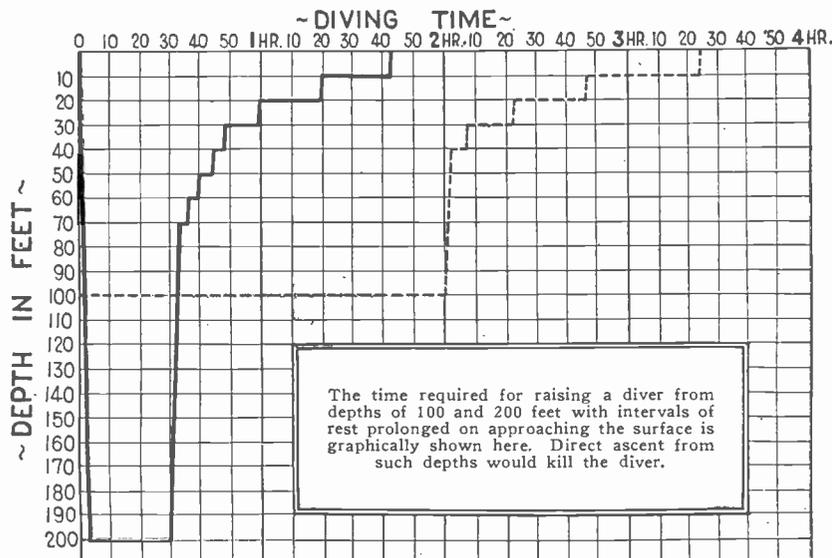
Rear view of an up-to-date diving suit showing oxygen tanks and potash cartridge for regenerating the air supply.

Germans have developed a ground pulley which relieves the diver of all vertical pull on the line. Its operation is illustrated in two accompanying sketches. The weight on which the pulley is mounted serves as a platform for the diver in descending, and on his arrival at the bottom he slips his telephone cable into the guides and over the wheel. He can then walk off in any direction as the pulley swings freely on its mounting shaft.

The rescue device for submariners already described has been adapted in two interesting types for use in swimming pools or at bathing beaches and for hydroplanes. The swimming-pool apparatus enables the wearer to work half an hour under water or in high breakers. The entire equipment is carried on the back in order to allow maximum freedom for the arms. Air bags attached to the apparatus are filled according to whether the wearer wishes to dive or rise to the surface. The apparatus is made for mouth breathing.

The rescuer for hydroplanes is very similar in its construction but special attention has been paid to minimizing its weight. The equipment enables the fallen flier to swim or to breathe for 30 minutes under water, thus giving him sufficient time to free himself from his disabled plane.

Diver descending on a weighted ground pulley. At work the diver uses the pulley to relieve all vertical drag on his life-line produced by the current.

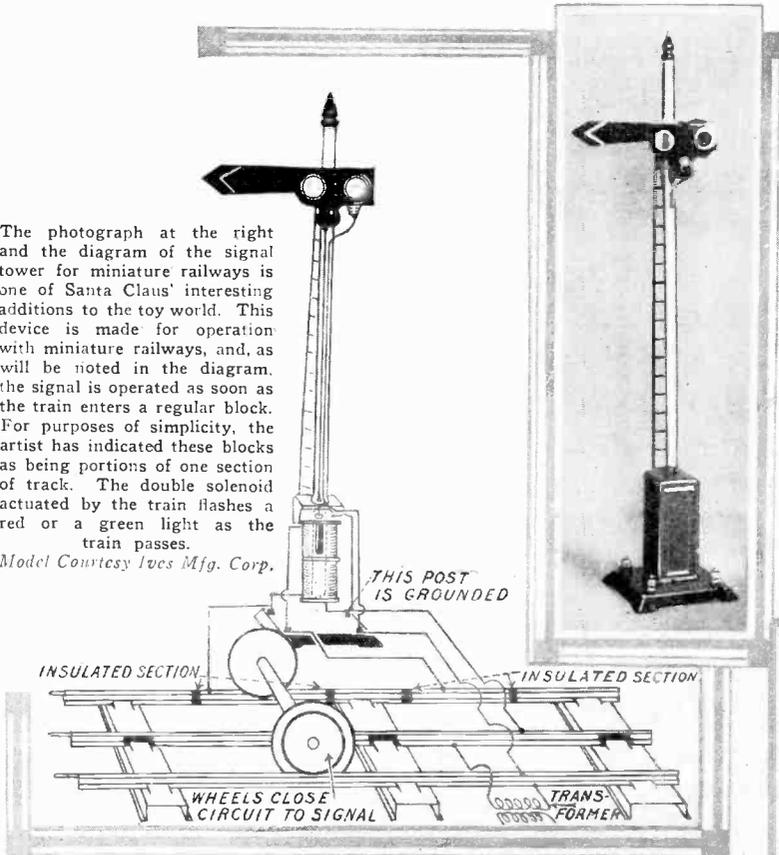


# Scientific Santa

By JOSEPH

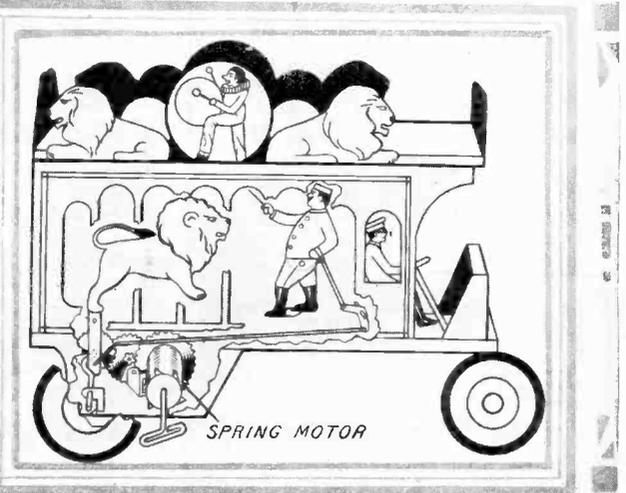
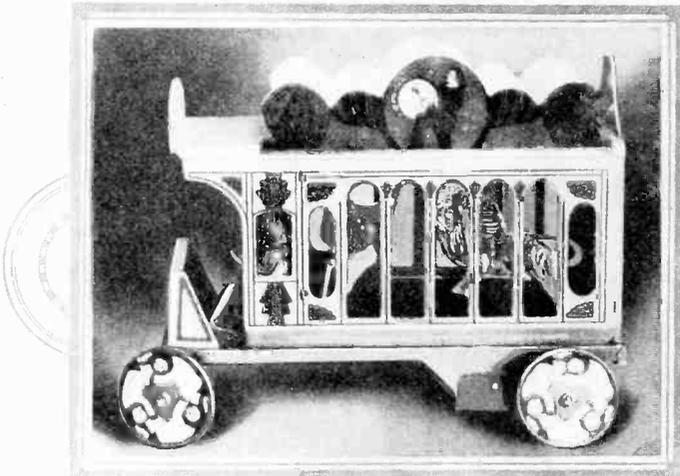
The photograph at the right and the diagram of the signal tower for miniature railways is one of Santa Claus' interesting additions to the toy world. This device is made for operation with miniature railways, and, as will be noted in the diagram, the signal is operated as soon as the train enters a regular block. For purposes of simplicity, the artist has indicated these blocks as being portions of one section of track. The double solenoid actuated by the train flashes a red or a green light as the train passes.

Model Courtesy Ives Mfg. Corp.



EACH year Christmas brings with it a lot of new toys to delight the youngster, and this year is no exception to the rule. As in the past, SCIENCE AND INVENTION Magazine again gives to its readers the details of a few of the best toys. So popular has our yearly toy page become that our readers anxiously look forward to it.

On these pages are illustrated an automatic electric railway signal of the semaphore type for toy train outfits. The arm is electrically operated by the train as soon as it enters a block. The two spring wound circus toys will be interesting to the younger folks. On the following page we illustrate a new type of electric train which may be automatically reversed by a button on the rheostat, and we also show a spring-operated porter and an automobile race track.

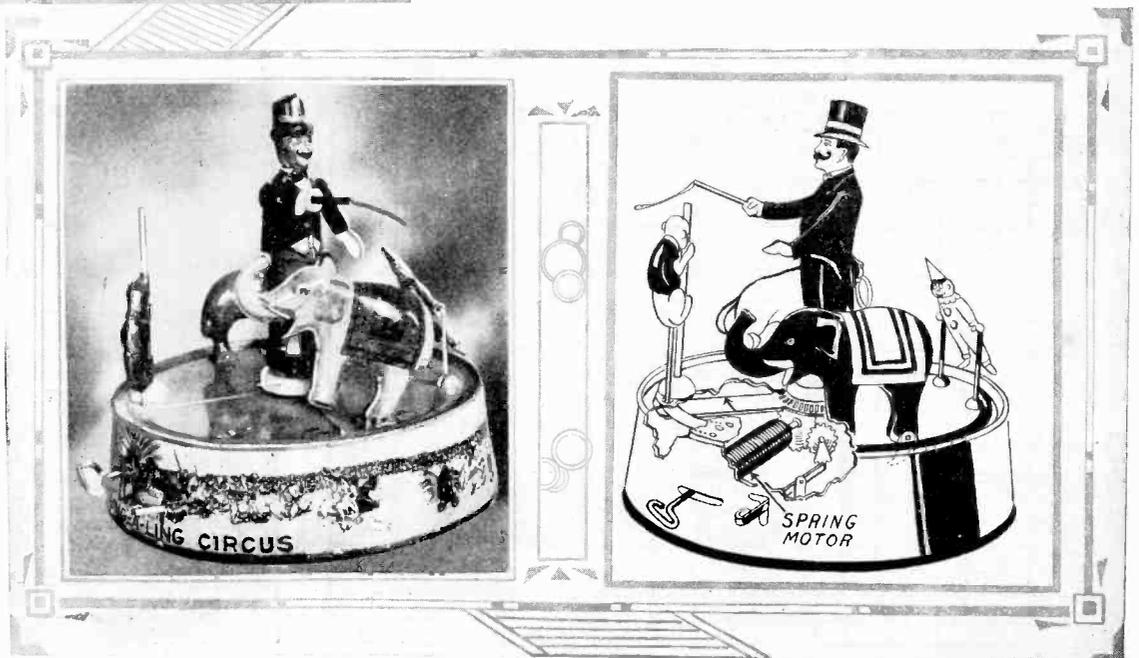


In the above illustration we find the details of a spring-wound toy in the form of a circus wagon containing a lion and its trainer. This toy may be wound up and it is not necessary to hold the wheels while the winding operation is being performed. As soon as the toy is placed on the floor, it starts to run, the lion moves up and down, and the trainer lashes his whip. The photograph of the toy is illustrated at the left. As may be seen by the photo, the device is pleasingly lithographed and there are no sharp corners to injure the smallest child. The wheels may be turned, causing the toy to travel in a circle when one is tired of watching it run straight along.

Model Courtesy Ferdinand Strauss Corp.

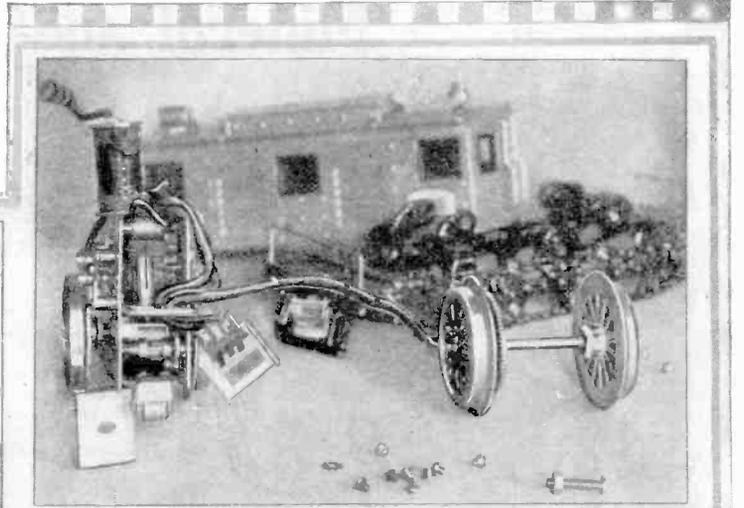
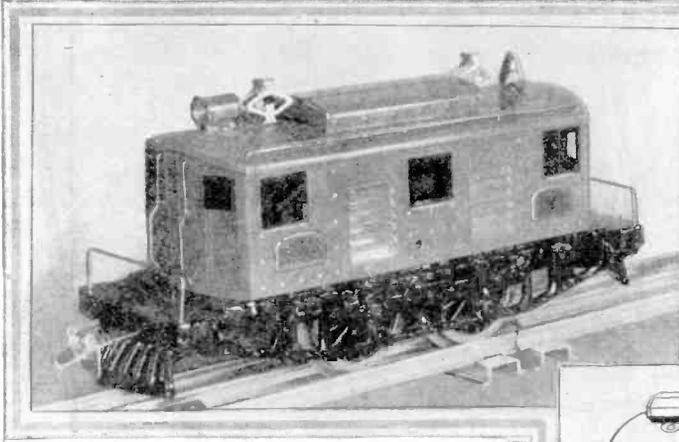
To the right we show a photograph and an illustration of the mechanism of a circus toy in which the master of ceremonies turns around and cracks his whip at the performers. Each time his arm goes down, either the performing animals or the clown go through their respective stunts. The elephant raises on his hind legs, the monkey slides down the pole, the lion stands up, but the clown will not spin around his horizontal bar until he is hit on the head. Notice in the mechanism that there is a lever with an arrow marked upon it, which turns around and raises the animals into their desired position. The clown is merely pivoted on his horizontal bar; consequently the crack from the performer's whip is necessary to make him spin around.

Model Courtesy Louis Marx & Co.



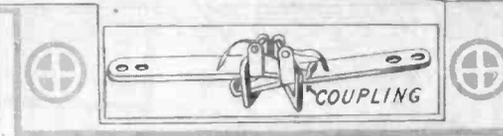
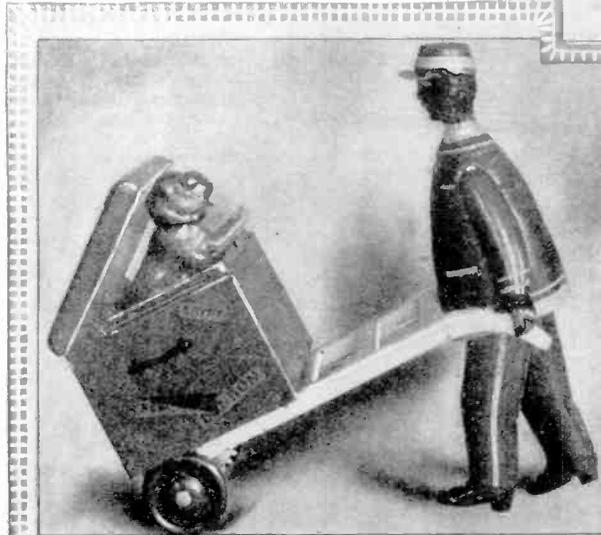
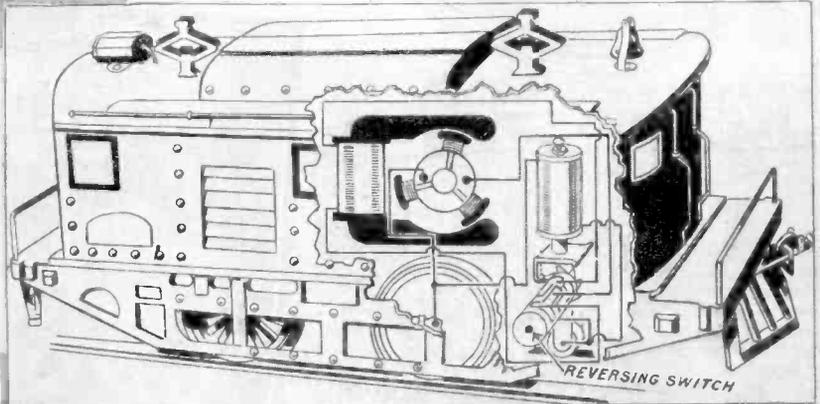
# Delights Children

H. KRAUS



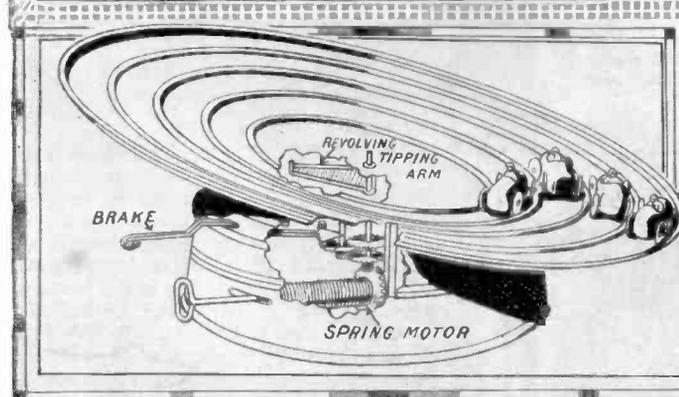
The two photos above and the diagram at the right show the latest type of electrical toy train which reverses automatically when a button on the rheostat is pressed. This button turns off the current to the rails momentarily, and allows an electro-magnetically controlled reversing switch to pull the switch around to the next position. Immediately the motion of the train is slowed up, the wheels begin to slip in the opposite direction, and finally the train runs backward along the track. This train is also fitted with automatic couplers illustrated in the drawing.

Model Courtesy Ives Mfg. Corp.



The photo and diagram at the left shows a mechanically operated porter pushing a trunk. As he moves along the floor, the cover of the trunk opens up and a dog seemingly growls at the porter, who hurries along with his burden. The mechanism is only applied to the wheels of the carrier, and yet one wonders at the remarkable way in which the porter walks along the floor. This is made possible through the ingenious crank movement to which the legs of the porter are fixed.

Model Courtesy Ferdinand Strauss Corp.



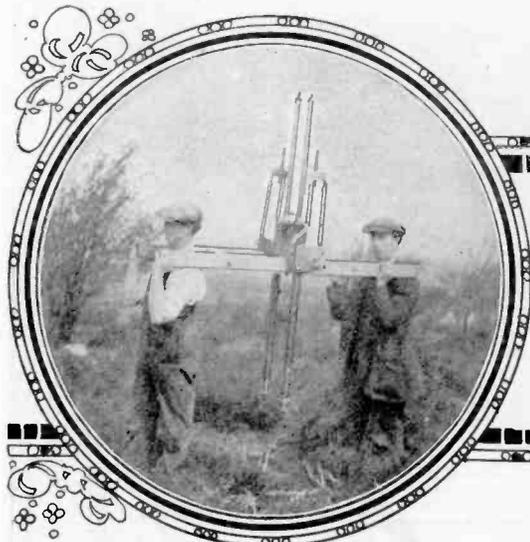
The turntable of the automobile race track illustrated above and to the right is caused to tip progressively by a small revolving tipping arm located immediately below the turn table. Four tiny automobiles are placed on the track and are caused to race around at a surprising speed. At times the innermost car will be in the lead, and at other times any of the other cars will take the lead.

Model Courtesy Louis Marx & Co.

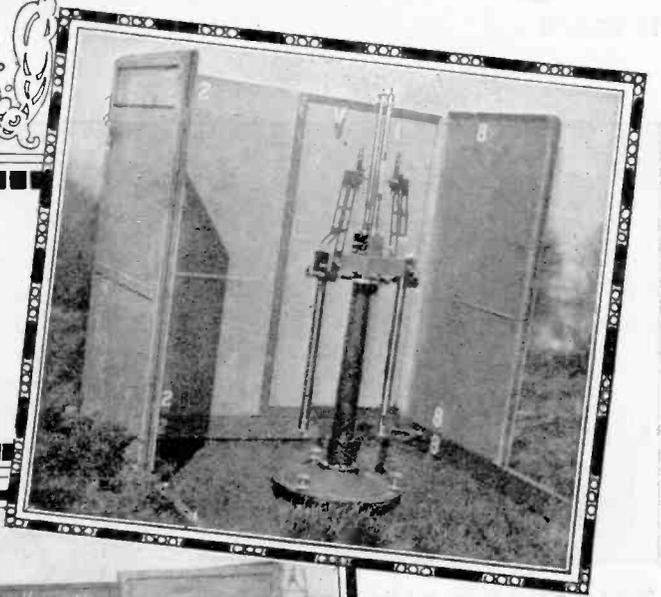


Addresses of these toy manufacturers may be had upon request.

# Mineral and Oil Finder

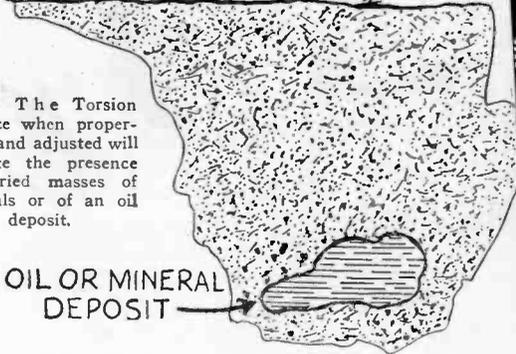


Left: The Eotvos Torsion Balance designed by Baron Roland von Eotvos of Budapest being taken into the field for testing its ability to locate oil and mineral deposits.

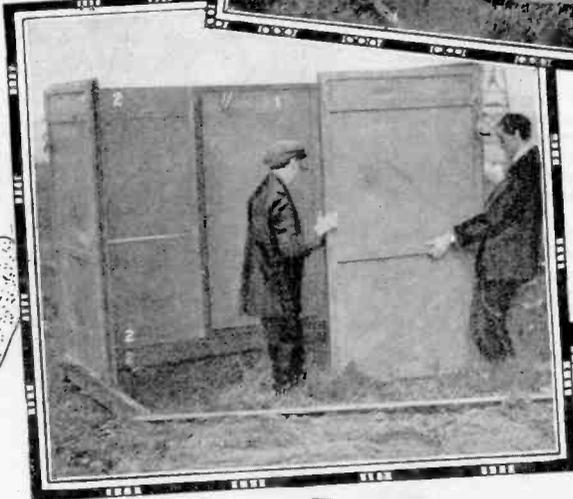


The balance is surrounded by a double or triple wall of metal sheets so that it will not be affected by outside disturbances. A deflecting mirror indicates the presence of minerals or oils.

TORSION BALANCE  
DETECTS PRESENCE  
OF OIL OR ORE



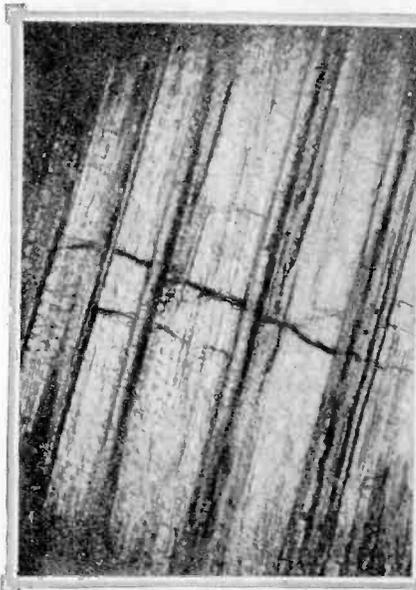
Right: The Torsion Balance when properly set and adjusted will indicate the presence of buried masses of minerals or of an oil deposit.



This device operates best at the edges of a deposit and therefore by proper manipulation can indicate approximate area.

# Machine Selects Wood

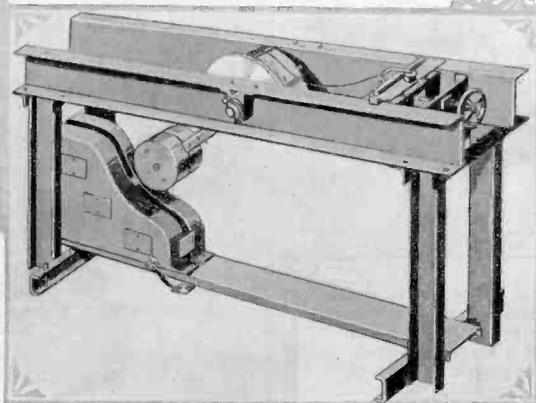
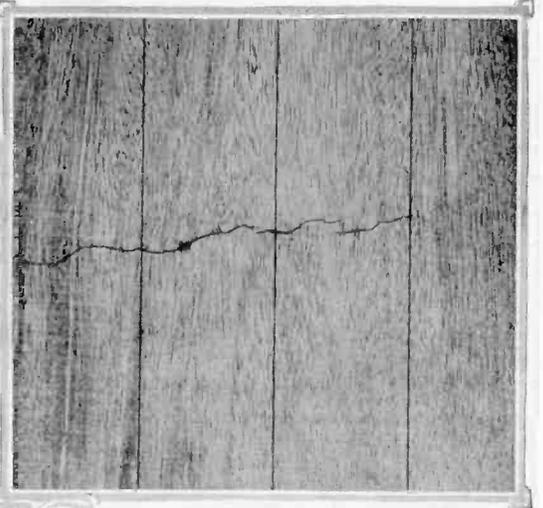
Right: Tree damaged by falling. This is a frequent cause of compression failure.



An enlarged view of a compression failure that was found in timber. This injury to the fibres was practically invisible to the naked eye but the microscope showed the fibres to be actually severed. This is shown in the enlargement above by the dark lines across the photograph.



The photograph at the right shows another compression failure that was so bad that it could be detected before the timber was put into use.



**FAILURES** of wood in building uses are due to many causes such as rough handling during the lumbering process, decay and some other natural causes. A machine that will aid in detecting flaws of various nature in timber has recently been designed and is in use in the forestry service of the Department of Agriculture. It is illustrated at the left. A cable that is wound up by the action of a pendulum is placed around the specimen of wood to be tested. Ordinarily when there is no specimen in the machine, the pendulum will swing through a certain arc when pulled back and released. When a specimen is under test, the pendulum does not swing as far as if it were free, but the arc through which it does swing indicates the breaking strain exerted on the wood.

# Railroad Wrecks in Movies

By FRANK GEORGE KERK

Wherein Capt. Kerk Explains How the Movie Producers Make Wrecks to Order

**T**HE following explanation could be likened to cover a picture made by King Vidor, or the recent Metro-Goldwyn-Mayer production, "Excuse Me."

A scenario calling for a train to fall from a bridge over the canyon in Arizona or Col-



Studio model maker constructing miniature bridge and following photograph for dimensions.

orado, could not have been accepted in the early days of motion pictures. It would have been impossible to get upon the films even could the producers afford the hundreds of thousands of dollars necessary to wreck a train and bridge. Then again the Santa Fé or other railroads might object to the destruction of their bridges, which took a long time to build.

Today such a scenario is gladly purchased, as the thrill can be put over at a nominal cost of a few hundred dollars. The effects are obtained by means of a miniature bridge, figures and train which are exact reproductions, made to scale and perfect in every detail, and by using the slow motion camera. The action and scenes would be made in the regular way with the real train, bridge and canyon, up to the point where the destruction begins. Then the scene would shift from the real train and bridge to the miniature without the eye being able to detect the change. When the miniature is brought into play it is placed near the camera and taken slightly out of focus to de-



Model being destroyed for wreck scene. Inset shows how foundation is seemingly washed away.

ceive the eye of the careful and critical motion picture habitué and gives an illusion of the real thing at a great distance. It frequently happens that the result desired is not obtained the first time, so that it is necessary to build the miniature sets over and over again.

The scenes of the real train and bridge would be taken "on location," as the technical term says, but the miniatures would be set up in the studio, or on the lot, and the camera would be placed very close, so that the ends of the bridge would exactly align with the ends of the bridge in the real scenes previously taken. The miniature train would then be run upon the bridge, which would collapse or do whatever the scenario called for and the train would proceed to do a nose dive to the bottom of the canyon. This is the point in operation in which the slow motion picture becomes essential.

According to natural laws a falling body will drop sixteen and a half feet the first second, forty-eight feet the next second, and ninety-six feet the third second and so on. For instance, the Canyon Diablo bridge is several hundred feet high, a train would take a certain number of seconds to fall that distance, and the camera would obtain sixteen pictures each second during the fall and the scene would look natural, but when you set up the miniature bridge and plunge your train off, it has only three or four feet to fall and following the natural laws it will reach the bottom of the canyon in a small fraction of a second and the camera running normally would obtain only two or three pictures during its fall to the bottom, which would be unnatural to the last degree and would not deceive any audience.

By computing the necessary number of pictures to be obtained to give it realism, the slow motion camera can be set to obtain that number of pictures in one-eighth or one-sixth of a second and the work of entertaining the public goes merrily on.

In order to cover details in construction of a miniature set we will assume the following as our own scenario briefly presented in abbreviation. The scene takes place over the Grand Canyon of Colorado—a railway bridge—heavy rains—washed out foundations. A train is half way across then falls from trestle hundreds of feet to the bottom of the canyon, depicting a terrible disaster, supposedly carrying hundreds of passengers to their death.

This would be accomplished in miniature by building a replica of a point in the Grand Canyon where the bridge is an actual fact. A still photograph of the real bridge would be taken for detail and notes of dimension, height, span and general appearance. In all operations of the construction of the miniature set, a careful scale would be adhered to. Where the bridge extended five hundred feet across the depths, the miniature set was constructed on a basis of three-eighths of an inch to a foot.

The material used to represent the steel girder construction of the bridge was sheet metal. For the railroad ties, wood was spliced and cut in proportion, then evenly spaced, after which they were set on flat strips that were bolted through to the floor of the stage and held the bridge in position until the destruction began. The rails were moulded or hammered out of metal strips. The appearance of heavy rains were obtained by a sprinkling can pouring its contents in front of the camera lens. The foundation base was boxed and a mixture of plaster of Paris and sand gave the appearance of a concrete foundation.

A heap of sand was placed around the

foundation and the water rushing through the channel, around the foundation would carry the sand away and give the appearance of undermining the bridge. The wash-outs were accomplished by a small stream



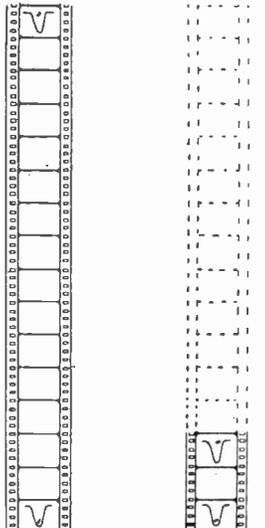
Photographs of the actual bridge are cut into the film to give semblance of reality.

of water running through a channel in the canyon and fed by a fire hose. The actual falling of the bridge was obtained by the use of piano wires attached to the extreme top of the trestle and passing down through the stage and around a pulley to a lever built near the set. As the sand would wash away the foundation, the lever was pulled slowly, and drew a section of the bridge to a lower level, giving the effect of the actual falling of the real bridge.

As the train reached the section over the washed-out foundation, a final pull of the lever would send the train crashing to the bottom of the canyon. A "cut-in" of the actual scene would then show the actors swimming around a passenger coach on its side, some crawling through the windows and others falling over the side into the water and then to be pulled out to safety.

The actual enacted scenes, using cut-ins now and then as required, create the vivid illusions desired. As a rule the miniature trains are electrically driven, and smoke pots in the funnel give the effect of a locomotive in action.

The diagrams at the right show how slow motion photography makes it possible to use miniature models in various action scenes. For instance, as shown in frames at the immediate right, a small object falling a short distance would only register on a few frames at normal speed. Where slow motion photography is resorted to, the same action fills a large number of frames. Thus, the time element that would be consumed if the action being filmed was performed by life size objects, is duplicated by a combination of miniatures and slow motion photography.



# Tarrano the Conqueror

SIXTH INSTALLMENT

By RAY CUMMINGS

First American and Canadian Serial Rights



He turned to leave us, and I became aware of a woman's figure standing in the shadows of the archway across the room. She started forward as Tarrano glanced her way. A Venus woman of the Cold Country. Yet, obviously, one of good birth and breeding.

## SYNOPSIS

**T**HE story opens in the year 2325 and is related by Jac, a writer of that time, employed by a large news organization of Great New York. On the afternoon of May 12 of that year, the President of the Anglo-Saxon republic is murdered in the midst of a speech. This happened at 5:10 P.M. At 6:15 of the same day the ruler of Allied Mongolia is murdered. Ten minutes later the leader of the negroes of Africa is killed while asleep. This leaves the earth without leadership. Jac and Grayson, a co-worker of his, suspect that the murders are the result of a plot on the part of the inhabitants of Venus. At 8:26 the mail from Venus lands. At 8:44 a message by helio from that planet announces the murder of the ruler of the Venus Central State. A warning comes with the same message and reads in part, "City being attacked. Tarrano, beware. you are in danger of . . ." The message stops at this point and further communication is impossible.

At 9 P.M. Jac is summoned to Northeast Island, off the coast of Maine, by a Dr. Brende.

Tarrano, the Doctor states, was at one time a lover official of the Cold Country of Venus. The doctor then announces that he, Brende, has perfected a medical method whereby human beings may be kept from growing old.

Unable to communicate with the Doctor's laboratory in northern Siberia, they set out for that point in Brende's aero. Arriving there they find no one outside and upon entering the laboratory building, are set upon by a group of "Venus-men."

In the ensuing battle, the Doctor is killed

and Jac, Elza, the Doctor's daughter, and Georg, the Doctor's son, are taken from the laboratory by Argo, a Venus-man. They are transported in an aero to Venia, a city on the earth inhabited by people of Venus. Here they meet Tarrano, who orders Jac and Georg imprisoned, keeping Elza in his presence.

Jac and Georg are imprisoned and held captive by walls of electrical charges that effectively prevent their escape. They are soon joined by Elza and hear that the earth governments have issued an ultimatum to Tarrano.

Tarrano sends a note to the earth governments refusing to come to terms and stating that if war is declared upon him, he will destroy all of Dr. Brende's records and will kill Georg.

By signals the little party of earth people have communicated with a Princess Maida of Venus who is also Tarrano's prisoner. The Princess sends a friend to rescue Jac, Georg and Elza, and the friend, Wolfgar, throws an isolation barrage around them. Suddenly interference is encountered and the barrage broken down.

In the resulting confusion, Georg escapes and joins the Princess Maida. Together with her they flee from Venia by helicopter and are picked up by an airship of the earth government. They are taken to Washington under heavy guard. The next day Tarrano offers to return the papers and models of Georg's father's invention, branding young Brende as an imposter who knows nothing of the invention. To offset this accusation, Georg is to tell his story to the world as well as to Venus and Mars by radio and helio. He and Princess Maida go to the station but there they disappear.

## CHAPTER XII THE WOMAN TARA

**I** MUST revert now to those moments in the tower room when Tarrano dissolved the isolation barrage which Wolfgar had thrown around us. Georg escaped, as I have recounted. Tarrano—there in the tower room—rendered me unconscious. I came to myself on the broad divan of the same room, with Elza bending over me.

I sat up, dizzily, with the room reeling.

"Jac! Jac, dear—" She made me lie back, until I could feel the blood returning to my clammy face; and the room steadied, and the clanging of the gongs in my ears died away.

"I—why, I'm—all right," I gasped. And I lay there, clinging to her hand. Dear little Elza! In that moment of relief that I had come to my senses, she could not hide the love which even now was unspoken between us. Tarrano! I lay there weak and faint; but with the pressure of Elza's hand, I did not fear that this Tarrano could win her from me.

Wolfgar was standing across the room from us. He came forward.

"You did not die," he said; and smiled. "I told her you would not die."

It was now morning. Wolfgar and Elza told me I had been unconscious some hours. We were still imprisoned as before in the tower. Georg had escaped with Maida, they

said; or at least, they hoped so. And they described the burning of the other tower. The city had been in a turmoil. It still was; I could hear now the shouts of the crowd outside. And turning as I lay there, through the casement I could see the blackened, still smoking ruins of Maida's tower; the broken iron terrace; the spider bridge melted away, hanging loose and dangling like an aimless pendulum.

The latest news, Elza and Wolfgar could not give me. The instrument room of our tower had been disconnected by Tarrano when he left some hours before. As they said it, we heard a familiar buzz; then the drone of an announcer's voice. Tarrano's guard had doubtless observed my recovery and had had orders to throw current into our instruments. Strange man, this Tarrano! He wished the news spread before us again. Confident of his own dominance over every crisis, he wanted Elza and me to hear it as it came from the discs.

We went to the instrument room. I found myself weak, but quite uninjured. Elza left us there, and went to prepare food which I needed to strengthen me.

The public events of those hours and days following, I have recounted as Georg saw them and took part in them in Washington. We observed them, here in the tower, with alternate hopes and fears. Our life of imprisonment went on much as before. Occasionally Tarrano visited us, always making us sit like children before him, while at his ease he reclined on our divan.

But he would never give us much real information; the man always was an enigma.

"Your friend Georg has a wonderful plan," he announced to us ironically early one evening. He smiled his caustic smile. "You have seen the tape?"

"Yes," I said. It was Georg's plan to address with Maida, the publics of Earth, Venus and Mars.

Tarrano nodded. "He and the Princess are going to convince everyone that I am an imposter."



My heart leaped into my throat. The woman Tara had produced from about her person a weapon of some kind.

I did not answer that; and abruptly he chuckled. "That would be unfortunate for me—if they could do that. Do you think they'll be able to?"

"I hope so," I said.

He laughed openly. "Of course. But they will not. That long note of mine to your government—you read it, naturally. But you didn't read in it my secret instructions to my agents in Washington, did you? Well, they were there in it—my commands—the letters ending its words made another message."

He was amused at our discomfiture. "Simple enough? Yet really an intricate code in itself. It made the phrasing of the main note a little difficult to compose, that was all." He sat up with his accustomed snap of alertness, and his face turned grim. "Georg will never address his audience. Nor the Princess—she will never appear before those sending mirrors. I have seen to that." Again he was chuckling. "No, no, I could not let them do a thing like that. They might turn people against me."

Elza began indignantly: "You—you are—"

His gesture checked her. "Your brother is quite safe, Lady Elza. And the Princess Maida also. Indeed, they are on the point of falling in love with each other. Natural! And perfectly right. It is as I would have it."

His strong brown fingers were rubbing each other with his satisfaction. "Curious, Lady Elza—how fortunate I am in all my plans."

"I don't think you are," I said. "Our government has you a prisoner here. They didn't withdraw the patrol as you demanded, did they?"

He frowned a trifle. "No. That was too bad. I rather hoped they would. It would have been a stupid thing for them to do—but still, I almost thought they'd do it."

I shook my head. "What they will do is sweep down here and overwhelm you."

"You think so?"

"Yes."

He shifted himself to a more comfortable position. "They are playing for time—so that when I fail to produce the model as I agreed, then the public will realize I am not to be trusted."

"Exactly," I said.

"Well, I am playing for time, also."

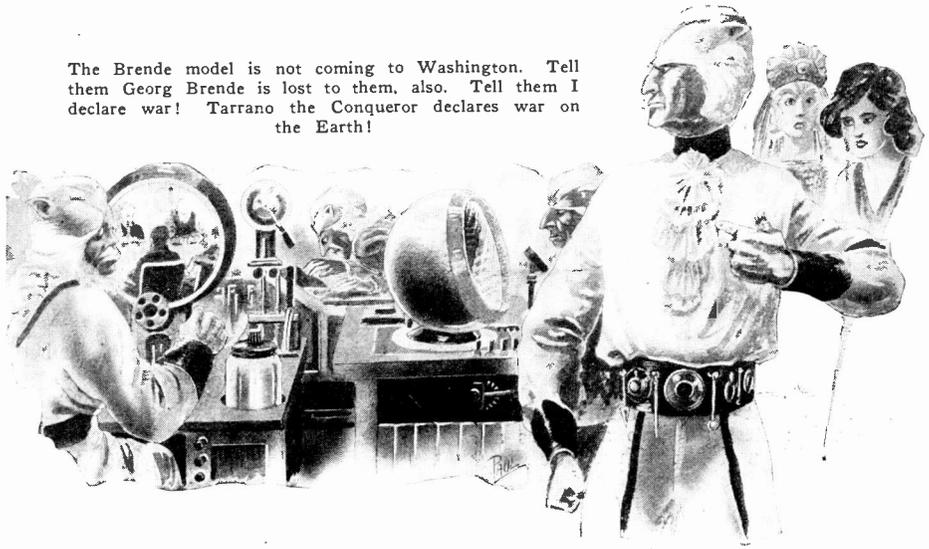
He seemed so willing to discuss the thing that I grew bolder.

"What have you to gain by playing for time?" I demanded.

He stared. "You would question me, Jac Hallen? How absurd!" He looked at Elza, as though to share with her his amazement at my temerity.

ment is better than yours. I would not let you lead us into disaster. You are a gentle little woman. Your instincts are toward humane treatment of everyone—toward mercy rather than justice. In all such things, I shall be guided by you. Justice—tempered with mercy. A union very, very beautiful, Lady Elza . . . But, you see, beyond that—you are wrong. I am a man,

The Brende model is not coming to Washington. Tell them Georg Brende is lost to them, also. Tell them I declare war! Tarrano the Conqueror declares war on the Earth!



Wolfgar said suddenly to Tarrano. "You will gain nothing."

Tarrano's face went impassive. I understood him better now; that cold, inscrutable look often concealed his strongest emotions. He said evenly:

"I should prefer you not to address me, Wolfgar. A traitor such as you—the sound of your voice offends me."

It struck me then as very strange—as it had for days before—that Tarrano should have failed to punish Wolfgar. I would have expected death; least of all, that Tarrano would have allowed Wolfgar to live here in the tower, in comparative ease and comfort. Tarrano's words now answered my unspoken questions. He was not looking at Wolfgar, but at Elza.

"You, Wolfgar—deserve death. You know why I cannot kill you? Why I let you stay here in the tower?" A faint, almost wistful smile parted his thin lips; he did not take his eyes from Elza.

"I am greatly handicapped, Wolfgar. The Lady Elza here would not like to have me put you to death. She would not even care to have me mistreat you. She is very tender hearted." He raised a deprecating hand. "Ah, Lady Elza, does that surprise you? You never told me I must be lenient with this traitor? Of course not."

"I—" Elza began, but he stopped her. "You see, Lady Elza, I have already learned to obey you." He was smiling very gently. "Learned to obey even your unspoken commands."

I wondered how much of this attitude might be sincere, and how much calculated trickery. Could Elza, indeed, control him?

She must have had much the same thought, for she said with a forced smile: "You give me a great deal of power. If you wish to obey me, you'll set us free—send us all to Washington."

That amused him. "Ah, but I cannot do that."

She gained confidence. "You are willing to be very gracious in things which do not inconvenience you, Tarrano. It is not very impressive."

He looked hurt. "You misinterpret. I will do for you anything I can. But you must remember, Lady Elza, that my judg-

and in the big things I must dominate. It is I who guide, and you who follow. You see that, don't you?"

The sincerity in his voice was unmistakable. And my heart sank as I watched Elza. Her gaze fell, and a flush mantled her cheeks. Tarrano added quietly: "We shall have no difficulty, you and I, Lady Elza. Each of us a place, and a duty. A destiny together. . . ."

He broke off and rose quickly to his feet. "Enough. I have been weak to say so much as this."

He turned to leave us, and I became aware of a woman's figure standing in the shadows of the archway across the room. She started forward as Tarrano glanced her way. A Venus woman of the Cold Country. Yet, obviously, one of good birth and breeding. A woman of perhaps 30 years, beautiful in the Venus cast; dressed in the conventional bodice breast-plates and short skirt, with grey stockings and sandals.

Within the room, she regarded Tarrano silently. There was about her a quiet dignity; she stood with her tall, slim figure drawn to its full height. Her pure white hair was coiled upon her head, with a rich metal ornament to fasten it. And from it, a mantle of shimmering blue fabric hung down her back.

Tarrano said: "What are you doing up here? I told you to wait below."

Her face showed no emotion. But there was a glitter to her eyes, a glow in their grey depths like *alumite* in the hydro-flame of a torch.

She said slowly: "Master, I think it would be very correct if you would let me stay here and serve the Lady Elza. I told you that before, but you would not listen."

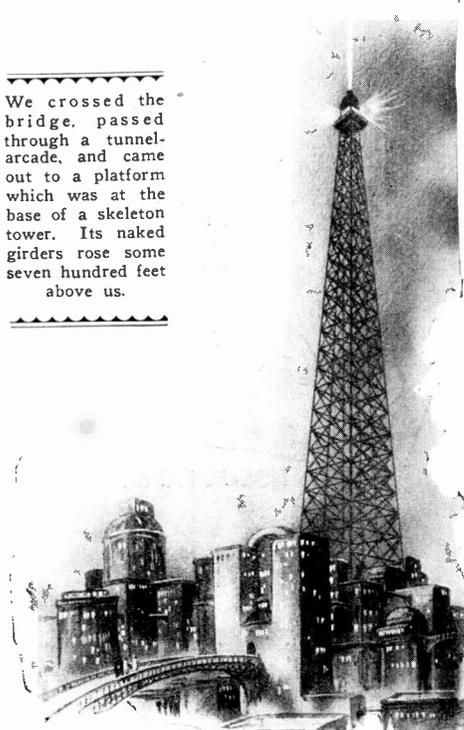
Tarrano, with sudden decision, swung toward Elza. "This is the Elta\* Tara. She was concerned that I should allow you to dwell here alone with this Jac Hallen, and this traitor from Mars." His tone conveyed infinite contempt for us.

The woman said quickly: "The Lady Elza would be glad of my companionship." She shot a swift glance to Elza. What it was meant to convey, I could not have said. Perhaps Elza understood it, or thought she did. She spoke up.

(Continued on page 754)

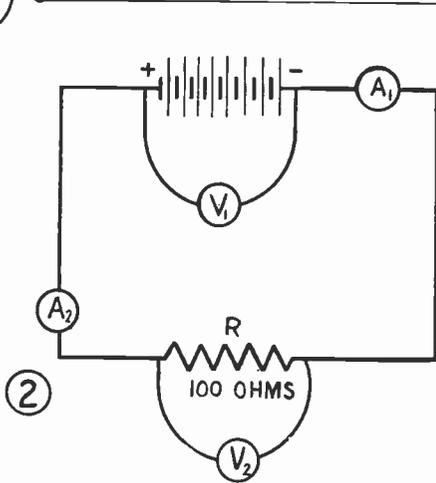
\*Elta—a term or title denoting rank by birth.

We crossed the bridge, passed through a tunnel-arcade, and came out to a platform which was at the base of a skeleton tower. Its naked girders rose some seven hundred feet above us.

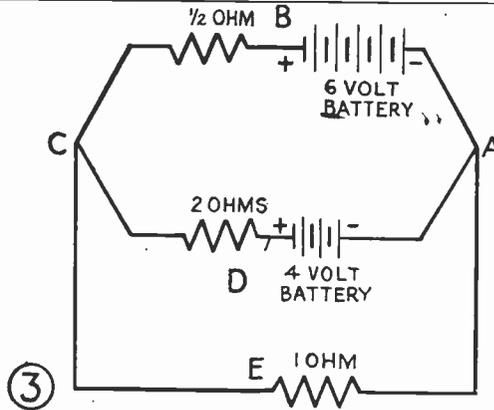


# Scientific Problems and Puzzles

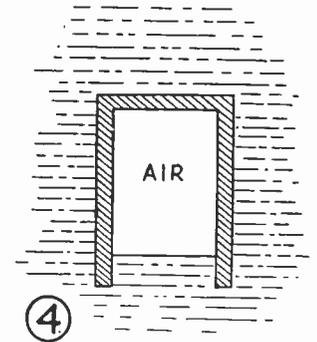
By ERNEST K. CHAPIN



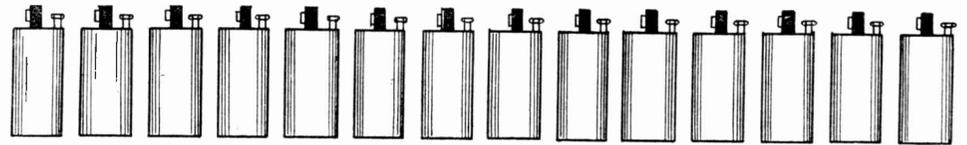
2 In the circuit shown in Fig. 2 above, two volt meters and two ammeters are connected in a circuit with a battery and resistance. In this particular case, which ammeter, if either, will read higher, and which volt meter?



3 Considering the resistance of the battery and the connecting wire as negligible, which way will current flow through the branch of the circuit ADC? What effect could a change in resistance in ADC have upon the flow of current in this branch?

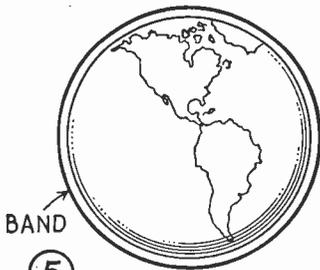


4 A cylindrical can, opened at one end is light enough so that it will tend to float as above. Can the can be pushed to a sufficient depth so that it will not rise when released?



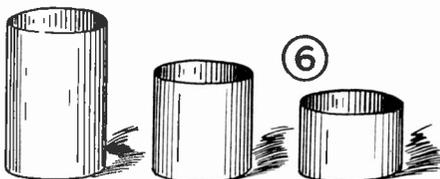
1

Given 14 dry cells without connections between them, can you arrange them in a circuit and connect them together so that the resulting battery so formed will have an E.M.F. of 9 volts total? Of course, in this case we are assuming the use of standard carbon-zinc dry cells which have a practical voltage of 1.5 each. In solving this problem, you can resort to any series or parallel connection or combinations of the two.



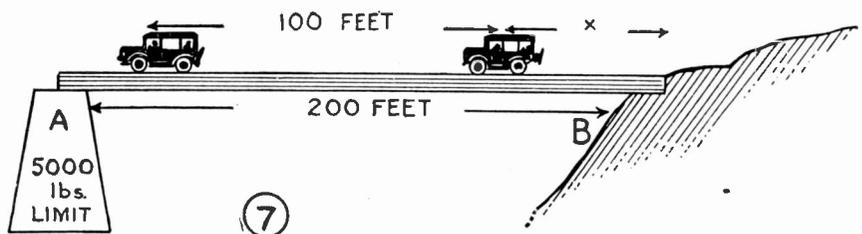
5

Assuming an inelastic band around the earth as above, and that the band is cut and an additional yard added, could the band be raised as much as five inches from the earth's surface all around?



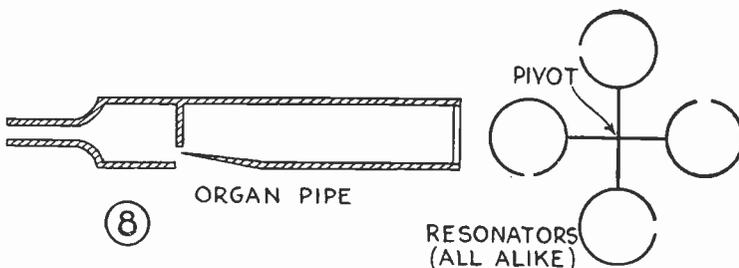
6

Should the diameter of a cylindrical can exceed, equal or be less than the height if the result is to have the most volume for the amount of material used in producing the can?



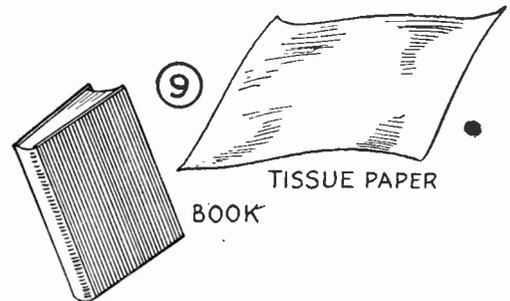
7

Assuming two cars on a bridge as above, with the various known factors indicated, will the pier A give way, providing both cars keep the same distance apart as indicated, and how far will the rear car be from the end B when the bridge gives way? In other words, solve the problem for the distance X when pier collapses.



8

If four resonators are mounted on a pivot so that they are perfectly free to rotate and if they are all alike, which way will they tend to rotate when a blast is blown on an organ pipe to which they are tuned?



9

Can a sheet of tissue paper be arranged so as to support a book several inches above the surface of a table?



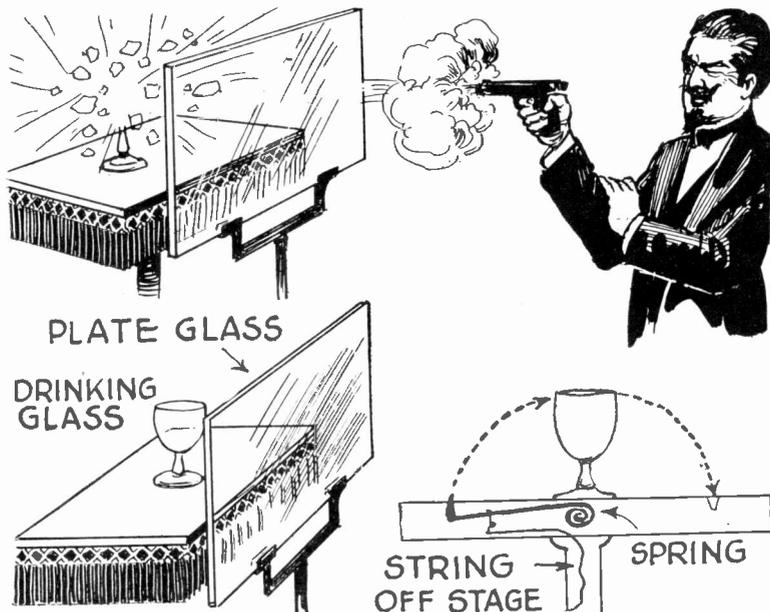
# MAGIC "DUNNINGER"

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

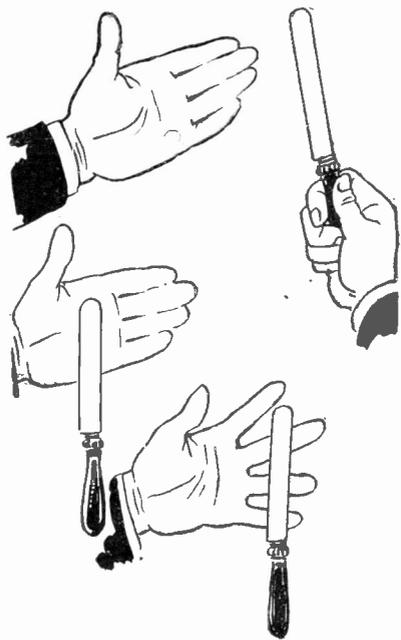


NO. 33 OF A SERIES

At the right is illustrated a new method of apparently shooting through a sheet of plate glass, and breaking a tumbler on the other side of it. It will be noticed that on the table an ordinary drinking glass is to be seen. In front of this a sheet of plate glass is held by a suitable holder. The magician picks up an automatic revolver and fires directly at the tumbler, which is seen to burst. The plate glass remains undamaged. The effect is produced by having a specially prepared table arranged with a spring trigger as illustrated. At the end of the spring a pointed weight is to be found, which spring when released by the assistant, comes up and breaks the glass tumbler. The revolver is loaded with blank cartridges. The spring flies into the top of the table.



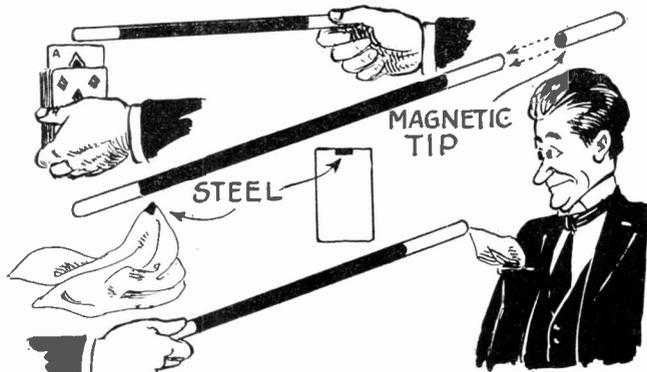
Below we find a new method for securing a "load" from an ordinary opera hat. A load, as every magician knows, is anything which the magician desires to produce for use in future tricks or with which he is attempting to make a hit. It may be silks, flags, flowers, rabbits, baby's clothes, vegetables, ribbons, or anything else. The opera hat from which this load is produced has a specially hinged compartment, which slides from the inside to the outside of the hat, as can be seen by referring to the diagram below. In this hinged compartment the load is located. When the inside of the hat is shown, the load naturally is pushed to the outside, where it is hidden under cover of the hand of the performer. A flip of the hat transfers the load to the inside to be removed at will.



The illustration below shows a new type of magic wand. Any ordinary magic wand may be used in constructing a device of this nature. The performer should have a good selection of magic wands, and they should all be similar in appearance, so that he can employ one or the other whenever needed, and the change in the selection of wands will be scarcely apparent. Strange as it may seem, a great many tricks may be done with wands alone. Thus we have a type of wand which defies gravity and will remain suspended in almost any position from the edge of the table, chair or book. Then there is the disappearing wand and the rising and falling wand, and countless other styles which in themselves make a very pleasing exhibition. Here, however, we have a tip which may be added to any wand, and with which two or more interesting tricks may be added to the magician's repertoire. The metal tip of the wand below is fitted with a bar magnet of the permanent type. This causes cards specially prepared with strips of clock spring attached to their backs to cling to the wand. The magician may also put a silk kerchief into the pocket of his assistant and withdraw it with the wand to which the silk clings mysteriously.



The above shows an interesting little parlor trick which may be performed around the dining table. The amateur picks up a knife, rubs it briskly on the palm of his hand and then suspends it from the finger tips, from the palm or from the back of the hand in a very mysterious manner. A very weak solution of seccotine and water is applied to the palms and fingers and allowed to dry. This is sticky enough to cause the knife to stay in any prescribed position.



The hat illustrated in the drawing above may also be used for the production of eggs in one of two ways. Two or three real eggs may be placed in the compartment, and the others may be of a collapsible spring type, or the performer may drop the real eggs into the compartment on the outside of the hat, push the compartment into the hat, and extract the eggs from the inside. The eggs may be secured from the vest or from a "servant" attached to the back of a chair.

# Mathematical Cross-Number Puzzle

By RICHARD H. TINGLEY

Here you are, cross-word puzzle fans, here is a puzzle that will tax your ingenuity to the utmost. The answers are given on page 752, but for your own sake do not refer to them until you have finished the puzzle or exhausted your fund of information. This puzzle is radically different from the usual type in which letters are inserted in blank space to form words. In this one,

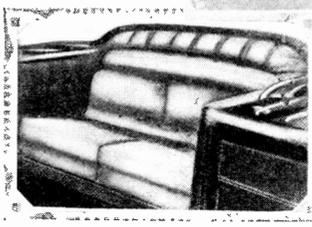
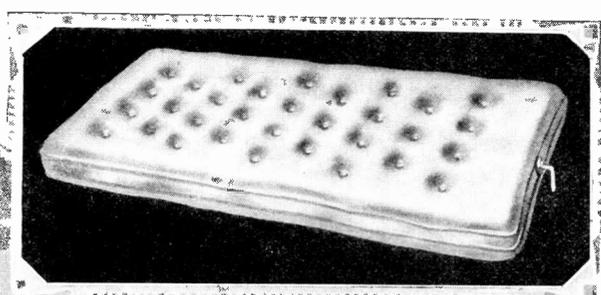
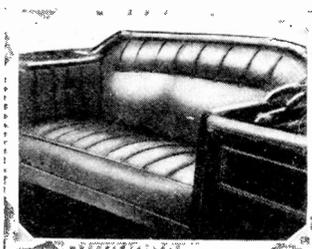
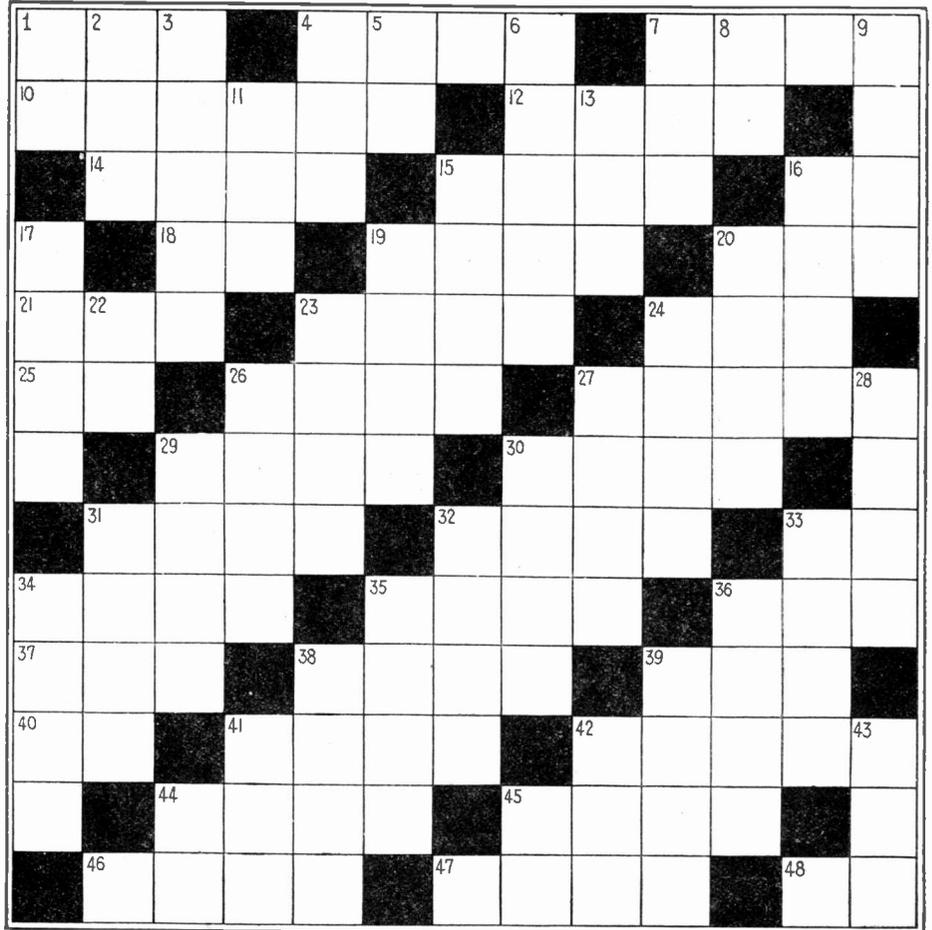
definitions are given which, by dint of hard thinking, can be worked out into numerals which numerals are inserted in the correct order in the blank spaces and which will line up both vertically and horizontally in the same way as the letters do in the ordinary cross-word puzzle. The first answer, 1 horizontal, is 3.11. We have named this new brain teaser "Cross-Number Puzzle."

**HORIZONTAL**

- 1—One quarter of the cube root of the present year; decimal after the first figure.
- 4—One hundred and thirty-eight poles plus ten feet.
- 7—The year the World War began.
- 10—Twenty-three sixty-fourths in decimals; decimal before the first figure.
- 12—The cube root of sixteen hundred and forty-three; decimal after the second figure.
- 14—The number of Troy ounces in six hundred and sixty-eight pounds.
- 15—Ninety-three less than the cube of thirteen.
- 16—The number of squares in a chess board.
- 18—The square root of .0064; decimal in front of the first figure.
- 19—The third musical note.
- 20—The number of days from June 20th to May 20th.
- 21—The number of degrees in a semi-circle.
- 23—Fifty-two sixty-fourths in decimals; decimal before the first figure.
- 24—Subtract eighteen from the square of tycenty-nine.
- 25—The abbreviation for the island upon which is a portion of New York City.
- 26—The beginning of the era of Abraham, B. C.
- 27—Add sixty to the number of cubic inches in 384 gallons.
- 29—Six hundred and fifty-four years ago.
- 30—Fifty-eight ten-thousandths more than the square of twenty-five hundredths; decimal before the first figure.
- 31—MDCCCLIII.
- 32—CCLXXXVI years ago.
- 33—The year of the destruction of Jerusalem, A. D.
- 34—The year of the fall of the Bastille.
- 35—The late President Harding was elected in this year.
- 36—The number of men in the "Charge of the Light Brigade."
- 37—The reputed age of Methusela; Genesis v-27.
- 38—Five less than ten milleniums.
- 39—CCII.
- 40—The number of Troy ounces in a pound.
- 42—The number of feet in ten miles, plus the number of feet in 2,812 yards.
- 44—Express two hundred and three meters in inches; then add four.
- 45—The number of pounds in the ton of coal the dealer doesn't sell to you.
- 46—Seven hundred and thirty-six years before Paul Revere's ride.
- 47—The year of Our Lord it will be ninety-five years from now.
- 48—The maiden of Greek mythology whom Hera turned into a heifer because her husband, Zeus, was too fond of her.

**VERTICAL**

- 1—The sum of money a man would earn by working 22 hours on a 40 hour per week schedule, at \$60 a week.
- 2—Eleven less than the square of the so-called unlucky number.
- 3—Two M's with a C between them; then multiply by ten.
- 4—The number of days from May 3 to February 3.
- 5—The square of V.
- 6—A roadway 2,000 feet long by 35.5525 feet wide contains how many square feet.
- 7—The number of days from the regular inaugural day of the presidents to September 4th.
- 8—The number of years it will take a dollar to be worth \$1.68 at 6 per cent. compound interest; decimal between the two figures.
- 9—Four IV's in a row.
- 11—Six times as old as President Coolidge was on July 4th, 1925.
- 13—The third letter in the alphabet, followed by a personal pronoun, first person singular.
- 15—The square of .45; decimal in front of the first figure.
- 16—Three hundred and ninety-six avoirdupois ounces.
- 17—1,872 ten thousandths part of an acre in feet.
- 19—Forty-five years after the Battle of Hastings.
- 20—The amount of money due a workman for 24 days labor at the rate of \$60 a week of 44 hours; decimal following the second figure.
- 22—Three cubic yards.
- 23—Two hundred and ninety-nine cubic yards.
- 24—The interest for eight days at 4 per cent., based on a year of 360 days in dollars; decimal before the first figure.
- 26—The square of forty-seven.
- 27—The number of cubic feet in three hundred and twenty cubic yards.
- 28—The square root of 1840; decimal in the middle.
- 29—Fourteen cords and ninety-seven feet more.
- 30—Four sixty-fourths expressed in decimals; decimal before the first figure.
- 31—One hundred and six and seventy-nine hundredths poles in feet.
- 32—Seventy years hence.
- 33—Add seven to the number of cubic feet in forty-seven cords.
- 34—The year the Lusitania was sunk.
- 35—The specific gravity of pure gold; decimal in the middle.
- 36—The par value of a Netherlands guilder in U. S. money; decimal before the first figure.
- 38—Set down four personal pronouns first person singular, followed each, by a saw-horse, all in a row.
- 39—A hundred pounds short of a long ton.
- 41—Par value in cents of a Roumanian leu.
- 42—The year Mohammed fled from Mecca.
- 43—The number of pounds in 50 Troy ounces.
- 44—Square IX and subtract XI.
- 45—The number of years it will take a dollar at 5 per cent. compound interest to amount to \$2.65.



## Pneumatic Auto Cushions

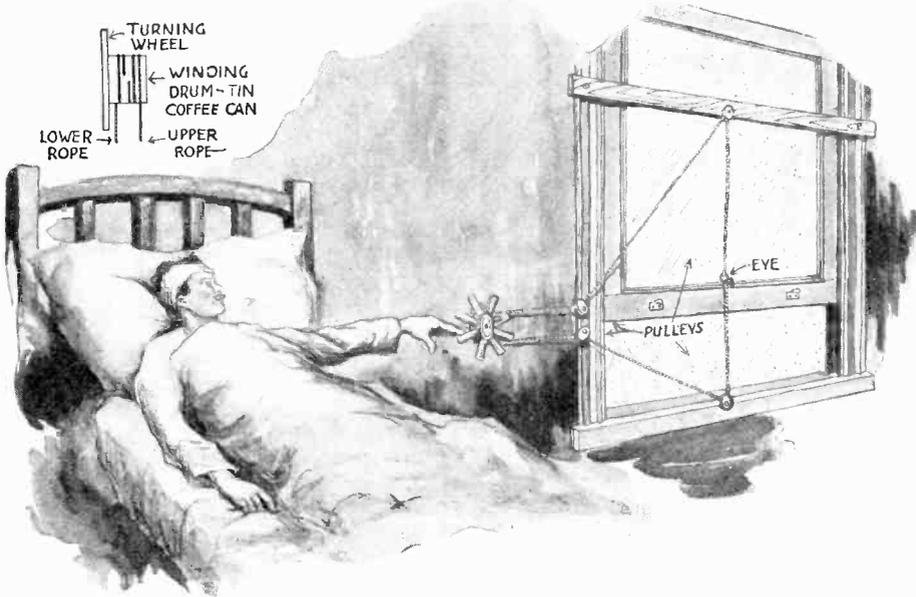
An English concern has recently adopted pneumatic cushions for use in their automobiles. The cushions, illustrated herewith are said to be most comfortable and can be obtained with various types of coverings. Made only of the best of materials, they will invariably outlast the car in which they are used.

- 15—The square of .45; decimal in front of the first figure.
- 16—Three hundred and ninety-six avoirdupois ounces.
- 17—1,872 ten thousandths part of an acre in feet.
- 19—Forty-five years after the Battle of Hastings.
- 20—The amount of money due a workman for 24 days labor at the rate of \$60 a week of 44 hours; decimal following the second figure.
- 22—Three cubic yards.
- 23—Two hundred and ninety-nine cubic yards.
- 24—The interest for eight days at 4 per cent., based on a year of 360 days in dollars; decimal before the first figure.
- 26—The square of forty-seven.
- 27—The number of cubic feet in three hundred and twenty cubic yards.
- 28—The square root of 1840; decimal in the middle.
- 29—Fourteen cords and ninety-seven feet more.
- 30—Four sixty-fourths expressed in decimals; decimal before the first figure.
- 31—One hundred and six and seventy-nine hundredths poles in feet.
- 32—Seventy years hence.
- 33—Add seven to the number of cubic feet in forty-seven cords.
- 34—The year the Lusitania was sunk.
- 35—The specific gravity of pure gold; decimal in the middle.
- 36—The par value of a Netherlands guilder in U. S. money; decimal before the first figure.
- 38—Set down four personal pronouns first person singular, followed each, by a saw-horse, all in a row.
- 39—A hundred pounds short of a long ton.
- 41—Par value in cents of a Roumanian leu.
- 42—The year Mohammed fled from Mecca.
- 43—The number of pounds in 50 Troy ounces.
- 44—Square IX and subtract XI.
- 45—The number of years it will take a dollar at 5 per cent. compound interest to amount to \$2.65.

(Continued on page 752)



# THE CONSTRUCTOR

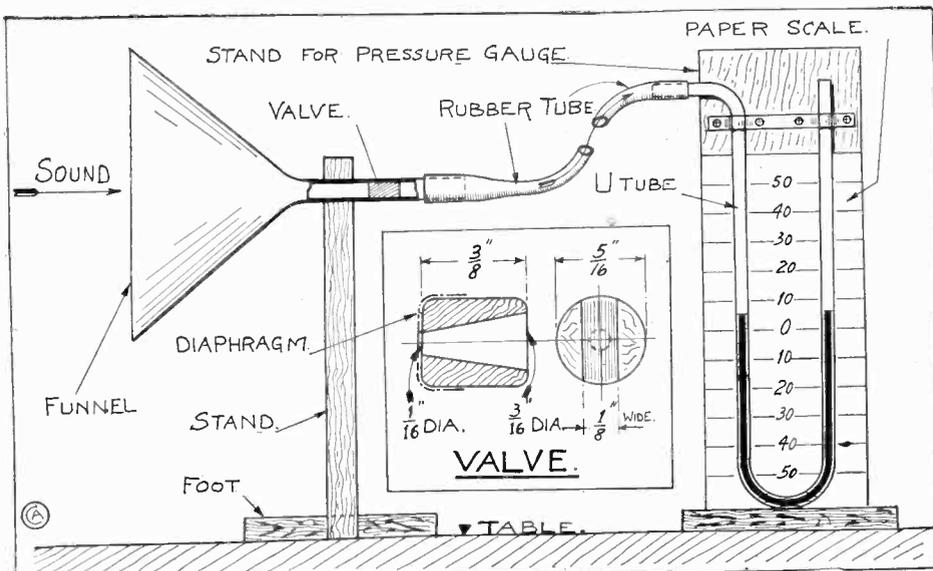
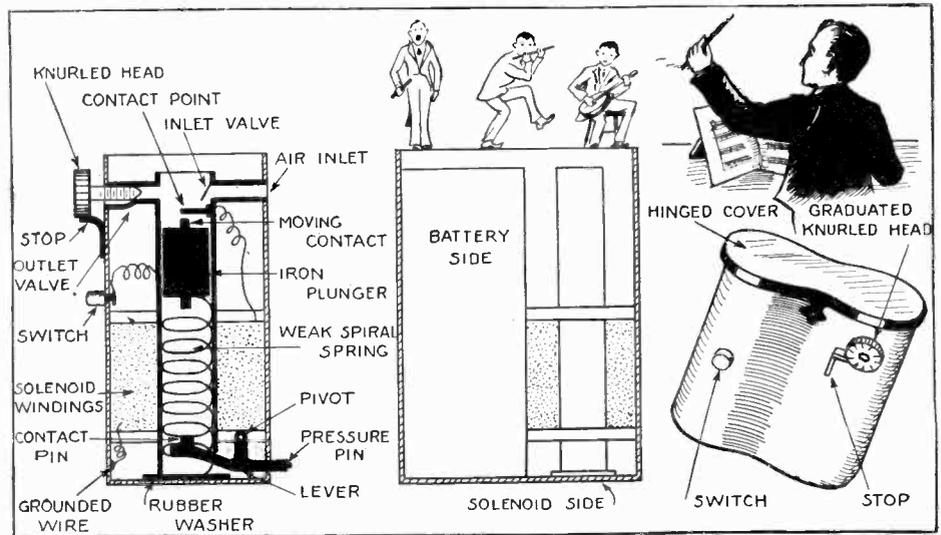


## Window Control

SO THAT the window can be easily opened and closed without the necessity of arising from bed, the installation illustrated at the left may be put into place. By turning the wheel, the window may be opened or closed. The installation is quite simple, only requiring a few pulleys, rope and other odds and ends that can be plainly seen at the left. The control wheel and its attached drum are fastened rigidly to the wall, yet not so tightly that they cannot be turned. The ends of the rope are wound around the drum as shown in the upper left-hand corner and the center of the rope is fastened to the lower sash. Turning the wheel will wind up one end of the rope and unwind the other. The rest of the rope will then, of course, run through the pulleys and will lift or lower the window sash, according to the direction in which the wheel is turned.—*Edward L. Salmon.*

## Pocket Metronome

AN INSTRUMENT which will aid the amateur orchestra conductor in preserving correct time can be made by following the diagram at the right. The device is carried in the waistcoat pocket and arranged so that the pressure pin will press against the leader's body periodically. The action of the device is obvious and the time between beats of the pressure pin is changed by turning the knurled knob which controls the size of the air outlet valve. When the plunger is going downward it has little air impedance, but on the upward stroke the inlet valve closes and the air in the chamber escapes only through the outlet valve.—*Dr. Russell G. Harris.*

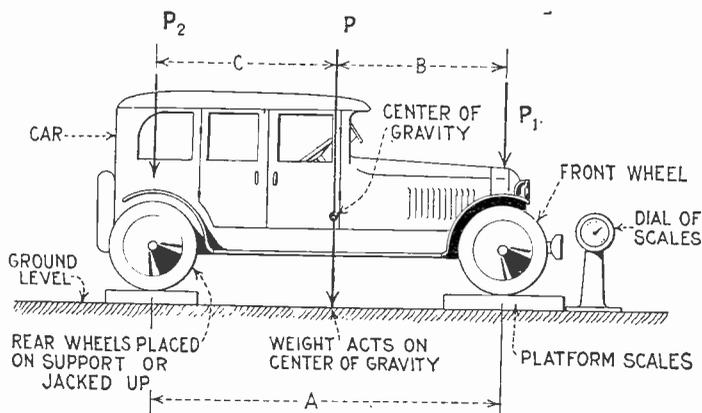


## Sound Gauge

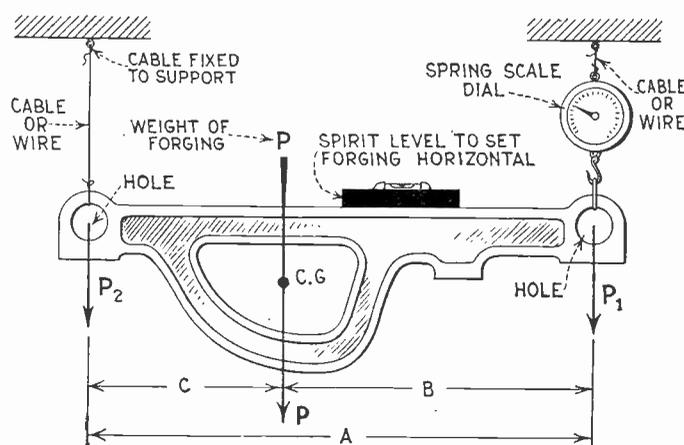
IN VARIOUS physical experiments, it is desirable to be able to measure in a comparative way the volume of sounds. With the simple arrangement of apparatus illustrated at the left, this becomes practicable. A funnel is used to collect the sound waves so as to make the instrument more sensitive, whereupon the waves strike upon the diaphragm in the valve and cause variations of the column of colored liquid in the U-tube. The valve consists of a plug of wood having a small tapered hole drilled in it of the size and shape shown. A thin rubber diaphragm is stretched across the small opening and fastened in place. The paper scale back of the U-tube is calibrated by a comparison method, or in any other way that the experimenter may desire to employ.—*C. A. Oldroyd, Reporter No. 4433.*

# Finding the Center of Gravity by Experiment

By C. A. OLDROYD, Reporter No. 4433.



The finding of the center of gravity of an automobile may seem to be a hard problem, but if approached properly it is easily solved.



Above: Finding center of gravity of an irregular forging.

**F**REQUENTLY, the center of gravity of a car, forging or other item is to be found. To do so by calculation requires a great deal of time and effort, as every single component of the subject must be weighed first, or worse still, its weight must be worked out from the drawings, if no additional parts, as in the case of a car, are available.

At best, such results are not very accurate, as calculated weights differ more or less from the actual finished weights.

There is, however, a simple way of avoiding tiresome calculations and waste of time, namely finding the position of the center of gravity by experiment. This method presupposes of course that a finished car, forging, etc., is available.

Fig 1 shows the method applied to a forging. The shape shown is a complicated one, and would need many hours' calculation. We select the shorter way and determine the position of the center of gravity experimentally.

Through the two holes at the ends of the forging, cables or wires are passed, and from them the forging is suspended. On the left, we have a clear run of wire to the roof structure or other support, on the right, how-

ever, a spring balance is connected to the two short wire ends, so that it indicates the tension in the wire.

The forging is now adjusted, by means of a spirit level, so that its plane surface is horizontal. The forces acting in the system are shown in the drawing, the total weight of the forging is "P," this is either already known or can be found by weighing it.

The tension in the right wire is "P<sub>1</sub>," in the left one "P<sub>2</sub>." The as yet unknown center of gravity is at the distance "B" from the right wire, and "C" from the left one. The distance between the two points of support (here holes), is "A."

The law of leverage tells us that: P<sub>1</sub> × A equals P × C, if P<sub>1</sub> is read off the dial of the spring balance. C can be found; it is:

$$C = \frac{P_1 \times A}{P}$$

"B" is now also known, for it is: A - C.

This simple calculation gives us the actual position of the center of gravity in far less time than any other method. It can be used in nearly every case, as an indication of the flexibility of the method, a second case is shown in Fig. 2; namely, finding the center of gravity of a car.

For the theoretical man, this is "some" problem, particularly if the position of the C.G. is to be found under different conditions, as for instance, with passengers in the car, or arranged in various ways.

Experimentally, the problem is as simple as the first.

We wheel the front wheels of the car on a platform scale, and jack up the back wheels, or else place them on a few pieces of timber. With a spirit level we set the frame horizontal, measure the distance "A" (from center of axle, rear to front) and read off the dial of the scale the front load "P<sub>1</sub>." The calculation is then as given above.

The application of this method is so wide that it will be unnecessary to give further examples, it may only be mentioned that it is very handy for finding the center of gravity of rowing or motor boats; in the latter case the influence of shifting the position of the engine can be easily studied. A well-known airship engineer has adopted this method for finding the center of gravity of airship power cars, containing the gears, engines, etc. The accuracy of the experimental method over theoretical means was most pronounced.

## The Specific Gravity of Solid Bodies

**T**HE specific gravity of a body is stated as the weight of a cubic centimeter in grams. Thus if 15 cubic centimeters of a body weighs 30 grams, its specific gravity is 2. If we weigh a stone on a letter scales and find, for instance, that it has a weight of 120.8 grams, all we need to know is the volume occupied by this stone in order to estimate its density or specific gravity. For this purpose we can use what the chemist calls a measuring cylinder, or a cylindrical glass vessel graduated on the side in cubic centimeters. Such vessels are used not only by chemists but by photographers, and one is shown in Fig. 1. We fill the vessel to a

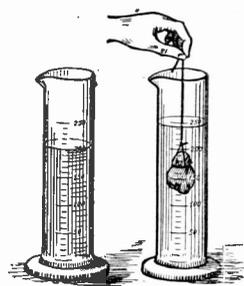
definite height, for instance, 200 centimeters. We fasten our stone to a very thin thread, or it may even be a long hair, and note how much the water rises when the stone is immersed in it, also shown in Fig. 1. Suppose the water rises to the mark indicated, 241.4 cubic centimeters, then the stone has a volume of 41.4 cubic centimeters. The specific gravity is 120.8 divided by 41.4, which equals 2.9. That is to say, a cubic centimeter of the stone weighs 2.9 grams.

If the substance to be examined is soluble in water, such as a crystal of alum or Rochelle salts, or anything of that sort, oil is used in the cylinder.

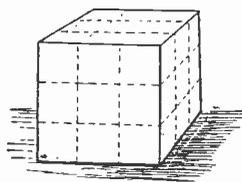
If we have pulverized or dust-like materials to work with, difficulties appear. The best thing to do then is to take a container

of known contents, say of 1,000 cubic centimeters, whose weight is known, and it will be easy enough to weigh it. The container is then filled with the dust or powder whose specific gravity is to be determined. It may be pulverized coal. The container is filled exactly even with the top and a second weighing gives the weight of its contents by subtracting the weight of the vessel from the last weight. Now if the weight of the coal dust, of course without including the weight of the container, is 2,100 grams, we know that the same volume of water weighs 1,000 grams, and the density or specific gravity of the coal is 2.1. But it will be found that pulverized material may have different densities according to how hard it is pressed down, when one is evening it off with the top of the vessel.

(Continued on page 765)



The specific gravity of bodies that are heavier than water can be determined by actual measurement of their volume if the method is followed; the method is explained in the text.

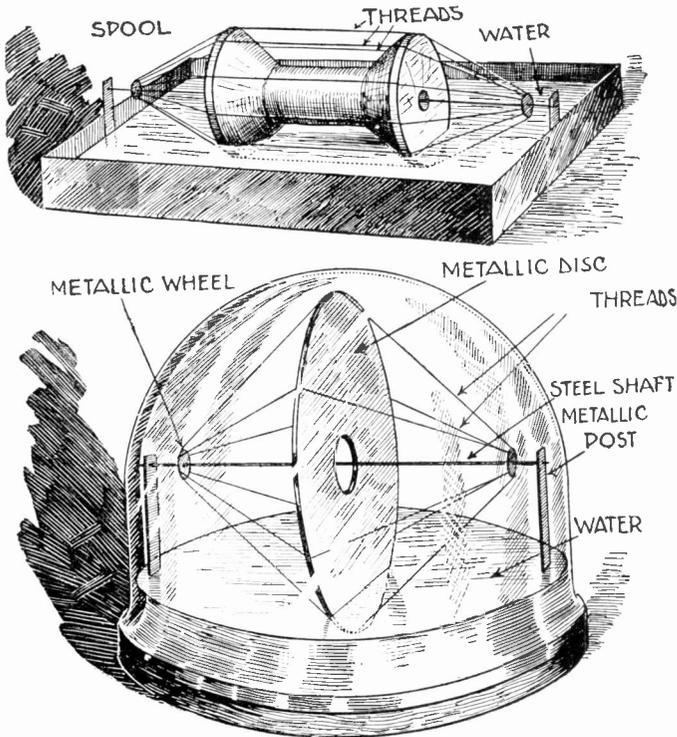


When the specific gravity of objects that are lighter than water is to be obtained, it can be done by direct measurement and weighing.



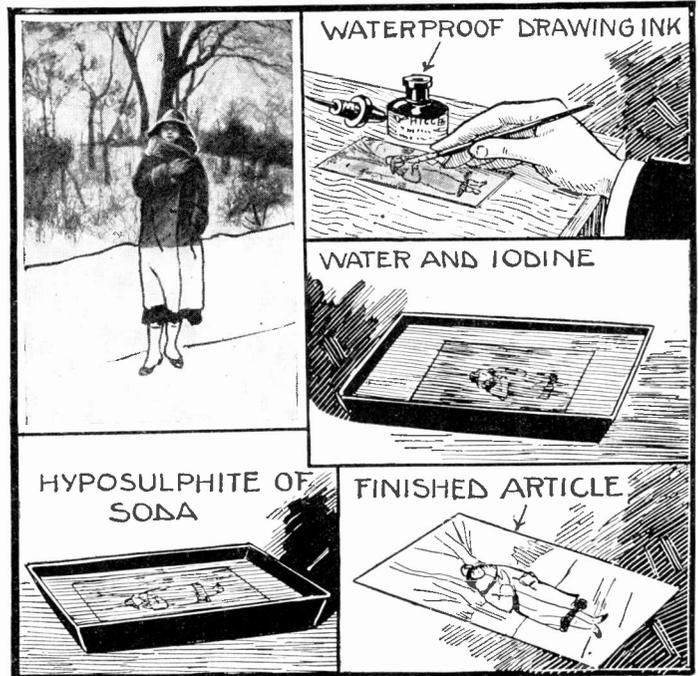
Obtaining the exact diameter of wire is often done by measurement as shown directly above.

## Hygroscopic Motor



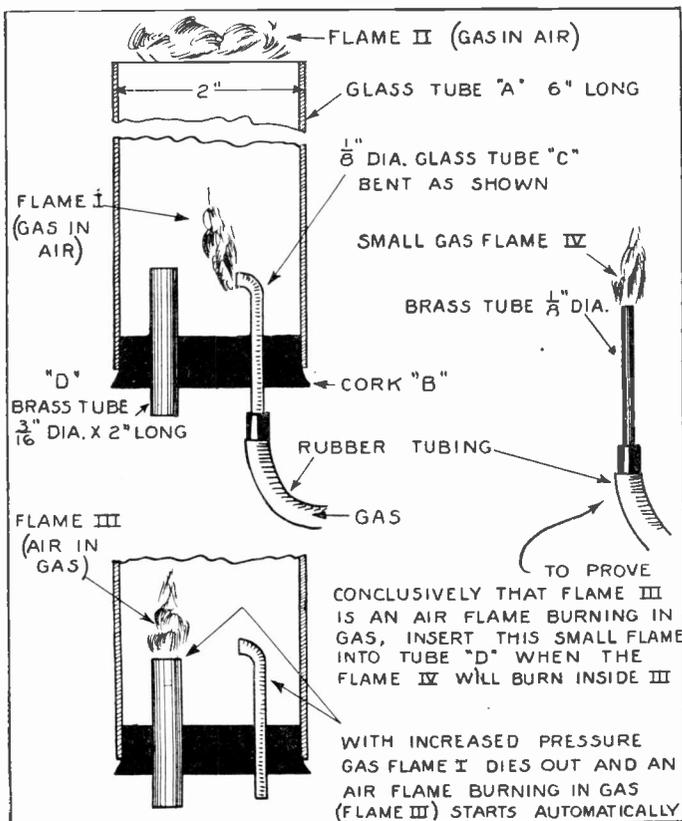
An interesting motor that will revolve without any visible external source of power is illustrated above. Two different types are shown. The uppermost can be quickly and easily made from a spool, several lengths of thread and a suitable wire axle. Assembled as shown, the wheel will turn about one revolution every 8 minutes. A more elaborate model may be made as shown in the lower part of the above illustration. —Emile Dion.

## Shadow Pictures



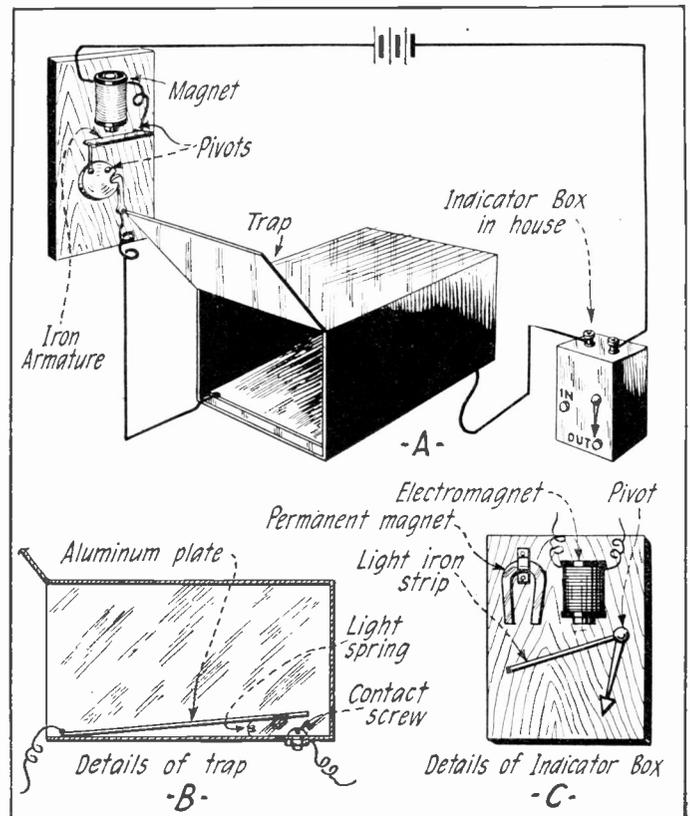
To produce shadow pictures, paint the shadows on a regular photograph heavily with ordinary water-proof drawing ink. A picture half prepared is shown in the upper left-hand corner. Then soak this prepared picture in a bath of water and iodine of a blood color until the back of the picture starts to become slate blue in color. Wash the print and soak in a strong solution of sodium hyposulphite (hypo). Dry the prints either in the ordinary manner or squeegee them on a standard sheet of ferrotype metal. A pleasing shadow picture such as illustrated will result. —M. C. Everett.

## An Air Flame



We know that a gas flame burns in air but will an air flame also burn in gas? This experiment answers the question. The apparatus necessary is shown. Connect the glass tube to the gas supply. Open the gas valve slightly and light. As long as the flame is small it will burn, but if turned on full, the flame will die out. At the same moment an air flame will form automatically on tube D and we can light another gas flame II at the top of the large glass tube. —C. A. Oldroyd.

## Pigeon Trap



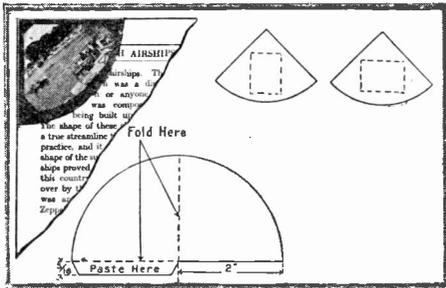
A pigeon trap that will not only catch and hold the bird but will also announce that a capture has been made is illustrated above. A bird entering the trap closes the contacts which sends the current through the indicator box and through the electro-magnet release. The door, which is heavy enough to hold itself closed, then falls and at the same time the indicator, detailed at C, shows that the trap has been sprung. Upon resetting the trap, reset the indicator by hand. —John Kautzner.



# HOW TO MAKE IT



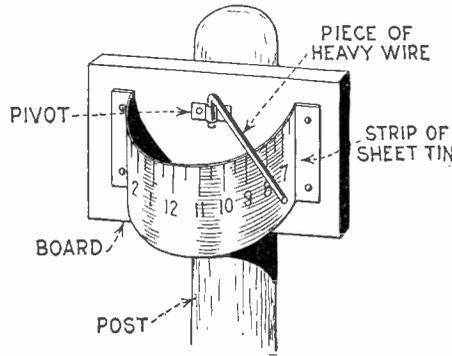
## Book Marker



A novel book marker may be made by cutting a semi-circle with a small tab attached from heavy paper or thin cardboard. The exact shape and dimensions are shown above. The semi-circle is folded over and the tab pasted to its adjacent edge. The book mark is used as shown and can be decorated by pasting a photograph on it or by making a sketch in pen and ink.

—T. B. Marsden, Jr.

## Sun Clock



The details of a unique sun clock are shown above. To read the time, the wire arm is swung until its shadow assumes a vertical position. The correct time is indicated by the shadow as at only one point on the dial will the shadow be vertical at a given time. The figures are inscribed on the dial by setting the sun clock each hour by a watch. In this way the clock is made quite accurate.

—Francis O. Boyd.

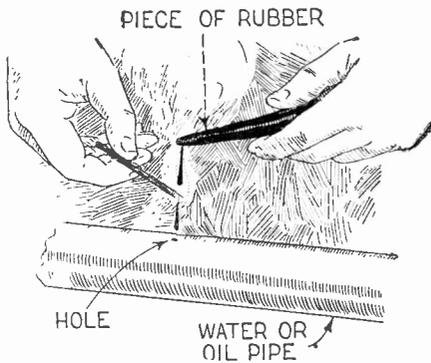
## Boxing Gloves



A pair of cheap boxing gloves can be made from a pair of cotton working gloves and an old pair of socks cut short and with holes cut for the thumb of the wearer. The space between the glove and the sock is filled with rags or cotton. A rubber band is placed around the wrist over the glove and another one in about the same position, but over the sock. These retain the finished boxing gloves on the hands.

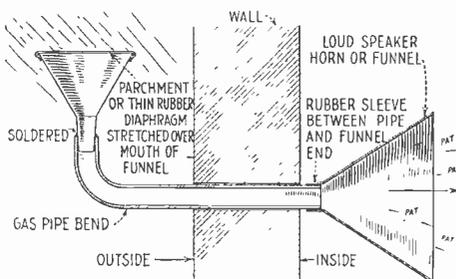
—Walter Schwartzmiller.

## Pipe Repair



A small hole in a water or oil pipe of an automobile can be temporarily mended by melting a piece of rubber over it and allowing the drops to fall over the hole. Make a permanent repair as soon as possible as the rubber will not last.

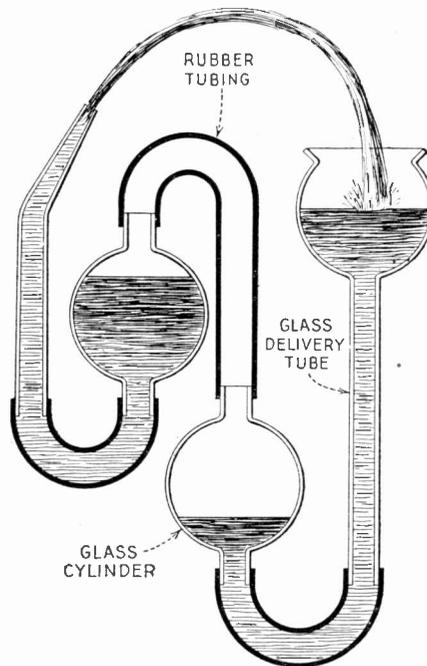
## Rain Alarm



A rain alarm that requires no batteries or moving parts is detailed above. Two funnels, a diaphragm and a bent gas pipe are all that are required. The rain falling on the diaphragm produces sounds that are plainly audible at quite a distance from the reproducing funnel. The rubber sleeve facilitates removal.

—C. O. Oldroyd, Rep. No. 4433.

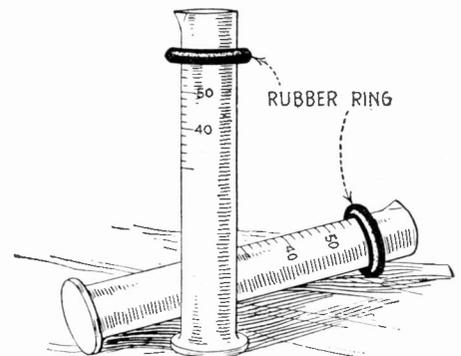
## Hero's Fountain



A simple model of that most interesting demonstration apparatus known as Hero's Fountain may be made as shown above. A glass delivery tube, 3 pieces of rubber tubing, 2 glass bulbs and a nozzle are all the apparatus required. Assemble them as shown, placing the parts at the various relative heights indicated. Pour water into the delivery tube until the entire system is full. The water will then flow from the nozzle and if the latter is properly directed, will fall into the delivery tube as shown. The length of flow depends upon the constriction at the nozzle. Some of these fountains have been known to flow for 12 hours without stopping.

—A. A. Blumenfeld.

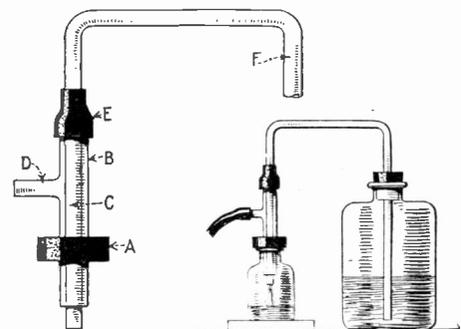
## Graduate Protector



If a rubber ring such as used on suction flasks is placed around a graduate as shown above, it will prevent breakage. If the graduate falls on its side, the rubber ring absorbs the shock.

—A. Eidman.

## Bottle Filler



When handling liquids having disagreeable fumes, the above device is useful. Attach D to a suction pump. A partial vacuum is created in the bottle being filled and the liquid from the large bottle passes into the small one through the long bent tube.

—Author please send address.

**TELEPATHY**

**Editor, SCIENCE AND INVENTION:**

I read your excellent magazine, SCIENCE AND INVENTION, with a great deal of pleasure, and also note your offer "to pay \$1,000.00 to anyone who will prove telepathy." The following may be a proof, at least it would seem so to me.

About three years ago, on a Sunday, while residing here in San Jose, California, and during the month of September, I was just getting ready to leave my home and go out to my office, located on the same plot of ground as my home. I usually spend most of my time at the office. My wife then made the following statement to me: "Can't you stay in the house? Why do you always go to the office? I never see you. Take your typewriter and bring it here and do your work here." Accordingly, I went out and got my typewriter and brought it back from the office to my home.

At about 4 o'clock, while busy forming a business letter, I suddenly stopped writing. Everything was quiet about me. Sitting at the table with me were my wife and a 16-year-old daughter. I looked up in a southwest direction and saw my oldest daughter, seemingly 70 to 75 miles away, near a town called Salinas. She was riding in a two-passenger cut-down Ford. In front of her was another machine occupied by a young couple I knew, but I had no idea that my daughter was accompanying the other couple. Ahead of the first machine was a five-passenger Ford slowing down and getting ready to make a sharp turn. I then saw in my vision the car containing my daughter and the car ahead collide with the machine making the turn. In a trice they were piled up on the road. In the vision, I saw my son-in-law start for the small town of Salinas to get help, and with this view the image faded.

Now, sir, remember I didn't know that my daughter was going to motor toward Salinas. I didn't know that she was to accompany another couple. At 10 P. M. that evening my daughter came home. She went directly to her mother and told her the story. She had just gotten into the tale when I interrupted her, saying that it took place near Salinas at 4 o'clock. Abruptly she turned to me and asked me how I knew. At the same time the young man, now my son-in-law, contradicted me and stated that the event took place at 5 o'clock. I then related the vision to him.

Monday night, while gathered around the table, the young man contradicted his previous statement and told me that the event actually took place the way I described it. I then tried to explain, and this was my theory:

Radio activity and electricity have always existed. Extreme intelligence is the origin of radio as well as electricity. That part of mind acting through my daughter's mind when the so-called accident took place while she was away from home, saw through her eyes the occurrence. This was flashed through space unconscious to her and I caught it with my mechanism, the wonderful brain which was actuated by the radio activity. This theory is not new. Those in the East possess that faculty of transmitting thought waves, whereas those in the New World have seemingly lost it, or are insensitive to the vibrations.

This is my own explanation of the so-called mystery, in the olden days called telepathy, now called radio activity. But here is a little further explanation. In order to see it, the animal matter in which I am dressed and was dressed when the accident took place, is only the flesh. But that is not me, the ego, self-personality, or whatever you may care to call it. The ego only used the material body in playing his role in the drama of life. Distance is nothing. I can't produce this state of telepathy at will, but it has taught me that, under proper conditions, such a thing can and does take place.

I will be glad to have your objections and a check for \$1,000.00.

C. J. CHRISTIANSON,  
Formerly Pastor Swedish Baptist Church,  
San Jose, Calif.

(The conditions of our contest call for the production of telepathy under test conditions. Mere statements of telepathy having taken place cannot be entered into the contest. If you are, therefore, prepared to produce telepathy under test conditions, and simple effects only would be asked, we would be glad to have you enter our contest. Needless to say, in spite of the many individuals calling themselves mind readers, not a one has appeared to make such a simple test as for instance, reading a five-letter sentence which somebody else may care to write on a slip of paper, seal and place in his pocket while a thin partition separates the telepathist and the writer.)

The theory which you have evolved is hardly plausible. Radio activity, as we know the term, is a recognized fact. Telepathy is not.—EDITOR.)

**A PREDICTION**

**Editor, SCIENCE AND INVENTION:**

Here comes an old reader of SCIENCE AND INVENTION as well as Practical Electrician now called The Experimenter, who would call your attention to the fact that there are some folks who know and are able to predict events, referring



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

to pages 905 and 940 of SCIENCE AND INVENTION, January issue, current year.

I predict that there will be war in Europe before the trees have put on their green garments, which means before the middle of the month of May. This war will be a general European war. This war will establish peace and tranquility in Europe.

(A subsequent letter reads as follows:)

In response to SCIENCE AND INVENTION, I make the following further predictions in regard to this coming war.

First, that the Russians and the Germans will wear the same color and style of uniform when the war is in full swing. Second, this coming

**Station**  
**WRNY**  
**NEW YORK**  
**258.5 Meters - 1160 kilocycles**  
*is owned and operated by the publishers of this magazine*  
*Our Editors will talk to you several times every week—*  
*See your Newspaper for details*  
**TUNE IN ON WRNY**

war will be the means of ending Bolshevism, and Russia will again be imperial, even before the war is over. Third, this coming war will bring about the end of the British Empire. It has been thus decreed by Him who still rules Heaven and Earth. All help and assistance will prove futile.

CHARLES M. MAHR,  
Bluffton, Ind.

(SCIENCE AND INVENTION Magazine is offering a prize of \$1,000, which is part of the \$11,000 Psychological Prize Contest, to anyone who can accurately predict events of such a nature that they would have no control over the same. The writer of the letter above has made a prediction, and like all predictions of this nature, it is far from accurate. June 1st has arrived and passed. There is no general European war.)

Now it would have been a simple matter for anyone to make a prediction of this nature, considering the fact that Von Hindenburg took the office of presidency over the German Republic. Von Hindenburg is disliked by German socialistic factions. On this basis, one could predict a war in Germany with the chances about even that such a civil strife would occur, provided of course that the individual making the prediction would not know much about the internal affairs of the German Republic. We do not believe that such a war will occur. We sincerely hope and trust that such a condition will not arise in Germany now, as they are making rapid strides for better social conditions, and rapidly coming forth into the commercial field again.—EDITOR.)

**DO THE BLIND DREAM?**

**Editor, SCIENCE AND INVENTION:**

I would like to have you answer this question in your Readers Forum department. Can a person born blind visualize images of things in his sleep?

HAROLD MATTHEWS,  
Martinsburg, Mo.

(Yes, a blind person visualizes images in his sleep. If the person has not been born blind, he often visualizes images and objects which seem to him to be concrete, and which seem identical with those objects he had known and seen during the days when his eyesight was not impaired. Even those blind persons afflicted since birth often visualize things in their sleep and dream about objects which seem to them real, and which they seem to actually see. These objects are not always correct in detail with those which the seeing person knows. If we permit a blind person to feel an object, and then describe it, his description may be erroneous, because he was unable to associate in his mind its shape unless that shape were simple. He is likely to dream of that object as he thinks it appeared to him.)

Some blind people, when they dream, only seemingly make use of those senses during their dreams over which they have control, and they may dream of feeling an object, smelling it or tasting it, but rarely visualize that object.—EDITOR.)

**DOESN'T LIKE OUR FICTION!**

**Editor, SCIENCE AND INVENTION:**

I have read your magazine since the August, 1923, issue, containing "The Man From the Atom," "Around the Universe," and other very interesting stories and articles, but it has become less interesting—to me, anyway.

Why can't you give science more room in your pages? There are plenty of magazines in existence that tell how to make butterfly nets out of broken knives, but it is hard to find one that tells much of science. I beg you to consider whether or not you give too much room to mechanics.

Also, your scientific stories have become less scientific than those I mentioned; I think that you will admit that that is true of such stories as "The Man From the Meteor." Why can't your stories be scientifically probable, rather than merely—and barely—possible?

But I am now in a hurry, and my typewriting ability is obviously poor, and I am excited, as I always am when I think of such stories as that of the gentleman on the meteor. Won't you consider what I have said, and, oh, yes, won't you tell the author of "The Living Death" that to make a description horrid he must use subtler means than stating the thing described is horrible? And that such words as "tis" are unusual and, consequently, they intrude upon the idea presented. "The Infinite Vision" was a fine story.

CHESTER GRIFFIN,  
Galveston, Texas.

(We should, of course, comment on this letter, but we will reserve that right and let our readers answer Mr. Griffin.—EDITOR.)

**ELECTRICITY IN PLANT GROWTH**

**Editor, SCIENCE AND INVENTION:**

I have been a reader of your magazine ever since it was first published, and have missed very few issues. It is needless to say that I am pleased with it. The thing I like most about it is that it deals with almost everything. There is one thing that it does not deal with, and that is scientific raising of flowers or vegetables. Things that a man could use in his back yard. I don't refer to ordinary knowledge of agriculture, but scientific knowledge of habits of plants.

Some readers might suggest that one interested in plants might buy magazines on the subject, but such magazines contain very little that is of value. Then, again, many readers of SCIENCE AND INVENTION, and similar magazines, do not read any other publication.

But most readers have a little back-yard garden. I have been experimenting this year with forcing dahlia growth by high frequency currents collected by radio antennae. The experiment is not completed, but others may be interested in it. Real professional plant growing is practically scientific.

I would like to hear through the Readers' Forum what others think of the suggestion.

L. RINGER,  
Cincinnati, Ohio.

(When any radical advance in horticulture is made, we always report about it. We have published articles on the construction of apparatus for stimulating plant growth by high frequency currents artificially produced, and also illustrated the method outlined by you, which is now a rather old system. We will continue to advise of the more important developments in this field.—EDITOR.)

**APPROVAL**

**Editor, SCIENCE AND INVENTION:**

Just a word or two to show my appreciation of the articles in two of your magazines, SCIENCE AND INVENTION and THE EXPERIMENTER. I have been getting the same for three years, although I am only 14 years of age. I have always been interested in science, but chemistry is my favorite. One of the many merits of your magazines are the excellent chemical articles, and I hope they will always be as good as at present.

JAMES H. BLACK,  
Johnstown, Pa.

(We thank you very much for your kind compliments and are glad that you like the magazines. We trust we shall always please you.—EDITOR.)



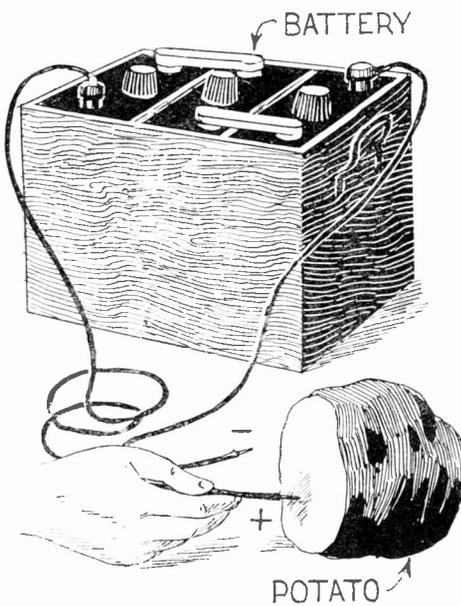
# WRINKLES

## RECIPES & FORMULAS



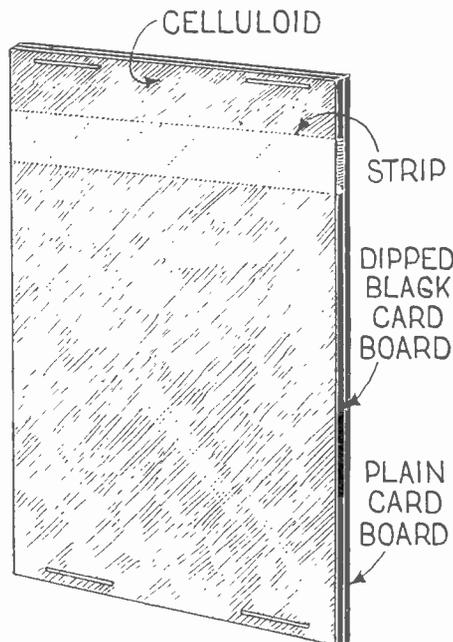
Edited by S. Gernsback

### Pole Indicator



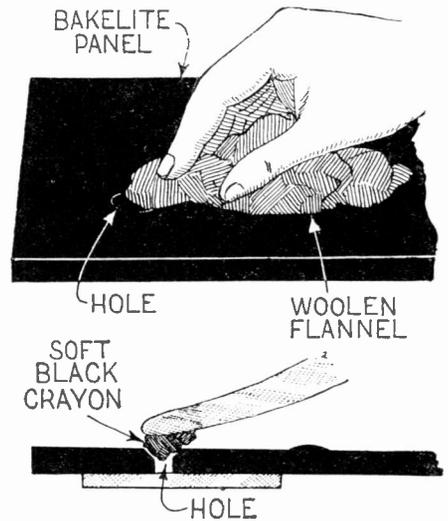
Often when a storage battery is to be used in some circuit, where polarity is an important factor in the final results, a satisfactory type of polarity indicator is not at hand and the marks on the battery are so indistinct as to be undecipherable. In such an event, cut a potato in half as above and thrust two wires that are connected to the battery into the potato. The positive wire will turn the potato green.—F. J. Wilhelm.

### Memo Pad



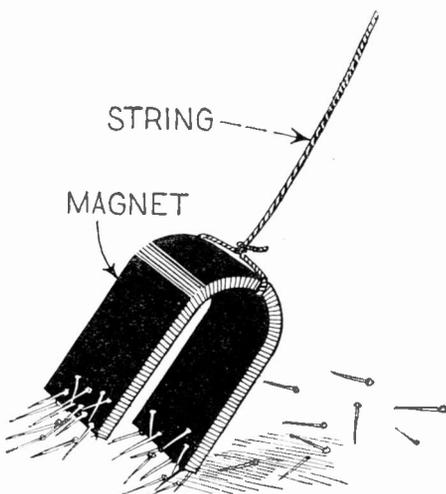
To make an everlasting memo pad, bind a strip of celluloid, a strip of prepared cardboard and one of plain cardboard together as above. Place an endless strip of paper around the prepared card so that it can be moved up and down. The prepared card is black cardboard dipped in paraffin. Writing on celluloid with pencil is erased by pulling the endless strip across the surface of the prepared strip.—Leo Preston.

### Panel Repair



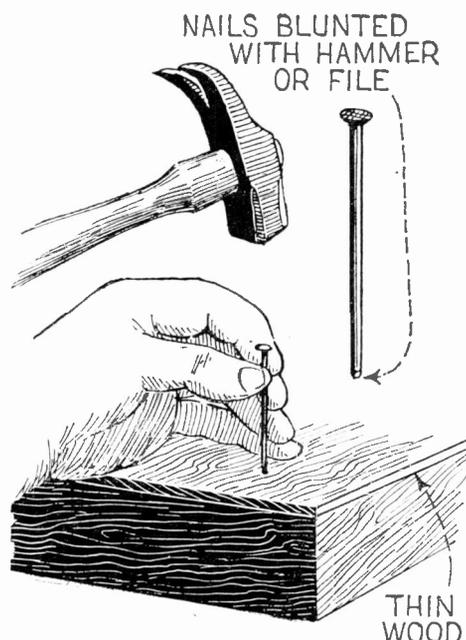
Often it is desired to use an old panel on a new set or for some other purpose but the holes drilled in the surface mar the appearance. These, however, can be easily filled up by pressing a small quantity of soft black crayon into the hole and then rubbing off the surface with a piece of woolen flannel as shown. When plugging the hole, a strip of glass should be placed under it so as to prevent the crayon from working out. In this way a smooth surface can be restored to a panel with little trouble and practically at no expense. Use mixed black and yellow wax for mahogany colored panels.—Wilton F. Swatch.

### Magnetic Broom



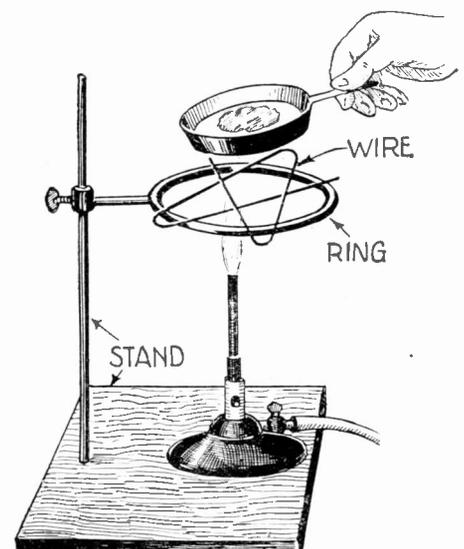
When a quantity of nails or other small iron or steel objects are spilled on the floor, they can easily be picked up by means of a magnet suspended on a string as shown above. The magnet is drawn across the floor several times and when picked up will be found to bring all of the magnetic objects with it. In this way, a job that was formerly tedious can be performed with little effort and in a small fraction of the former time.—E. L. Dunbar.

### Nailing Thin Wood



To avoid splitting thin wood, hammer or file the ends of the nails to a wedge shape and drive the nails so that the wedge-shaped point crosses the fibers. Much splitting of thin wood will thus be eliminated.—Max Ruschmann.

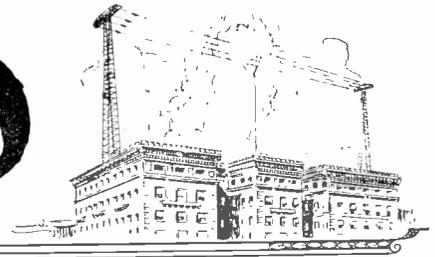
### Ring Stand



In the chemical laboratory, often large ring stands only are available. To support small evaporating dishes or other apparatus on them, bend a piece of wire into the shape shown above and support the receptacle thereon. In some cases, two large wire hairpins can be laid across the ring, with the same results. This kink is one worth bearing in mind as it will often come in handy.—Jesse Walters.

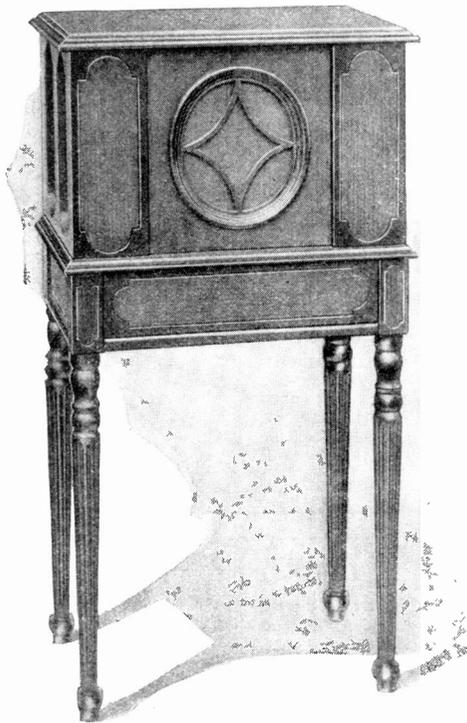


# RADIO



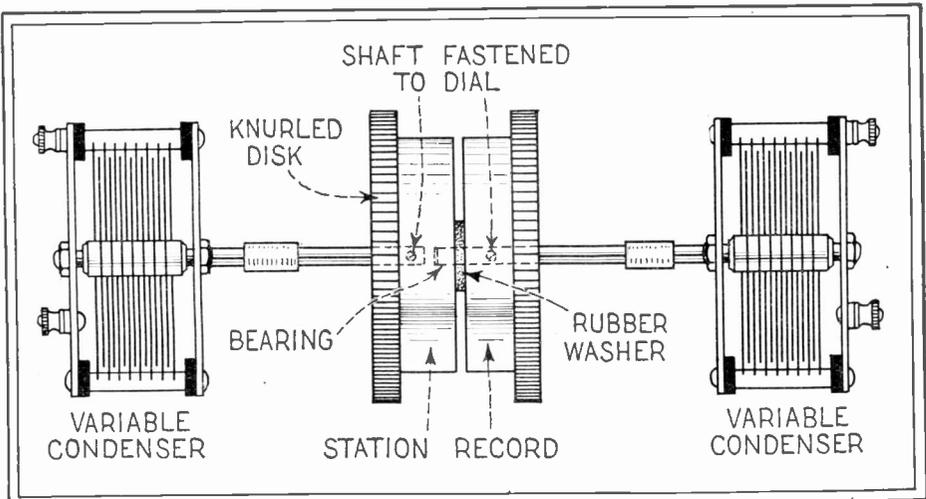
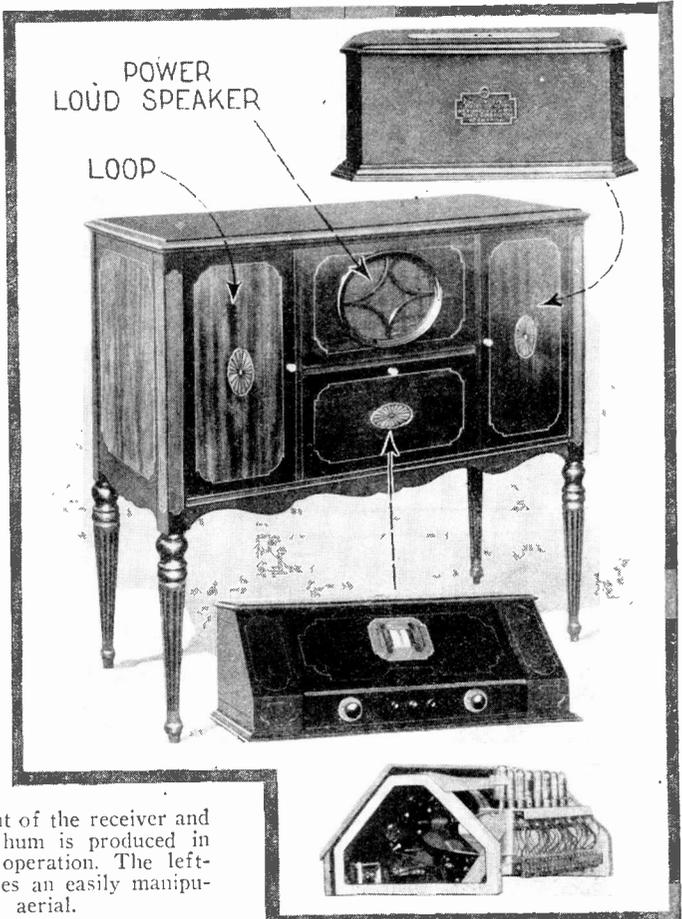
## New Power Speaker and Super-Heterodyne on A. C.

By L. PORT



This new power speaker that is operated on alternating current is manufactured with a small table as above for use with any radio set and also is incorporated in various other large elaborate models of complete receivers. The above view shows the speaker ready for use. A specially designed amplifying unit enables this speaker to reproduce great volume with absolute fidelity.

THE photographs at the right illustrate a new type of Super-Heterodyne receiver that is absolutely self-contained. It requires no battery for its operation and all that is necessary to do is to plug in on the 110 volt A.C. lighting circuit and manipulate the set. The receiving set proper is mounted in back of a folding door which can be let down, exposing the controls and at the same time furnishing a writing desk. The type of 8-tube Super-Heterodyne receiver used in this impressive piece of furniture is shown directly below the cabinet. Front and rear views of the set are shown. The unit that furnishes both "A," "B" and "C" supplies is shown in the upper righthand corner. Using a tube rectifier, it furnishes a remarkably smooth current for all purposes. This unit is placed in a compartment to the right of the receiver and is so shielded that no hum is produced in the set when it is in operation. The left-hand compartment houses an easily manipulated loop aerial.



Here is a suggestion to the radio constructor that will enable him to make up a tuning unit similar to that used in this new Super-Heterodyne receiver. Variations of this method will suggest themselves. The condensers are mounted with the plates at right angles to the panel and the shafts are connected to the two dials protruding through the panel.

IN the 8-tube set shown above, an exceedingly simple method of control is employed. Two knurled disks, to which station log disks are fastened, protrude through the cabinet and are so constructed that when one is turned, the other will follow it. However, by holding one dial with the fingers of one hand so that it cannot turn, and moving the other one with a light pressure, fine tuning can be obtained and slight discrepancies in the tuning of the set, that will not allow one-dial control, can be corrected. This system can be obtained by the method shown at the left. The rubber washer allows the two dials to turn together but also allows one of them to be stopped.

This instrument possesses unusual operating features, as well as quality and volume. This instrument evoked prolonged applause when exhibited in operation at a recent dinner given in New York City to radio editors and engineers. It has a trans-continental range under good operating conditions. The tremendous volume obtained with the new loud speaker corresponds to that of a small orchestra.—Photos Courtesy Radio Corporation of America.

# WRNY Plan Expands

By Charles D. Isaacson, Program Director

**A**S I write this, we are on the eve of our WRNY Artists' Supper. Let me explain what that means. We will meet in the Grand Ballroom of the Hotel Roosevelt, which is our headquarters. It will be the first time that all the artists who give the programs at our

station will be together. It will be, I think, one of the most motley crowds ever assembled. There will be ministers, priests, rabbis, chefs, food experts, dieticians, grand opera singers, light opera singers, actors, actresses, violinists, pianists, dancers, physical culture experts, jazz players, ukulele players, American Indian princesses, cornetists, pipe organists, architects, sculptors, painters, poets, novelists, authors, philosophers, radio authorities, editors, children's fairy tale authors, aviators, automobile manufacturers, finance experts, lawyers, designers, photographers, doctors and labor experts.

This general "get-together" will be as dramatic an explanation of the WRNY plan as anything we can say, and so we are going to take flashlights that night for you to see, and broadcast the merriment for you to hear. We will have a roll call, the like of which has never been presented on stage or screen, for everyone, in response to his name, will have something to say or do by way of entertainment.

We have just finished counting the list of people who belong to the WRNY Company; there are over 700, but only the principals will be present at the dinner. By this, I mean that we shall have the heads of the departments, the soloists and the chief speakers only. Members of the chorus and musicians in the orchestras and bands will not be on hand, but will be represented by their chiefs and directors.

### THE RADIO THEATRE PLAYERS

Since last month, much has happened. One of these is the organization of the "Radio Theatre Players," an organization of professional actors and actresses under the direction of Mr. Alfred Rigali. Each member of the cast has been leading lady or leading man in some production or stock company, or touring dramatic company. The cast is as follows: Madaline Hunt, Maisie Cecil Klark, Ruthelma Stevens, Edna Marshall, George V. Dill, Gladys Pabst, Santos Ortega, Herbert MacDonald, Alfred L. Rigali, Harry Mervis. There is also a second dramatic stock company which has organized, and next month we will tell you more about that.

By the way, practically all big events at WRNY work in duplicate, since it is easier to have two companies to do one performance than for one company to do two performances. Thus, you will find that Clementi de Macchi alternates with the Remo Taverna Opera Company. The cast of the de Macchi Opera Company includes Cornelia Zuccari, Edna Estwald, Sophie Reznick,

Dorothy Edward, John Fobert, John Argentino and Mae Gertwin.

The Taverna Opera Company is composed of Hortense Dorvalle, Adelaide Vilma, Teresa Demarchis, Vincent Carelli, Giovanni Lombardo, Luigi Dalle Molle, Louise Vermont. Then we have also other grand



**Harriet A. Seymour**, founder of the Seymour School of Musical Re-education and a well-known musical author.



**I. Lonka**, ballet mistress, from whom many interesting talks may be expected.



**Bernece Kazou-noff**, who will give piano recitals of interest to all music lovers.



**Florence Geringer**, jazz piano queen who will be heard from WRNY every other Monday evening.



**Merryle Stanley Rukeyser**, an authority on finance, speaks at WRNY every other Wednesday.



**Matthew Woll**, Vice-President of the American Federation of Labor, talks once each month on Labor—Capital.



**Chef Roger Cretaux**, of the Roosevelt, who gives "Eating Chats" every Thursday evening.



**Harvey Wiley Corbett**, well-known architect, who talks on "Great Buildings" every Wednesday.



**Baroness Leja de Torinoff**, writer, lecturer and singer, who will conduct a novel fiction service.



**Sascha Fidelman**, first violin of the N. Y. Orientale, which renders musicales every Sunday.



**Louis Aschenfelder** will be one of the features every Friday evening in an "opera duet."



**Frederick Hulsmann** will talk on the care of your body every Sunday afternoon.



**Joseph Pavloff**, who will present the "Ballade Minstrel" every other Thursday evening.



**J. Van Cleft Cooper**, who, with his Russian Cossacks, broadcasts musical travelogues every Monday.



Gennaro Mario Curci, assisted by many other musical artists, will entertain every other Wednesday.

Director Taverna, whose operetta will be presented through WRNY every other Friday evening.

opera units: Mr. Louis Aschenfelder, who is concentrating on French music, has the group to aid him which includes Marian Cornwell, Arthur Riehl and Louise Keller. Another excellent grand opera company is that of Leo Braun. He has a splendid cast: Franklin Riter, Waldemar Rieck, Fred Shaer, Siegfried Philip, Palmira Felici, Sybil Van Wezel, Frances Golden, Helen Braun and Isabelle Wood.

In light opera, Gordon Hampson and Mme. Andres Parker alternate. The personnel of Gordon Hampson's company includes Charlotte Roze, George Brandt, Rita Sebastian, Pierre Remington and Eleanor Rogers. Mme. Parker's company consists of Lou Ellen Remmy, Paul Largy, Ann Ermet, Vera Grace Perry, Miss Schwei, Sara Sampson and Chad Parker.

In the interpretation of great song literature, we have some extraordinary combinations—Dr. Sigmund Spaeth's Ampico artists, for instance. These artists have, so far, included John Tasker Howard, Wallace Cox, Frederic Dixon, Stuart Ross and Adam Carroll. Gennaro Mario Curci, best known as the brother-in-law and coach of Amelita Galli-Curci, leads another group. Then we have the Meta Christensen Quartette, directed by Elmer Zoller.

You have probably already heard "The Love Song Girl," Lorna Lea; "The Lullaby Lady," Kathryn Behnke; "The Ballade Minstrel," Joseph Pavloff, and "The Poet-Peasant," Rose Dreeben. But have you heard "Svanhilde," the Swedish singer, or Francine Vyde, our unusual coloratura soprano, or have you, by any chance, yet noticed the work of Louise Vermont, who is presenting "Moods in Song"? Many are there who have enjoyed the popular "Old-Time Songs" by Anna Russo, and Englishmen everywhere have listened to James Gordon Beaver.

**WRNY'S ORCHESTRAS**

There is Ben Bernie's Orchestra, Orlando's Roosevelt Concert Orchestra, Jimmy Lent's Stellar Orchestra and Ferrucci's Orchestra, playing the "Evolution of Jazz."

There is no finer ensemble in America than the New York Quintette, which is composed of Mark Gumburg, Sascha Fidelman, Bernard Ochs, Samuel Stillman and E. Ligas Shuk. Chamber music is well handled by Rose Becker and the Sadrian, Volga and Bernstein Trios.

In the piano department, we have Bernice Kazanouff and Margaret Hart, who give two-piano recitals, and such soloists as Rita Maginott, Tilly Sper, Iris Brussels, Alex Chigrinsky and Charles Haubiel. J. Van Cleft Cooper carries us "Around the World in Music"; in the violin department, we

have Paul Bernard and the Rudolf Larsen Violin Ensemble, and so it goes, through all the instruments.

Anita Browne is in charge of literature, poetry, fiction and philosophy.

The theatre department is one of the most interesting which we have. *Theatre Magazine* is in charge of the chats which give the gossip of the theatre.

The New York *Telegraph* has charge not only of the theatre news but also of the sports. Their sport flashes, unexcelled in radio, give last-minute news in all branches of sport. The *Telegraph* is presenting "Up and Down Broadway," which has proved extremely popular.

Have you heard anything about the Little Theatre contest and the fact that Mrs. Brock Pemberton, who designed the costumes for "The Green Hat," is doing a series here called "Costumes of the Theatre," and that Resta Crowell is presenting a series called "Theatre Classics"?

**THE ARTS**

Harvey Wiley Corbett, who designed the Bush Terminal at 42nd Street and the memorial to Washington and Alexandria, will discuss architecture.

Alexandre Zeitlin, one of the foremost modern sculptors, discusses the art of sculpture weekly at our station.

Celeonor Dugas, of the painting series, tells of the great painters of the past and present, and Mrs. Rose Berry, who is the head of the Art Department of the Federated Women's Club, appears regularly.

Speaking of women, WRNY has recently inaugurated a Woman's Hour. Nestor Matson will give exercises for reducing, Dr. Harry Finkel will speak on "Diet," Dr. Siegfried Block on "Health," Mrs. Berry on "Arts" and Mrs. Mary F. Roberts, of *Arts and Decorations*, discusses interior decoration, and *Pictorial Review*, through its editors, appears regularly once a week.

We are particularly fortunate in being able to announce that some of the editors of *Life*, Charles Dana Gibson, Robert Benchley, Foster Ware, Henry William Hanemann and Robert B. Sherwood, as well as many other illustrators and feature writers, will appear regularly at WRNY. And let us not forget that the greatest food expert in America, Alfred McCann, will give "Food Talks," and that Chef Cretaux discusses the culinary arts each week.

The children are not forgotten, for Gregory Hartswick tells fairy tales, and we have Rita's Kiddy Parties, and Lonka's Kiddy Dances.

In the educational groups we have Major Dent Atkinson, who takes charge of the geography period.

For finance, we have Mr. M. Ruckuyser, author of "Common Sense of Investment" and editor of the financial column of the *New York American*.

In law, we have Charles A. Vilas, who handled the famous Consolidated Gas suit. We also have speakers from the Constitution League and Women Lawyers' Association, and every candidate of political importance

The Radio Theatre Players, a dramatic stock company whose presentations will interest all, are shown in the photograph below.



Anne Russo, whose specialty is old-time songs, is sure to be most interesting every time she appears before the microphone.

Meta Christensen, leader of a quartette which can be heard at WRNY every other Wednesday evening at 9:45 o'clock.

is appearing or will appear at this station.

In aviation, we have associated with WRNY the American Society for the Promotion of Aviation.

The Religious Department is in the hands of Dr. Christian F. Reisner, and the Jewish Circle is directed by Dr. Isaac Landman.

Matthew Woll, Vice-President of the American Federation of Labor, discusses economic problems.

Frederic Hulsmann is in charge of the Physical Culture Department.

Have I left some things out? Perhaps I have, but I will tell you more next month.

**MUSIC OF THE MONTH**

The Sadrian Trio has been playing old-time music, which has included "Woodland," "Babes in Toyland," "Merry Widow," "Pink Lady," "Floradora," "The Chocolate Soldier," "Mme. Modiste," and "The Fortune Teller." Amongst old operas given have been an outline of "The Mikado," "Pirates of Penzance" and general selections by the Mme. Parker Singers and selections from "The Merry Widow" and others by the DeMacchi Opera Singers, also "Rigoletto," and general programs, and similar numbers in the Taverna group.

Grand opera has brought in the Aschenfelder series, giving selections from "Romeo and Juliette" and "Cavalleria Rusticana."

The Celtic Concert and Theatre Guild gave an interesting program of Irish music and poetry.

Giuseppe Adami, in his violin series, played selections by Monti, Sirori and Boccherini.

Anna Drittell, in her first appearance, played from Granados, Haydn and Saint-Saens.

Thelma Schiffman gave a general operatic program and sang selections by Amina, Bellini, Del Riego and Fritz Kreisler.

Lorna Lea, in her first appearance, chose Bemberg, Tosti, Dobson, Lohr and Spross.

The Volga Trio has been playing a series of "Around the World" concerts. England and France have been their first choice. They include favorite melodies, as well as music of the great composers. For instance, in the English music, they played "Banks of Allen Water," "Cherry Ripe," "Sailors' Horn-Pipe" and "Rule Britannia." Composers read in the English group were Tate and Sir Edgar Elgar.

One of the interesting novelties was the appearance of Sigmund Spaeth, creator of "The Barber Shop Ballads."

Francine Vyde, our coloratura singer, brought such numbers as "Caro Nome," "La Partida" and "Charment Oiseau." That was her first appearance. Another appearance included Proeh's variations and the

(Continued on page 769)

# One Tube Regenerative Interflex

A Remarkable Single Tube Receiver for "DX" Reception

By HUGO GERNSBACK

**T**HE general trend of radio receiving set design today is toward receivers that can be made simple in control yet retain many other desirable features. Up to the present, attempts at single control receivers have usually resulted in decreased selectivity to such a great degree

stands are given in Fig. 4 and the complete construction of the coil is described below and shown in the illustrations.

In the various photographs, a specially designed coupler is shown, but the reader should have no trouble in duplicating it or in making some other kind that will work

the batteries and place a tube in the socket. Light it to about normal brilliancy by turning the filament rheostat and then vary the tuning condenser. If absolutely nothing is heard, reverse the position of the crystal detector in the circuit. The set will probably oscillate but if it does not, turn the screw

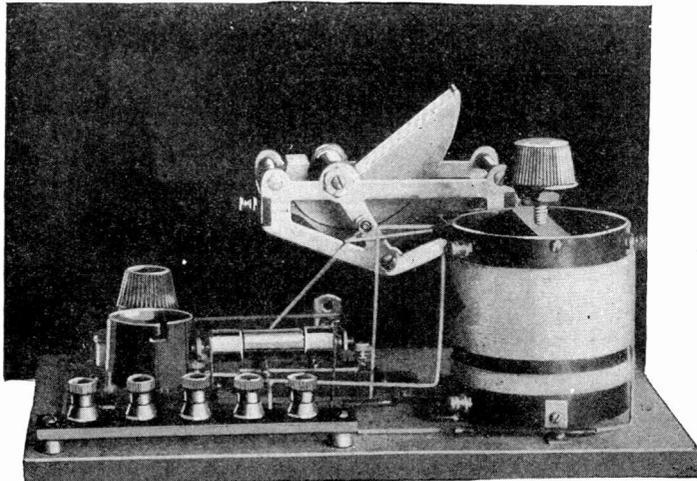


Fig. 1. A rear view of the simply designed single tube Interflex receiver, showing fixed crystal detector at right of tube socket.

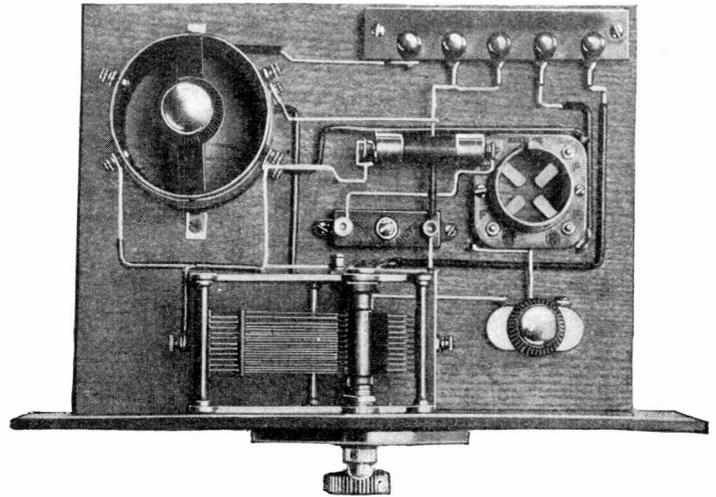


Fig. 2. Top view of receiver. Note balancing condenser directly below the fixed carborundum crystal detector of the cartridge type.

that the sets become valueless except for local reception. Other so called single control receivers have often incorporated other auxiliary controls than the main one, which make up for the discrepancies in the receiver and render the tuning sharp. The writer, however, has designed a set which is described here, which can truly be called a single control receiver and which is excellent for D.X. reception. For the purpose of balancing the set there are other variable constants but once these are placed in the correct positions for the tube and instruments used, the only part that must be varied is the tuning condenser, controlled by the large vernier dial on the panel. Thus, the set is controlled solely by the one dial, once the rest of the instruments are at their correct values.

In order to facilitate the tuning of this receiver, and to split up the stations on equal distances around the periphery of the dial, a straight line frequency variable condenser is employed. This type of instrument makes for much easier tuning, particularly on the shorter wave-lengths, if the tuning inductances are properly designed. In this particular case, all of the necessary con-

equally as well. For instance, experimental work with this set could be carried on by using a standard three-circuit coupler with the number of tickler turns cut down to the value shown in Fig. 4, approximately 25 turns. If, however, you wish to make your own coupler and to be sure of having every-

thing correct, select a thin wall bakelite tube, 3 inches in diameter and near one end wind 8 turns of No. 22 D.C.C. wire. This constitutes the untuned or aperiodic primary. Starting about one-quarter of an inch above this winding, wind 46 turns of No. 22 D.C.C. wire, thus forming the secondary. Now, if you want to stick to the design used by the writer, and this is advisable, mount the tickler coil within the stator and use a coarsely threaded rod to vary its position. The rod can be fastened to the honeycomb coil by means of a disk, which will just fit within the hole in the center of the latter, and two guide rods can be arranged to prevent that coil from turning. Make flexible connections from the tickler coil to binding posts on the stator.

After these adjustments have been made, it will be found that the tuning is extremely sharp. You will need a good vernier dial to get the best results. With careful manipulation, very good "DX" results can be easily obtained. On local stations the volume is much greater than the usual one tube set. Fair loud speaker results are usually had. For additional details see "Radio News" December issue.

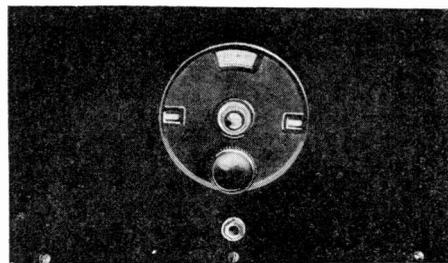


Fig. 3. The panel view of this receiver shows the extreme simplicity of tuning. Only a single tuning control is employed.

After you have connected up all of the instruments by following the diagram shown in Fig. 4, the set is ready to put into operation. The one shown in the photographs incorporated a filament control jack, which is just a little refinement, that can be added at your own discretion. Now connect all

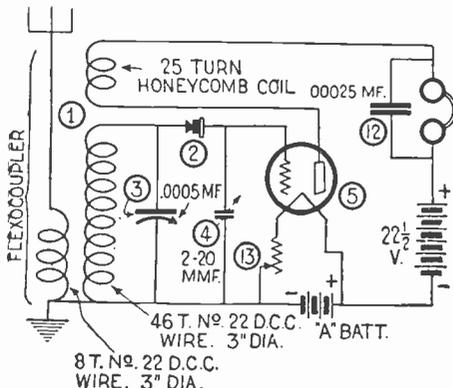


Fig. 4. The circuit diagram of the one tube Regenerative Interflex receiver shows all of the connections for the various instruments used. A variable grid condenser can be placed at 4.

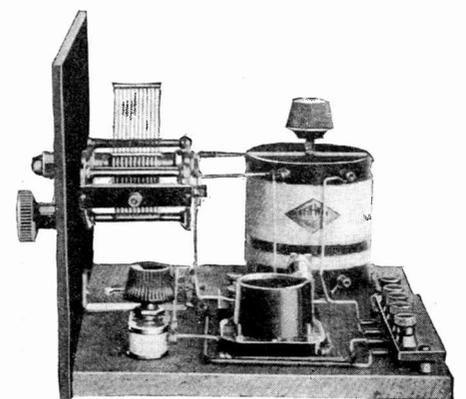


Fig. 5. A side view of this set shows the position of the filament rheostat placed directly in front of the tube socket and fastened to the baseboard. Special coupler is shown in this set.

# The Radio Constructor

## How to Build a Complete Five- or Fifty-Watt Amateur Transmitter for Use on the Short Waves

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

**T**HE article appearing under the head of *The Radio Constructor* in the October issue of this magazine has occasioned so much interest that we have decided to present all of the necessary details for constructing a higher powered transmitter.

### TRANSMITTING AERIALS

Many questions have arisen regarding the types of antennas that are suitable for radio transmission work. Today it is a generally accepted belief that a single wire aerial can be used for transmission with almost as good results as the multi-wire types. This is particularly true on the shorter waves such as the 80, 40 and 20 meter bands. The set that is described here is designed for use on the 40 meter band and, therefore, we will consider in particular an aerial and counterpoise system that will be suitable for such work. The aerial proper should not be over 35 feet long over all. This includes the lead-in down to the antenna binding post on the set. In some localities it is quite possible to use a vertical antenna of this length, although in other places a short flat top must be used. At one station, a flat top 20 feet long and a lead-in 15 feet long are used. The highest point of the aerial is 30 feet above the ground. The counterpoise is run about 3 feet above the ground and is as well insulated as the aerial. It has approximately the same dimensions as the latter. In other words, the lead from the counterpoise to the set is about 15 feet long and the part of the counterpoise that is parallel to the ground is about 20 feet long. From this data you can undoubtedly evolve an aerial that will suit your own particular locality and still will not be too long or too short for 40 meter work.

### GENERAL ARRANGEMENT

Before going into the actual construction of this radio transmitting set, let us consider for a few moments the general arrangement of a station equipped for transmission. It is preferable of course to have a room separate from all other places in which excessive noise is present. This is because of the fact that many signals are weak and hard to read. A little noise in the same room may make it impossible for working some "DX" station. The writer's location is on the third floor of his home and is some distance from all of the other occupied rooms of the house. It is impossible to hear anyone in other parts of the house and thus complete quiet and freedom from disturbance are assured.

After having selected the room in which your set is to be located, you should make arrangements for table space. The latter is quite important, as in order to be able to

do experimental work quickly and easily, the apparatus must be accessible. This it will not be if part of it is stowed under the table, another part of it on the table and the rest of it off in some closet or some other place where it cannot easily be reached. The writer has gone through all this sort of work and has used arrangements that are most unhandy. The final result of experience so gained is the extremely accessible layout shown in Figs. 1 and 3 on this and the next page. One quite large table is devoted to the receiver only. None of the transmission apparatus is on this table with the exception of the power switch and the key. These are located directly to the right of the receiver where they will be near the operator's hand when they are to be used. The rest of the table is

ing table. With the meter and wave-length control panel placed across the short end of the transmitting apparatus table the apparatus is easily seen by the operator at all times. See Fig. 1 for a complete view of the arrangement. The key is designated by 21 and the power switch by 23. To transmit, all that the operator has to do is to close the switch and manipulate the key. When through with transmission, flip the switch open and the power will be disconnected. This system requires the use of two aerials, a counterpoise and a ground. One aerial and the counterpoise are used for transmission, while the other aerial and ground are connected to the receiving set. Using this arrangement, no change over switch is necessary as the two sets are always connected to their own particular antennas. It is advisable, however, when working the transmitter at or near the wave to which the receiver is tuned, to push the filament switch when starting to send. This avoids the annoying key clicks in the phones and prevents paralyzing the detector tube with the strong signal that will be picked up by the receiving antenna.

### APPARATUS USED

The following is a list of the apparatus used in this transmitter. The figures are the same as those on the various photographs and illustrations on the two succeeding pages.

1. 0- to 2-ampere radio frequency ammeter.
2. .0005 mf. variable condenser.
3. Antenna coil.
4. .0005 mf. variable condenser.
5. Oscillator coil.
6. .0005 mf. variable condenser.
7. 5,000- to 10,000-ohm grid leak.
8. .002 fixed condenser.
9. 0- to 15-volt A.C. voltmeter.

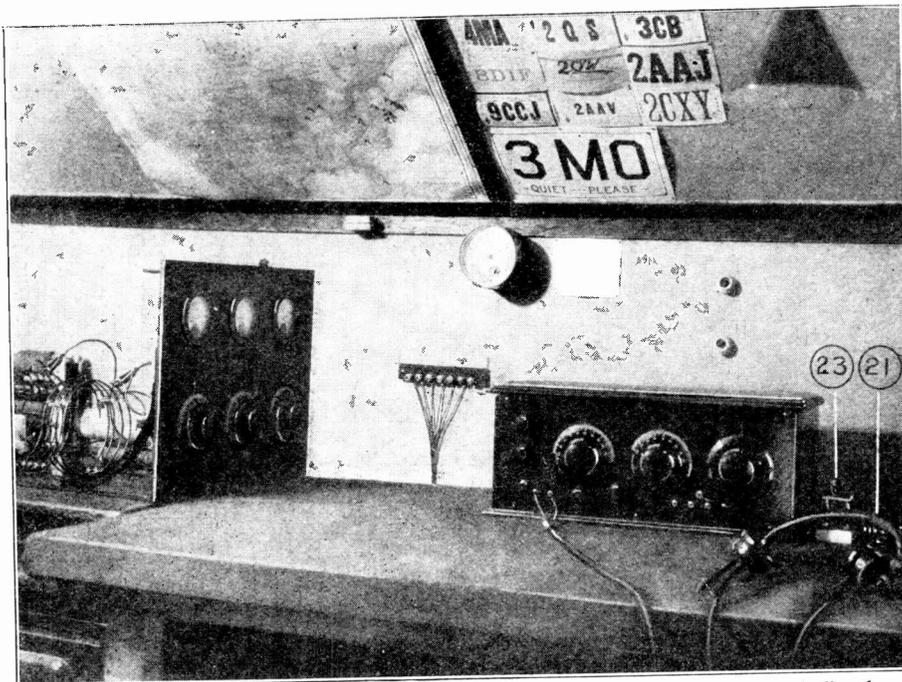


Fig. 1. A general view of the layout at the writer's station is shown in the photograph directly above. Note how the transmitter wave-length controls and the meters are always accessible and visible to the operator when he is seated in front of the receiver. The switch for turning on the current to the transmitter and the key for sending out the signals are located at 23 and 21, respectively. They are close to the operator's right hand at all times.

completely clear and the operator is not cramped for space in any way whatsoever. Thus records of transmission and reception can be entered into a book placed in front of the receiving set and other work of a similar nature can be done without having to move apparatus in order to make room for the book. Over in one corner of the table is the wave-meter, a most handy adjunct to any transmitting station and one that is almost indispensable. Wave-meters have been described in various past issues of this magazine and it will pay interested readers to look them up. An instrument of this type should be at hand at all times for checking the wave-length of the transmitted wave or the wave-length of received signals.

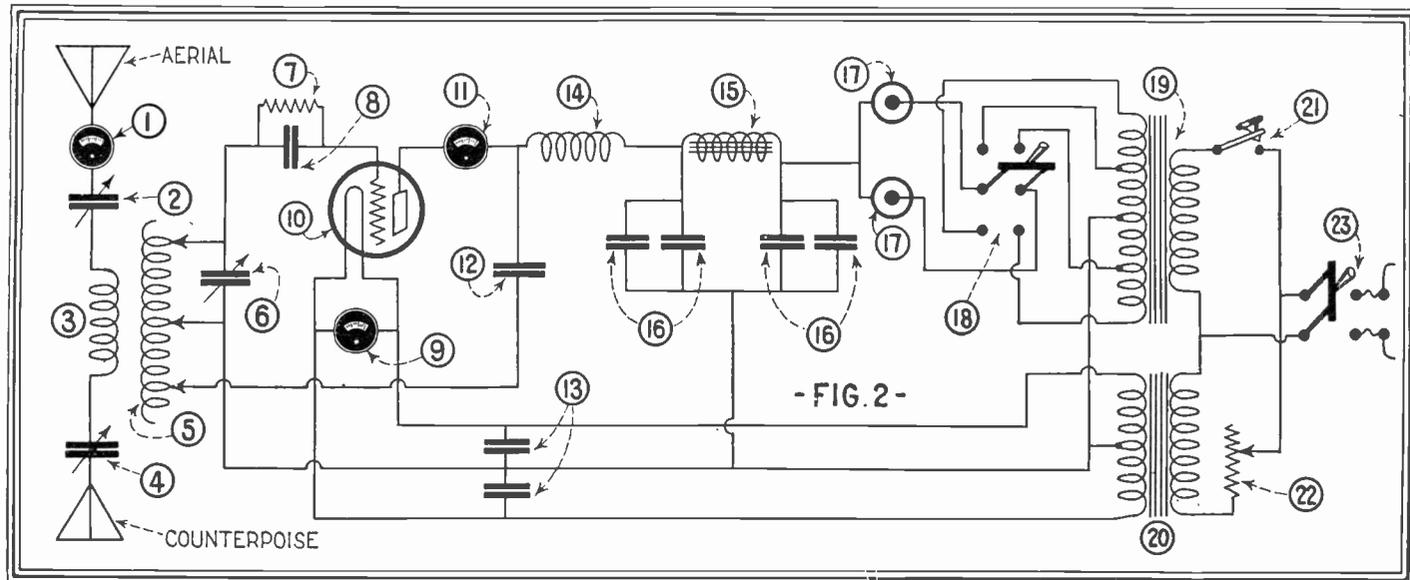
Formerly the transmitting apparatus at the writer's station was partly on top of the table and partly under it. However, with the acquisition of an "S" tube rectifier, the old bulky and cumbersome yet efficient electrolytic rectifier could be abandoned and all of the apparatus could be quickly and easily mounted on the top of another small table placed directly alongside of the operat-

10. 5 or 50 watt tube socket.
11. 0 to 300 milliammeter.
12. .002 fixed condenser.
13. Two 1-mf. condensers.
14. R. F. choke (see text).
15. 30 to 50 henry iron core choke coil.
16. Four 1-mf. condensers (2000 volt test).
17. "S" tube rectifiers.
18. Double-pole double-throw switch.
19. Plate transformer.
20. Filament transformer.
21. Key.
22. Primary rheostat.
23. Fused switch.

Some of the parts used in this transmitter can be made at home with little or no trouble and in the following paragraphs the writer will outline the simplest methods for doing so.

The meters and variable condensers used in this transmitting set cannot very well be made at home and you should buy well-made instruments of a reliable type. Those used by the writer and shown in the various photographs accompanying this article are perfectly reliable. The variable condensers are of a standard receiving type and there is nothing special at all about them. Even using a 50-watt tube with 1100 volts on the plate, these condensers do not break down

(Continued on page 742)



DIRECTLY above is shown the complete circuit diagram of the transmitter described in this issue. Every detail has been outlined, but a good many experimenters find it quite possible to eliminate some of the instruments that are designated in the above diagram. For instance, the variable condenser, 4, is not an absolute necessity, but is sometimes a tuning aid. By careful manipulation of the clips on the coil, 3, the variable condenser, 6, can be eliminated if the number of turns in the coil is increased somewhat. Often it is found that the condensers, 13, are not always needed, but they usually aid in clearing up the transmitted note.

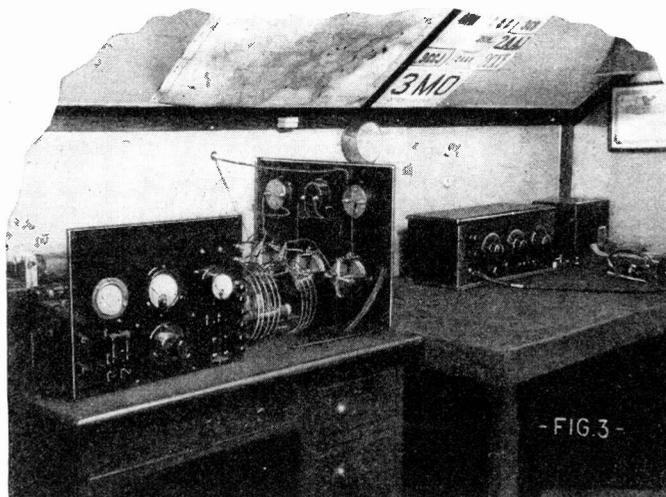
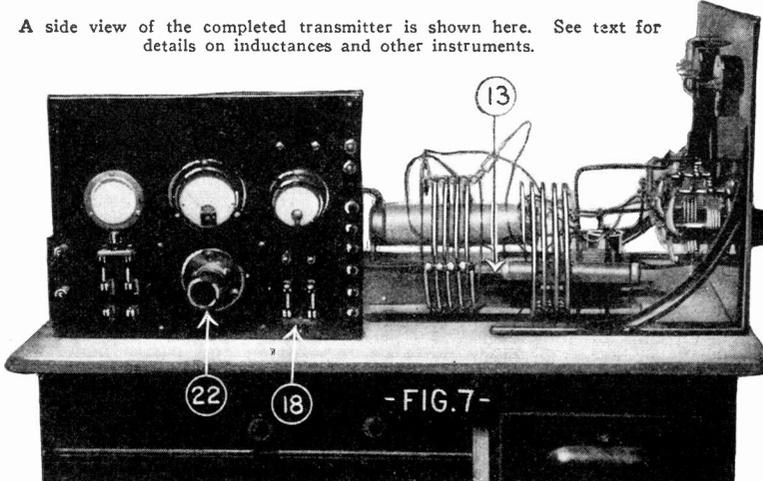
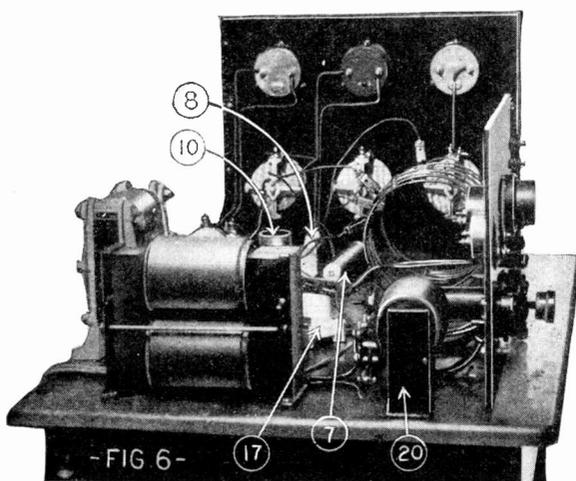
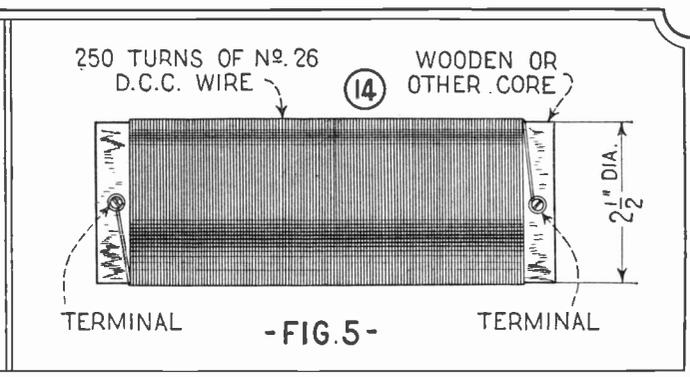
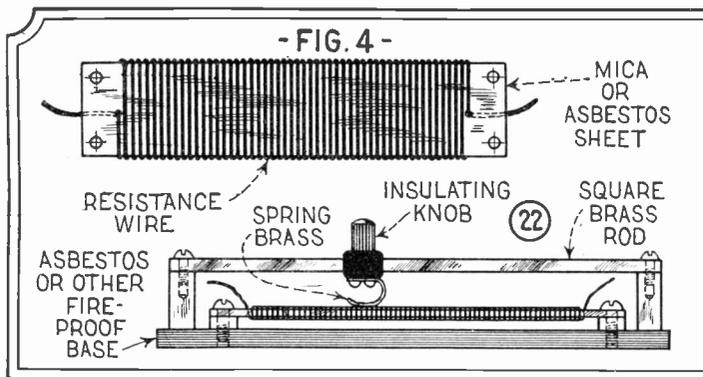
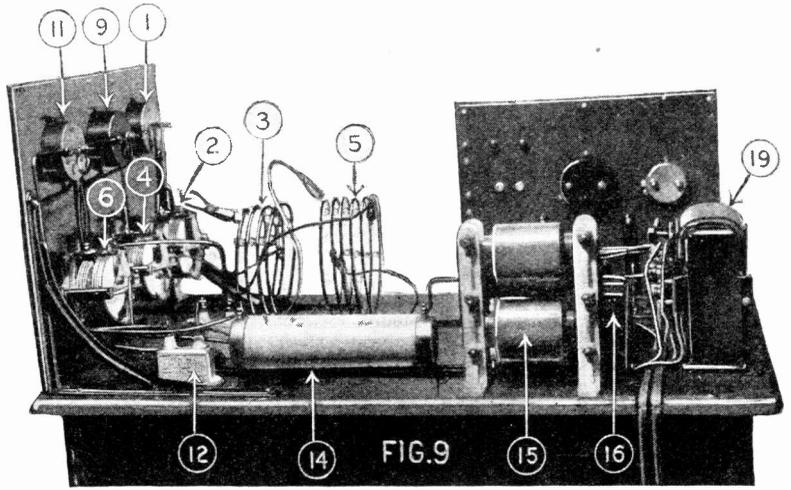
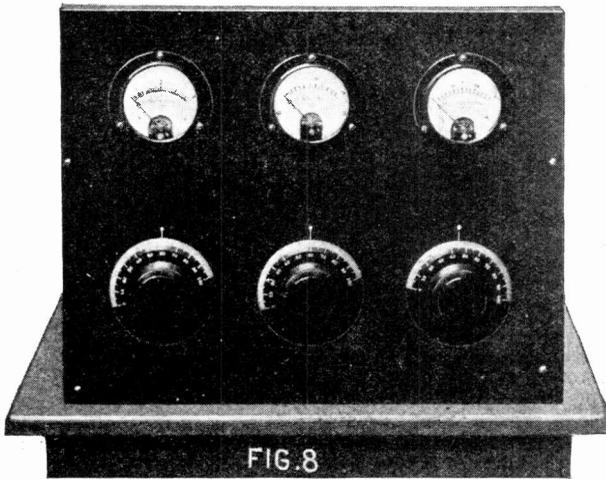


FIG. 3 at the left shows an interior view of the writer's station. The transmitter under discussion is shown at the left of the photograph. A simply constructed type of filament rheostat is shown in Fig. 4. Fig. 5 outlines the construction of the R.F. choke coil designated by 14 in the circuit diagram above. Figs. 6 and 7 show other views of the completed transmitter. The panel upon which the rheostat, 22, and the switch, 18, are mounted as shown in Fig. 7 is not an absolute necessity, but was one ready at hand when the writer was building this set. Meters for keeping a careful check on the power supply can be mounted in this location but they are not necessary.



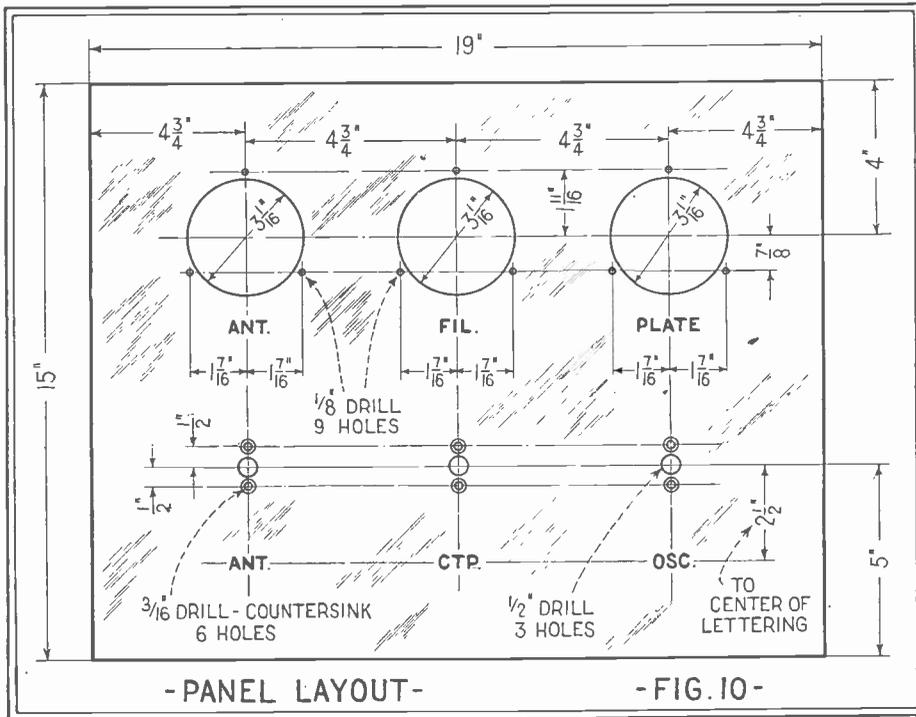
A side view of the completed transmitter is shown here. See text for details on inductances and other instruments.



The panel containing the wave-length controls and the various meters is shown directly above. The dial indicators are scratched in the panel and then filled in with white paint.

Another side view of the transmitter is shown here. The filter choke coil and the plate transformer can be seen at the right-hand end of the photograph. The R.F. choke coil is in the center indicated by 14.

THE panel layout of the wave-length control and meter panel is shown directly at the right. The size of the meter holes are correct to fit the particular type of meters that the writer used. Quite a commercial-like appearance can be added to the set if the lettering indicated in Fig. 10 is placed directly on the panel. This can be done with white ink or the letters can be engraved and filled in with white paint. Be sure that the condenser designations are placed far enough below the center line of the condenser shafts, so that the dial will not cover part of the lettering. The condensers used in this particular set were of the type that required three holes for mounting and these are indicated in detail.



IT must be realized that the various layouts of apparatus and panels given on these pages need not be absolutely adhered to. However, the arrangement has been made with convenience in mind and unless you have some definite reason for changing the arrangements, you will do better to follow the various details given herewith. Every piece of apparatus is absolutely accessible to the operator at all times, and any changes that may become necessary can be made without the necessity of removing several other instruments to get at the one to be changed.

Directly below are the details for making an electrolytic rectifier, the inductance coils and the cores for either transformers or filter choke coils.

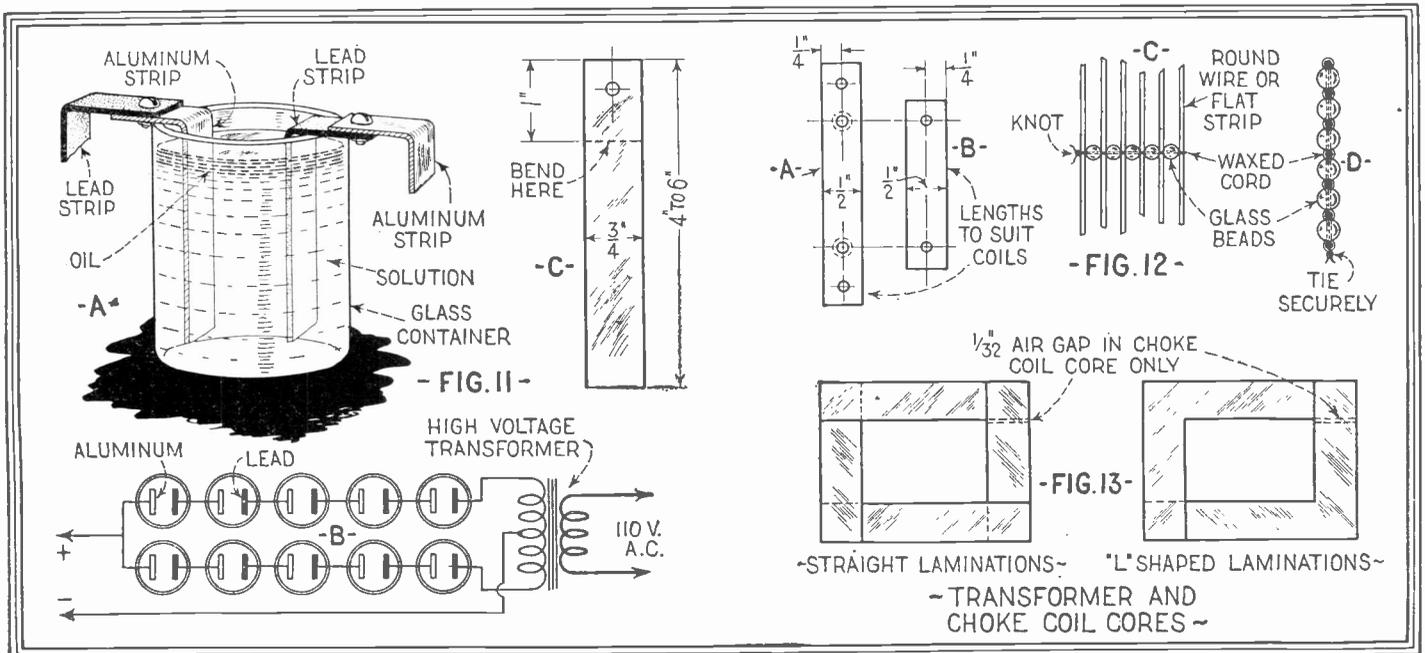


Fig. 11 gives all of the necessary details for constructing an electrolytic rectifier and for connecting it in a circuit. Follow carefully the directions

given in the text when making this unit. Fig. 12 shows coil construction and Fig. 13 how transformer and choke coil cores are made.

# The Radio Constructor

(Continued from page 739)

or flash over except occasionally when the set is improperly tuned. No harm is done by this flash over in this circuit. Under actual operating conditions they can be depended upon to "deliver the goods" at all times. Many experimenters when working on short waves have found that two of the three variable condensers can be eliminated. Only one is used in series with the antenna and the primary or oscillator tuning is accomplished solely by varying the positions of the three clips. Tuning is a much harder process in this way but the cost of the completed installation is reduced. In practically all cases, the counterpoise series condenser can be eliminated and the secondary inductance connected directly to the counterpoise.

The instruments that the writer has used are adaptable to either a 50-watt or a 5-watt set. In other words, tubes of either rating can be used with the same instruments and with few if any changes. The only difference is that the 1100 volt side of the plate transformer should never be used on a 5-watt tube. Doing this will cause the tube to break down and become useless. Do not try it even though you think that you can get greater distance in this way. The filament transformer will operate either one of the two tubes mentioned. In fact, it will operate three or four 5-watt tubes in parallel. It will not, however, operate one of the old style 50-watt tubes that draw 6.5 amperes, but it will prove amply large enough for a newer type of tube drawing on the order of two or three amperes.

## THE INDUCTANCES

It is rather difficult to purchase short-wave transmitting inductances on the open market at the present time, but it can be done. However, they are rather expensive and the average amateur constructor will undoubtedly want to build his own. The writer did that and evolved a very satisfactory type of coil that can be quickly and easily made. Either edgewise wound copper ribbon  $\frac{1}{2}$  inch wide by  $\frac{1}{16}$ th inch thick, wound in a circle five inches in diameter or No. 6 or No. 8 bare copper wire, wound in the same sized circle can be employed. The type of ribbon mentioned must be purchased. It cannot satisfactorily be wound at home. In either case, the method of spacing the turns is exactly the same and is simple in the extreme. Glass beads and strong waxed linen thread perform this duty. All of the details for this work can be seen in Figs. 12C and 12D. The strip or the copper wire is wound in the required form and then the beads are placed between the turns and held in position by means of the waxed thread. The thread is pulled as tight as possible and knotted securely over the last turn of the inductance.

In general, for 40 meter work, 6 turns of wire in a form 5 inches in diameter will be all that are required for the oscillator coil. The antenna coil should have from 3 to 5 turns and its exact size should be determined by experiment. Clips and flexible leads are used to make connection to the various turns of the inductances. The writer used flexible lamp cord for the leads and strong spring clips for making the actual contacts. The inductance coils are mounted in an upright position on the table as can be seen in the various photographs. Two bakelite, hard rubber, celeron or radion strips are used for mounting each inductance and they are detailed in Figs. 12A and 12B. The long strip goes between the coil and the table and the short strip goes inside the coil and clamps to the longer one. These coils should not be permanently fastened to the table until the best relative distance between

them is determined under actual transmitting conditions. In the drawings of these strips no dimensions are given in regards to the length as they will vary according to the way in which the builder constructs the coils. Make them amply long enough so that the turns in the inductance will not touch the mounting screws.

A good many amateurs attempt to construct their own grid leaks and grid condensers. This, however, is not advisable. A few dollars spent here will relieve you of a lot of trouble and time consuming work. Even at that, home-made high voltage condensers and good home-made grid leaks are a rarity and are hardly worth constructing. However, even though a fixed grid leak is shown in the accompanying photographs, still a variable type can be used. A good many experimenters have achieved excellent results when using variable resistances as grid leaks such as the type designed to be used across the secondaries of audio frequency amplifying transformers. Such a variable resistance should have a range of from 5000 to 25,000 ohms. Even higher than this can be employed. The exact value and the correct setting of the variable grid leak will depend almost entirely upon the tube used and upon the way in which the set is tuned.

## Want a New Thrill ?

Try radio transmission! You will get a bigger punch out of actually talking to some other ham a thousand miles away than receiving from a broadcasting station 3000 miles away. On the short waves, no quiet hours need be observed and you can operate for 24 hours at a stretch if you so desire and can keep awake. This article gives all the details on a complete transmitter that will help you towards that thrill.

## POWER SUPPLY

Since the majority of amateurs will have A.C. available for their power supply, we will consider that almost entirely in this article. Where D.C. is the only source available, motor-generators must be resorted to for both filament and plate supplies. However, such machines cannot be constructed and must be purchased so we will not consider them here.

It is preferable to heat the filament of a transmitting vacuum tube with A.C. and in fact all transmitting tubes are of such a rating that they could not be operated from a six volt storage battery. Therefore, we will first consider the construction of a filament transformer. True, it is possible to make one transformer that will supply both filament and plate currents, but this is not desirable for many reasons. Its only advantages are in its compactness and lower cost. In the end it is far more satisfactory to make separate supply units. In Fig. 13 we show two different methods of building up transformer cores. No air gaps are used in them. The material used is preferably silicon steel strips .014 inch thick. For the filament transformer, use strips 1.5 inches wide and build the core up 5 inches square in outside dimensions with the legs 1.5 inches high. The primary consists of 550 turns of No. 22 D.C.C. wire and the secondary of 70 turns of No. 12 D.C.C. wire, tapped exactly at the 35th turn. On a voltmeter test, the voltage between the center tap and either end must be exactly the same. If not, shift the center tap until they are.

With a transformer of this nature, some type of primary rheostat must be used. Do not use a rheostat in the secondary circuit as this will destroy the use of the center tap and unbalance the circuit. An excellent type of manufactured rheostat operating on the carbon pile principle is used by the writer and may be seen in Fig. 7, being indicated by No. 22. This rheostat gives very fine control over the voltage in the secondary circuit. If, however, you desire to make your own, a suggestion for this work is given in Fig. 4. The resistance wire can be obtained from an old electric pressing iron heating unit and should be rewound upon a non-inflammable insulating strip. The dimensions are not given in the drawing or here because of the fact that you will probably want to change them to suit materials at hand.

## THE PLATE TRANSFORMER

A very satisfactory transformer for supplying the plate current to one or more five watt tubes can be built up on a core having legs 2 inches square, the entire core being 8 inches square in outside dimensions. This core is also built up of strips of silicon steel .014 inches thick. The primary is wound with 440 turns of No. 15 D.C.C. wire and the secondary with 8000 turns of No. 24 D.C.C. wire. The latter should be wound in layers and every second layer should be covered with a strip of thin paraffin paper. Taps are brought out at the 2000th, 4000th and 6000th turn. The 4000th tap is the center tap and the other two supply 500 volts. In case you are only going to use a 5 watt tube, use only 4000 turns on this transformer tapped at the center. With a 50 watt tube it is advisable to have the two voltage ranges available so that low power can be used for short distance work or so that new tube rectifiers of the type mentioned below can be "broken in" on a low voltage before submitting them to 1000 volts. In winding a transformer of this type where many turns are required, wind half of the primary on one leg and the other half on the other. Then wind half of the secondary over one of the primary sections and the other part over the rest of the primary. Be sure that all coils are wound in the same direction. The winding is preferably done on a form or spool that can be slipped over the core legs.

## RECTIFIERS

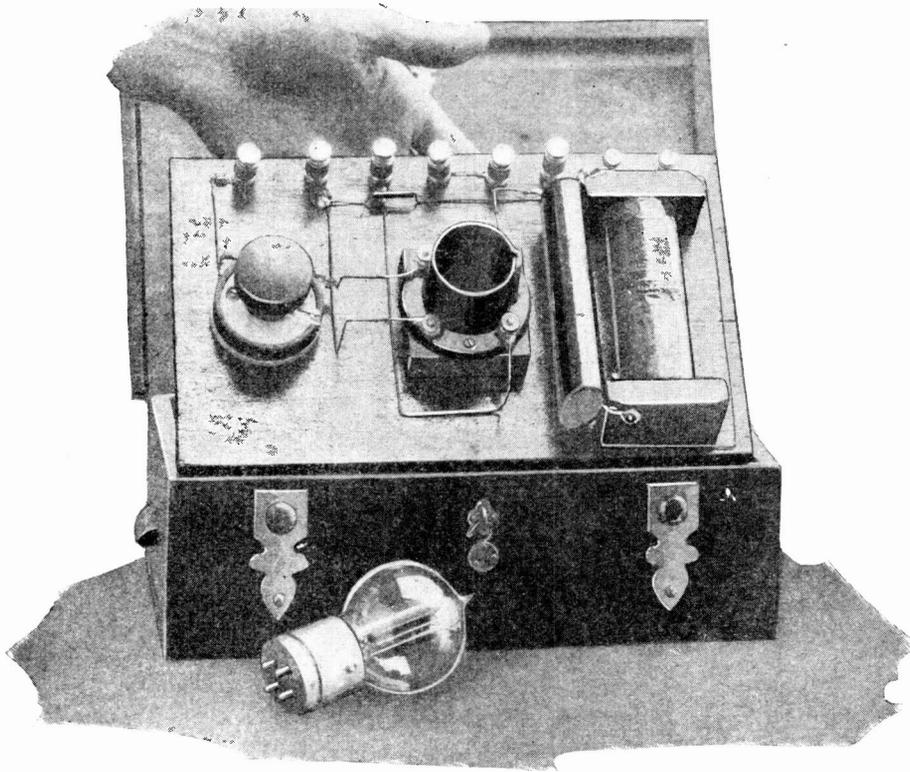
Probably the most satisfactory form of rectifier available for the average amateur is the "S" tube type and connections for the tubes are indicated in the diagram in Fig. 2. These tubes can be purchased on the market today at a rather reasonable figure, considering their long life. Once having been installed in the circuit and preferably broken in on low voltage, say around 500 volts, they can be used almost indefinitely unless an abnormal voltage is applied whereupon break-down may take place. This, however, is no fault of the tube and the user must avoid overloading them if he would obtain the best results for his money. The writer is personally using "S" tubes at the present time and is obtaining exceptional results with them. They give almost perfect rectification with a comparatively low voltage drop through the rectifier.

Some experimenters, however, prefer to make their own rectifiers and in this event the electrolytic type is the most satisfactory. It consists of several electrolytic rectifier cells connected as shown in Fig. 11B. The details of the rectifier jars are given in Figs. 11A and 11C. The elements are made up of lead and aluminum strips, cut to the size

(Continued on page 773)

# Novel Audio Frequency Amplifier

By R. L. YOUNG



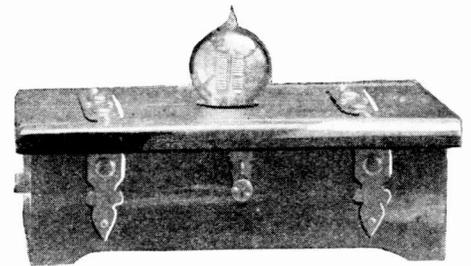
The interior layout of this novel third stage audio-frequency amplifier is shown above. Notice the extreme simplicity of the wiring and the arrangement of the binding posts. The latter system allows all of the leads to the amplifier to be brought out through the back of the cabinet, thus eliminating unsightly wires in front of the unit. In this particular amplifier, the Ford spark coil has been provided with wooden ends which are used to support it. The rheostat does not need frequent adjustment and therefore can be located inside of the cabinet.

other tubes, if great economy must be practiced. If, however, the best results and the clearest reproduction are desired, use the separate "B" battery.

The writer uses this amplifier with either a VT-2 or 216A power tube. With 120 volts of separate "B" battery applied to the plate, wonderful results are obtained. It is possible, however, to use a UV-201A, with the normal "B" battery voltage applied to it. In this case volume will be sacrificed.

After you have connected the amplifier to your set, it is possible that it may not work on first trial. In such case, reverse the wires to the input binding posts and if the directions given above have been followed and the connections are made correctly, the amplifier will work perfectly.

*(Editor's note. The amplifier that Mr. Young has built and which is described on this page is most certainly a step in the right direction for the amateur radio builder to take. The making of various radio reception units from odds and ends of electrical apparatus is a hobby that not only gives enjoyment, but at the same time is a financial relief from the purchasing of high-priced apparatus. We like Mr. Young's idea and hope that a good many of our readers will follow in his path.)*



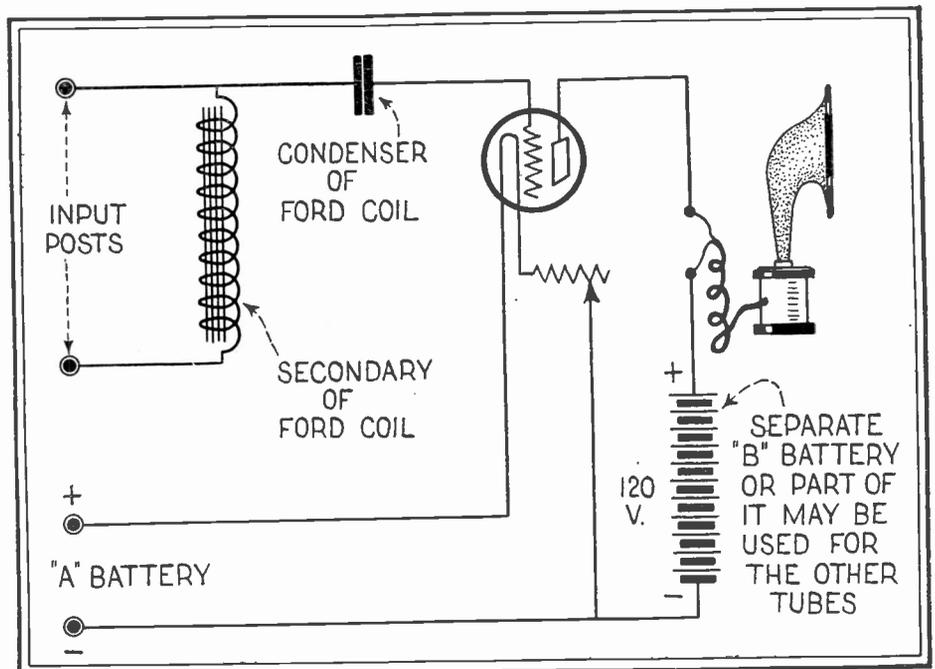
The completed assembly with the cover closed and the tube in position. The cabinet used makes a most effective ornament for any radio receiving set.

**A**N audio frequency amplifier, that can be used to give a third stage of amplification with a minimum of distortion and noise, may be constructed from a few simple parts as described below and illustrated here. The writer chose a novel cabinet for housing this unit. It consists of a miniature cedar chest that was formerly used as a novelty packing box for candy. Of course, the parts illustrated can be adapted to mounting in any type of cabinet that the reader may desire, with no difference in results.

The essential parts of this instrument, aside from the usual binding posts and tube, are a socket, a Ford coil and a rheostat. After you obtain the Ford coil, and it is a wise idea to use a new one rather than a second-hand one, because often the latter are burned out before they are discarded, remove the casing and melt out the wax so that the condenser and the coils can be easily worked on. Preserve both of these carefully as they are to be used in the set. Remove all the connections, being sure to leave sufficient wire on the ends of the secondary coil to allow for future connections and also preserve the connections to the condenser. The next step is to distribute the instruments on a suitable baseboard and the arrangement shown in the photographs is to be recommended. Wire them up according to the diagram given, using only the two secondary coil connections. The primary is disregarded but left in place together with the core.

In connecting this unit to your present receiving set, connect the two input binding posts to the output binding posts of the amplifier of this set. Connect the "A" battery

leads of the amplifier to the regular "A" battery, so that the same source of current heats the filament of all the tubes. The "B" battery should be a separate unit but it may be the common one that is used on the



The circuit diagram for this third stage amplifier is shown directly above. This amplifier is of the impedance coupled type and in order for it to operate correctly, the same "A" battery must be used on the filament of the amplifier tube, as is used on the other tubes. The grid condenser is very necessary to prevent the high voltage from reaching the grid.

# RADIO ORACLE

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

### SHORT-WAVE RECEIVER

(416) Q. 1. Maxwell Kline, Stamford, Conn., requests a circuit diagram of a short-wave receiver that can use interchangeable coils for tuning over various bands of wave-lengths.

A. 1. In these columns you will find the requested circuit diagram. The coil, L, consisting of three or four turns of wire on a 3½-inch form

A. 1. There are several points in connection with your receiving set that must be looked into. Possibly the leads in your transformers are reversed. Try reversing them one by one. If the trouble does not disappear, make sure that your "B" battery is of the correct voltage. Too high a voltage on the detector would cause the results you mention. If you are not using a "C" bat-

### "B" ELIMINATOR PARTS

(420) Q. 1. William T. Edwards, New Rochelle, N. Y., asks where he can purchase parts for the various "B" eliminators described in September, 1925, issue of this magazine.

A. 1. We will be only too glad to forward you the names and addresses of companies supplying the various parts upon receipt of a stamped addressed envelope.

### DETECTOR HOWLS

(421) Q. 1. Ben Crawford, Powers, Ore., has built a four-tube set using one stage of R.F., a regenerative detector and two stages of A.F. He says that the only way the set will operate at all is with the detector tube filament just barely turned on. Heating the filament further causes the set to howl. Also there is often a scraping sound noticed when the variable condensers are being adjusted. He asks our aid in locating his trouble.

A. 1. First consideration of your problem seems to point toward the wrong value grid leak or grid condenser. Also it is quite possible that your detector tube is not getting the correct plate voltage. Try varying this voltage.

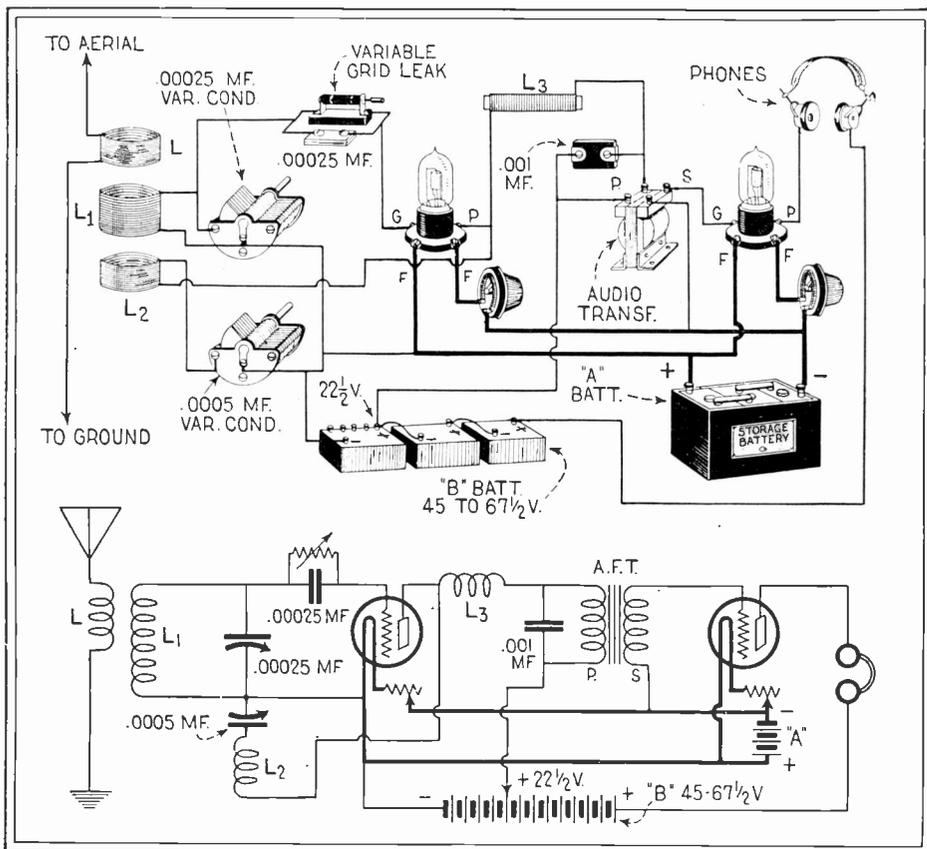
Possibly your variable condenser plates are touching and such can be easily determined by observation. If they are, pry them apart a short distance until they do not scrape. It would seem, however, that aside from the little noise that you get in your set you are getting very good results. Undoubtedly fixing the variable condensers and substituting grid leaks and condensers until you find the right values will clear up your trouble.

### CRYSTAL RECEIVER

(422) Q. 1. W. L. Calvert, San Pedro, Calif., asks how to connect up a crystal detector with an absorption type of tuner.

A. 1. The connections are very simple as can be seen in the accompanying diagram. This tuner is quite sharp and the details are as follows: Coil A is 50 turns of No. 22 D.C.C. wire on a 3½-inch form. Coil B is wound on top of coil A and insulated from the latter by a layer of paraffined paper. Coil B consists of 12 turns of No. 22 D.C.C. wire.

A very good kink can be readily perceived from the accompanying sketch. A wave-trap can be converted into a crystal detector circuit by con-



A short-wave receiver opens new fields for the radio enthusiast. An excellent type for use with headphones is shown above. The data for coils covering the 40 and 80 meter amateur band is given in the text. Follow it carefully in order to obtain the best of results.

may be used for practically all waves that this set will cover. The coils L<sub>1</sub> and L<sub>2</sub>, however, must be changed for the various bands. In general, L<sub>2</sub> will have half as many turns as L<sub>1</sub>. For the 40-meter amateur band use eight turns in L<sub>1</sub> and five in L<sub>2</sub>. For 80 meters use 16 turns in L<sub>1</sub> and 10 in L<sub>2</sub>. The choke coil L<sub>3</sub> is permanently wired in the circuit and need not be changed. One hundred turns of No. 26 S.C.C. wire on a 1-inch form will be sufficient.

### TYPE OF RECEIVER

(417) Q. 1. James H. Fougner, Gilsum, N. H., asks what kind of a receiving set we would advise him to buy.

A. 1. The particular type of receiving set that you will need depends upon whether or not you desire to operate a loud speaker or are content to listen in on headphones. In the latter event, any standard one- or two-tube receiving set would be quite sufficient for your needs. If, however, you wish to use a loud speaker, at least three or possibly four or five tubes should be employed. The circuit you mention in your letter is quite good, but if you wish consistent loud speaker reproduction, we would advise something similar to a Neutrodyne.

Patterns delineating the design and construction of various types of receiving sets can be purchased for a nominal sum. We will be glad to furnish anyone with the name and address of a company supplying them upon receipt of a stamped, addressed envelope.

### SQUEALING

(418) Q. 1. S. J. Fort, Menno, S. D., has built a radio receiving set following directions given in this magazine some time ago. The set works perfectly on the detector alone, but when the two stages of audio frequency amplification are used, squealing is present that makes reception almost impossible. He asks our aid in locating this trouble.

tery, it might be well to try one of about 4½ volts in the grid circuits of the amplifier.

Furthermore, we would advise that a 10 to 1 transformer very often gives poor results. We would most heartily suggest that you replace this one with a transformer having a 5 to 1 ratio.

Furthermore, you should keep your grid and plate leads separate and not run them parallel for any great distance.

Also, be sure that the cores of the transformers are at right angles to each other. If parallel, trouble may arise unless they are shielded.

We believe that if you will look into all the above-mentioned points you should be able to locate your trouble.

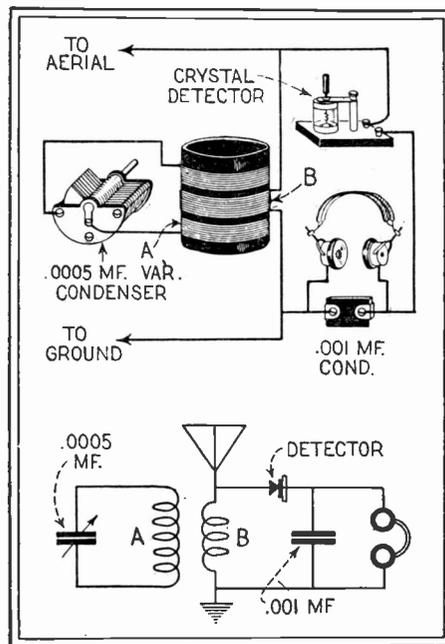
### TWO-TUBE SET

(419) Q. 1. Frank A. Fick, Santa Cruz, Calif., refers to a set described in the April, 1925, issue of this magazine and asks how the double wound coil described therein is to be made.

A. 1. In regard to winding the double wound coil in the radio receiving set you mention, we would advise you to measure off the length of wire necessary for winding one of the coils, double this length and connect the center lead to the point where the wire is doubled. Then proceed with the winding of the form exactly as though one wire only was being used, except, of course, laying the two wires together in the spider-web form.

Q. 2. Will a neutralizing condenser, consisting of two flat-head brass screws placed end to end and separated about one-sixteenth of an inch have sufficient capacity for this circuit?

A. 2. We would advise you to use a larger capacity of neutralizing condenser. Probably soldering two 1-inch discs of copper to the machine screws you show in your letter of recent date would give a large enough capacity. The space must be varied until the best results are found.



A simple crystal detector circuit using the absorption method of tuning is shown above.

necting the detector and phones across the antenna and ground terminals of the wave-trap in the same manner as they are connected across coil B in the accompanying diagram. The aerial and ground are also connected to the same posts and the output terminals of the wave-trap are not touched. This, of course, applies to the usual inductively coupled type of trap, wherein two coils similar to A and B in our diagram are employed.

# Non-Science

## MANUFACTURE OF WOOD PULP

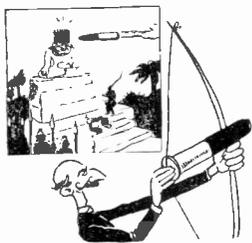


The following item appeared in the "Chaperon" columns of the *Kansas City Star* on July 15th, 1925: "A woman is seated immediately when she enters a restaurant. If she wishes, she may then slip out of her coat, spreading it back on the back of her chair as she eats."

This, no doubt, refers to the days of "Tarrano the Conqueror," when many things will be used for food that are not used now. A vegetarian, we presume, should include wood as part of his repast. Soft wood may be easily digested, but hard wood is better for the molars.—Miss Minnie Stevens.

## SHELL AND ALL

In *Sidney Smith's famous news comic of the "Gumps,"* we find a picture in the Sunday paper of the scene illustrated herewith, depicting little Chester and the Chinaman with necks outstretched awaiting the descent of the fatal blade. At the critical moment a well-directed shell from Uncle Bim's ship shatters the idol and all are saved. The projectile, however, probably by accident, has carried the cartridge, or shell case, along with it, and one wonders what happened to the gun as the cartridge tore its way through the rifling, or how the aim could be so straight and, incidentally, one wonders where the propulsive charge was located which started the ensemble going. Will some ex-gob of 1918, please elucidate?—L. O. Lofquist.



### Money for Science Mistakes

The newspapers throughout the country, as well as the magazines, occasionally err. Sometimes these errors are misprints. At other times they are pure scientific misstatements. If you happen to see any of these humorous mistakes in the press, we will be glad to have you clip them out and send them to us. Give the name of the newspaper or magazine in which the error appeared and accompany the inclosure with a few humorous lines. The most humorous ones will be printed in this department, and for each one accepted and printed we will pay \$1.00. No NON-SC(i)ENCE entry will be accepted, unless the printed original accompanies the same. All NON-SC(i)ENCE entries must be scientific and addressed to:  
 Editor, NON-SC(i)ENCE Dept.,  
 c/o Science & Invention Magazine,  
 53 Park Place, New York City.

## RIGHT THROUGH



In the August *Popular Science Monthly* I find the following statement: "An ingenious camera that photographs the interior of the stomach was displayed recently at Atlantic City, N. J. The apparatus consists of a metal tube that can be slipped down the patient's windpipe. At one end of the tube is a powerful electric light that illumines the stomach, and at the other end a special camera, with a series of lenses in between."

"Well, this is certainly an ingenious camera. Indeed, by the time the tube has reached the stomach by way of the "windpipe," the patient will be dead enough to enable the physician to carry on a post-mortem examination. Such an examination should be more "enlightening."—Mrs. Chas. L. Williams.

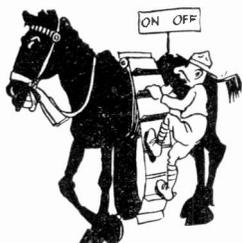
## SOME DEPTH

The *Daily Press* of Newport News, Va., for Sunday, September 13th, 1925, contained the following item: "The Antarctic Ocean has an average depth of 5,731 miles."

As the mean diameter of the earth is 7,700 miles, and the polar diameter is 7,899.984 miles, either one of two things must be conceded. If this depth of "5,731 miles" be correct, the whole Antarctic end of the earth is an abysmal sea of water, or there is an enormous hole in the bottom of the earth deeper than half the distance through the earth straight to the North Pole. A miss is as good as a mile, but here the typographical error amounts to about 5,731 miles. Quite a "miss!"—J. L. Kibler.



## OFF AGAIN—ON AGAIN



In the edition of the *Camp Lewis News*, dated September 12th, 1925, we find the following: "Sgt. Goldstein is trying to invent a way to get on a horse from the off side."

Using this method of procedure, how would the man approach the animal in order to get away from him?—Geo. Dewey Smith.

## A NEW INSTRUMENT

The following advertisement appeared in the *Ace High Magazine* for August: "Have ukulele, half coonhound and half airedale (male), flashlights. Want guitar .22 repeater."



Now, what kind of a genius invented this contraption? Evidently all the freaks are not in the circus. We wonder whether musicians play on the coonhound and airedale combination, and whether one can find accomplished musicians to play on the pesky critter. We should want our ukulele pedigree.—(Author please send name.)

## A LONG STRETCH

In the April, 1925, issue of *Popular Mechanics* appears an article on sleuth hounds of the sea in which we find the following statement: "... and officers mark on a chart a series of parallel lines A QUARTER OF A MILE APART..."



Evidently these officers have extraordinarily long arms in order to reach the two extremes of the chart a quarter of a mile apart. We hope that the chart is well supported between ships, as it would be difficult to place a chart this large in one vessel. I have not as yet heard of any United States ship one-quarter of a mile long which will accommodate this record.—Sidney Lang.

## A HEAVY SHADOW



In an advertisement appearing in the September, 1925, edition of the *Classic*, we find the Silph Reducing Chewing Gum advertised for removing fat. The photograph shows a picture of a beautiful Brooklyn girl and under it we find this caption: "I AM THE SHADOW OF MY FORMER SELF." The remarkable part of it is that the shadow is almost twice as large as the photo of the girl. I am sure that most girls would rather be the original figure than the shadow, and that the advertisers got their statements twisted and should have said, "I am not the shadow of my former self."—Harold E. Skelton.

## NE'ER THE TWAIN SHALL MEET

The following item appeared in the August 15th, 1925, edition of the *Portland Oregonian*: "Lost — White male collie with sable markings on west side."



I would like to know which side of a collie is its west side, especially if the dog is facing west. Under these circumstances, the dog would not have a west side—it would be a west end, would it not?—Harold Charters.

## I WILL NOW SING A SEXTETTE



In the *Grand Rapids Herald*, Sunday morning, August 30th, 1925, a photograph of three horses was shown. Under it we find the following caption: "An interesting feature of the annual convention of the New York State Volunteer Firemen's association was the three-horse team of five horses which still faithfully pull one of the engines of the Mamaroneck, N. Y., fire department."

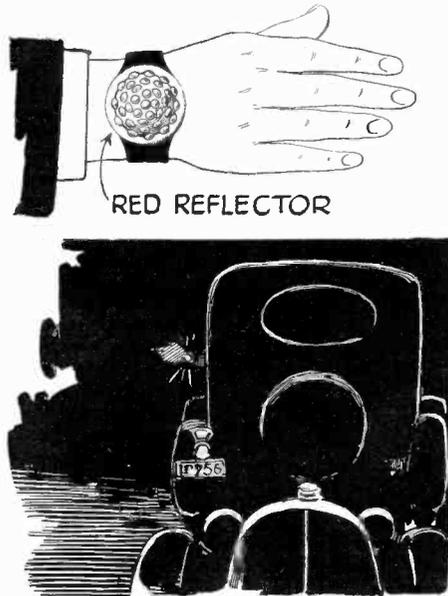
Now that we have a three-horse team of five horses, we hope someone will give us a five-sided triangle.—L. G. Winegar.



# LATEST PATENTS



### Auto Signal



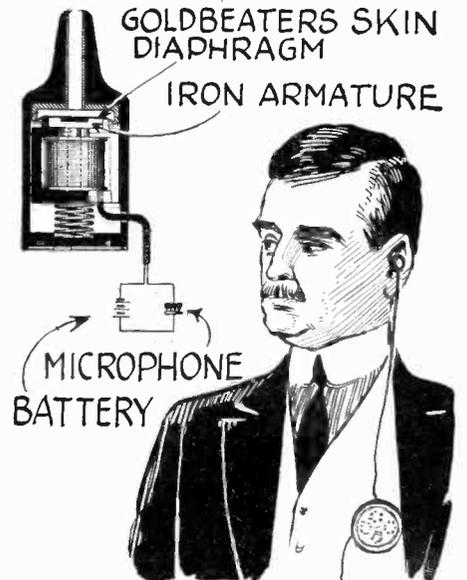
No. 1,548,916 issued to J. R. Thompson describes a night signal device for automobiles that requires no mechanical or electrical connections and that always operates if the lights of following cars are turned on. It merely consists of a red reflector strapped to the wrist of the driver. All of the standard hand signals can be given with this device in use.

### Broom Holder



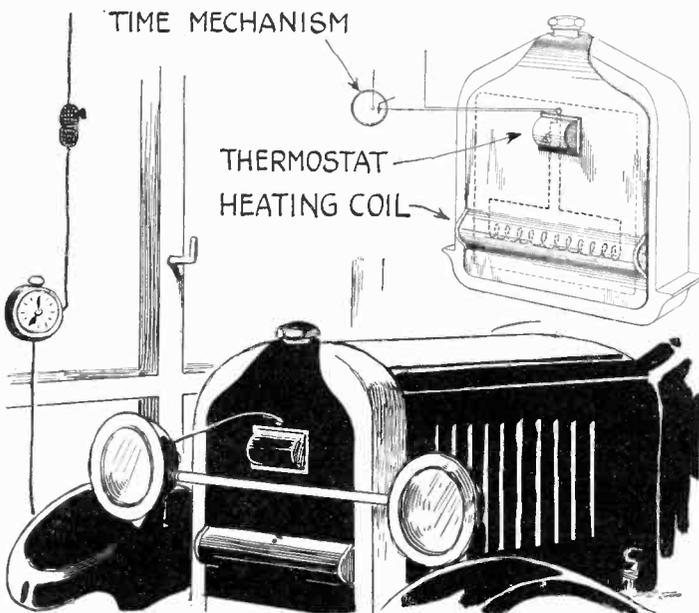
No. 1,540,291 issued to W. P. Sessions pertains to a novelty that should find wide use among housewives. The broom holder is screwed to the wall and to hold a broom in position it is only necessary to push it upward through the hole and release it. The catch holds the broom in place. To remove, lift up the bottom of the catch with the finger and take the broom out.

### Small Telephone



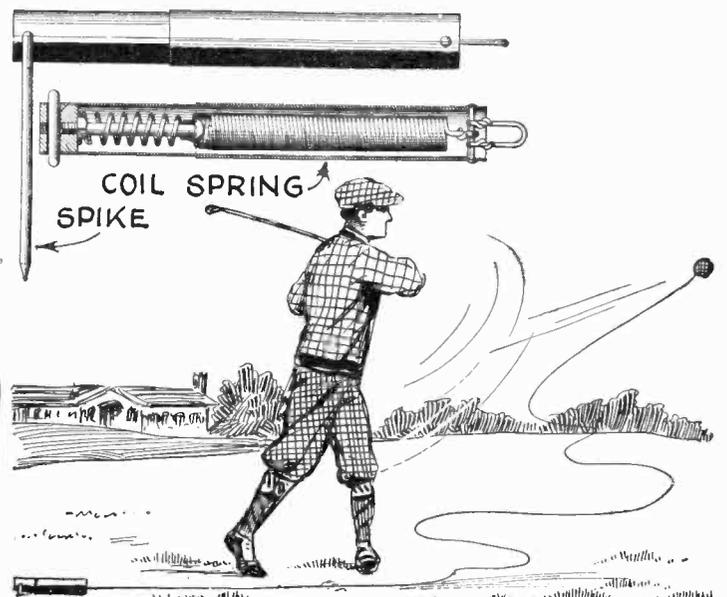
No. 1,545,525 issued to H. Sell protects a novel type of very small telephone receiver that fits into the ear and requires no head band or other holding device. The details of one of the receivers are shown in the upper left-hand corner and the device is illustrated in use above. It can be used for various purposes, the most important being as an aid to people hard of hearing.

### Radiator Heater



No. 1,534,220 issued to A. J. Kercher covers a device that should make cold weather motoring more of a pleasure and that certainly will prevent an excessive drain on the battery when starting. Actuated by a clock, the heating coil is turned on at a predetermined time, but if the car is not used in a short period, the device cannot overheat because of the thermostat included. The apparatus is removed when the car is taken out of the garage.

### Golf Practice Device



No. 1,541,420 issued to G. H. Lambert protects a device that enables golf practice to be carried on in a limited space. Furthermore, it enables the golfer to practice driving without having to chase the ball. As shown, a heavy coil spring is connected to a long cord, to the other end of which the ball is fastened. The ball is placed on a tee in the usual way and driven. It can only go as far as the cord will allow it to travel.

# Scientific Humor

## GOTTA HAVE SOME FOR VACUUM TUBES

PROFESSOR: "A vacuum is lighter than any gas known."

BRIGHT FRESHIE: "Why don't they fill dirigibles with it, then?"—*Charles A. Voelckel.*

## BEEF WAS HIGHEST WHEN COW JUMPED OVER THE MOON

"How much is this meat?"  
 "Thirty-eight cents a pound, ma'am."  
 "That's very high, but I guess that's the aviation meet I've been reading so much about lately."—*A. Andersen.*



## IS THIS A SKIN GAME?

TEACHER: "Can anyone tell me who Luther Burbank is?"

DUNCE: "Aw, he's nothin' but a grafter."—*Leland Ray.*

## ANYTHING THAT GOES UP

GEOLOGY PROF.: "How many kinds of water-falls are there?"

SOPHOMORE: "There are three kinds: one is the geyser. This is the kind where the water falls up."—*Leota E. Schoff.*

## CAN YOU PICTURE THIS?

SHE: "Why is a flapper like a spoiled film?"

HE: "Because she's under-developed and over exposed."—*M. Bercovitch, Reporter No. 21358.*

## RELATIVELY SPEAKING

PROF.: "What is the difference between the Einstein theory and the Darwin theory?"

STUDENT: "Einstein says that all things are relative and Darwin says that all things are relatives."—*Harold Phifer.*

## THIS ONE DIDN'T

DAD: "Son, what do you mean by trying to fold my rule sideways, when it should be pushed together. You've broken it."

SON: "Aw, Dad, I didn't mean to, but you said a good rule should work both ways."—*Murray Orscr.*

## STRETCHING THE TRUTH



ADAM: "Do you believe that story about Lot's wife turning into a pillar of salt?"

EVE: "Why not? Whenever you see a flapper pass you turn to rubber."—*Jas J. O'Connell.*

## NOT A LIE DETECTOR

DE STYLE: "If George Washington was living today he could never get a job in a chemical works."

GUNBUSTA: "Why not?"  
 DE STYLE: "He could never tell a lie."—*F. P. Pitzer.*

## SOMETHING FOR NOTHING

Toricelli, the man who first made a vacuum, was the only inventor who produced absolutely nothing, and got credit for it.—*M. Bercovitch, Reporter No. 21358.*

**FIRST PRIZE \$3.00**  
**HE'LL GET IT**

PROVOKED WIFE (discovering drunken husband on front steps fiddling with door knob at 2:00 a. m.): "What are you doing there, John?"

DRUNKEN HUSBAND (still turning knob): "Pshh! I'm trying to get Los Angeles."—*L. Keiser, Jr., Reporter No. 27612.*

## THIS MAKES THEM COLD-BLOODED

QUESTIONER: "And how is the climate there?"

MISSIONARY: "Oh! The only trouble is that they have to feed cracked ice to the hens so they won't lay hard-boiled eggs."—*Wolfe N. Bishop, Reporter No. 22554.*

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

## SOME BABY

SLIM: "Did you hear about that baby that gained 100 pounds in a month because it lived on elephant's milk?"

JIM: "Naw, it can't be done. Quit your kidding."

SLIM: "Sure it was the elephant's baby."—*Dan C. McCall.*

## HIGHER MATHEMATICS



"Hey, you two handle that gunpowder carefully!"

"Why?" they asked.

"Don't you know that some of that same stuff exploded last month and killed

seven men?"  
 "Well," one of the two replied, "that couldn't happen now, there are only two of us here."—*Edward D. Muir, Reporter No. 14122.*

## WRNY's MASCOT

MARY: "Oh, yes, my dear he has wireless eyes."

GEN: "Wireless eyes?"

MARY: "Yes, my dear. You see he has a broad cast in them."—*Frank Anderson, Reporter No. 16895.*

## U R 2 Ys

"What is Na<sub>2</sub>O<sub>7</sub>?"  
 "Never heard of it."  
 "Isn't it borax?"  
 "I thought you wrote borax Na<sub>2</sub>B<sub>4</sub>O<sub>7</sub>."  
 "Well, that's what I said. Na<sub>2</sub> before O<sub>7</sub>."  
 —*H. S. Johnson.*

## NEEDS A SHOCK ABSORBER

DINER: "Waiter, what kind of meat is this?"

WAITER: "It is spring lamb, sir."

DINER: "I thought so! I've been chewing on one of the springs for an hour."—*L. Keiser Jr., Reporter No. 27612.*



## SOLELY

PROFESSOR (to inattentive pupils): "Is leather an organic or inorganic compound?"

PUPIL: "Er—inorganic."

PROFESSOR: "Then give me the chemical name."

PUPIL: "Ox hide of beef."—*Stanley Eastman.*

## NOT A (S) MILE

MANUFACTURER to manager of a patent selling concern when shown an invention—"That sure is a far-fetched idea you have there."

THE MANAGER: "You're certainly right. This invention was brought from a small town in Siberia."—*Wilson G. Walters, Reporter No. 6385.*

## MAKING LIGHT OF IT

PESSIMIST: "It's a hell of a heavy thunder storm."

OPTIMIST: "Yes, but don't you see it's lightning every minute."—*Leslie F. Carpenter.*

## DON'T TELL MA

"Papa," asked little Willie, "why do they call it the 'mother tongue?'"

"Well," answered Father, "just see who uses it the most."—*L. Keiser, Jr., Reporter No. 27612.*



## HOW ABOUT MIC ROBE (?)

PROF. (in physics class): "What is a microfarad, Mr. Smith?"

MR. SMITH: "Well, I think it's about the same thing as a farad, only some people call it a microfarad because Faraday's first name was Michael."—*G. E. Davis.*

## ROUND AND ROUND

REPORTER: "You believe the Flettner rotor is as powerful as an ordinary sail?"

MARINER: "Yes,—of course, in a round-about way."—*J. Bront.*



# THE ORACLE



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

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

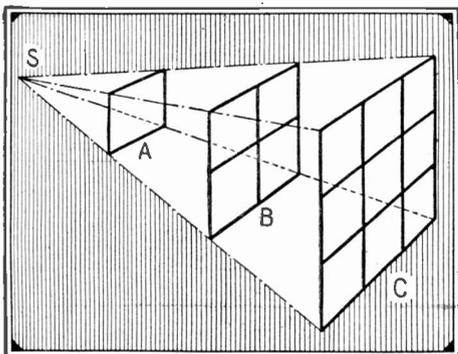
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail free of charge.

4. If a quick answer is desired by mail, a nominal charge of 50 cents is made for each question. If the questions entail considerable research work or intricate calculations, a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

## INTENSITY OF LIGHT

(1952) Q. 1. Hubert Ross, Kansas City, Mo., asks: At what ratio does the intensity of light vary at distances from the source, the source being a theoretical point of light?

A. 1. The law governing this phenomenon of light states that the intensity of light varies inversely as the square of the distance. In other words, a source of light that will produce a given intensity at a given distance, will give only one-



A diagram showing graphically how the intensity of light varies inversely as the square of the distance. S, A, B and C are equal distances apart.

quarter that intensity at twice the distance or one-ninth at three times the distance. This can be readily seen from our illustration given in these columns wherein, S, is the source of light and A, B and C are spaced at distances apart equal to that between S and square, A. It will be noted that the light from the source illuminates a square of the size shown at A, whereas it illuminates four such squares at B, and nine at C, so that a square of the size of A if at C receives only one-ninth the light.

## INDUCTION—INDUCTANCE

(1953) Q. 1. Chas. F. Arthur, Derby, Conn., asks us to differentiate between the terms induction and inductance.

A. 1. The term induction specifically applies to the phenomena which takes place in current-bearing wires. The term inductance is sometimes used interchangeably with induction, although it is also used to specify a coil of wire, usually with an air core, and also in connection with valves, to denote certain electrical properties of a coil of wire. The term induction is occasionally used in reference to spark coils which are sometimes termed induction coils.

## RENEWING DRY CELLS

(1954) Q. 1. John J. Martin, Kansas City, Mo., mentions several methods which he has heard of regarding the renewing of dry cells and asks our opinion on them and directions for any other process that we may know of.

A. 1. There is no real good system for renewing dry cells. After they have once become run down, they can be given a short lease on life by charging or wetting down, but cannot be made as good as new. We do not believe that the method of heating that you mention would give any very good results. The only method which is fairly good is that of pouring a saturated solution of sal-ammoniac into the cell and allowing the depolarizer to absorb as much as possible. Do not, however, dry the cell by heat, but reseal as soon as the sal-ammoniac solution is absorbed. This is the best method, aside from that of leaving the cells with the zinc only drilled full of holes in a solution of sal-ammoniac.

In any event, good results will not be noticed when it is attempted to renew the life of a flashlight cell. The usual cause of a run-down cell in this case is a worn-out zinc element, whereupon, of course, it is impossible to revive the cell.

## NEWTON'S LAW

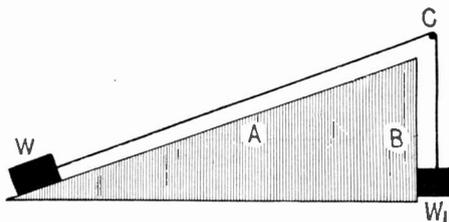
(1955) Q. 1. James J. Silver, Portland, Me., asks: What are Newton's three laws of motion?

- A. 1. Briefly stated, the laws are as follows:
1. Every body continues in its state of rest or of uniform motion in a straight line unless compelled by external forces to change that state.
  2. The rate of change of momentum is proportional to the applied force and takes place in the direction in which the force acts.
  3. To every action there is an equal and opposite reaction.

## PERPETUAL MOTION

(1956) Q. 1. George Stevenson, Roscoe, N. Y., asks why perpetual motion is a fallacy and why it is considered to be a problem without a solution.

A. 1. The majority of perpetual motion machines are based upon fallacious reasoning. Practically all of them which depend upon revolution of a wheel or upon the rising and falling of weights do not take into consideration one certain fundamental fact that is illustrated graphically in these columns. That fact is that raising a weight to any given height requires the same amount of energy to be expended, regardless of how it is raised to the final position. Referring to the figure which we have simplified as far as possible, we have the proposition of raising the weights, W, and, WI, to the point, C. One weight can be drawn up the incline A, and the other raised vertically through the distance, B. It would seem offhand that the weight, W, could ascend the incline, A, with a smaller expenditure of energy than raising the weight, WI, directly to C. This is not the case, however, and neglect-



The above diagram aids in understanding why many perpetual motion machines will not operate.

ing friction in all phases of the proposition, we find that the same amount of energy must be expended in both cases. This line of reasoning can be applied directly or indirectly to practically every proposed form of revolving perpetual motion machine.

Unless some force is applied to the wheel or other device during one-half of its revolution, and then removed for the next half, devices of this nature cannot operate. It is physically impossible to apply and remove this force intermittently, as would be necessary to fulfill the conditions and, therefore, to date, it has been found impossible to construct devices of this nature. We are awaiting anxiously and skeptically the entry of some successful device operating by the force of gravity alone in our "Perpetual Motion Prize Contest." As yet, not one model has been submitted.

## CENTRIFUGAL FORCE

(1957) Q. 1. Nick Davlantes, Chicago, Ill., asks: How is centrifugal force calculated?

A. 1. We are giving you below the formula necessary for the calculation of centrifugal force:

$$V = \frac{2\pi RN}{60}; F = \frac{WV^2}{GR}$$

In the formula, R = the radius of the curved path in feet; F = the centrifugal force exerted upon the arm or cord connecting the body with the shaft; W = the weight of the body in pounds; N = the number of revolutions per minute; V = linear velocity of the center of gravity of the body in feet per second; G = 32.174.

## HEAT-PROOF CEMENT

(1958) Q. 1. Fernand M. Yax, Scranton, Pa., says that he desires a material which can be placed in a position where it will be in contact with a red-hot wire for long periods of time, but which, when in use, will not be disturbed. He asks for a formula for a material of this nature.

A. 1. A simple material which can be used in the way you mention and which will give satisfactory results is some sort of an asbestos cement. Shredded asbestos mixed with fire clay and water glass to the desired consistency should be found quite satisfactory.

## ELECTRIC TROLLEYS

(1959) Q. 1. A. Chapple, Nashton, B. C., Canada, asks why the electricity which operates trolley cars does not leak off into the earth, and why the ground around the rails of a trolley car system is not charged.

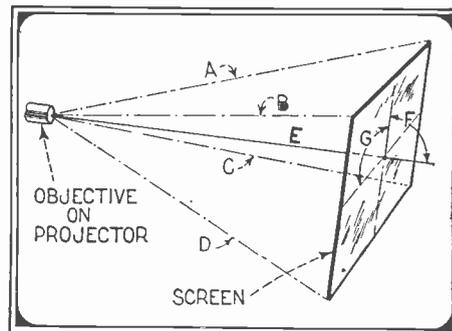
A. 1. The answer to your question on the trolley system is perfectly obvious if you will stop to consider that only one pole, or one side of the generator supplying the current is connected to the rails. Obviously, there can be no flow of current, except by the overhead trolley wire (which is connected to the other side of the generator) and the rails or the ground.

Of course, the ground around the rails might be considered to be charged, because, if it were in a damp condition and you were to stand thereon and touch the trolley wire with a metallic pole, you would receive a severe and possibly fatal shock.

## MOVIE SCREEN

(1960) Q. 1. Raymond B. Williams, Pasadena, Calif., says that he is setting up a small theatre for private entertainments and has incorporated a small motion picture booth and motion picture screen in it. However, the booth is at some distance above the stage and when a picture is thrown from the machine upon a screen perpendicular to the stage, the result is a distorted image, wider at the bottom than at the top. He asks our assistance in correcting this fault.

A. 1. One trick of motion picture projection is to file the gate of the projection machine so as to compensate for the discrepancy on the screen. This, however, is not an advisable method as it does not always cure the distortion and, therefore, should not be relied upon. Probably the best solution to your problem is to change the position of the screen so that a line drawn through the center of it and perpendicular to its plane will be on



Under certain conditions, a motion picture screen must be tilted in relationship to the stage at an angle, determined by the line shown above.

the center line of the projection objective lens. This is clearly shown in our illustration herewith. The center line, E, is drawn so that the angles, F and G, are 90°. and the screen is tilted until this line strikes the objective on the projector as shown. When the screen is in this position, lines drawn from the lens to the four corners of the screen as at A, B, C and D, will be of equal length. We are sure that if you follow this procedure you will have no further trouble with distortion of pictures.

**METALLIC CLOTH**

(1961) Q. 1. Edward Butts, Georgetown, Colo., asks us to describe a process whereby metallic copper may be precipitated from its salts upon cloth.

A. 1. Your problem of charging a piece of cloth with metallic copper is a peculiar one. If a copper salt such as the sulphate is treated with hypophosphorous acid or with a solution of sodium hypophosphite, copper hydride will be precipitated. If this is heated to 60° C. (140° F.) the hydrogen will be expelled and metallic copper will remain. The copper will be very finely divided.

Saturate your cloth with copper sulphate solution, dry it, immerse in, or better, distribute sodium hypophosphite over it with an atomizer and heat to above temperature. You will then have metallic copper all through the cloth.

This may answer your purpose; it is the best suggestion we can give.

Q. 2. How can gelatine be made insoluble?  
A. 2. To make gelatine insoluble use potassium bichromate and expose to sunlight. Also try formaldehyde.

**STORAGE BATTERY TROUBLE**

(1962) Q. 1. E. H. Discher, Columbus, Miss., asks what causes a storage battery to lose its charge when standing idle.

A. 1. Your trouble is diagnosed as being an internal or self-discharge. You can readily detect it by a drop in voltage.

In order to verify this, see whether the battery will hold charge on standing idle, whether there are any impurities in the electrolyte, whether it gradually loses its current capacity, whether there is a drop in specific gravity, whether it is abnormally sulphated and if it gasses while standing idle. Your troubles may be remedied by renewing the electrolyte, renewing defective separators, eliminating short circuits and keeping the battery clean, especially where the terminal and connection posts are made.

**NATURAL STEAM**

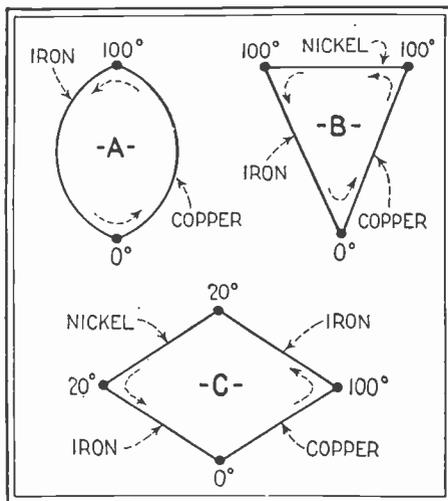
(1963) Q. 1. John Hawkins, Cedarville, Calif., asks how the extraction of steam from natural sources is accomplished.

A. 1. Large pipes are driven into the ground at advantageous points near volcanoes or hot springs so that they tap underground rivers of hot water. The steam and vapor from the same is then conducted upward through the pipes and used for any purposes to which they can be put.

**THERMOCOUPLES**

(1964) Q. 1. James Malone, Stamford, Conn., asks: Does the introduction of a metallic wire or other circuit in that of a thermocouple make any difference in the actual operation of the couple?

A. 1. No, providing the terminals of the metal that is not one of the thermo elements, are at an equal temperature. Referring to the three small drawings herewith makes this clear. In all three circuits the electro-motive force is the same or on the order of .001 volts for a difference in temperature of 100° C. (212° F.) between the hot and cold junctions. In Fig. A, only iron and copper are used with the usual result. In Fig. B, a length of nickel wire has been introduced into the circuit and when its terminals are at the same



Thermocouples operate just as well with a third metal in the circuit, providing the terminals of that metal are at equal temperatures. More details on the three figures shown above will be found in the text.

temperature, in this instance 100°C., the E.M.F. in the circuit is the same as in Fig. A. In Fig. C, the nickel wire is at another point in the circuit, distant from the 100° junction. Its terminals are at a temperature of 20° each, but the result is still the same. The circuit will deliver the same E.M.F. as Fig. A.

**CARBON PAPER**

(1965) Q. 1. D. B. Baskerville, Salem, Va., asks for some details on carbon or duplicating papers.

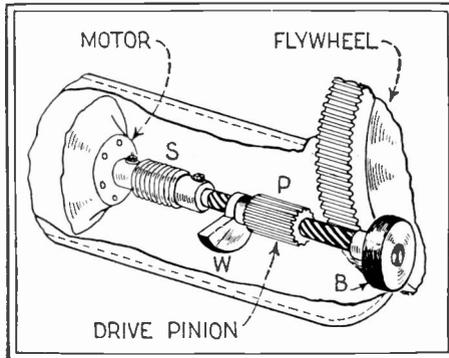
A. 1. Many carbon papers act by virtue of a detachable pigment, which, when the pigmented paper is placed between two sheets of white paper, and when the uppermost paper is written on, transfers its pigment to the lower sheet along lines which correspond to those traced on the upper paper and, therefore, gives an exact copy of them on the lower sheet.

The pigments used are fine soot or ivory black, indigo carmine, ultramarine, and Paris blue, or mixtures of them, and various others. The pigment is intimately mixed with grain soap and then rubbed onto thin but strong paper with a stiff brush. Fatty oils, such as linseed or castor oil, may be used, but the grain soap is preferable. Graphite is frequently used for black copying paper. It is rubbed into the paper with a cotton pad until a uniform light-gray color results. All superfluous graphite is then carefully brushed off.

**BENDIX DRIVE**

(1966) Q. 1. Adolph Peters, Orange, Texas, asks how the Bendix drive, which connects the starting motor of an automobile engine with the fly-wheel, operates.

A. 1. We illustrate herewith and describe below the exact operation of this device. It acts on the principle of inertia. When the starting motor is actuated by means of the storage battery, the inertia of the weight W causes it and the pinion P to travel forward along the triple thread screw called the lead screw. The ends of the pinion teeth and the teeth on the fly-wheel are beveled so that they can mesh easily. The inertia serves to engage them firmly, whereupon the starting motor turns the fly-wheel and consequently turns the engine until it starts. Immediately that this happens, the direction of the driving force is reversed and instead of the pinion



A diagram of a standard Bendix gear for automobile starting motors is shown above and described in this column.

driving the fly-wheel, the fly-wheel drives the pinion. Therefore, the pinion is thrown out of mesh with the fly-wheel. The bearing, B, serves to steady the entire assembly and the spring, S, permits some play to take place between the motor shaft and the lead screw. It thus takes up the shock which naturally takes place when the gears engage.

**GAS PRESSURE**

(1967) Q. 1. F. R. Kiedinger, New Orleans, La., asks: If I have one cubic foot of air compressed to 100 pounds per inch at a temperature of 50° Centigrade, how many cubic feet of air will result if the temperature is raised to 100° C, presuming that the air is kept at a constant pressure of 100 pounds?

A. 1. The answer to this query depends upon Charles' law of gases and the absolute temperature scale. The latter, for any degree Centigrade can be obtained by adding that figure to 273. The initial pressure of the gas has no bearing upon the result in this particular calculation and the

$$\frac{V}{T} = \frac{V_1}{T_1}$$

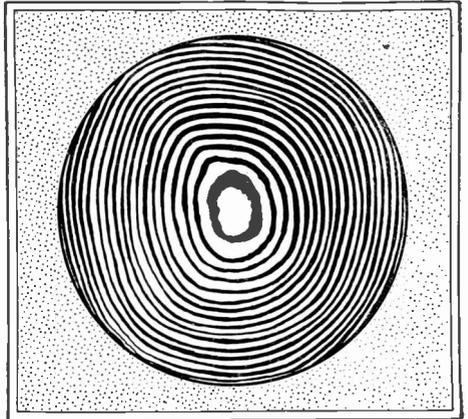
plus the initial temperature and  $T_1$  is equal to 273 plus the final temperature.  $V$  equals the starting volume. In your particular problem, the air under a constant pressure will expand so as to occupy 1.15 cubic feet. The figures representing  $T$  and  $T_1$  are known as the absolute temperatures.

**NEPTUNE**

(1968) Q. 1. Joseph Caverson, West New York, N. J., has been told that the planet Neptune cannot be seen with the naked eye and that it was discovered by calculation. He asks if this is true.

A. 1. Yes, this is entirely true. The planet Neptune is 2,800,000,000 miles distant from the sun and takes 164 earth years to travel around that heavenly body. The planet was first discovered by calculation and these calculations were started by observations of the planet Uranus which did not move in accordance with the predictions made by astronomers. Many prominent men connected with this work investigated the reasons for the erratic movements of Uranus and

by means of a series of calculations spread over a period of years, they reached the conclusion that an unknown heavenly body was present in a certain position. A search with telescopes was made, and within half an hour the new planet was discovered in almost its exact calculated position. This took place on September 23, 1846, and the credit goes to John C. Adams, an Englishman, and Urbane Leverrier, a Frenchman.



Newton's rings formed as described here take the appearance illustrated above. Note the gradations of widths of the rings.

**NEWTON'S RINGS**

(1969) Q. 1. Richard Fleischer, Miami, Fla., asks: What are Newton's rings?

A. 1. These rings are formed when a convex lens of very large radius of curvature is placed in contact with a flat plate and the combination is illuminated by any light. With a so-called monochromatic light, such as the sodium light, the surface of the circular area between the slightly curved lens and the glass plate will be seen to be covered with alternate dark and bright concentric rings. If a white light is used, colored rings will be seen surrounding the point of contact between the lens and the plate. These rings will correspond to definite thicknesses of the air film. The illustration herewith shows the appearance of Newton's rings viewed under sodium light. They are due to interference of light.

**CASEIN**

(1970) Q. 1. A. Hering, Brooklyn, N. Y., asks us to tell him what part of the milk adheres to the walls of the pot when milk is boiled, and wants to know how this can be avoided.

A. 1. When milk is boiled, the casein contained therein adheres to the walls of the pot. This cannot be prevented.

**POWDER FIRE EXTINGUISHERS**

(1971) Q. 1. A. Yust, San Francisco, Calif., asks about the efficiency of fire extinguishing powders and also for formulas for the same.

A. 1. The efficiency of various powder fire extinguishers is questioned by some authorities. We give you herewith two formulas for making up powder fire extinguishers, but cannot guarantee them. You should test them before placing too much faith in their fire-extinguishing abilities:

- No. 1
- Alum ..... 24 parts
  - Ammonium Sulphate ..... 52 parts
  - Ferrous Sulphate ..... 4 parts
- No. 2
- Sodium Chloride ..... 6 parts
  - Ammonium Chloride ..... 6 parts
  - Sodium Bicarbonate ..... 8 parts

Fine sand or earth also make excellent extinguishers for gasoline and oil fires.

**CLEANING COPPER**

(1972) Q. 1. W. C. Albers, Chicago, Ill., asks: Can you tell me one or two good methods for cleaning the black coating from copper surfaces? This is for use in cleaning the copper tub in a washing machine that becomes black due to a continued action of soap upon it.

A. 1. Hot caustic soda should readily remove the black coating of dirt on the copper tubs. You must remember that caustic soda is injurious to the hands and must be used with extreme care. Try household ammonia but wash out every trace of it with clean water.

Another way in which to clean this would be to use wool grease, 46 parts by weight, fire clay, 30 parts, paraffin, 5 parts, Canova wax, 5 parts, coconut oil, 1 part and 1 part oil of Mirbane. After mixing these definite ingredients which constitute a paste, this is molded in order to give a cylindrical form and introduced into a case so that it can be used like a stick of cosmetic. This paste is not injurious to the hands, but "elbow grease" must be used in order to get the dirt off. You might try vinegar and salt or vinegar and oxalic acid after which you must wash the tub thoroughly and polish with sweet oil.

# \$15,227.00

PAID BY

## SCIENCE and INVENTION Magazine

During the Past Year

**T**HIS issue brings to a close the second fiscal year of SCIENCE AND INVENTION Magazine's monthly prize contest. During the year of 1924 SCIENCE AND INVENTION paid the sum of \$13,320.00 to 1,112 prize winners. These prize winners submitted articles to this publication, and when published were awarded prizes by the judges in accordance with the \$1,000.00 monthly contest.

During the past year this publication has paid \$15,227.00 for articles alone appearing in this magazine. This figure is exclusive of a great many special prize contests which this magazine is still offering. For instance, the \$11,000.00 prize contest for proofs of psychical phenomena has not yet been collected. Consequently this prize contest is still open. Those attempting to compete for awards must demonstrate their ability to produce any sort of a psychical phenomenon. These are outlined in the rules. Joseph F. Rinn and SCIENCE AND INVENTION Magazine have brought the total amount for the awards up to \$11,000.00 for such proofs.

Then there is the Perpetual Motion prize contest offering \$5,000.00 in awards. This likewise has not been collected, nor has anyone sent a working model of a perpetual motion machine to these offices. We merely desire the privilege of examining the machine, and will return it to its inventor and

will pay him \$5,000.00 on condition that his machine is a perpetual motion device. This prize offer is made merely to protect the many investors who would like to place money in perpetual motion machine stock.

And now we come to another prize contest—the banner feature of the year. This is the \$5,000.00 prize contest announced elsewhere in this issue for models built entirely of matches. The article speaks for itself and you, your friends, your colleagues, your daughters, your sons or school pals may try for the prizes. The editors advise that you look through this issue and read about this interesting pastime, which has already taken the country by storm.

In order to make room for more text this page of prize announcements published monthly will be discontinued, and the new prize announcements will be published from time to time elsewhere in the magazine.

Beginning with the January issue SCIENCE AND INVENTION will pay a regular rate of two cents a word for material accepted and published. Photographs will be paid for at a rate of \$2.00 apiece for all those accepted and published. Special articles will be paid for at special rates. The editors, of course, reserve the right to increase the rate for any articles of particular worth.

### \$1000.00 Monthly Contest Awards

**FIRST PRIZE \$100.00**

New Rescuing Methods for Submariners, by F. W. Horton..... 718

**SECOND PRIZE \$75.00**

How Movie Railroad Wrecks Are Made, by Frank George Kerk..... 723

**TWO PRIZES OF \$50.00 EACH**

Trick Photography in "The Gold Rush," by Edwin Schallert..... 714  
The Strength of Insects, by Dr. Ernest Bade..... 716

**THREE PRIZES OF \$35.00 EACH**

Science in Prison Escapes, by Joseph Fulling Fishman..... 707  
Electric Fountains Float in the River Seine, by A. N. Mirzaoff..... 709  
A Novel Audio Frequency Amplifier, by R. L. Young..... 743

**FIVE PRIZES OF \$25.00 EACH**

Bridge Is Great Engineering Feat, by A. N. Mirzaoff..... 706  
New Fruits, by A. N. Mirzaoff..... 711  
Mineral and Oil Finder, by H. T. Wilkins..... 722  
Finding the Center of Gravity by Experiment, by C. A. Oldroyd, Reporter No. 4433..... 730  
Shadow Pictures, by N. C. Everett..... 731

**FIVE PRIZES OF \$20.00 EACH**

Mathematical Cross-Number Puzzle, by Richard H. Tingley..... 728  
Pocket Metronome, by Dr. Russell G. Harris..... 729  
Sound Gauge, by C. A. Oldroyd, Reporter No. 4433..... 729  
Hygrosopic Motor, by Emile Dion..... 731  
Automatic Storage Battery Filler, by J. Bront..... 777

**TEN PRIZES OF \$15.00 EACH**

Novel Sun Clock, by Ernest Brennecke, Jr..... 717  
Window Control, by Edward L. Salmon..... 729  
An Air Flame, by C. A. Oldroyd, Reporter No. 4433..... 731  
Pigeon Trap, by John Kautzner..... 731  
Book Marker, by T. B. Marsden, Jr..... 732  
Sun Clock, by Francis O. Boyd..... 732  
Rain Alarm, by C. A. Oldroyd, Reporter No. 4433..... 732  
Bottle Filler (author please send address)..... 732  
Multiple Detector, by G. A. Luers..... 775  
Magnifying Readings, by A. E. Jones..... 775

**FIFTEEN PRIZES OF \$10.00 EACH**

Boxing Gloves, by Walter Schwartzmiller..... 732  
Pipe Repair, by Donald Bowie, Jr., Reporter No. 22261..... 732  
Graduate Protector, by A. Eidman..... 732  
Hero's Fountain, by A. A. Blumenfeld..... 732  
Pole Indicator, by F. J. Wilhelm..... 734  
Memo Pad, by Leo Preston..... 734  
Panel Repair, by Wilton F. Swatch..... 734  
Magnetic Broom, by E. L. Dunbar..... 734  
Nailing Thin Wood, by Max Ruschmann..... 734  
Ring Stand, by Jesse Walters..... 734  
Switch, by Robert Aaron..... 777  
Screw Driver, by J. E. Tewksburg..... 777

(No further entries)

**Other Pending Contests**

\$100.00 in prizes awarded for uses of old photographic films. Contest announced in the November, 1925, issue and closes December 30, 1925.

### \$31,000.00 In Prizes Has Been Paid By SCIENCE AND INVENTION MAGAZINE

During the past two years SCIENCE AND INVENTION Magazine has paid more than \$31,000.00 to its contributors and correspondent reporters. During the past year \$15,227.00 has been paid. This magazine now has more than 28,000 reporters in the field. The prizes won by reporters during the past year will be greatly augmented during the coming year, judging by all appearances. Consider the fact that the year 1926 is opening with prize contests totaling \$21,100.00 and no consideration is made of the moneys to be paid to contributors, and no one knows what additional prizes are to be offered our readers during the year.

In order to assist our contributors in obtaining material for this publication, we are still issuing "Reporter" cards. These may be obtained without charge. A sample of our reporter's card is illustrated at the right. If any of our readers desire one, they may secure the same by simply sending a postal card making the request. Address the card to Field Editor, SCIENCE AND INVENTION Magazine, 53 Park Place, New York City.

REPORTER



**SCIENCE and INVENTION**

CORRESPONDENT REPORTER'S IDENTIFICATION

**NO. 10000**

*L. H. Shackerian*

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

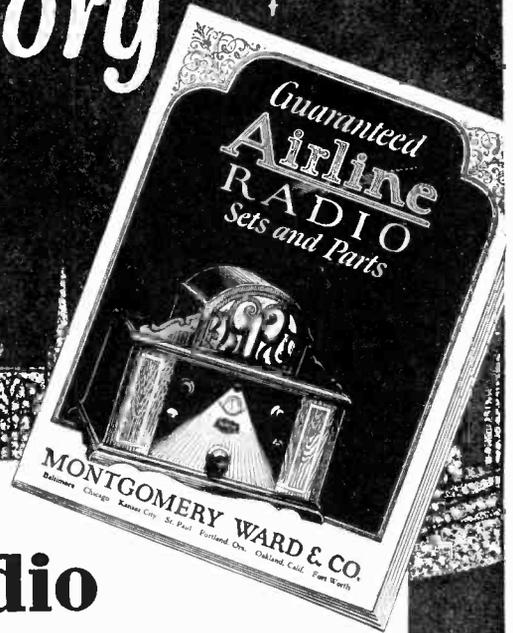
EXPERIMENTER PUBLISHING CO.

*Herms Ball*

PRESIDENT

(Note—Unavailable material not accompanied by postage will not be returned.)

# The World's Greatest Radio Story



## Ward's New Radio Catalogue is Now Ready

Are you interested in seeing what is new in Radio— what is best and what has been approved?

And do you wish to know the lowest prices on tested sets, prices made without the usual "Radio profits?"

### This Catalogue is a Complete Guide to Radio

Ward's is headquarters for Radio, with probably the largest retail radio department in the whole world.

This new 52 page Radio Catalogue shows everything in parts, batteries, cabinets, contains a list of stations, a radio log for recording stations. It shows the best of the new sets. One tube sets that give amazing results.

Five tube sets with a single dial to turn. Think of tuning in one station after another by turning a single dial!

Every price quoted means a big saving to you. Everything offered is tested by our own Radio Experts. In fact, the best experts compiled this Catalogue for you.

Write for this 52 Page Book. It is yours free.

### Our 53 year old Policy

For 53 years we have sold only quality merchandise under a Golden Rule Policy. You can rely absolutely upon the quality of everything shown in this Radio Catalogue.

ESTABLISHED 1872  
**Montgomery Ward & Co.**

The Oldest Mail Order House is Today the Most Progressive  
Baltimore Chicago Kansas City St. Paul Portland, Ore. Oakland, Calif. Ft. Worth

To Montgomery Ward & Co., Dept. 40R.

Baltimore Chicago Kansas City St. Paul  
Portland, Ore. Oakland, Calif. Fort Worth

(Mail this coupon to our house nearest you.)

Please mail my free copy of Montgomery Ward's New Radio Catalogue.

Name.....

Local address.....

Post office.....

State.....

*It stands to reason: There is no substitute for personal, practical training in great shops!*



# ELECTRICITY

—as taught in the Great COYNE Shops—  
**Prepares You for a Big-Pay, Fascinating Steady Job!!!**

Electricity is the Field of Wonderful Opportunities today. It offers BIG PAY, clean, fascinating work and steady employment—anywhere, any time! COYNE-TRAINED MEN are in demand because COYNE training is complete and thorough.

## Complete Electrical Training in 12 Happy Weeks at COYNE

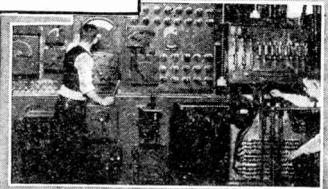
My newly-enlarged Electrical Course is the result of 27 years of experience, solving the needs of young men and of the Electrical Field. My course is absolutely thorough, easy to master, covers every single phase and factor of the subject and fits men for BIG Electrical jobs, HIGH-SALARIED, thrilling jobs.

**YOU DON'T NEED ADVANCED EDUCATION OR EXPERIENCE**

**HUNDREDS OF COYNE Trained Men EARN \$60 TO \$200 A WEEK**

**Earn While You Learn**  
 My EMPLOYMENT DEPARTMENT helps you to get a job to earn part or all of your expenses while training and assists you to a good job on graduation. It stands by you THROUGH LIFE without cost to you.

We are Specialists in teaching Electricity. We have taught it for more than a quarter of a century



Send Right Away for My Big FREE Book and Special Offer of 2 Big Extra Courses. Be sure to send at once for my big FREE BOOK containing 161 actual photos of electrical operations and methods; also my special offer of 2 Big Courses without extra cost. Write today before offer is withdrawn.

# COYNE ELECTRICAL SCHOOL

H. C. LEWIS, President Established 1899  
 1300-10 W. Harrison St., Dept. 5339 Chicago

H. C. LEWIS, President  
 COYNE ELECTRICAL SCHOOL  
 1300-10 W. Harrison St.  
 Dept. 5339 Chicago, Illinois

Dear H. C.—You can just bet I want one of those big handsome FREE 12x15 books with 161 actual photographs of electrical operations and shop scenes, printed in two colors. Send it quick, before the supply is exhausted. Be sure to tell me all about Special Offer of 2 Big Extra Courses.

Name.....  
 Address.....

## Answers to Cross Number Puzzle

(Continued from page 728)

### ANSWERS HORIZONTAL

- 1— $\sqrt{1925} = 12.44$   
 $\div 4 = 3.11$
- 4— $138 \times 16.5 = 2277$   
 $\div 10 = 227.7$
- 7—1914
- 10— $\frac{64}{.359375} = 23 \div 64 = .375$
- 12— $\sqrt{1643} = 11.80$
- 14— $668 \times 12 = 8016$
- 15— $13^3 = 2197 - 93 = 2104$
- 16— $8 \times 8 = 64$
- 18— $\sqrt{.0064} = .08$
- 19— $M1 = 1001$
- 20—334
- 21—180
- 23— $\frac{52}{64} = 52 \div 64 = .8125$
- 24— $29^2 = 841 - 18 = 823$
- 25— $L1 = 51$
- 26—2015 World Almanac
- 27— $384 \times 231 = 88704 + 60 = 88764$
- 29— $1925 - 654 = 1271$
- 30— $\sqrt{.25} = .0625 + .0058 = .0683$
- 31—MDCCCIII = 1803
- 32—CCLXXVI = 276 : 1925 = 276 = 1649
- 33—69 World Almanac
- 34—1789
- 35—1920
- 36—"Charge of the Light Brigade" — 400 Tennyson\*
- 37—969 Genesis V = 27
- 38—10000 — 5 = 9995
- 39—CII = 202
- 40—12
- 41—1925
- 42— $5280 \times 10 = 52800$   
 $2812 \times 3 = 8436$   
 $\frac{61236}{8436} = 7.26$
- 44— $39.37 \times 203 = 7992 + 4 = 7996$
- 45—2240
- 46— $1775 - 736 = 1039$
- 47— $1925 + 95 = 2020$
- 48—The maiden's name was IO
- 1— $\frac{22}{40} = 55\%$
- 2— $13^2 = 169 - 11 = 158$
- 3—MCM = 1900  
 $\frac{10}{10} = 1000$
- 4—276
- 5— $5^2 = 25$
- 6— $2000 \times 35.5525 = 71105$
- 7—184
- 8—9
- 9—IV. IV. IV. IV. = 4444
- 11— $53 \times 6 = 318$
- 13—CI = 101
- 15— $.45^2 = .2025$
- 16— $396 \times 16 = 6336$
- 17— $43560 \times .1872 = 8154$
- 19— $1066 + 45 = 1111$
- 20—\$32.73 — From tables
- 22— $3 \times 27 = 81$
- 23— $299 \times 27 = 8073$
- 24—\$.8889—From tables
- 26— $47^2 = 2209$
- 27— $320 \times 27 = 8640$
- 28— $\sqrt{1840} = 42.90$
- 29— $14 \times 128 = 1792$   
 $\div 97 = 1889$
- 30— $\frac{4}{64} = 4 \div 64 = .0625$
- 31— $106.79 \times 16.5 = 1762$
- 32— $1925 + 70 = 1995$
- 33— $47 \times 128 = 6016$   
 $\div 7 = 6023$
- 34—1915
- 35—19.26—From tables
- 36—4020
- 38—IX. IX. IX. IX. = 9999
- 39— $2240 - 100 = 2140$
- 40—19.3 cents
- 42—622
- 43— $50 \times 12 = 600$
- 44— $IX^2 = 81$   
 $\frac{X1}{70} = 11$
- 45—20 From tables  
 \*Eraatum. Correct number is 600.

1	3	2	1	3	4	2	5	8	6	7	1	8	9	1	4
10	3	5	9	3	7	5	1	1	8	0	4				
			14	8	0	1	6		15	2	1	0	4		16
17	8		18	0	8		19	1	0	0	1		20	3	3
21	1	8	0		23	8	1	2	5		24	8	2	3	
25	5	1		26	2	0	1	5		27	8	8	7	6	4
	4		29	1	2	7	1		30	0	6	8	3		2
			31	1	8	0	3		32	1	6	4	9		33
34	1	7	8	9		35	1	9	2	0		36	4	0	0
37	9	6	9		38	9	9	9	5		39	2	0	2	
40	1	2		41	1	9	2	5		42	6	1	2	3	6
	5		44	7	9	9	6		45	2	2	4	0		0
			46	1	0	3	9		47	2	0	2	0		48

## Refrigerated Theatres

(Continued from page 713)

ence as regards the transmission of colds or other disease germs.

As will be seen from the accompanying drawing by Mr. Wall, one section of blowers and water sprayers on the roof take care of the air which is blown down through the openings in the ceiling of the auditorium, while another section of blowers and sprayers take care of the air blown through the openings in the proscenium arch.

This same air circulation system is well adapted for winter-time heating and ventilating, and in this case the carbon dioxide cooling plant in the basement is not used. The circulating fans on the roof and the water sprayers are used to wash the air and properly humidify it, and in connection with this part of the circulating scheme, steam heat is provided in the air conditioning chambers, so that warm air of the correct temperature and humidity is blown out through the openings in the ceiling and proscenium arch.

Most of the information given and the opportunity for our artist to inspect the plant thoroughly is due to the courtesy of Mr. George O'Day, chief engineer of the Capitol Theatre. It is interesting to remark in closing that the carbon dioxide gas used

in operating this huge cooling plant is particularly well adapted for its important role, due to the fact that it is colorless, odorless, tasteless, non-poisonous and is also very effective as a fire extinguishing medium. The engineers who installed the apparatus also state that mechanical refrigeration helps to eliminate excess moisture from the air, and thus what was once a dream of the progressive theatre manager has come to be a real live actuality; namely, "twenty degrees cooler than the street." If you don't believe it, try it!

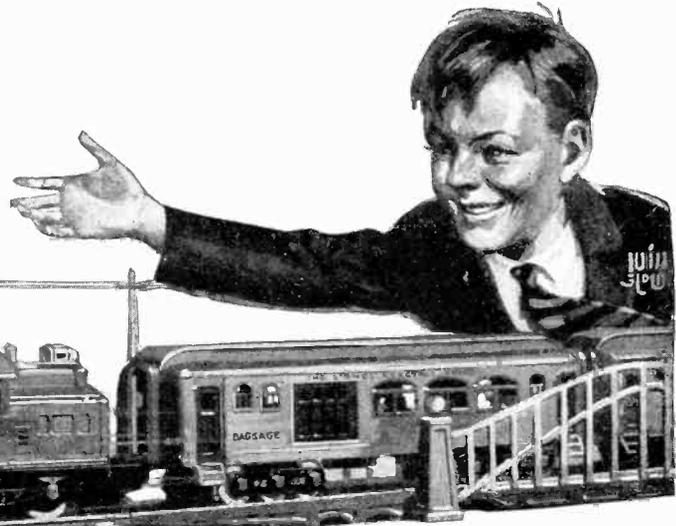
## THE LATEST HOBBY \$5,000.00 For Models

Models made of match sticks are simple in construction, inexpensive to make and may win for you part of the \$5,000.00 that SCIENCE AND INVENTION Magazine is offering for this work. See the article in this issue for full and complete details.



**The Late A. H. Smith**  
Famous President of the New York Central Lines, under whose direction the gigantic task of electrifying the road from New York City to Harmon, N. Y., was accomplished.

\* \* \*  
The boys who today are learning railroad principles by running their Lionel Model Railroads are fitting themselves to be America's transportation leaders of the future.



*Lionel Automatic Train Control. The greatest achievement in model railroad engineering. Starts and stops trains automatically. Just one of the many wonderful realistic railroad devices in the Lionel line of Accessories.*



## Lionel Trains and Real Trains Differ Only in Size!

**W**HEN you wake up on Christmas morning and see your own Lionel Model Railroad—

You'll be the happiest boy in town.

Lionel engineers are skilled in the art of developing electrically and mechanically perfect Model Trains and Railroad Accessories in exact reproduction of the latest big electric railroad devices.

For twenty-five years they have built Lionel Model Railroads, Multivolt Transformers and Model Railroad Accessories that *look like* real trains and *work like* real trains.

Lionel Standard Locomotives for 1925 are more powerful than ever. They are equipped with the wonderful "Three-point armature shaft bearing Super-Motor" and new reduction gearing that greatly increase hauling power and reduce current consumption.

Be sure to examine the great detail of Lionel Locomotives, Coaches and Accessories—the powerful 8-wheel, twin-motor locomotives for both Standard and "O" Gauge Track—real electric headlights—Lionel automatic couplers—the latest 6-wheel trucks on

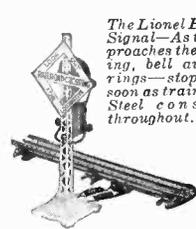
the largest Pullman and observation cars—interior car lighting—everything that represents a real railroad.

Take father and mother to your store to see these amazing Lionel Model Railroads. Then you'll know and they'll know why more Lionel Railroads were sold last year than any other make. And remember: Lionel trains are lowest in price consistent with high quality—complete outfits from \$5.75 up. (Slightly higher in the far West.)

*For sale at all good toy, hardware, sporting-goods, electrical and department stores.*

**THE LIONEL CORPORATION**  
Dept. G, 48-52 E. 21st St., New York City

The new Lionel catalog is a wonder book of model railroads—44 pages in actual colors. It shows the complete Lionel Line. Send for it today—it's free.



*The Lionel Bell Warning Signal—As the train approaches the grade crossing, bell automatically rings—stops ringing as soon as train has passed. Steel construction throughout.*



*No miniature railroad is complete without the new Lionel Automatic Crossing Gates. Down goes the gate as the train approaches—up again when the train has passed. It works by itself—just like the real ones.*



*Lionel "Multivolt" Transformers—Ever-reliable power plants. Run all trains best. A type for every size train.*

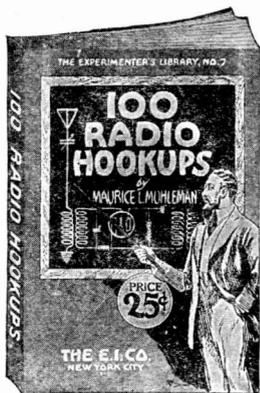
"STANDARD OF THE WORLD SINCE 1900"

# LIONEL ELECTRIC TRAINS

MODEL RAILROAD ACCESSORIES

## "MULTIVOLT" TRANSFORMERS

# 100 RADIO HOOK-UPS



## 3rd Edition

Completely revised  
rewritten and  
enlarged.

16 Pages of the  
Latest Hook-ups Added

The most complete, practical and up-to-date radio hook-ups book obtainable. Revised and brought up to the minute by one of the foremost radio engineers in the industry.

Contains only practical, efficient hook-ups. Crystal sets, one tube sets, reflex, regenerative, radio frequency, and super circuits.

Gives complete wiring diagrams and full instructions on each and every set so that nothing further is needed in the way of patterns or diagrams.

One of the finest books to have on hand at all times for reference as to the various types of hook-ups and the most practical way of constructing each. Send for or buy a copy today.

ALL ORDERS FILLED  
WITHIN 24 HOURS

You Can Obtain a Copy  
at All Reliable Radio  
and Newsdealers



Prepaid

**E.I. Company**  
CONSRAD COMPANY, Inc.  
Selling Agents  
233 Fulton St., New York

## Tarrano the Conqueror

(Continued from page 725)

"I would like to have you very much, indeed." She added to Tarrano, and there was on her face a look of feminine guile:

"You, of course, could not refuse me so small a favor? After all your protestations—"

He gestured impatiently. "Very well." And he added to Tara: "You will serve the Lady Elza as she directs."

He stalked away into the darkened passage. In the gloom there, he stopped and again faced us; the light from a small blue tube in there illumined him dimly. He was smiling ironically.

"I shall maintain the instruments for you. The mirrors will show you Georg and Maida. They are just about arriving at the Mountain Station. Watch them! You will see how far they progress with their wonderful speeches."

He left us. We heard his measured tread as he stalked down the tower incline. The barrage about the tower was lifted momentarily as he went out. Then it came on again, with its glow beyond our casements, and its low electrical whine.

### ELZA IN DANGER

I was just turning back to the room when a sound behind me made me face sharply about. My heart leaped into my throat. The woman Tara had produced from about her person a weapon of some kind. She thought she was unobserved, but from the angle at which I stood, I saw her. A gleaming metal object was in her hand. And then she launched it—a small flat disc of metal, thin, and with its circular edge keen as a knife-blade.

Whirling with a very soft hum hardly audible, it left her hand and floated upward across the room. Circling the casements up near the ceiling, and then heading downward straight for Elza! And I saw, too, that the woman was guiding it by a tiny radio-control at her girdle.

The thing was so unexpected that I stood gaping. But only for an instant. I saw the deadly whirling knife-disc sailing for Elza . . . It would strike her . . . shear her white throat. . . .

With a shout of horror and anger, I leaped for the woman. But Wolfgar, too, had seen the disc; and he resumed and acted better than I. The divan was beside him. He snatched up a pillow: flung it upward at the disc. The soft pillow struck the disc; together, entangled, they fell harmlessly to the floor.

I was upon the woman, snatching the handle of the control-wire from her hand, wrenching its connection loose from her robe. Under my onslaught, she fell; and I kneeled beside her, gripping her while she tore at me and screamed with hysterical, murderous frenzy.

### CHAPTER XIII LOVE—AND HATE

I did not harm this Tara, though I was sorely tempted to; and after a moment we quieted her. She was crying and laughing by turns; but when we seated her on the divan she controlled herself and fell into a sullen silence. Elza, pale and frightened at her escape, faced the woman, and waved Wolfgar and me aside. Strange little Elza! Resolute, she stood there, and would brook no interference with her purpose. Wolfgar and I withdrew a pace or two and stood watching them.

Tara's breast was heaving with her pent emotion. She sat drooping on the divan, her face buried in her hands.

Elza said gently: "Why did you do that, Tara?"

There was no answer; only the woman's catching breath as she struggled with her sobs. Across the background of my consciousness came the thought that Tarrano or one of his guards would doubtless momentarily appear to investigate all this turmoil. And I was vaguely conscious also that from our instrument room the sounds of an unusual activity were coming. But I did not heed them. Elza was insisting:

"Why did you do that, Tara? Why should you want to harm me?"

Tara looked up. "You have stolen the man I love."

"I?"

"Yes. Tarrano—"

She broke off, set her lips firmly together as though to repress further words; and her fine grey eyes, filled with unbidden tears, were smoldering to their depths with hate.

Impulsively Elza sank to the floor beside the woman. But Tara drew away.

Elza said: "Tarrano—he is a wonderful man, Tara. A genius—the greatest figure of these three worlds. . . ."

My heart sank to hear her say it! " . . . a genius, Tara. You should be proud to love him. . . ."

"You—" The woman's writhing fingers seemed about to reach for Elza. I took a sudden step forward, then relaxed. Elza added quickly:

"But I would not steal Tarrano from you. Don't you realize that?"

"No!"

"But it's true."

"No! No! You have stolen him! With your queer Earth-beauty—that colored hair of yours—those rounded limbs—you've bewitched him! I can see it. You can't lie to me! I made him angry once and he admitted it."

"No. I tell you!"

"I say yes. You've stolen him from me. He loves you—and he mocks and laughs at me—"

"Tara, wait. I do not love Tarrano. I tell you. I would not have him—" How my heart leaped to hear her say it so convincingly. She added:

"He loves me, perhaps—but I can't help that. He has me prisoner here. I am forced—"

"You lie! You are playing to win him! What girl would refuse? You say yourself he is the greatest man of the ages. You lie when you tell me you do not want him!"

Elza had taken the woman by the shoulders. "Tara, listen—you *must* listen! Are you mated with Tarrano?"

"No! But years ago he promised me. I took his name then, as we do in the Cold Country. They still call me Tara! Years I have waited, true to my promise—with even my name of maidenhood relinquished. *His* name—Tara! And now he tosses me aside—because *you*, only an Earth-woman, have bewitched him."

"I didn't want to bewitch him, Tara." Elza's voice was very gentle; and a whimsical smile was plucking at her lips. "You think I want him because he is a genius—the greatest man of our time?"

"Yes!"

"Is that why *you* want him?"

"No, I love him."

"You loved him before he was very great, didn't you?"

"Yes. Back in the Cold Country. When he was only a boy—and I was no more than a girl half grown. I love him for himself, I tell you—"

Elza interrupted; and her voice risen to greater firmness, held a quality of earnest pleading.

(Continued on page 756)

### LUMINOUS PAINT

**Make Your Watches, Clocks, Etc., Visible by Night**

The very latest discovery in the scientific world. Hitherto, practically unobtainable except at an exorbitant price, we have succeeded in producing this remarkable LUMINOUS PAINT which applied to the surface of any article, emits rays of white light, rendering it perfectly visible in the dark. THE DARKER THE NIGHT, THE MORE BRILLIANT IT SHINES. Quite simple to use. Apply to the dial of your watch or clock with the push buttons or switch plates of your electric lights, match boxes, and innumerable other articles; make your own Luminous Crucifixes, Luminous Rosaries, etc. Bottle containing sufficient to coat several articles. Price 25c. Larger sizes 50c and \$1 postpaid. Johnson Smith & Co., Dept. 329 Racine, Wis.

### The "Little Giant" Typewriter

**A First Class Writing Machine For \$1.50**



A perfect little typewriter for \$1.50. There are thousands of persons who would like to use a typewriter, but whose needs and business do not warrant the expense attached to the purchase and use of a fifty or seventy dollar machine. To such persons we confidently recommend our Little Giant. It is a simple, sturdy machine in construction, so that anyone can quickly learn to operate it, and write as rapidly as they would with pen and ink. The letters of the alphabet are printed on the type, so that the numerals 1 to 10, and the punctuation marks, are printed in the same way. You can send your best typewritten love letters, address envelopes, make out bills, and do almost any kind of work not requiring a large, expensive machine. With each typewriter we send a tube of ink and full printed instructions for using the machine. Price complete \$1.50 by mail postpaid to any address in the world.

### Every Boy His Own Toy Maker

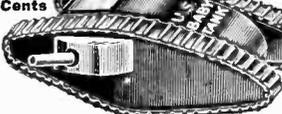
Greatest boys' book written. Tells how to make a Pinhole Camera, a Canoe, model Railroad, a Telephone, Boomerang, Telegraph Instrument, Box Kite, Talking Machine, Microscope, Electric Motor, Electric Door Bell, Water Wheel, Paddle Raft, a pair of Skis, a Dog Sled, Bird House, Rabbit Yard, etc. 64 pages, 150 illustrations. PRICE, 10c postpaid; 3 for 25c.



**GOLD TEETH**  
You know how fashionable it is to have gold crowns—you can afford it. These gold-finished shells fasten over your real teeth and look like very healthy fillings. Can be slipped on and off in an instant. Get some and surprise your friends. PRICE, 6 Cents Each, 3 for 15c, or 50c for 1 doz. postpaid.

JOHNSON SMITH & CO., Dept. 329 Racine, Wis.

### U. S. BABY TANK



It goes with real Yankee Pop—by its own power. Most remarkable toy ever invented. By drawing the Tank backward, either with the hand or over the floor or table and then placing it down, it will crawl along, overcoming all obstacles in the same like-like manner as the larger Tank that proved so deadly in the great war. What makes it go is somewhat of a mystery, for there is no mechanism to wind up as is usually understood with mechanical toys, yet this tank will keep plodding along ten times longer than the ordinary run of toys. It will perform the most wonderful stunts. It will go backward or forward at will. 2 1/2 inches long. Price only 25 cents prepaid.

### BOYS! BOYS! BOYS! THROW YOUR VOICE



Into a trunk, under the bed or anywhere. Lots of fun fooling the teacher, policeman or friends.

**THE VENTRILO**  
a little instrument, fits in the mouth out of sight, used with above for Bird Calls, etc. Anyone can use it.

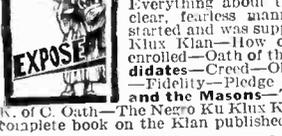
Never Fails. A 32-page book on ventriloquism, and the Ventrilo, ALL FOR 10c postpaid.

### MIDCET BIBLE

**GREAT CURIOSITY**  
Smallest Bible in the world. Size of a postage stamp. 200 Pages. Said to bring good luck to the owner. A genuine work of art. Must be seen to be appreciated. Make good money selling them to friends, church acquaintances, etc. PRICE, 15c. 3 for 40c. 12 for \$1.35, 100 for \$7.50. Also obtainable in Leather Binding, with gold edges. Price 50c each, 3 for \$1.25, \$4.50 per doz. Magnifying Glass for use with Midcet Bible. 15c



### KU KLUX KLAN EXPOSE



Everything about the Ku Klux Klan told in a clear, fearless manner. Book tells all how it started and was suppressed in 1871—The New Ku Klux Klan—How organized—How members are enrolled—Oath of the Klan—Questions for Candidates—Creed—Objects of the Order—Obedience—Fidelity—Pledge of Loyalty—Ku Klux Klan and the Masons—The Jews—The Masons—Real K. of C. Oath—The Negro Ku Klux Klan, etc., etc. Latest and most complete book on the Klan published. Price, 35c, postpaid.

### Female SEX Indicator



### Male SEX INDICATOR



Hold the MAGIC INDICATOR over a man's hand—instantly it moves in a straight line, backward or forward. Hold it over a woman's hand and it describes a complete and continuous circle. The same action can be obtained over a letter written by a man or woman, etc. It is fascinating; baffling. We have never been able to figure out how it's done—but we've never seen it fail. Many novel and entertaining feats may be performed with the Sex Indicator. For example, similar results can be obtained with animals, cats, dogs, rabbits, over birds, chickens, canaries, etc. Also used to determine the sex of chickens and birds, etc., in fact it is sold as a patented egg tester in Europe. Price 25c, or 3 for 65c, postpaid.

A Deluxe Edition of our new 1925 CATALOG mailed on receipt of 25c. Handsome cloth binding. Only book of its kind. 150 pages of all the latest tricks in magic, the newest novelties, puzzles, games, sporting goods, interesting books, chromosome in seeds and plants, etc. Price 25c.

### STAGE MONEY



With a bunch of these bills, it is easy for each person of limited means to appear as a prosperous business man by flashing a roll of these bills at the time and peeling off a genuine bill or two from the outside of the roll. The effect created will be found to be all that can be desired. Prices, postpaid: 40 Bills 20c, 125 for 50c, or 53.50 thousand postpaid.

### Wonderful X-Ray Tube



A wonderful little instrument producing optical illusions both surprising and startling. With it you can see what is apparently the bones of your fingers, the lead in a lead pencil, the interior opening in a pipe stem, and many other similar illusions. A mystery that no one has been able to satisfactorily explain. Price 10c, 3 for 25c, 1 dozen, 75c. Johnson Smith & Co.

### Good Luck Ring



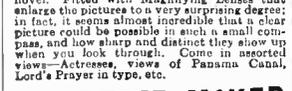
A VERY striking and uncommon ring. Silver finish, skull and crossbones design, with two brilliant, flashing gems sparkling out of the eyes. Said by many to bring Good Luck to the wearer, hence its name, Good Luck Ring. Very unique ring that you will take a pride in wearing. ONLY 25 CENTS.

### Exploding Cigarettes



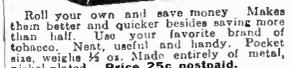
JUST LIKE ORDINARY CIGARETTES. BUT SUCH REAL STARTLERS! The box contains ten genuine cigarettes of excellent quality. They appear so real, but when each cigarette is about one-third smoked, the thin sets a very great surprise as it goes off with a loud bang. A great, mild provoker yet entirely harmless. Price 25c per box.

### Popular Watch Charms



Very pretty little curiosities and decidedly novel. Fitted with Magnifying Lens that enlarges the picture to a very high degree; in fact, it seems almost incredible that a clear picture could be possible in such a small compass, and how sharp and distinct they show up when you look through. Come in assorted views—Admirals, views of Panama Canal, Lord's Eraser in type, etc.

### CIGARETTE MAKER



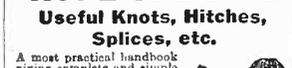
Roll your own and save money. Makes them better and quicker besides saving more than half. Use your favorite brand of tobacco. Neat, useful and handy. Pocket size, weighs 1/2 oz. Made entirely of metal, nickel-plated. Price 25c postpaid.

### MAGIC FLUTE



The Magic Flute, or Human-toned, is a unique and novel musical instrument that is played with nose and mouth combined. There is just a little knack in playing it which, when once mastered, will enable you to produce every sweet musical note that a flute resembles a flute. It can be played all kinds of music with facility and ease. When played as an accompaniment to a piano or any other musical instrument, the effect is as charming as it is surprising.

### NEW BOOK ON ROPE SPLICING



A most practical handbook giving complete and simple directions for making all the most useful knots, litches, rigging, splices, etc. Over 100 illustrations. All about wire rope attachments, latching, blocks, tackles, etc. 37 Heraldic Knots illustrated. Of great value to mechanics, riggers, carpenters, boatmen. Price 20c ppd.

### BLANK CARTRIDGE PISTOL



This well made and effective Pistol is modelled on the pattern of the latest type of Revolver, the appearance of which alone is enough to scare a burglar, whilst, when loaded, it will probably prove just as effective as a revolver with real bullets, without the danger to life. It takes the standard 22 Calibre Blunt Cartridges, that are obtainable most everywhere. Even the most timid women can use it with perfect safety and frighten a thief without risk to herself or anyone else. A Great Protection Against Burglars, Tramps and Dogs. You can have it lying about without the danger to other revolvers. We sell large numbers around the 4th of July. Well made of solid Metal. PRICE ONLY \$1.00 Postpaid. Blank Cartridges, 22-cal., shipped by express only, 50c per 100. Johnson Smith & Co., Dept. 329 Racine, Wis.

### Sneezing Powder



Place a very small amount of this powder on the back of your hand and blow it into the air, and everyone in the room or car will begin to sneeze without knowing the reason why. It is most amusing to hear their remarks, as they never suspect the real source, but think they have caught it one from the other. Between the laughing and sneezing you yourself will be having the time of your life. For parties, political meetings, car rides, or any place, all where there is a gathering of people, it is the greatest joke out. Price 10c or 3 for 25c.

### Mystic Skeleton



A jointed figure of a skeleton will dance to music and perform various gyrations and movements while the operator may be some distance from it.

### Serpent's Eggs



Box contains 12 eggs. When lit with a match, each one gradually hatches itself into a snake as a snake grows a foot long, while it is hatching and twists about in a most lifelike manner. Price per box 10c ppd.

### Microphone Transmitter Button



You can easily make a highly sensitive detectophone by using this Transmitter Button to collect the sound waves. You can build your own outfit without buying expensive equipment. It is simple and inexpensive. You can install an outfit in your home and hear conversations being held all over the house. You can connect up your rooms of a hotel. This outfit was used by secret service operatives during the war. It is built used on the stage. It is ultra-sensitive and is the greatest invention in microphone. Persons mount the button almost anywhere—card board boxes, stove pipes, staff calendars, on the wall behind a picture frame, etc. Button is so light and small it cannot be detected. Persons can be overheard without suspecting it. You can listen in on conversations in another room. A deaf person in the audience can hear the speaker. Connected to phonograph, piano or other musical instrument, music can be heard hundreds of feet away. Button may be used to renew telephone transmitters; often makes an old line "talk-up" when nothing else will. The ideal microphone for radio use; carries heavy current and is extremely sensitive. Amplifies radio signals. Countless other similar uses will suggest themselves. Experimenters find the button useful for hundreds of experiments using the lines of telephones, amplifiers, loud speakers, etc. Many fascinating stunts may be devised, such as holding the button against the throat or chest to reproduce speech without sound waves. \$5.00 is given to anyone who sends in a new suggestion for the use of the Button providing the manufacturer and it suitable for use in their literature. PRICE \$1.00 POSTPAID ANYWHERE.

### ANARCHIST BOMBS



One of these glass vials dropped in a room full of people will cause more consternation than a hamburger cheese. The small can be overheard in a split second. 10c a Box, 3 Boxes for 25c.

### INVISIBLE INK



The most confidential messages can be written with this ink. Nine separate articles in one. Everybody delighted with it. Odd, curious and interesting. Lots of pleasure as well as very useful. It is a double microscope for examining the wonders of nature. It is also an Opera Glass, a Stereoscope, a Burning Lens, a Reading Glass, a Telescope, a Compass, a Pocket Mirror, and a Laryngoscope for examining eye, ear, nose and throat. It is worth all the cost to locate even one painful cinder in the eye. Folds flat and fits the pocket. Something great—you need one. Don't miss it. Sent by mail, postpaid. Price, only 35c or 3 for \$1.00 postpaid.

### LOOK 35c Look



Wonderful Instrument. Greatest thing yet. Nine separate articles in one. Everybody delighted with it. Odd, curious and interesting. Lots of pleasure as well as very useful. It is a double microscope for examining the wonders of nature. It is also an Opera Glass, a Stereoscope, a Burning Lens, a Reading Glass, a Telescope, a Compass, a Pocket Mirror, and a Laryngoscope for examining eye, ear, nose and throat. It is worth all the cost to locate even one painful cinder in the eye. Folds flat and fits the pocket. Something great—you need one. Don't miss it. Sent by mail, postpaid. Price, only 35c or 3 for \$1.00 postpaid.

### RESURRECTION PLANT



One of the most wonderful plants known. Possesses the strange power of turning in a few minutes from an apparently lifeless, dry herb to a BEAUTIFUL LIVING FERN-LIKE PLANT of a dark green color. Simply place the plant in saucer of water, it will open up and start to grow in 20 minutes. When taken out it will dry up and go to sleep on placed in water again. House plant—summer or winter. 10 cents each or 3 for 25c. Agents Wanted postpaid.

ADDRESS ORDERS FOR ALL GOODS ON THIS PAGE TO  
**JOHNSON SMITH & CO., DEPT. 329, RACINE, WIS.**

Postage Stamps Accepted



# "How I Earn \$112 a Week Having Lots of Fun"

And I Learned Cartooning Easily —At Home!

IT was much easier than I ever dreamed—learning cartooning at home in spare time. I don't think I could have drawn a straight line when I started, yet it wasn't long before I was making real cartoons. I actually sold enough work during my training to pay for it! That may seem remarkable, but it isn't. I know lots of chaps who have done the same thing. In the Washington School of Cartooning course everything is made so clear and easy that you can't help but get ahead quickly. That's the wonderful part about it. When I think of how hard I used to work, I thank my lucky stars for enrolling in this famous school. Right now I'm earning \$112 a week and my work is really fun."

The above is typical of what many of our students say about this new easy way of learning cartooning. Hundreds have found it a quick way of increasing their earning power, a sure way into a pleasant, high-paying career.

Never before have the opportunities in cartooning been so great. Millions of dollars were spent last year by newspapers and magazines for good cartoons. And more will be spent this year. The demand for good cartoonists cannot be met. Many are needed right now.

You, too, can easily enter this fascinating profession. You don't need to have any talent. No matter if you've never touched a drawing pencil, this wonderful method makes it easy to learn cartooning. And it's actual fun this new "at home" way.

## Personal Instruction Method

You start right in with straight lines and curves. Then you learn sketching, the little tricks of exaggeration, shading. Every bit of your work receives the personal attention and correction of one of America's foremost artists. It's just as if the instructor were at your very elbow!

In a surprisingly short time you should be making real cartoons. And almost before you realize it you should be actually drawing cartoons that sell. Even before finishing their training many of our students sell enough of their work to more than pay for the course.

## Send for FREE Book

Learn more about this profitable profession and how you can quickly master it through just a little of your spare time at home. A wonderfully interesting little booklet which describes this new easy method in detail, and gives you the experiences of many of our students will be sent to you absolutely FREE. Simply mail the coupon TODAY, to Washington School of Cartooning, Room 2612-C, 1113 15th St., N. W., Washington, D. C.

WASHINGTON SCHOOL OF CARTOONING, Room 2612-C, 1113-15th St., N. W., Washington, D. C.

Please send me, without obligation, your illustrated FREE BOOKLET on Cartooning.

Name ..... (Write Name Plainly)

Address .....

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

If under 16 years, please state age.....

## Tarrano the Conqueror

(Continued from page 754)

"Wait, Tara! You love Tarrano for himself—because you are a woman capable of love. It is the man you love—not his deeds, or his fame or his destiny. Isn't that so?"

"Yes. I——"

"Then won't you give me credit for being a woman with instincts as fine as your own? The love of a good woman goes unbidden. You can't win it by conquering worlds and flinging them at her feet. Tarrano thinks you can. He thinks to dazzle me with his feats of prowess. He wants to buy my love with thrones for me to grace as queen. He thinks my awe and fear of him are love. He thinks a woman's love is born of respect, and admiration, and promises of wealth. But you and I, Tara—we know it isn't. We know it's born of a glance—born in poverty and sickness—adversity—every ill circumstance—born without reason—for no reason at all. Just born! And if anything else gives it birth—it is not a true woman's love. You and I know that, Tara. Don't you see?"

Tara was sobbing unrestrainedly now, and Elza, with arms around her, went on:

"You should be proud to love Tarrano. If I loved him, I would be proud of him, too. But I do not——"

A step sounded near at hand. Tarrano stood in the archway, with arms folded, regarding us sardonically.

### CHAPTER XIV DEFYING THE WORLDS

"So?" Tarrano eyed us, evidently in no hurry to speak further, seemingly amused at our confusion. Had he heard much of what the two women had said? All of it, or most of it, doubtless, with his instruments as he approached. But, even with the knowledge of Elza's vehement appraisal of him, he seemed now quite imperturbable. His gaze touched me and Wolfgar, then returned to the women.

"So? It would seem, Tara, that your plan to wait upon the Lady Elza was not very successful." He dropped the irony, adding crisply: "Tara, come here!"

She rose to her feet obediently, and stood facing him. Humble, fearful, yet a trifle defiant. For a moment he frowned upon her thoughtfully; then he said to Elza:

"Your policy of mercy is very embarrassing, Lady Elza." He made a deprecating gesture, and again his eyes were twinkling. "This woman threatened your life. My guards were lax—though I must admit they had good excuse, with the other tasks which I thrust upon them. . . . Your life was threatened—you escaped by the merest chance of fortune. You know, of course, what justice would bid me do to this intending murderess?"

Elza was on her feet, standing beside Tara. She did not answer.

Tarrano now was smiling. "I must let her go unpunished? Embarrassing, this merciful policy to which you have committed me! Yet—your will is my law as you know—though I feel that some day it will involve us in disaster. . . . You, Tara, will not be punished, much as you deserve it." He paused, then said as an afterthought: "You Jac Hallen, I thank you for what you tried to do in thwarting the attack. You acted in very clumsy fashion—but, at least, you doubtless did your best." Gravely he turned to Wolfgar. "I shall not forget, Wolfgar, that, in an emergency, you saved the life of Lady Elza. . . . Enough! These are busy moments. You chose an awkward time to raise this turmoil. Come with me—all of you."

(Continued on page 758)



## Be Playing in 30 Days! Make Big Money!

Happiness—increased earnings—popularity—all await you if you play a musical instrument. The famous LYON & HEALY instruments, favored by experts, are amazingly easy to learn with aid of FREE Instruction Books and Scale Charts furnished you. Wonderful tone qualities—easy blowing and fingering. You can play simple melodies in an hour. Many join bands and orchestras in 30 days!

Come out of the shadows. Get in the swim of popularity! We supply every instrument known. Guaranteed quality. FREE TRIAL! Easy Terms! Only \$9.75 down will bring complete outfit you want. You play as you pay. Don't delay. Write TODAY for catalog! Mention instrument you are interested in.

### LYON & HEALY

67-97 Jackson Blvd., Chicago, Ill.

Band Leaders! Write for Special Arrangement

## 1/2 SAVED on all Standard Typewriters

**AT LAST**—World's best Typewriters with every modern writing feature at positively lowest prices and on easiest terms offered.

**10 DAYS FREE TRIAL**  
A Year to Pay  
**5 YEARS GUARANTEE**

Standard Machines so perfectly Re-Manufactured by the exclusive Young Process that they look and write like brand new. Our exclusive, distinctive process makes possible better typewriters at lower prices.

**FREE BIG ILLUSTRATED TYPEWRITER BOOK**  
Write now. See our amazing typewriter bargains. Read what users say and the unusual service we will give you. Don't wait—write today.

**Young Typewriter Co.** 654 West Randolph, Dept. 116C Chicago, Ill.

Underwood  
Young Process Re-Manufactured  
Looks Like New

**FAMOUS 'COAST TO COAST' MIRACO GUARANTEED**

## RADIO'S-FACTORY PRICES GET SPECIAL OFFER!

Users everywhere report Miraco Radios get programs coast to coast on loud speaker; outperform sets three times as costly. Many hear foreign countries. Radio's most amazing values in guaranteed factory-built, factory-tested long distance sets—let testimony of users convince you.

**MIRACO RADIO GETS 'EM COAST TO COAST**

Powerful New Multi-tube Miraco gets long distance on loud speaker. Set, **\$27.35** retail.

**FREE!** Literature on latest improved 1 to 5 tube models, new low prices, testimony of users and SPECIAL OFFER. Write **AGENTS DEALERS Write!**

**MIDWEST RADIO CORP'N**  
Pioneer Builders of Sets  
409 +E. 8th St., Cincinnati, Ohio

"Build a long distance single tube Radio for less than \$6.00 with my

**"MIMAX" Coil**

Coil, circuit particulars \$1.00 post paid. Add. Thos. Carver, Mgr.

**SPECIALTY SALES CO.**  
Greeley St. Milwaukee, Wis.

"Ask for Catalog"

## "LIGHTING FIXTURES"

**READY TO HANG**

Direct from the manufacturer. Completely wired including glassware. Send for new Catalogue No. 27 (Just reduced prices)

*Special Proposition to Dealers*

**ERIE FIXTURE SUPPLY CO.**  
Desk B Erie, Pa.

# Your Attention, Please—Special Offer

To get you started dealing with us, we offer special prices on these most popular two kits. But your order will have to be sent by December 31 when our regular catalog prices will again be in effect.

Your chance to get the best kit at a *big saving!* Take it!

All of our Kits contain complete parts for receiver, including drilled and engraved Bakelite-Dilecto panel, finest, roomy mahogany finish cabinet, simple new-style blueprint and instructions, everything—nothing more to buy. All parts highest grade—advertised, well-known, reliable, dependable—fully guaranteed by manufacturers and ourselves. Look at these brands. You cannot get better kits!

## Our New Method of Wiring—Perfectly Simple—No Radio Knowledge Needed

No solder—No bare wires—No poor connections—No dissatisfaction.  
No tools needed except a common screw-driver and common pliers.



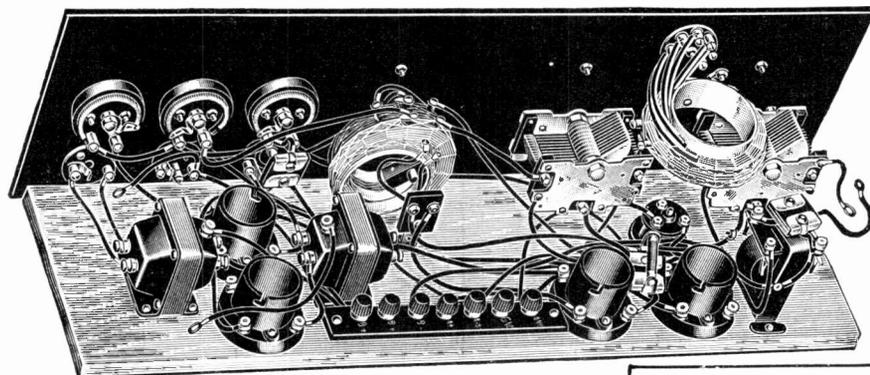
All connections are made by the use of our flexible, insulated eyeletted connecting wire in place of bus bar or wire, and solder. And in a fraction of the time usually required when using the old fashioned way. And when the job is done it is neat and your connections are tight.

### 4-Tube Roberts Knock-Out

Superior to most other sets REGARDLESS OF NUMBER OF TUBES!

**Spl. \$43<sup>57</sup>** Postpaid  
Kit KZ, 9215  
Range 3500 Miles

Combines principles of Reflex, Neutralization, Tuned Radio Frequency, Regeneration (without blooming), and Push-Pull Amplification. Smooth-working—easily tuned—non-howling—non-squealing—non-radiative. Guaranteed absolutely to give entire satisfaction.



### See What You Get—Best Quality

Fine 7x24x8 mahogany finish cabinet, drilled and engraved Bakelite-Dilecto panel, extra good, non-warping baseboard, sickles' Roberts' coils, 2 Hammarlund low loss variable condensers, 3 E-Z Toon vernier dials, Thordarson transformer, pair Modern push-pull transformers, 3 Pa-cent rheostats, 4 Bell Bakelite low loss sockets, Improved single-circuit jack, Improved double-circuit jack, Cutler-Hammer inductance switch, Smilear filament switch, Pa-cent grid leak, Hileco grid condenser and mounting, 2 Hileco fixed condensers, Amplex grid-denser, 7 Aristocrat binding posts, binding post strip, complete set "No-Sod-er" connecting wires, hardware, blueprint and instruction sheet. You can assemble in only three hours or so. List price, \$64.69; our regular catalog price, \$48.56—Special price to December 31, only \$43.57.

### Special Features

Great volume.  
Utmost clearness.  
Sweetness of tone.  
Highly selective.  
(Cheap to build.)  
Easy to operate.  
Receives great distance.  
Does not radiate or cause squealing in your neighbors' receivers.  
Low cost of upkeep.  
It offers a better combination of sensitivity, selectivity and quality for the total cost than any other circuit we have ever known.  
The best 4-Tube set for home construction ever produced.

See what Doubleday, Page & Co., through Mr. Arthur H. Lynch, Editor of their magazine, "Radio Broadcast," say about the Radio Broadcast's sensational 4-Tube Knock-Out Set developed by Walter Van B. Roberts:

"Tube for tube, dollar for dollar, result for result, we will stack it up against any receiver for home construction ever described by any radio publication and gamble that it comes out winner."

### MR. LYNCH ADDS—READ IT!

"It is the best we have ever seen—and we have seen and operated almost every type made and used during the past twelve years. It has pulled in forty-six stations on a loud speaker with two tubes, using an indoor antenna. Its signals have been heard through the air more than a quarter mile. It is not merely the best four-tube receiver, but the best by a very good margin."

### CUSTOMERS PRAISE IT!

Receives Calif. from N. Y. on Two Tubes!

"I have followed the development of the Roberts circuit with results far beyond all expectations. I find it to be EXACTLY as efficient as described, although I was skeptical as to the unusual operation that it was said to have accomplished. I no longer have any doubts, for in the last week of August and to date in September, I have received KGO at least four times. On one of these occasions I received it on my Dictogrand loud speaker, using only two tubes! I have consistently received long distance, such as Dallas, Fort Worth, Auburn, La., Hastings, and Kansas City, in all about 65 stations, while just "fishing" Locals, such as Pittsburgh,

Schenectady, New York City, Chicago, Boston, etc., it need not be mentioned, are perfect, even on occasions when I have used neither aerial nor ground. I am sure it was a lucky day when this set came to my attention." L. L. Clifford, 190 Second Street, Fulton, NEW YORK.

### Selectivity Better than Eight tube Heterodyne

"Last week I constructed the four-tube Roberts Knock-Out set. I am more than pleased by its operation, its selectivity being better than my eight-tube super-heterodyne. On a poor night I was able to bring in WOS, WGN, WOC, WSAI, WBZ, and all at loud speaker intensity." Louis R. Jeffrey, 51 Newark Street, Hoboken, NEW JERSEY.

### 3-Tube LoLos \$26<sup>57</sup> Postpaid—Kit KR6996 Explorer—Spl. Range 1000 Miles on Loud Speaker

**Stations Logged in 2 hours at New York City All on Loud Speaker**

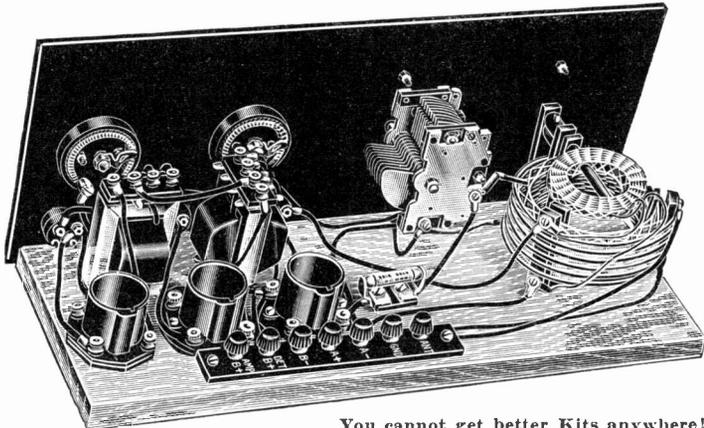
By one of the editors of "Radio News"

WJZ	72	65	N. Y. City
WEAF	86	77	N. Y. City
WFRH	65	21	N. Y. City
WFAM	55	18	St. Cloud, Minn.
WAO	73	40	N. Y. City
WBBH	75	43	Chicago
WJY	72	52	N. Y. City
KDKA	70	32	Pittsburgh, Pa.
WTAS	67	25	Elgin, Ill.
WGBS	67	30	N. Y. City
WFN	72	39	N. Y. City
WJAX	88	48	Cleveland
WIT	75	83	Philadelphia, Pa.
KYW	74	93	Chicago
WOC	83	71	Davenport, Iowa

Positively a "hummer!" We have never tested an outfit at anywhere near our price more suitable for long distance broadcast reception. Contains a low loss 3-circuit tuner, a low loss condenser, low loss sockets, etc. Special Features: Sensitive—Selective—Clear reception—Simple to construct—Simple to operate—Dependable—Low loss design—Receives long distances—Great volume.

### We Give You High-Class Parts

Fine 7x18x8 mahogany finish cabinet, drilled and engraved Bakelite-Dilecto panel, extra good, non-warping baseboard, Gen-Win low loss coupler, Hammarlund low loss variable condenser, 2 Bell Bakelite dials, 2 Rasco verniers, 2 Pa-cent A. F. transformers, 2 Pa-cent rheostats, 3 Bell Bakelite low loss sockets, Improved single circuit jack, 2 Improved double circuit jacks, Smilear A battery filament switch, Hileco fixed grid condenser and mounting, Pa-cent grid leak, 7 Aristocrat moulded binding posts, binding post strip, complete set "No-Sod-er" connecting wires, hardware, blueprint and instruction sheet. You can assemble in only a couple of hours. List price for parts, \$37.84. Our catalog price, \$30.25. Special Price to December 31st, only \$26.57.



You cannot get better Kits anywhere!

This is a dandy! Order it!

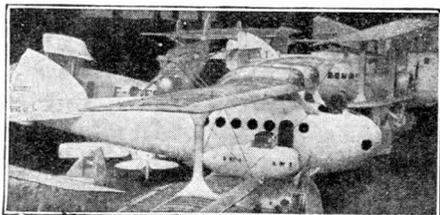
**ORDER DIRECT FROM THIS AD ON APPROVAL NO MONEY IN ADVANCE—SHIPPED SUBJECT TO EXAMINATION WHEN REQUESTED—WE PAY TRANSPORTATION—24-HOUR SHIPMENT—SATISFACTION OR MONEY BACK—OLDEST RADIO MAIL ORDER FIRM IN AMERICA**

(Foreign customers will please remit with order and include enough for transportation and insurance which we do not pay.)

# Send for BIG FREE CATALOG--36 pages

FILLED WITH BIG BARGAINS IN KITS, PARTS AND ACCESSORIES. SEND TODAY!

**RADIO SPECIALTY CO., Kit Div. 165Z, 245R, Greenwich St., N.Y.**



# Aviation Brings Quick Success

**T**O young men of daring no other field of work offers such a fascination, such high pay, nor such opportunities for quick success as the field of Aviation. As yet, aviation is practically in its infancy. But now is the time to get in.

## Amazing Opportunities in Airplane Industries

In the automobile industry and in the moving picture business hundreds of men got rich by getting in at the start. They made their success before others woke up. Today, these lines offer no greater opportunities than a hundred and one others. **BUT AVIATION IS NEW.** Get in while the opportunities are big. All over the country there will be a clamor for trained men. It will not be a question of pay but of getting capable men

## Become an Aviation Expert \$50 to \$100 per Week

The study of aviation is almost as fascinating as the actual work. Every lesson is full of interest. That is why it is easy to learn aviation. You do not have to make yourself study—it is like reading an interesting book that tells you things you have always wanted to know. Only one hour each evening will give you the basic training in a surprisingly short time.

One student, S. F. McNaughton, Chicago, says: "Your lessons are like

### Fascinating—Daring—Big Paying

- Prepare Now for One of These Positions
- Aeronautical Instructor \$60 to \$150 per week
  - Aeronautical Engineer \$100 to \$300 per week
  - Aeronautical Contractor Enormous profits
  - Aviation Repairman \$60 to \$75 per week
  - Aviation Mechanician \$40 to \$60 per week
  - Aviation Inspector \$50 to \$75 per week
  - Aviation Salesman \$5000 per year and up
  - Aviation Assembler \$40 to \$65 per week
  - Aviation Builder \$75 to \$200 per week

more, after one reading, the student gets a thorough understanding. One never tires of reading them." James Powers, Pa., another student, says, "I am indeed surprised that such a valuable course can be had from such practical men for so little cost."

**Personal Instruction by Experienced Men**  
Men who have had actual experience give you personal attention. They select the lessons, lectures, blueprints and bulletins. They tell you things that are essential in everyday practice. Each lesson is easy to read and understand.

## Get Big FREE Book—Now

Send coupon below for New Book, just out, "Opportunities in the Airplane Industry." It is interesting and instructive. It will show you many things you never knew before about aviation. We have but a limited supply of these books—send the coupon before they are all gone.

**American School of Aviation**  
3601 Michigan Ave., Dept. 1429 Chicago, Ill.

**American School of Aviation**  
3601 Michigan Ave., Dept. 1429 Chicago, Ill.  
Without any obligation, send me your Free Book, "Opportunities in the Airplane Industry", also information about your course in Practical Aeronautics.

Name.....  
Street.....  
City..... State.....

## Tarrano the Conqueror

(Continued from page 756)

He summoned Argo and two other guards. Unceremoniously, and with more haste than I had ever seen in Tarrano, he led us from the building. A hint of his purpose came to me, as he bade Elza gather up her few personal belongings, and gave them to a guard to carry.

In a group, he herded us across the spider bridge. It was early evening, but night had fully fallen. The city was ablaze with its colored lights. We crossed the bridge, passed through a tunnel-arcade, and came out to a platform which was at the base of a skeleton tower. Its naked girders rose some seven hundred feet above us. The highest structure in the city. A waiting lifting-car was there. We entered, and it shot us upward.

At the top, the narrowed structure was enclosed into a single room some thirty feet square. A many-windowed room, with a small metal balcony surrounding it outside. Immediately above the room, at the very peak of the tower, was a single, powerful light-beam; its silver searching ray swept the cloudless, starry sky in a slow circle.

The room was crowded with instruments. Unlighted, save by the reflected glow of its many image-mirrors, all of which seemed in full operation. A dozen intent men sat at the tables; a silent room, but for the hum and click of the instruments.

Tarrano said softly: "We have been very busy while you below were engaged with your petty hates and jealousies."

He seated himself at a table apart, upon which was a single mirror, and he gathered us around him. The mirror was dark. He called:

### IN TOUCH WITH MARS

"Rax—let me see Mars—you have them by relay? The Hill City?"

The mirror flashed on. From an aperture overhead, a tiny beam of the blue helio-transformer came down to it. In the mirror I saw an image of the familiar Hill City. A terraced slope, dotted with the cubical buildings, spires and tunnel mouths. An empty channel\* curved down across the landscape from the north.

A distant scene, empty and lifeless save for black puffs which rose in the air above the city.

Tarrano called impatiently: "Closer, Rax!"

The image dissolved, blurred; turned red, violet, then white. We seemed now upon a height close above the city. It was seething with confusion. Fighting going on in the streets. Animals and men, fighting; a crowd of the Little People thronging a public square, with beasts of war charging them.

The Hairless Men! I had heard of them, with their animals trained to fight, while they—the humans—lurked behind. A mysterious, almost grewsome race, to us who live on Earth—these hairless dwellers of the underground Mars. Dead-white of skin; sleek and hairless; heavily muscled from the work of their world; and almost blind from living in the dark.

They were swarming now into the Hill City of the ruling Little People. The beasts, at their commands, were running wild through the streets . . . dripping jaws, tearing at the women . . . the children. . .

I felt Elza turn away, shuddering. Tarrano chuckled. "The revolt. It came, of course, as I planned. This Little People government—it was annoying . . . Colley!"

(Continued on page 762)

\*Canal, as it now is thought to be.



## Learn to Draw at Home

Simple Method Makes It Amazingly Easy

Trained artists earn from \$50 to over \$250 a week. Tremendous demand right now for good art work. Magazines, newspapers, advertisers, printing houses, etc. Become an artist through this quick, easy method—right at home in spare time. Learn Illustrating, Designing and Cartooning. Actual fun learning this way. Individual attention by mail from one of America's most famous artists. Learn to draw and earn big money.

### Send for FREE BOOK

Just printed—a new book which describes the latest developments and wonderful opportunities in Commercial Art, and gives full details on this quick, easy method of learning to draw. Tells all about students—their successes—what they say—actual reproductions of their work—and how many earned big money even while learning. Write for this Free Book and details of special free offer. Mail postcard or letter now.

**WASHINGTON SCHOOL OF ART**  
Room 2612-C, 1115-15 St. N.W., Washington, D.C.

**The Famous KON-VER-TER Slide Rule**  
Instantly adds, subtracts, divides, multiplies, converts fractions or decimals of an inch. Gives sines, co-sines, versed sines, anti-log sines, tangents, co-tangents, secants co-secants of angles directly. Gives square roots, squares, cube roots, cubes and fifth roots and powers of all numbers. Logarithms, co-logarithms, anti-logarithms. Instructions with rule. DeLuxe Model \$3. Cash or C.O.D. New England Novelty Company Wakefield, Mass.

## Seal Rupture With a Quarter

Now you can throw away forever steel bands, chafing leg straps and other heavy makeshift devices. For a well known American inventor has found a new easy way to support rupture assisted by means of a wonderful little invention weighing less than a 25 cent piece. Not only does it get away with the objectionable pressure and tightstrapping, but you eliminate the "coming down" of rupture—when running, straining, exercising, sneezing, etc.—which too frequently leads to strangulation. So great has been the success of this wonderful device that it is being offered to ruptured people on an absolute guarantee of instant satisfaction or no cost. Simply drop a postcard or letter requesting free literature to **NEW SCIENCE INSTITUTE, 4519 Clay St., Steubenville, Ohio**

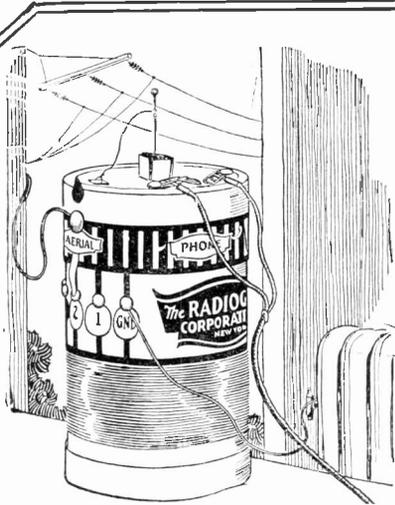
**LAW STUDY AT HOME**  
Become a lawyer. Legally trained men in high positions and big success in business and public life. Be independent. Greater opportunities than ever before. Big corporations are headed by men with legal training. Law-trained men earn \$5,000 to \$10,000 Annually. We guide you step by step. You can train at home during spare time. Degree of LL.B. conferred. LaSalle students found among practicing attorneys at every state. We furnish all text material, including fourteen-volume Law Library. Low cost, easy terms. Get our valuable 108-page "Law Guide" and "Evidence" books free. Send for them NOW. **LaSalle Extension University, Dept. 7 2384-L Chicago**  
The World's Largest Business Training Institution

## Learn Advertising at HOME

Some of the highest paid men in the world are advertising men. You can learn easily and quickly at home during your spare time. Bigger opportunities now in advertising than ever before. Constant demand for our graduates at big pay. Send for **FREE Book**. Giving interesting information and vital facts—just what you want to know about advertising. Write today! **PAGE-DAVIS SCHOOL OF ADVERTISING**  
Dept. 1429 3601 Michigan Ave., Chicago, U.S.A.

**Start a Movie Show**  
SMALL CAPITAL STARTS YOU  
Big opportunity to become independent. No experience needed. We show you how. Our easy payment plan makes it easy to start. We equip you complete. Our machines used and endorsed by government institutions. Write today for free catalog. **LAS MOVING PICTURE CO.**  
6368, Dearborn St. Dept. 89, Chicago

**Print Your Own**  
Cards, Stationery, Circulars, Paper, etc. Save money. Print for others, big profit. Complete outfits \$8.85 Job press \$12.35. Rotary \$150. All easy, rules sent. Write for catalog presses type etc. **THE PRESS CO., Y-47, Meriden, Conn.**



The Simplest Practical Radio Set Made

\$ 1<sup>00</sup>  
1<sup>—</sup>

The **RADIOGEM**

The simplest radio outfit made—yet as practical as the most expensive. A crystal receiving set that you can operate and enjoy even though you know absolutely nothing about radio. You receive the RADIOGEM unassembled, together with a clearly written instruction book, which shows you how to quickly and easily construct the set, using only your hands and a scissors. The outfit comprises all the necessary wire, contact points, detector mineral, tube on which to wind the coil, etc., etc. The instruction book explains simply and completely the principles of radio and its graphic illustrations make the assembling of the RADIOGEM real fun.

**AERIAL OUTFIT**

Complete aerial outfit for the RADIOGEM, consisting of 100 ft. of standard copper aerial wire and two special porcelain insulators. Price .....50c.

- Radiogem - - - \$1.00
- Aerial Outfit - - - .50
- Radiogem and Aerial Outfit - - - 1.50

**RAGEMCO**

Radio Headquarters for the Finest and BEST Radio Tools



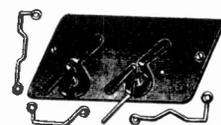
**RADIO TOOL SET**

This is the handiest set of tools ever made for Radio Work by the makers of the famous "YANKEE" Tools. It contains the following: 1 Ratchet Screw-driver, 6 1/2 in. long holding all attachments; 1 Blade, 5 1/2 x 3-16; 1 Blade, 3 1/2 x 1/2; 1 Blade 2 1/2 x 1/4; 1 Countersink; 2 Socket Wrenches for all small nuts; 1 Reamer to enlarge holes in panel from 1/8 x 1/2; 1 Wrench, one end 5-16" square or hex. for jack, other 1/2" hex., etc. PRICE per set—No. 701.....\$3.00



**HAND DRILL**

The hardwood handle is hollow to store drills. Iron frame, nickle-plated parts, ball bearing three jawed chuck holding and centering accurately round shank drills from 0 to 3-16. Length of drill, 12 inches. PRICE—No. 303.....\$2.25



**WIREBENDING TOOL**

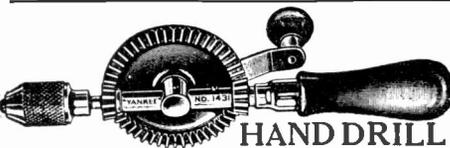
For making eyes, loops, bends, and offsets on Bus Bar wire. With this device any Radio Constructor can wire his set to compare favorably with any factory made set. Easier to use and more accurate than pliers. Pull directions in box. Made of heavy steel, blued and finished. PRICE—No. 203.....\$1.00

**CIRCLE CUTTER**



Especially designed for the Radio Constructor. Made of the finest material and equipped with the highest grade high steel cutting bits. It does three things at once. It drills its own pilot, cuts out plug and puts bead or scroll around the hole in one operation. Cuts holes 3/4 to 4 in. in diam. PRICE—No. 402.....\$3.00

401. Same tool but smaller and not fitted with bead or scroll in one operation. PRICE—No. 401.....\$2.00



**HAND DRILL**

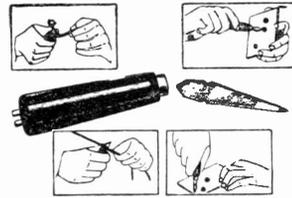
Especially designed for Radio Work by the makers of the famous "Yankee" Tools. A beautiful balanced, small, powerful drill with 4 to 1 ratio of gears for speed. Special chuck 9-32" capacity, to take largest drill, mostly furnished with drill or tool sets. Length over all, 8 1/2 in. Weight 1 1/2 lbs. PRICE—No. 302.....\$2.75



Three-in-One Nut Wrench. Consists of handle with hollow stem 6 inches in length and three interchangeable sockets fitting popular sizes of nuts. The hexagon sockets grip the nut solidly. PRICE per set—No. 301.....65c



Side Cutting Nipper, Lap Joint. For cutting all kinds of wire. Jaws hardened and oil tempered. Natural steel finish with polished jaws. Length 6 inches. PRICE—No. 201.....75c



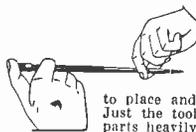
**RADIO HANDI-TOOL**

Bends Bus Bar or wire strips and scrapes wire, bores and reams holes, etc. Tool consists of 4 in. black japanned handle, to which is attached wire bending device, with nickle ferrule and 3 in. long two sided reamer. PRICE—No. 702.....50c



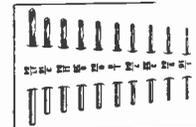
**TOOL CHEST**

Set consists of "LOCK-GRIP" master handle, 5" long, black Rubberoid finish with steel chuck, nickel plated, buffed and with the following 9 tools: Saw, brad-awl, large screwdriver, file, scratch awl, gimlet, reamer, chisel, small screwdriver. Each tool of fine steel, drop forged tempered, hardened, and nicely finished. Set comes in leatheroid box with tray. PRICE—No. 703.....\$1.85



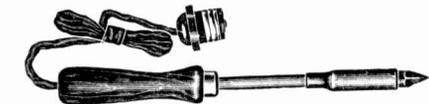
**SCREW STARTER and DRIVER**

Holds any screw by its slot with a firm grip, makes it easy to place and start screws in difficult places. Just the tool for the Radio Constructor. All parts heavily nickle-plated and polished. PRICE—No. 304.....\$1.00



**RADIO DRILL SET**

Composed of 10 straight shank twist drills, fitting all hand and breast drills. The selection of these drills has been especially made for Radio Constructors and consists of the following sizes: 1-16, 5-64, 3-32, 7-64, 1/8, 9-64, 5-32, 11-64, 3-16, 17-64. Drills are mounted on white Holland Linen with sizes clearly marked. PRICE—No. 305.....\$1.25

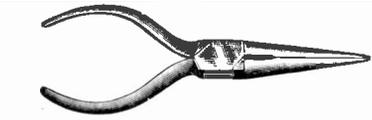


**ELECTRIC SOLDERING IRON**

A perfect tool for Radio Work. Operates either on 110-volt A.C. or D.C. The heat element is of Nichrome, which prevents overheating and assures the desired even temperature. Size of iron, 10 1/2 in. long. A 4-ft. cord and plug is furnished. PRICE—No. 800.....\$2.00



Combination Plier, Wire Cutter, Wire Former and Wrench. Drop forged, slender but exceptionally strong. 6 in. long. PRICE—No. 202.....75c



Long Sharp Nose, Side Cutting Pliers. Just the pliers for the radio constructor. Bends and cuts all kinds of soft wire. Nose 1 1/2 inches long, black body, polished jaws. Length 5 1/2 inches. PRICE—No. 200.....75c

Order all tools by order number. All goods are shipped free of transportation charges to all parts of the United States and possessions the same day as the order is received.

**MONEY REFUND GUARANTEE**

If you are not satisfied money will be refunded on return of goods.

**The RADIOGEM CORP., 66-S W. Broadway, New York**

# U.S. PATENTS



## Don't Lose Your Rights

Before disclosing your invention to anyone send for blank form "Evidence of Conception" to be signed and witnessed. A sample form together with printed instructions will show you just how to work up your evidence and establish your rights before filing application for patent. As registered patent attorneys we represent hundreds of inventors all over the U. S. and Canada in the advancement of inventions. Our schedule of fees will be found reasonable. The form "Evidence of Conception" sample, instructions relating to obtaining of patent and schedule of fees sent upon request. Ask for them,—a post card will do.



Registered Patent Attorneys in U.S. and Canada  
255 Ouray Bldg., Washington, D. C.  
"Originators of form Evidence of Conception"

# PATENTS

TRADE MARKS · DESIGNS  
FOREIGN PATENTS

## MUNN & Co.

PATENT ATTORNEYS

Associated since 1846 with the Scientific American

618 Woolworth Building, New York City  
325 Scientific American Bldg., Washington, D. C.  
414 Tower Building, Chicago, Ill.  
367 Hobart Building, San Francisco, Cal.  
222 Van Nuys Building, Los Angeles, Cal.

Books and Information on Patents and Trade Marks  
by Request.

## FREE BOOKLET FOR INVENTORS

If your invention is new and useful it is patentable—send me your sketch. Inventions developed, patented. Trade marks and copyrights obtained in the U. S. and Foreign countries.

**Z. H. POLACHEK**

Reg. Patent Attorney  
Professional Engineer

70 Wall Street New York

# PATENTS

BOOKLET FREE HIGHEST REFERENCES  
PROMPTNESS ASSURED BEST RESULTS  
Send drawing or model for examination  
and report as to patentability

**WATSON E. COLEMAN, Patent Lawyer**  
644 G Street, N. W., Washington, D. C.



Edited By  
**A. P. PECK**

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

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

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

### WINDOW PROTECTOR

(918) Benjamin Wolfeld, New York City, has designed a device for the protection of jewelers' show windows. He desires to know whether or not we think that the same is worthy of a patent.

A. 1. There are many devices upon the market for protecting jewelers' show windows. We do not advise your attempting to patent anything of this nature, as its marketing possibilities are practically nil.

Nearly all jewelers are insured against theft and fire, and the protection of which you speak would not prevent burglary, nor would it materially decrease the insurance rates. Consequently, very few jewelers would undertake the installation of your system.

### AUTOGRAPHIC CAMERA

(919) Edwin S. Warner, State College, Pa., has designed a device wherein a ground glass and an opaque slide are placed on the back of a camera. Writing to be impressed on the negative is done on the ground glass whereupon the opaque slide is removed for a short time, thereby exposing a short section of the film to the light and impressing the writing thereon. He asks our advice.

A. 1. No doubt the autographic attachment which you have devised would operate, but why add all this additional apparatus to the camera when the autographic films operated with a stylus, access to which film is obtained by means of a small opening in the back of the camera, do the work equally well if not better than your device?

Perhaps if you will give a reason for suggesting your apparatus, we could advise more fully.

### PUZZLE

(920) N. Baker, New Bedford, Mass., submits a design and model of a wood block puzzle upon which he desires our comment.

A. 1. We have looked over your puzzle and have operated it according to your directions. We find it to be very interesting and absorbing. The one draw-back to the applying for a patent of such a device is that it would be hard to get a manufacturer to make it for you. If, however, you are in a position to make this device cheaply and finance the manufacture of it yourself, we see no reason why you should not apply for a patent. You can have your specifications drawn up by a patent attorney and filed in the Patent Office. You can then proceed to manufacture the device yourself, stamping it "patent pending."

Then in the course of a year, you can see how the sale of the device will go. At the end of that time you can judge for yourself just what the results will be. This is practically the only way to place such a device on the market, as very few, if any, companies are ready to finance the manufacture of puzzles.

### WRITING AID

(921) H. Sheffel, New York City, has designed a stencil for use in teaching the child how to write. The child merely places the stencil on a sheet of paper and draws around it. He believes this is superior to the method of using a rack of metal in which the letters have been indented, and the child traces the movements with a pen or pencil until he becomes familiar with them. He also desires to know what he can do without finances.

A. It is very difficult to do anything at all without the necessary finances. In the first place, you cannot protect your idea sufficiently to warrant further work, and in the second place you cannot interest the manufacturers, unless you build working models to demonstrate the feasibility of your system, and you should also have the opinion of some teacher of writing who has studied the probable effect of your system on a class of pupils, and instructed half by means of the regular method, and the other half by means of your system.

We frankly do not believe that your system of teaching is superior to the regular grooved letters of which you spoke in your communication, inasmuch as in your system the individual does not form letters but draws around the letters. This is of no earthly use in teaching the youngster to write, as he would never under any circumstances go through so many moves in order to form a single letter, as are necessitated in your system of teaching.

We would most assuredly advise that you forget this idea, as you will find that whatever money you put into this system of teaching will, in our opinion, be hopelessly lost.

### WRENCH

(922) W. F. Morgan, Chicago, Ill., submits a design of a quick action wrench wherein the worm on the lower or moving jaw can be released from the rack, allowing quick adjustment. He asks our advice.

A. 1. The wrench which you have designed is not new, except that instead of using springs for holding the gear in place, you also employ a trigger to release the gear. A monkey wrench of a similar nature has been found in New York, in which one merely pulls back on the worm, releasing it from the teeth of the wrench, after which the lower jaw may be slid in either direction, and then the worm gear is permitted to slip back in mesh with the rack on the fixed jaw and handle. This is a rather expensive method of doing the work, and it meets with several difficulties. In the event of an excessive strain upon the wrench, one of two things generally occurs. Either the worm gear locks itself fast into the toothed rack of the wrench so that it is almost impossible to remove it, or else the worm gear slips away from the teeth, due to weakness on the part of the springs.

For this reason an inventor has designed a monkey wrench in which a slit is cut transversely through the worm gear, and when the worm is turned into a certain position, it may be slid back and forth without engaging with the toothed rack. A slight eighth of a turn again meshes the gear and rack, and further adjustment is made with the worm. A bench vice of similar design has also been found upon the market. We would not suggest that you apply for a patent on your tool.

# INVENTORS PROTECT YOUR IDEAS

Send for our Guide Book, HOW TO GET A PATENT, and Evidence of Invention Blank, sent Free on request. Tells our terms, model or sketch and description of your invention for INSPECTION and INSTRUCTIONS FREE. TERMS REASONABLE. BEST REFERENCES.

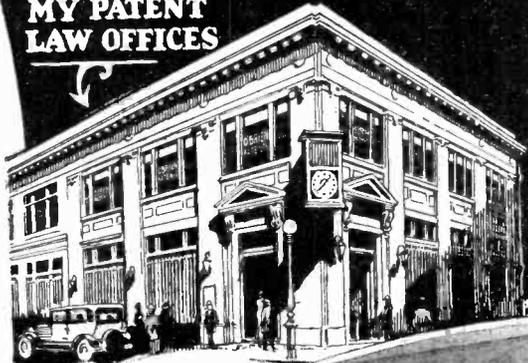
Name .....

Street .....

City .....

**RANDOLPH & CO.**  
Dept. 172, WASHINGTON, D. C.

**MY PATENT  
LAW OFFICES**



**JUST ACROSS  
STREET FROM  
U.S. PAT. OFF.**

# PATENTS

**INVENTORS  
Write for these  
FREE BOOKS!**



At the left is a view of my drafting and specification offices where a large staff of experienced experts are in my constant employ. All drawings and specifications are prepared under my personal supervision.



## PROTECT YOUR IDEAS

**Take the First Step Today—ACTION COUNTS**

If you have a useful, practical, novel idea for any new article or for an improvement on an old one, you should communicate with a competent Registered Patent Attorney AT ONCE. Every year thousands of applications for patents are filed in the U. S. Patent Office. Frequently two or more applications are made for the same or substantially the same idea (even though the inventors may live in different sections of the country and be entirely unknown to one another). In such a case, the burden of proof rests upon the last application filed. Delays of even a few days in filing the application sometimes mean the loss of a patent. So lose no time. Get in touch with me at once by mailing the coupon below.

### No Charge for Information on How to Proceed

The books shown here contain valuable information relating to patent procedure that every inventor should have. And with them I will also send you my "Record of Invention" form, on which you can sketch your idea and establish its date before a witness. Such evidence may later prove valuable to you. Simply mail the coupon and I will send you the books, and the "Record of Invention" form, together with detailed information on how to proceed and the costs involved. Do this NOW. No need to lose a minute's time. The coupon will bring you complete information entirely without charge or obligation.

### Prompt—Careful Efficient Service

This large, experienced organization devotes its entire time and attention to patent and trademark cases. Our offices are directly across the street from the U. S. Patent Office. We understand the technicalities of patent law. We know the rules and requirements of the Patent Office. We can proceed in the quickest, safest and best ways in preparing an application for a patent covering your idea. Our success has been built on the strength of careful, efficient, satisfactory service to inventors and trademark owners located in every state in the Union.

## Clarence A. O'Brien

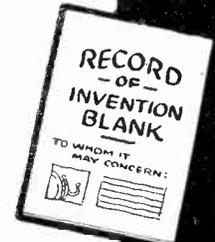
**Registered Patent Attorney**

Member of Bar of: Supreme Court of the United States; Court of Appeals, District of Columbia; Supreme Court, District of Columbia; United States Court of Claims

**Practice confined exclusively to Patents, Trademarks and Copyrights**

### Strict Secrecy Preserved Write Me in Confidence

All communications, sketches, drawings, etc., are held in strictest confidence in strong, steel, fireproof files, which are accessible only to authorized members of my staff. Feel free to write me fully and frankly. Your case will have my personal attention. It is probable that I can help you. Highest references. But FIRST—clip the coupon and get my free books. Do THAT right now.



## Mail this Coupon NOW.

**CLARENCE A. O'BRIEN,**  
Registered Patent Attorney,  
5398 Security Savings & Commercial Bank Bldg.,  
Washington, D. C.

Please send me your free books, "How to Obtain a Patent," and "Invention and Industry," together with your "Record of Invention" form without any cost or obligation on my part.

Name .....

Address .....

(Important: Write or Print name clearly)



**Ernest Pechin**  
Cornet Virtuoso  
Uses a Conn

## How to Win Success in Music

Begin with the right instrument. This is the advice of the world's foremost artists. Conn instruments, used and endorsed by the most successful players, are easier to play, most beautiful in tone, perfect in scale; reliable in action—possess many exclusive features, yet cost no more than others.

Free Book by Sousa and nine other famous artists on "Success in Music," helps you choose the instrument for your talent. Send now for your copy and details of Free Trial, Easy Payments on any Conn instrument.

C. G. CONN, LTD.  
1256 Conn Bldg. Elkhart, Ind.



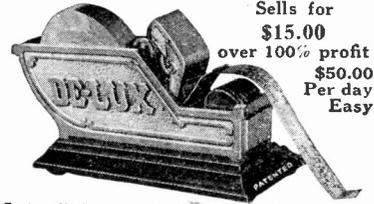
**CONN**  
BAND INSTRUMENTS  
WORLD'S LARGEST MANUFACTURERS

### LOOK! "Boys," We Have It!

## The "DE-LUX"

### Automatic Paper-Tape Printer.

Sells for \$15.00  
over 100% profit  
\$50.00 Per day  
Easy



Just pull the tape—the DE-LUX will do the rest. The modern method used in place of twine by progressive merchants. Saves time and makes packages neater.

We want men financially responsible to act as our distributors in exclusive territory. Wire or write

**METAL PRODUCTS COMPANY**  
Dept. M, 124 W. 4th St., Los Angeles, Calif.

### 13 WEEKS FOR 15 CENTS

## The Pathfinder

SHOWS THE WAY THROUGH THE JUNGLE OF EVENTS

You've heard your neighbor praise the old reliable Pathfinder, the wonderful national weekly home magazine that 3 million people read. You can try this unbiased digest of domestic and world affairs for a trifle. The Pathfinder is in a class by itself—nothing else to equal it; time-tested, wholesome. Chuck full of the choicest reading—the cream of everything. Science, politics, travel, fun, question box, health, radio etc.; real stories, pictures—instruction, entertainment for all. Send 15c (coin or stamps) for this big paper on trial 13 weeks, or \$1 for full year (52 issues). **Pathfinder, Washington, D. C.**

## NEW VEST POCKET ADDING MACHINE

ADDS · SUBTRACTS  
MULTIPLIES · DIVIDES

Does all the work of a \$300.00 machine, yet fits the vest pocket. Easy to operate—does any kind of figuring in a jiffy. The neatest and best constructed portable adding machine made.

**Counts Clear Up to 999,999,999**

Total visible at all times. A pull of the finger clears it. Invaluable to anyone who uses figures. Saves many times its cost by preventing mistakes.

**10 Days' Trial** Send no money, just name and address and we will send machine post-paid. Pay postman on delivery \$2.95. Use it 10 days to prove it does all we claim. Your money back if not perfectly satisfied. Don't be fooled by cheap imitations. Order your Ve-Po-Ad now from this ad.

Reliable Adding Machine Corp., Dept. 169  
184 W. Washington St., Chicago, Ill.

Here's a money maker. Everybody wants one. Splendid profit. Write for special offer.

**AGENTS**

## Tarrano the Conqueror

(Continued from page 758)

"Master?"

"Send the message, Colley. Fling it audibly over Mars! Tell the rulers of the Little People that if they send up the green bomb of surrender—Tarrano will spare them further bloodshed. Tell them that I am not giving the Brende secret to Earth. In a moment I shall defy the Earth-Council. Promise them that the Brende secret is going to Mars. Assure them they will have everlasting life for everyone. . . Wohl!"

"Master?"

"Give me the Cave Station."

The mirror went dark. Then came bright. A cavern in the interior of Mars. A dark scene of wavering yellow torches. Around a table of instruments sat a score of hairless men. Tarrano snatched up a mouth-piece—murmured slowly into it. I could see the leader of the hairless men nod after a time, as the message reached him. And I saw him turn away to issue swift orders as Tarrano had commanded.

Tarrano said brusquely: "Enough! . . . Wohl!"

The mirror went dark. A voice called: "Master, the green bomb has gone up from the Hill City! Do you wish to see?"

"No. . . Give me Venus. Olgan! Are they quiet on Venus?"

"Yes, Master."

"Congratulate them that we have conquered the Little People. Tell them Mars is ours now! Tell them I am coming to Venus at once—with the Brende model. . ."

"Master, you wish to see Venus? I have direct communication—"

Another voice interrupted. "The Earth-Council, Master! They demand an explanation of why you say the Brende model is going to Mars. You have promised it to Earth. They demand—"

Tarrano rasped: "Tell them to wait . . . I don't want Venus, Olgan. . . Megar! Give me the Earth Mountain Station."

He turned to me, and his voice dropped again to that characteristic sardonic drawl: "We must see how your friend Georg Brende is faring."

The mirror showed Georg, standing irresolute on the platform before the sending discs. Tarrano called: "The Princess Maida—can't you locate her?"

The scene blurred momentarily, then showed us the outside of the Station. A white expanse of snow, with purple starlit sky above. From a side door of the building, as we watched, the figures of two women appeared. A woman leading Maida. As they came out, with Maida all unsuspecting, from the shadows a group of men pounced upon them—dragged Maida swiftly away.

Tarrano laughed. "Enough! . . . Show me Georg Brende again. . . Hurry! Do you want me to miss his plunge?"

We saw Georg waver and leap through the window, fall into the snow, where, from the shadows of the building, other men rushed out upon him . . . hurried him away after the captive Maida. . .

Tarrano's laugh was grim and triumphant. "Ha! We win there, also! Enough! Nunz? Nunz—now you can give me the Earth-Council! Where is it sitting? Washington, or Great-London?"

"Washington, Master."

"Very well. . . No, never mind connecting me. You speak for me. Tell them I've changed my mind. The Brende model is not coming to Washington. Tell them Georg Brende is lost to them, also. Tell them I declare war! Tarrano the Conqueror declares war on the Earth! Tell them that, with my compliments. Tell them to come down here and overwhelm me—it ought to be very easy!"

End of Part VI—To Be Continued.

# PATENTS

## TO THE MAN WITH AN IDEA

I offer a comprehensive, experienced, efficient service for his prompt, legal protection and the development of his proposition.

Send sketch, or model and description, for advice as to cost, search through prior United States patents, etc. Preliminary advice gladly furnished without charge.

My experience and familiarity with various arts frequently enable me to accurately advise clients as to probable patentability before they go to any expense.

Booklet of valuable information and form for properly disclosing your idea, free on request. Write today.

**RICHARD B. OWEN, Patent Lawyer**  
164 Owen Building, Washington, D. C.  
41V Park Row, New York City

### TRADE-MARKS REGISTERED

**C. L. PARKER**  
Ex-Member Examining Corps, U. S. Patent Office

### Attorney-at-Law and Solicitor of Patents

American and Foreign Patents secured. Searches made to determine patentability, validity and infringement. Pamphlet of instructions sent upon request

**MCGILL BUILDING WASHINGTON, D. C.**

## INVENTIONS Commercialized

ON A CASH OR ROYALTY BASIS  
PATENTED OR UNPATENTED

In Business 25 Years—Complete Facilities—References.

Write **ADAM FISHER MFG. CO.**  
205D Enright Ave. St. Louis, Mo.

## INVENTORS

who derive largest profits know and heed certain simple but vital facts before applying for Patents. Our book *Patent-Sense* gives those facts; sent free. Write **LACEY & LACEY, 644 F St., Washington, D. C.** Established 1869.

## INVENTORS

Patent your invention. Costs reasonable. Pay as you earn. Quality service. Patent booklet free.

**AMBROSE T. BUCKLEY**—Patent Attorney  
30 Church St. New York City

## LEARN DRAFTING

AT HOME IN SPARE TIME

Become an expert Machine Designer—\$50 to \$200 per week. Complete course personal instruction. Easy monthly payments. We furnish complete set of drawing instruments. FREE BOOK explains all—write for it.

**THE PRACTICAL MECHANIC**  
Dept. 105, South Haven, Mich.



## Only \$5 Down

Buys Any WITTE Latest Model All-Fuel Engine UP TO 10 H.P.

The One-Profit Engine. Sold Direct From Factory To You. Easy Terms on best engine built. Burns Kerosene, Distillate, Gas-Oil, Gasoline or Gas. Change power at will. Equipped with the famous WICO Magneto, speed and power regulator and throttling governor. 2 to 25 horsepower — ALL STYLES.

**FREE** Write today for my Big Engine Book. Sent free — no obligation on your part. Or, if interested, ask for our Log and Tree Saw, 3-in-1 Saw Rig or Pump Cataloga.

**WITTE ENGINE WORKS**  
3757 Witte Building, KANSAS CITY, MO.  
3757 Empire Building, PITTSBURGH, PA.

Insure your copy reaching you each month. Subscribe to SCIENCE AND INVENTION—\$2.50 a year. Experimenter Publishing Co., 53 Park Place, New York City.

**Photo-Electric Eye  
Sorts Cigars**

(Continued from page 710)

galvanometer as shown in the diagram. In this galvanometer the current is just heavy enough to swing the needle over a small arc. But the swing of the needle is divided into six major divisions, each of which in turn is broken up into five parts, and the whole 30 divisions thus made have each an interlocking terminal.

There is a *dog*, or extension catch, depending from the extreme end of the ammeter needle so made as to fit into the interlocking terminals of the 30 divisions of the switch. When the eye is viewing a cigar, the ammeter needle swings freely, until it comes to rest at a point on the scale corresponding to the current caused to flow through the potassium-terminated tube. Then two jaws working from either side of the galvanometer switch close in and cause the *dog* on the end of the needle to make contact with the particular switch terminal located opposite the point at which the needle came to rest.

The switching device is so constructed that no contact is made between the swinging needle and the contact points corresponding to the 30 compartments of the table, until such time as the needle comes to rest. At that instant two locking jaws close in from either side, and cause contact to be made between the needle and the particular *dog* toward which the needle points; thus allowing a local current to pass, sufficient to energize the proper magnet to trip the rotating finger as it reaches the right compartment. The needle's motion is, therefore, unimpeded.

**Feature Articles in  
December "Radio News"**

- The Regenerative Interflex Circuit.  
By Hugo Gernsback.
- The latest development of this interesting circuit is the addition of regeneration, making an efficient one-control receiver.
- Thirty Years in a Dark Room.  
By W. B. Arvin.
- Biography of D. MacFarlan Moore, the maker of the first vacuum tube.
- Britain's New Superpower Broadcast Station.  
By A. Dinsdale.
- Transatlantic Telephony.  
By G. C. B. Rowe.
- Multiple Grid Vacuum Tubes and Their Advantages.  
By Theodore H. Nakken.

After this a heavy current is passed through the needle, *dog* and proper terminal (the three closing the circuit) and it is this current which operates magnetic trips on a circular sorting table, causing the cigar (now being carried by troughs above this sorting table) to be passed unerringly into the proper compartment corresponding to its color.

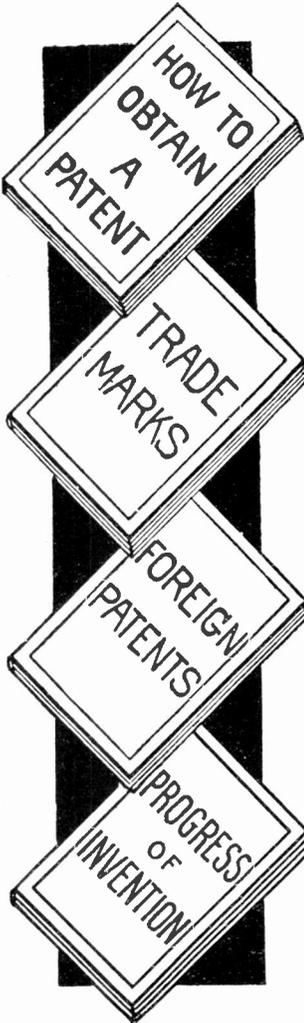
One operator controls the entire machine, and the sole duty of this operator is to watch and see that no unforeseen thing causes the machine to stop. The accuracy of the sorting is so perfect that inspection of the cigars in each compartment is entirely unnecessary. In fact, it is doubtful whether any human being could distinguish any difference in color between the cigars in any one compartment after this sorting.

The machine is not being sold, but is leased on a royalty basis; the amount varying with the number of cigars passed through the machine, as determined by a counter attachment.

Plans are under way now for the adaptation of this machine to the needs of several other industries where color selection plays a large part in determining the value of finished products.

**PATENTS TRADE-MARKS  
AND  
COPYRIGHTS**

**OUR OFFER: FOR THE PROTECTION  
OF YOUR INVENTION**



*YOUR FIRST STEP* before disclosing an invention. The inventor should write for our blank form—

**"Record of Invention"**

This should be signed and witnessed and returned to us together with model or sketch and description of the invention for INSPECTION and INSTRUCTIONS.

NO CHARGE FOR THE ABOVE INFORMATION

**Our Four Books Mailed  
Free to Inventors**

*Our Illustrated Guide Book*

**HOW TO OBTAIN A PATENT**

Full instructions regarding U. S. Patents. Our Methods, Terms, and 100 Mechanical Movements illustrated and described.

**OUR TRADE MARK BOOK**

Shows value and necessity of Trade Mark Protection. Information regarding *Trade Marks and unfair competition in trade.*

**OUR FOREIGN BOOK**

We have Direct Agencies in Foreign Countries, and secure Foreign Patents in shortest time and at lowest cost.

**Progress of Invention**

Description of World's Most Pressing Problems by Leading Scientists and Inventors.

**IMPORTANT**

Do not submit your invention to anyone before you furnish proof that the invention is patentable or application has been filed. IN ORDER TO HAVE YOUR CASE MADE SPECIAL TO AVOID DELAY YOU SHOULD TAKE THE PRECAUTION OF HAVING YOUR CASE MADE SPECIAL IN OUR OFFICE to secure protection, save correspondence and secure early filing date in Patent Office. To secure special preparation of your case send \$25.00 on account with model, sketch and description.

All communications and Data Strictly Confidential. Interference and Infringement Suits Prosecuted. Our Organization offers PERSONAL SERVICE by Experienced Patent Solicitors and Draftsmen.

*We Regard a Satisfied Client* as our best advertisement, and furnish anyone, upon request, lists of clients in any state for whom we have secured patents.

*Highest References—Prompt Attention—Reasonable Terms*

WRITE TODAY

**FREE  
COUPON**

**VICTOR J. EVANS & CO., Patent Attorneys**

New York Offices Philadelphia Offices Pittsburgh Offices  
1007 Woolworth Bldg. 714-715 Liberty Bldg. 514 Empire Bldg.  
Chicago Offices, 1114 Tacoma Bldg. San Francisco Offices, Hobart Bldg.

Main Offices, 779 Ninth Street, Washington, D. C.

Gentlemen: Please send me FREE OF CHARGE your books as described above.

Name..... Address.....



## In 18 Evenings He mastered this wonderful instrument

"I date my success," writes a successful young bond salesman, "to the day I got my Buescher Saxophone. It did two things for me that greatly contributed to my success - it gave me a stimulating worth while recreation that developed an unknown talent - and it gave me a social advantage that has made for me hundreds of friends that have been very valuable to me in my business."

### Easy To Play - Easy To Pay

What this man has done in 3 weeks, practicing only a couple of hours each evening, you can do. You don't have to be "gifted". If you can whistle a tune you can quickly master the



This, sweetest of all wind instruments, harmonizes perfectly with piano, voice, or any other music. Easily played, soft or loud. Perfect tone in all registers, warbling and screeching eliminated. Simplified key arrangement. It is common for persons who have never played any instrument to learn scales in an hour and play popular tunes in a week.

### Six Days Free Trial - Easy Terms

Try a Buescher, any instrument you choose, in your own home. Six Days FREE. Surely this is a most liberal offer. It places you under no obligation. We take the risk. If you like the instrument and decide to keep it, pay a little each month. Play as you pay. Get the details of this wonderful plan. Clip the coupon below and send it for the free literature. Send today.

**BUESCHER BAND INSTRUMENT CO.**  
Everything in Band and Orchestra Instruments  
1027 Buescher Block Elkhart, Ind.

Free



**SAXOPHONE  
BOOK**

This 64 page book tells about the various models with pictures of professionals using them. Send for copy of this wonderful

**Clip the Coupon NOW!**

**Mail** BUESCHER BAND INSTRUMENT CO.  
1027 Buescher Block, Elkhart, Indiana  
Gentlemen: Without obligation to me, send your beautiful book "The Story of the Saxophone". Check here!

If you prefer other literature describing other band or orchestra instruments, check below.  
Cornet  Trumpet  Trombone  Tuba

Mention any other.....

Write plainly, Name, Address, Town and State in Margin Below

## Science in Prison Escapes

By JOSEPH FULLING FISHMAN  
(Continued from page 707)

smile. A trick of the officers, he felt quite sure, to discourage any prisoner who might attempt it. It probably became wider again after a few feet. He smiled triumphantly after he had gone on a little further. The conduit did widen out to its original size just as he had thought it would. He hastened his progress as he knew it was but a few hundred feet to the little stream where the prison sewage had an outlet. Already he could smell the air of freedom and, busy as he was, he could not help speculating with amusement on the surprise of the officials when they found he had gone. His heart pounded as little streaks of light appeared, and a thrill shot through him as a draught of air struck him in the face. Funny though the streaks of air weren't larger. He did appear to be quite near now. Just about twenty feet more and he was free! He'd crawl through and—and—

With a muttered curse and with infinite difficulty he reversed his body and began the long, tiresome journey back to the prison, fervently hoping that his absence wouldn't be noticed. For in this battle of wits the officials had won. Inside the larger pipe and extending for a distance of about twenty-five feet to the end was a battery of twelve three-inch pipes through which no human being could possibly crawl.

### AN INGENIOUS ESCAPE

The recent escapade of "Dutch" Anderson, for many years a pal of Gerald Chapman, the notorious bandit, brings to mind the method in which Anderson escaped from the Federal Penitentiary at Atlanta. Anderson was tubercular and occupied one of the tents used for the tubercular colony in the yard of the institution. These tents, about twenty in number, are about twenty-five or thirty feet from the wall surrounding the institution. These tubercular prisoners do no work at all, but simply "take the cure," being allowed all the milk and eggs they can eat. They are encouraged to get as much air as possible, to cultivate a large garden surrounding the tents and to do nothing outside of that except to nurse themselves back to health. The flaps of these tents are kept open during the day but are closed at night.

Anderson and two other prisoners decided to dig their way out under the prison wall. The wall is thirty feet high, the foundation running into the ground for a distance of about eight feet. Each tent is equipped with a large square rug in the center. This rug the prisoners used to conceal the hole which they began to dig. The digging was done with a small shovel and pick, each about eighteen inches long. After they got down to a distance of about ten feet they started digging toward the wall. The hole which they made was large enough to admit a man's body. They would take turns in digging, lying flat on their stomachs and laborously digging and shoveling while in that uncomfortable position. The problem of disposing of the dirt was a difficult one but they solved this by continually digging and working in the garden in a large area, so that the dirt could be distributed without raising the level of the garden to a suspicious extent.

As the digging progressed it became more and more difficult to get the dirt back into the tent. Anderson solved this problem by building a small wagon out of pieces of wood which he picked up here and there. This wagon was moved with a piece of twine attached to a pulley at each end of the tunnel.

**NOW** Genuine Silent No. 8  
**\$49.50** L.C. SMITH



**You SAVE \$55.50**

**30 DAYS FREE TRIAL**

You can save \$55.50 on a Model No. 8 L.C. SMITH the genuine "Silent Smith." Or you can save \$60.00 on the L. C. SMITH Model No. 5!

### Like New in Looks and Service

Both are literally like new! Guaranteed for 5 years. Each has all latest improvements. Standard keyboard; 84 characters. Ball bearing shift, carriage and keys; two-color ribbon, etc. No. 8 "Silent Smith," in addition, is SILENT. It has the newest decimal tabulator, with column selector.

### 30-day Free Trial; Satisfaction Guaranteed

Try either model 30 days. If it does not please you in every way, send it back at our expense and we will refund every dollar you have paid. Send postcard for full details.

Cut Prices On All Standard Makes

**LINCOLN TYPEWRITER COMPANY**  
INCORPORATED

America's Leading Independent Typewriter House  
Dept. 57B, 298 Broadway, New York City

# WANTED



MEN TO MANUFACTURE  
METAL TOYS AND  
NOVELTIES



Good chance to start your own well-paying business producing such big sellers as Toys, Novelties, Ash Trays, Book-blocks, Souvenirs, Advertising Specialties, Paper Weights, etc. We furnish forms with complete outfit for speedy production. Absolutely no experience or tools necessary; no special place needed. Small investment puts you on road to success. Demand exceeds supply and we assist you and co-operate with our manufacturers in selling their products. We put you in touch with the buyers and assure an outlet for your goods. Strictly a business proposition and thorough investigation invited. A splendid opportunity for an enormous and profitable business for ambitious men. No others need apply. Catalog and information mailed on request.

**METAL CAST PRODUCTS CO.**  
1696 Boston Road, New York

**5-TUBE NETSODYNE**

LATEST AND MOST EFFICIENT TUNED RADIO FREQUENCY CIRCUIT. EASY TO OPERATE.

ON SALE DURING THIS MONTH AT ONLY..... **\$27.75**

Okeyed by Radio Experts. Dials can be log g'ed, and you'll get your favorite station on the same dial - numbers, every time. A set you'll be proud of. Long Distance reception guaranteed. All Accessories for above set, consisting of: 5 tubes, "A" batteries, "B" batteries, ear-phones, insulators, lightning arrester, ground clamps, lead-in wire, antenna wire, etc., costing \$25.00 will be sent to you for only \$15.74 additional, thus making the complete 5-tube set, ready to work, nothing else to buy, to cost only \$43.49.

Free Instructions with Each Set

Full Satisfaction Guaranteed or Money Back \$5.00 deposit required, pay balance to postman on arrival. Order today!

**NETSON RADIO MFG. CO., INC.**  
78 Cortland St. Dept. 10 New York City

LEARN



**Aviation**

Take a W. A. C. Course in Applied Airplane Engineering. Men & women earn \$2000 to \$10,000 a year. Big Free outfit of airplane parts. Write for Free catalog.

**WESTERN AIRPLANE CORPORATION**  
Dept. "S"-12 Monadnock Bldg., Chicago, Ill.

But the man in the tent end of the tunnel would have to know when the wagon was full so that it could be hauled in and emptied. A signalling system was devised to solve this problem. A cord was run along the side wall of the tunnel. It was attached to the side with small staples placed in the wall about five feet apart. To each end of the rope was attached a small flag. When the man engaged in digging wanted to signal that the wagon was full he jerked the cord, which pulled upright the flag at the other end. The man in the tent end of the tunnel would then haul the wagon in and carefully distribute the dirt around the garden. He would then pull the cord on his end, when the other flag would be pulled upright and the man doing the digging notified that the wagon was empty and ready to be pulled back for reloading.

After months of the most laborious and back-breaking work the tunnel finally was underneath the wall. The prisoners decided to go at once, notwithstanding the fact that it was the middle of the day and that they might be seen as they emerged on the outside by one of the tower guards, who are always armed. But luck was with them. They emerged safely, brushed the dirt from their faces and hair and strolled away, being taken for one of the dozens of "outside trusties" who are seldom within the walls. This was the last heard of Anderson until a short time ago when a farmer, who is said to have "squealed" on Chapman, was murdered. On his death bed he whispered "'Dutch' got me!"

**Important Articles to Appear In Dec. Issue of "The Experimenter"**

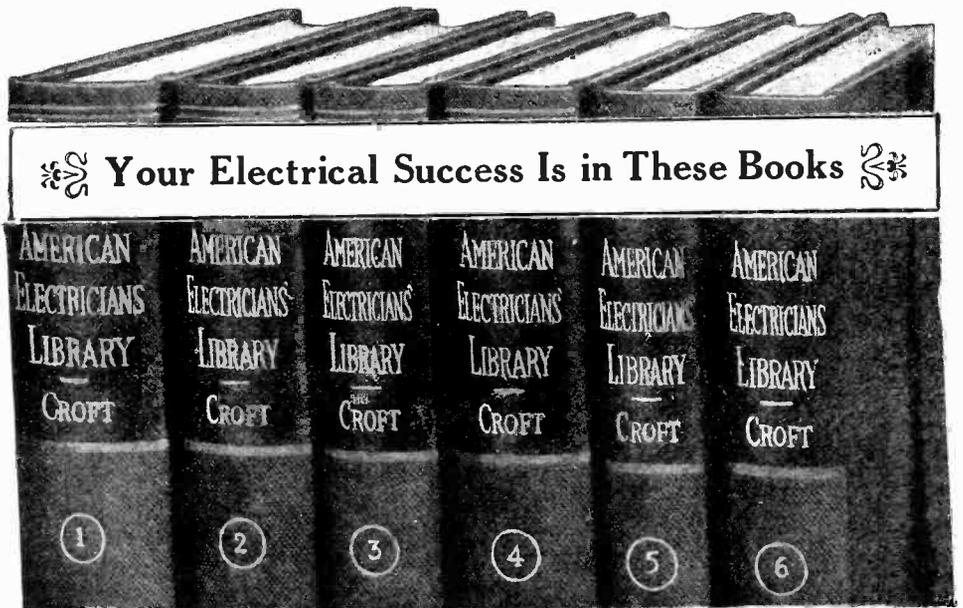
- The Story of the Bell Telephone.  
By T. O'Connor S'okane, Ph. D.
- The Evolution of the Vacuum Tube.  
By Leon L. Adelman.
- Sound and Audio Frequency Amplification.  
By Theodore H. Nakken
- Home-Made Geissler Tubes.  
By F. Castro
- A Practical Tesla Coil.  
By Willis L. Nye
- Chemical Fun With Light Rays.  
By Raymond B. Wailes

**The Specific Gravity of Solid Bodies**

(Continued from page 730)

Sometimes we have to determine the specific gravity of substances which are lighter than water. In this case, as for instance with the samples of different woods, a cube of the material of exactly three centimeters on a side, can be cut out and weighed, Fig. 2. Its volume is of course 27 cubic centimeters, and if it weighs 20 grams, its specific gravity is found by dividing 20 by 27, which gives 0.74, or approximately  $\frac{3}{4}$ , as its specific gravity. This method can be also used for stones and the like if it is practical to cut them, but if the cutting out of a true cube is impossible, the volume of the body is determined by putting a knitting needle into it, assuming it to be lighter than water, and pressing it down into the water in the measuring cylinder and noting the rise of the water. The error due to the volume of the portion of the needle immersed may be safely neglected, but it can easily be allowed for if such accuracy is necessary.

Very often one has to determine the thickness of a thin wire. It is then best to determine its volume by a species of measure-



**Would You Like to Make \$10.00 an Hour?**

Sounds like big pay, doesn't it? But thousands of men, when they have climbed the ladder and figured back, have found that the time they spent in spare-hour reading and studying paid them bigger than any wages they ever earned.

Let's figure it out. There are at least three evening hours a day that can be used in putting practical knowledge into your head. Suppose you used just a fair portion of these, putting in, say, 500 hours a year for two years—1000 hours in all.

The well-informed man in any business can expect to earn \$2000 a year more than the uninformed one. In five years this difference amounts to \$10,000, or \$10 for every hour of your spare-time employment.

We are putting it conservatively. Many men have found their use of spare time paid them as high as \$25 to \$50 an hour. Spare-time investment is the biggest thing you can undertake.

**American Electricians' Library**

Six volumes—over 2,000 pages—fully illustrated—special, durable library binding—\$2.00 in ten days and \$2.00 monthly for seven months

The six volumes of the AMERICAN ELECTRICIANS' LIBRARY bring you step-by-step directions for the installation of every type of conduit wiring job; they tell you just how to handle every kind of lighting circuit and switch job; they give you stunts for saving time on maintenance routine; they give you usable tips on electrical machinery erection; they offer you practical, clear explanations of all kinds of A.C. armature winding jobs; they bring you a thousand armature winding and electrical machinery and control diagrams; they show you the surest, quickest methods of locating and remedying circuit troubles. They cover a thousand and one problems that you have to face daily. They give you the kind of practical job information that has made all of the Croft books famous. They are books of useful hows and whys and wherefores for wiremen, trouble shooters, armature winders, electrical maintenance men and electrical contractors. The books prepare you quickly and surely for the biggest-paying jobs in the electrical field.

**Everything Needed for the Big-Pay Job**

- how to lay out a conduit wiring job.
- how to install conduit wiring for all types of buildings and all types of work.
- how to measure conduit requirements.
- how to ream conduit.
- how to arrange three- and four-way switch circuits.
- how to install master and emergency circuits.
- how to handle remote-control switching.
- how to install door and time switches.
- how to arrange three- and four-way switch circuits.
- how to locate a circuit trouble surely and quickly.
- how to determine the nature of a fault.
- how to break down a fault.
- how to determine polarity.
- how to handle electrical machinery and control circuits.
- how to wind armatures.
- how to use armature winding diagrams.
- how to handle theatre wiring jobs.
- how to install a burglar alarm system.
- how to connect voltmeters, ammeters, wattmeters, etc.
- how to rewind a machine for the same conditions.
- how to reconnect an existing stator winding for different conditions.
- how to test stator windings for faults.
- how to unload and move electrical machinery.
- how to support electrical machinery.
- how to erect, locate and fix electrical machinery.

**Judge for yourself. See the books free. Send no money. Mail just the coupon**

Let us send you this new, fact-packed, pay-raising set for your free examination. You send no money. We stand all the expense. The six books will bring you information that is needed in the bigger and better electrical jobs—information that you can obtain nowhere else in the same clear and complete form. Mail your coupon now—you'll be glad you did when the books arrive.

Gentlemen — Please send me the Croft American Electricians' Library (shipping charges prepaid), for 10 days' free examination. If satisfactory, I will send \$2.00 in ten days and \$2.00 per month until \$16.00 has been paid. If not wanted, I will write you for return shipping instructions. (Write plainly and fill in all lines.)

McGraw Hill Book Co., Inc., 370 Seventh Avenue, New York.

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

Company.....  
(Books sent on approval to retail purchasers in U. S. and Canada only.) S.I. 19-1-25

**The first step to a big-pay electrical job!**

**Mail this coupon NOW!**

# Here's the career for YOU



Get into this wonderful, big-paying profession. Hundreds of openings now in Motion Picture Camera Work, Portrait and Commercial Photography. Learn at home. Big money while learning.

Earn Up To **\$250 a Week**



High salaried positions everywhere or open your own studio. "My business averages \$700 to \$1000 a week," writes Michael Gallo. Others doing equally well. Even spare time work pays up to \$75 a week!

**CAMERA FREE**

to students. Your choice of real Motion Picture Camera taking standard professional film used by all theatres, or 5x7 View Camera, latest model, genuine anastigmat lens.

**Send for Book**

Tells all about Professional Photography and how to make big money quickly. Also details of Free Camera Offer. Write today. NOW!

New York Institute of Photography  
143 West 36th St., New York (Dept. 82)

**NOTE:**  
If you prefer to come to our New York or Chicago Studios for personal instruction, day or evening classes, write for Catalog #102 to nearest address: 141 West 36th St., New York, or 630 So. Wabash Ave., Chicago, Ill.

## RADIO CATALOG



**also LOG**  
**Save** on all the latest standard radio merchandise! No exceptions. Our 1926 Beautifully Illustrated Catalog

**JUST OFF THE PRESS!!**  
Everything new in Radio at **SLASHED PRICES.**

Write for it today, before you buy anything. Delay means losing exceptional chance to participate in this great **BARGAIN-SALE.** Rush your name and address at once and get also a **LOG BOOK FREE.**

**ECONOMY RADIO SALES COMPANY**  
288 6th Ave. Dept. K New York  
**DEAL DIRECT AND SAVE REAL MONEY**  
(No Dealers)

## Genuine Diamond Ring

**Biggest Diamond Bargain Ever Offered**  
Sent to You for Only

**\$1.00 Down**  
Complete Price Only

**\$37.50**

**FREE** Big Diamond Book sent absolutely free. Write today!



**LOFTIS** No. 49 - Wrist Watch, 18-K White Gold; 17 Jewels. Price only \$37.50. \$1.00 down and \$1.00 a Week  
**BROS. & CO. EST'D. 1858**  
Dept. G22 Stores in Leading Cities  
**108 NORTH STATE STREET, CHICAGO, ILLINOIS**

**Radio Fans:** Listen in on WYTT every Tuesday night from 7 to 7.30, every Friday night from 10 to 10.30 Central Standard Time.  
**LOFTIS BROS. & CO.'S** hour of music

## Straightens Shoulders - Increases Pep

**THE NATURAL BODY BRACE**—Corrects stooping shoulders, straightens the back, gives the lungs chance for normal expansion, induces proper breathing. Brings restful relief, comfort, energy, and pep. For men and women.

**Costs nothing to try it**

Write for 30 days free trial offer and free book.  
**NATURAL BODY BRACE CO.**  
Howard C. Rash, Ft. 286 Rash Bldg., Salina, Kansas

Insure your copy reaching you each month. Subscribe to **SCIENCE & INVENTION**—\$2.50 a year. Experimenter Publishing Co., 53 Park Pl., N. Y. C.

ment, for if it is immersed in water or oil, a certain amount of air, some perhaps as visible bubbles, will adhere to it.

Referring to Fig. 3, the wire may be wound, say 20 times, around a lead pencil, and squeezing the convolutions together, the length they occupy is measured. Suppose the wire occupies a space of 65 centimeters, or say 2.6 inches, then our wire has a thickness obtained by dividing this figure by 20, which gives 3.25 millimeters, or about .125 inch. Squaring this gives us the cross-sectional area of the wire, and its length is then measured, and multiplying the cross-section by its length we get its volume. If this is done in the metric system, the cross-sectional area will come out 0.000825 square centimeter; if it is 78 centimeters long, its volume will be 0.06325 cubic centimeter. The weight of this piece of wire is too little to be accurately determined by our letter scales, so we will take ten times this length. Suppose it weighs 4.8 grams, then our short piece of wire weighs 0.48 grams, giving its specific gravity as 0.48 divided by 0.06325, which equals 7.7. We are supposed to have taken a bit of wire such as used by florists for mounting flowers.

### OWNERSHIP STATEMENT

Of the Ownership, Management, Circulation, Etc., Required by the Act of Congress of August 24, 1912, of **SCIENCE AND INVENTION**, published monthly at New York, N. Y., for Oct. 1, 1925. State of New York, } ss. County of New York, }

Before me, a notary public in and for the State and county aforesaid, personally appeared Hugo Gernsback, who, having been duly sworn according to law, deposes and says that he is the editor of **SCIENCE AND INVENTION**, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are: Publisher, The Experimenter Publishing Co., Inc., 53 Park Place, New York, N. Y. Editor, Hugo Gernsback, 53 Park Place, New York, N. Y. Managing Editor, H. Winfield Secor, 53 Park Place, New York, N. Y. Business Manager, R. W. DeMott, 53 Park Place, New York, N. Y.

2. That the owners are: (if owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent. or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) The Experimenter Publishing Co., Inc., 53 Park Place, New York, N. Y.; Hugo Gernsback, Sidney Gernsback, R. W. DeMott, H. W. Secor, Dr. T. O'Connor Sloane and Mrs. Catherine Major, all of 53 Park Place, New York, N. Y.; M. M. Finucan, 720 Cass Street, Chicago, Ill.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent. or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds or other securities than as so stated by him.

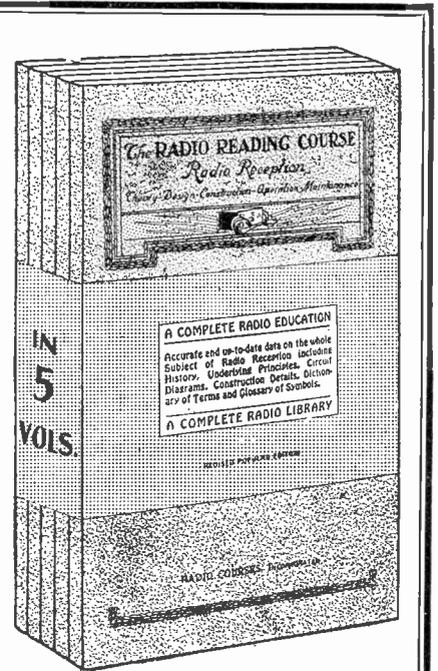
5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is ..... (This information is required from daily publications only.)

H. GERNSBACK, Editor.

Sworn to and subscribed before me this 28th day of September, 1925.

(SEAL)

**JOSEPH H. KRAUS,**  
Notary Public, Queens County Register's No. 4523, New York County Register's No. 7364, New York County Clerk's No. 481. (My commission expires March 30, 1927.)



Price \$1.97

# A RADIO EDUCATION

IN 5 VOLUMES

Theory, Design, Construction, Operation and Maintenance

LEARN AT HOME

These five component parts of a complete Radio Instruction Course are outlined in five volumes that contain not merely the essentials as so many books do, but more, they contain all that any modern up-to-the-minute textbook on any subject would cover. They are in themselves a **COMPLETE** radio education teaching every possible portion of Radio science.

Size of each book 6 by 9 inches, handsomely bound and illustrated with charts, diagrams, descriptions of equipment, etc.

**SEND NO MONEY** for these books. Just forward your name and address. We send you the books at once. On receipt of same you pay the postman \$1.97 plus a few cents postage and then they are yours.

Distributed by

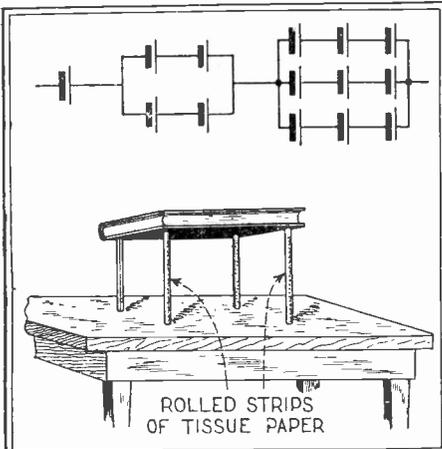
**The Consrad Co.**  
233 Fulton St., New York, N. Y.

**Answers to Scientific Problems and Puzzles**

(Continued from page 726)

1. Diagram herewith shows 14 cells arranged so as to form a battery of 9 volts.  
2. Ammeters  $A_1$  and  $A_2$  are connected in series with the rest of the circuit. Hence the same current will pass through both, and their readings should be the same.

A voltmeter reads the product of the current and resistance between its terminals. The resistance across  $V_1$  consists of the entire circuit outside of the battery, *i. e.*, the two ammeters, resistance coil R and the connecting wire, whereas the resistance across  $V_2$  is only R.  $V_1$  therefore will read higher than  $V_2$ . However, since the resistance of two good ammeters and the connecting wire is small in comparison with R of 100 ohms the voltmeter readings would hardly differ by an appreciable amount.



Top: How dry cells are connected to form a 9-volt battery. Bottom: Supporting book with tissue paper.

3. Suppose for simplicity, that branch D is at first open while the circuit ABCE is closed. Then, by Ohm's law the current through E will be 6 divided by  $1\frac{1}{2}$ , or 4 amperes. And the fall of potential across E will be  $4 \times 1$  or 4 volts. But this exactly equals the E.M.F. in branch D, so no current can pass through it regardless of the resistance in this branch.

A more rigid proof:

By Kirchoff's law the sum of the separate falls of potential around a circuit is always zero. Let I be the current through ABC,  $I_2$  the current from A to C through D, and R the resistance in D.

$$\text{Then } 6 - \frac{1}{2}I_1 - I_2 = 0$$

$$\text{Or } 6 - \frac{3}{2}I_1 - I_2 = 0 \quad (1)$$

$$\text{and } 4 - RI_2 - I_2 = 0$$

$$\text{or } 4 - I_2(R+1) - I_2 = 0 \quad (2)$$

$$I_1 = \frac{2}{3}(6 - I_2) \quad \text{from (1)} \quad (3)$$

$$4 - I_2(R+1) - \frac{2}{3}(6 - I_2) = 0 \quad \text{by combining (2) and (3)}$$

**WANTED**

ARTICLES pertaining to automobiles such as handy kinks, roadside repairs and anything of interest to the man who drives a car. \$50.00 in prizes every month are offered by MOTOR CAMPER AND TOURIST for such articles. Get a copy at your newsstand and see what is wanted. If your newsdealer cannot supply you send for free sample copy to:

MOTOR CAMPER & TOURIST  
53 Park Place,  
New York City.

**22 YEARS OF SUCCESS**  
FROM THIS RECOGNIZED COLLEGE OF ENGINEERING  
a Home-Study Course in  
**DRAFTING**

Everything today is built from drawings made by Draftsmen. Industry calls for 50,000 new men yearly. Draftsmen work hand in hand with the architect, the engineer, the designer, the builder. And thus many men rise from such positions to be heads of great contractors' organizations, directors of railroads, chief engineers—responsible positions commanding very attractive salaries.

**FREE TRIAL LESSON**

Prove your fitness and liking for one of industry's highest paid professions. We want you to know what Drafting is like . . . how readily you can progress . . . how we train and teach you by mail. So, before you enroll . . . FREE . . . without cost or obligation . . . we send you a trial lesson to study in your own home.

**Within Ten Months Increase Your Income**

No special training or talent is required. In 10 months' time or less . . . we can train you . . . at home, in your spare hours . . . to be an expert Draftsman.

And remember this: In Drafting, a big income is open to every properly trained man. Thousands today are earning \$35 to \$100 per week. The reason is simple: Good Draftsmen are in constant demand.

**Book of Facts FREE**

We will send you a 40-page Book. It tells you all about Drafting . . . and our courses. What prominent men say . . . where Draftsmen are employed . . . their salaries . . . their opportunities . . . what our students have done and are doing . . . how many have increased their salaries even before finishing their courses . . . how many hold high-salaried executive positions today. Tells how 34 instructors give you from this recognized 22-year-old college a practical, short, home-study course.

**The Coupon Below Means Money to You**

Find out what Drafting may mean to you . . . mail that coupon. Here is a field in which you can work and win.

We make the test easy, for, with no obligation, we send you a trial lesson FREE. Note the fairness of this offer, the absence of exaggerated promises.

**\$25 Outfit Included**

When you enroll, you will need drafting instruments; so included in the cost of the course, is a \$25 "lifetime" set. If you have instruments, credit will be allowed. Note that we do not claim to give you these instruments "free". Tuition is low, payments easy.

**In Chicago—Earn While You Learn**

Those who can come to Chicago will find opportunity to earn living expenses in part-time positions, outside of school hours, while attending day or evening classes at the College.

Chicago Technical College, founded 1904, is known as one of America's oldest and largest schools of specialized engineering. Over 1000 men enroll in resident day and evening courses yearly.

Diplomas in Civil, Mechanical and Electrical Engineering and Architecture granted after two years. Degree of B. S. conferred after three years in the day course. Short courses offered in Drafting, Plan Reading, Estimating, etc. Evening classes for day workers.

If interested in attending Day or Evening Classes at the College in Chicago write for 72-page "Blue Book"—mailed free.

Send Today for FREE Trial Lesson  
Fill Out the Attached Coupon NOW

**Chicago TECHNICAL College**

Drafting—Engineering—Electricity—Architecture . . . all branches

Chicago Technical College,  
Dept. 1245 118 E. 26th St., Chicago, Ill.  
Send me, without cost or obligation, your  
FREE Trial Lesson and your 40-page Book  
of Facts about Drafting.

Name .....  
Address.....  
City and State.....



## The Tired Old Man who may some day be you!

He's a kindly, well-meaning old fellow, but somehow a failure. Seems as if he never could quite make the grade.

Too frequently now you will find him scanning the Help Wanted columns of the newspapers, searching for something—for anything—to do. You feel a tinge of pity as you pass him by, and breathe a hope that you will never come to that.

Take care, young man—take care lest some day that Tired Old Man be you!

Prepare yourself now for the great day that is Tomorrow. Plan your future as carefully as an architect would plan a building of value beyond price. Train yourself to do some one thing outstandingly well. For then, and then only, will the years find you rising instead of falling.

There is no better way to prepare for advancement in any line of business than to study at home in spare time through the International Correspondence Schools. Such a course will lift you out of the ranks of the untrained and jump you to success far quicker than if you try to make the journey alone.

Mail the coupon for free booklet!

### INTERNATIONAL CORRESPONDENCE SCHOOLS

Box 6224-D, Scranton, Penna.

Oldest and largest correspondence schools in the world. Without cost, please tell me how I can qualify for the position or in the subject before which I have marked an X:

#### BUSINESS TRAINING COURSES

- |   |   |
|---|---|
| <input type="checkbox"/> Business Management            | <input type="checkbox"/> Salesmanship           |
| <input type="checkbox"/> Industrial Management          | <input type="checkbox"/> Advertising            |
| <input type="checkbox"/> Personnel Organization         | <input type="checkbox"/> Better Letters         |
| <input type="checkbox"/> Traffic Management             | <input type="checkbox"/> Show Card Lettering    |
| <input type="checkbox"/> Business Law                   | <input type="checkbox"/> Stenography and Typing |
| <input type="checkbox"/> Banking and Banking Law        | <input type="checkbox"/> Business English       |
| <input type="checkbox"/> Accountancy (including C.P.A.) | <input type="checkbox"/> Civil Service          |
| <input type="checkbox"/> Nicholson Cost Accounting      | <input type="checkbox"/> Railway Mail Clerk     |
| <input type="checkbox"/> Bookkeeping                    | <input type="checkbox"/> Common School Subjects |
| <input type="checkbox"/> Private Secretary              | <input type="checkbox"/> High School Subjects   |
| <input type="checkbox"/> Spanish                        | <input type="checkbox"/> French                 |
| <input type="checkbox"/> Illustrating                   |   |

#### TECHNICAL AND INDUSTRIAL COURSES

- |   |  |
|---|--|
| <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Architect               |
| <input type="checkbox"/> Electric Lighting      | <input type="checkbox"/> Architects' Blueprints  |
| <input type="checkbox"/> Mechanical Engineer    | <input type="checkbox"/> Contractor and Builder  |
| <input type="checkbox"/> Mechanical Draftsman   | <input type="checkbox"/> Architectural Draftsman |
| <input type="checkbox"/> Machine Shop Practice  | <input type="checkbox"/> Concrete Builder        |
| <input type="checkbox"/> Railroad Positions     | <input type="checkbox"/> Structural Engineer     |
| <input type="checkbox"/> Gas Engine Operating   | <input type="checkbox"/> Chemistry               |
| <input type="checkbox"/> Civil Engineer         | <input type="checkbox"/> Automobile Work         |
| <input type="checkbox"/> Surveying and Mapping  | <input type="checkbox"/> Airplane Engines        |
| <input type="checkbox"/> Metallurgy             | <input type="checkbox"/> Agriculture and Poultry |
| <input type="checkbox"/> Steam Engineering      | <input type="checkbox"/> Radio                   |
| <input type="checkbox"/> Mathematics            |  |

Name..... Street..... City..... State.....

Address..... 6-26-25

City..... State..... Occupation.....

If you reside in Canada, send this coupon to the International Correspondence Schools Canadian Limited, Montreal

## Learn How to BOX

**JIMMY DE FOREST**  
World's Greatest Trainer  
Will Teach you BY MAIL  
In 20 weeks I will teach you all there is to know about boxing—just what I taught Jack Dempsey and a host of other champions and great contenders. Every 6 months I select champions in all weight classes from my pupils. I train them at my own expense at my Long Branch, N. J., camp. Then **TEX RICKARD**, greatest of all promoters, stages them in bouts in his new Madison Square Garden at New York. Send today for my big FREE book, "The Golden Age of Boxing." Enclose 10c to cover cost of mailing. Greatest book of its kind ever written. Profusely illustrated with photos of great fighters and fully describes my course and FREE OFFER. There's fame and fortune waiting for you if you become a good boxer. Get my book and read all about it. Do it NOW. **JIMMY DE FOREST, Box 741, 347 Madison Ave., New York City**



**Magic Tricks** Send 10c, and we mail 200 Magic Tricks with coins, cards, dice, ribbons, rings, etc., explained, so simple you can do them at once. Astonish and amuse friends and make money. Be a wizard, shine as a star in your town. We send free with Tricks Catalog 1000 Bargains. Write now Bates Magic Co., Dept. 52, Melrose, Mass.

$-I_2(R+1) + \frac{2}{3} I_2 = 0$   
Hence  $I_2=0$  for any value of R.  
4. Yes. As the cylinder is forced downward the air within it is compressed and the cylinder will displace less and less water. Eventually, it will reach a depth such that it displaces a weight of water less than its own weight, whereupon it will sink permanently.

5. Let D represent the diameter in inches of the band before it is lengthened. Then  
 $\pi D + 36$

will be the diameter after its circumference is lengthened by 36 inches. The change in diameter thus produced will be  
 $\frac{\pi D + 36}{\pi} - D$  or  $-\frac{36}{\pi}$

inches. And the possible elevation all around will be half of this or  $-\frac{18}{\pi}$  or about 5.7 inches.

Thus it can be seen that the elevation would be the same whether the earth were as large as the sun or as small as a pea.

6. The most economical size for a cylindrical can closed at both ends is one in which the height just equals its diameter. It then has the greatest possible volume for the amount of material used in its construction.

7. Let X be the distance of the rear car from B when the pier A gives away. Then by the principle of moments  
 $3,500 X + 3,500 (100 + X) = 5,000 \times 200$   
from which X turns out to be nearly 93 feet.

8. When the sound from the organ pipe strikes a resonator, some of the sound enters through the opening and is reflected by the walls until it reissues from the mouth of the resonator. In the act of reflection a reaction is produced which will cause the resonators to rotate in a clockwise direction provided the friction of the bearings is not too great.

9. Divide the sheet of tissue paper into four equal strips and roll them into compact cylinders. The book may then be balanced upon them in the manner shown.

### STAR MAPS

Quite a few of our readers are interested in maps of the heavens showing the constellations and where to find them. Due to the large number of subjects covered by SCIENCE AND INVENTION every month, and as there seems to be more of a need of the Star Maps in our sister publication, MOTOR CAMPER & TOURIST, these appear only in that publication at this time, and we gladly recommend the attention of our readers to MOTOR CAMPER & TOURIST.

### IMPORTANT

#### TO NEWSSTAND READERS

In order to eliminate all waste and unsold copies it has become necessary to supply newsstand dealers only with the actual number of copies for which they have orders. This makes it advisable to place an order with your newsdealer, asking him to reserve a copy for you every month. Otherwise he will not be able to supply your copy. For your convenience, we are appending herewith a blank which we ask you to be good enough to fill in and hand to your newsdealer. He will then be in a position to supply copies to you regularly every month. If you are interested in receiving your copy every month, do not fail to sign this blank. It costs you nothing to do so.

To..... Newsdealer

Address.....

Please reserve for me..... copies of SCIENCE & INVENTION every month until I notify you otherwise, and greatly obliged,

Name.....

Address.....

## A new Parks!

**Cabinet Shop Special**  
No. 7  
**\$250**  
AS ILLUSTRATED WITH MOTOR

You ought to have this handy Parks in your shop!

A compact, complete machine designed just like a big production outfit at one-fifth the cost. Nothing extra to buy. Motors included, operating from any light socket. Fits in a corner of your basement. Does any kind of cabinet and joinery work. Circular saw, jointer and bandsaw on permanent all-steel frame. Add lathe, shaper and other attachments at small cost. You can make money with this Parks! Write for circular.

The Parks Ball Bearing Machine Co.

1553 Knowlton St., Cincinnati, Ohio  
Canadian Fac: 200 Notre Dame East, Montreal, Can.

# PARKS

WOODWORKING MACHINES

## Save 20 to 50% FREE RADIO CATALOG

**LATEST IN HOOD-UPS AND RADIO**  
Get the lowest rock-bottom prices on radio parts, sets, kits. New free Radio Catalog and Guide brimful of standard, reliable, guaranteed goods. Over 100 latest hood-ups and illustrations. Be sure to get this thrifty book before you buy. It puts money in your pocket. Saves you as much as half on a set. Also please include name of radio fan. Send letter or postal NOW.

THE BARAWIK COMPANY

104-136 S. Canal St., Chicago, U. S. A.

# Radio Dealers WANTED!

If you are the type of dealer who hustles after business, who isn't content to wait for trade to come in but who takes sets out to demonstrate, can talk and sell quality merchandise, and knows Radio values, we have a big proposition for you. Are you that dealer?

50% DISCOUNT TO DEALERS

We manufacture a complete line of high grade receivers and sell to dealers at 50% discount. We are distributors for more than 225 Nationally advertised lines.

Write today for amazing offers, new 112-page catalog and regular monthly catalogs quoting below-the-market prices on latest merchandise—all free. Everything in Radio for less.

AMERICAN RADIO MFG. CO., 1428 McGEE ST., KANSAS CITY, MO.

Sale!

## A Cinch to Make \$25 a Week

— In Spare Time

Amazing new home-study method makes it easy to learn to make big-paying clever show cards. Great demand. No talent needed. Write for special Free offer and illustrated book to Washington Show Card School, Room 2612-C, 1115-15th St., N.W., Washington, D. C.

Free

Leatherette Carrying Case Free with Big 8 Foot Wonder Telescope. 5 sections. Brass bound. Powerful lenses—all free. See people and objects miles away as if they were close. See moon and stars as never before. Useful and entertaining. Could tell color of a way. Mrs. aerophone 4 miles away. Horn. Read numbers on freight cars mile away. A. C. Pa. inest. Thousands pleased. Watch my scope with FREE Case and Strap. deposit with Postman only \$1.85 plus few pennies postage. Satisfaction guaranteed or deposit returned. Order NOW. FERRY & CO., Dept 1259, 3224 N. Halsted St., Chicago

**WRNY Plan Expands**

By CHARLES D. ISAACSON  
(Continued from page 737)

"Waltz Song" from Gounod. It would be impossible to list all the old-time songs by Anna Russo, as she is selecting from every school.

The Lullaby Lady, Kathryn Behnke, like the old-time song girl, chooses her selections from all types of music.

Sigmund Spaeth has shown most interestingly how the simplest kinds of melodies have developed into great music and has shown how some of our popular music of today, changed in characteristics, could sound almost like great music, also he has shown how great composers would handle some of our simplest themes like "Yankee Doodle."

In the violin series, Samuel Polonsky has done fine work. His selections have included many Kreisler numbers and special arrangements of old themes and Hebrew melodies.

The world of chorus was well represented by the Clara Novello Davies singers in selections from oratorios and by the fine Irving Quartette, with Meta Christensen as its sponsor and leader.

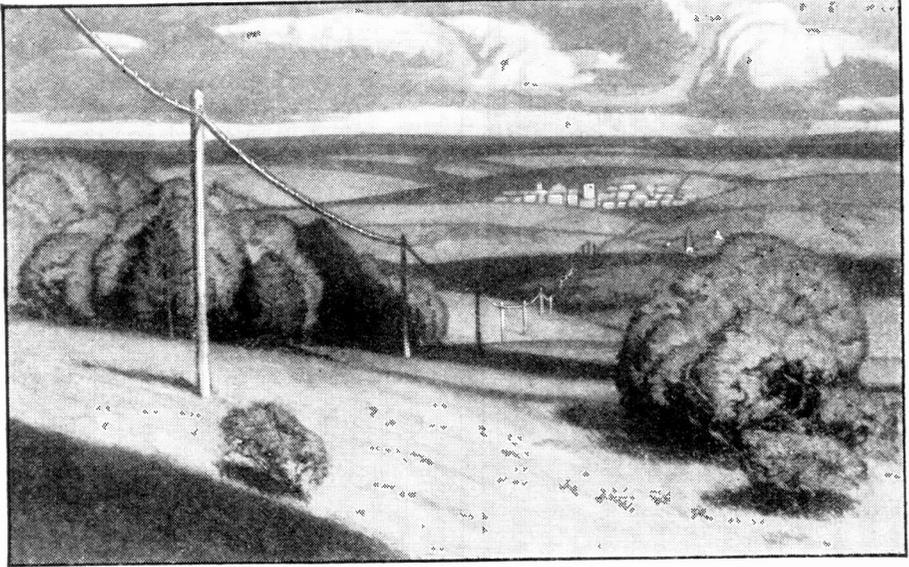
Among the novelties presented at WRNY on Fridays was the broadcasting from the Woolworth Building at noon, six o'clock and ten in the evening. A seance was held in the studio one evening and on another evening ghost stories were told.

**SPECIAL FEATURES**

One of the interesting special events was the celebration of the 42nd Street Association, which brought, among others, the motion picture actress, Evelyn Brent; Josephine Duval, of "Not So Long Ago"; Sidney Machot, of "Outside Looking In"; Miriam Lax, of the Rialto; Anna Dale, of "The Fool," and such speakers as Louis Wiley, of the Times; Julius Kugelmann and the Hon. Travis Whitney.

The English Speaking Union dinner was broadcast. John W. Davis, the Rt. Hon. Sir Robert Horne, Capt. H. Arthur Evans, F. W. Pethwick-Lawrence, Esq., and Major-Gen. Sir Robert Hutchinson were among the speakers at this banquet.

The Near East Golden Rule dinner was also broadcast. The principal speakers were Dr. John Finley, Bishop James Cannon, Hamilton Fish, Jr., and Charles Vichrey. Dr. S. Parkes Cadman also made a short address.



**Safeguarding the lanes of speech**

The New York-Chicago telephone cable has been completed and is now in service. A triumph of American telephone engineering, the new cable is the result of years of research and cost \$25,000,000 to construct. Its first reach extended along the Atlantic seaboard, then steadily westward until this last long section to Chicago was put into service.

To the public, this cable means dependable service irrespective of weather conditions. It is now not likely that sleet storms, which at times interfere with the open wire type of construction with 40 to 50 wires on a pole, will again cut off the rest of the nation from New York or from the nation's capital as did the heavy sleet storm on the day of President Taft's inauguration.

The new cable means speedier service, as it provides numerous additional telephone circuits and will carry a multitude of telephone and telegraph messages. It would take ten lines of poles, each heavily loaded with wires, to carry the circuits contained in this most modern artery of speech.

This cable, important as it is, is only one of the Bell System projects that make up its national program for better telephone service to the subscriber. It is another illustration of the System's intention to provide the public with speedier and even more dependable service.

**The Experimenter**

has come back! If you are one of the one hundred thousand readers of the old ELECTRICAL EXPERIMENTER, you will no doubt be glad to hear that the EXPERIMENTER is coming back BIGGER AND BETTER THAN EVER. PRACTICAL ELECTRICS has been changed into an entirely new kind of magazine entitled

**The Experimenter**

In this magazine which has been greatly enlarged in point of contents, illustrations and circulation, you will find the following new departments:

- Experimental Radio
- Experimental Chemistry

There is an entirely new treatment of radio containing experiments only. 90% of the magazine contains pure experiments written by the foremost authorities in their respective fields, also a monthly editorial by the writer.

A fine roto-gravure section is now added to brighten up the magazine. If you want experiments, this is your magazine.

Be sure to reserve a copy from your news-dealer before the issue is sold out. The next issue of THE EXPERIMENTER will be on sale at all newsstands beginning November 20th, 1925.

**Hugo Gernsback**  
Editor



**AMERICAN TELEPHONE AND TELEGRAPH COMPANY**  
AND ASSOCIATED COMPANIES

**BELL SYSTEM**

*One Policy, One System, Universal Service*

**Electrical Engineering**  
Course for men of ambition and limited time. Over 4000 men trained. Condensed course in Theoretical and Practical Electrical including the closely related subjects of Mathematics and Mechanical Drawing taught by experts. Students construct motors, install wiring, test electrical machinery. Course complete

**In One Year**  
Prepare for your profession in the most interesting city in the world. Established in 1893. Free catalog.

**BLISS ELECTRICAL SCHOOL**  
222 Takoma Ave., Washington, D. C.

*Photo-Letter-Writer*

Wonderful, new device, guides your hand; corrects your writing in few days. Big improvement in three hours. - No failures. Complete outline FREE. Write C. J. Ozment, Dept. 44 St. Louis, Mo.

**AGENTS WANTED**  
**ANTI-MIST**  
Guarantees Clear Vision

**YOU** can quickly build a big money-making business of your own selling Anti-Mist. Sells to auto owners, garage and auto supply stores, opticians, druggists, cigar stores, railroads, and street car companies. Anti-Mist makes glass frost-proof, steam-proof and weather-proof. Clear vision guaranteed in all weather; money back guarantee if it fails.

\$50 to \$100 WEEKLY  
Others are doing it. Sells on sight. Anti-Mist retails at 35c for 3/4 oz. can—\$1.50 for 8 oz. can. Send 35 for 3/4 oz. can and full particulars of exclusive agency NOW.

**ANTI-MIST CHEMICAL COMPANY**  
Dept. 863T 201 E. Ontario Street, Chicago, Ill.

**The Math Pony**

A table of partial products which saves time and mental effort in multiplication and division. To multiply—add. To divide—subtract. Absolutely accurate. Invaluable for students. 50c (money order).

**MATH PONY, 229 N. Harvey Ave., Oak Park, Ill.**



## I'll Show You How FREE

Give me thirty minutes of your time, and I'll teach you more about playing piano than you can learn in two weeks studying by any other method.

YES, I'll do just this, and won't charge you a single penny for the instruction. Just fill out the coupon below and mail it today—and I'll send you an interesting sixty-four page booklet, "How to Learn Piano" or organ, and two lessons of my course, absolutely free.

No previous training necessary to study my way. I start you from the very beginning—yet in four lessons you will begin playing pieces from notes in every key. You don't have to spend years, and hundreds of dollars to learn how to play—you can learn in quarter the time ordinarily required, yet pay only a few cents a lesson. Remember, however—that you can obtain the first two lessons of my course absolutely free—by mailing the coupon at once.

### FREE LESSON COUPON

QUINN Conservatory Studio S.1.12, 598  
Columbia Rd., Boston 25, Mass.

Please send me, without cost or obligation, your free booklet, "How to Learn Piano or Organ," free sample lessons and full particulars of your method.

Name .....  
Address .....



# Elto

(Designed and built by Ole Evinrude)  
**Quick Detachable**

## Rowboat Motor

Powerful, Light Weight, Speedy, Quiet Running, Practically Vibrationless. Starts on a quarter turn. Easily carried with you anywhere you go. No rowing, no work, no bother. Just ride and enjoy the greatest of water sports. Slow down for fishing. Speed up for racing. Great power.

Write for **FREE Catalog** describing all the new features, especially the famous Propello Pump. Only Elto has it. Write today.

ELTO OUTBOARD MOTOR CO. Dept. 48  
Ole Evinrude, Pres.  
Man'rs Home Bldg., Milwaukee, Wis.



Sent for **\$1.00** down!

Balance in easy monthly payments buys the famous

## STUDEBAKER 21 The Insured Watch Jewels

60 Different Art Beauty Cases. 8 Adjustments. Buy direct—save 50 percent. Free Book. Write today for Book of Studenaker Advance Watch. Limited offer. Styles and \$1.00 down offer. Studenaker Watch Co., Dept. K97 South Bend, Indiana



## Matchcraft— The Latest Craze

(Continued from page 705)

is easier to handle. After the antenna was put in place, it was silvered with an ordinary aluminum "silver," which gives the antenna a sparkling appearance when held under the light. The foliage is the ordinary type of grass used in aquariums. Tiny holes are punched into the wooden board underneath to permit of the insertion of the stems. The green lawn is ordinary green blotting paper. In this case the towers were painted with a metallic silver paint.

Fig. 12 shows a small radio set built of matches; buttons serve as dials and green silk thread is used for the wiring of the loop. The loop is cemented fast to a button.

The beautiful windmill, illustrated at Fig. 13, was built by Mr. Joseph F. Odenbach, also of the staff of SCIENCE AND INVENTION Magazine. The matches for the tower and the top were first laid down. Then the structures for the edges of the vanes of the windmill were built and inserted into a cork, which was mounted on the end of a knitting needle. The vanes were then cross-braced, care being taken that they had a sufficient rake. The matches were then glued in place on the vanes, and when they were dry the entire device was assembled. When this is held in front of an ordinary electric fan the windmill revolves quite rapidly.

A working model of a derrick was built by Mr. A. P. Peck. This is shown in Fig. 14. The boat and the house were both built separately. By employing the foundation principle described in the construction of the bridge, the girders for the shovel were built as previously intimated. The chimney was made entirely of matches which were cemented together, using a pencil as the form upon which the matches were laid. A rubber band was then strapped around the matches forming the chimney to hold them in place while they dried, and after they were dried the pencil was removed. A pin was then driven into the pole and the house mounted upon it, which permits the house to swing back and forth. Pieces of cheesecloth soaked in plaster of Paris were then dropped upon the nails to give the wave effect and tick plaster of Paris was then molded in place to finish the wave formation. Note particularly how realistic these waves seem. The shore was made of plaster of Paris, upon which bird gravel was sprinkled, while the plaster was still wet.

From the above information, the construction of these match novelties will be apparent. It is now up to you. You probably have a little more time at your disposal than the editors of this publication have. Nevertheless, it will be worth your while to spend a few dreary evenings on Matchcraft. You may elaborate on the ideas presented in this publication and build a device of a similar nature to those illustrated by us if you should so desire. You need not decorate your model or lend realism to it by using plaster of Paris or other backgrounds, as it is merely those items made entirely of matches which will be looked upon by the judges in making the award. Remember that matches must constitute 90 per cent. of the model. You may use any kind of glue you desire and may do anything with the matches that you care to. They may be cut, drilled or bent.

Match tricks, that is, that variety of tricks where matches are laid loosely on a surface to form puzzling combinations, geometrical designs, etc., are not eligible in the Matchcraft Contest.

Incidentally, the editors have discovered that Matchcraft is a very fascinating pastime. You actually have no idea how fascinating it is until you have tried it.



# Stamp out Tuberculosis with these Christmas Seals



The National, State, and Local Tuberculosis Associations of the United States



**WRITTEN 2 YEAR GUARANTEE**

### Battery Prices SMASHED!

**To Consumers Only**

Here is a real battery quality, guaranteed to you at prices that will astound the entire battery-buying public. Order Direct From Factory. Put the Dealer's Profit in your own pocket. You actually save much more than half, and so that you can be convinced of true quality and performance, we give a **Written 2-Year Guarantee**. Here is your protection! No need to take a chance. Our battery is right—and the price is lowest ever made. Convince yourself. Read the prices!

<b>Auto Batteries</b>	<b>Radio Batteries</b>
6 Volt, 11 Plate, \$9.50	6 Volt, 100 Amp. \$9.50
6 Volt, 18 Plate, 11.50	6 Volt, 120 Amp. 11.50
12 Volt, 7 Plate, 13.00	6 Volt, 140 Amp. 13.00

**Buy Direct—Send No Money**  
We ask no deposit. Simply send name and address and style wanted. Battery will be shipped same day we receive your order Express C.O.D. subject to your examination on arrival. Our guarantee accompanies each battery. We allow 5% discount for cash in full with order. You cannot lose! Send your order today—NOW!

**ARROW BATTERY CO.**  
Dept. 9 1215 So. Wabash Ave., Chicago

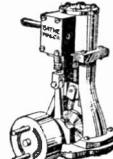


**MODEL SLIDE VALVE MARINE ENGINE—**

1/2" bore, \$12.75, or 3/8" bore, \$15.75

Be sure to power your boat with a Bathe steam engine and boiler model. We are builders of working model engines and boilers of many types. We can supply you with a power unit that will meet the requirements of your particular model boat. Model boiler and pipe line fittings. Special work. New illustrated catalogue, 20c.

**BATHE MFG. CO.**  
Dept. 2, 5214 Woodland Ave., Phila., Pa.



## Book Review

**THE PRINCIPLES OF REASONING**, by Daniel Somner Robinson, Ph.D. Hard covers 5 1/4" x 8 3/4", 390 pages. Published by D. Appleton & Co., New York City. \$2.50.

The reviewer admits, perhaps with shame, that he never studied logic as such. In this work we have a thorough development of logic and of the syllogisms, which often seems so puzzling. We can simply say this much about the book, that if anybody wishes to really study, what is called the science of logic, he can spend many hours on this interesting treatise. Hardly anything seems to be omitted from its pages, and a useful bibliography is given at the end, followed by a six page index.

**THE FINGER PRINT INSTRUCTOR**. By Frederick Kuhne. Hard covers, 6" x 9 1/4", 155 pages. Published by Scientific American Publishing Co., New York City. \$3.00.

This work is a thorough treatise on finger printing, naturally with special reference to the courts and to the police. All details are given. The classification on which the whole subject is based, the practical details of the case, the very simple apparatus required, and the method of taking the finger prints, are all given. As an example of the details, even the subject of how to get impressions from people having missing, deformed or bandaged fingers as the caption puts it, is considered. Here a special classification is required; even oddities with their classification are considered.

Then the second part goes into the subject of filing the imprints which is very elaborate. The preparing of magnified views of finger impressions for use in the courts in police cases is treated with a number of examples. The claim is made that a finger print made accidentally on glass can be powdered and photographed three months after it is produced, which is a very important point in the way of testimony in court.

Part three gives a list of questions and answers, which type of instruction for some reason or other has really proved very popular. One hundred and ninety-five illustrations of finger prints follow the question and answer department, and the book closes with an index, which latter is quite adequate.

**EYELESS SIGHT**, by Jules Romains, translated by C. K. Ogden. Hard covers 5" x 7 3/4", 251 pages. Published by G. P. Putnam's Sons, New York City. \$2.00.

If all that this book claims and describes were true, the spiritualist might be in danger of going to the rear. The idea is that things can be seen under definite conditions without the use of the eyes. There seems to have been some very spirited discussions about it in France, about the subject of extra-retinal vision, as it is called, and the claim is made that now it has become a branch of real study and open to serious investigation. The book certainly seems to have a curious aspect. Once extra-retinal vision is believed in and accepted, then this book will prove for those interested a very valuable treatise.

**CONSCIOUS AUTO-SUGGESTION**, by Emile Coué and J. L. Orton. Hard covers 5" x 7 1/4", 211 pages. Published by D. Appleton & Co., New York City. \$1.25.

This book treats of what is called Couéism in the different stages of life. The reader will remember the invasion of this country by the French apothecary who claimed that disease could be cured by psychical methods. Those who are interested in it will find in this book considerable matter to interest them, and its application to the school room and education in moral reform are given. An instance for its application is for the relief of stage fright. The trembling subject is supposed to be before going on the stage repeat over and over rapidly, "I have no funk," and thus come out on the stage perfectly self-possessed.

**MECHANISM, LIFE AND PERSONALITY**, by J. S. Haldane, M.D., LL.D. Hard covers 5" x 7 3/4", 152 pages. Published by E. P. Dutton & Co., New York City. \$2.00.

Dr. Haldane has a way of perpetrating small books which have a way of becoming somewhat abstract, and we cannot lose the conviction that Dr. Haldane thinks that his conception of things are about right. The lazy way of reviewing a book is to use the contents and the index. The contents of this book consists of four lines and there is no index. We fear that it will not be popular in Dayton, Tenn.





3VB  
PAT. PENDING



5VA  
PAT. PENDING

### These perfect tubes carry their pedigrees with them

**EVERY MUSSELMAN Certified Radio Tube is sold with its pedigree, in the form of a characteristic curve chart, packed right with the tube. This chart gives the exact operating data for that particular tube, as read from delicate electrical instruments at the factory. Regardless of whose tube it is, there is no other way to tell what kind of a tube you are getting. Only MUSSELMAN Certified Radio Tubes offer you this absolute protection against disappointment in buying tubes for your set. If your dealer cannot supply you, order direct. List price: \$3.00.**

Sales Office  
**A. J. MUSSELMAN**  
652 Machinery Hall  
Chicago

Manufacturer  
**THE VAN HORNE CO.**  
549 Washington Blvd.  
Chicago

---

**A. J. MUSSELMAN, 652 Machinery Hall, Chicago.**

I inclose \$..... for which send me ..... Musselman Certified Tubes. It is my understanding that if they do not prove all you claim for them, you will replace them or refund my money.

Name .....

Address .....

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

# WANT

## \$1700 to \$2700 Year?

### RAILWAY POSTAL CLERKS MAIL CARRIERS

*TRAVEL—See Your Country*

**MEN—BOYS, 17 UP SHOULD MAIL COUPON IMMEDIATELY**

*Steady work. No layoffs. Paid Vacations*



**FRANKLIN INSTITUTE,**  
Dept. K182, Rochester, N. Y.

Sirs: Send me without charge: (1) Specimen Railway Postal Clerk and Mail Carrier Examination questions; (2) FREE book containing list of U. S. government positions open; (3) Free sample coaching.

Name.....

Address.....

## ENLARGED PROSTATE

Are you of middle-age and one of the 65% that Medical Men agree are so troubled after 40? Do you want to know what science has done in tracing the cause of this general affliction? That you don't have to suffer and can completely recover? My free book and sincere advice will come to you without cost if you write today. H. Wilson, Sup't, Box 415, Milford, Geary Co., Kans.



## Make Money! Taking Pictures!

We train you quickly at home. No experience necessary. Spare time or full time. Professional camera free. Photographs in big demand by magazines, newspapers, advertisers, etc. Also train you to take better portraits than the average professional photographer! Equip you to make \$50 to \$100 a week in business of your own. New plan. Nothing else like it. Write today for amazing details.

**International Studios, Inc.**  
Dept. 1429 3601 Michigan Ave., Chicago, Ill.

# Just the Receiver you want—can be built at home, quickly and easily, with CONSRAD Patterns and Books

No one can dispute the fact that radio signals vary greatly depending on the distance or location from the nearest broadcast station. Some listeners require a set of small power while others need a great deal of amplification to get the same result. The sure way to get complete satisfaction at your location is to build your own receiver. Thousands upon thousands of listeners are building their own sets today. It's amazingly simple. You need only a few ordinary household tools. CONSRAD publishes a long list of complete patterns and 64 page books that will give you all the information you need to build the set most suitable for your location. Select the set you want, check it on the list below and mail the coupon today.

## USE THIS BLANK TO ORDER

Just clip out this coupon, check the patterns or books you want and mail it to us with full remittance.

The Consrad Co., Inc.  
233 Fulton St., New York, N. Y.

Gentlemen: I have checked below the patterns and books I desire. Enclosed find \$....., the full price. Kindly send me the items checked postpaid.

### Consrad Patterns—50c each

- ....No. 2. How to Make a Two-Stage Amplifier.
- ....No. 4. How to Make a Reinartz Receiver.
- ....No. 5. How to Make a Reflex Receiver.
- ....No. 6. How to Make a Cockaday Receiver.
- ....No. 7. How to Make a Neutrodyne Receiver.
- ....No. 8. How to Make the Autoplex Receiver.
- ....No. 9. How to Make the S. T. 100 Receiver.
- ....No. 10. How to Make the Ultradyne Receiver.
- ....No. 11. How to Make a Five Tube Cockaday Receiver.
- ....No. 12. How to Make a Portable Receiver.
- ....No. 13. How to Make a Harkness Receiver.
- ....No. 14. How to Make the Original Genuine Super-Heterodyne. List \$1.00.
- ....No. 15. How to Make a Low Loss Receiver.
- ....No. 16. How to Make a Tropadyne Superadio.
- ....A. Radio Map of the U. S. on Cloth.
- ....B. 20 Radio Diagrams and Hook-ups. New Edition.
- ....C. All About Aerials and Their Construction.
- ....D. Radio Amateurs Practical Design Data.

### Radio Books—25c each

- ....No. 1. Tips for the Radio Constructor.
- ....No. 2. How to Make Practical Radio Receivers.
- ....No. 3. Radio Questions Answered.
- ....No. 4. Radio Frequency Amplification.
- ....No. 5. Loud Talkers and How to Build Them.
- ....No. 6. How to Tune Your Radio Set.
- ....No. 7. One Hundred Radio Hook-ups. New Edition.
- ....No. 8. All About Radio Parts.
- ....No. 9. History and Operations of Vacuum Tubes.
- ....No. 10. The Neutrodyne and All About It.
- ....No. 11. How Radio is Received.
- ....No. 12. How to Locate Troubles in Your Radio Set.
- ....No. 13. Reflex Radio Receivers.
- ....No. 14. The Super-Heterodyne Theory and Construction.

### Special Books

- ....Radio News Amateurs' Handibook.....\$1.00
- ....Radio Log Book......50
- ....Wireless Course in 20 Lessons—Leather Binding 2.00
- ....The Radio Instructor ..... 1.00

Name .....

Address .....

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



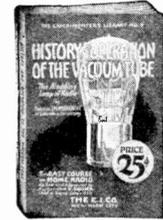
**The Neutrodyne Receiver**  
The Standard Hazeltine Circuit. Pattern gives full size blueprints of wiring and panel layout together with 16 page instruction booklet. Everything is complete ready to build.  
Pattern No. 7—Price 50c



**The Five-Tube Cockaday**  
A set designed to give every ounce of power that 5 tubes permit, loud and clear. Patterns of circuit and panel are drawn full size and instruction booklet gives all additional information necessary.  
Pattern No. 11—Price 50c



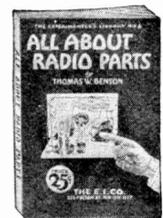
**How to Tune Your Radio Set**  
Don't struggle in the dark, looking for stations—here is an inexpensive book that gives you detailed instructions on just how to handle your Radio set. You will be surprised at the increased results that can be obtained through proper tuning.  
Book No. 6—Price 25c



**History and Operation of the Vacuum Tube**  
The Vacuum Tube is a marvelous piece of apparatus. A short study of it as given in this book gives you the principle on which every Vacuum Tube Radio Receiver operates.  
Book No. 9—Price 25c



**How Radio is Received**  
The simplest and yet most complete Radio Guide Book for any amateur broadcast listener. In print only two weeks, fresh from the press.  
Book No. 11—Price 25c



**All About Radio Parts**  
Everyone who constructs a radio set should know the simple fundamentals of the various parts of his set. The E. I. Company has set these forth in a compact little book that is valuable at all times.  
Book No. 8—Price 25c

Consrad Patterns and Books are sold by all Radio and News Dealers  
Published and Distributed by  
**THE CONSRAD COMPANY, INC.,**  
233 Fulton St. New York, N. Y.

### The Radio Constructor

By A. P. PECK

(Continued from page 742)

and shape shown and bent near one end. Only chemically pure aluminum should be used and the plates must be perfectly clean before being placed in the solution. Sandpaper after scraping thoroughly and preferably clean in hot lye solution. Caution here as the lye will inflict serious burns if allowed to come in contact with the skin. Before you start to cut up and clean the electrodes, mix up enough of a saturated solution of borax in water to fill all of the jars in the entire rectifier. Allow this to stand for 24 hours and then fill the jars with the clear solution, leaving any of the borax that may have settled at the bottom of its container. The number of jars in the rectifier depends entirely upon the amount of voltage being used. Allow approximately 50 volts from the transformer for each jar in the rectifier. For 500 volts, use 10 jars on each side of the line, hooking them up as shown in Fig. 11B. After the strips have been bolted together and placed in the jars, fill each jar with solution to within one-half an inch of the top. Then pour a layer of oil about one-quarter of an inch thick on the top of the solution. This effectively prevents evaporation. Ordinary machine oil of a good thin grade can be used for this work. By using this precaution, the solution in a rectifier need never be renewed until the elements have to be taken out for cleaning which usually need not be done oftener than every six months.

#### THE FILTER SYSTEM

Rectified A.C. is by no means D.C. and it must be smoothed out somewhat in order to be satisfactory for use in transmission. This is done by means of a filtering system which consists of an iron core choke coil and high capacity condensers used in a circuit such as that shown. These instruments are indicated by 15 and 16 on the diagram and the photograph. In making a choke coil, a core very similar to that used in a transformer is employed with the exception that an air gap about 1/32nd of an inch wide should be left in one leg of the core. This can be done by placing a strip of cardboard of that thickness in position and binding the core tightly with clamps. The details for a suitable choke coil are as follows. The legs of the core should be built up of silicon steel strips .014 inches thick by 1.5 inches wide. The resulting core should be 1.5 inches high. The inside dimensions should be 4 inches by 3 inches, and the total number of turns should be 12,500. No. 26 wire should be employed and half of the winding may be placed on each of the longer legs of the core.

It is almost impossible to make satisfactory filter condensers and, therefore, you should purchase them. Two having a capacity of 2 mf. may be used or four having a capacity of 1 mf. may be connected in the circuit as shown in Fig. 2.

The rest of the necessary details for the construction of this complete transmitter can be seen from the various diagrams and photographs. The tuning is something that can only be learned by practice. For a starter, we would advise using two turns between the grid and filament clips and the rest of the oscillator inductance between the filament and plate clips. Vary the condenser until the milliammeter reads quite low and check wave with wavemeter.

Then put the clips on the antenna inductance and vary the antenna and counterpoise circuits until the antenna meter shows a reading. With the antenna and counterpoise condensers, bring the antenna meter

(Continued on page 781)

### Ideal XMAS GIFT for Dad, Brother, Son!

Sizzling Sun—Cold—Rain—Snow—Jars—Shocks—Exposure do not affect the New SHOCK-PROOF

## Waltham "Sportsman" Strap Watch

REMARKABLE Waltham achievement. Designed for Camping, Hunting, Golfing, Fishing, Outdoor Sports, Office use. Has wonderful SHOCK-PROOF movement with Steel wheels, plates, escapement. Famous Jewel Series movement. Built into special DUST-PROOF, MOISTURE-PROOF case. Impervious to weather and shocks! We have sold hundreds to big business men, professional men, sportsmen. They are ASTONISHED at its marvelous performance! Regular price \$35. We secured several hundred of them at special price concession. Our price (while they last)..... **\$29.50**



Jewel Series Size



Importers and National Mail Order House Largest Distributors of Waltham "Sportsman" Watches  
**365 Washington Street, Boston, Mass.**  
 For prompt attention address Dept. 142 Gentlemen: Please send me \$29.50 Waltham "SPORTSMAN" Strap Watch. I enclose NO money, and pay NOTHING to Postman. If I am satisfied, after 10 DAYS' TRIAL, I have the privilege of paying for it at the rate of \$1.00 monthly or of deducting \$2 and sending \$27.50 in FULL SETTLEMENT. Otherwise I shall return it.

NAME .....  
 ADDRESS .....  
 Please write PLAINLY! Tear this coupon out NOW! If you wish to tell us something about yourself, it will be appreciated. S.I. 12-25

SEND NO MONEY

10 DAYS' FREE TRIAL

NOTHING TO PAY POSTMAN  
 Wear it! Time it! Test it—under most strenuous conditions. If satisfied after \$4 a MONTH Account Plan at the rate of.....  
 or, if you wish to pay cash within 10 DAYS, take \$2 Discount, and send check or money order for..... **\$27.50**

THE Strap Watch is here to STAY!—increasing in popularity daily! It is SO HANDY—SO CONVENIENT! No need to unbutton coats! No need to fumble in pockets! "A twist of your wrist—there's the time." THE WALTHAM "SPORTSMAN" is designed for dress affairs or sport. It is smart looking. Handsome CUSHION shape that wins admiring glances. GOLD FILL-ED Case, double stock. RADIUM numerals and hands that show time in darkness Vividly! Strap is genuine pig-skin. A handsome, sturdy Watch for real MEN!  
**ORDER TODAY!** Quantity is limited. Send NO Money! 10 Days Trial.



### AMBROID is a cement, a glue and a solder



## STICKS THINGS NOTHING ELSE WILL STICK

Ready for Use

AMBROID is the modern, improved adaptation of the old fashioned glue that was once used exclusively for hundreds of commercial materials.

AMBROID not only glues materials—it welds, cements them together in a permanent joining and is quick acting, positive. It is applied easily in a liquid form, but it dries almost instantaneously.

AMBROID is used everywhere, not only in thousands of households, but in great commercial factories throughout the country.

In your home AMBROID will serve wherever glue is needed except on china and glassware.

AMBROID IS USED EXCLUSIVELY ON ALL MODELS IN THE SCIENCE AND INVENTION MATCHCRAFT CONTEST

AMBROID is sold in 3/4 ounce, 2 ounce and 5 ounce and larger sizes for commercial uses. If your Dealer cannot supply, send 35¢ for 2 ounce can or 65¢ for 5 ounce can to

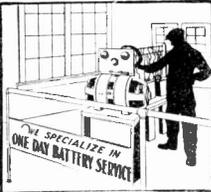
**AMBROID CO., 227 Miller Avenue, Brooklyn, N. Y.**



\$150 to \$300 MONTHLY PROFITS EASILY WITH ONE DAY CHARGING

You can earn a lot more money in your shop with One Day Battery Charging. Tire shops, radio stores, accessory dealers have added \$150 to \$300 monthly to their profits with One Day Charging Service. Big money—no experience needed. Only \$35 cash puts complete H.B. One Day Charging outfit in your shop. Long easy terms let your profits quickly pay balance. 30 days free trial on moneyback guarantee. Write for free bulletin 100.

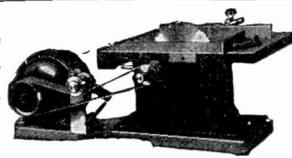
HOBART BROS CO., Box S12 Troy, Ohio  
 MORE H.B. BATTERY CHARGERS AND IN MANY OTHER MAKE



Buy Now Pay Later

### LET BOICE HELP YOU BUILD IT!

No matter what you want to build, Boice can help you. He'll send you the Boice-Crane Junior monthly payments. Machine shown saws 2 1/2" stock. Table 10"x13", elevates for grooving. Dadoes 3/4"x5/8". Attachments for grinding and sanding. Sold with or without motor. Money-back guarantee. Heavy Duty Motors 1/4 H.P. 110 V. 60 C. 1750 r.p.m. Single phase with cord, 1/3 A.P. plug and 1 1/2" flat or grooved pulley. Guaranteed \$11.95 100% overload. Satisfaction guaranteed. These prices not listed in regular price list. For immediate acceptance, cash with order only. F.O.B. Toledo.  
**W. B. & J. E. BOICE Dept. S. I. 12-A**



TOLEDO, OHIO

# Keeping Pace with the World's Greatest Achievements

in

# RADIO - SCIENCE CHEMISTRY - ELECTRICITY

Do you want to know what is going on in these great fields from month to month?

### RADIO NEWS

Tells you about the whirlwind progress of the mighty new force in the life of the people throughout the world. RADIO NEWS is radio's greatest and largest magazine, containing new hook-ups, up-to-the-minute news and information, illustrations and all the details of the great Radio Industry.

### SCIENCE AND INVENTION

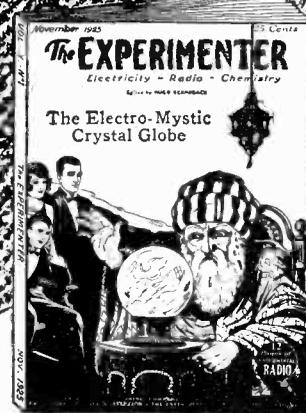
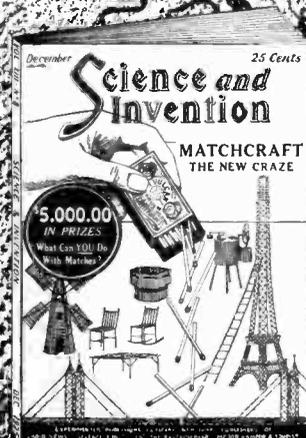
Contains page after page of startling, new scientific achievements with plenty of news and pictures from every corner of the world. A never-ending panorama of events in the great world of Science and its co-partner, Invention. Everything in SCIENCE AND INVENTION is illustrated in pictures or drawings and many novel ideas are explained for home builders.

### THE EXPERIMENTER

Any man who loves to build things at home and develop and design his original ideas should read THE EXPERIMENTER. It is full of news, hints and suggestions for the experimenter and contains page after page of information on new experiments, large and small. Every word is of benefit. Interesting from cover to cover. THE EXPERIMENTER will afford many hours of pleasure and entertainment.

Published and Distributed by

**THE EXPERIMENTER PUBLISHING CO., Inc.**  
53 Park Place New York, N. Y.



### Get These Valuable Premiums

With every subscription to any one of our magazines we are giving free, your choice of a beautiful "Ekko Stamp Album," the new radio craze for keeping stamps of various stations logged, or a copy of the "Radio News Amateurs' Handibook," a compact, illustrated Radio Instruction Book containing over 200 pages of radio data and information.

### SUBSCRIPTION OFFERS

One Year's Subscription to:—  
 RADIO NEWS .....\$2.50  
 SCIENCE & INVENTION ..... 2.50  
 THE EXPERIMENTER ..... 2.50  
 Combination Subscription  
 Any two magazines, One year each .....\$4.25  
 Or any one magazine for Two years.

EXPERIMENTER PUBLISHING CO., Inc.,  
53 Park Place, New York, N. Y.

Gentlemen: I am enclosing \$..... for a ..... years subscription to  RADIO NEWS,  SCIENCE AND INVENTION,  THE EXPERIMENTER.

NAME .....

ADDRESS .....

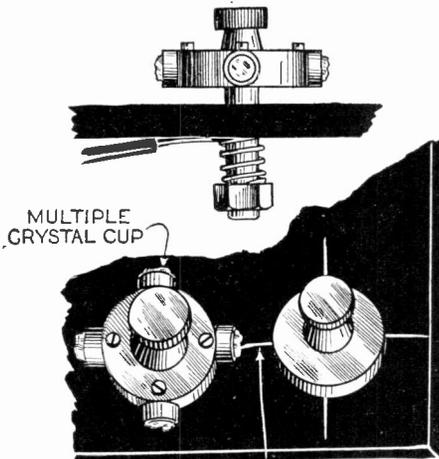
CITY ..... STATE .....

PREMIUM DESIRED .....

## RADIO WRINKLES

UNDER this heading we are going to publish items of interest to everyone who likes to build radio instruments. In order to continue this department it is necessary for our readers to tell us about their latest experiments. Write us a short description of some time- or money-saving kink you have discovered and send it to us along with a few sketches. Our regular rates will be paid for this material. Be brief and try to put everything in the drawing. Don't be too elaborate. Address "RADIO WRINKLES" Editor, care of SCIENCE AND INVENTION.

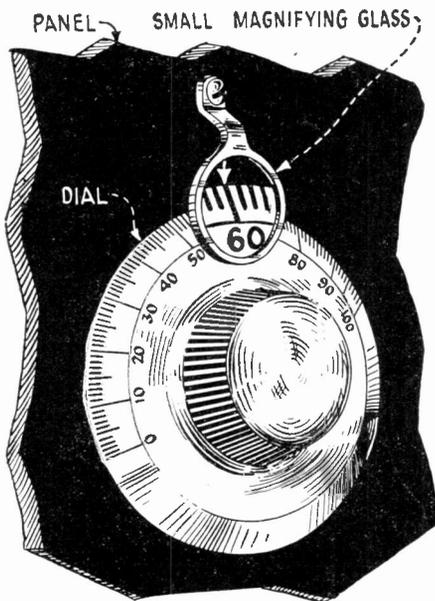
### Multiple Detector



MULTIPLE CONTACTS

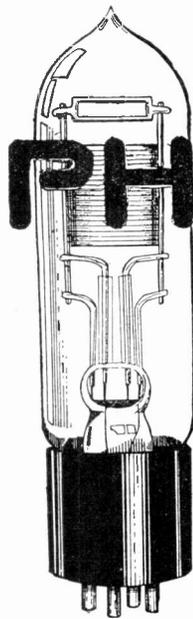
Sixteen different combinations of crystal and contact point can be obtained with an arrangement such as that illustrated above. Four points and four crystals are arranged on adjacent revolvable disks. —G. A. Luers.

### Magnifying Readings



On small dials it is often hard to read the exact setting. This trouble can be eliminated by arranging a small magnifying glass directly over the pointer as shown above. Close tuning is also simplified in this manner.

—A. E. Jones.



## The Practical and Sensitive Photo-Electric Tube

THE

# PHOTOTRON

An alkali-metal tube for use in radio movies, picture telegraphy, talking movies, and other light actuated devices. Write for interesting list of uses.

PRICE

**\$20 each**

Just the thing for the experimenter! A strong, permanent tube fitting the ordinary radio socket.

Write for descriptive literature

### PHOTON ELECTRIC CORPORATION

1269 Cochran Ave.,  
Los Angeles, Cal.

247 Park Ave.,  
New York City

**10 DAYS FREE TRIAL - MONEY BACK IF NOT SATISFIED**

**THE NEW INKOGRAPH SELF FILLER**  
IMPROVED **GREATEST VALUE EVER OFFERED**

**We Want AGENTS**

*The Perfect Writing Instrument* **\$1**

Writes with ink free and easy as a lead pencil, without a miss, skip or blur. Its steady uniform flow of ink actually improves your hand writing. Won't blot, scratch, leak, or soil hands.

Makes 3 or 4 Carbon Copies With Original In Ink. Anyone can write with your Inkograph, no style of writing or pressure can benefit it. It is safe, injure or distort its 14 kt. gold point.

Actual size 6 in. long

Patent Automatic 14 kt. gold feed prevents clogging. Made of best grade, highly polished, hard rubber, highest class workmanship. Pocket clip attached makes it an instrument of refinement. You'll never use a fountain pen once you try an Inkograph. No complicated mechanism to clean or get out of order. **SEND NO MONEY.** Pay postman \$1.50 plus postage. Year's guarantee certificate assures absolute satisfaction. Write name and address plainly.

**IN KOG R A P H C O . , I n c . 1 7 9 - 1 3 C e n t r e S t . , N e w Y o r k**

**AGENTS** Sell Inkographs make bigger profits, more sales, without investment. Quicker commissions, popular prices, no collecting, no competition. Send for an Inkograph or write for special sales plan booklet.

**RADIO-AERIAL-WIRE**

**Scheelercon**  
"80% CONDUCTIVITY"

Brings distant signals in more clearly. Original 19-strand non-corrosive. Block tin coated. Flexible, easily handled.

Send **\$1.00** for 100 foot trial coil sent postpaid.

**BUFFALO WIRE WORKS COMPANY**  
316 Terrace, Buffalo, N. Y. or 9-11 So. 7th Street, Philadelphia, Pa.

**Chemical Experimenters!**

Send for our Free, Illustrated Price-List of CHEMICALS, APPARATUS, REAGENTS, ETC.

**BAKER & UNVERHAU, Dept. S**  
Hicksville, L. I., N. Y.

**Learn to Write**

Begin Today—Write for My FREE BOOK. I can make a good penman of you at home during spare time. Write for my FREE BOOK, "How To Become a Good Penman." It contains specimens and tells how others mastered penmanship by the Tamblyn System. Your name will be elegantly written on a card if you enclose stamps to pay postage. Write today for book.

**F. W. TAMBLYN, 424 81dgs Bldg., Kansas City, U. S. A.**

**RADIO EXPERTS NEEDED**  
NO EXPERIENCE REQUIRED

Practical radio came like a bolt out of the sky. But the big growth is just ahead. The world is short of real radio experts. Thousands of excellent positions are open to those who qualify as radio sales engineers, factory set designers, as testers, repairmen, operators on ships, broadcasting stations, etc., here and abroad. A lifetime opportunity to get in on the ground floor of a new profession in its infancy and whose miraculous growth will be the marvel of all ages. Those with vision now will reap rich rewards.

**THE PROFESSION OF ROMANCE, FORTUNE**

An unusual proposition is offered to anyone who wants to get into this romantic profession of fabulous fortunes. Who can tell how many Henry Ford radio will turn out? This is the age of progress—radio—electricity—invention. Once you qualify as a radio expert, you are the master of the greatest science of all the world. Opportunity is knocking. Don't you get it by unheeded. Write today for free book, "Millions Unreached." It tells how you can make your radio at home in spare time.

**FREE SUPERDON** Offered to those who enroll now. Write me personally. There's no obligation. Mail letter or postal today and learn how to make \$50-\$200 a week. J. J. Mendala.

**AMERICAN RADIO ENGINEERS,**  
Dept. 27 Board Bldg., Chicago, U. S. A.

**Play the HAWAIIAN GUITAR**  
Just as the Natives Do

**FREE** when you buy a \$15 HAWAIIAN GUITAR and Case

Only 4 Motions used in playing this fascinating instrument. Our native Hawaiian instructors teach you to master them quickly. Pictures show how. Everything explained clearly.

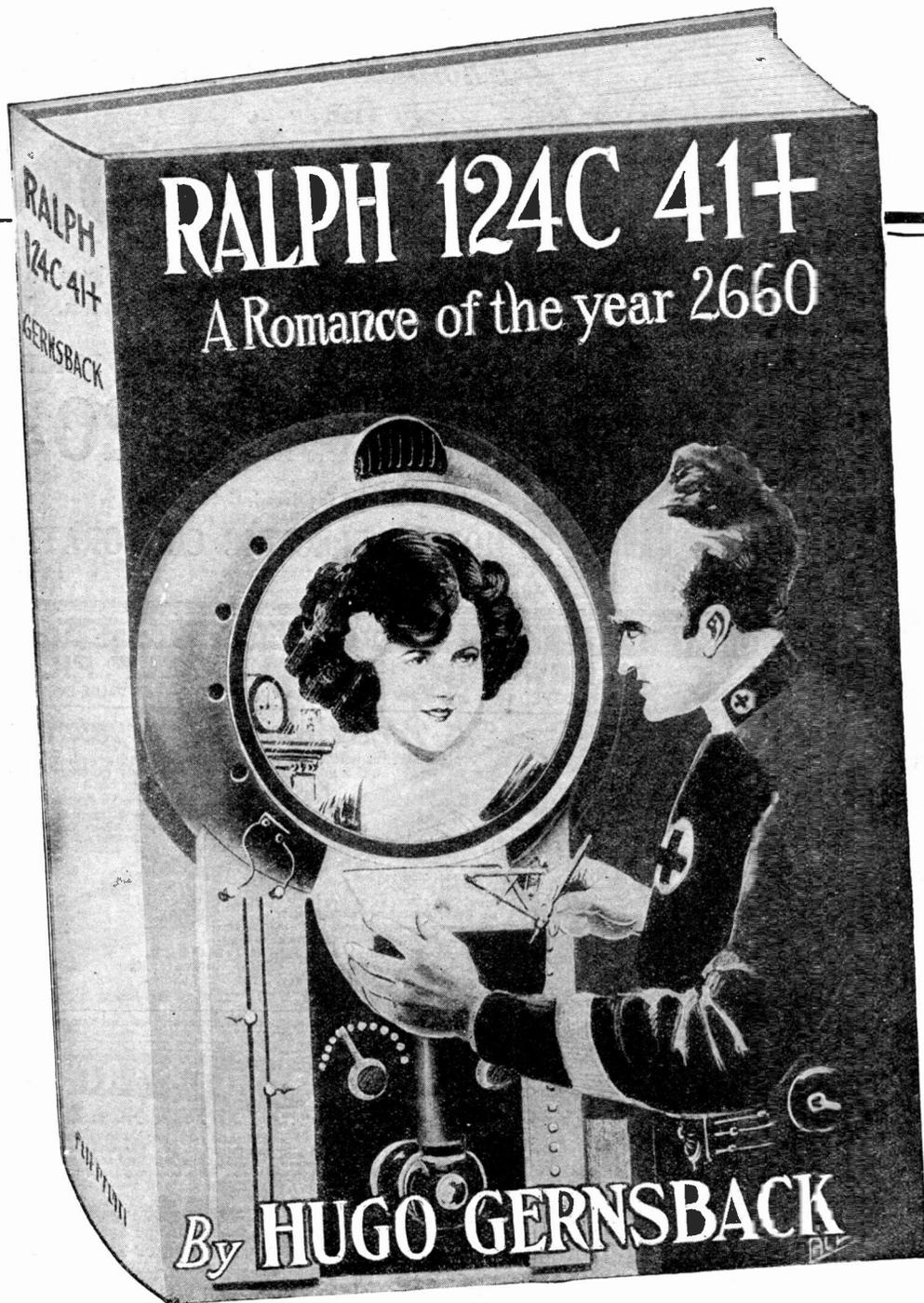
**Play in Half Hour** After you get the four easy motions you play harmonious chords with very little practice. No previous musical knowledge necessary.

**Easy Lessons** Even if you don't know one note from another, the 52 printed lessons and the clear pictures make it easy to learn quickly. Pay as you play.

**Free Guitar and Outfit** In Genuine Seal Grain Fabricoid Case as soon as you furnish. No delay.

**Write at Once** You'll never be lonesome with this beautiful Hawaiian Guitar. Write for Special Offer and easy terms. A postcard will do. ACT!

**FIRST HAWAIIAN CONSERVATORY OF MUSIC, INC.**  
9th Floor, Woolworth Bldg., Dept. 140, New York, N. Y.  
Approved as a Correspondence School Under the Laws of the State of New York



Against an amazing background of mechanical electrical and chemically altered life of mankind there is set a brilliant and colorful romance in the life of the greatest living scientist of that age.

Ralph's love for the beautiful stranger, his conquest of his rival and the worsening of the great saturnine Martian, culminating in a running fight in space with tragedy and terror conquered by almost unbelievable and incredible weapons, make one of the most interesting and gripping stories ever told.

# 700 YEARS HENCE

**I**N 1908, Mr. Hugo Gernsback, Editor of RADIO NEWS, published the first radio magazine the world had ever seen—"Modern Electrics." In one of these volumes he ran a story entitled "Ralph 124C 41+ A Romance of the Year 2660." This story, although written many years ago, proved more valuable as the years went by, because many of the prophecies made in this book gradually came true.

This was in the days before broadcasting had even been thought of, and before we had the radio telephone, yet all of this is faithfully chronicled in this story.

Old-time readers of "Modern Electrics" probably remember the story, and now have a chance to get the complete book.

A pioneer in the electrical and radio field, Mr. Gernsback has a profound knowledge of the subjects, coupled with a finely trained and highly imaginative mind.

This unusual combination has enabled him to foreshadow

with almost unbelievable accuracy some of the more recent developments. His earlier predictions, which have appeared from time to time during the past decade in many newspapers and magazines, are now realities. Every prophecy is based on accurate scientific knowledge. His ideas are no more fantastic than the realities and commonplaces of our everyday life would have been to our great grandfathers.

-----ORDER BLANK-----

EXPERIMENTER PUBLISHING CO.,  
53 Park Place, New York City.

Gentlemen:—Enclosed find \$.....for which please send me  
.....copies of "RALPH 124C 41+," by Hugo Gernsback.

Name .....

Address .....

.....

PRICE \$2.15 POSTPAID      S&I 12

**THE STRATFORD COMPANY, Publishers**

**For Sale by**

**EXPERIMENTER PUBLISHING CO., Inc., 53 Park Place, New York, N. Y.**

# COFFEE

By  
**RALPH HOLT CHENEY, Sc.D.**  
Assistant Professor of Biology,  
New York University

While clearly a scientific work, and consequently primarily interesting to the student concerned with the botanical and chemical structure of the coffee tree and its fruit, it nevertheless contains much information of practical value to the trade, and of more than passing interest to the lay reader. The chronological table which just precedes the author's economic discussion of his subject is in itself an amazing amount of historical data presented in concrete form for ready reference. For exhaustive scientific research, for wealth of bibliographical reference to a species of plant life that has become a great economic factor, it is likely to be accepted as an authoritative and standard work.

—CILASE & SANBORN.

Octavo, xviii x 244 pages; 77 half-tone illustrations; bound in blue cloth, gold lettered. Price \$4.50

THE NEW YORK UNIVERSITY PRESS  
30 Washington Place New York City

## Hawaiian Guitar

# FREE

to Students



This Hawaiian Guitar expert and professor, wants the opportunity to welcome you as a student, so you will quickly learn how to play the Hawaiian Guitar—so you will be able to play just like the native Hawaiians. To get you started and help you towards your musical success which will bring you popularity, you will receive a beautiful Hawaiian Guitar the same as the one pictured here free, when you enroll. Our short cut method of instruction will enable you to play a piece almost from the first lesson. We do not only furnish you with easy-to-understand printed lessons, but we also furnish pictures of our native instructors in action, phonograph records for each lesson and charts. You will play a piece almost from the first lesson. We guarantee to teach you. Don't send a single cent. Just drop a line—telling you are interested in receiving full particulars, and to reserve one of our regular \$18.00 gift Hawaiian Guitars for you. Supply is limited. Write now and receive big descriptive book and free sample lesson.

Hawaiian Studio No. 539 of New York Academy of Music  
100 Fifth Avenue, New York

## WANTED-MEN TO LEARN RADIO



**\$75 to \$200 a Week**  
Right now, everywhere, big, easy money is being made in Radio. Field unlimited. You can master radio quickly at home in spare time. No previous experience necessary. Now is the time to enter this new, uncrowded field.

**1,000 MILE RECEIVING SET Given to Every Student**  
Our new home-study methods make everything about radio amazingly simple. No other course like it. Makes you expert on radio operation, repairs and installations of all kinds. Send for literature telling all about opportunities and how we give you a 1,000 mile receiving set. Don't miss this big offer—**ACT**. Write now for this free book.

**RADIO ASSOCIATION OF AMERICA**  
4513 Ravenswood Ave., Dept. 612 Chicago

**King of Revolvers** Cut to \$8.99

Has all improvements of finest Spanish & American guns, \$35 value, left wheeler, removable plate, double safety, hand ejector, guaranteed never out of order, 6-shot, 32-20 or 38 cal. **Send No Money.** Pay on delivery \$9.75 plus postage.

Federal Mail Order Corp., 614 Broadway, New York, Dept. E80

Wade Bench Lathe Cap: 4" dia. x 12" length. Slidest has travel entire length of bed. Lead-screw inside bed. Hollow spindle. Turning, facing, boring, drilling, winding, thread-cutting. No. 1 Lathe, plain headstock, \$28.00. No. 2 Lathe, back-gear headstock, \$35.00. Complete line of accessories at equally low prices. New catalog sent free.

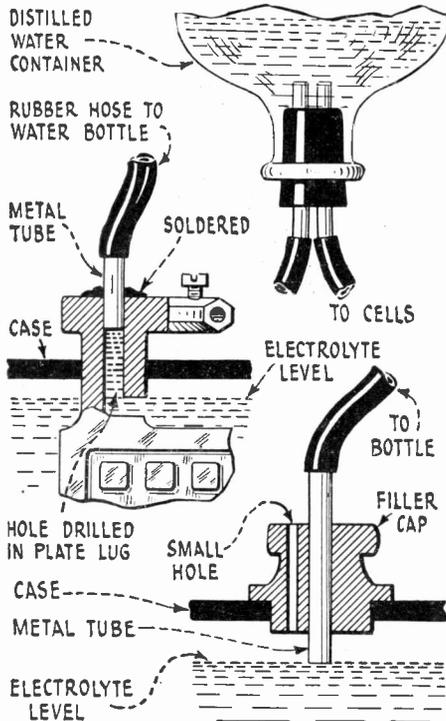
**THE GEROLD COMPANY**  
Dept. S-10 120 Liberty Street New York

**CLASS RINGS & PINS**  
Largest Catalog Issued—FREE

Samples loaned class officers. Prices \$1.20 to \$8.00 each. No order for class, society, club, unless for large or too small. Special designs made on request.

**METAL ARTS CO., Inc.**, 7723 South Ave., Rochester, N. Y.

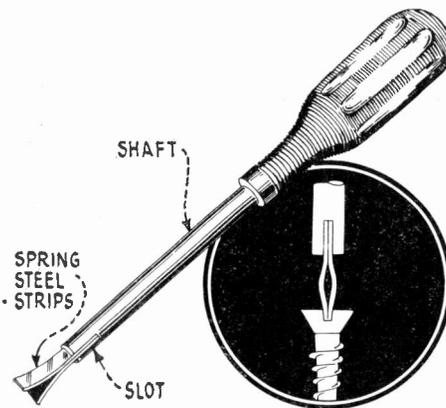
## Automatic Storage Battery Filler



The electrolyte in a storage battery can be kept at constant level if an inverted distilled water container is placed at a point higher than the battery and is equipped with tubes, one running to each cell of the battery. Two methods of allowing the water to enter the battery are shown. All tubes must be airtight.

—J. Bront.

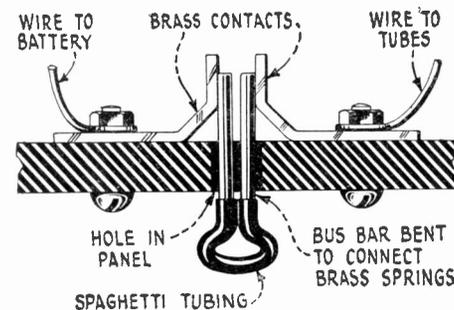
## Screw Driver



A screw driver that will hold a screw while it is being started in an accessible place is made by using two spring steel strips as above.

—J. E. Tewksburg.

## Switch



A simple "A" battery switch is made from two brass contacts and a length of bus bar bent as shown.

—Robert Aaron.



## Couldn't Play a Note — Now Makes \$100<sup>00</sup> a Week

"When I sent for your catalog, I didn't know a note of music. A few months after I bought my Wurlitzer instrument, I had taken my place in a professional orchestra. Now I am making \$100 a week, three times what I made as a clerk. I wish everybody knew how easy it is—anyone who can whistle a learn to play a musical instrument."—Bill Carola.

## Free Trial—Easy Payments

You may now have any Wurlitzer instrument for a week's free trial in your own home. Examine the instrument, note the fine workmanship, the full, rich tone value and especially how easy it is to play. No obligation to buy—no expense for the trial. We make this liberal offer because we want you to try for yourself a genuine Wurlitzer instrument, the result of 200 years' experience in musical instrument building.

Easy payments are arranged to suit your convenience. This is your opportunity to try a famous Wurlitzer instrument in your own home.

Send for **Free Book**

Illustrates and describes every known musical instrument—more than 8000 articles, many of them shown in full colors. All genuine Wurlitzer instruments—buy direct from Wurlitzer and save money. Special offers on complete outfits.

We also give you our Free Trial, Easy Payment Plan. No obligation.

**Send Coupon Today!**

## Send this Coupon

The Rudolph Wurlitzer Co., Dept. 1259  
117 E. 4th St. Cincinnati 329 S. Wabash Ave. Chicago  
120 W. 42nd St. New York 250 Stockton St. San Francisco

Send me your Free Book on musical instruments. Also your Free Trial, Easy Payment Plan. No obligation.

Name .....

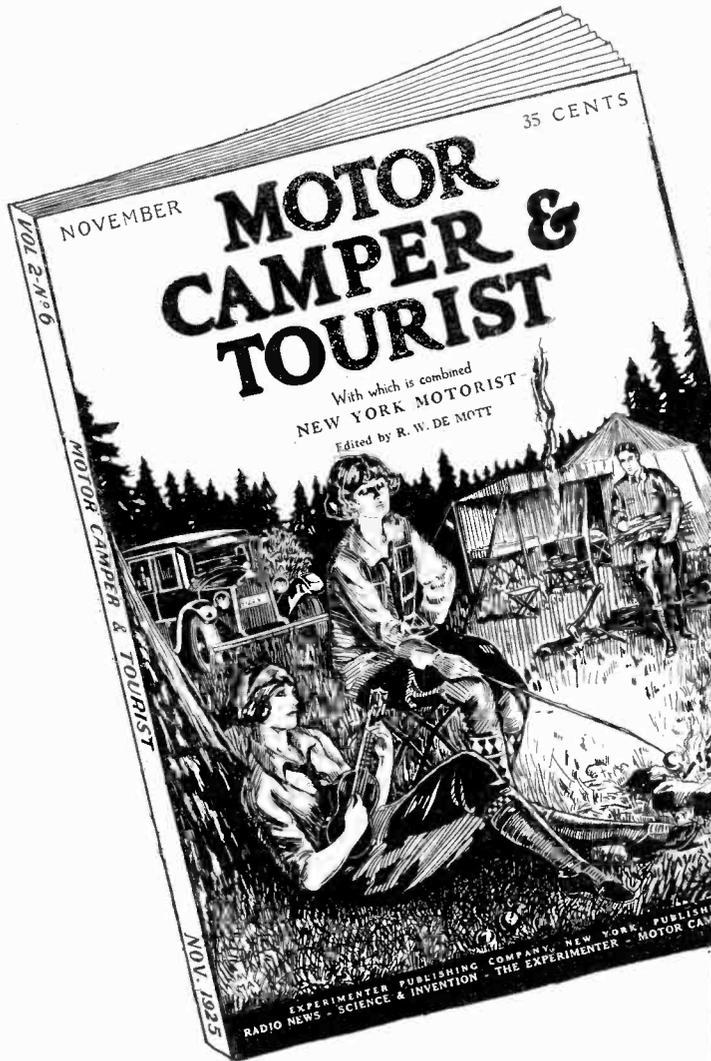
Address .....

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

Instrument.....



Copyright 1925, The Rudolph Wurlitzer Co.



**Motor Camper & Tourist**  
 has purchased the **NEW YORK MOTORIST** which is now combined with this magazine.

*80 Pages of information  
 for Motor Tourists*

**35¢ Everywhere**

Subscription, - - - \$3.50 for twelve issues

You can combine your subscription with **RADIO NEWS**; thus, **RADIO NEWS** and **MOTOR CAMPER & TOURIST**, 12 issues each.....\$6.00

GERMOTT PUB. CO., INC.  
 53 Park Place, New York, N. Y.

Enclosed find \$3.50 for one year's subscription to **MOTOR CAMPER & TOURIST** (twelve issues).

Name .....

Address .....

City and State .....

**Sixteen  
 More Text Pages  
 Added to  
 MOTOR  
 CAMPER &  
 TOURIST**

*Big Increase in the Number of Articles by Noted Authorities and Experienced Tourists*

You can get greater pleasure out of any motor trip, see more places of interest and travel with greater comfort and less expense if you read **MOTOR CAMPER & TOURIST**. Experienced tourists tell you what trails to travel upon, where to stop, what luggage to take along, and to leave home and how to care for your equipment.

**More Than Forty Motor Touring Experts Give Advice and Personal Experiences**

Thousands who have been "over the ground" and who have spent days and weeks on the road have learned by experience the safest, most comfortable and most pleasurable way to camp and tour. These authorities write in **MOTOR CAMPER & TOURIST** each month for anyone who contemplates a trip in the United States.

**Timely Trips and Topics of All Kinds**

One of the features of **MOTOR CAMPER & TOURIST** is the fact that many departments and articles are written especially for the man who is planning an immediate trip in his own car. They give the best trips of the season. In each issue is a complete road map and camp guide of a state of the Union.

**Camping and Touring Equipment and How to Use It**

What you take along on your trip is at times just as important as where you are going because a good outfit is half the pleasure of the trip. **MOTOR CAMPER & TOURIST** gives many, many helpful hints on what to buy and how to buy, and how to use the things you buy.

And then there are many special articles and departments in **MOTOR CAMPER & TOURIST** of general interest to every man who owns and operates a car. Ask for a copy at your local news stands or use the coupon on this page.

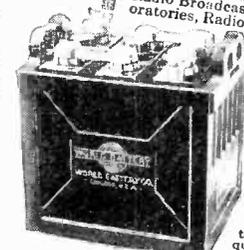
**THE GERMOTT PUBLISHING CO.,**

*Owners*

*Licensed Publishers — Experimenter Publishing Co.,*  
**53 Park Place New York, N. Y.**

**You Save 50%**

**Approved!**  
Listed as Standard by Leading Authorities including Radio News Laboratories, Popular Science Institute of Standards, Popular Radio Laboratories, Radio Broadcast Laboratories, Radio in the Home and Le. Ex. Inc.



World Radio and Auto Batteries are famous for their guaranteed quality and service. Backed by years of successful manufacture and thousands of satisfied users. Equipped with Soft Rubber Case, an insurance against acid and leakage. You save 50 per cent.

**2-Year Guarantee Bond in Writing**

WORLD BATTERY owners "tell their friends." That's our best proof of performance. Send your order in today.

<b>Solid Rubber Case Radio Batteries</b>	
6-volt, 100 Amperes	\$11.25
6-volt, 120 Amperes	13.25
6-volt, 140 Amperes	14.00
<b>Solid Rubber Case Auto Batteries</b>	
6-volt, 11-Plate	\$11.25
6-volt, 13-Plate	13.25
12-volt, 7-Plate	16.00

**SEND NO MONEY**

Just state battery wanted and we will ship day order is received, by Express. C. O. D., subject to your examination on arrival. Extra Offer: 5 per cent discount for cash in full with order.

**WORLD BATTERY COMPANY**  
Dept. 19  
1219 So. Wabash Ave., Chicago, Ill.

**World**

**"HELP WANTED"**  
-Uncle Sam.



Over 22,000 Carriers, Clerks, Railway Mail Clerks appointed last year.

**\$1140 to \$3000 Year**

**Become Railway Postal Clerks**

**Steady Work Paid Vacations**

Common education sufficient

Franklin Institute  
Dept. K180  
Rochester, N. Y.

Kindly send me, entirely free, of charge, (1) A full description of the position checked below; (2) A list of U. S. Government Jobs obtainable; (3) Send free sample coaching lessons.

Railway Postal Clerk	(\$1900 to \$2700)
Postoffice Clerk	(\$1700 to \$2100)
City Mail Carrier	(\$1700 to \$2100)
Rural Mail Carrier	(\$2100 to \$3300)
Income Tax Auditor	(\$2040 to \$3000)

Mail coupon today—**SURE**

Name.....

**CHEM-CRAFT**  
THE CHEMICAL OUTFIT

THE BEST KIND OF FUN AND USEFUL INFORMATION FOR EXPERIMENTERS

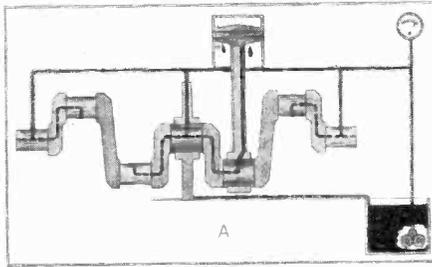
You can make dyes, inks, paint, soap, test water, food, soil and many other materials; perform mystifying tricks of chemical magic and do hundreds of fascinating and useful experiments with CHEM-CRAFT. Five sizes—75c; \$1.50; \$2.50; \$5.00 and \$10.00. Each complete with chemicals, apparatus and big instruction book. Sold in toy departments or sent prepaid upon receipt of price. Demand CHEM-CRAFT—the original and best chemistry set.

**BIG BOOK FREE**  
Boys' Handbook of Chemistry; full of useful chemical information. Write for it now.

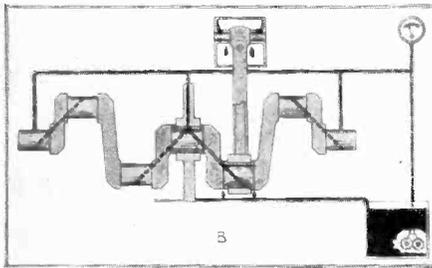
The Porter Chem. Co.,  
105 Washington St.,  
Hagerstown, Md.



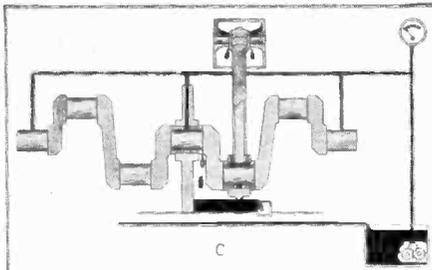
**Motor Hints**  
By TOM C. PLUMRIDGE  
**Lubrication Troubles**



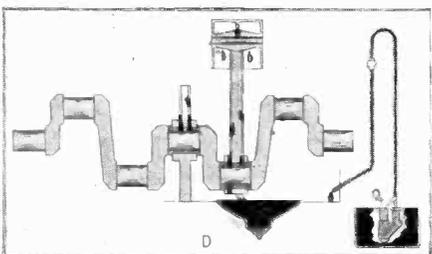
In Fig. A above we illustrate a full forced feed system of motor lubrication. A pump forces oil through the hollow crankshaft to the main bearings and then to the connecting rod bearings and up the side of the connecting rod through a tube to the wrist or piston pins. Black lines show the course of the oil.



In the forced feed system, the oil is only forced to the main bearings and to the connecting rod bearings as in Fig. B above. The piston or wrist pins and the cylinder walls are lubricated by the oil splash from the crankcase.



In the splash-pressure system, the oil is forced to the main bearings only. The connecting rods pick up their oil from troughs into which fins, spoon-like projections on the bottom of the connecting rods, dip. The troughs are filled by the pump and the rest of the engine is lubricated by oil splash.



The simple splash system depends upon the height of the oil in the bottom of the crankcase into which fins on the connecting rods dip. This is shown in Fig. D above. The oil level in the crankcase must be maintained by filling before running or by a special pump and an outside oil tank.

**\$1.00 DELIVERS Complete Outfit**



**Violet Ray**

**QUICK RESULTS No Medicine**

Just \$1.00 brings you a complete outfit identical with the kind doctors have bought from us for years and used successfully in treating the ailments listed. Violet Rays give quick relief, permanent results. They scientifically and painlessly remove the cause of pain and sickness. Dr. L. H. Leight, Millerton, N. Y., writes: "I am having wonderful success in treating neuritis, and all stomach cases. I have given over 2,000 treatments with your outfit."

**10 Day FREE Trial at your home**

Send for Violet Ray Outfit without fail. Treat yourself and family with it. You'll be amazed at how Violet Rays enable you to conquer pain, disease, nervous troubles—how they give vigor, beauty, health. Owning an outfit saves doctor bills, delays, medicines—relieves pain. You should have this health machine in your home.

**Send for FREE Book**

Explains how Violet Rays (discovery of the world renowned scientist, Nikola Tesla) work and heal, what doctors and plain folks accomplish with them. Shows charts of human body explaining where pains start and how to banish them. Send for FREE copy today. Free for limited time only. Vi-Ray Company, 211 S. Peoria St., Chicago.

For special free advice, state your ailment

**for Health Vigor Beauty**

**Ailments successfully treated with Violet Rays**

- Rheumatism
- Neuritis
- Paralysis
- Catarrh
- Nervousness
- Skin Diseases
- Hay Fever
- Headache
- Colds
- Constipation
- Sprains
- Asthma
- Deafness
- Eczema
- Eye Diseases
- Falling Hair
- Goitre
- Insomnia

**Mail Coupon — Send No Money**

**VI-REX COMPANY**  
211 S. Peoria St., Dept. 4012, Chicago

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

Name.....

Address.....

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

Ailment.....

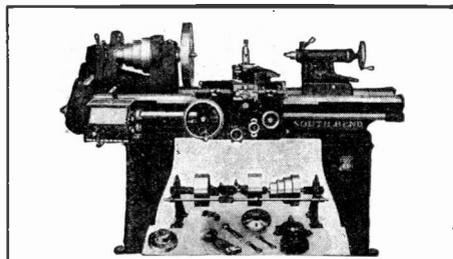
**Music Lessons**  
WITH AN ACCREDITED SCHOOL  
**At Home**

**A Complete Conservatory Course By Mail** Wonderful home study music lessons under great American and European teachers. Endorsed by Paderewski. Master teachers guide and coach you. Lessons a marvel of simplicity and completeness.

**Any Instrument** Write telling us course you are interested in—Piano, Harmony, Voice, Public School Music, Violin, Cornet, Mandolin, Guitar, Banjo, or Reed Organ—and we will send our Free Catalog with details of course you want. Send now.

**UNIVERSITY EXTENSION CONSERVATORY**  
229 Siegel-Myers Bldg. Chicago, Illinois

Insure your copy reaching you each month. Subscribe to **SCIENCE & INVENTION**—\$2.50 a year. Experimenter Publishing Co., 53 Park Pl., N. Y. C.



# THIS LATHE in your shop

SOON EARNS ITS OWN COST ON OUR  
**Easy Payment Plan**

We will ship you any size South Bend Lathe on terms of a small payment down and balance in convenient monthly payments. In this way the Lathe saves and earns its own cost.

**Note Our Low Prices**

On South Bend Screw Cutting Standard Change Gear Lathes

9" x 3' Lathe.....\$211	15" x 6' Lathe.....\$376
11" x 3 1/2' ".....244	16" x 8' ".....438
13" x 5' ".....304	18" x 10' ".....656

Quick change Gear Lathes in the above sizes can be furnished at a slight increase in price.

**FREE CATALOG** shows 98 styles and sizes. Write for it today.

**SOUTH BEND LATHE WORKS**

504 E. Madison St., South Bend, Ind.



## High School Course in 2 Years

This simplified, complete, High School Course—specially prepared for home study by leading professors—meets all requirements for entrance to college, business, and leading professions.

### 20 Other Courses

Over 200 noted Engineers, Business Men, and Educators, helped prepare the special instruction which you need for success. No matter what your inclinations may be, you can't hope to succeed without specialized training. Let us give you the practical training you need.

**AMERICAN SCHOOL**  
Drexel Ave. and 58th St.  
Dept. H 926 Chicago

© A. S. 1925

**Money Back When You Finish If Not Satisfied**

American School, Dept. H, 926 Drexel Ave. & 58th St., Chicago  
Send me full information on the subject checked and how you will help me win success in that line.

- |                          |                          |
|--------------------------|--------------------------|
| ... Architect            | ... Electrical Engineer  |
| ... Building Contractor  | ... General Education    |
| ... Automobile Engineer  | ... Lawyer               |
| ... Civil Engineer       | ... Mach. Shop Practice  |
| ... Structural Engineer  | ... Mechanical Engineer  |
| ... Business Manager     | ... Steam Engineer       |
| ... C.P.A. & Auditor     | ... Sanitary & Heating   |
| ... Bookkeeper           | ... Surveyor & Mapping   |
| ... Draftsman & Designer | ... High School Graduate |

Name .....

Address .....

## Clear-Tone FOR PIMPLES

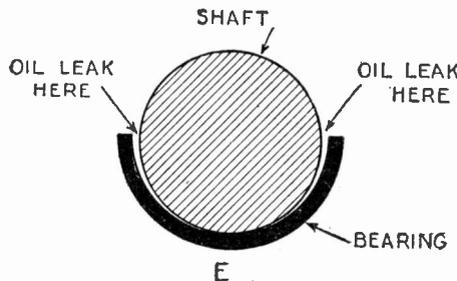
Your skin can be quickly cleared of Pimples, Blackheads, Acne Eruptions on the face or body, Barbers Itch and Eczema, Enlarged Pores, Oily or Shiny Skin. CLEAR-TONE has been Tried, Tested and Proven its merits in over 100,000 test cases.

**FREE** WRITE TODAY for my Free Booklet — "A Clear-Tone Skin"—telling how I cured myself after being afflicted for fifteen years.

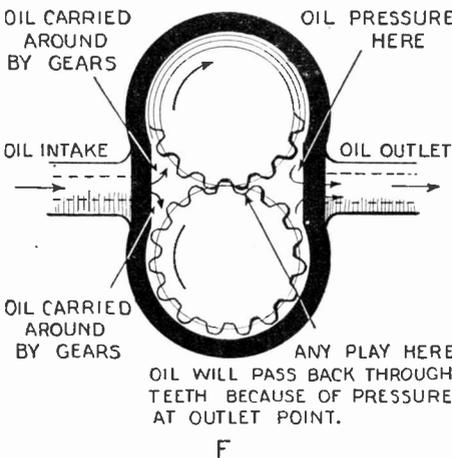
E. S. Givens 168 Chemical Bldg., Kansas City, Mo.

### "BECOME A LIGHTNING TRICK CARTOONIST"

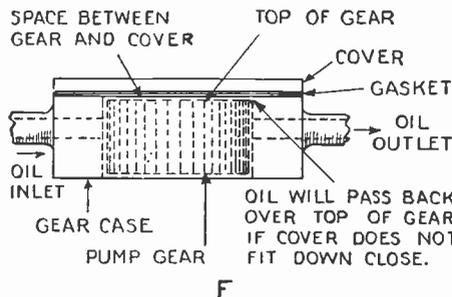
Make money chalk drawing. Send \$1 for 30-day program of trick drawings, with instructions by a professional cartoonist. Satisfaction guaranteed. Circular free. Balda Art Service, Dept. 4, Oshkosh, Wis.



Oil becomes thin during service and should be changed every 500 miles. This is particularly true in winter-time because of the steam which is a product of combustion and which gets down into the crankcase in the form of water. On all pressure oil systems there is an oil gauge which will indicate whether the system is working correctly. Low oil pressure may be due to one of several troubles or to a combination of all or several. Thin oil will cause low pressure. Worn bearings as in Fig. E will give the same indication because the oil will leak out around the shaft.

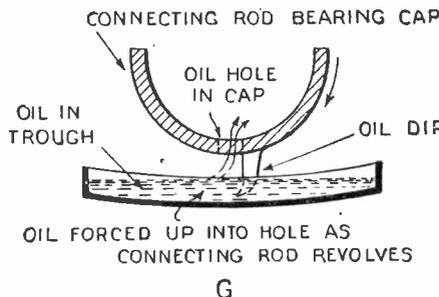


ANY PLAY HERE OIL WILL PASS BACK THROUGH TEETH BECAUSE OF PRESSURE AT OUTLET POINT.



OIL WILL PASS BACK OVER TOP OF GEAR IF COVER DOES NOT FIT DOWN CLOSE.

Two other causes of low pressure are shown in Fig. F above. If there is play in the teeth of the gear pump, the oil will not flow properly and the pressure will be low. If the cover on the gear case is not tight, there will also be a lack of pressure. The remedies are obvious. New gears in the first case and a new gasket or tightening of the cover in the second place.



OIL FORCED UP INTO HOLE AS CONNECTING ROD REVOLVES

In the splash-pressure system, the connecting rod bearing cap should be placed in such a position that the oil will be forced up through the hole by the action of the oil dip. If the cap is on backwards, lubrication will not take place and burned out bearings will result. This is plainly seen in Fig. G. above.

## Play "JAZZ" on the Saxophone

Become a musician so quickly as to astound everyone. Learn by playing real music—instead of tiresome exercises. You'll soon become the most popular person in your "set."

**New Easy Method** is a revelation. Nothing else like it for thoroughness and rapidity. So simple that young and old find it easy to play with amazing skill. No "trick music"—but actual notes, learned quickly right in your own home.

**FREE BOOK AND DEMONSTRATION LESSON** offers this wonderful musical opportunity. Send for them today before copies are exhausted. You'll be astounded, thrilled, fascinated, at this easy, rapid way to become a veritable master of your favorite instrument. Instruments supplied when needed, cash or credit.

Learn to Play Any Instrument

Piano	Mandolin
Organ	Harmony and Composition
Violin	Drums and
Banjo	Clarinets
Clarinet	Trans
Flute	Sight Singing
Harp	Ukulele
Cello	Piccolo
Cornet	Trombone
Guitar	Saxophone
Piano Accordion	
Voice and Speech Culture	

U. S. SCHOOL OF MUSIC, 3012 Brunswick Building, New York City

Send me your amazing free book, "Music Lessons in Your Own Home." Introduction by Dr. Frank Crane, also demonstration lesson. This does not put me under any obligation.

Name .....

Address .....

Instrument ..... Have you this Inst. ? .....

## OWN A TYPEWRITER



### \$3 and it's yours if you clip this now

The ace of writing machines—at a bargain price! A free trial, and easiest monthly payments if you buy! This Underwood No. 5—rebuilt from top to bottom—five-year-guaranteed—removes the last reason for not owning your own machine. Get our proposition with new and valuable Typewriting Manual, free.

**FREE!** Typewriting Manual, large catalog, and full particulars of free course in touch writing, if you mail this to SHIPMAN-WARD MFG. Co., 2189 Shipman Bldg., Chicago.

Name .....

Address .....

## LATEST WHOLESALE RADIO CATALOG

### FREE TODAY

Simply send name for big 64-page book explaining liberal proposition paying agents \$60 to \$100 a week, and how to get latest radio goods at Wholesale. Live dealers and agents wanted.

Standard Radio Co., 1412 Walnut St., Kansas City, Mo.

## You can be quickly cured, if you STAMMER

Send 10 cents for 288-page book on Stammering and Stuttering, "Its Cause and Cure." It tells how I cured myself after stammering 20 yrs. B. N. Bogue, 8123 Bogue Bldg., 1147 N. III. St., Indianapolis

### CALCULATIONS

in the Store, Office, Shop, Etc., can be instantly made with the Midget Slide Rule. If you have any figuring to do, order one on trial. It is the most versatile calculator ever invented.

The Engine-Divided Scales are on white celluloid, mounted on aluminum, grease- and water-proof. Size 4".

Price, with Instruction Book, (Patented 1-17-22) \$1.50. Leather Case 50c extra. Sent C. O. D., if desired. Catalog free. Your money back if you are not satisfied.

**GILSON SLIDE RULE CO., Niles, Mich.**



**RADIO Storage "B" Battery**

**32 Cells 24 Volts**  
 Economy and performance unheard of before. Recharged at a negligible cost. Approved and listed as Standard by leading Radio Authorities, including Pop. Radio Laboratories, Pop. Sci. Inst. Standards, Radio News Lab., Lefax, Inc., and other important institutions. Equipped with Solid Rubber Case, an insurance against acid and leakage. Extra heavy glass jars. Heavy, rugged plates. Order yours today!

**SEND NO MONEY** Just state number of batteries wanted and we will ship day order is received. Extra Offer: 4 batteries in series (96 volts), \$12.75. Pay expressman after examining batteries. 5 per cent discount for cash with order. Mail your order now!

**WORLD BATTERY COMPANY**  
 1219 So. Wabash Ave., Dept. 83 Chicago, Ill.  
 Makers of the Famous World Radio "A" Storage Battery  
 Prices: 6-volt, 100 Amp. \$11.85; 120 Amp. \$13.25; 140 Amp. \$14.00.  
 All equipped with Solid Rubber Case.

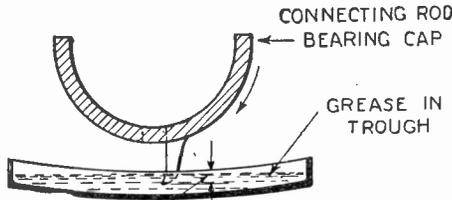
**World STORAGE BATTERIES**  
 Set your Radio Dials at 210 meters for the new 1000 watt World Storage Battery Station, W5BC, Chicago. Watch for announcements.  
 KDKA - WEA - WGN - WJS - KHJ - KGO - KFAF - WJY - KOE

**This Tenor Banjo**



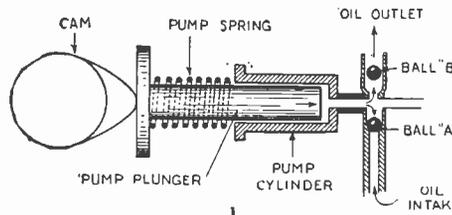
**FREE**  
 When you enroll we want to present you with one of these wonderful, delightful instruments. We want to help every music lover attain success. No musical knowledge is necessary. Learn in 30 minutes. Our picture method shows you and you imitate. We start your popularity, success and fame by supplying you with a handsome instrument. Under personal supervision you will be given the benefit of Prof. Six's 22 years' experience as director of Glee and Instrumental clubs of New York University. We furnish photos of the professor along with phonograph records for each lesson, together with our printed and illustrated easy-to-read course. It is easy to learn. We guarantee to teach you.

**DON'T SEND A SINGLE CENT**  
 Just drop us a line—telling you are interested in receiving full particulars, and to reserve one of our regular \$18.00 full size professional gift tenor banjos for you. Write now for free book and sample lesson. N. Y. Academy of Music, Studio 49 100-5th Avenue, New York.



DISTANCE DIP GOES INTO OIL, INCREASE LENGTH OF DIP, FOR MORE OIL TO BE FORCED UP INTO CONNECTING-ROD BEARING.

Sometimes the oil dip in a splash system does not go deep enough into the oil trough. To test this, fill the trough with grease, put into place and revolve the engine. The distance that the dip cuts into the grease will indicate the depth that it dips into the oil. Remove grease before assembling engine.

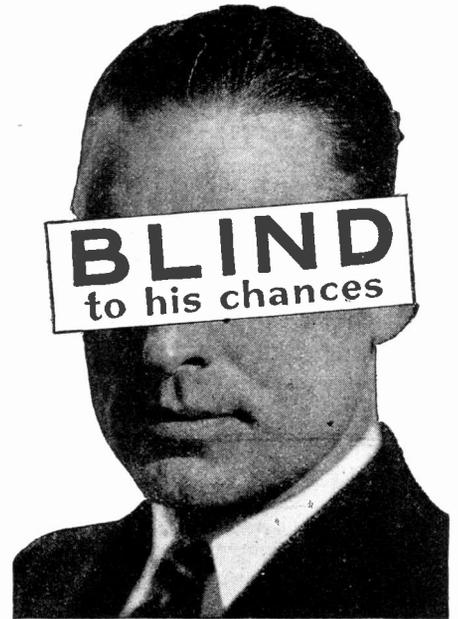


Some force-feed systems use a plunger pump of the type shown in Fig. 1. If the pump plunger becomes worn, it will not operate correctly. Furthermore, dirt or grit around either ball A or B will reduce the pressure in the system by not allowing the balls to seat properly.

**The Radio Constructor**  
 By A. P. PECK  
 (Continued from page 773)

up to the highest possible reading. The circuits are now in full resonance but the transmitted wave will not be absolutely steady. This unsteadiness is not desirable and, therefore, one or the other of the antenna circuit condensers should be tuned slightly until the antenna meter reading is at a point that shows about 9/10ths of the highest obtainable current. The antenna circuit is now slightly off resonance from the oscillator and not quite as much power is being put into the antenna, but nevertheless, you will "get out" better because of the fact that the note and wave will be much steadier. All of this time, keep the filament volt-meter at the proper reading and watch the tube for signs of overheating. A sudden rise in temperature of the plate of the tube usually denotes that the circuit is out of oscillation. The circuit is also not oscillating when a variation in the oscillator tuning condenser does not cause the plate ammeter to change. From these few hints about the tuning and with a little practice, you should encounter no serious difficulty in getting your set to work. After you get on the air with it and communicate with two or three of your fellow hams, you will be able to tune the transmitter to its most efficient point. It may take days and even weeks to do this, but you will eventually arrive there and will be able to tune your set to any wave that you may desire to transmit upon.

(Author's Note: In case any readers are not sure as to where various instruments suitable for radio transmission can be purchased, the writer will be only too glad to help them upon request if they will address him in care of this magazine. Enclose a stamped addressed envelope and state just what instruments you wish to purchase.)



[By WILLIAM R. DURGIN]

Don't YOU make this man's mistake! If you seek a \$100 a week pay envelope—yes, or \$200—don't learn a fifty-dollar trade!

And don't pick a line that's hard work, and **HARD TO LEARN**. It's just ordinary, common sense to choose something that's interesting and **EASY!** A few months will make anyone who can read and write, a draftsman. I know a man who **KNOWS** drafting—and who will teach YOU.

Drafting is **FASCINATING** work. Some of my friends are learning at home, and I can't **DRAG** them out evenings. No wonder! One of them made \$40 on the side last week—drafting some plans for a contractor—and he began this Chief Draftsman's course less than two months ago!

Good machinists work **WHEN WORK IS PLENTY**. Electrical shops have Waiting Lists. I've seen "automotive experts" washing cars! And a beginner in aviation needs make only **ONE** mistake!

But I never heard of a draftsman who was ever injured or laid off. Did you?

Take my tip. Drafting is **THE** field. Every barn that's built, every wheel that turns, calls first for **DRAFTSMEN**. You never see work that you don't see **BLUEPRINTS!**

If you don't send for Dobe's free book about drafting—you are **BLIND** to your opportunity—that's certain!

**CHIEF DRAFTSMAN DOBE, DIV. 14-29**  
 1951 LAWRENCE AVE., CHICAGO

Please send me **FREE** and **POSTPAID** your book **Successful Draftsmanship**, and all material needed to see how drafting is learned at home, and whether I would like it. Include your offer of complete tools at no extra cost.

Name..... Age.....  
 St. or No.....  
 P. O..... State.....

**Free Mailing Lists**  
 Will help you increase sales. Send for FREE catalog giving counts and prices on thousands of classified names of your best prospective customers—National, State and Local—Individuals, Professions, Business Concerns.  
**99% Guaranteed 5¢ each** by refund of 5¢ each  
**ROSS-Gould Co.** 35 N. 10th St. St. Louis

**Study AT Home**  
 Become More Efficient  
 Courses in Mathematics, Chemistry, Psychology, Education, Business, and 40 other subjects command either High School or College Credit. Start any time.  
**The University of Chicago**  
 27 Ellis Hall CHICAGO, ILL.

**6-Shot Finest Perfected Revolver** \$5.55  
 This gun "free" if you can beat our price anywhere—4 or 6 in. barrel—blue or nickel—6 shot, 32 caliber. Also 38 and 22 caliber—all same price. Powerful, accurate, hard-hitting, satisfaction guaranteed. Pay on delivery \$5.55, plus postage. Mail Order Co., 414 B'way, N.Y. Dept. X-80

**SEND FOR THE INTERNATIONAL CATALOG**  
 Our net price list. Full line of auto bodies and accessories for Fords at Wholesale Prices. Save big money on bodies by buying Direct from Factory.  
**FOR FORD**—Prices from \$27.85 up. Factory to consumer direct—Pay only One Profit  
 International Body Wks, 914 W. Ohio St., Dept. 4, Chicago, Ill.

## Opportunity Ad-lets

**YOU** will find many remarkable opportunities and real bargains in these columns. It will pay you to read and investigate the offerings made every month by reliable firms, dealers and amateurs from all over the country. No matter what you may be seeking, whether supplies, automobile accessories, the opportunity to make money, or anything else, you will find listed here the best and most attractive specials of the month.

Advertisements in this section twelve cents a word for each insertion. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. No advertisement for less than 10 words accepted. Ten per cent. discount for 6 issues, 20 per cent. discount for 12 issues. Objectionable or misleading advertisements not accepted. Advertisements for the February issue must reach us not later than December 10th.

**The Circulation of Science and Invention is over 175,000 and climbing every month**

EXPERIMENTER PUBLISHING CO., INC., 53 Park Place, New York City, N. Y.

### Advertising Agents

Advertising in all magazines and newspapers at publishers' lowest rates. Rate book free. Taylor's Advertising Service, Dept. 6, Freeport, Ill.

### Agents Wanted

**Agents Wanted Full or Part Time** to sell on liberal commission new **Thermostatic Automatic Carburetor** control Attachment for Ford cars. Increases mileage 100%. No holes to drill. Attached in 2 minutes. Does automatically exactly what Ford Manual instructs driver do by hand. Cadillac now using **Thermostatic Carburetor Control** under Blanche license. Write at once, A. C. Blanche & Co., Dept. 863X, 602 W. Lake St., Chicago.

**Robt. H. Ingersoll** of \$1 Watch fame wants good men to sell his **Dollar Stropping** outfit, an ingenious invention for sharpening all makes of safety razor blades. Great Economic value. Meeting with nationwide approval. Easy to sell. Big repeat business. Agents having remarkable success. Full particulars. **Robt. H. Ingersoll**, 47611 Broadway, New York City.

**Agents—Best seller**; **Jem Rubber** repair for tires and tubes; supersedes vulcanization at a saving of over 800 per cent; put it on cold. It vulcanizes itself in two minutes and is guaranteed to last the life of the tire or tube; sells to every auto owner and accessory dealer. For particulars how to make big money and free sample, address **Amazon Rubber Co.**, Dept. 601, Philadelphia, Pa.

**Agents—Write for Free Samples.** Sell Madison "Better-Made" Shirts for large Manufacturer direct to wearer. No capital or experience required. Many earn \$100 weekly and bonus. **Madison Company**, 566 Broadway, New York.

**Big money—fast sales.** Every owner buys gold initials for his auto. You charge \$1.50; make \$1.35. Ten orders daily easy. Write for particulars and free samples. **American Monogram Co.**, Dept. 71, East Orange, N. J.

**Earn \$10 daily** silvering mirrors, plating and refinishing metalware, chandeliers, bedsteads, headlights. Outfits furnished. **N. Deele Laboratories**, 1133 Broadway, New York.

**\$60—\$200 a week.** Genuine Gold Letters for store windows. Easily applied. Free samples. Liberal offer to general agents. **Metallic Letter Co.**, 441 E. North Clark, Chicago.

**\$10 daily silvering mirrors,** plating and refinishing lamps, reflectors, autos, beds, chandeliers by new method. Outfits furnished. Write **Gunmetal Co.**, Ave. D, Deatur, Ill.

**Wonderful invention** eliminates needles for phonographs. Preserves records. Abolishes scratching. Day's supply in pocket. \$20 daily. Sample on approval if requested. Everplay, Desk H12, McClurg Bldg., Chicago.

**Big money—fast sales;** everyone buys gold initials for their auto; sell \$1.50 profit \$1.41. Ten orders daily easy. Samples, information free. **World Monogram**, Dept. 32, Newark, N. J.

**Easy Money Applying Gold Initials,** Monograms on automobiles. Anyone can do it. Simply transferred from paper; takes 5 minutes. Make \$1.50, cost 5c. Samples free. "Radio," 1013 Washington, Boston, Mass.

**Only one sale a day means \$200 per month!** Marvellous new adding machine. Retails \$15.00. Work equals \$350 machine. Adds, subtracts, multiplies, divides, automatically. Computes feet and inches. Speedy, accurate, durable, handsome. Five year guarantee. Offices, Stores, factories, garages, lumbermen buy one to dozen. A fortune for live agents. Write quick for protected territory and free trial. **Lightning Calculator Co.**, Dept. V, Grand Rapids, Michigan.

**Why work for others?** Make and sell your own goods. We show you how. Free book explains everything. **National Scientific Laboratories**, 1900 A Broad, Richmond, Va.

**Greatest temper saving device!** Takes slack and kinks from telephone and electric iron cords. \$25 daily. Samples on approval if requested. **Neverknot**, Dept. 127 McClurg Bldg., Chicago.

**At Last! Diamond Rival Discovered!** Amazing blue-white **Rajah Gem** astounds jewelry world and deceives experts; Beautiful sample case free! \$100 weekly! Write quick! **Rajah Diamond Co.**, Dept. F11, Salisbury, N. C.

**Bankrupt and Rummage Sales.** Make \$50.00 daily. We start you, furnishing everything. **Distributors**, Dept. 171, 609 Division, Chicago.

**Wash clothes the new way.** Use the **Torrent Automatic Washer**. You will be delighted. Special offer to one in each locality. **Storm Royalty Co.**, 3602 Enright Ave., St. Louis, Mo.

**Mirrors Re-Silvered At Home.** Costs less 5 cents per square foot; you charge 75 cents. Immense profits, plating autoproducts, reflectors, tableware, stoves. Refinishing metalware, etc. Outfits, furnished. Write for information. **Sprinkle, Plater 935**, Marion, Indiana.

**Agents—\$100 Weekly for Your Spare Time.** Radio is calling you. The biggest season in history is about to open. Let us show you how to make \$80 to \$125 per week working all or part time selling our marvelous five-tube radio set on 30 days' free trial direct from factory to user at a saving to your customer of about half, at the same time making a good profit for yourself. We want exclusive agents everywhere. No experience necessary. Write for proposition today. **Metro Electric Co.**, 1243 S. Wabash Ave., Desk 579, Chicago, Ill.

**Marvellous New Invention 400% Profit Liquid Quik** Mend for hosiery and fabrics. Tremendous demand. Over hundred other fast sellers. Local and General Agents. **J. E. Johnson Co.**, Dept. 836, 69 E. South Water St., Chicago.

### Agents Wanted (Continued)

I'll prove to you that you can make \$96 a week taking orders for **Jennings Guaranteed Hosiery**. I furnish complete equipment and offer you an **Essex Coach** without cost. Write now, **The Frank B. Jennings Co.**, Dept. Y-5, Dayton, Ohio.

**No Dull Times Selling Food.** People must eat. Federal distributors make big money; \$3,000 yearly and up. No capital or experience needed; guaranteed sales; unsold goods may be returned. We furnish you with license. Your \$20.00 starting order sent on trust. Free Samples to customers — Repeat orders sure; Exclusive territory. Ask now, **Federal Pure Food Co.**, SS2311 Archer, Chicago.

**Razorite—Keeps safety blades sharp—No stropping—Patented Chemical—Demonstrator 25c.** Claus, 1864 Harman Street, Brooklyn, New York.

**\$2.00 an hour** for special advertising work among local families. Exceptional opportunity; pay starts immediately. **American Products Company**, 4210 American Bldg., Cincinnati, O.

**Succeed with Your Own Products—Make them yourself.** Formulas. Processes by experts. Trade-Secrets. Modern master methods. Catalog free. **D. Thaxly Co.**, Washington, D. C.

**Make \$150.00 to \$400.00 weekly** selling **Start Rite Switch** for Ford Cars. To start car just retard spark lever. No floor button needed. Saves bendix and starter trouble. **Demonstrator** furnished. Write today for plan and proof of \$1800.00 monthly profit. Dept. 10A, **National Sales Co.**, Inc., Olin, Iowa.

**\$100 weekly—pleasant work;** appointing local agents to introduce **Mother Hubbard Foods**; no canvassing; no delivering; no money invested. **Mother Hubbard**, 550 Congress, Chicago.

**Free Mail Order Information.** Write today. **Fruitt Publishing Co.**, Sta. E-403, Kansas City, Mo.

### Battle Photos and War Relics

**For Dens:** Relics Collected from Europe's Battlefields. Firearms, medals, helmets, etc. Illustrated catalogue and sample War photographs 25c. **Lieut. Welch**, 1889 Albany Ave., Brooklyn, N. Y.

### Books

**Free—Upon request** will send you my literature illustrating the following books: Astrology, Character, Clairvoyance, Concentration, Healing, Hypnotism, Magnetism, Mediumship, Personal Magnetism, Personality, Physiology, Salesmanship, Seership, Success, Sex, Will, Yogi Philosophy, Gazing Crystals, etc. **A. W. Martens, E. E. 6**, Burlington, Iowa.

### Business Opportunities

**Free Book.** Start little Mail Order business. **Pier, 998** Cortland Street, New York.

**You can have a business-profession** of your own and earn big income in service fees. A new system of foot correction; readily learned by anyone at home in a few weeks. Easy terms for training, openings everywhere with all the trade you can attend to. No capital required or goods to buy, no agency or selling. Address **Stephenson Laboratory**, 18 Back Bay, Boston, Mass.

**Stop Plodding! Be Successful.** Operate a **Tire Repair Shop**. Make big profits in any locality. We teach you and furnish complete equipments \$100 up. **Book of Opportunity** free. **Haywood's**, 1312 South Oakley Avenue, Chicago.

**\$1000 Monthly.** The **Master Business Plan** gets money easily, quickly, steadily, without fail. Details free. **Albert Braut**, Davis, Ill.

**Make Money!** 150 Plans **Free!** **Wolverine Bureau**, (E-1), Muskegon, Michigan.

### Chemistry

**Develop latent finger prints** with non-eradicating powders. With directions 35 cents prepaid. **The Rogers Laboratory**, Rib Lake, Wis.

**Learn Chemistry at Home.** **Dr. T. O'Connor Sloane** noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our ad on page 696 of this issue. **Chemical Institute of New York**, 66 W. Broadway, New York City.

**Experimenters** chemical apparatus and radio supplies. Catalog 5c. **Chemical Apparatus Co.**, 4400 West End, Chicago.

### Correspondence Courses

**Used correspondence school courses.** All kinds. Sold on repurchase basis. Big saving. Money back guarantee. Lists free. (Courses bought). **Leo Mountain**, Pisgah, Alabama.

### Educational

**Correspondence courses.** All schools. Lowest prices. Terms. Catalog free. Mention Subject. **Economy Educator**, 440-H Sansome, San Francisco.

### Educational (Continued)

**Used Correspondence School courses** save over half. Bargain catalog 1600 courses free. Used courses bought. **Students' Exchange**, Dept. A, 47 West 42d Street, New York.

### Farms and Orchards

**Pecan-Orange-Fig Groves "On the Gulf"**. Guaranteed care. Monthly payments. Big, quick returns. **Suburban Orchards**, Dept. I, Biloxi, Miss.

### Female Help Wanted

**Women—We can put you in touch** with good paying clean work, in any city or town. Full time or spare time. No charge for service. **Betty Buck's Employment Service**, Box 240, c/o Science & Invention, New York, N. Y.

### For Advertisers

**I write letters, folders, booklets,** complete followup for manufacturers, mail order dealers. Long experience. Write for details. **L. Taylor**, Box 344, Freeport, Ill.

**Alaska Pathfinder**, illustrated magazine, three issues with years privilege Alaska information bureau, One dollar. **Pathfinder of Alaska**, Anchorage, Alaska.

### For Inventors

**We Develop Your Ideas** into commercial shape for presentation to purchasers making working models, drawings, experiments or tests. Courtesy, efficiency, secrecy and ample equipment; 30 years' experience. **Ducorron-Rich Engineering Co.**, 504 Pacific Mutual Bldg., Los Angeles, Cal.

**Unpatented Ideas Can Be Sold.** I tell you how and help you make the sale. Free particulars (Copyrighted). Write **W. T. Greene**, 803 Jenifer Bldg., Washington, D. C.

**Your Chemical problems** solved and working process furnished for Five Dollars. Write me, **W. Stedman Richards**, Consulting Chemist, Box 2102, Boston, Mass.

**Get Cash** for your patent or invention under our new plan. Write at once to **Inventors' Syndicate**, 22 Palladium Bldg., St. Louis, Missouri.

**Stronger Patents** less money. Drawings, specification, claims \$20. Send half fee with sketch and description. Prompt, efficient action. **American Patents Corporation**, Barrister Building, Washington, D. C.

**Inventors** assisted in preparing and prosecuting their own patent applications. Searches made. Drawings prepared. General patent advice. Lowest fees. **Harold C. Chambers**, Box 1544, Washington, D. C.

### Formulas

**Create a sensation—manufacture Composition Gold Nuggets** that deceive experts. They have the weight, color and look like the genuine article. Think this over if you are looking for something different. These nuggets attract attention—**Quick Sales—large profits—Inexpensively compounded and will wear forever.** Copyrighted manufacturing directions in detail, also four other valuable formulas for \$1.00 (No stamps). Your money back if not as represented. **Western Specialties Laboratory**, Dept. S, 902 Hastings Ave., Coeur D'Alene, Idaho.

### Formulas and Trade Secrets

**We solve Chemical problems,** furnish tested formulas or analyze your samples. Reasonable. **Research Laboratories**, Williams & Washington, Roxbury, Mass.

**Tested and Guaranteed formulas, \$1.00.** Chemical analysis for duplication. **Roxbury Laboratory**, Research Department, 11 Williams St., Roxbury, Mass.

### Games and Entertainment

**Free with \$25 order** our large die box. Send 20c for our large catalogue of tricks, puzzles, wigs, sensational escapades. **Oaks Magical Co.**, Dept. 549, Oshkosh, Wis.

### Health

**Tobacco Habit Banished.** No matter how long you have been a victim, no matter how strong your craving, no matter in what form you use tobacco, there is help for you. Just send postcard or letter for our **Free Book**. It explains everything. **Newell Pharmaceutical Co.**, Dept. 788, Clayton Station, St. Louis, Mo.

### Help Wanted

**Silvering Mirrors, French plate.** Easily learned. Immense profits. Plans free. **Wear Mirror Works**, Dept. 36, Excelsior Springs, Mo.

**All men-women, 18 to 60,** wanting to qualify for Government Position, \$140-\$225 monthly, local or traveling, write, **Mr. Ozment**, 293, St. Louis, Mo., immediately.

**Detectives Earn Big Money.** Travel. Excellent opportunity. Great demand everywhere. Experience unnecessary. Particulars free. Write, **American Detective System**, 1974 Broadway, N. Y.

**Help Wanted (Continued)**

**Detectives Needed Everywhere.** Work home or travel. Experience unnecessary. Write: George Wagner, former Government Detective, 1968 Broadway, N. Y.

**Earn \$25 weekly,** spare time, writing for newspapers, magazines. Experience unnecessary. Copyright book free. Press Syndicate, 986, St. Louis, Mo.

**Firemen, Brakemen, Baggage-men,** Sleeping car, train porters (colored) \$110-\$200. Experience unnecessary. 397 Railway Bureau, East St. Louis, Ill.

**U. S. Government Jobs.** Railway Mail Clerks — Mail Carriers. \$1700-\$2700 year. Steady. Men 18 up. Sample coaching—Free. Write immediately. Franklin Institute, Dept. K20, Rochester, N. Y.

**How To Entertain**

**Plays, musical comedies and reviews, minstrel music, blackface skits, vaudeville acts, monologs, dialogs, recitations, entertainments, musical readings, stage handbooks, make-up goods.** Big catalog free. T. S. Denison & Co., 623 So. Wabash, Dept. 99, Chicago.

**Instruction**

**Learn Chemistry at Home.** Dr. T. O'Connor Sloane, noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See ad on page 696 of this issue. Chemical Institute of New York, 66 W. Broadway, New York City.

**Correspondence Courses sold complete;** one-third usual prices because slightly used; easy terms; money back guarantee. All schools and subjects. Write for special Free catalog. Courses bought for cash. Economy Educator Service, E202, West 49th St., New York.

**Machinery and Tools**

**Concrete Building Block Machines and Molds.** Catalogue free. Concrete Machine Co., 305 South Third St., St. Louis, Mo.

**Manufacturing**

**Mechanical Work:** all branches. Perfect models. Articles manufactured to order. Reliable. Jarma Engineering Works, Brooklyn Station, Cleveland, Ohio.

**Male Help Wanted**

**Men—We can put you in touch with good paying clean work,** in any city or town. Full time or spare time. No charge for service. Betty Buck's Employment Service, Box 210, c/o Science & Invention, New York, N. Y.

**Miscellaneous**

**Formulas for Beverages, Syrups, Extracts, flavors, etc.** Other good manufacturing specialties. Free information. The Formula Co., 1613 Queen Anne Ave., Seattle, Wash.

**At last—a perfect duplicator at low price.** Send for detail. Itten Sales, 406S, Whittier, Calif.

**Lighting Electrolyte.** Charges storage batteries instantly. Gallon costs 59c, sells \$10.00. Make it yourself. Guaranteed formula \$5.00. Write for free circulars. Murphy Chemist, Tujunga, Calif. Box A.

**Imported Pups and Grown Dogs.** VerilBest Police Dog Kennels, Portland, Ind.

**Tattooitid removes tattoo marks painlessly,** leaves no scar, full treatment on trial. Vestfold Company, 952—42nd St., Brooklyn, N. Y.

**Razor Blades for Gillette Style Razors.** Dozen 45c., half dozen 25c. Piedmont Novelty Shop, Box 631, Danville, Virginia.

**Book Collectors—let me know your wants.** Have 5000 volumes, all subjects. V. P. Simon, 719 Oakton St., Evansston, Ill.

**Smallest Dictionary in the world.** 18,000 words, readable type, paper cover 25c.; leather 50c. Agents wanted. A. H. Kraus, 409 Chestnut St., Milwaukee, Wis.

**You can receive 25 letters a day each containing \$1.00.** Legitimate working plan and formula, \$1.00 bill. Henry Peter Bergman, 802 East 3rd St., Tulsa, Oklahoma.

**Pennants, flags, banners—all kinds—any quantity—satisfaction guaranteed.** Thompson, Box 1921, Norfolk, Va.

**Gears and Model Supplies,** of every description. Catalog 5 cents. Experimenters Supply House, Box 10, Station Y, New York City.

**Motorcycles—Bicycles**

**Don't buy a Bicycle Motor Attachment until you get our catalogue and prices.** Shaw Mfg. Co., Dept. 6, Galesburg, Kansas.

**Musical Instruments**

**Violins—Deep, Mellow, Soulful—on easy credit terms.** High grade, wonderful instruments of my own make. Development of many years' experience. Write for book. Gustav A. Henning, 2124 Gaylord St., Denver, Colo.

**Novelties**

**Magic goods, cards, books, novelties, tricks.** Catalog free. Clifford Penner, 2401 Jefferson, Louisville, Ky.

**Old Money Wanted**

**\$2 to \$500 Each paid for hundreds of Old or Odd Coins.** Keep all old money. It may be very valuable. Send 10c for new illustrated Coin Value Book, 4x6. Guaranteed Prices. Get Posted, We pay Cash. Clarke Coin Company, 14 Street, LeRoy, N. Y.

**Patents**

**Inventions commercialized.** Patented or unpatented. Write Adam Fisher Mfg. Co., 205 Enright, St. Louis, Mo.

**Patent Attorneys**

**Patents.** Send for free booklet. Highest references. Best results. Promptness assured. Send model or drawing for examination and opinion. Watson E. Coleman, Patent Attorney, 644 G Street, N. W., Washington, D. C.

**Inventors write me about patents.** My fees payable monthly. Booklet free. Frank Fuller, Washington, D. C.

**Unpatented Ideas Can Be Sold.** I tell you how and help you make the sale. Free particulars (Copyrighted 1923). Write W. T. Greene, 809 Jennifer Bldg., Washington, D. C.

**Lacey Patent-Sense.** "The book the inventor keeps." Free. See page 762.

**"Inventor's Advisor,"** the valuable Patentbook with 159 Mechanical movements and illustrations, sent free upon request. M. I. Labiner, Patent Attorney, 3 Park Row, New York.

**Herbert Jenner, Patent Attorney and Mechanical Expert,** 606 F Street, Washington, D. C. I report if patent obtainable and exact cost. Send for circular.

**Get your own patents.** Application blanks, complete instructions \$1. Cutting Bros., Campbell, Calif.

**Patents.** Time counts in applying for patents. Don't risk delay in protecting your ideas. Send sketch or model for instructions or write for Free book, "How to Obtain a Patent" and "Record of Invention" form. No charge for information on how to proceed. Communications strictly confidential. Prompt, careful, efficient service. Clarence A. O'Brien, Registered Patent Attorney, 9298 Security Bank Building (directly across street from patent office), Washington, D. C. See page 761.

**"Inventors' Guide"** free on request; gives valuable information and advice for all who have original ideas or improvements. Frank Ledermann, Registered Attorney and Engineer, 17th Floor, Woolworth Bldg., New York.

**Millions spent annually for ideas!** Hundreds now wanted! Patent yours and profit! Write today for free book—tells how to protect yourself, how to invent, ideas wanted, how we help you sell, etc. American Industries, Inc., 212 Kresge Bldg., Washington, D. C.

**Patents:** My fee in installments. Free personal advice. Frank T. Fuller, Washington, D. C.

**Inventors—Send for form "Evidence of Conception"** to be signed and witnessed, Form, fee schedule, information free. Lancaster and Allwine, Registered Patent Attorneys in United States and Canada, 242 Ouray Bldg., Washington, D. C.

**Monroe Miller, Ouray Bldg., Washington, D. C. Patent Attorney; Mechanical, Electrical Expert.** Free Blue Book gives candid advice.

**Patents Procured; Trade Marks Registered—A comprehensive, experienced, prompt service for the protection and development of your ideas.** Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 130 Owen Bldg., Washington, D. C., or 41-T Park Row, New York.

**Personal**

**Get acquainted.** Make new friends. Exchange Letters. Enclose stamped envelope for plan. The Lilly Club, Station H, Cleveland, Ohio.

**Radiomact Removes Warts, Moles, Superfluous Hair, Corns, Powder and Tattoo Marks.** Particulars sent free. Radiomact Co., 1416 Cadwallader St., Philadelphia, Pa.

**Printing Outfits and Supplies**

**Print your own cards, stationery, circulars, paper, etc.** Complete outfits \$8.85; Job Presses \$12, \$35; Rotary \$150. Print for others, big profit. All easy, rules sent. Write for catalog presses, type, paper, etc. Press Company, A-6 Meriden, Conn.

**Radio**

**Attention!** 50 Vacuum Tube Hook-Ups. The greatest collection of Vacuum Tube Circuits ever brought under two covers at such insignificant cost. These diagrams will be found in the great "Rasco" catalogue which contains raw materials and parts in a greater profusion than any other catalogue. 15c in stamps or coin will bring the catalogue to you. Radio Specialty Company, 100 Park Place, New York City.

**Boys, don't overlook this!** The "Rasco" Baby Detector. Greatest detector ever brought out with molded base. Fully adjustable. See former advertisements in this publication or our catalogue. Detector with Galena Crystal complete, 50c; the same Detector with Radiocite Crystal, 75c, prepaid. Send for yours today. Radio Specialty Co., 100 Park Place, New York City.

**Real Estate**

**How to Sell Real Estate.** For information address Angelus Sales Co., Los Angeles.

**Salesmen Wanted**

**Take orders for coffee, sugar, flour, meats, canned goods, staple groceries, also paints, radio sets, tires, auto and tractor oils.** No capital or bond required. We deliver and collect. Permanent business. Big pay. Write at once. Hitchcock-Hill Co., Dept. 83, Chicago.

**Sells for \$9.75.** Prints ad on wrapping paper, envelopes, etc. \$1.00 commission. Send 10c for sample work. Automatic Ad-Stamp, Joplin, Mo.

**A Salesman wanted in every town or city within 25 miles of a broadcasting station to sell Radiogem,** the complete radio receiving set that retails for \$2.50. With Radiogem there is nothing else to buy—the outfit includes the Radiogem receiving apparatus, 1,000-ohm phone, and aerial outfit. The cheapest radio outfit on the market—yet as practical as the most expensive. Big money to the right man. Send \$2.00 for sample outfit. The Radiogem Corp., 681 West Broadway, N. Y. City.

**\$10,000 Yearly.** Manufacturer World's Greatest Envelope Sealer. Sells \$4.50. Tremendous Demand!! Big Repeats. Write quick for exclusive territory. Red-E, 2037 Nottingham Bldg., Boston.

**A Paying Position Open to representative of character.** Take orders shoes-hosiery direct to wearer. Good income. Permanent. Write now. Tanners Shoe Mfg. Co., 10-163 C St., Boston, Mass.

**Song Poems**

**Song Poem Writers—Send for proposition.** Ray Hibbler, 121, 4010 Dickens Ave., Chicago.

**Stamps and Coins**

**California Gold,** quarter size, 27c; half-dollar size, 53c. Columbian nickel and catalogue, 10c. Norman Shultz, Box 146, Colorado Springs, Colo.

**Stamps 100 All Different 3 cents.** S. I. Quaker Stamp Company, Toledo, O.

**25c. buys \$1.00 worth different foreign stamps from our mail.** Free Premium. Calculator Corp., Grand Rapids, Mich.

**Stamps, 50 varieties,** Africa, Brazil, Peru, Cuba, Mexico, etc., 10c. 60 different U. S. 25c.; 1,000 mixed, 40c.; 1,000 hinges 10c. List free. C. Stegman, 5945 Cote Brillante, St. Louis, Mo.

**Stories or Manuscripts Wanted**

**Stories, poems, descriptive articles, plays, etc., are wanted for publication.** Submit Miss or write Literary Bureau, 165, Hannibal, Mo.

**Ventriloquism**

**Ventriloquism taught almost anyone at home.** Small cost. Send 2c. stamp today for particulars and proof. Geo. W. Smith, Room 843, 125 N. Jefferson Ave., Peoria, Ill.

**Wanted**

**Detectives Earn big Money.** Work home or travel. Experience unnecessary. Write: George Wagner, former Government Detective, 1968 Broadway, N. Y.

**BOYS!**

**Earn Money in Your Spare Time**

Through our practical plan you can quickly earn all the extra money you would like to have—in your spare time. It's easy. Simply sell and deliver SCIENCE AND INVENTION and our other four popular magazines in your neighborhood. We will pay you liberal commissions and award dandy prizes.

There are many boys just like you who are turning their spare time into cash as members of our Young Men's Sales Association. You can do the same. No experience or investment is necessary. Take your pencil now and fill in your name and address on the coupon below.

.....-Clip here—Mail To-day-.....

E. J. FOLEY, Department S.I. 12, EXPERIMENTER PUBLISHING Co., 53 Park Place, New York City.

I would like to make money and earn prizes. Please tell me how I can do so and become a member of your Young Men's Sales Association.

Name .....

Address .....

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

**Ozarka Senior Console—\$197.50** East of Rockies  
 Complete with Tubes, Batteries and Speaker



*The Sweetest Story  
 Ever Told*



# A Good Wife and a Good Radio Assures Lasting Satisfaction

**A** LITTLE more time, a little more care in making the selection in the first place generally tends to more lasting satisfaction.

Out of every 100 Ozarka's sold in 1922 only eight are not today in the hands of the original owners—this does not include 17 out of each 100 who have purchased later Ozarka models in newer type cabinets. If there is a single Ozarka that is not in active service today, we have never heard of it.

Without the Ozarka Service in charge of direct factory trained representatives, such a record would not be possible. Ozarka service can be had today in almost every country. Purchasers in South Africa, Alaska, Sweden, Newfoundland, New Zealand, and Japan all receive the same practical service as those in Canada, United States, Mexico and Cuba. Whenever you find the sign of the Ozarka long distance goose, you'll find a man who knows Ozarka instruments perfectly.

If such service added more to your cost price it might be a matter to consider, but it doesn't. Quality for quality you'll find Ozarka prices lower—four tube Ozarka's with built-in loud

speakers retail for \$58.00—five tube with built-in speaker \$64.00, up to solid walnut console design, \$160.50.

Our nearest representative will gladly set up an Ozarka in your home, without any obligation whatever. He won't tell you what it will do—he will let you do all the tuning. With the Ozarka you must satisfy yourself, as to distance, tone, volume, ease of tuning and selectivity.

More than this you will be very agreeably surprised at Ozarka prices—selling as we do, thru our own direct factory representatives, our selling expense is very low—we give Ozarka purchasers the benefit of it.

Where is there a value to compare with the one shown above—solid walnut cabinet (no walnut finish or veneer), imported English loud speaker of a marvelous tone, five tube instrument with 75 ampere Exide storage battery, 90 volts of Eveready "B" battery, 5 tubes, aerial equipment all erected and the price is only \$197.50.

## A Few More Men are Needed to Sell Ozarka

In a great many counties we have the man we want. He is rapidly building up a permanent and profitable business of his own because he has an instrument that will more than meet all competition. More than this, he is trained to back up his sales with the kind of service that counts.

Many well established Ozarka representatives started by giving us only their spare time—their evenings. If your county is open you can do the same.

The investment in cash is very small. The investment in time necessary for study is considerable. It requires patience, but the results have enabled many men to get out of the salary and time clock class.

Any previous sales experience is helpful but not necessary. We can and will teach you how to sell.

### Send for 84 Page Book— "The Ozarka Plan"



This book is entirely too expensive to be sent out on postal card requests. It will be sent FREE to any man who mails the coupon below and who is really anxious to improve his condition. Tell us about yourself—ask for Ozarka Plan No. 100 and don't fail to give the name of your county.

# OZARKA

122 Austin Avenue K  
 Chicago, Illinois



Ask the Man Who  
 Wears this Button

# INCORPORATED

122 Austin Avenue K  
 Chicago, Illinois

Gentlemen: Without obligation send book "Ozarka Instruments No. 200" and name of Ozarka representative.

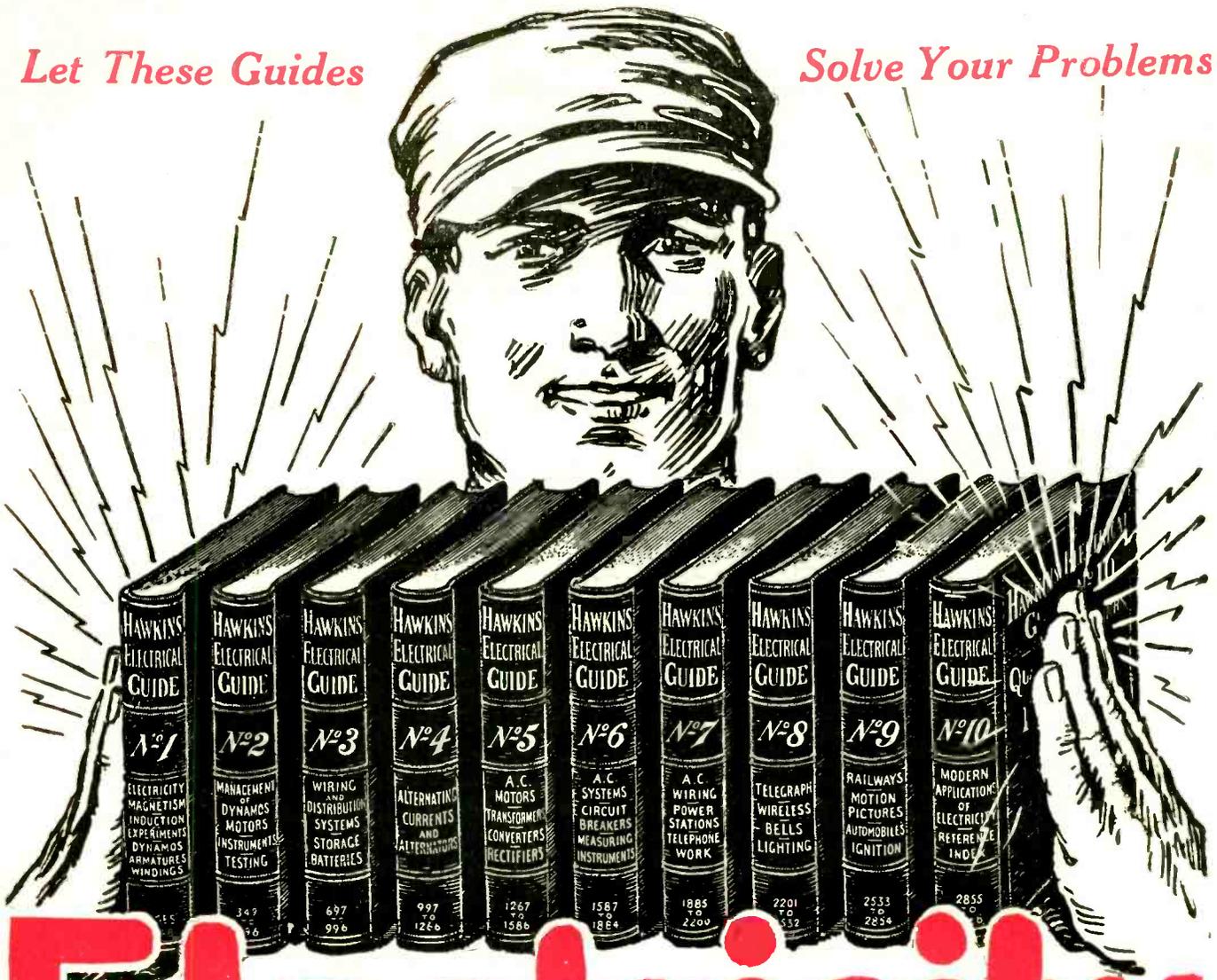
Name.....  
 Address..... City.....  
 County..... State.....

Gentlemen: I am greatly interested in the FREE book "The Ozarka Plan No. 100," whereby I can sell your radio instruments.

Name.....  
 Address..... City.....  
 County..... State.....

Let These Guides

Solve Your Problems



# Electricity at your finger ends

## HAWKINS ELECTRICAL GUIDES IN TEN VOLUMES

3500 PAGES  
4700 PICTURES

\$1 A VOLUME  
\$1 A MONTH

SEND NO MONEY—SEND ONLY THIS COUPON

Know the facts in Electricity. They mean more money and better position for you. Hawkins Guides tell you all you need to know about Electricity. Every important electrical subject covered so you can understand it. Easy to study and apply. A complete, practical working course, in 10 volumes. Books are pocket size; flexible covers. Order a set today to look over.

**LEARN ALL ABOUT**

Magnetism—Induction—Experiments—Dynamoes—Electric Machinery—Motors—Armatures—Armature Windings—Installing of Dynamoes—Electrical Instrument Testing—Practical Management of Dynamoes and Motors—Distribution Systems—Wiring—Wiring Diagrams—Sign Flashers—Storage Batteries—Principles of Alternating Currents and Alternators—Alternating Current Motors—Transformers—Converters—Rectifiers—Alternating Current Systems—Circuit Breakers—Measuring Instruments—Switchboards—Wiring—Power Stations—Installing—Telephone—Telegraph—Wireless—Bells—Lighting—Railways. Also many Modern Practical Applications of Electricity and Ready Reference Index of the ten numbers.

**SHIPPED FREE**

Not a cent to pay until you see the books. No obligation to buy unless you are satisfied. Send Coupon now—today—and get this great help library and see if it is not worth \$100 to you—you pay \$1.00 a month for ten months or return it.

**THEO. AUDEL & CO.**  
65 West 23rd Street, New York City

Please submit me for free examination, HAWKINS ELECTRICAL GUIDE (Price \$1 a number). Ship at once prepaid, the 10 numbers. If satisfactory, I agree to send you \$1 within seven days and to further mail you \$1 each month until paid.

Name .....

Occupation .....

Employed by .....

Home Address .....

Reference .....

S.I., December

**D**ON'T be a low-pay man. Don't be a Job-Hunter. Change quick from Empty Pockets to STUFFED POCKETS. YOU TOO, have a right to enjoy BIG MONEY—there is a fast way to do it. I'll show you a QUICK way—so quick that it is positively amazing—just a few happy, easy weeks. My Auto Book tells this romantic story of QUICK RESULTS. It's FREE to you. Send for it NOW—That Coupon brings it.

**B. W. COOKE**

Directing Engineer  
CHICAGO



I WILL  
TRAIN YOU  
AT HOME

Get a  
**Quick  
RAISE  
in PAY**

Be an **AUTO  
EXPERT**

Earn up to **\$150** a week

You want RAISES IN PAY—Well then, take the QUICKEST way to them. **QUICK RAISES** are what you want. Clip Coupon—Get my free Book. Student after student reports \$100 a month extra, some even over \$200 a month EXTRA, spare time money, long before graduation—right in the early weeks of this famous "JOB-WAY" Auto Training. Did you ever hear of training that can show such quick and big results? Right at your home. I train you for a fine Big-Pay Auto Business of Your Own or the splendid Auto Experts' positions paying up to \$150 a week.

Get Into the **AUTO BUSINESS**

The World's Biggest Business

Think of it—18,000,000 cars on the roads today—5 Thousand Million Dollars spent every year for upkeep alone! Wonderful opportunities to make Big Money and Quick Money in this gigantic Auto Industry. Get B. W. Cooke "Job-Way" Training. Be your own boss—go into business where up to \$10,000 or \$15,000 a year can easily be made! Remember with Cooke "Job-Way" training you don't have to wait. Hundreds of my students start right in collecting and spending Big Extra Money in the very first few weeks of their training! Read what John F. Plow did.

**\$30 a Week More Pay**

—Right in the First Few Weeks of My Training!

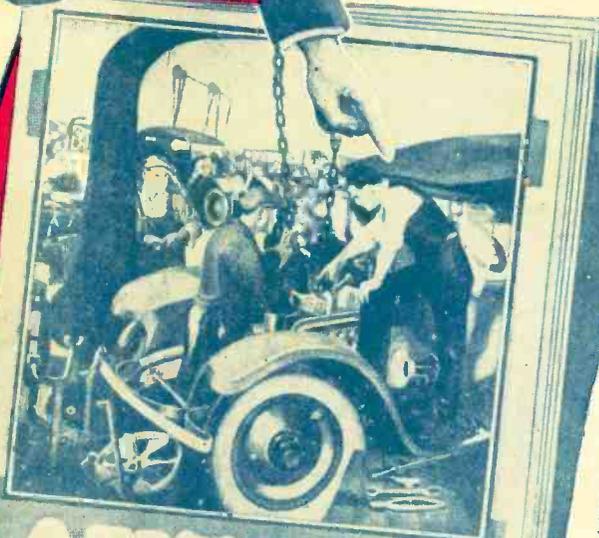
22 year old John F. Plow, Box 370, Ironwood, Mich.—still in the earliest part of his training—writes that he has averaged \$30 a week EXTRA MONEY over his regular pay. But Mr. Plow is only one of hundreds. Think of it—how would you like a fine quick \$30 a week raise! That's the kind of opportunity Cooke "Job-Way" offers you! Mr. Plow says: "I can't get away without thanking you for it. Your course is ONE in a million and I'll back up my statement with anybody."



**\$300 in a Week! Big Pay Jobs Open**

Speaking of Pay Raises—look at this! Joseph Woronecki, 186 Adick St., Hartford, Conn., was making only \$21 a week when he wrote me. Just four months later he wrote that he made \$300 in one week in his own garage! That's an example of how quick my training gets amazing results. Find out what it can do for you. Get my Free Book today!

More trained Auto Men needed today than ever before! See how I back you up with the entire Resources of this Institution—how I give you Consultation Service—Employment Service for your whole life! Not a penny extra charge. See how the demand for B. W. Cooke "Job-Way" trained men grows Bigger and Bigger every year. Send for my Free Auto Book quick!



**AUTO  
FACTS**

**Get the PROOF!**

If you want a quick boost in Pay—if you want to make up to \$150 a week—send for my Free Auto Book right now! You don't need previous Auto Experience to MASTER Automotive.

Work the B. W. Cooke "JOB-WAY" Common schooling all you need. I'll show you how so many men between the ages of 15 and 60—from all walks in life—become Garage Owners, Managers, Superintendents, Foremen, Auto Executives. Get ALL the Facts! Clip Coupon Now!

**4 BIG OUTFITS  
INCLUDED  
FREE  
of extra cost**

Tools, Tool Bag, Test Bench, Radio Receiving Set—all equipment included. Also 283 Wiring Diagram Charts. Write quick.

LEARN THE COOKE  
**AT HOME "JOB-WAY"**

Keep your JOB! STAY HOME! Earn all your present job pays you, PLUS the big extra money which comes to so many of my students so quickly. Get started this quick way to Big Pay as an Auto Expert through Cooke "JOB-WAY"—RIGHT IN YOUR OWN HOME. Being a practical Directing Engineer, Owner, and Head of this Institution I know what practical, money-making training you need to be a Big Pay Man—and what training you need to bring you QUICK BIG MONEY—that training I give you!

The Only "JOB-WAY" Training on Earth

My training includes all Electrical Work—Ignition, Starting, Lighting—All Mechanical End—Welding, Brazing, Vulcanizing—also Business Course, Salesmanship, Advertising, Buying, How to Keep Simple Books—also Automotive Magazine, also 4 Outfits. Nowhere else I know of can you get ALL this training. Find out how B. W. Cooke "Job-Way" fits you for Big Pay and Quick Raises. Learn what it has done for others. See what it can do for you. MAIL COUPON RIGHT NOW!

**B. W. COOKE** Directing Engineer  
CHICAGO MOTOR TRAINING CORPORATION  
1916-1926 Sunnyside Ave. Dept. 984 Chicago, Ill.

**MAIL THIS QUICK!**  
**FREE AUTO BOOK**  
**B. W. COOKE,**  
Directing Engineer

Send me your Free Book "AUTO FACTS" and PROOF that you'll show me the way to a QUICK RAISE and BIG PAY as an Auto Expert, also send your 4 Outfits offer. It is understood that this obligates me in no way, and that no salesman will call on me.

Name  
Address