AUGUST

25 CENTS

Science and Invention

ARTHUR H. LYNCH
Editorial Director

$2,000,000 SHAM BATTLE

DIESEL ENGINES FOR AIRCRAFT

MAKE A CONTRACT TO BECOME WEALTHY *Says* John J. Raskob

THIS ISSUE Contains These UP-TO-THE-MINUTE Articles by WELL-KNOWN Authors

NEXT MONTH

Crack-Ups!

Some of the most interesting photographs of actual airplane crack-ups that you have ever seen. That pilots would take such chances seems almost incredible.

Perspective Movies

We have predicted colored talking movies in perspective for years—at last they have been actually exhibited and a complete description will appear in the next issue.

Flying Animals

There are a number of animals that fly, and Dr. Ernest Bade presents a very interesting illustrated description of them in the next issue.

Noah's Ark—A la Movie

Mr. Edwin Schallert, well-known motion picture writer, tells the story, accompanied by exceptional pictures, of Noah's Ark as actually reconstructed for the movies.

What of Your Spare Time?

Dr. Edward C. Worden, famous industrial chemist, has a most interesting hobby, and just what it is will be revealed by Alfred M. Caddell.

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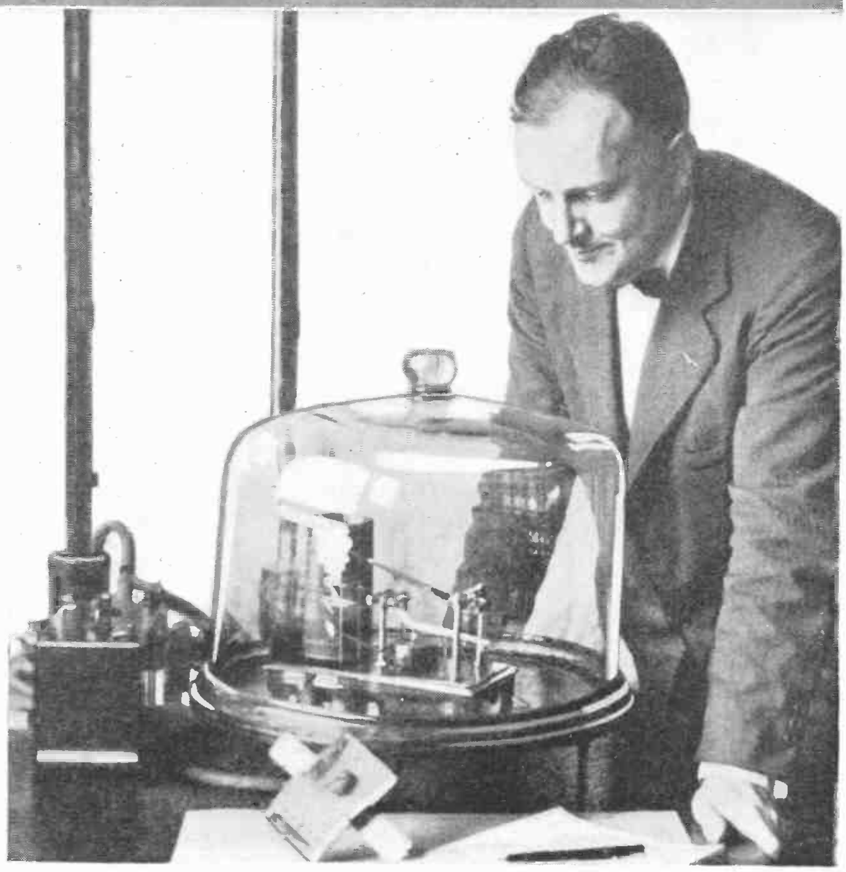
Lt. Apollo Soucek, U. S. N., Twice a Hero

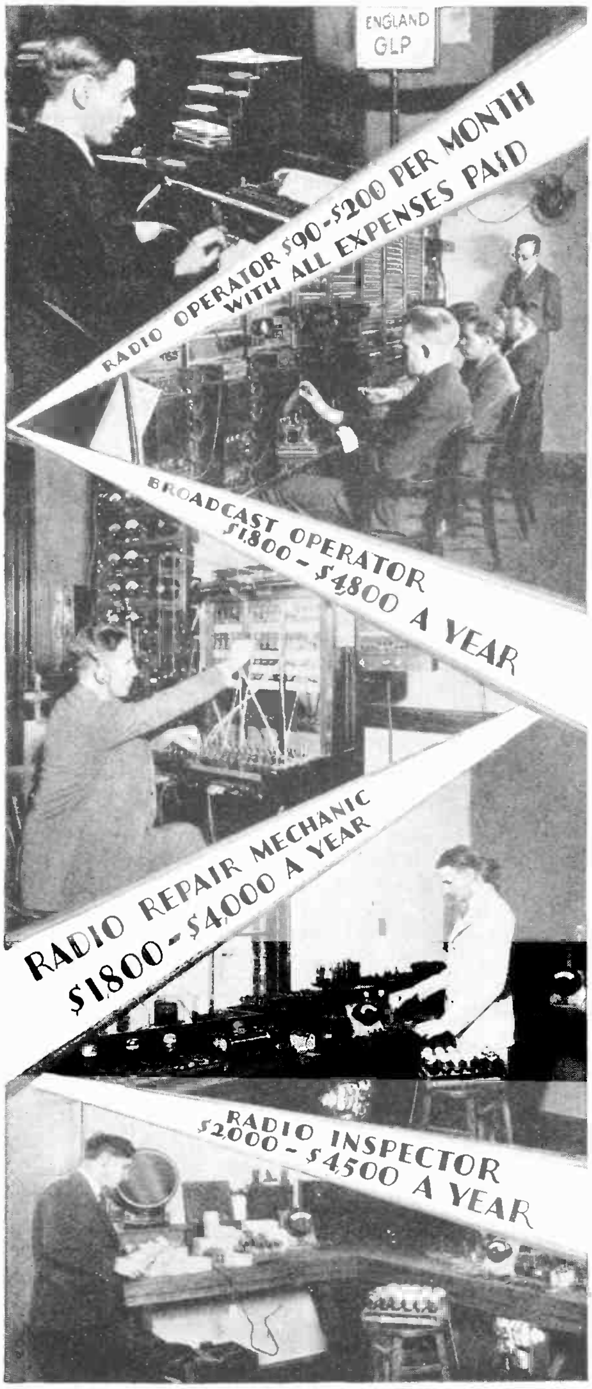
ON May 8 of this year, Lieutenant Apollo Soucek of the United States Navy established a new altitude record for airplanes when he reached a height of 39,140 feet. His record was soon broken, however, for on May 26, Willi Neunhofen, Junkers (German) flier, soared to a height of 41,795 feet, breaking the world's airplane altitude record. So great was the change in the temperature that it was 80 degrees F., in the shade, when he took off, and 76 degrees below zero F., when the highest point in the flight was reached.

Due to the rarefied nature of the air at these great heights, it is imperative that the flier use oxygen. The small insert photo at top shows Lt. Soucek equipped with apparatus for breathing this gas which is added to the air drawn in from the outside. The German flier's plane was provided with an automatic release, which liberated the oxygen when his hands were taken from the steering wheel.

Spurred on by the flight of Neunhofen, Lt. Soucek set a new world altitude record for seaplanes on June 4, when he climbed to a height of 38,560 feet, according to the barograph. The temperature changes on this flight ranged from 65 degrees above zero F. to 70 degrees below zero F. Before the recorded height could be determined accurately, the barograph of the plane had to be checked. The photograph at the right shows how barograph is calibrated at the U. S. Bureau of Standards.



Pick the RADIO Job you want ... and fill it



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Science and Invention

AUGUST, 1929
NUMBER 4

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

Entertainment

MORE money is spent on entertainment than on any one other commodity. Such a statement might, at first sight, be questioned. For instance: we might consider the expense involved in the purchase of food, automobiles, clothing or any of a hundred things, and the report of the amount spent for them in a year might make the amusement and entertainment figure look rather small. But, in the final analysis, is it not true that much of the money spent for most of these commodities might well be put under the heading of entertainment? And under the heading of entertainment we may look for many of the latest entertainment features from the scientists and the inventors.

To consider many fields of endeavor would, perhaps, be interesting, but it is doubtful if a single example of greater breadth could be found than is represented in the applied science and invention found in the present and the immediate future of the talking motion picture.

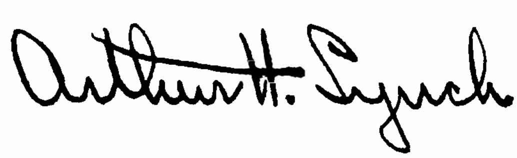
The talking motion picture of today is a fact. It has been accepted by the public in a manner which a year ago would not have been predicted by the most optimistic "talkie" enthusiast. The talking motion picture industry now represents millions of dollars of invested capital, and to those who had the foresight to get into it early, it has given a great profit—a profit, by the way, which may well be cumulative.

It is the realization of fundamental truths which has enabled many folks to amass large fortunes. Where is this more apparent than in the huge mergers in the radio, talking machine and motion picture fields? To those investors who have realized the possibilities of such entertainment—provided, of course, they were wise enough to pick the companies with firm foundations—has come a great return. Nor is the day for investment in entertainment passed. There still remains a tremendous opportunity.

To outline the possibilities in various fields of entertainment would, of course, be outside the limitations of the space we could devote to the subject here. Let us consider the movies alone. Today they are infinitely better than they were a few years ago. By the application of sound and speech they have attracted a new audience. Now two other results of science and invention are to be added. These will bring even greater audiences. Color, natural color, will to a very great extent render the movies more realistic, and then what has apparently been an insoluble problem up to the present time is about to be solved. The movies are to be put on the screen for us in three-dimensional form. In other words, there is to be depth of view. A picture of a bridge or a smoke stack three miles behind the people in the foreground will, when we see it reproduced on the screen, appear to be three miles from the actors. It is stereoscopic effect that is to be realized.

Radio and acoustic engineers have greatly improved the reproduction and the recording of speech and music; photographers have contributed greatly to the illusion; chemists have given us the benefit of their brains and made it possible for the photographers to secure the beautiful effects they do, and now by a combination of all these and many other sciences we are going to have colored, three-dimensional talking motion pictures for our entertainment.

We salute the scientific geniuses who have thus contributed to our welfare and to the financiers who have had the courage to back the costly laboratory work from which this wonderful achievement is about to emerge.



Editorial Director.

If a GIANT METEOR Hit a MODERN CITY!

By Professor
Wm. J. Luyten
OF HARVARD COLLEGE
OBSERVATORY

Such a modern city as New York may some day be knocked flat as a pancake in a few seconds by a meteoric shower, such as that which visited Siberia on June 30, 1908, says Prof. Charles P. Olivier, Director of the Observatory, University of Penn.

OUT in the wilds of Southwest Africa a new meteorite has been discovered, one of these mysterious messengers in the cosmos, that come to us, bearing evidence that space is not altogether empty, but populated with a vast multitude of small fragments. The new addition to our captive part of this stray population of the cosmos lies on "Hoba Wes," the farm owned by a Mr. J. H. Oosthuizen, near Grootfontein, the end of the narrow gauge railroad in Southwest Africa.

The first I heard of the new find was through a telephone call from the editor of the Bloemfontein newspaper, who had received a photograph from one of his readers, which photograph was supposed to be of a giant meteor. It undoubtedly was, the metallic structure of the "rock" could be seen even on the small snapshot taken with a No. 2 Brownie, and an investigation was decided on immediately. A cable to the New York *Times* brought authorization within twenty-four hours, and everything was ready. Everything except the trains, for these run only once a week, and I had just missed one.

However, I boarded the next "South West Limited," an express train that runs the distance of 1,550 miles to Grootfontein in the unbelievably short time of four days and four nights. An average speed of some 17 miles per hour, but then, one must remember, we are in Africa!

When I got to Grootfontein, I immediately drove out to where the meteorite lies, twelve miles due west, near the siding of Otjihaenene. As it lies there, unassuming, in its silent tomb of limestone, there is nothing dramatic in its appearance: a solitary block of metal, great and massive, lying in the desolate wilderness of the "veld." But if we only try to visualize the conditions under which it arrived we find it gave a spectacle surpassed by few in dramatic appeal.

"A black mass of iron, cruising through empty space invisible to all. Suddenly it enters the atmosphere of the earth; its great speed and the resultant friction heat it to incandescence in some seconds or less. Transformed into a gigantic fireball, white hot, it darts across the sky with lightning rapidity, and approaches the ground with an angry hiss. A terrific roar as it strikes the ground, a shower of sparks sand, rock, and metal, a cloud of dust, and soon all is quiet again. With its nose buried deep in the soft rocks, the meteor will soon be covered up entirely by the surrounding limestone, and its tomb will be sealed against the curious eyes of posterity. Thus it will lie in state in its grave, unwatched in its descent except perhaps by some awestricken primitive man who might well have believed that the prophet Elijah had returned to earth. After centuries of erosion have removed most of the protecting top layers, perchance some prospector may notice a small, black, metallic looking rock, and having become suspicious of this strange individual, begins to dig it out."

In this manner the meteor was actually brought to light, and a deep pit was excavated around it to show the full extent of its great bulk. By a fortunate coincidence the meteor seems to have landed in such a way that its thickest side encountered only soft limestone, while the thinnest side struck hard rock, thus leaving the upper surface almost horizontal. The whole of its present conformation is nothing less than remarkable: there is an almost flat, nearly level surface, practically square, nine by ten feet in size, and with almost vertical sides, about four to five feet deep on the northeastern side, and up to three feet on the southwestern side. Its position is so regular that it would be hard to improve upon it had it been designed for show purposes in a museum.

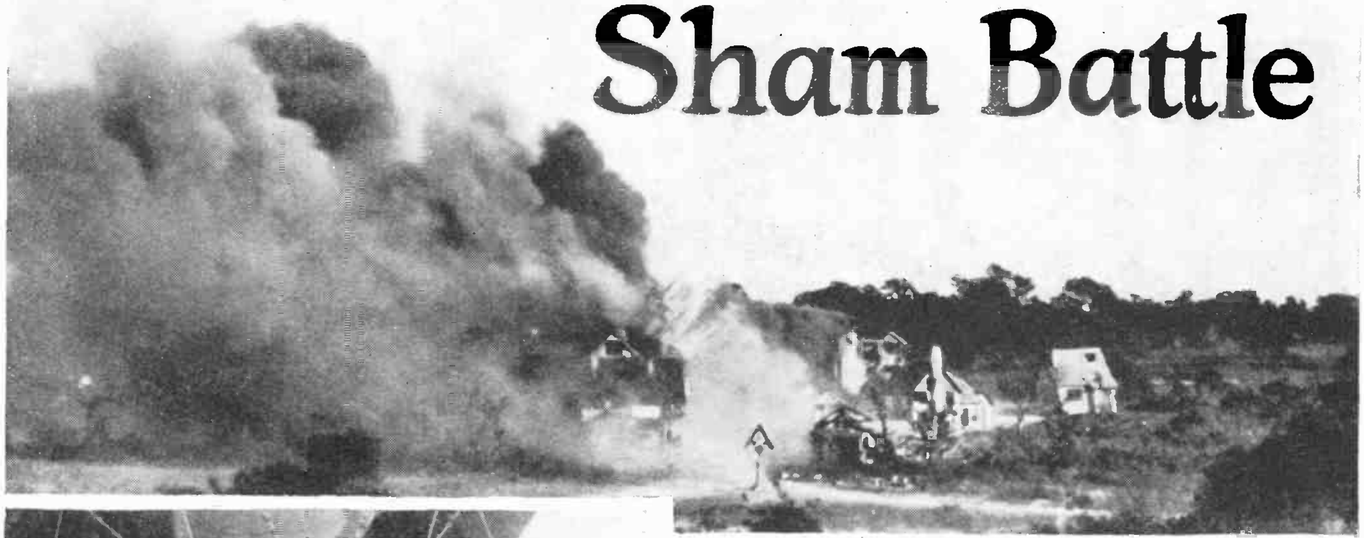
Though the first impression as it is seen there in the wide space of the veld, and in the pit dug around it, is not too overwhelming, this changes when one comes closer. Imagine such a huge block of solid metal, ten by nine by four feet, about as large as a room in a small city apartment. One may well be thankful that one wasn't too close when it fell. Still, I think, I should like to have watched it fall from a safe distance, a mile or so. Owing to the impossibility of finding out how much of the meteor is buried in the limestone it is difficult to make a good guess about its weight. From the outside measurements it is estimated, however, that it must weigh at least fifty tons. Fifty tons, one hundred thousand pounds of solid iron, truly a rock of ages!

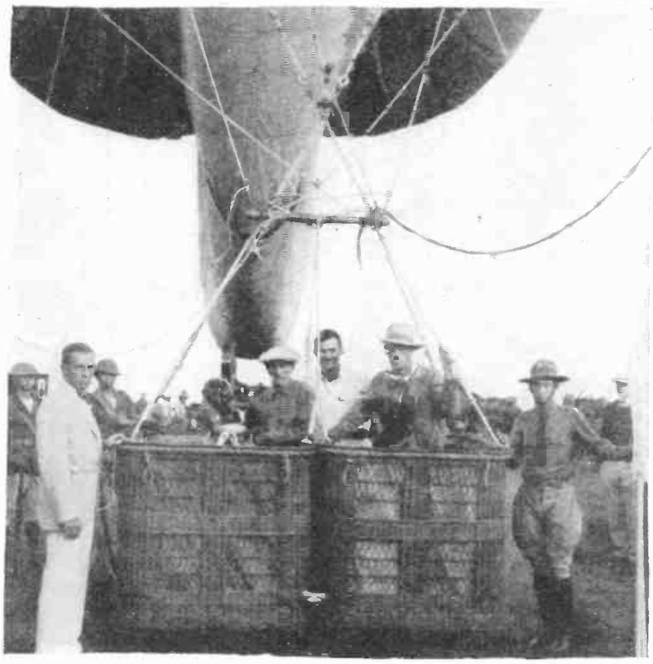
The upper surface is smooth, and but slightly rusty, the only remaining evidence of the tremendous heat to which the meteorite has been subjected. A few shallow, circular holes, so typical of all meteorites, where the softer parts have been melted away, complete the description of the natural surface. Actually the upper surface is marred by several blue, slag-like places, scars left by the vandals, who operated on it with an oxy-acetylene flame, in order to obtain a few pieces for chemical analysis. In a few other spots one notices the shining silvery surface left by a hacksaw, marks from which one can judge the painfully slow process that accompanies such an inadequate tool when used on the tough body of a meteorite.

For tough it is, tougher than any but the very best steel we can manufacture, comparable only to the steel used in locomotive wheels. One can just (*Continued on page 365*)

OUR artist has graphically shown the effect of a shower of giant meteorites hitting the buildings of a modern city such as New York or Chicago. The photograph at the left, taken by Prof. Luyten, shows the Grootfontein meteorite, which he recently examined in South Africa; this is thought to be the largest meteorite known and measures about 9'×10'×4', weighing 50 tons, or 100,000 pounds. Meteorites may have a velocity of from 25 to 70 miles per second. Prof. Luyten thus describes a meteorite—"A black mass of iron, cruising through empty space, invisible to all. Suddenly it enters the atmosphere of the earth; its great speed and the resultant friction set it ablaze in a fraction of a second. Transformed into a gigantic fire ball, white hot, it darts across the sky with lightning rapidity, and approaches the ground with an angry hiss."

$2,000,000 Sham Battle





By
Captain E. P. Ketchum,
Corps of Engineers, U. S. Army,
WHO ENGINEERED THIS PROJECT

"Wings"—War Movie—Cost $182.00 Per Second to Produce. In One Battle 5,000 Soldiers, 1,100 Mexicans, 50 Airplanes, 20 Tanks and 100 Tons of Dynamite Were Used

A TOUR of duty at Fort Sam Houston from the military standpoint is always interesting, but when in addition to the normal life of the Second Division one is detailed as sort of a consulting engineer for a moving picture, it becomes particularly interesting and perhaps justifies recording in some fashion.

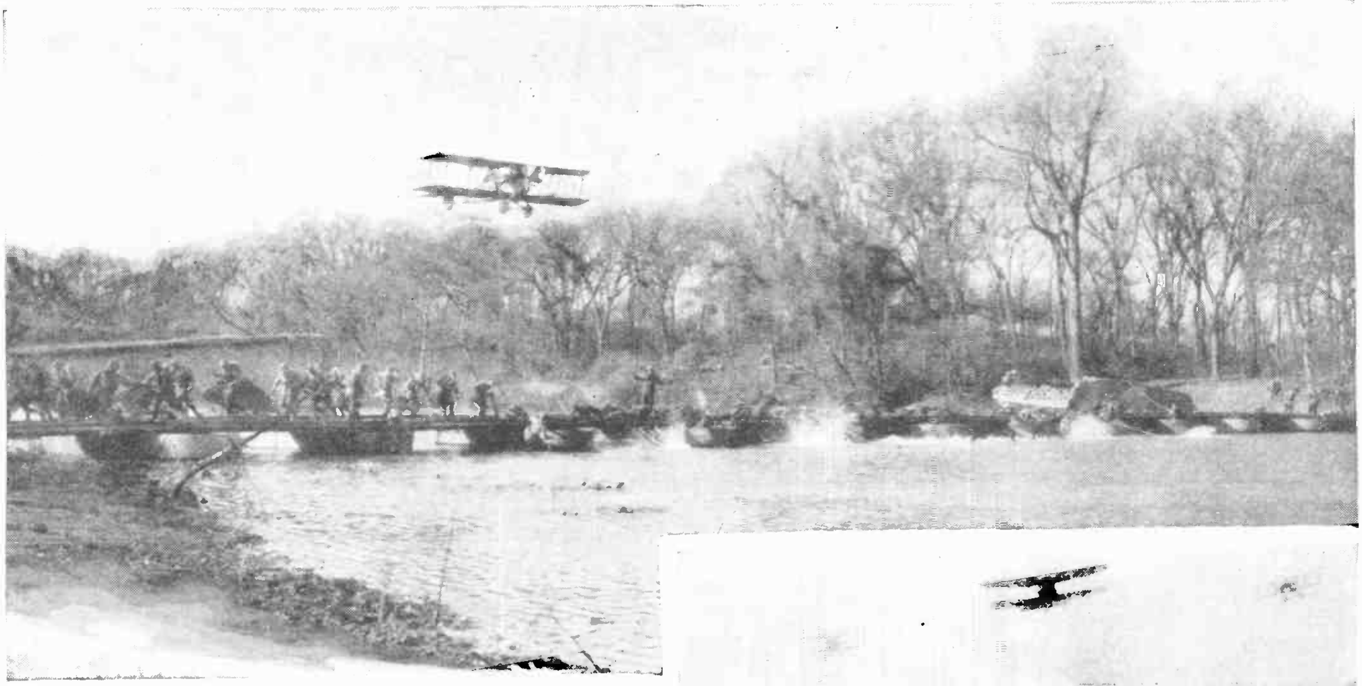
The above photograph shows the baskets attached to the blimp from which aerial scenes were photographed. The author of this article may be seen at the right-hand side of the picture holding the flags.

The author had only recently joined the 2nd Engineers at Fort Sam Houston when he was detailed to Camp Stanley to insure the military correctness of some fortifications that a movie company was to build there. Having just completed a three-year detail at Wilson Dam or Muscle Shoals where the engineering work was of a very high order, the movie engineering to follow proved to be not of such a high order, but certainly as interesting.

A conference with the representatives of the Paramount people was held at Division Headquarters. The theme and sequence of the picture was gone over. Much stress was placed upon photographing the battle scenes from the air. This latter plan meant to me and all concerned that less "faking" could be resorted to because a camera from the air always reveals (as we learn in camouflage) footpaths, etc.

At the right is a photograph of one of the scenes in the screen production "Wings." Fifty airplanes and 20 tanks were used in this stupendous movie "sham battle."

Before proceeding further it should here be inserted that "Wings" originally was to be purely an air picture and it was only at the insistence of the division commander



that the ground *battle scenes* were inserted. How well and wisely they were added is attested to by the length or footage allowed these scenes in the completed picture.

The picture people having always in mind photographing the battle scenes from the air desired a very extensive battlefield and at first and until a rough estimate of labor and material was furnished them they were speaking in terms of miles! As finally constructed the battlefield was perhaps the largest ever constructed in peace times for any purpose. Full depth trenches were executed for the American front; support and battalion reserve lines with communication trenches, dugouts, etc., for a width of 200 yards with an additional 100 yards on each flank that tapered from the full depth trench up to the virgin soil. The same lines were constructed for the German position. The German front line was in ordinary earth, but the remainder of the position was on a rocky hill! Air compressors and drills were used in the German position!

The author in laying out the trench design with tracing tape, used no standard "trace" (such as the traverse, wavy, zig-zag, etc.), but some of all known traces, with the hope that the completed system would resemble the *actual front* and not a *training camp* layout.

Men Divided in Groups

THE Army had intended my work to be that of a consultant for correct military engineering detail only, but here was quite an engineering problem, and after watching the futile efforts of the picture staff to handle the labor, material, etc., necessary for this construction, I volunteered to organize and direct the work. At the peak of construction there were eleven hundred Mexican laborers employed on the battlefield and most of these were employed on trench construction. These eleven hundred laborers were placed in gangs of about fifty men, each under a foreman. These foremen were nearly all ex or retired soldiers. These gangs were then grouped under general foremen for the following work:

Trench construction; trench accessories (dugouts, revetment, etc.); demolition; wire entanglements.

The general foremen were all army sergeants, and too much credit cannot be given them for their efficient work.

It is one thing to lay out and construct an entrenched position for training and another and more difficult task to lay out and construct one that, when photographed, would resemble the western front. This latter task required the following:

Numerous and varied shell holes; the demolition and burning of trees and foliage; the aging of the trenches; the aging of the wire entanglements; the "dressing" of the battlefield. (*Continued on page 376*)

At top is one of the "battle scenes" in the picture. The pontoons for the bridges are of real German design, having been brought from the other side for use in the photoplay. Center is another "shot" taken on the battlefield, and at the bottom of the page is a scene in one of the "French villages," built for the filming of the picture.

MAKE A Contract TO Become WEALTHY

—*Says John J. Raskob*

Can the Average Person Ever Hope to Build Up a Sizable Fortune? "Yes"—Says John J. Raskob, One of the World's Outstanding Financiers

By Alfred M. Caddell
Financial Editor

YOU have of course heard of the time-payment plan for purchasing automobiles, pianos, radio sets, refrigerators and sewing machines. Now comes a financier who aims to sell wealth to the average individual by allowing him to purchase it on the partial payment plan. John J. Raskob, who was the guiding hand in making General Motors Corporation what it is today—he was Chairman of the Finance Board—is the man behind the plan to enable anyone who desires to buy financial independence on the installment plan to engage in that constructive effort.

An enormous proportion of our total business, embracing the purchase of everything from a suit of clothes to a home, has been built up on personal credit and confidence in the future. Never before in our industrial history have we witnessed a business expansion equal to that of the last few years. American prosperity has been tuned to the key of optimism that has reflected prosperity in business, prosperity in the home and a general surge forward nationally.

"The time-payment plan is largely responsible for our remarkable national progress," said Mr. Raskob the other day when reviewing his proposal to enable the man of small means to make profitable investments.

For years economists have struggled with the big question as to whether or not buying anything on the installment plan is good for people and business generally. The principle of mortgaging one's future has been roundly condemned by some and warmly defended by others. One school of thought says that it leads to excesses of extravagance that sometimes prove very costly. Other students of the situation say that mortgaging one's future generates a feeling of responsibility that is good for the individual, causing him to plan or budget his income more or less scientifically. But both parties to this debate agree most thoroughly that the easy-payment plan is the line of least resistance, that both buyers and sellers can get together more quickly under its influence. And buying and selling constitutes the life of trade.

"I believe in intelligent debt," said Mr. Raskob. "Utilizing one's personal credit and setting up a goal to be reached by striving to attain it is the finest character and wealth-builder that I know of.

"We found in the automobile industry that, given an incentive for which to lay aside part of its income and an opportunity to obtain credit, the public not only adopted the idea, but those who extended the credit found it a safe and profitable business.

"The incentive to save in this connection is the desire to own a motor car. Under my financial plan, the incentive would be the desire to build up a competence or an estate. Fortunes in this country, large and small, have been built up largely through investment in sound equities based upon the growing prosperity of the United States. Excepting the facilities extended by some of our corporations like the American Telephone and Telegraph Company, the United States Steel corporation, the General Electric and others, which enable their employees to purchase their securities on the weekly payment plan, there has existed no facilities to enable the average man or woman to acquire equities in sound securities on the partial-payment plan. These facilities are what I have uppermost in mind.

"The plan to which a lot of thought has been given contemplates formation of two companies. One of these, probably to be called the Equity Securities Company, would sell its stock to the public and invest the money thus derived in well-seasoned common stocks for permanent investment. Naturally, it would be desirable to have some form of public supervision, similar to that exercised over banks and insurance companies, to prevent the possibility of unscrupulous exploitation of the idea by fraudulent imitators.

"It would of course be desirable to have the stock of this proposed company listed on the New York Stock Exchange so that any holder of stock could liquidate his investment at any time that he may desire. Moreover, the rules of the Stock Exchange require companies whose stock is listed with them to meet certain requirements designed to protect the investing public, including among other things a detailed statement of assets to be published periodically.

"The Equity Securities Company should not be permitted to borrow money and its only liability would be its capital stock. It should not invest more than a limited percentage of its assets in any one company or industry, nor should it purchase more than, say, a 10% interest in any one company, as it should not be in a position to assume the responsibility of management of any company in which it became a stockholder.

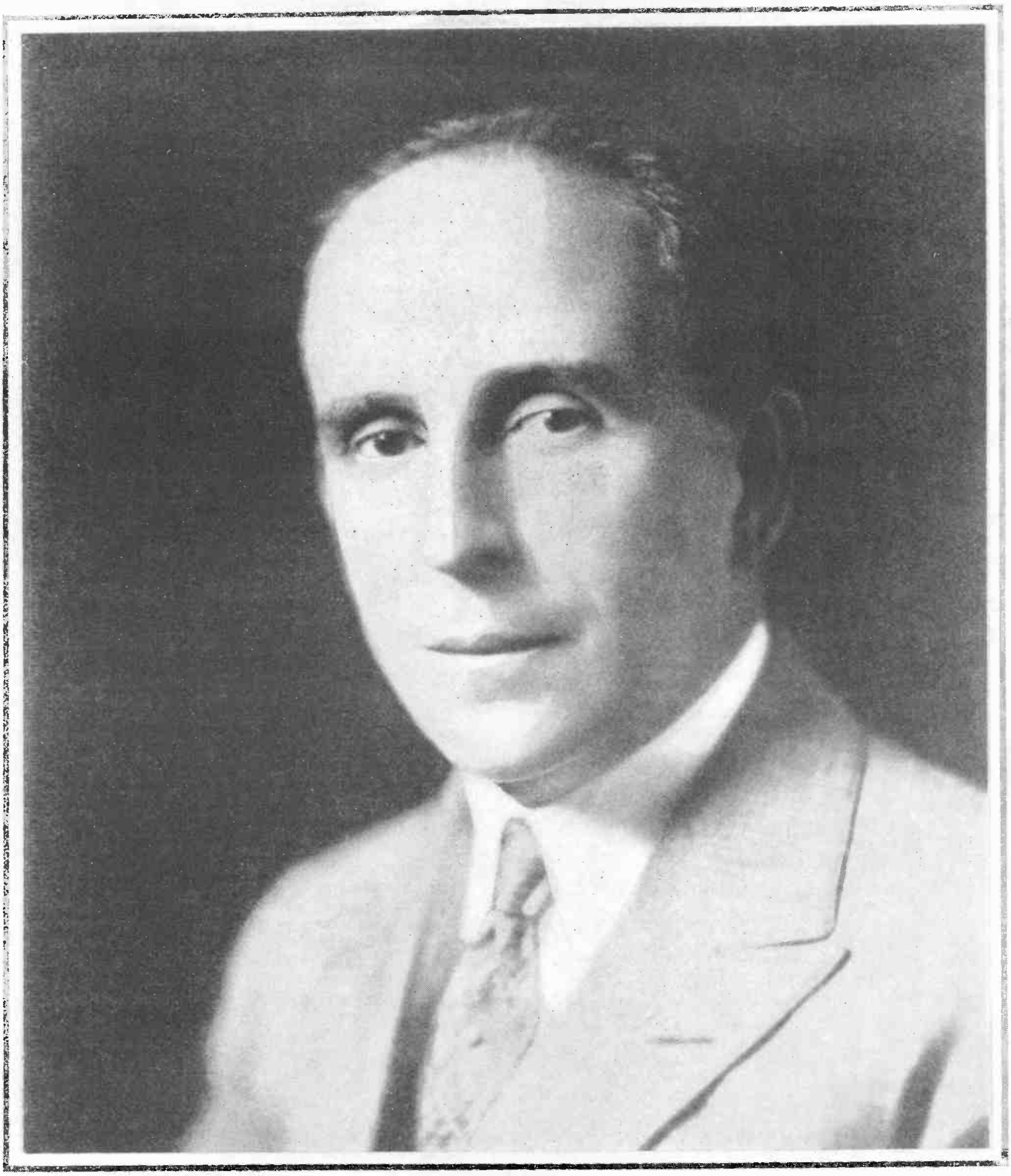
"The other company to which I refer should make credit available to people of small means; that is, it would be similar to the finance companies which have been formed to grant installment credit to purchasers of motor cars. It would grant loans payable in installments over a period of twelve months against collateral consisting of stock of the Equity Securities Company, making a finance charge for its services similar to that of the automobile finance companies.

"For instance, the worker who has saved up $200 could purchase, say, $500 worth of stock in the Equity Securities Company, paying $200 cash for and depositing the stock with the credit bank as collateral on a loan of $300, which would be payable in monthly installments of $25. To meet the installments, he would lay aside from his income an average of about $6 a week. His entire indebtedness would thus be liquidated in one year, and in the meantime he would share in any increase in the value of the stock of the Equity Securities Company.

"In brief, the plan enables people of small means to share in the country's growing prosperity and wealth through investment in equities and encourages savings under a systematic plan by those who wish to employ credit for investment."

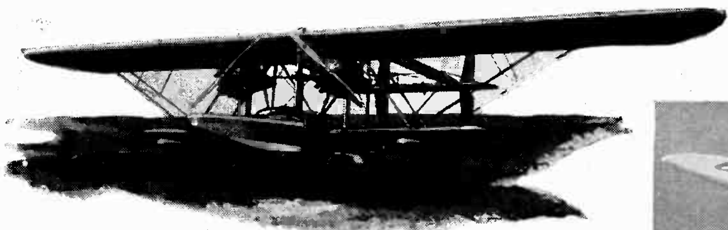
The reader may probably assume that Mr. Raskob is optimistic regarding the country's prosperity. He is; decidedly so. And he has good reason to be. He can point to any number of industrial enterprises, the ownership of a small share of which have made people, if not wealthy, at least comfortably well off.

Let us take General Motors, for instance, the corporation with which Mr. Raskob up until (*Continued on page* 366)

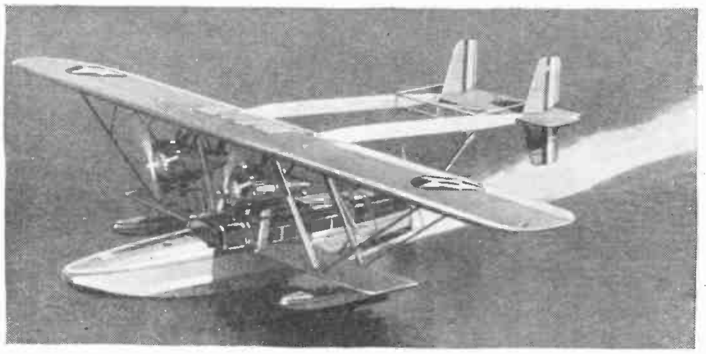


John J. Raskob

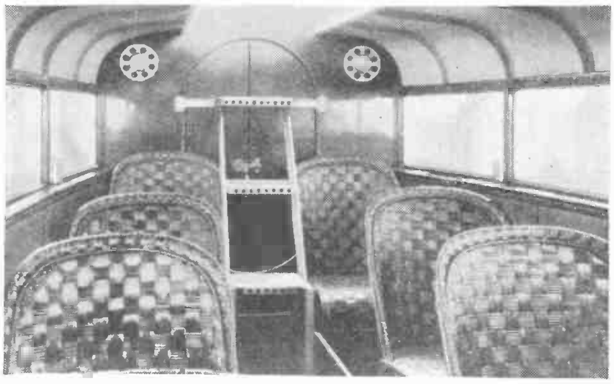
MR. RASKOB is conceded to be one of the most practical and far-sighted financial men of the day. He inaugurated the financial policies of General Motors which led to the tremendous sales and earnings of that corporation. He is a staunch advocate of ownership of dividend-bearing securities by people of small means. More particularly, Mr. Raskob has great faith in American business and believes that through the medium of public ownership of the industries that serve them a more intelligent and satisfied Democracy, and hence a greater economic stability, will prevail. To that end he proposes building a vast public ownership of securities by means of the time-proven credit facilities plan. The working out of Mr. Raskob's plan will be awaited by financiers and by the public with great interest.—FINANCIAL EDITOR.



Left: The Sikorsky amphibian as it appears on land. Below: The same ship in the water. It is this type which is used by Curtiss Aircraft, Inc., in its New York-Atlantic City Service.



Below: An interior view of the cabin of the eight-passenger Sikorsky, showing the arrangement of the seats. The removable stairway in the back is used for entering and leaving the plane.



NOW *We Gather* News by Airplane

By Joseph H. Kraus

Largest Auditorium Story "Covered" by Airplane (See page 304)

IT was on the edge of one of those critical times of the month known in newspaper parlance as the dead line; namely, the time when all material must be ready to go to press. There were not so very many more hours to go, and just at this time the managing editor handed me a "lead" to the effect that the world's largest convention hall was to be opened at Atlantic City the next day. The air route distance between New York City and Atlantic City is 109 miles. The railroad time is about three hours, while the plane does it in about one hour.

Our Editorial Director, Arthur Lynch, was approached with the "lead" and in his inimitable style said, "I think that's a good racket; let's get busy on it."

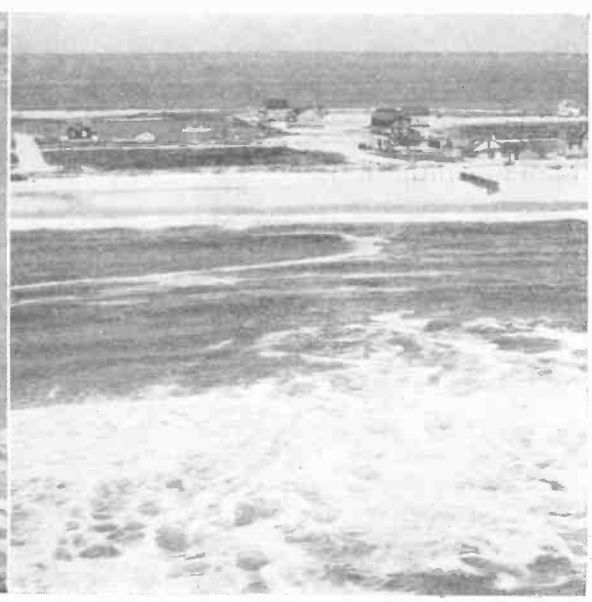
We immediately called up the Curtiss Flying Service and were informed that there were planes leaving daily for Atlantic City and return. We announced our desire to go there and were told to be at the Hotel Biltmore, at Forty-third Street and Madison Avenue, at 10:30 A. M. This was on Wednesday, May 20th, and the Convention Hall was to be officially opened on Thursday.

The Start of an "Aerial" News Chase

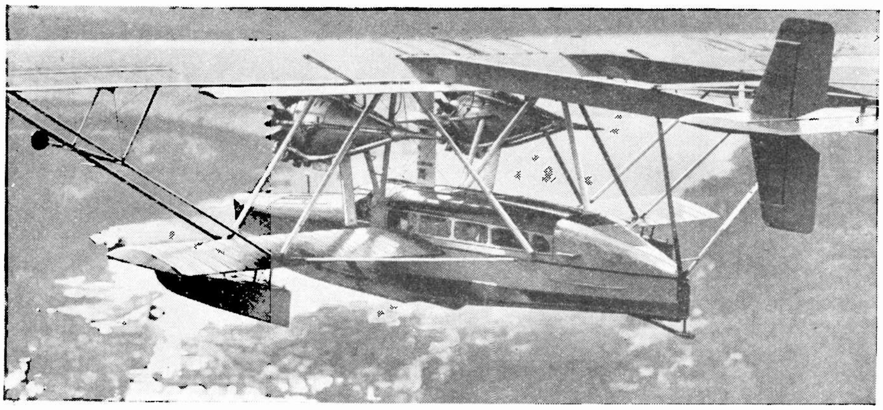
ARRIVING at the Hotel Biltmore at 10:25, the writer found that he was being *paged*. Calling at the desk, Mr. Kuhn presented the writer with a ticket, through the courtesy of Charles J. Goodwellow, General Manager of the New York office of Curtiss Flying Service. The writer was then introduced to William M. North, of the Curtiss Flying Service; D. H. Reed, engineer in the construction department of Curtiss Aircraft, Inc., and Dr. David Ulner, a physician, who was en route to Atlantic City to attend the Tuberculosis Conference being held there at noon that day.

The four of us then walked out of the hotel and entered a waiting limousine. The ride was a short one, only down to Forty-second Street and the East River. At this point we got out of the car and stepped into a Dodge *water car* (although at the time you read this article these fast open speed boats will have been replaced with equally fast cabin cruisers). In a few seconds the boat was under way. It sped up the East River, under Hell Gate Bridge and around into

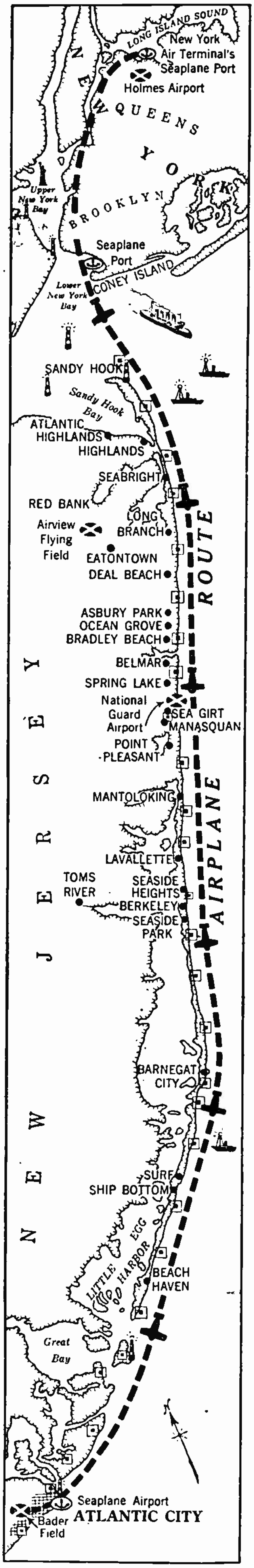
The "Hell Gate Arch" as it looks from the air.



An interesting view of the surf.

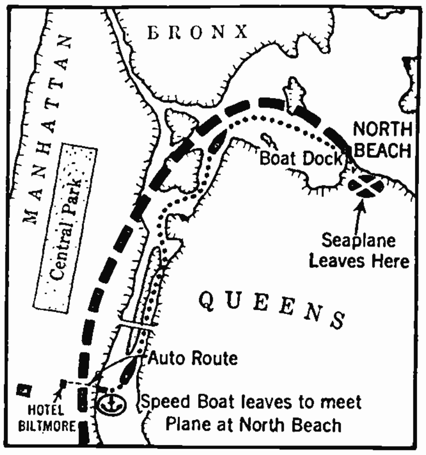


Left: The Sikorsky in the air. Right: The route taken by the planes along the shore in their regular daily trips from New York to Atlantic City and return.



Flushing Bay, winding up at North Beach within fifteen minutes after we left Forty-second Street, a ride which in traffic would take an hour.

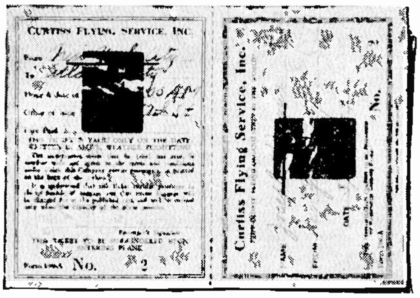
Here the plane, an eight-passenger orange-and-black Sikorsky, powered by two Pratt-Whitney Wasp engines, was seen on the landing. As we approached it, two mechanics stepped up on the wings and started to turn over the impulse engine starters. The mechanic was at the throttle. In another moment the motors were humming. Meanwhile the passengers' baggage was being weighed on the platform, on a scale provided for the purpose. Everything was being operated with a methodical precision. We had just time enough to take one or two photographs of the plane when the signal was given, "All aboard, Atlantic City." Climbing up a few steps, we entered the plane through the roof of the cabin and seated ourselves in the comfortable cane chairs. The pilot climbed into his place in the cockpit and gradually the boat slid down the board platform and settled itself in the water of the bay. The mechanic was now observed to be pushing a lever back and forth. "What's he doing?" one of us asked. "He's raising the wheels," was the information that was volunteered. Meanwhile the amphibian (land-and-water plane) was taxiing out into the water of the bay, so as to head into the wind before taking off. We found, much to our surprise, that we could carry on a conversation admirably well. The noise of the engines interfered but slightly.



Above: This diagram indicates how an auto takes one to pier at Forty-second Street, where a motor-boat delivers passengers to Seaplane Port at North Beach.

We're Off

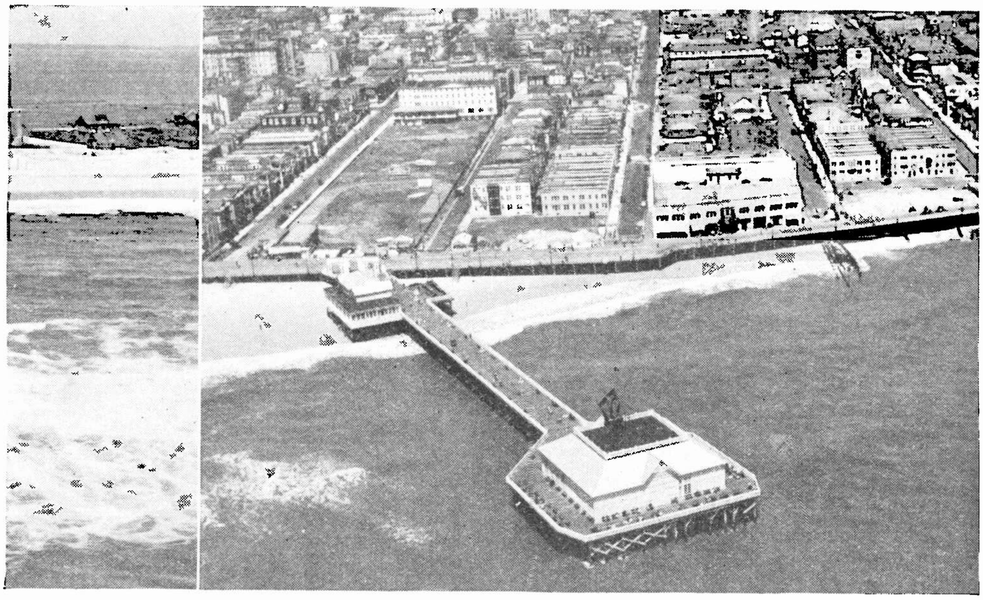
THE motors speeded up, and a moment later the giant ship left the water, and were it not for the fact that we were paying (*Continued on page* 380)


CURTISS FLYING SERVICE, INC.

No. 2

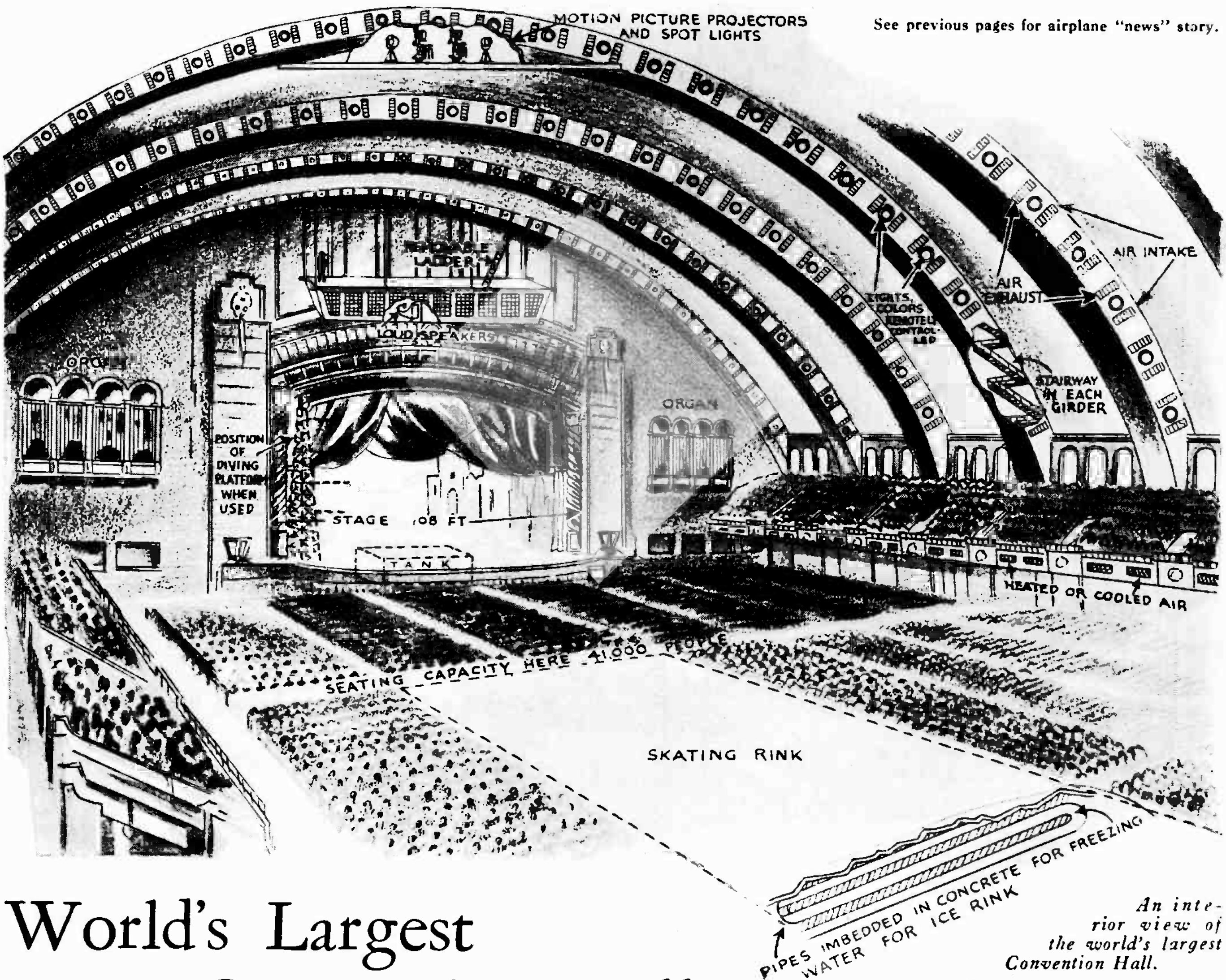
Curtiss Flying Service, Inc.

This ticket was good for a trip from New York to Atlantic City and return.



The Heinz Pier at Atlantic City "as we saw it from the air."

See previous pages for airplane "news" story.

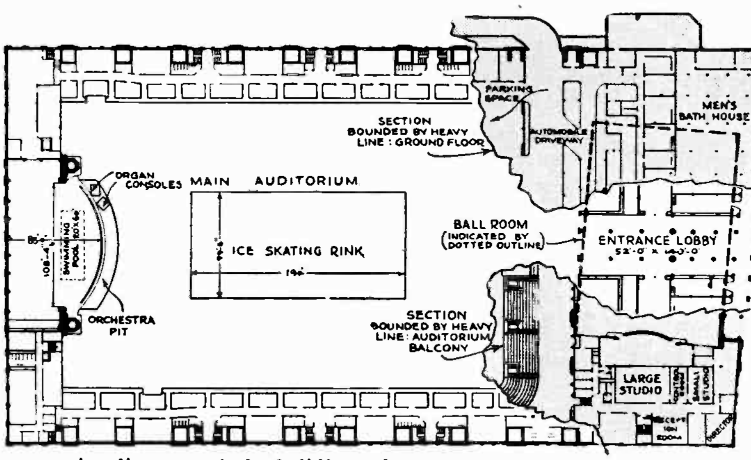


An interior view of the world's largest Convention Hall.

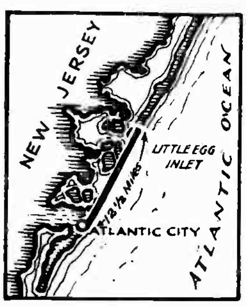
World's Largest Convention Hall

Story "Covered" by Airplane

FRONTING the board walk at Atlantic City there is a new Convention Hall, built by the city at a cost of $10,000,000 and operated by the Municipal Government. This hall is 350 feet wide and 650 feet deep. The main auditorium alone seats 40,000 people, and the entire building can



A composite diagram of the building, showing parking space under the building, main auditorium, ballroom, and the radio transmitting studio found in the Atlantic City Convention Hall.



Allowing but one foot per person, the 66,000 people that can be seated in the building would form a single line 12½ miles long.

seat 66,000 and still leave standing room. In addition to the main auditorium, where the seats are removable and where the world's largest stage is located, there is a large ballroom, measuring 130 by 185 feet, with a seating capacity of 5,000 persons. This is also provided with a stage. In the concrete floor brine pipes have been imbedded where an inch layer of water will be placed and will be frozen for ice-skating. There is no column in the building. The massive structural steel girders have stairways in them for replacing the lamps, which shine out through either side of the girders. A diving tank is placed underneath the stage for diving contests. Provision has been made for voice and music amplification.

An air view of the Convention Hall at Atlantic City.

REFUELING RECORDS

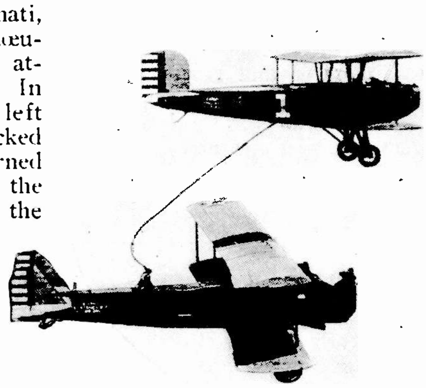
"Fort Worth," piloted by Robbins and Kelly stays in air 172½ hours. Plane from Dayton, Ohio, "Bombs" New York.

Above, the record flyers and their wives. Reading from left: Reginald L. Robbins, Mrs. Robbins, James Kelly, Mrs. Kelly, taken after record was established. Right, the "Fort Worth" refueling in air.

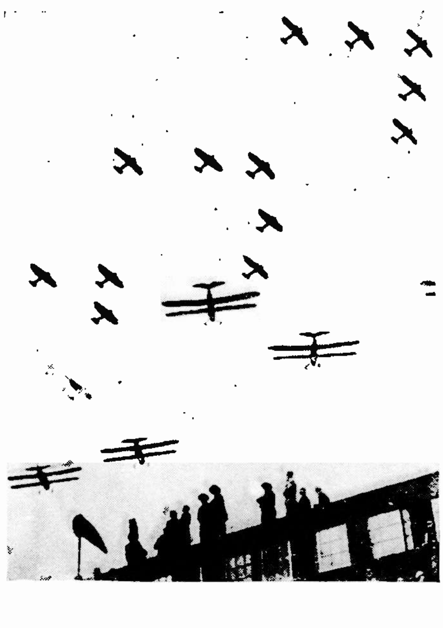
ALL sustained flight records were smashed when the monoplane *Fort Worth*, piloted by Reginald L. Robbins and James Kelly, was brought to earth after remaining in the air for a period of 172 hours 31 minutes and 10 seconds. The pilots, by their feat, eclipsed the record of the sustained flight of the *Question Mark* by 21 hours 51 minutes and 10 seconds and established a new record for single, dual and tri-motored planes, for lighter-than-air machines, and for crews, regardless of size.

The plane used was a rebuilt, single-motored Ryan, virtually the same type as was used by Colonel Lindbergh in his Paris flight. The motor was a Wright Whirlwind, which Robbins picked up after another flyer had discarded it. It never missed a beat in the air and was running perfectly when the flyers decided to land. A cracked propeller caused so much vibration that it was thought best to bring the ship to earth.

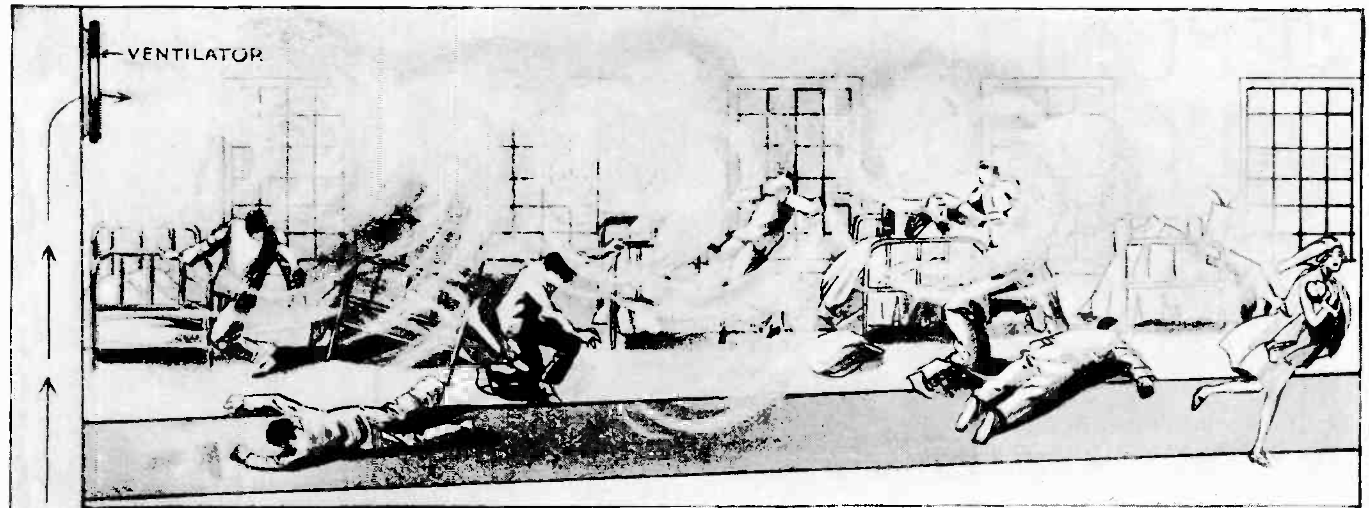
One of the photographs on this page shows a "bombing" expedition "attacking" the city of Cincinnati, Ohio. As part of the army maneuvers, this fleet of "enemy" planes attacked and "destroyed" the city. In another experiment, a bomber left Dayton, Ohio, refueled in air, attacked and *destroyed New York* and returned to Washington. A photo shows the striking scene illuminated by the "bombs" which, instead of being flares, could just as well have been filled with poisonous gases and high explosive material. They could likewise have been dropped on the city proper.

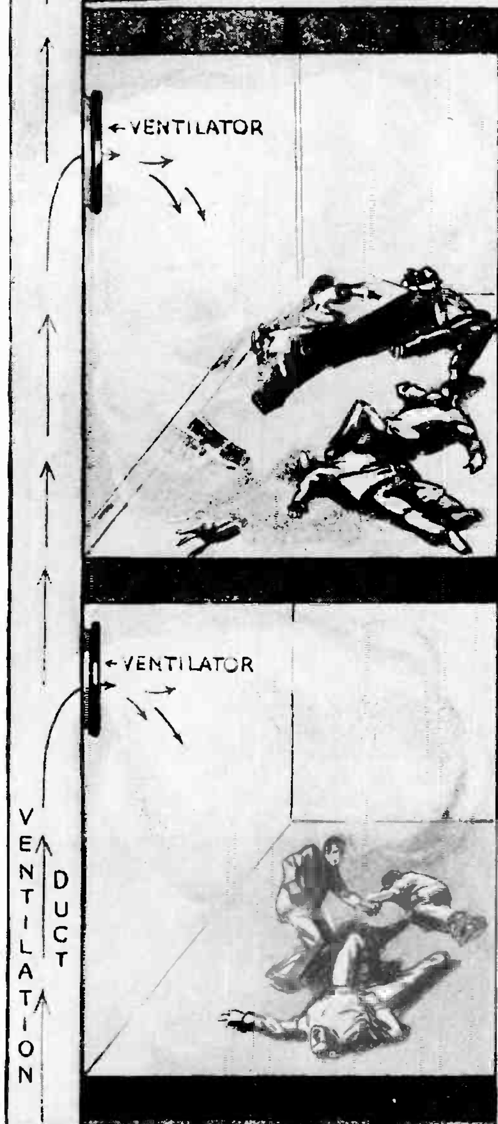


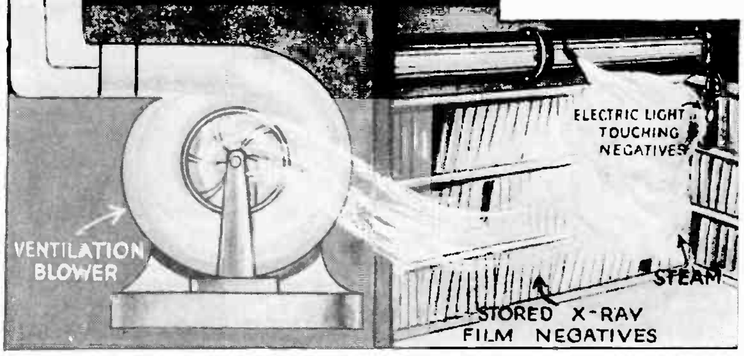
In circle, the giant army bomber refueling in air before it completely "wiped out" Governors Island and "destroyed" New York in a mimic air raid.



Left, the start of an air attack that "reduced" the city of Cincinnati to ruins. Here the "enemy" fleet is seen passing over the Lunken airport, which was to be first "destroyed." Above, in spite of protective measures, great "damage" was done by the airplane in dropping bombs on Governors Island. Illumination was produced by two of the flare bombs. After the destruction of New York, the plane returned to Washington; bad weather prevented refueling on the return trip to Dayton.







Lethal gases spread through hospital ventilator ducts.

X-Ray Films Cause

Burning X-ray Films in Storage Room Cleveland, Ohio, Liberate Deadly

By H. Winfield

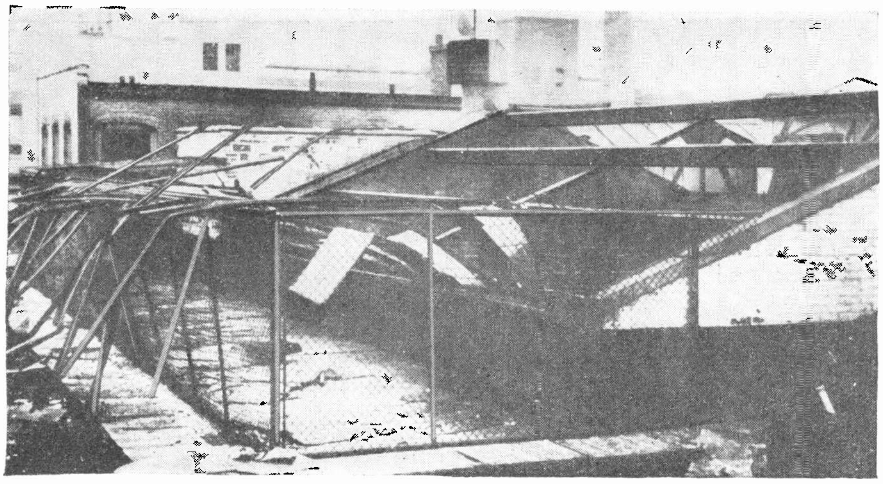
ON May 15th, yellow gas fumes emanated from the X-ray room in the basement of the Cleveland clinic, and following a deafening explosion, ended the lives of 98 patients, doctors, nurses, hospital aids and rescuers in one of the greatest hospital disasters in history.

Others who left the hospital apparently healthy succumbed while they were awaiting treatment for minor injuries or died at their homes because of mysterious gases, which increased the toll to 123 people. Men and women trapped in the building dropped in the halls, unable to escape the deadly fumes. The explosion blasted the gas upward through ventilator shafts, up stairways and through halls, as the diagram indicates. The fire itself blazed up immediately thereafter, feeding on the woodwork, causing walls to bulge and windows to burst.

The stampede, which a sudden disaster of this nature invariably creates, has already been well covered in the press reports, so there is no need of dwelling here upon this or other human reactions incident to such tragedies.

What interests us most is how to prevent such occurrences in the future, what caused the fire, and what was the nature of the deadly gases?

The first reports indicated that the fire started probably by a leaky steam pipe, which caused the negatives in the storage room to heat up and combust spontaneously. A second report indicates that the technician in the X-ray department, who had charge of filing the old films, had an electric-light extension cord and bulb put into the X-ray film storage room and that it was this light which produced enough heat to set the film on fire.



The roof of the Cleveland Clinic Hospital which caved in after a terrific blast.

Major General Amos A. Fries, U. S. Army, Retired, Chief Chemical Warfare Service more than nine years, says:

It is known from experiments that when photographic films are burned in a confined space with little outside oxygen, they develop carbon monoxide together with nitrous oxide, NO_2, both of which are very powerful, or in common language, deadly gases. Of course carbon dioxide and other gases not seriously harmful are also generated.

The two that, in my opinion, did the work in the Cleveland Hospital, were carbon monoxide and nitrous oxide. Experiments which the Chemical Warfare Service has carried out on smokeless powders have shown that nitrous oxide has about half the strength of certain important war gases and at times has a decided delayed action. Carbon monoxide, on the other hand, acts swiftly, not to say instantly, in high concentrations that might be encountered in such a disaster as occurred in Cleveland.

DISASTER

of the Cleveland Clinic Hospital, Gases, Killing 123 People

Secor

General view of the rescue scenes following catastrophic explosion at the Cleveland Clinic Hospital.

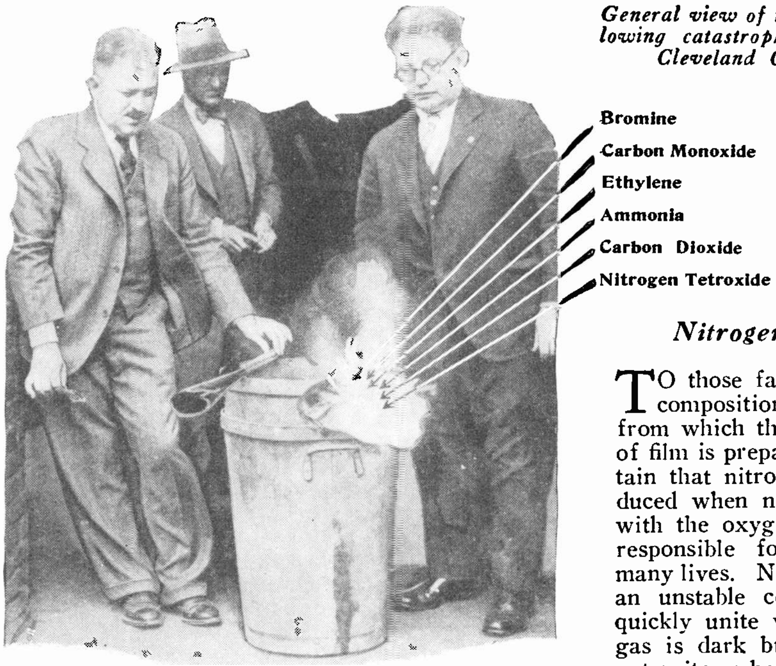
Today a nitro-cellulose compound is used in the making of the usual X-ray film. This celluloid film burns very easily and produces an intense flame. While there is non-inflammable film available on the market, this is rarely used for X-ray work, because of its tendency to curl too easily, making it difficult to file the negatives. The pyroxylin film does not have these drawbacks.

The Mysterious Gas

NEWSPAPER reports were replete with suppositions concerning the gas that so mysteriously snuffed out the lives of rescuers and rescued, even long after they had been taken from the scene of the disaster. Many authorities claimed that the gas was bromine. They argued that bromine has the same characteristic color as was seen at the hospital, and that the heat of the film burning broke down the silver bromide on the film into bromine and other compounds. Films do contain such salts of silver, but in developed films the amount of bromide present is relatively small. It is also quite impossible to break down the stable silver bromide by heat so as to produce bromine gas in quantities anywhere near large enough to produce such toxic effects.

Other reports concerning the mysterious gas were that it was probably carbon monoxide or nitrous oxide. Ethylene also came in for its share of the blame. This is a highly inflammable gaseous compound used as an anesthetic. The other gases blamed were ammonia and carbon dioxide.

Major General Amos A. Fries, U. S. A., Retired, attributes the causes of death to carbon monoxide and nitrous oxide.



Showing the difference between slow-burning and regular X-ray film. Note blaze at right giving off the gases.

Nitrogen Tetroxide

TO those familiar with the decomposition of nitro-cellulose, from which the inflammable type of film is prepared, it is quite certain that nitrogen tetroxide, produced when nitrous oxide unites with the oxygen of the air, was responsible for the loss of so many lives. Nitrous oxide is quite an unstable compound and will quickly unite with oxygen. The gas is dark brown in color, but not quite as heavy as bromine. It readily reacts with the hemoglobin of the blood and also on the lungs. Undoubtedly there was quite a quantity of carbon monoxide, another very deadly gas, present, but this carbon monoxide could not of itself account for the loss of life in such great numbers.

It is little consolation to those whose relatives and friends lost their lives in this catastrophe to think that anything that might here be suggested would (*Continued on page* 379)

SAFEGUARDING

Sound-proof rooms, dark rooms, lights that in instruments help to make better babies and con-

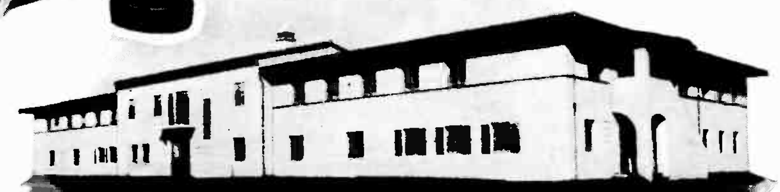
Weighing the baby periodically is necessary to tell whether the child is gaining or losing, and from this information the doctors can prescribe correct diet.

IF we want a better race, we must have better babies. Most babies when they are born are in a very good condition, but many are not properly taken care of, and it is with this end in view that a $134,000 plant for the production of better babies and the conservation of health has been completed by the Board of Supervisors in Belvedere, Los Angeles Co., Calif. This was just formally opened to the public. It is the fifth link in a chain of similar institutions already started. The chain will be continued throughout the county.

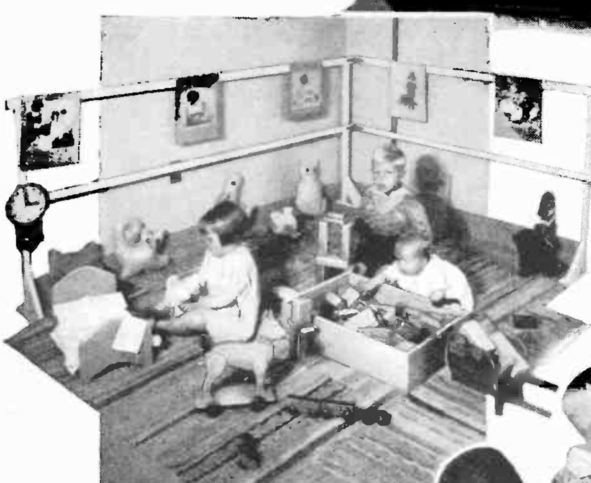
It is firmly believed that the Belvedere Health Center is the most modernly equipped institution of its kind in America. It has sound-proof rooms, wherein cardiac examinations are made.

There are dark rooms for eye tests; light rooms where either the infra-red rays or the ultra-violet are used for their curative value. There are rooms where babies' play and laughter is the order of the day, while nurses busy themselves with bathing, weighing and measuring chubby youngsters and telling mothers how to keep their offspring in the blue-ribbon class.

The Health Center plan was inaugurated by Dr. John L. Pomeroy, Health Officer of Los Angeles County, for the decentralization of the county health department and the bringing of its functions closer to the rural communities and the 31 incorporated cities within the area of 3,500 square miles served

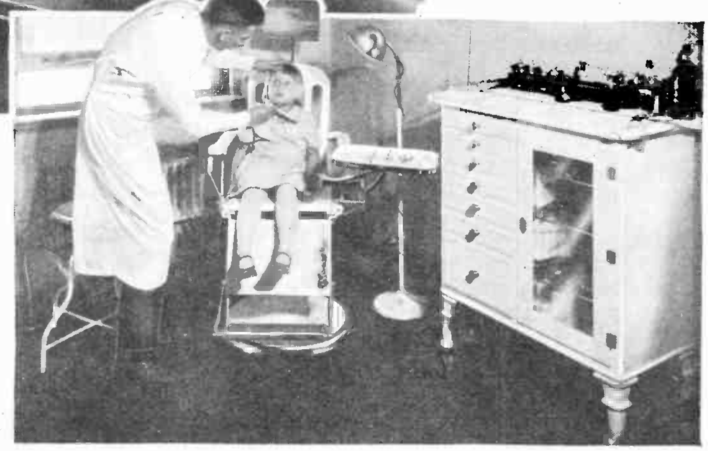


This photograph shows the new $134,000 "Health Center," said to be the finest equipped institute of its kind in the United States. It is located in Los Angeles County, Calif.



Instead of a wearisome waiting time to see the doctor, the children at the Health Clinic are permitted to play. Note that the pictures on the walls are all in line with the children's eyes when they stand up to look at them.

The pre-school child is also taught at the Health Center. Here we find the children playing with peg boards and round or square objects. The habit of training is of vast import and cannot be neglected even at the tender pre-school age.



Many children suffer from respiratory conditions. Examination of the nose and throat is regularly made at the Health Center. The illustration at the right shows a child about to have her tonsils looked after. Note that the chair in which she sits is of small size.

BABIES' HEALTH

their intensity rival the sun, and the latest scientific serve health in a most modernly equipped institution

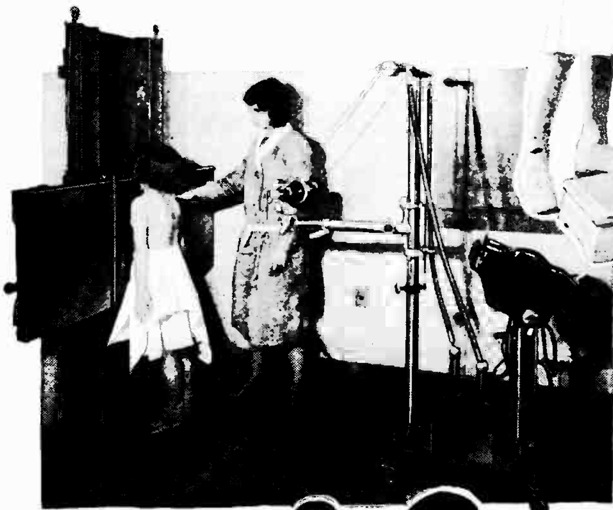
by the health department of this county, certainly an extended field of operation.

Each of these health centers is equipped with clinics for the examination of the nose, throat, eye, ear and mouth. X-ray rooms can be found wherein chest examinations are made. Every possible attempt is made to prevent tuberculosis and to treat this condition should it accidentally arise. There are sterilizing rooms and laboratories; ample provision being also made for surgical intervention, should that become necessary. One finds physio- and hydro-therapy rooms; helio- and electro-therapy departments; maternal and child hygiene clinics; a diet kitchen and a bacteriological laboratory. Toys for the young are made in various forms, so that the children can be both amused and entertained. The children are taught to develop orderliness, and the parents are told how to teach their children these things.

Of greatest importance is the equipment of these district health centers with emergency hospitals. Any accident victims or any of those requiring treatment can thus reach the hospital in record time instead of requiring to be rushed 50 miles or more from outlying points to the general hospital. Prompt treatment at the health centers thus saves many lives.

So successful have these hospitals been that other counties are already taking steps to duplicate the arrangement now found in Los Angeles County. The modern mother does not bring up her children with a knowledge gained only from the school of experience. She realizes that she can learn more in a few days or weeks than grandmother knew in her entire life-time, so she attends the clinic lectures faithfully.

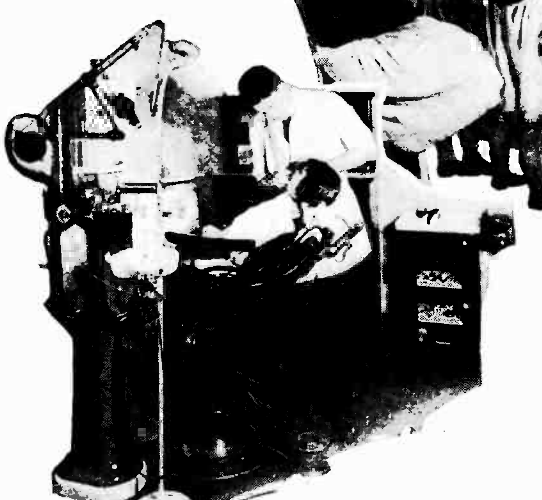
Growth and weight gains are records which are taken even when the child passes infancy.



Elaborately equipped X-ray laboratory aids in the early diagnosis of juvenile tuberculosis

Milk adds inches of growth and also pounds to the flesh of the infant's body. While one child is being weighed, another is being measured and, at the same time, this child is receiving its meal. If you will look closely, you will see that the youngster is holding a half-emptied bottle.

The photograph above shows that children alone are not given all of the instruction, but that mothers are also taught how to take care of their young. Here Ely D. Fogg, dietitian for the Los Angeles County Public Health Association, is seen demonstrating the A, B, C's of vitamins to the mother. The larger book with pictures, seen in the background, is intended for instructing the children.

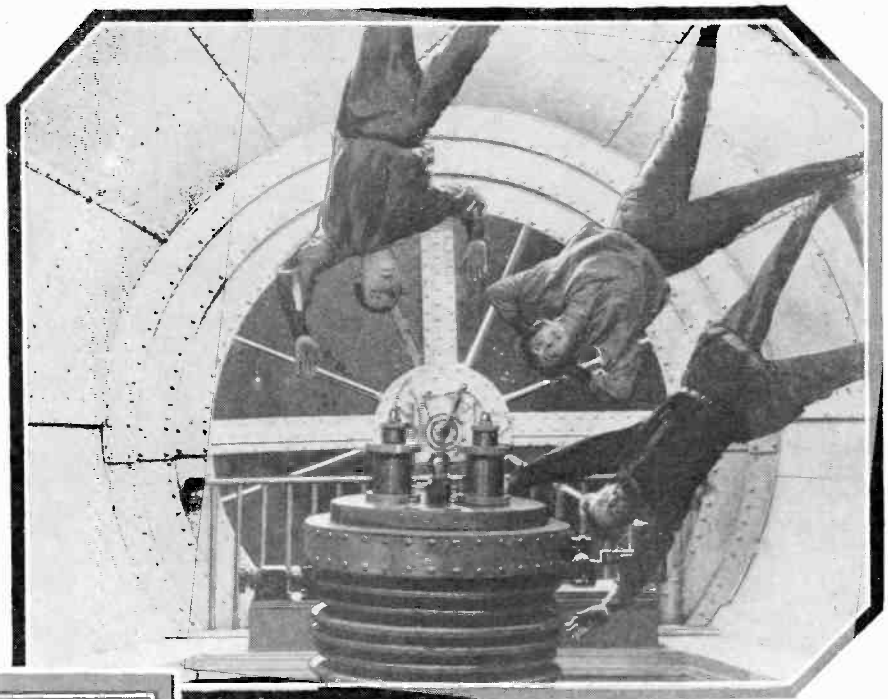


Second teeth mean second health, and the dental clinic safeguards the health of the children, taking care of both teeth groups.

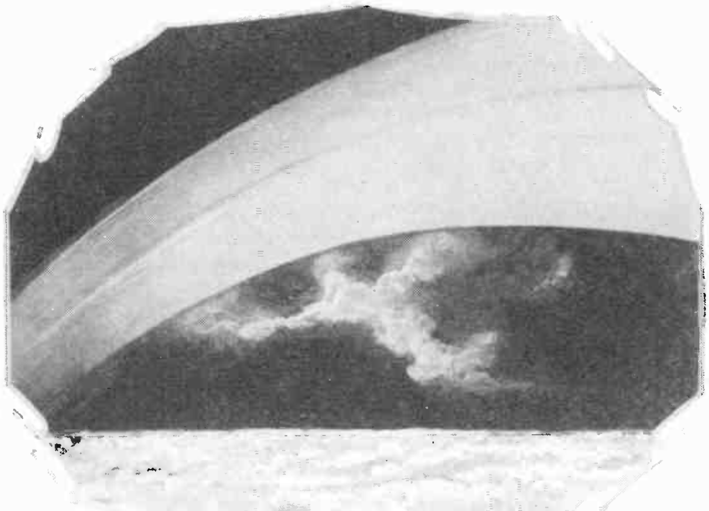
Filming *the* Future

Wonderful Presentation of Astronomical Exploration 2,000 Years Hence

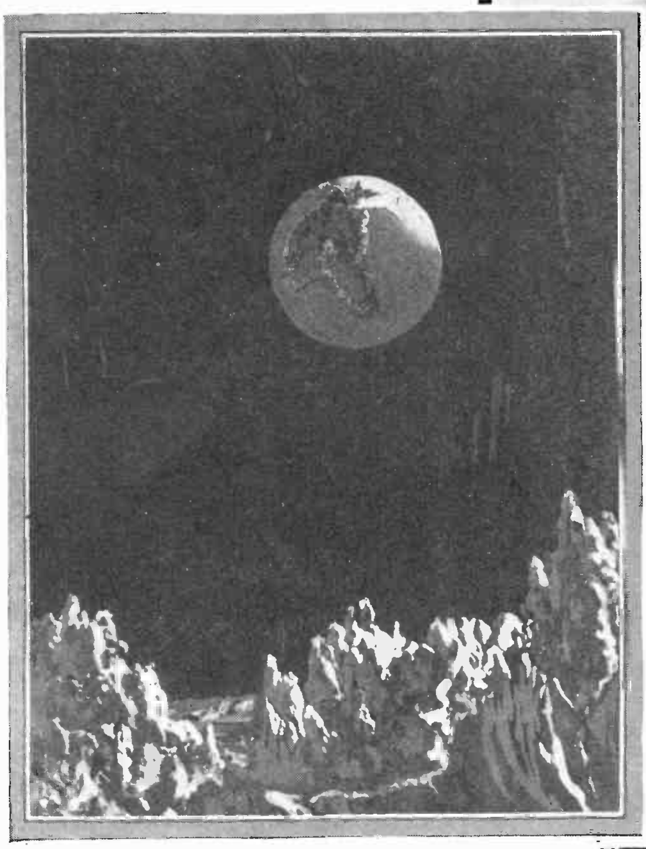
The illustration at the right shows a striking scene taken inside of a spherical airship which leaves the earth on a journey into space. In this view the airship has traveled beyond the earth's gravitational influence. As a result, the passengers of the ship are standing in a position that to them appears to be vertical and erect. This view then indicates the relativity of position when in space.



The structure across the sky is one of Saturn's rings.

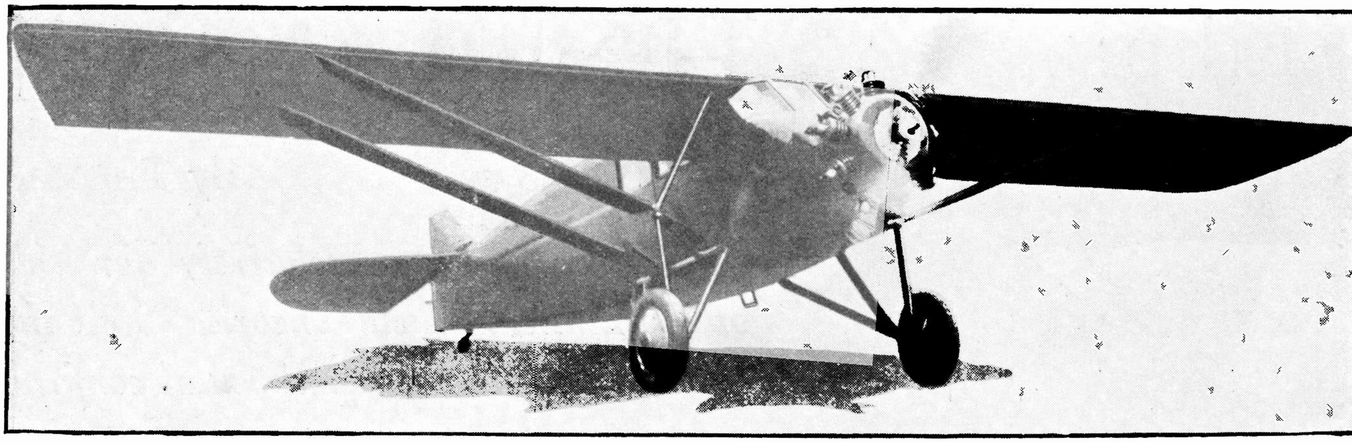


The immense cloud surfaces of Saturn.



Above appears one of the scenes from new astronomical film. This particular view was taken from the moon and shows the earth at a distance. Note how the sun, shining on the earth, makes a moon of it to any who might be positioned on the surface of our satellite. Observe the rocky crags in the foreground, which are the mountains of the moon. Right: A striking polar view.

IF the atmosphere on this earth were as rarefied as it is on the moon, the inhabitants of this planet would see intense shadows and brilliantly lighted surfaces, as in the view of the moon above. It is the atmosphere which diffuses the light. Dust also aids. The film is replete with incidents based on strictly accurate astronomical data.



Exclusive photograph of the Stinson monoplane which flew from Detroit to Langley Field, powered by Packard-Diesel engine.

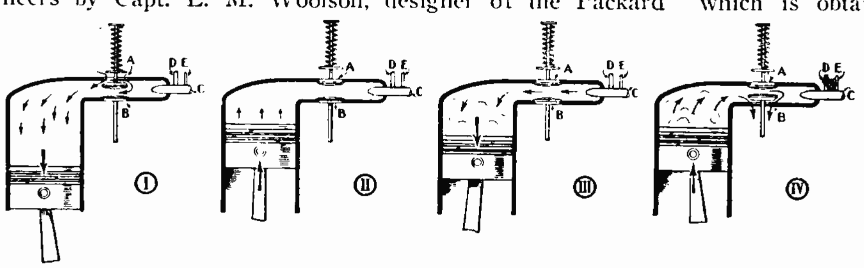
At Last. DIESEL ENGINES for Planes

By William F. Matthews

NO achievement in the aeronautical world has made such an impression on designers, manufacturers, pilots, government officials, financiers and the ever-increasing air-minded public, as the development of the Packard Motor Car Co. of a successful Diesel aircraft engine which recently powered a Stinson-Detroiter monoplane from Detroit, Michigan, to Langley Field, Virginia, a distance of approximately 700 miles, at the average speed of 100 miles an hour. Hailed as one of the milestones in the progress of aviation, the activity in several of the leading automotive plants of the country, notably the Allison Engineering Co. of Indianapolis (now owned by General Motors), the Ford Motor Company, the Winton Engine Co., the Sperry Development Co., the American Machine & Foundry Co., not to overlook several European firms, presages ultimate widespread use of this type of motor.

The danger of fire hazard attached to ordinary gasoline engines will be eliminated by the Diesel engine.

The reason for this activity is not difficult to see. In a summary of a paper read before a group of automotive engineers by Capt. L. M. Woolson, designer of the Packard Diesel aero engine, the following advantages in behalf of the Diesel were enumerated:



The four cycle operation of the Diesel engine is illustrated above. The atmospheric air is first sucked in through the valve A as shown at 1. It is compressed on the next stroke and valve A closes as illustrated at 2. Compressed air forces oil into the cylinder through the jet C, as shown at 3; on the exhaust stroke the valve B is opened, allowing the gases to escape as shown at 4.

Advantages of Diesel Engine

1. The Diesel engine is fundamentally more reliable than the gasoline engine, because it is not dependent either upon an intricate electrical ignition system, or a delicate carburetor system for fuel supply; separate fuel injection into each cylinder assures a dependable and uniform supply of fuel, thus constituting in a nine-cylinder radial engine (such as the Packard) nine individually operated motors in one.

2. Due to the tremendous heat necessary before fuel oil (the fuel used in Diesels) will burn and the practical impossibility of obtaining this heat outside the cylinders, the fire hazard of flying is eliminated.

3. The cost of fuel oil is about eight cents per gallon, compared to aviation gasoline costing about thirty cents per gallon; and inasmuch as the fuel consumption of a Diesel is only three-fourths that of a gasoline engine for the same mileage, the resulting saving in fuel costs is estimated to be 80 per cent.

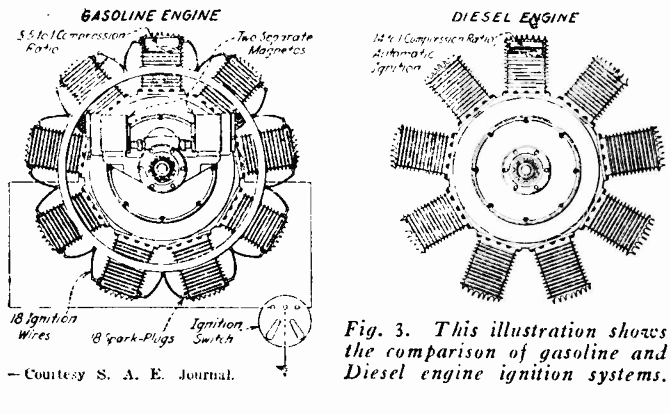
4. Due to a great reduction in exhaust noises in a Diesel and absence of the fire hazard due to lower exhaust temperatures, no exhaust manifold is needed from operating point of view, although it may be desirable for passengers.

5. The operation of a Diesel is not affected by temperature or humidity conditions; flexibility of control, which is obtained by variances in the fuel charges, is assured at all times.

6. Due to the absence of an electrical ignition system, interference with radio reception, a most important factor in safe operation of aircraft, is entirely eliminated.

7. The basic reliability of the Diesel engine justifies a reduction in the number of power plants for large airplanes, with the further important reduction in the cost of maintenance and operation.

8. Due to (Continued on page 379)



—Courtesy S. A. E. Journal.

Fig. 3. This illustration shows the comparison of gasoline and Diesel engine ignition systems.

How I Control

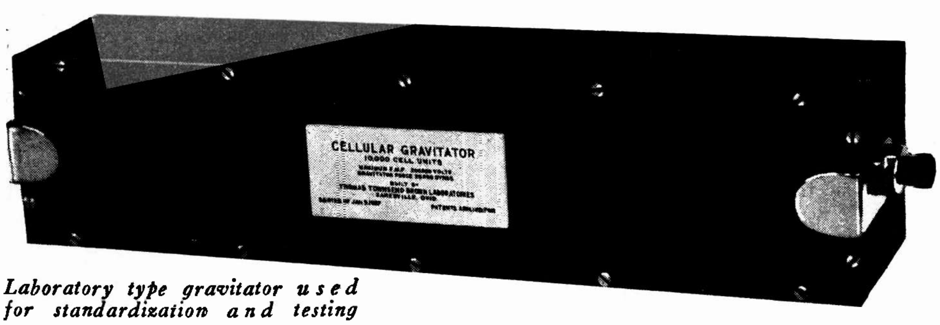
By THOMAS

An article written exclusively for this of the Einstein "Field Theories" and the gravitation. Actual experimental confirm-

The author, who is one of the leading American physicists.

THERE is a decided tendency in the physical sciences to unify the great basic laws and to relate by a single structure or mechanism such individual phenomena as gravitation, electro-dynamics and even matter itself. It is found that matter and electricity are very closely related in structure. In the final analysis matter loses its traditional individuality and becomes merely an "electrical condition." In fact, it might be said that the concrete body of the universe is nothing more than an assemblage of energy which, in itself, is quite intangible. Of course, it is self-evident that matter is connected with gravitation, and it follows logically that electricity is likewise connected. These relations exist in the realm of pure energy and consequently are very basic in nature. In all reality they constitute the true backbone of the universe. It is needless to say that the relations are not simple. Unfortunately at present they are not even well understood. The handicap is the outstanding lack of information on the real nature of gravitation.

The Theory of Relativity lends a new and revolutionary light to the subject by injecting a new conception of space and time. Gravitation thus becomes the natural outcome of so-called "distorted space." It loses its Newtonian interpretation as a tangible mechanical force and gains the rank of an "apparent" force, due merely to the condition of space itself.

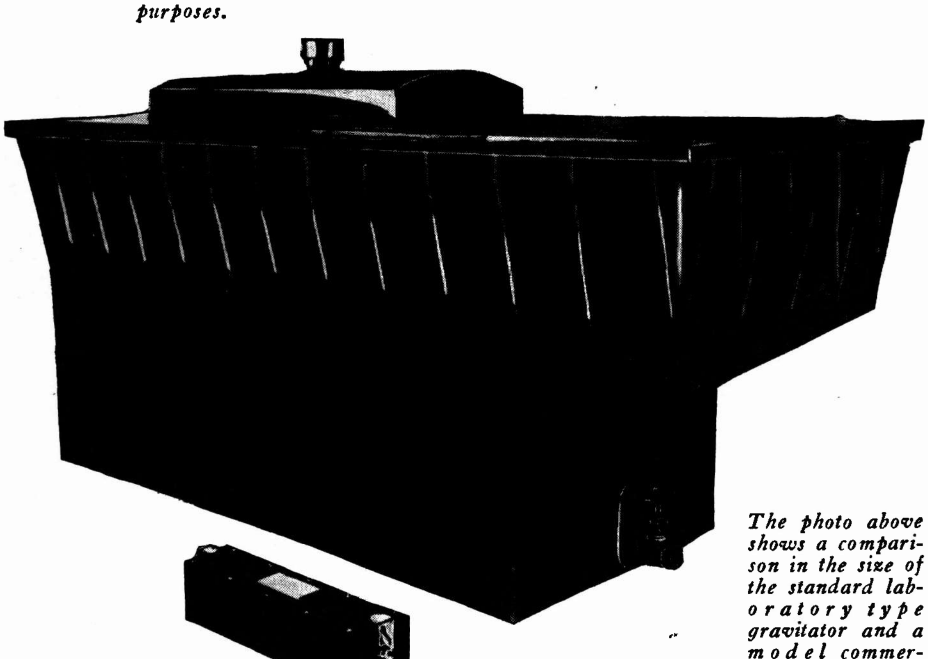


Laboratory type gravitator used for standardization and testing purposes.

Fields in space are produced by the presence of material bodies or electric charges. They are gravitational fields or electric fields, according to their causes. Apparently they have no connection, one with the other. This fact is substantiated by observations to the effect that electric fields can be shielded and annulled while gravitational fields are nearly perfectly penetrating. This dissimilarity has been the chief hardship to those who would compose a Theory of Combination.

It has required Dr. Einstein's own close study for a period of several years to achieve the results others have sought in vain and to announce with certainty the unitary field laws.

Einstein's new field theory is purely mathematical. It is not based on the results of any laboratory test and does not, so far as is now known, predict any method by which an actual demonstration or proof may be made. The new theory accomplishes its purpose by "rounding out" the accepted Principles of Relativity so as to embrace electrical phenomena.



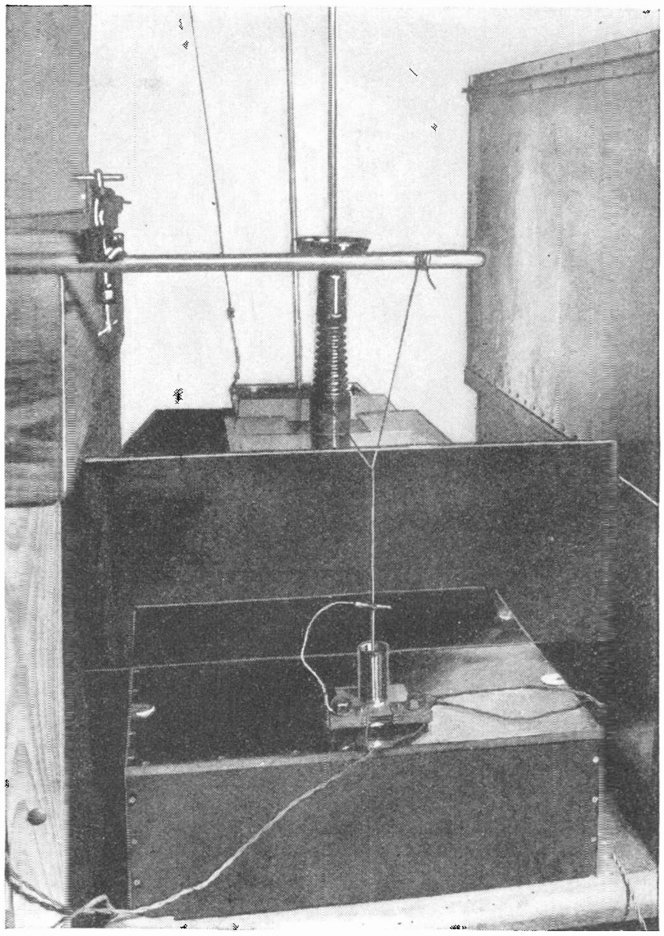
The photo above shows a comparison in the size of the standard laboratory type gravitator and a model commercial gravitator for marine use.

The Theory of Relativity thus supplemented represents the last

GRAVITATION

T. BROWN

magazine, dealing with the meaning relation between electro-dynamics and ation and practical results are given.



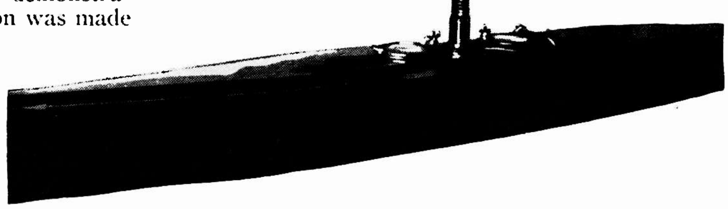
word in mathematical physics. It is most certainly a theoretical structure of overpowering magnitude and importance. The thought involved is so far reaching that it may be many years before the work is fully appreciated and understood.

However, Dr. Einstein's announcement of his recent work has spirited the physicists of the entire world to locate and demonstrate, if possible, any structural relationship between electro-dynamics and gravitation. It is not that they questioned or doubted Einstein's reasoning or his mathematics (for they have learned better), but that they realized that the relation should exist and were eager to find it.

Early Investigations

THE writer and his colleagues anticipated the present situation even as early as 1923, and began at that time to construct the necessary theoretical bridge between the two then separate phenomena, electricity and gravitation. The work was slow at first, due to the scarcity of information and lack of proper equipment, but the search gained speed as it gained information.

The first actual demonstration of the relation was made in 1924. Observations were made of the individual and combined motions of two heavy lead balls which were suspended by wires 45 cm. apart. The balls were given opposite electrostatic charges and the charges were maintained. Sensitive optical methods were employed in measuring the movements, and as near as could be observed the balls appeared to behave according to the following law: "Any system of two bodies possesses a mutual and uni-directional force (generally in the line of the bodies) which is directly proportional to the product of the masses, directly proportional to the potential difference and inversely proportional to the square of the distance between them."

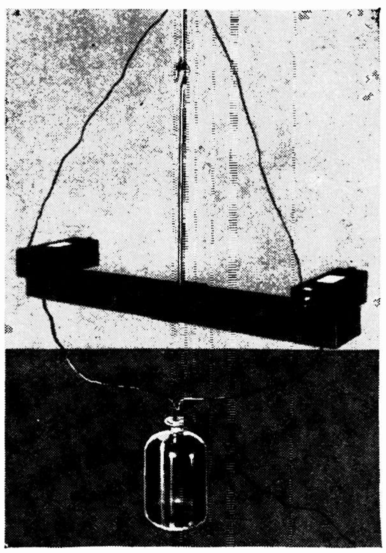


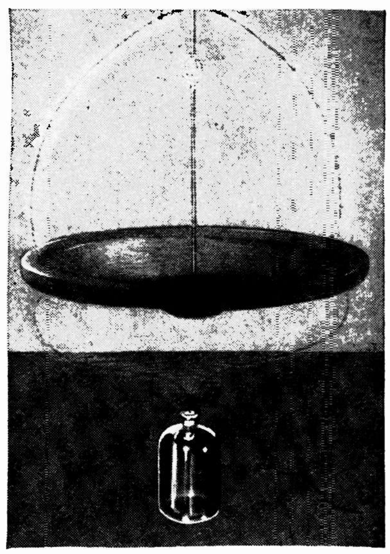
The electro-gravic pendulum as it is set up in the author's laboratory. It is by means of this equipment, together with accurate recording machines, that the relative gravitational effects of the sun, moon and the planets can be observed. At the left is a model gravitator boat 12 feet long.

It will be noted that this law is merely a combination and slight variation of Newton's law of gravitation and Coulomb's law of electrostatic attraction. In the specific test of this law the movement is in the negative to positive direction.

THE PECULIAR RESULT IS THAT THE GRAVITATIONAL FIELD OF THE EARTH HAD NO APPARENT CONNECTION WITH THE EXPERIMENT. THE GRAVITATIONAL FACTORS ENTERED THROUGH THE CONSIDERATION OF THE MASS OF THE ELECTRIFIED BODIES.

The newly discovered force was quite obviously the resultant physical effect of an electro-gravitational interaction. It represented the (*Continued on page 373*)

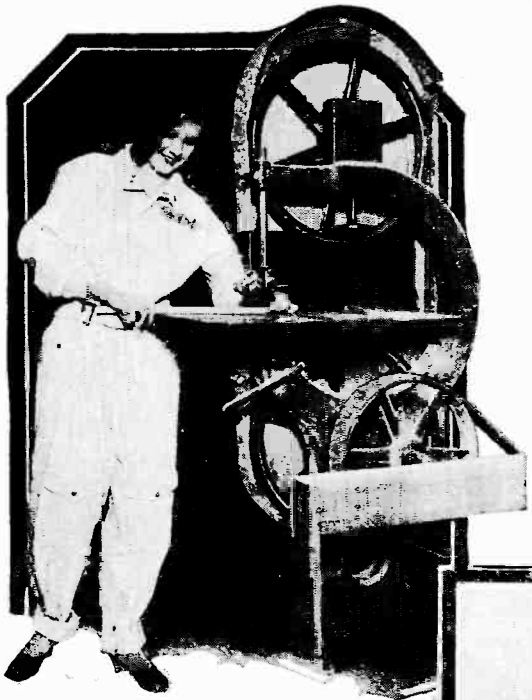




The above photograph at the right shows the movement of the rotor after two minutes of operation. After impulse is exhausted, the rotor comes to a stop even while potential is still on. Ball bearings offer uniform resistance. The photo at the left shows a two-unit gravitator rotor.

Girls Learn to

Girl Students Now Enroll in Trade Schools and Learn the Fundamentals of Airplane Construction and Repair



The above photograph shows Miss Mildred Miller at work at one of the machines in the Aviation Service and Transport School, of Chicago, Illinois. At the right a girl flier is seen making a repair on an airplane. In addition to learning to be a pilot, the young women are instructed in motor repair, wood work, aerial photography, rigging and meteorology. Extensive instruction in theoretical as well as in practical aeronautics is given to the students, and girls learn as quickly as the male students.

THE modern girl, having raided the business world, now turns her attention to further conquests in the mechanical field. Typewriters and notebooks have been abandoned, while the hammer and wrench have been chosen as the new tools. Former tasks which have been allotted to women have been relegated to the past.

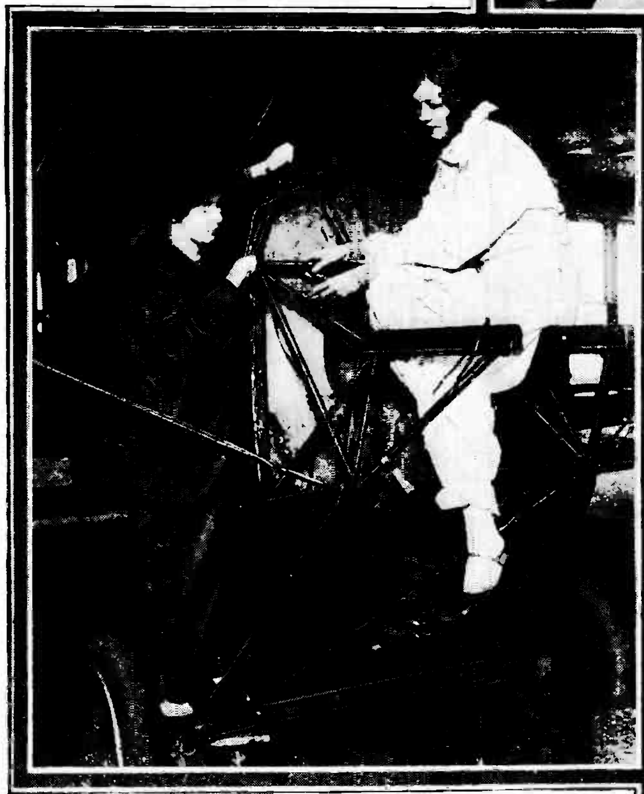
Trades for Women

THE fair sex are entering fields of labor which will better recompense them. The chief trades which are now open to women include plumbing, automobile repair, welding, battery repair, and any work in connection with radio transmission and reception. Sign painting has also been included.

Girls Learn Aviation

CHICAGO girls have taken up flying in the Aviation Service and Transport School of that city. This school has several women students who are taking complete courses which include instruction in learning to pilot a plane, woodworking, rigging, motor repairing, aerial photography, and meteorology. The photographs show some of the fair students at work. One aviatrix may be seen repairing an airplane motor. She has been flying alone for two months. To become a graduate and obtain a pilot's license she must only complete a course in stunt flying. Complete instruction in theoretical as well as practical aeronautics is given to the students. The instructors state that the girl students show a marked aptitude for mechanical devices and quickly learn the principle of operation and how to make repairs, be it on an automobile engine, an airplane or a storage battery.

More recently aviation has captured the fancy of young women, as is evidenced by the accompanying photographs.



The above photograph shows Miss Betty Sessur and Miss Mildred Miller working on the front of a plane preparatory to installing the engine. At the right four of the students are shown repairing one of the airplane engines in conjunction with their aviation course. The engine is completely taken apart and then assembled by the students for practice and experience.

Repair Engines

Modern Automobile and Aviation Schools Well Patronized by the Fair Sex. Women Learn Engine Details Quickly Instructors Say.

The above photo shows Miss Jea.? La Rene, of Chicago, putting the finishing touches to her flying course. She has been flying alone for several months.

Automotive Instruction

ANOTHER school is devoted to the teaching of automobile operation and repair. In connection with this course, automobiles are com-pletely stripped and then reassembled by the students. Repairs are made on engines, carbon removed and the valves ground. The various types of ignition systems are also studied and the women students soon become expert in wiring a car.

Above is a scene in the auto repair shop showing girls at work on an automobile gasoline motor.

Battery Repair

THE students are also required to study the construction of storage batteries and are well grounded in the chemical action which takes place. They learn to insert new cells and to equip the battery with new plates when necessary. Lead burning is also taught and several girls may be seen in the photo engaged in this work.

Night School

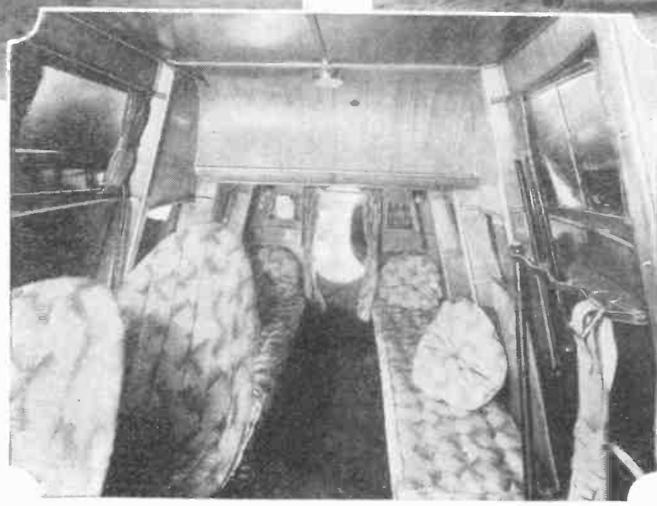
SEVERAL schools giving courses in aviation and automobile repairing have opened their doors to women, who, though surprising as it may seem, actually like this sort of work and do as well as the male students.

Besides the regular classes which are held during the daytime, some of the schools also offer night courses for girls in many of the mechanical trades, thus the girl, who pounds the typewriter during the day or stands behind the sales counter, can pursue her studies at night, attending about three two-hour classes each week. The photographs appearing upon this and the opposite page will serve to give one an idea of just what women are now doing in what were previously regarded to be exclusive fields of occupation for the male of the species only.

Members of the class in battery repairs are shown above with their instructor.

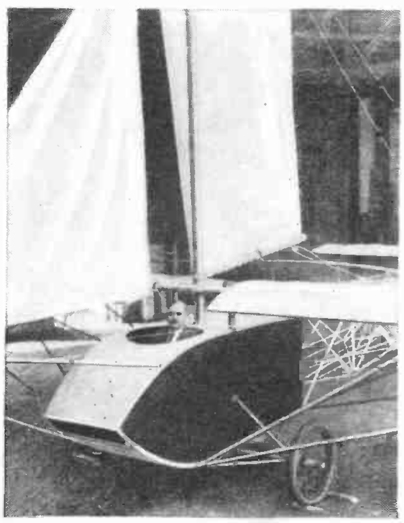
The photograph at the left shows another class in automobile mechanics receiving instruction in one of the schools.

Advances in Aviation



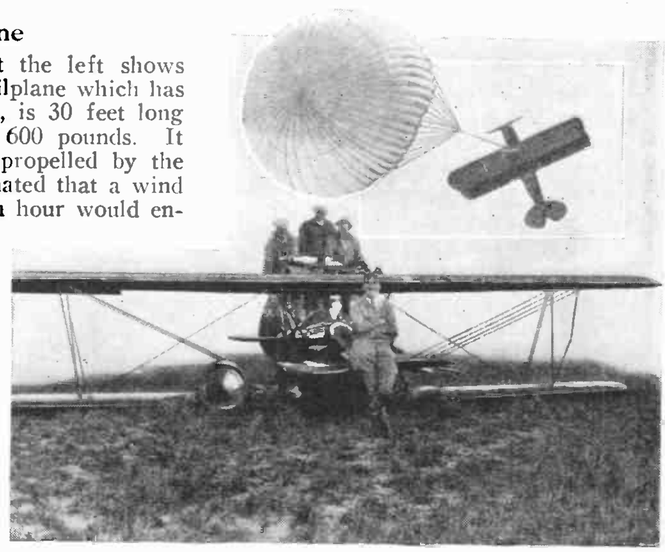
Flying Yacht

THE three photographs appearing here show views of a new flying boat with an all-metal hull. Retractable landing gear is provided for using the plane on land. This craft is one of the few monoplane amphibians developed up to the present time. The main passage cabin has a total length of 15 feet and an average width of 5 feet.



Sailplane

THE photograph at the left shows the world's first sailplane which has a 40-foot wing spread, is 30 feet long and weighs less than 600 pounds. It has no motor and is propelled by the wind only. It is estimated that a wind velocity of 20 miles an hour would enable the plane to rise from the ground. The inventor claims that the craft will attain a speed of 40 miles an hour. As yet the inventor has not tested the plane, but it would be interesting to see the results of such an experiment.

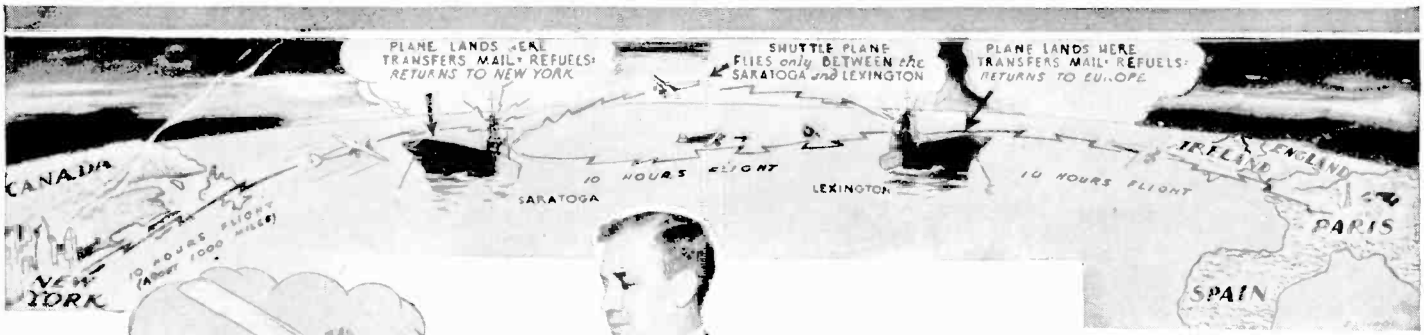


Parachutes for Airplanes

THE above photographs show a plane equipped with a new parachute which enables the pilot to bring his craft safely to earth. Large photo shows plane landed in this manner.

"Detachable" Plane

THE photographs below show a combined plane and glider. The motor and fuel tank can be detached from the plane, transforming it into a glider. The photograph directly below shows the plane just before it was taken up in the air and below at the left an airplane view of the plane in flight.



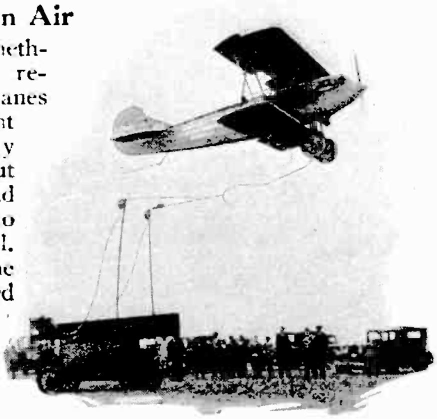
Trans-Atlantic "Air Mail" Service

THE above illustration shows a system which makes trans-Atlantic air mail service possible. The plan uses the two airplane carriers, the *U. S. S. Saratoga* and the *U. S. S. Lexington*. These ships would be anchored approximately 1000 miles apart across the Atlantic. A plane carrying European mail would fly to the *Saratoga*, anchored nearest New York, making the journey in ten hours. The mail would be taken up by a second plane flying between the *Saratoga* and the *Lexington*. A third plane would carry the mail from the *Lexington* to Europe.

Ship to shore air mail

A PLAN has been proposed for depositing and picking up mail by plane, from the deck of a ship. The photograph at the right shows Dr. L. S. Adams, the inventor of an automatic device which makes the ship to shore air mail possible.

Refueling in Air



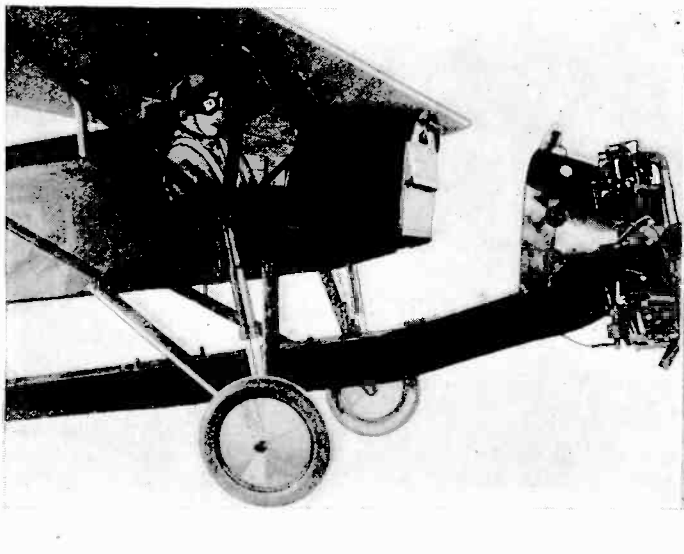
A NEW method for refueling airplanes while in flight has recently been tried out in Long Island and proved to be successful. The gasoline can is carried by a truck equipped with two uprights. A wire is attached to the uprights and the gasoline can. The plane, flying low, drops a hook which engages the wire releasing a catapult which throws the gasoline can forward, at a velocity approximating that of the airplane, so that there is no shock of impact. The rope or cable carrying the gasoline is then reeled up to the plane.

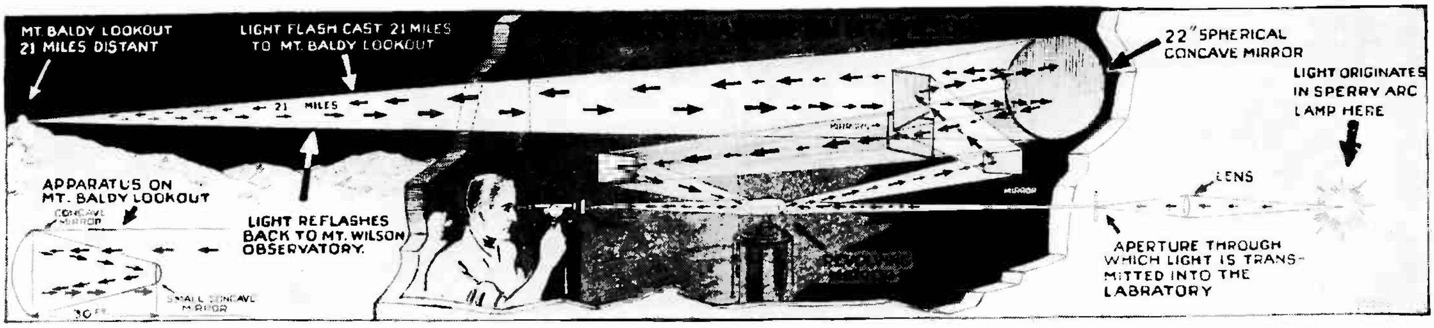
All-Streamline Airplane

THE first all-streamline airplane to be built in the United States is shown in the above photograph. On its initial flight it attained a speed of 200 miles an hour and made a smooth landing at 40 miles an hour. All cables and rods are placed within the plywood wings and fuselage. The cabin holds three passengers.

Glider-Airplane

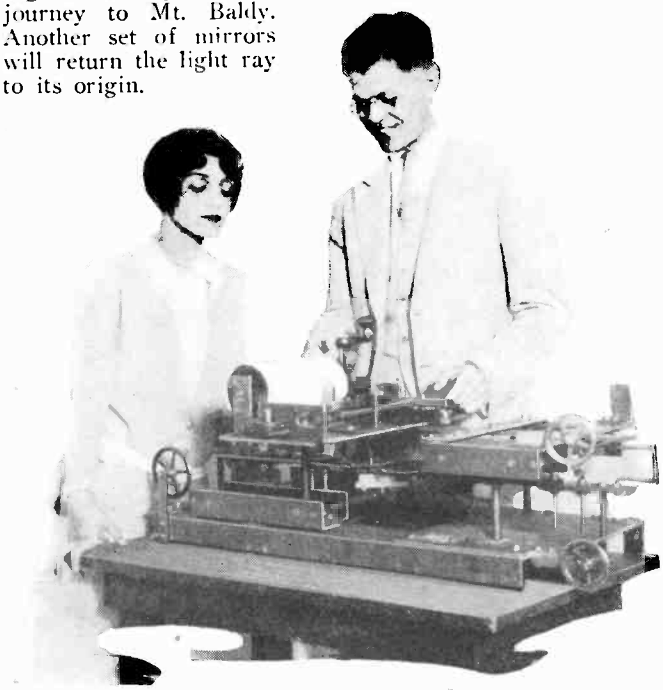
VIEW below was taken just after motor and fuel tank had been detached and dropped to earth. In this state the plane is transformed into a glider. A photograph taken after the plane landed is also shown. The pilot glided down from a height of 5,500 feet, but the landing was not quite successful. The plane landed gently, but turned over. The pilot was uninjured.





Measuring Speed of Light

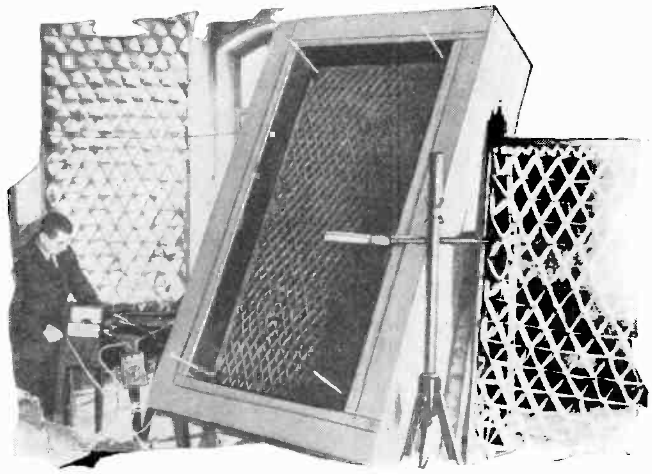
THE above illustration shows how Prof. A. Michelson intends to measure the speed of light. The light ray will be sent out from Mt. Wilson and travel to a revolving mirror, from whence it will be reflected from a series of mirrors to a 22-in. concave reflecting glass and begin its twenty-one-mile journey to Mt. Baldy. Another set of mirrors will return the light ray to its origin.



Sound by Light

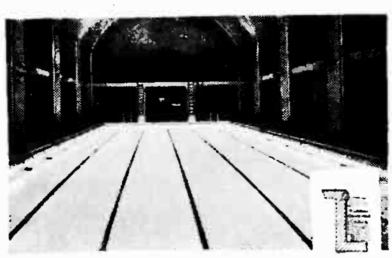
THE above photograph shows a new device which produces and controls sound artificially by means of light, utilizing a new type of portable sound synthesizer. It is believed that this apparatus will answer the need of the talking movies and phonograph companies.

Scientific



Utilizing Sun's Rays

THE above photograph shows V. B. Weinberg, head of the Technology Institute of Leningrad, Russia, with an apparatus of his own invention, known as the "cell absorber." This device transforms the solar energy into heat. Practical uses for the apparatus will be found in the drying of fruits and in the extracting of salt from water. A number of the solar heaters are to be constructed and will undergo rigorous tests.

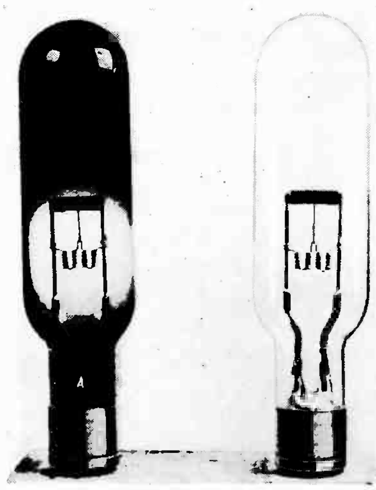


Lights for Swimming Pools

THE above photograph shows a new method of lighting adapted for swimming pools, wherein the lamps are placed beneath the water. The pool appears to be empty but is really full of water.

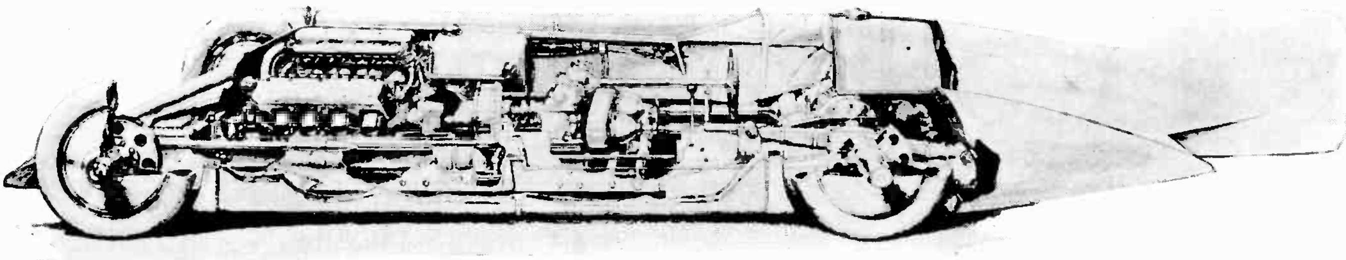
Fossil of Ichthyosaurus

AT the left is a fossil Ichthyosaurus recently found in England. It measures 29½ feet in length.



Self-Cleaning Lamp

THE General Electric Company has developed a practical method for removing the black deposit which collects on the inner surface of high-powered incandescent lamps. The deposit remover is a tablespoonful of coarse tungsten powder placed within the lamp before it is sealed. The above photo shows an old and new lamp.



The Golden Arrow

ABOVE is a cross-section of Major H. O. D. Segrave's racing car, the Golden Arrow. This view shows all details of the construction of the car which captured the world's speed record at Daytona Beach, Florida. The drawing is published by permission of Major Segrave and has been given to us exclusively.

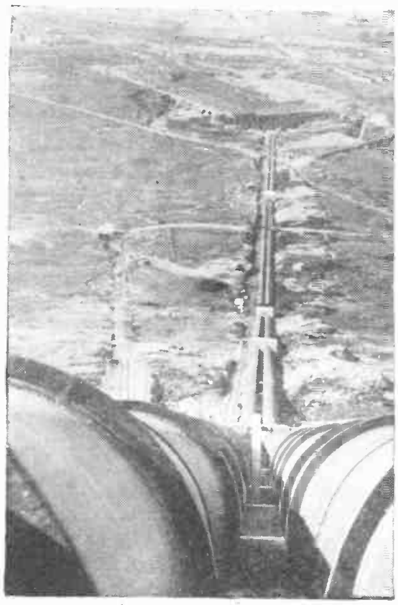
Progress

Science Catches Criminals

THE photograph at the right shows bullets taken from bodies of gangsters which match with the bullets from the killers' guns. No two bullets have the same markings if fired from different guns. The criminologist fires a bullet from the suspected murderer's gun and compares the markings with the bullet taken from the victim's body.

Moon Model

ABOVE is shown a model of the moon constructed by German astronomers and given to the Field Museum, of Chicago, by Mr. Lewis Reese. The photo shows Prof. O. C. Farrington, curator of geology, explaining the globe to some children.

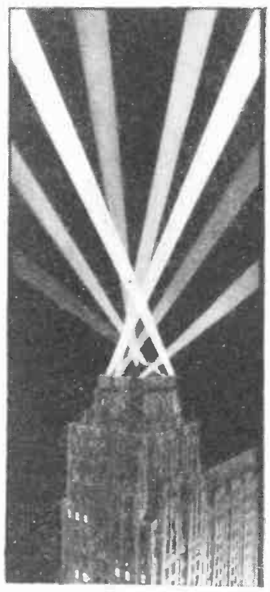


Check Signer

THE photograph at the left shows a new machine which will affix your own signature to checks at the rate of 125 per minute. The machine cuts the checks apart and stacks them.

Fifteen-Mile Tunnel

A FIFTEEN-MILE tunnel is nearing completion in Great Britain. It will provide water power for industry and runs through the base of one of Great Britain's highest mountains. The photograph at the left shows the two huge pipe lines which carry the water.



Floodlighting for Buildings

THE Fisher Building at Detroit, Michigan, has been arranged especially for flood lighting by illuminating engineers. The building surface is entirely of marble sufficiently rough to take the flood lighting readily. The edifice was adapted for night illumination by the use of setbacks. The above photo shows the building at night.

Is a College Education

Justice John Ford, Justice of the Supreme Court, State of New York, was born at Knowlesville, Orleans County, New York, on July 28, 1862. He received a degree of A.B. from Cornell University in 1890 and served in the State Legislature during the years 1896 to 1900 inclusive. He served on the National Guard for eight years and retired as a captain. He was elected to the Supreme Court in 1906 and again re-elected in 1920.

Is a College Education Worth While?

SOME time or other, in the lives of all of us, this question crops up. We must weigh it carefully and give it due consideration.

Perhaps we would like to go to college.

Perhaps we have sons or daughters whom we would like to send to college.

Perhaps they would care to go, but we question the value of that college education.

The most logical step to take would be to ask some-one who knows.

This publication has tried to make it easier for you, and before the next college term opens, and prior to matriculation, we will present to you the opinions of the leaders in industry, arts and sciences on this subject. The determination of the value of the college education we will leave to you.

If perchance you care to say something on the subject, remember that there is a "What Our Readers Think" Department for just such comments.

By JUSTICE JOHN FORD
Supreme Court, New York

ONE'S personal experience naturally colors his views upon the value of collegiate training. I was one of a family of eight children on a sixteen acre farm in Western New York and "hired out" as a farm hand at the age of thirteen. My desultory attendance—winters only—at the old-fashioned district school left me at the age of eighteen with very little education. I could read and write and knew some geography but no grammar. My arithmetic was fragmentary. I had no financial resources or backing. My earnings had gone into the family exchequer as they continued to go until I entered the university. I practically prepared myself for entrance—Latin, Greek, English, algebra, geometry, all were mastered. Altogether I spent about forty weeks at an academy which rather delayed than speeded my progress.

An uncouth country boy, I presented myself at the county seat as a candidate in a competitive examination for a free tuition scholarship in Cornell University. I won. I entered the University where I took a second competitive examination in Latin and Greek for a classical scholarship which paid $200 a year in cash for four years. I won again. With the two scholarships and what I earned in vacations, together with about $250 in cash prizes which I won and some earnings from newspaper work, I managed to acquire my B.A. and a Phi Kappa Key with a job already in my pocket as associate editor of a weekly paper published in New York City.

I regard my university course as a great help to my success. A college education constitutes a valuable equipment for the battle of life. It does indeed help to a successful professional or business career. I am not referring to the B. A. degree particularly, but to any degree conferred by a reputable college or university. Employers prefer bearers of such degrees. With the wide diffusion of higher education, business men cannot afford to have persons of inferior education around them, and if the captain of industry is himself a little shy in the higher reaches of erudition, the more he values the college man or woman.

Of course I do not mean to express the view that one is superior to another merely because the one sports a degree while the other does not. All I mean to assert is that, other things being equal, the college graduate has the advantage. While you cannot make a silk purse out of a sow's ear, a college education will make the best that it is possible to make out of that sort of material.

Thus far I have had in mind material success in life alone. Now I touch upon those other things which a liberal education brings to its possessor and which adds to the happiness of life far more than material success alone can bring. I mean the poise, the broader vision, the kindly tolerance which drips into the soul as the student imbibes the wisdom begat of the human experiences and achievements of the ages. College graduates with rare exceptions are not conceited of their learning. Rather they have gained from their studies a keen realization of how little they know about a thousand things they long to understand. But they have gained a philosophical outlook upon their world and a deep insight into its problems which comfort and cheer through all the vicissitudes of the years.

By FRANCES ROCKEFELLER KING
President Frances Rockefeller King, Inc., Bureau

A boy may go to college
And still can be a fool,
For there's a lot of knowledge
One never learns at school.

EDUCATION is mental calisthenics. It not only develops the mind just as physical training develops the muscle, but also helps the student to use his or her mind to the best advantage. Here again the professor has the same objective as the coach.

In the professions a college education is obviously imperative; yet all the degrees in the world will not produce a good lawyer, doctor, or engineer. It merely supplies the tools. The amount of skill used in handling them is up to the individual.

Thinking may be one of the lost arts. Pre-digested thought on any subject is retailed very much like any commodity and therefore in these days it may be that the

Worth While?

only possible way of getting the younger generation to use its brain is by matriculation in a brain foundry. Otherwise a college education is no more essential than a high hat in an Easter parade. The topper may be a fashion—even attractive—but it certainly is not necessary.

Frances Rockefeller King entered Teachers College, but soon found a place for herself on a newspaper. She became press agent and also acted as a New York representative for the London Court Circular. A few of her society friends complained of the difficulty they had entertaining their guests at social functions, and Miss King believed that this difficulty might be solved by a private entertainment bureau. Putting the idea into practice, she established a new profession. She took this idea to the head of the B. F. Keith circuit and convinced him of its worthiness. For a number of years this department has been particularly successful. She has just incorporated the Frances Rockefeller King, Inc., Bureau to continue to provide private entertainment and develop further the service she originated.

Therefore, in my humble opinion, it is of little importance what the motivation process may be. The thing that counts is mental action. This may be obtained in many different ways and is not at all contingent on a university training. "Old Man Experience" is one of the greatest schoolmasters. A public library is an excellent class-room. Desire for knowledge is the important factor. Create an appetite for learning and the hungry youth will find a way to appease the yearning.

The fault that I find with most college graduates is their thought that the world is the oyster and their diploma a knife to open it with. As a matter of fact, the diploma is merely a whetstone upon which the knife must be sharpened before it will even cut butter.

College has deprived many a firm of a good truck driver, while on the other hand, many a truck driver has gained business and professional heights because he had the urge to get somewhere.

To sum up briefly, in fact to put the whole question as I see it into a single sentence, "it all depends upon the boy or girl."

A boy can go to college
And still can be a fool.

By MAJOR GENERAL AMOS A. FRIES
U. S. Army, Retired
Chief Chemical Warfare Service U. S. Army More Than 9 Years

Major General Amos Fries was born in Debello, Vernon County, Wisconsin, March 17, 1873. He was graduated from the New York Military Academy in 1898; Engineering School graduate in 1912. He was commissioned as a Second Lieutenant of the Engineers in 1898, and promoted through grades to Lieutenant Colonel in 1917 and Colonel in 1917; Brigadier General and Chief of the Chemical Warfare Service of the A. E. F. during the entire war; Brigadier General in 1920 and Major General in 1925. Since August 16, 1920, he has been Chief of the Chemical Warfare Service. He was awarded the D.S.M. (U. S.); Comdr. Legion of Honor (France); Companion St. Michael and St. George (British).

IS a college education worth while? By all means, and in every way, yes! To explain, I shall be somewhat personal. I am writing this on the thirty-first anniversary of my graduation from West Point. In those thirty-one years I have been thrown among all classes of men, American, European, Asiatic.

Among each of these groups I have met many successful men, most of course being among Americans. I have watched them and worked with them in the Army and in civil life—in peace and in war—on land and sea, in the mountains and on the plains, in cities and in tropical jungles.

Everywhere and in every line of work the trained man beats the untrained man—health, mind and physical power being equal. A college education is simply the highest form of training.

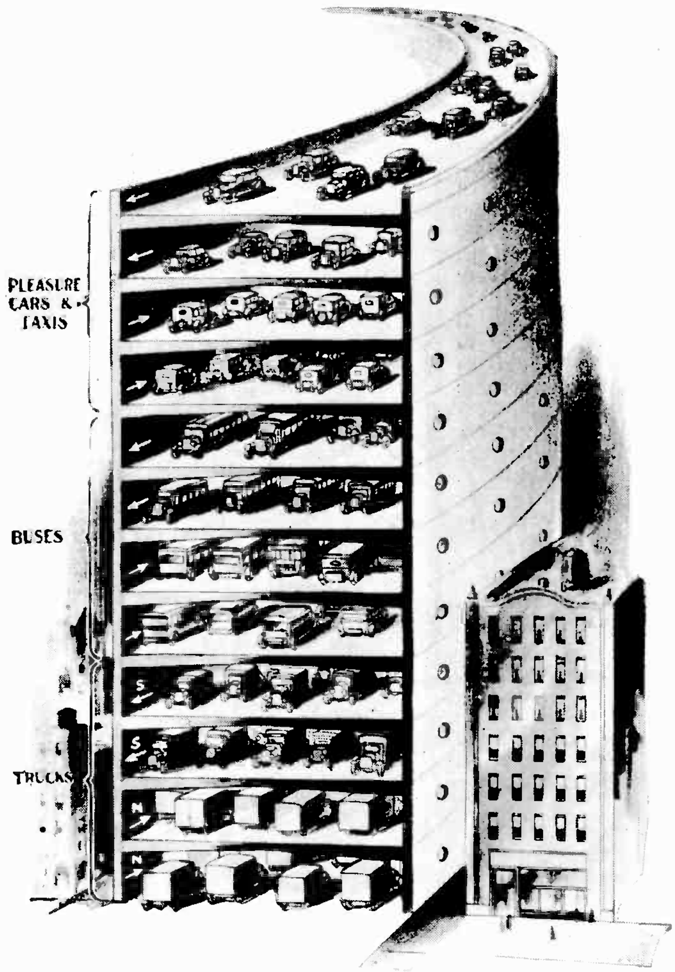
Now war is the ultimate in energy and force. It is the supreme test of skill and leadership. Today that nation is strongest which combines highest scientific achievements with vast manufacturing and commercial development.

We live in a power age—a machine age—an age where man-power in war, and in peace for that matter, is wholly secondary to *materiel* power. In hydro-electric plants, steam plants, locomotives, automobiles and other types of power plants we have nearly seven horsepower working day and night for each man, woman and child under the Stars and Stripes. Materiel, used above, is a French word which is all-inclusive for ships and guns, for railroads and automobiles, for rifles, gas masks and airplanes.

In the World War we raised and trained men enormously faster than we could equip them with transportation, rifles, guns and ammunition. Indeed, so far as artillery, airplanes, and artillery ammunition were concerned, we fought the war entirely with foreign purchases.

These last two paragraphs are not wholly pertinent to the question of the value of a college training, but as America stands at the forefront in wealth and manufacturing, and as China stands at the bottom of the ladder among civilized peoples in wealth and manufacturing, just so America leads in education and the use of power while China is lowest in those prime requisites of wealth, health and happiness. (*Continued on page* 381)

Multiple Highways for Traffic



The above illustration shows our artist's conception of the multiple highway of the future which will eliminate traffic congestion. Separate north bound and south bound roadways will be provided for pleasure cars and taxis, buses and trucks.

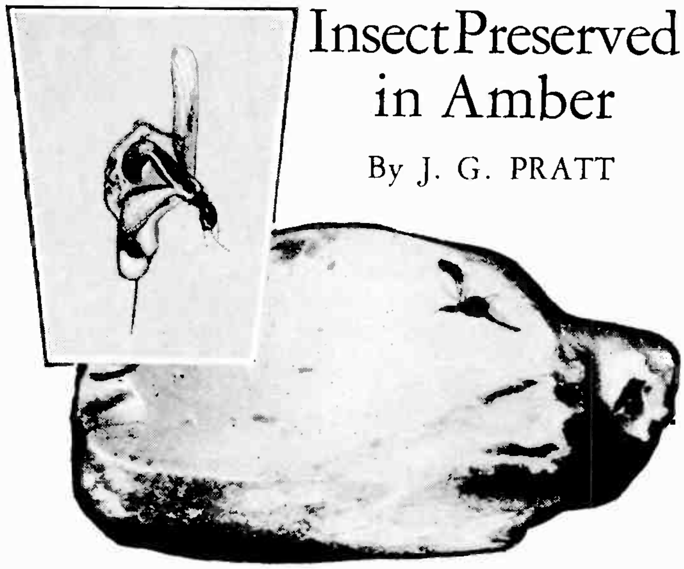
IN order to relieve traffic congestion in New York and other large cities, a multiple highway has been suggested. The first four decks or tiers on the bottom could be devoted solely to trucks providing two north and two south bound roadways. The next four decks may be used exclusively for buses and the next four tiers or road levels would be used only by pleasure cars and taxis. The multiple highways, except for the top deck, would be enclosed and protected against the weather. Enormous parking space would also be provided on each level. For each highway it would be necessary to sacrifice one north and one south thoroughfare. It has been suggested that Ninth Avenue, in New York City, be used for such a highway, because at present this street is undeveloped.

The elevated motor express highway on the west side of New York City has greatly helped traffic and its footings have been designed to permit the addition of a second deck or tier. However, at best, it can only furnish temporary relief and within a comparatively short time will doubtlessly be overtaxed. The cost of constructing an elevated highway would be small when compared with the yearly losses sustained by the increase in traffic congestion which is estimated to be $500,000,000 in New York City alone.

The cost of such a highway would be between $100,000,000 and $200,000,000.

Insect Preserved in Amber

By J. G. PRATT



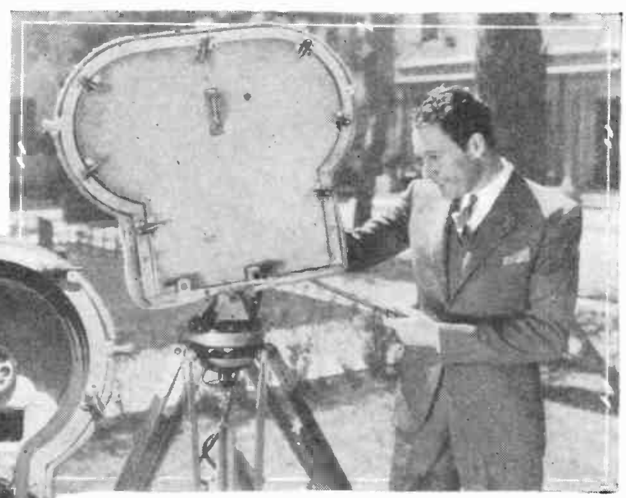
The above photograph shows a species of white ant which was preserved for about 2,000,000 years in a piece of amber.

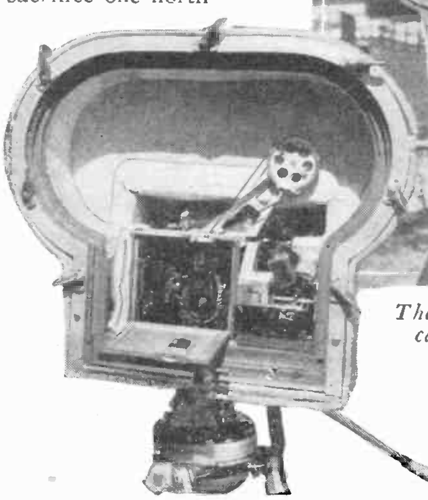
EXTENSIVE mining operations are conducted on the East coast of Prussia for Baltic Sea amber or succinite, which occurs in the Lower Oligocene strata, and appears to have been partly derived from an earlier Tertiary deposit (Eocene). In the Baltic Sea amber well preserved fossils of plant life and insects which existed on the earth between 2,000,000 and 4,000,000 years ago are often found. The accompanying photographs show a species of termite or white ant which was thus preserved. It is difficult to photograph these specimens because of the reddish color of the amber, and it was found necessary to employ a powerful spotlight from above and another from underneath which were used alternately during the exposure.

Noiseless Camera

By DAYTON STEPP

A NOISELESS motion picture camera has been perfected at the Paramount, Hollywood studios, and is used in filming sound motion pictures. The camera is enclosed in a sound-proof casing and the mechanism and electric motor is encased in layers of rubber, cork, cloth and special fibre board to insure complete sound insulation. Thus, all clicking and noise is kept from the recording microphones. The stuffy sound-proof booths in which the camera men were previously compelled to work have been eliminated by the new noiseless camera. Placing the camera and operator in a booth was cumbersome.

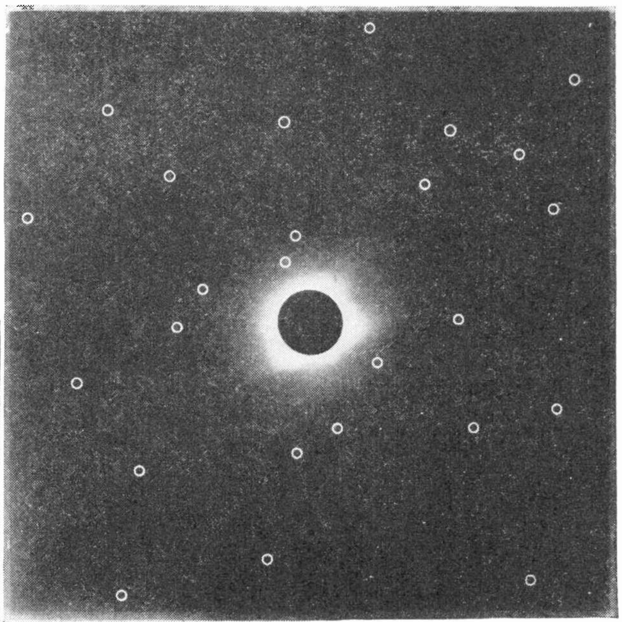


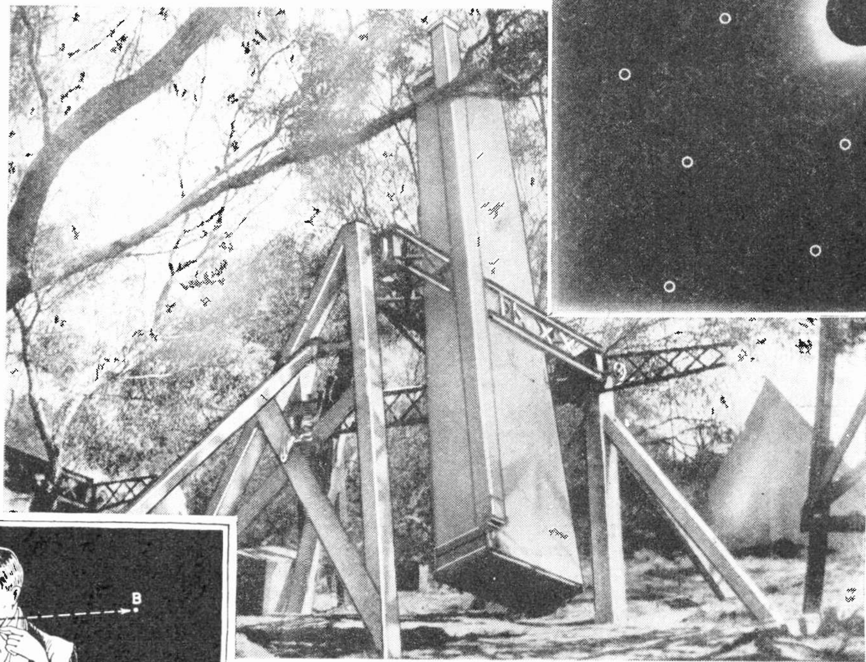


The above photograph shows the noiseless movie camera in use, and at the left an interior view.

Space, Time *and* Relativity

By DONALD H. MENZEL





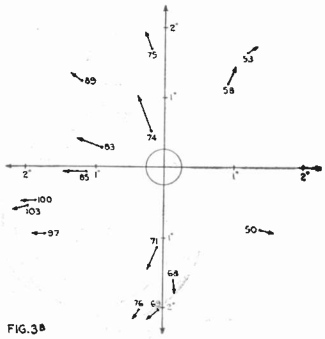


FIG.3B

The photograph in the upper right-hand corner shows the sun and surrounding stars denoted by circles. Figure 3A shows a scale of deflections relative to the size of the sun, the circle at the center which is magnified 2,500 times, that is, the arrows are 2,500 times too long. The photograph directly above shows one of the huge cameras used to obtain pictures of the sun and stars.

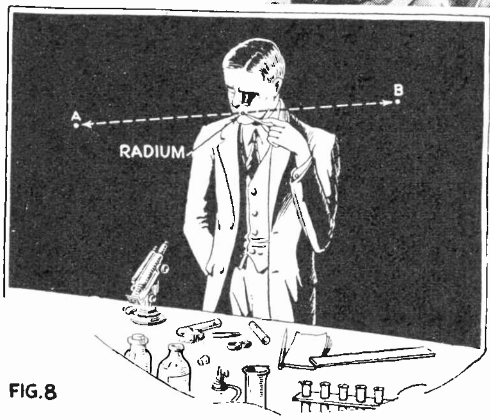


FIG.8

A piece of radium ejects in opposite directions two alpha particles traveling at the rate of 100,000 miles per second. This is illustrated at the left.

"THE proof of the pudding," so runs the old adage, "is in the eating," and relativity is no exception to the statement. In past articles I have tried to show you how, step by step, the theory of relativity developed. First of all, I must emphasize that no one insists that the theory must inevitably be true. There are certain assumptions that we made, and the correctness of our theory depends upon the truth of these assumptions. A mathematician might work out a theory of insurance premiums along the line that the average life of a man is ninety years. But if he tried to test his theory in actual practice, the company would soon go into bankruptcy, not because his mathematics are wrong but because the original postulates are wrong. There are, of course, ample statistics available to guide him in judging man's average life. But if he had not been able to refer to these, I suppose that he would have had to start with some plausible assumption. I can imagine with what anxiety he might then await the company's annual balances, for by that method alone could he judge of the accuracy of his postulate.

So it is with relativity; we start with assumptions that may or may not be correct. We develop these assumptions mathematically, and then we test, not the correctness of our figuring, but the validity of our hypotheses by the results.

Two Fundamental Hypotheses

THERE are two fundamental hypotheses, both of them quite simple as far as they go. The first is *all motion is relative*. To elaborate, we may always measure our speed relative to some specific object—the earth, the sun, a star, or a nebula. But it never is possible for us to find out for certain which is moving, we or the object; *i.e.*, we can determine *relative* but not *absolute* motion.

This postulate is reasonable, but not necessarily true. If there is a great sea of that hypothetical material, the ether, through which the stars and the planets fly like birds through the air, we should be able to refer our motion to this stationary sea. Many beautiful experiments have been devised for the express purpose of detecting such motion, but all have failed. In fact, Einstein's theory of relativity is an attempt to find a reason for the failure of the experiments. But more of this later.

The second postulate had not the experimental backing of the first. It requires that all physical laws appear everywhere to be exactly uniform, whether we are moving or stationary, or whether we are in an intense field of gravitation. One consequence of this postulate is that, no matter how fast an object may travel, it cannot exceed the speed of light. A slightly more accurate statement would be, *No measured velocity will be greater than that of light.* Postulate number two is a stumbling block for many. "Why," you ask, "is the speed of light so fundamental?" I confess that I do not know. "Why not the speed of sound?" I can answer that one, the point being that we know of many cases where objects travel faster than sound—the planets, projectiles.

We might have built up a relativity hypothesis with the speed of sound as fundamental, but our theory, like the insurance company, would

(*Continued on page* 370)

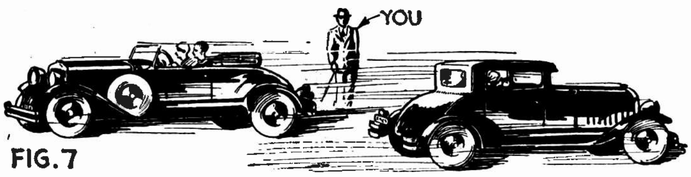


FIG.7

Two automobiles pass an observer at the rate of 60 miles per hour. If you were seated in one of the cars and observed the speed of the other, you would find a value of 120 miles. According to the theory of relativity, your prediction will be verified to a high degree of accuracy. However, see Figure 8.

Motor Hints

Conducted by George A. Luers

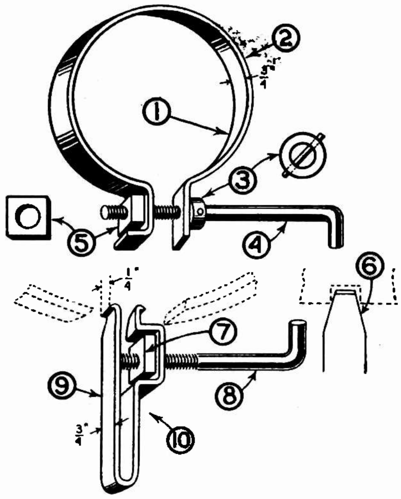
Handling Piston Rings

TOOLS for removal of rings and replacements, which will be appreciated by any owner, are shown in the attached sketch. These are duplicates of some shop-made tools used by one careful owner.

The tool for compressing the rings is made from a strip of steel, one length of iron rod, small steel collar and a quarter-inch nut.

The expanding tool is similarly made from a strip of steel rod, threaded at one end, and a nut.

The simple details of these tools will be apparent by reference to the illustrations. Make up a set of these tools in your spare time and you will find them not only time savers, but a means to save piston rings from being broken or mutilated.



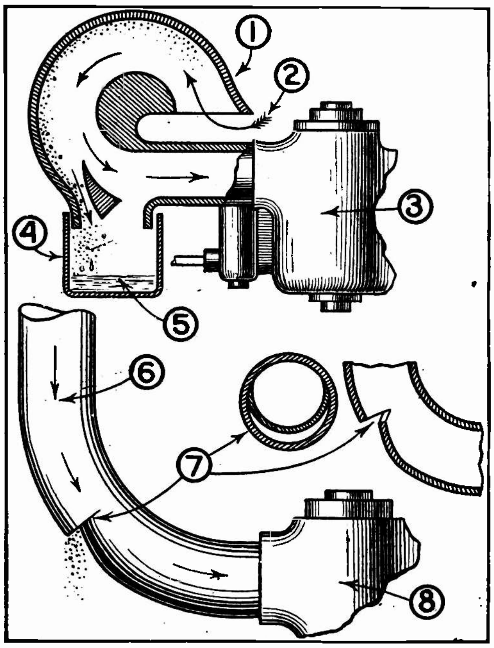
Above—1, is a 1/16" steel strip, 2, piston ring compressor, 3, collar, 4, ¼" rod, 5, ¼" nut, 6, chamfered end, 7, ¼" nut, 8, ¼" rod, 9, ⅛" steel strip and 10, piston ring expander.

Cleaning Carburetor Air

THE upper part of the sketch is a section typical of the usual air purifying operation.

In the sketch it will be seen that the air is diverted from a straight path by a curved intake. The heavier particles of grit are thrown against the wall and find their way into a bowl on the bottom of the cleaner. This bowl is made detachable for cleaning and is usually filled with oil or grease to retain the grit.

A simpler means for air cleaning, which is of use on any car having a curved intake breather pipe to the carburetor, is shown in the lower section of the sketch. In this method a slit is made in the pipe, and the edge is forced in, to separate the grit from the air.

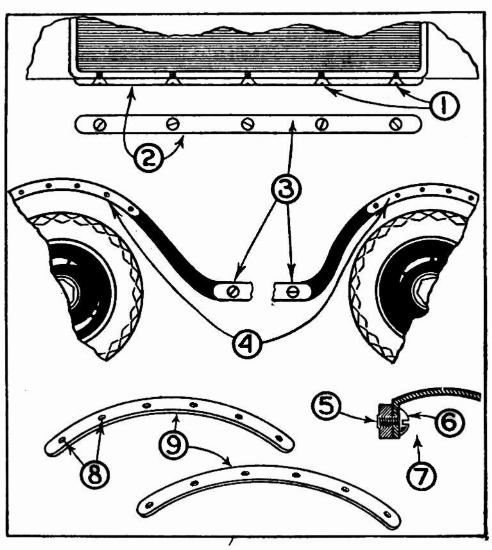


Above—1, section of air cleaner operation, 2, air flow, 3, carburetor, 4, clean-out bowl, 5, oil or grease in collector, 6, intake heater pipe, 7, section through pipe, 8, carburetor.

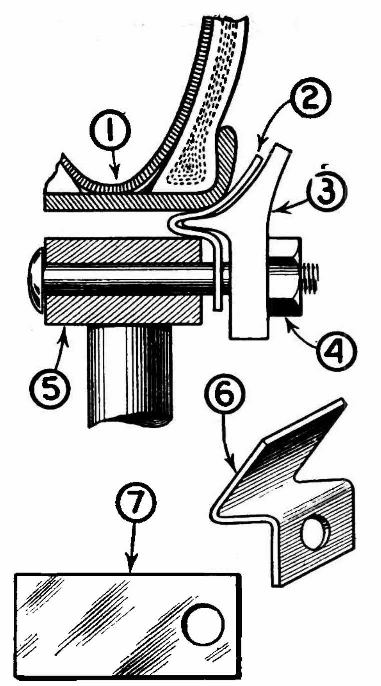
Fender for Heavy Traffic

TO reinforce the fenders and running boards, strips of brass one quarter inch by one inch wide can be attached in the manner shown in the appended sketch.

These strips are made for attaching to the outer edges of the fenders and running boards. Small screws secure these solidly in place where they serve to reinforce the parts to prevent injury, both in traffic and also while going into parking spaces.



Above—1, screws, 2, brass strip, 3, reinforcement and rubbing strip for running board, 4, same for fender, 5, brass screw riveted over, 6, brass screw, 7, section showing strip secured to fender, 8, tapped holes, 9, brass strips curved to fit fenders.



Above—1, section through tire at rim, 2, metal shim, 3, rim lug, 4, rim lug bolt, 5, felloe of wheel, 6, rim lug shim bent to shape, 7, shape of sheet metal before bending.

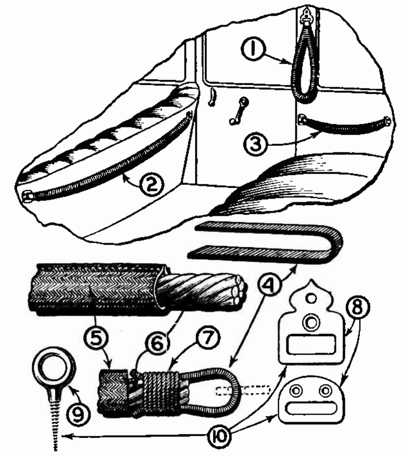
Tightening Worn Rim Lugs

WHERE wedge type of rim lugs wear to the extent of being loose and squeak, these may be tightened through the insertion of shims of sheet metal, as shown in the sketch, thus making the lugs tight and keeping the tire running true.

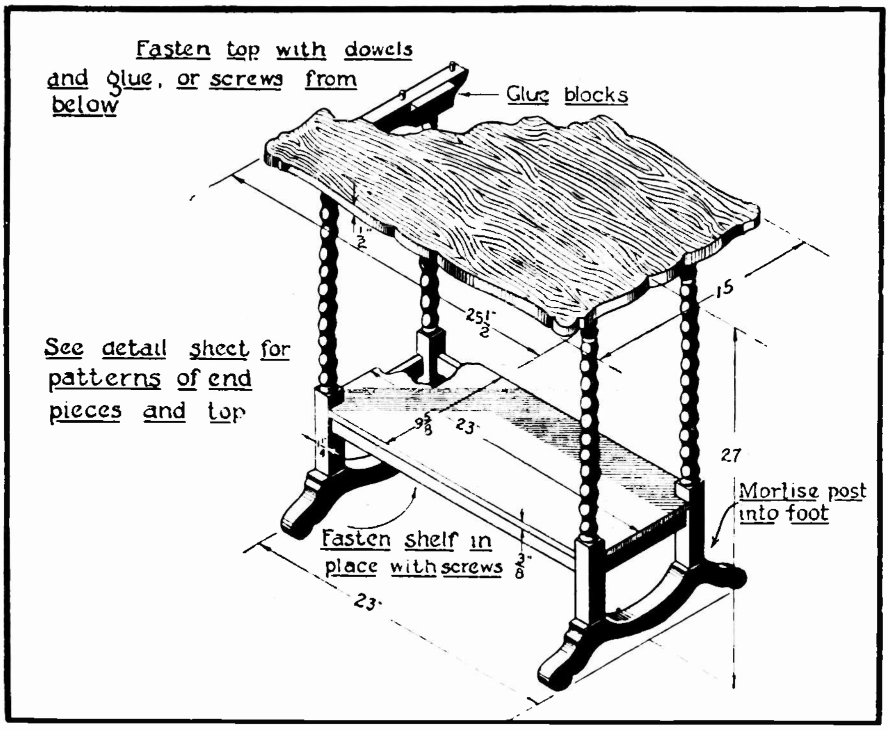
An ordinary piece of tin serves for making these shims, simply cutting strips about one inch wide, punching a hole for the rim lug bolt and forcing it into place with the lug, which shapes it into the space between the rim and the wheel.

One wedge will usually suffice. However, it is easy to add one above another to correct excessive wear.

This repair can be made quickly, will prove as solid as the original lug, and one of the main advantages is that it is applicable without delay or cost. (*Continued on page 372*)



Above—1, assist cord, 2, rope, 3, cloak rope, 4, leather, 5, fabric, 6, cotton rope, 7, twine, 8, ⅛" brass, 9, screw eye, 10, end fasteners.



All dimensions of the table are given in the above drawing. See detail sheet for patterns

A Small Table With Turned Legs

Wood Turning

By
H. L. WEATHERBY

Article Number Twelve In a Series

ANOTHER table is always welcome; particularly when it is a table that has so many uses as those of the "Small Table," illustrated this month. It will grace any room in the house, with the possible exception of the kitchen, and look very much as if it "belonged." It is light and easily carried from one room to another, as need for a table arises. It would be an excellent table for mother's sewing, or dad's radio, or it will look well in the living room with books and flowers on it, and it can be used in the hall as a telephone table. In other words, it is just a very convenient, beautifully designed and well-proportioned small table.

Although listed as a turning project, there is not a great deal of turned work involved in its construction. What little there is, however, is rather difficult, and calls for the convex concave cuts explained in detail earlier in these articles, and mentioned at that time as among the most difficult of turning operations. Another difficulty that will arise will be found in the ever-present vibration that goes along with slender work. The readers of these articles should know by this time, however, how to handle long, slender pieces to secure best results, and further directions concerning this point would be a mere repetition of what has gone before. Great care should be taken to secure uniform turning and well-rounded curves. A full-size template, made of cardboard, may be an aid in securing uniform results.

The completed table with turned legs is shown in the above photograph.

The Material

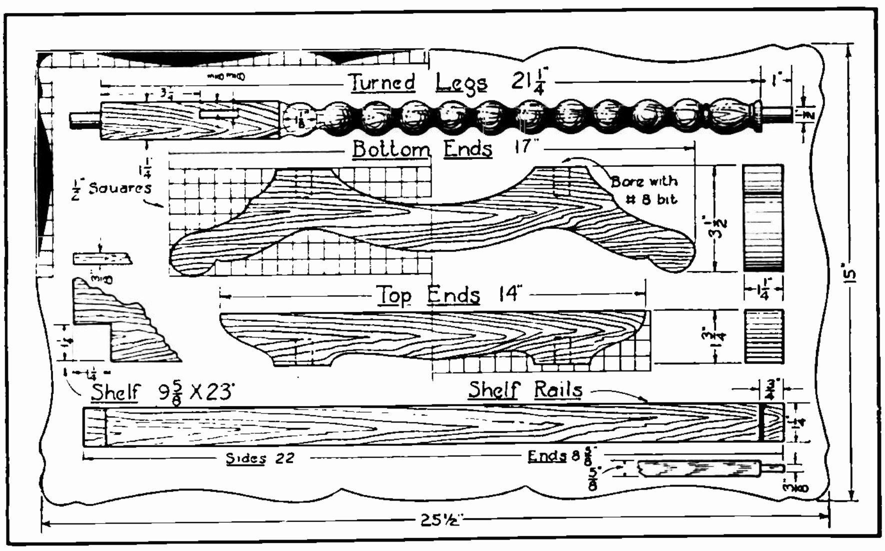
FOR furniture of the period which this table represents, nothing takes the place of mahogany. Walnut runs a close second, and then, lacking either of these, a good substitute will answer if properly stained and finished. Mahogany works easily, is not too hard, and takes a beautiful finish with less trouble than do most cabinet woods. Its price is sometimes prohibitive and probably ranges from thirty to fifty cents a board-foot, depending upon locality. Walnut is somewhat cheaper and will be little more difficult to work. Poplar or other substitutes, such as maple or beech, will cost only a fraction as much as either of the hardwoods mentioned and will prove to be very satisfactory.

Buy your material then according to the following list, keeping in mind that these are finished sizes.

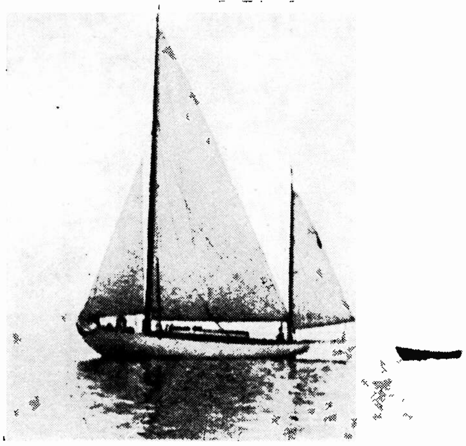
One top, ½" × 15" × 25½".
Four legs, 1¼" × 1¼" × 23¼".
One shelf, ⅜" × 9⅝" × 23".
Two shelf rails, ⅝" × 1¼" × 22".
Two shelf rails, ⅝" × 1¼" × 8⅝".
Two top ends, 1¼" × 1¾" × 14".
Two bottom ends, 1¼" × 3½" × 17".
Dowels or screws to fasten top to frame.

Scraps to glue to underside of top at ends—"glue blocks."

(*Continued on page* 364)



Details of the turned legs, bottom ends, top ends and shelf rails are given here.



HOME MOVIES

How to Dress Up the Vacation Film in a Professional Manner

Conducted by DON BENNETT

"THE average home-made film, from the viewpoint of one outside the interested circle of those in the films, lacks one thing—interest. This interest factor covers several details, such as dramatic values, continuity, editing and appropriate and explanatory titles. There is usually no direction and no acting in the personal film."

"But, Mr. Jones——" The president of the Rockland Movie Club rose to his feet to remonstrate, "we want our films to be personal, not carbon copies of Hollywood's products!"

"True, Mr. Blake, but is that any reason why your personal films should be inferior, lack vitality, be dull and boring to the visitor whom you force to sit through an evening's exhibition of your films?

"Don't you want your films to earn applause instead of comments that must be polite? Isn't 'Show that one again' better than 'Very nice films, Mr. Blake'?

"If you analyze the professional photoplay, you will see it is the reflection of life as it might be or even is really lived by the characters of the story. True, it may be fiction, but isn't fiction what our writers think life is, or what they want it to be? Don't we all act, every day, in every phase of our existence? Don't we try to '*act natural*'? That is what good acting on stage or screen amounts to, the ability to be natural in the part one portrays.

"You know, I have been through all the stages of home movies that you club members are enjoying or suffering. When the home outfits were first put out, I filmed everything about my daily life that could be put on film. When vacation time rolled around, my camera went with me, and Mrs. Jones and I took turns making shots so that each would appear throughout the film. Whenever an obliging stranger could be prevailed upon, we both appeared in the scene. My first films were just what I am asking you not to make, a hodge-podge of meaningless shots, no thought of continuity or planning. Titles were put in after the films were almost worn out and all our friends had seen them. Just a waste of money.

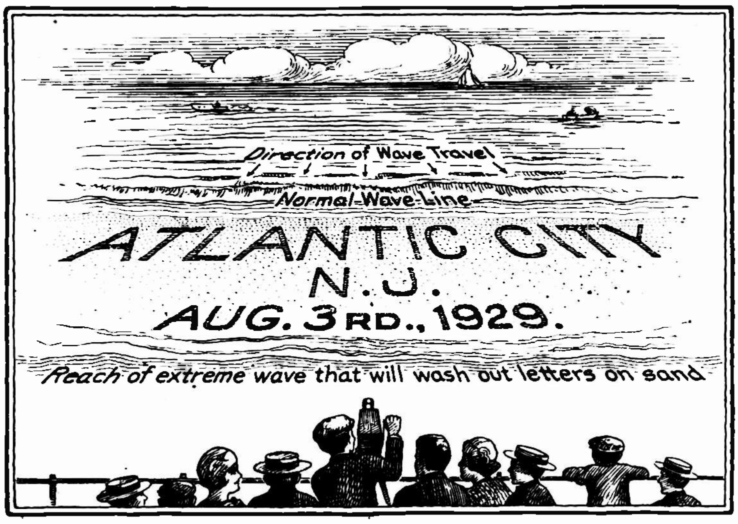


Fig. 1—The above picture shows how an artistic sand title is made.

"Last summer was vastly different, and this summer I hope to improve my vacation film still more. We have planned a trip that will last a month, motoring to the seashore, staying there a few days and then going up to the mountains. In planning our trip, planning the film record of it was the second step before we had decided on hotels or anything else. I have with me the continuity. Would you like to hear it?"

"Yes." "We'll find fault with it." "What's a continuity?"

"I'll answer the last first. A 'continuity' is merely a plan of what you are going to shoot. It provides the scenes and provisional titles, but everything is subject to changes on location. If a better shot presents itself than the one we have planned, we shoot both and select the best one after we have returned home. Well, here's the continuity. As I read it, I will make comments on the handling of each scene.

(*Fade in*) *Main title*—Vacation, 1929 (*Fade out*)

(*Fade in*) *Title* 1—A record of our adventures and misadventures on our annual vacation. (*Fade out*)

Scene 1—Fade in on our car (*Continued on page* 380)

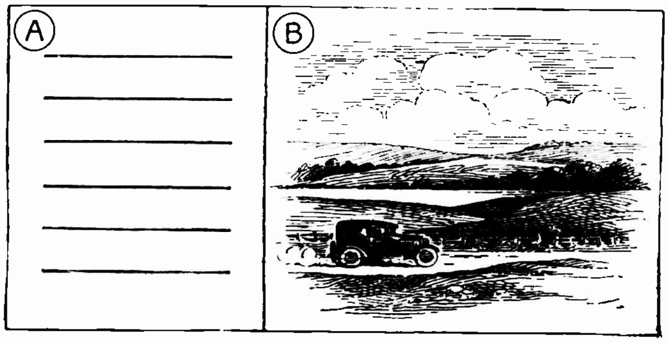


Fig. 2, above, shows an example of horizontal line composition which covers most landscapes or flat country.

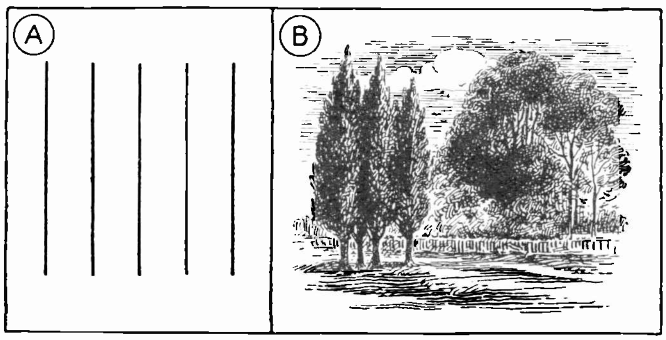
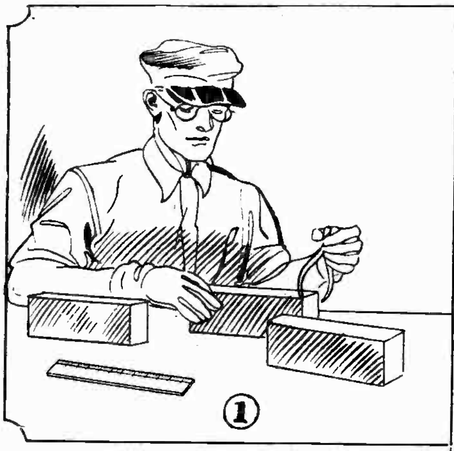
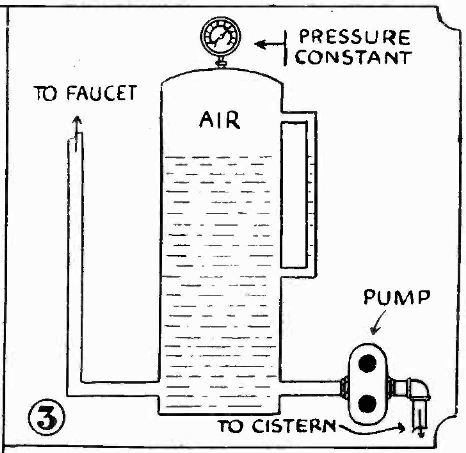


Fig. 3—Showing an example of vertical composition, mostly found in tall buildings or trees which stand out individually.



A mechanic wishes to construct a set of gauges from three blocks which when used singly or in combination will give him any integral number of inches from one to as high as possible.



The above pressure tank has an automatic pump which keeps the air in the top of the tank at a constant pressure. The drawing at the left shows a thermometer thrust in boiling water. There will be a momentary drop in the mercury column before it rises.

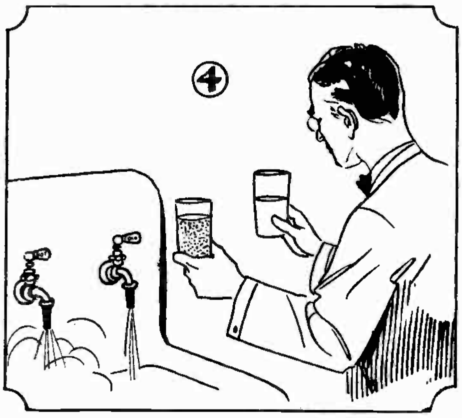
Scientific Problems and Puzzles

By ERNEST K. CHAPIN

A MECHANIC wishes to construct a set of gauges consisting of three blocks which when used singly or in combinations of two or three placed face to face will give him any integral number of inches from one up to as high as possible. What should be the dimensions of each block and what is the maximum number of inches he can measure with them?

THRUST a thermometer into boiling water and there will be a momentary drop in the mercury before it begins to go up. Why?

A PRESSURE tank is often used to supply cistern water to homes. If the pump works automatically so as to keep the air imprisoned in the top of the tank at constant pressure will the volume of air in the top of the tank gradually increase, decrease, or remain constant? And why?

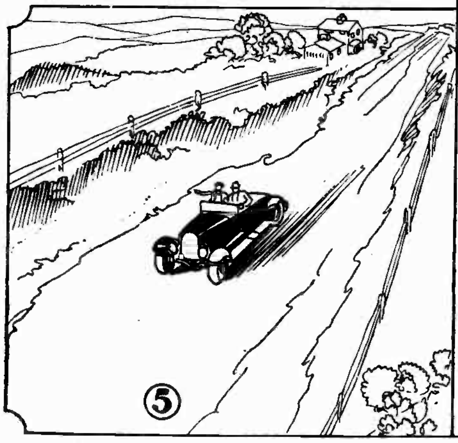


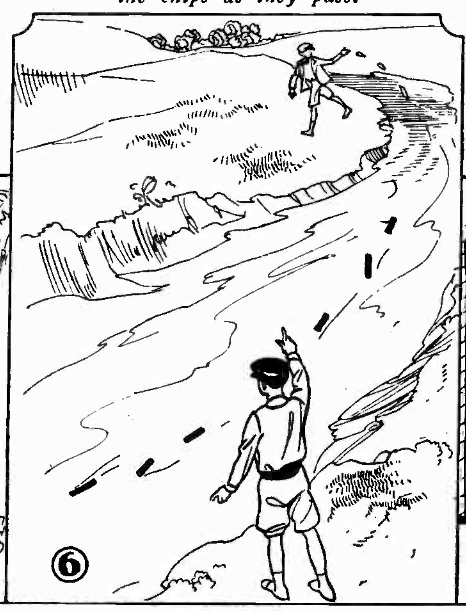
Hot water often appears milky white when drawn from the faucet. Cold water seldom appears this way. Below—a river flows at the rate of 300 ft. per minute and a boy walks 200 ft. per minute down stream throwing chips in the water. Another boy counts the chips as they pass.

HOT water often appears milky white as it is drawn from the faucet. Water from the cold water pipe seldom appears that way. What causes this?

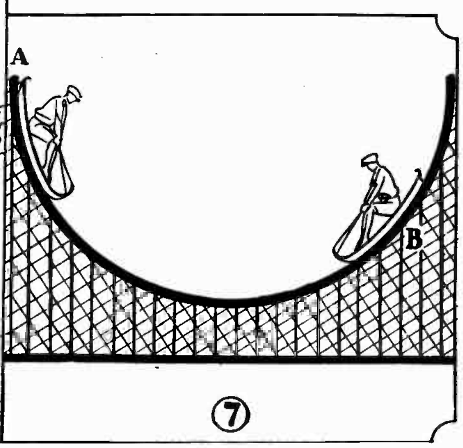
BOBBY and his daddy are in the habit of taking a drive every Sunday. If they travel at their usual speed they find that they can motor to the city and back in four hours. One day Bobby made the observation that if they had traveled at twice their usual (*Continued on page* 368)

Bobby and his father can motor to the city in four hours. Bobby made the observation that if they travel at twice their usual speed toward town and half that speed on the way back they would have turned around at his uncle's house 12 miles from town, and would have spent just four hours on the trip.





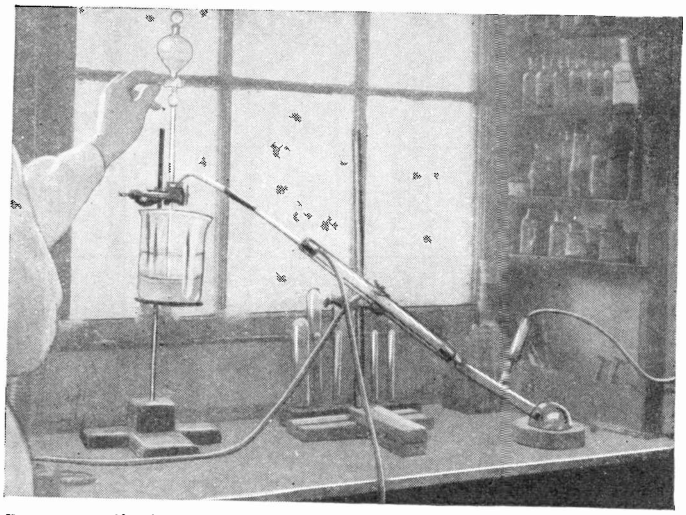
If a toboggan slide were shaped like an inverted cycloid, which toboggan would reach the bottom first, one that starts at the top, as at A, or one that starts half way from the top, as at B?



Experiments With Acetic Acid

By DR. ERNEST BADE, Ph. D.

An Interesting Field of Entertainment is Offered to the Amateur Chemist in this Article

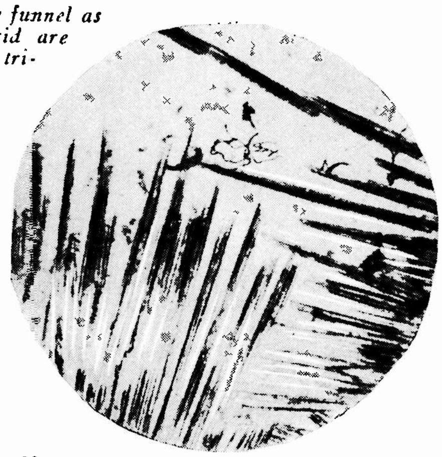


Prepare a flask for distillation with a dropping funnel as shown above. Twenty-four c.c. of acetic acid are placed in the flask and 12 c.c. of phosphorus trichloride in the funnel.

A LARGE number of different kinds of chemicals and raw products for the industries are obtained with the aid of acetic acid. Although the acid itself is more or less weak in character when compared to mineral acids, it is one of the strongest organic acids and as such it combines with a large number of other substances, transforming them into new products of great value.

The addition of a halogen and more especially of chlorine, since this is the cheapest on a commercial scale and is therefore used most extensively, changes the acetic acid into the acid chloride also known as acetyl chloride. This is prepared by using two distilling flasks, the larger one holding 24 cc of glacial acetic acid while the drop funnel, which holds 12 cc of phosphorous trichloride, leads to the acetic acid. This flask also connects to a condenser and a distilling flask as a receiver. The open end of the receiver is connected to a calcium chloride tube. Moisture must be excluded and the free end of the calcium choride tube should lead to the fume cupboard to take care of the hydrochloric acid gas given off during the reaction. Cool the flask with ice cold water as the phosphorous trichloride is slowly added to the acetic acid. Then slowly heat the water bath to 40° or 50° C and keep at this temperature until no more gas is given off and two layers of liquid collect in the distilling flask. Then heat the water to boiling and the upper layer of acetyl chloride will pass over. To purify the acetyl chloride redistill, keeping the temperature of the thermometer in the flask between 50° and 58° C. The same precautions should be taken to keep out moisture by using a calcium chloride tube. The acid chloride has a pungent odor and fumes in the air.

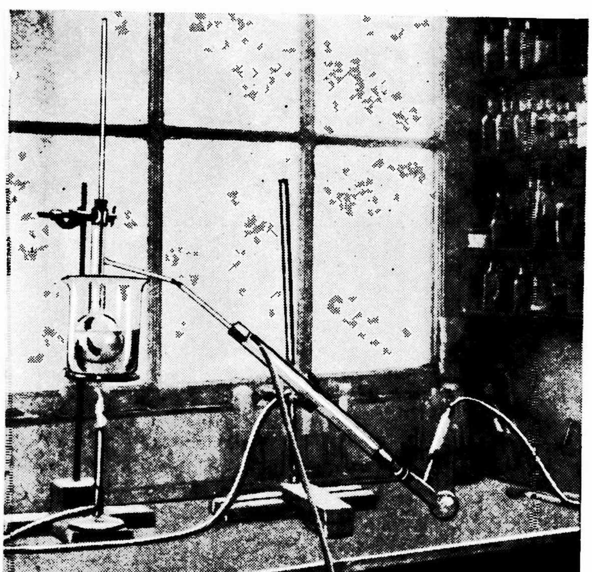
When water comes in contact with acetyl chloride, hydrochloric acid is formed while the original acid remains behind, heat being generated at the same time. This is shown by adding a few drops of acetyl chloride to 5 cc of water. If equal quantities, about 2½ cc of acetyl chloride and ethyl alcohol are mixed under cold running water, and if ½ cc of water is added and mixed, still keeping the test tube cold, ethyl acetate will separate if made weakly alkaline with sodium hydroxide or the addition of a little common ordinary table salt. Acetanilide is formed when 1 cc of acetyl chloride is slowly added to 1 cc of aniline, cooling the test tube as the addition is being made. The acetanilide then separates out in plates on the addition of 5 cc of water. This chemical may be purified by recrystalizing from boiling water.



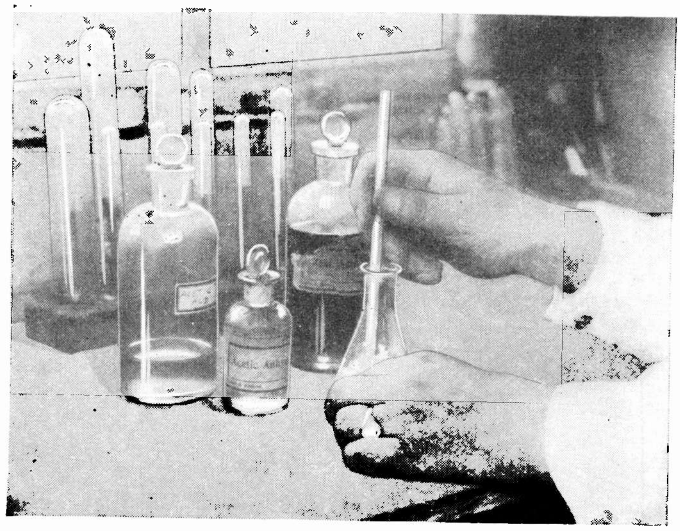
Above are some crystals of acetanilide as they appear through a microscope.

The organic anhydrides may be considered as two molecules of an acid from which a molecule of water has been removed. They are prepared from the acid chlorides and the sodium salts of the same acids. By taking the sodium salt of one acid and the acid chloride of another a mixed anhydride is prepared. Acetic anhydride, the simplest member of the series has a pungent odor but does not fume in the air. The anhydrides have a higher boiling point than the acids.

Acetic anhydride is prepared by fusing sodium acetate and powdering quickly and placing in a (Continued on page 369)



The receiving flask used in the first experiment should be placed in boiling water and the distillate redistilled as shown.

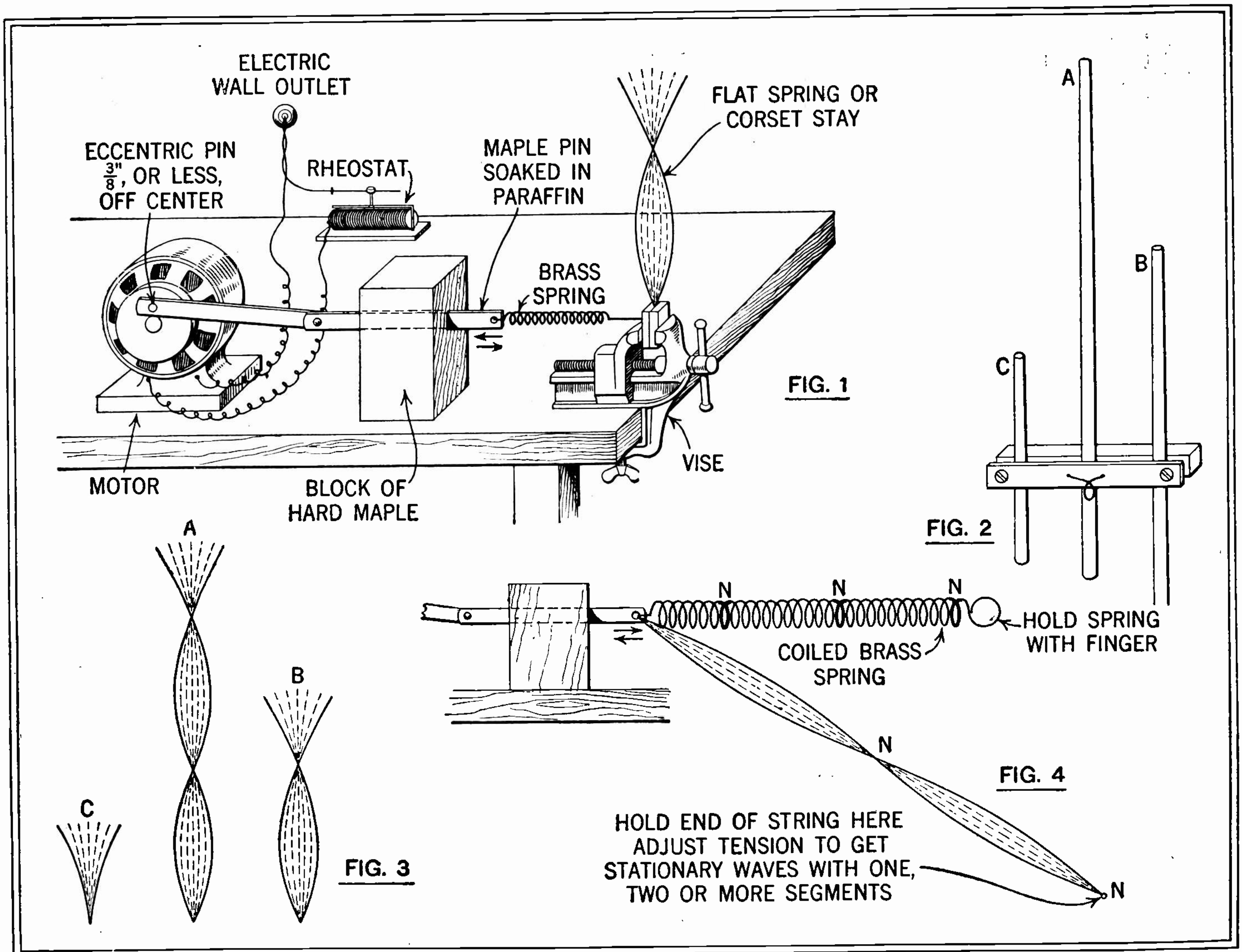


In order to make cellulose acetate, some cotton is pressed into a flask and 20 c.c. of acetic acid, 6 c.c. of acetic anhydride and a drop or two of sulphuric acid are added.

EXPERIMENTS WITH STATIONARY WAVES

By ERNEST K. CHAPIN

FASCINATING experiments can easily be performed with simple apparatus. A motor, a flat metal spring, a piece of string and a coil spring are all that are needed to produce stationary waves or points of no vibration, called nodes. Complex vibrations in long springs and stationary waves in coil springs can all be demonstrated as described below.



In the above illustration Fig. 1 shows an arrangement for producing stationary waves in a flat metal spring while Fig. 2 shows three rods which vibrate as shown in Fig. 3.

Fig. 4 shows how the same apparatus can be used to produce stationary waves in a coil spring and also in a stretched cord. The points marked N are called nodes and appear stationary.

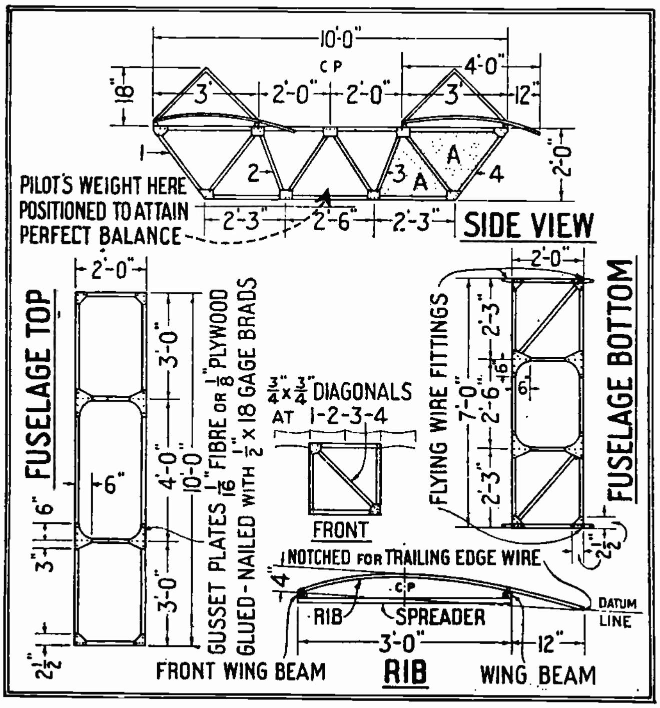
ANYONE with a small electric motor can perform some fascinating experiments with stationary waves. Fig. 1 shows the arrangement which will produce excellent stationary waves in a flat metal spring. The motor moves a bar back and forth through a hole in a block of hard wood. The pin, in turn, transmits periodic impulses to two or three metal springs clamped in a vise at the edge of the table.

If the motor is started slowly, and its speed gradually increased by means of a sliding rheostat, it will be found that at first none of the springs vibrate appreciably. At a certain critical speed, however, if reached, the longest spring, A, will begin to vibrate vigorously while the others still appear undisturbed. Increasing the motor speed will cause A to stop vibrating but will soon bring B into response. At still higher speed C will vibrate while the other two springs are practically quiet or else are vibrating in one or more segments as shown in Fig. 3. With proper adjustment of the motor speed the longest spring may be made to vibrate in (Continued on page 369)

Simple glider can be built at home by young boys at a low cost of construction

This GLIDER

SINCE writing my article on the sport plane powered with the "Chevrolet" automobile engine, I have received numerous requests to present an article on glider construction.



A side view of the glider together with details of the fuselage top, rib, and fuselage bottom are given above.

In accordance with SCIENCE AND INVENTION'S wishes, and along with my own views on the subject, I have decided to present at least one such article for amateur builders for the following reasons.

Many a lad from the ages of 12 years to 16 years is imbued with the desire to build a glider, and while enjoying the incomparable sport gliding affords, he will receive very valuable experience both in the construction and flight ends of the game, but is discouraged at the high technicality and cost of such a venture as presented in most articles of this kind.

It is my desire in writing this, the first of my articles, to assure the youthful builder that a real glider may be built both simply and cheaply by the average 12- to 16-year-old lad—and it is boys of this age that are most interested. At this age the boy is just becoming imbued with a burning desire to fly, and naturally the glider offers his best possible chance of realizing his ambitions.

So this first article is presented solely for the lad of 12 to 16 years, the substance of the same being a non-technical and simple description of how to build a small glider at least cost and with least labor.

This glider is really small, but as complete for flight presents approximately 92 sq. ft. of lifting surface, and as the glider weighs under 50 lbs., and is designed for a live load averaging 100 lbs., the total flight load will not exceed 150 lbs., giving a square foot load factor of less than 2 lbs. per sq. ft.

This glider is purposely designed of small size, expressly for the boy, and while it may be flown successfully by a heavier person, the flight speed would have to be faster to make up for the heavier wing-loading and the landing speed might easily be dangerous. So if you happen to be out of this class, do not be disappointed, as my next article will deal with a larger glider for youths of 18 to 20 years, or average weight of 125 to 175 lbs.

In choosing the tandem type, we find many advantages—short span eliminating many brace wires—greater strength—much simpler construction, as you will find by comparing these drawings with biplane or the regular monoplane type. The machine may be said to be tailless, as the fuselage sides at the rear section are covered to act as a rudder or fin surface, and the rear wing acts as the stabilizer and our glider is more stable than the usual biplane or monoplane glider.

Then again—it has larger lifting surface with smaller size of ship as a whole, and the construction is the last word in simplicity. Each wing (fore and aft) is built up in one panel, being a complete unit and interchangeable at both positions (fore and aft).

No movable controls are employed, control being effected by shifting the body. This not only saves labor and weight, but adds to the simplicity of the whole, and the body-shifting method is very effective in a small plane.

Many sustained flight records have been set in a tandem glider of this type, but this particular glider is not designed for such work; simply for the boy to step between the longerons, lift ship up and run down hill into the teeth of a steady breeze till the glider lifts him from the ground and he literally slides down hill on a cushion of air.

More will be said of the methods of flight and of precautionary methods—things to do and things that you should never do with a self-respecting glider and yourself.

Now for the material layout.

Construction

FIRST make certain that all material is of the highest grade. All fittings are of mild carbon steel, bolts semi-hard, and all lumber straight-grained spruce, free from knots.

Material Lay-out

4 Wing beams, 12' × ¾" × 1¼"
14 Wing beam spreaders, 3' × ¾" × ½"
26 Wing ribs, 4' 2" × ¼" × ¾"
4 Fuselage longerons, 10' × ¾" × ¾"
5 Fuselage longeron diagonals, 10' × ¾" × ¾" (To be cut for verticals and diagonals)
150 ft. No. 16 guy wire—steel piano wire
1' × 1' × 1/16" Sheet steel—mild carbon or cold rolled.
Bolts—so-called stove bolts.

Miscellaneous

10 yards cloth—good grade sheeting or muslin
Dope—boiled starch and water
Varnish—optional
Tacks—ordinary small tinned carpet tacks for leading edge.

Sew cloth to trailing edge wire and sew loop around rib and then cloth every 6" along each rib to hold cloth to rib form when in flight. Ordinary store string will suffice for this.

Spruce, and good spruce, must be used for framing to insure the utmost rigidity with the minimum of weight.

The balance of material has been selected mainly for easy accessibility and economy to the youthful builder.

In constructing the wings, lay two wing beams 12' long on flat floor surface spaced exactly 3' apart, and squarely aligned.

Measure off and mark every two feet, including the beam ends.

Lay the spreaders for the wing, which are 3'×¾"×¾", across beams at these positions, drill for and bolt firmly with 3/16" stove bolts, washered both under the head and nut.

Draw just tight enough not to rupture spreader ends or weaken main beams.

Ribs are 4' 2" strips ¼"×¾" and are nailed (and glued) with small brads about ½" long, arching the ribs when attaching so that the completed wing has a curvature of

Easy to Build

By
George A. Gerber

approximately 4″ at its deepest point midway between the two beams, and this 4″ camber being from top surface of rib to datum line, as illustrated.

This arching is easy because the spreaders hold the beams rigidly in position and once arched and attached, the ribs maintain this curvature.

It is a good plan to wrap each rib attachment point with several turns of "store" string and daub with glue.

The drawings make the construction quite clear.

The two ribs in each wing (both wings are built up exactly alike) are cut away at longeron position, permitting the finished wing to be bolted directly to the fuselage longerons.

The trailing edge is made by stretching the No. 16 piano wire along the trailing tip of each rib, which has been notched slightly to receive it, and is attached with light tin and brads, or any other method which may suggest itself to the builder.

Do not stretch this trailing edge wire so tight that it will break the ribs when cloth is doped and shrinks taut.

It is a good plan to run a diagonal brace from the trailing tip of the outside ribs to the rear beam at the second rib attachment position to stiffen the outside ribs against collapse from strain of the cloth shrinking against the wire edge.

Cover the wings with sheeting or muslin, stretch nicely and uniformly to remove wrinkles, but not drum-tight. Cover top surface of wing only.

Tack at leading edge, sew to wire trailing edge, and sew loops around the ribs and through cloth at 4″ intervals along the rib chord to insure the cloth holding to the rib when supporting the load in flight.

At greater expense regular wing dope may be used, but the most economical means of air-proofing the fabric is to "dope" with a boiled starch solution which mother will probably help you make.

The starch should be boiled just enough to become a light paste, and it is spread on lightly with a paint brush. Two coats should suffice, and one coat will do nicely if put on evenly. This is not a weather-proof finish and the glider must be housed from rain and general dampness.

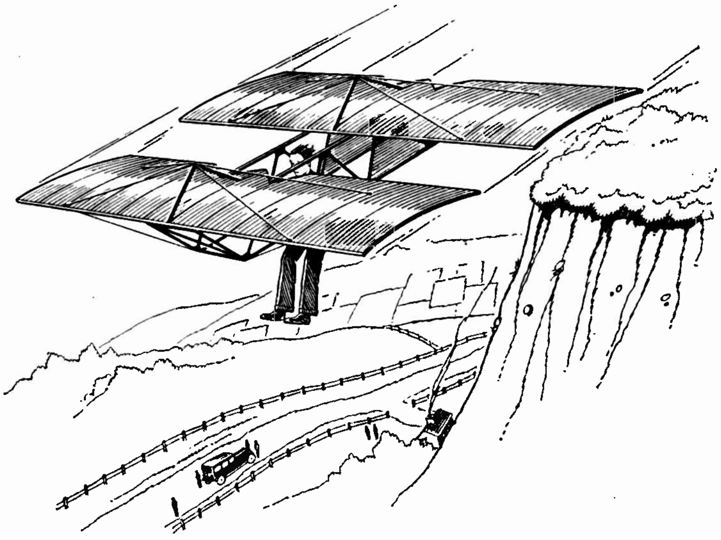
The fuselage is built up truss style, using 1/16 fibre for plates, glued, and nailed with ½ × 18 brads.

Study the drawings carefully and you will learn more than I could write in hours as regards general assembly. You must use plenty of caution in the matter of your workmanship.

The fuselage is square in section with the pilot's position midway between the approximate center pressure average of the two wings, this position being found by testing.

The usual method of pilot's body suspension is to hang the arms over the lower longerons so the body weight rests on the longerons under the armpits.

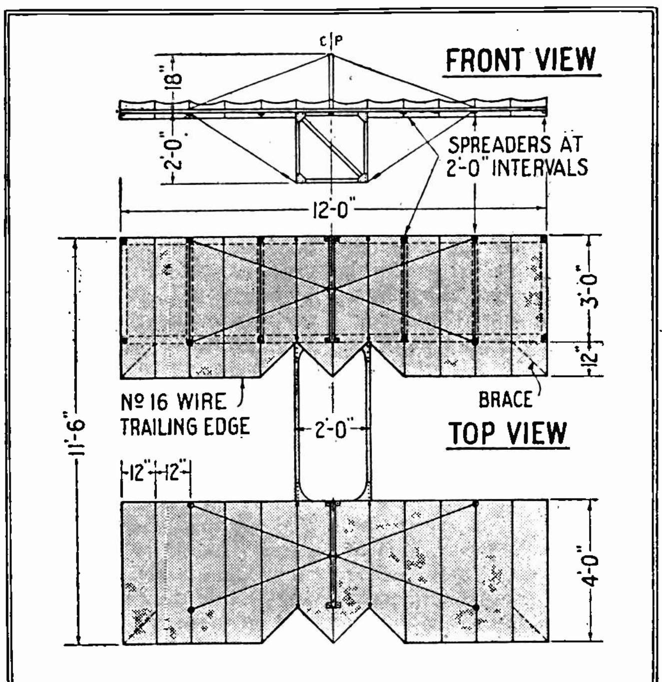
Perhaps the builder may have his own ideas on this; a canvas seat perhaps sewed around the lower longerons or a built-up arm rest attachment may be used. The builder must suit his taste here, remembering to keep the general safety factor high and not adding extra weight which may prevent his glider from flying. The two sides of the fuselage are built upon a flat surface floor, and then the top, bottom, and plane spreaders and bracings are built in.



Make all joints tight or a "wobbly" fuselage will be the result.

The wings are set with beams directly on longerons, drilled through and bolted with 3/16″ stove bolts.

Be sure and keep all wing surfaces of uniform curve, and carefully measure the attachment position to fuselage, or a perfectly balanced glider cannot be obtained.



A front and top view appear above. The completed glider measures 11 feet 6 inches long and twelve feet wide. Spreaders are placed at intervals of two feet. The wire trailing edge is made from number 16 piano wire. The fusilage is square in section. The wing trussing runs from the lower fuselage "V's" to beam-spreader bolts.

The wing trussing, as plainly illustrated, runs from lower fuselage "V's" to beam spreader bolts, to which has been attached a steel fitting to receive same.

Turnbuckles may be used to line up the parts, but add weight and by careful adjustment alignment may be attained without their use.

Brace wires should be tight enough to take pilot's weight in flight position without any noticeable sagging of wings with the plane carefully blocked up at wire fitting points on wing.

The upper wires are to prevent the wings sagging downward when the plane is at rest and must be nearly as tight as the lower wires to insure rigidness. The upper wiring "V's" (inverted) are made up of ¾″ × ¾″ spruce with fittings to attach to wing beams with ⅛″ stove bolts and 3/16″ bolt at upper junction with fittings to take landing wires.

Flying wire fittings at fuselage "V's" run to

(*Continued on page 375*)

Building a Sport Plane

Single-Passenger Airplane of Proven Performance Has a Ceiling of 7,000 Feet and a Speed of 100 Miles an Hour When Powered by a 30-Horse-power Motor

IT is with great pleasure that we introduce our readers herewith to the greatest of all sports today, that of flying. Thanks to the great advances made in the designing and building of easily constructed aircraft, Young America doubtless will soon be winging its way over the countryside. There are sufficient flying fields in most locations, so that if desired the man who builds or buys such a plane as the one described here can take flying lessons and thus obtain a first-hand knowledge of the "feel of the air." By practising with the plane and taxying over the field, allowing the plane to rise a short distance and then landing again, flying knowledge can be obtained at first hand. We recommend, however, that whenever possible, the services of a competent pilot be obtained in order that he inspect the machine before any flights are taken, to see that it is sufficiently strong in all of its parts, especially if the craft is home built. Also he will give you all the pointers you should know before ever trying to rise from the ground. This includes such instruction as always starting off or landing *into the wind*. We have not the space here to give a course in flying, and the people who sponsor this sport plane and who supply all the parts, engines, propellers, as well as the complete plane, ready to fly if so desired, also furnish a low-priced practical *home study course* in aeronautics. The complete blueprints, as furnished by the builders of this famous sport plane, cost a nominal sum, and orders will be filled by the publishers of this magazine without any extra charge above the prices quoted by the manufacturer.


Science and Invention for July, 1926

THE CONSTRUCTOR

How to Build Your Own Airplane

This Handsome Single Passenger Sport Plane of Proven Performance Has a Ceiling of 7,000 feet and a Speed of 100 Miles Per Hour with 30 H. P. Engine.

The sport plane finished and ready to fly.

We Were Three Years Ahead of Time!

OUR readers have shown such an interest in the article dealing with home-built planes that we are reprinting the construction details of a sport airplane which originally appeared in the July and August, 1926, issues of this publication. Part of the page bearing the article as previously presented is shown herewith. The design of this Lincoln sport plane still remains top notch and denotes the care and judgment exercised by the editors in their original choice of this particular plane design from which many planes have been successfully built and flown. Blueprints are available.

Engine and Speed Data

This little sport plane is of very beautiful lines and has attained a speed of one hundred miles per hour, its usual maximum speed being rated at 90 m.p.h., with a cruising speed of 75 m.p.h. Its landing speed is 35 m.p.h., which is quite safe, all these speeds being obtained with the Anzani three-cylinder 30-35 h.p. engine. This engine will cost several hundred dollars, but it is one of the finest makes for aircraft that is available today. Another engine is the Lawrence, 28 h.p., two-cylinder type, and this with propeller is fairly cheap. Quite a creditable performance can be obtained with this sport plane utilizing a common motorcycle engine. There are a number of other light airplane motors on the market, and of course these could be fitted without a great deal of trouble. To those interested in assembling the complete plane with Anzani motor, it may be said that the price is about $1,250.00, and if a standard 28 h.p. two-cylinder engine is substituted, the plane ready to fly will cost considerably less, while the plane parts complete without any engine but with mounting for engine cost about $500.00.

This little sport plane is very economical, and will fly thirty-five miles per gallon of gasoline used. The flying range of this sport plane is 250 miles with one loading of fuel, and it can climb at the rate of 800 ft. per minute. It is interesting to note that the designers have figured on a factor of safety throughout of eleven; *i.e.*, each part of the plane, when properly constructed and assembled, is eleven times stronger than necessary to stand the given load and strain.

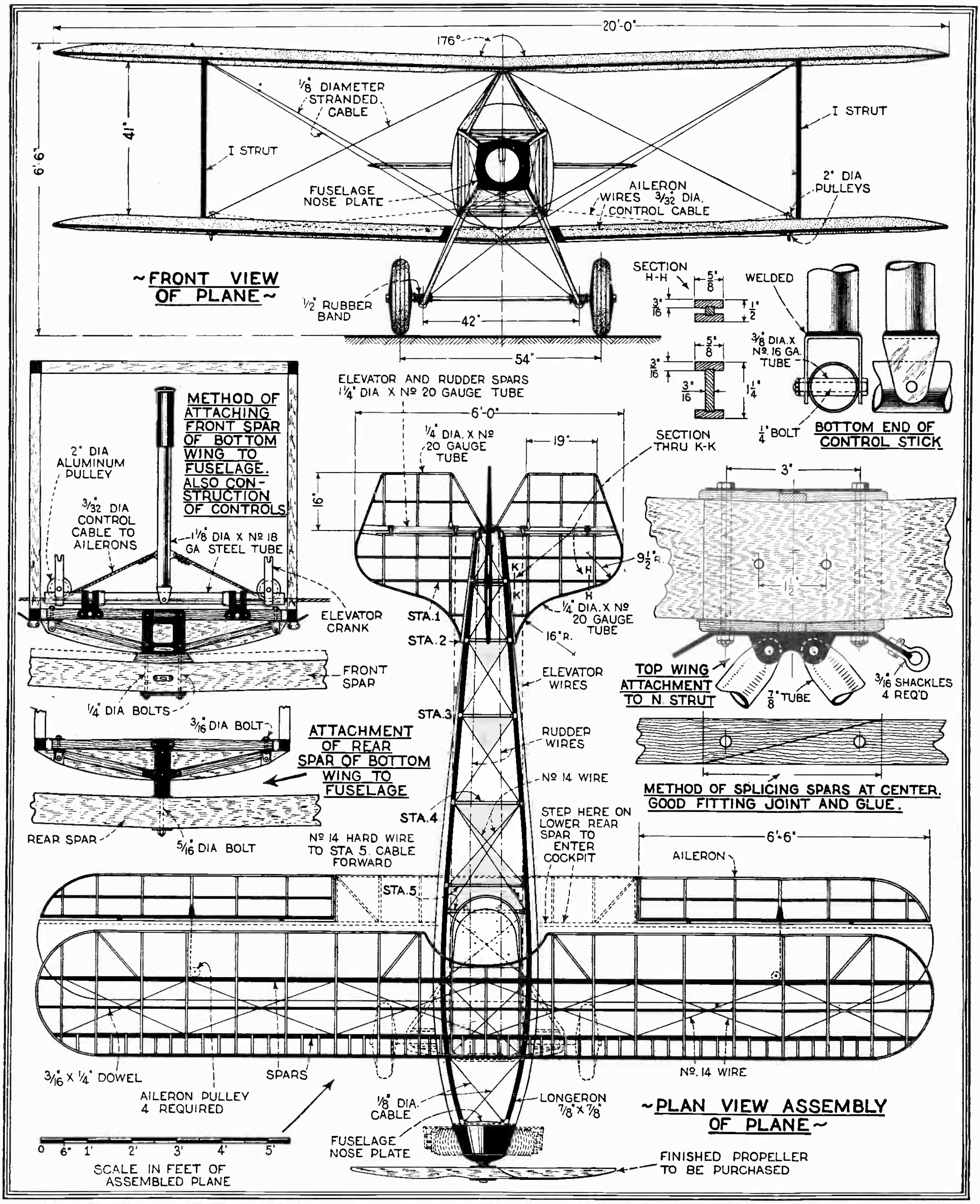
It will be seen by inspecting the drawings herewith that the span of the plane is 20 ft., which means that it can be stored in a very small hangar. The wings are covered with grade A linen, or airplane cloth; which should receive five coats of nitrate dope, and they are then finished with two coats of Valspar varnish. There are a number of books available in public libraries or from publishers which contain information on how to cover the wings and apply the nitrate dope, but the course mentioned above is strongly recommended if you have had no experience in building aircraft before. In the next installment special drawings made by our own draftsman will show just how to build the wings and cover them with the linen cloth. It is an interesting process, this coverings of the wings, and the method of sewing the cloth to the ribs will be shown in the forthcoming drawings in the September number.

Details of Construction

There are many new features found in this little craft, and by the removal of seven bolts the plane may be dismantled and made ready for crating or storage within thirty minutes. The entire tail unit is of welded steel tubing construction. The stabilizer is of symmetrical camber and detachable, while the rudder and the fin are built into the fuselage, so that there is a small fin exposed on the underside to which is attached the tail skid, this also being of steel and resting on the usual shock absorber cord.

The undercarriage is of steel tube construction with through axle. The struts are streamlined with basswood; 20"×4" wheels are used. Span of axle is 4½ ft. Wings—The webs of the ribs are basswood with the usual lightening holes, while the capstrips are of spruce. Spars are of the routed I-beam sections, also of (*Continued on page 372*)

Sport Plane Details



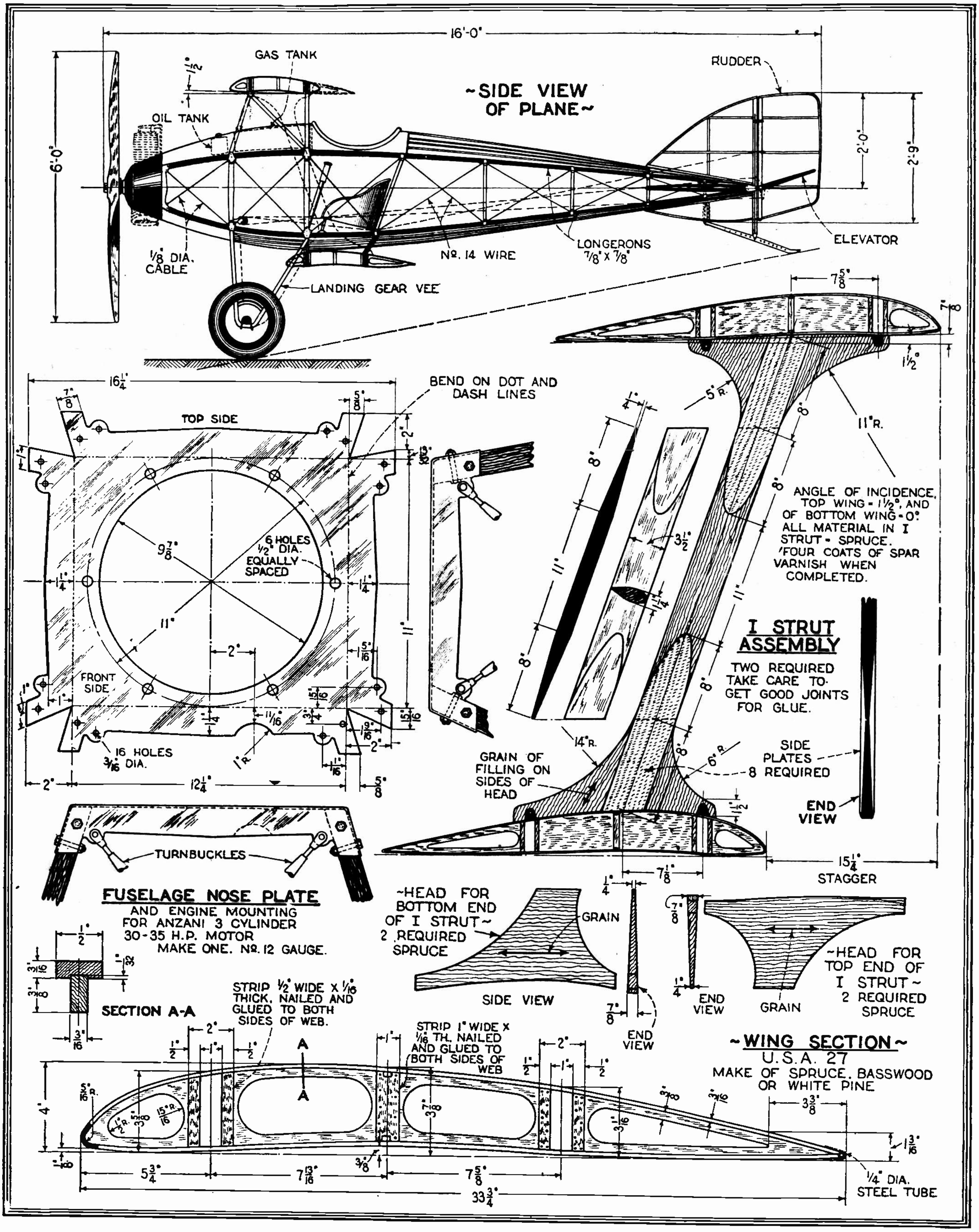
The above drawing shows in considerable detail the top and front views of the two-passenger sport plane described in the accompanying article. The plane has a ceiling of 7,000 feet and a speed of 100 miles an hour when powered with a 30-horsepower engine. A motorcycle engine can be used by the builder in order to keep the cost as low as possible. It is advised that one of the motors mentioned in the text be used, as a three- or four-cylinder engine is far superior to the usual two-cycle motorcycle engine. The control features are simple and will be illustrated and described in the September issue of this magazine. A complete set of blueprints will soon be available from the Blueprint Department.

(Continued on next page)

Details for Sport Plane

Side View and Details of Wing Ribs, Engine Mounting Plate and I Strut

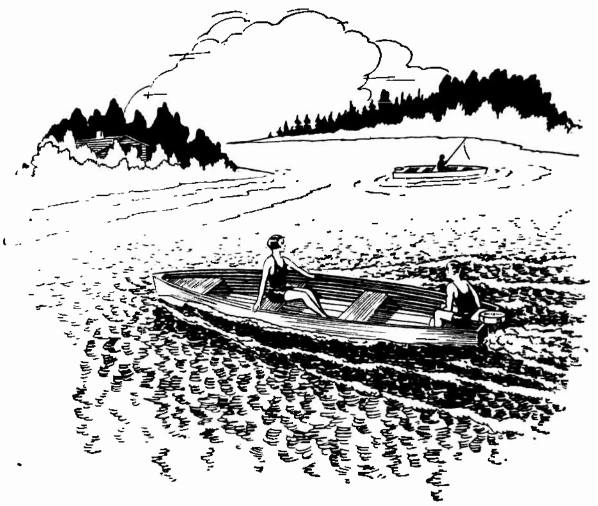
(Continued from previous page)



In the above illustration a side view of together with details of the wing ribs, engine mounting plate and I strut, are given. The mounting plate for the engine is made of steel, and for motors other than the Anzani three-cylinder, 35-horsepower engine a different design will have to be made by the constructor. The engine mount should be guyed securely.

The axle supporting the landing wheels is resiliently mounted on the landing gear vees by wrapping ½-inch airplane rubber band around the bottom of the vee frames and the axle. The propeller cannot be built by the amateur with any degree of accuracy and should therefore be purchased. The method of covering the wings will be given next month.

How to Build a Small OUTBOARD BOAT



A Sixteen-Foot Family Boat That Is Capable of Being Used for a Wide Variety of Purposes

By William F. Crosby

Our Marine Editor

PROBABLY the chief reason why the outboard-engined type of small boat is so popular is because of its simplicity of construction and because there is no special trick required to install the engine. The design presented herewith is no exception to this rule, and if anything it is indeed easier to build than most of the others.

This particular boat is sixteen feet in length with a beam of five feet and is constructed along the simplest lines possible. There are two planks on each side and five or six on the bottom. There are three frames to make, a stem and the transom or stern. The interior arrangement may be made to suit the builder either with two or three seats arranged across the hull or, if you desire, with a short forward deck and the conventional runabout arrangement. For general purposes, such as fishing and summer camp work, it might be better to leave the hull without a deck and with an arrangement much like those used in an ordinary rowboat.

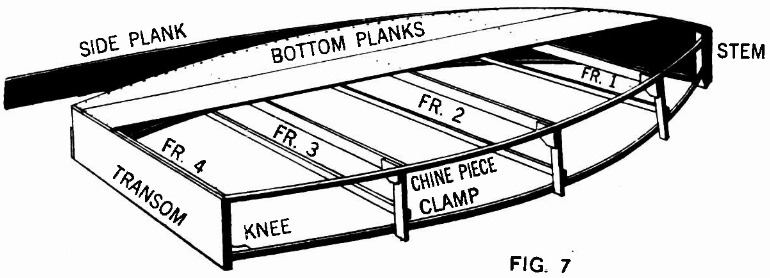


FIG. 7

This illustration shows how the bottom and side planking is put on the boat frame.

The first thing to do is to make the frames. By referring to the drawings, it will be seen that these are numbered from one to four and, since there are no curved surfaces, it will not be necessary to do any steam bending. In Figure 1 we have the dimensions for the various frames. These should be laid off full size on a fairly flat floor. This is done by arranging a datum line to work from, as indicated over the cross sections in Figure 1, and laying off the measurements from this point down and from a center line out. Every dimension is given for the work and there should be no difficulty.

As each frame is drawn in at full size on the floor, arrange the material for the frame so that the edge comes three-quarters of an inch in and parallel to these pencil lines. The three-quarters of an inch is deducted on account of the thickness of the planking. The vertical half of the frame butts up against the horizontal section and the two are held together with a bracket in the corner. These brackets should be securely screwed in place and a temporary piece of wood should be nailed across the two tops of the vertical frames in order to make them firm. These pieces are removed after the boat is planked and the cross seats are added.

The boat should be built upside down, as shown in Figure 7. The frames are erected exactly four feet apart and, since the floor now becomes the datum line, each frame is raised off the floor the dimension as given in Figure 1. Thus the upper end of frame 1 will be 4 inches, the upper end of frame 2 will be 6 inches and so on, clear of the floor. Each frame must be securely blocked and braced in position.

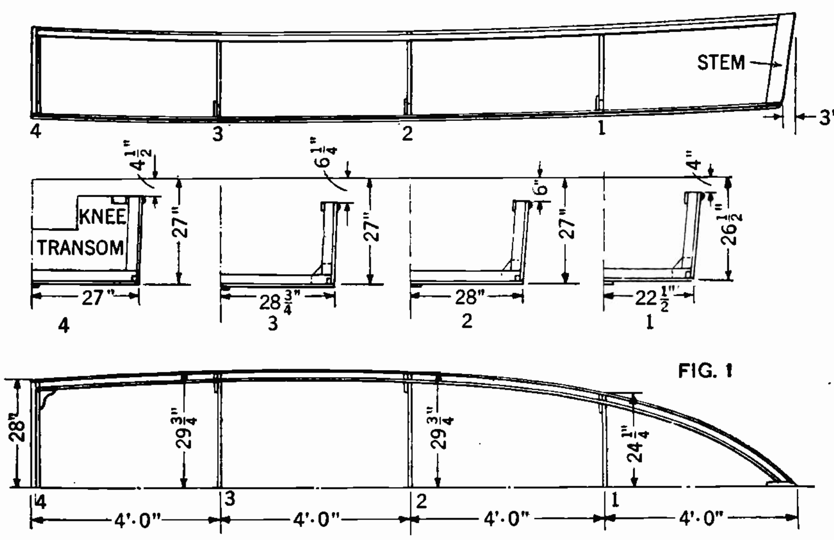


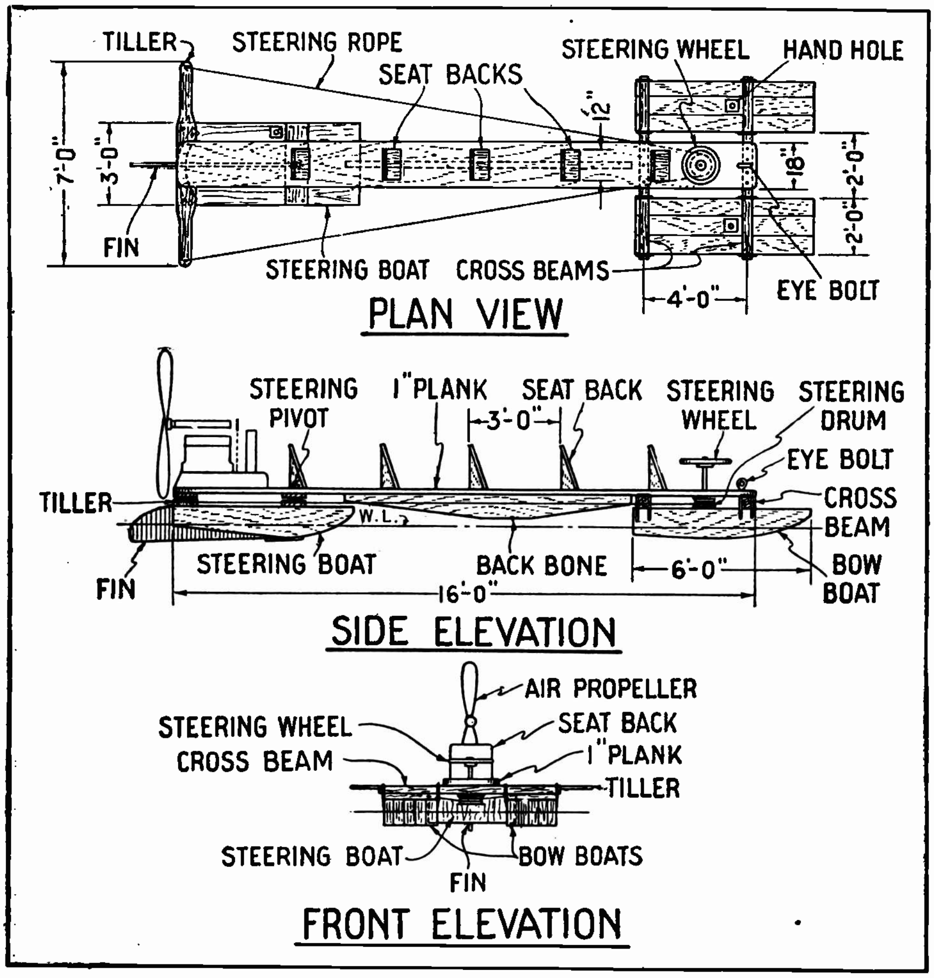
FIG. 1

This drawing shows the principal dimensions of the boat frame.

In Figure 4 will be seen a detail of the stem, which is quite easy to make provided one has a fairly sharp chisel. This is erected four feet ahead of frame 1, and is so arranged that it has a slope of three inches as shown. The transom is fitted directly over frame 4, and in this particular case, after the transom is in place, the corner brackets to hold the two sections of the frame together may be removed. The center of the transom may have to be cut away a little to permit the outboard motor to set down low enough. This is shown in the section on the extreme left-hand side of Figure 1.

The sharp angle formed by the upper and lower frames is known as the *chine*, and it should be reinforced with a light strip of wood which runs all the way from bow to stern. This will prevent leaks and make a much stronger job. Along the upper edges of the vertical frames another piece is run fore and aft throughout the length of the boat. This is called a clamp and is used to reinforce the hull at this point. It is nailed to each frame as is (*Continued on page* 378)

HOW to Build a Water



This illustration shows the plan, side and front views of a marine bob-sled. Dimensions are also given. This water sled will provide a source of endless amusement.

SLIPPING over calm water at a breath-taking speed in this marine bob-sled is enough to intrigue even the most ardent lover of winter sports. With a powerful enough equipment it will attain all the speed desired and with perfect safety to the passengers. Considering its size and carrying capacity such a water craft can be built for a sum well within the limits for the home constructor.

The bob-sled consists of three hulls supporting a narrow deck or platform upon which all the load is carried. Their arrangement is such that there is every factor for safety from capsizing and everything is kept dry while under full speed.

The two forward hulls should be built exactly alike and after the dimensions shown. Cut one side as a pattern and then cut the others from it. Use ¾ inch clear pine or cedar stock. First lay two sides parallel, bottom up on a level floor. Then nail in the bow and stern pieces 1 ft. 10½ inches long, and plank over them after inserting the ribs 2 ft. apart as indicated. Bottom boards should be beveled slightly to take the caulking but deck boards can be laid snug. Nail securely into every rib and countersink the heads. Plane off all bulges in planking surface, sandpaper smooth and then paint both inside and out with at least two coats of good paint. Spread white lead under all seams. Then cut out the hand holes indicated and fashion a tight-fitting plug. These holes are for pumping out water that may leak in and keeping the hulls clear of such weight.

The steering or stern boat is built in precisely the same manner except for the slight difference in dimensions.

When all boats are completed they should be assembled as shown. Connect the two forward hulls by two cross timbers 6 ft. 4 in. in length—2 x 4 laid on edge. Spread the hulls 2 ft. apart and parallel, clamping cross timbers to them by U irons bolted to the hull sides.

Steering Arrangement

ARRANGE the steering hull slightly different as shown. The tiller is bolted to the stern end so that 2 feet of it project out on each side. A steel arc should then be fastened to the tiller and under the riding deck where the tiller will oscillate when steering. Grease these plates when assembling. The arrangement of the pivot bolt is shown in detail.

A fin should then be attached with angle irons to the center of the bottom of the steering boat. Make this fin of straight grained hard wood.

The body plank is 16 feet long by 18 inches wide of rigid, hard wood 1¼ inches thick. Bolt a backbone of the same stock to the underside and drill a hole to fit over the pivot bolt where indicated.

The steering gear is a flanged wooden drum, through which passes a 2 ft. length of pipe for the shaft. A steering rope is wound several times about the drum and fastened to the tiller ends to complete this arrangement.

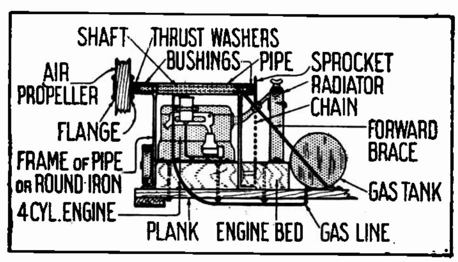
The side view and elevation sketches show exactly how the bob-sled will appear when fully assembled. Adjust all moving parts so just enough movement is allowed for easy working but no more. All fastenings such as U irons and bolts must be made as rigid and solid as possible.

The seat backs are merely plain boards braced at a convenient angle but hinged so they can be folded to the deck when desired. Just forward of the steering wheel can be placed the tie-up eyebolt or cleat.

When fully completed give all exposed parts a final coat of paint and paint all iron work with non-corrosive material and varnish seat backs, etc., if desired.

Mounting the Engine

THE power plant can consist of any light weight automobile engine developing around 20 H. P. and capable of 2,000 R. P. M. As engines differ in size, shape, etc., no definite installing measurements can be given but will have to be worked out by the builder. The



Above is merely a suggestion for the mounting of the engine. The builder can devise a different plan should his engine make it necessary.

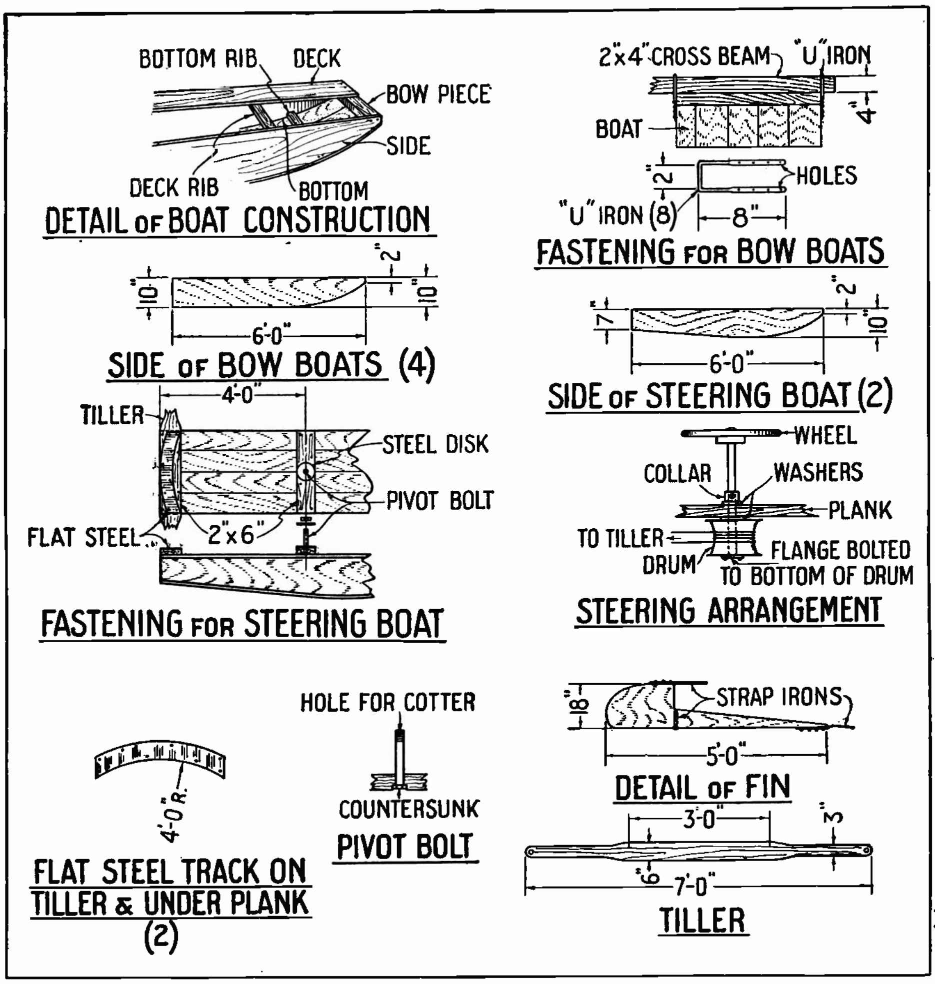
Bob-Sled

By L. B. Robbins

suggested mounting is, however, adaptable to any ordinary auto engine and can be built to suit your particular requirements.

The engine bed consists of two heavy timbers bolted to the deck plank to suit the crankcase shape of the engine.

The propeller shaft is 1 in. steel running through a pipe with a bushing in each end. The brackets can be satisfactorily made as the diagram indicates. They are constructed triangular in shape and of galvanized piping to straddle the engine bed and are bolted to the plank. The height depends upon the propeller length which will be around 6 feet. Two such brackets are needed to support the shaft and bearings. Two supplementary braces are also needed forward to take up the torsion produced by the propeller thrust at high speed. The illustrations show this arrangement in detail. The driving sprockets from motor shaft to propeller shaft should be of such a ratio that with the engine running maximum speed the propeller will turn over from 1,500 to 1,800 R. P. M. See that the propeller is centered evenly on its hub. No wobbling should occur. If it does, make exact centering adjustment by means of the flange bolts holding it to the hub.



This shows how the hulls which support the narrow deck or platform are built, and gives the arrangement for steering the vessel. Passengers are kept dry even at full speed.

The Controls

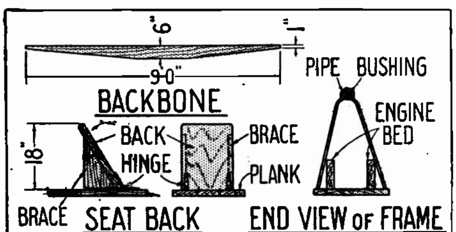
GASOLINE and spark controls should be led underneath the plank to the driver's seat behind the steering wheel. Also install here a supplementary switch for cutting off the engine in case of emergency.

Soak up the hulls by anchoring the bob-sled in shallow water a few days, then pump them dry through the hand-holes.

The engine is started by adjusting the controls and rocking the propeller. Keep clear of it at all times when in motion. When under full speed avoid making too short turns. It is a tremendous strain on all fittings and hulls. It is much better to slow down and take a wide turn whenever possible.

Additional Details

STEERING is accomplished by means of a wheel placed in the forward part of the sled. A rope passes from the wheel to either side of the tiller. The steering gear is a wooden drum around which the rope is wound several times. The plan drawings give all the details of the steering arrangement. All moving parts should be adjusted so that they work freely. Do not allow too much play. The side view and elevations serve to give the builder an idea of the appearance of the finished bob-sled.



Details for the construction of the engine bed, the making of the seats and the backbone are given in the illustration here.

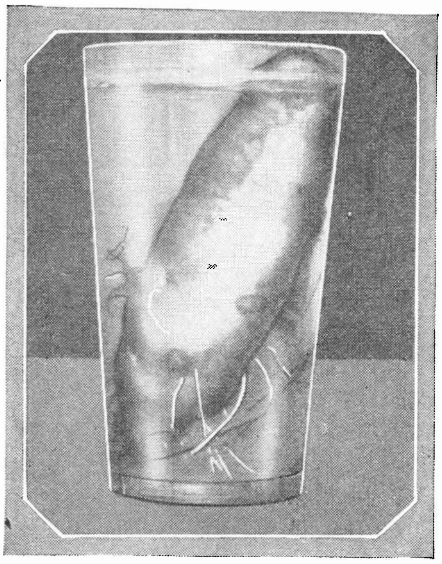
Second-hand, lightweight engines for the power plant can be bought cheaply. One developing about fifteen to twenty horsepower at a speed of 2,000 revolutions per minute should be chosen. A mounting suggestion for the engine is given here. It is regretted that no definite details can be given for the mounting, but as engines vary greatly in size and shape such a procedure is obviously impossible. The engine installation will have to be figured out by the builder. The suggested mounting is applicable to most automobile engines and the constructor should have no difficulty on this score. The bed for the power plant merely consists of two heavy pieces of wood fastened to the deck.

The brackets are made from piping, preferably galvanized, and straddle the bed for the engine. The height will be dependent upon the propeller length chosen. The torsion produced by the propeller thrust at high speed is taken up by two braces placed forward. With the motor running at high speed the propeller should turn over at 1,500 revolutions per minute at a minimum. It is important that the propeller does not wobble but runs true. Exact centering is necessary.

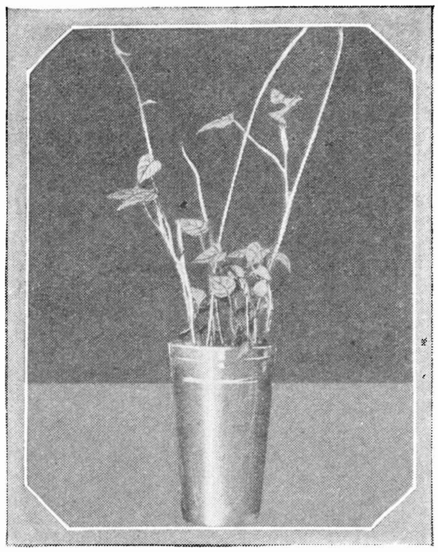
All metal which is exposed should be coated with a good non-corrosive paint for protection against the elements. When the sled is completed all exposed woodwork should also be given a final coat of paint. White lead should be pressed under all seams to assure a watertight construction.

HOW TO MAKE IT

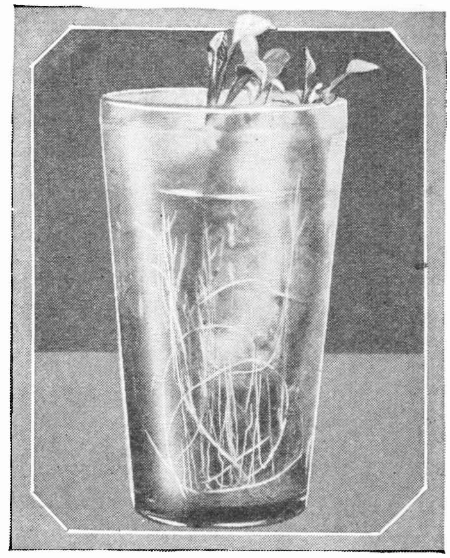
Growing Sweet Potatoes for Ornaments



In two or three days the roots will begin to sprout, as shown above. The skin is cut before placing in water.



The shoots soon rise to a considerable height in a few days. When placed in a hanging vase, the shiny green leaves make a fine house plant.



The above photograph shows the potato after the leaves have just started to sprout. Notice length of roots.

FEW would believe that the sweet potato is a root. But nevertheless a root it is, filled with starch or stored-up energy, as one might call it, waiting to be released under certain suitable conditions.

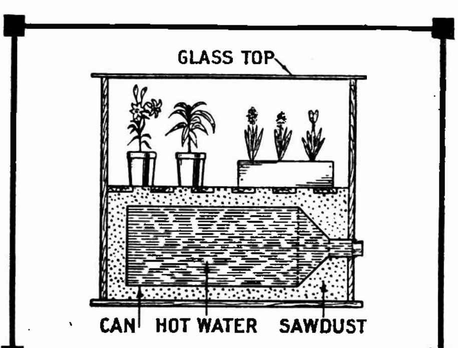
The potato, both the sweet and white or Irish variety, is composed mainly of starch, covered with an outer layer of what is really cork. This layer acts as a protective covering, preventing the drying out of the water contained within and around the starch grains, and keeps out the smaller insects which would rob the potato of its valuable contents.

But make a few marks so as to cut the corky wall of the potato, and a change occurs when the potato is placed in a tumbler of water. Shoots and roots will be sent out by the tuber in the period of two or three days. The shoots will soon rise to a height of several feet. When the growing tuber is placed in a hanging vase an excellent house plant is formed. Instead of placing the potato in a glass of water, the tuber can be hollowed out and filled with water. It can then be fitted with a stand made from wire or suitably suspended from the wall or ceiling.

Carrots may be grown in the same way and form a pretty and ornamental house plant. The green shoots contrast pleasingly with the orange-red color of the carrot itself. Potatoes and carrots may be grown in the manner described here and make fine house plants for the winter months.—*R. B. Wailes.*

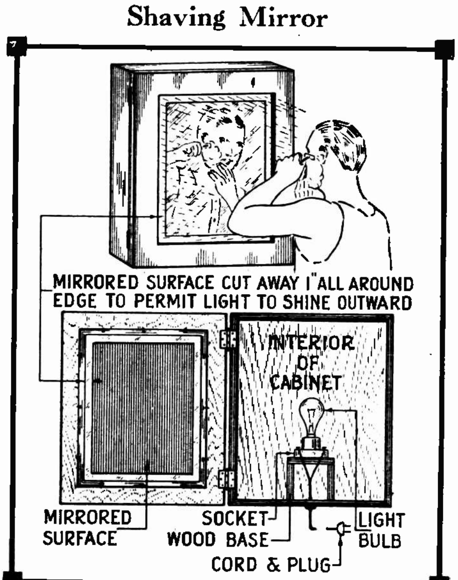
Miniature Hot-House

A SMALL hot-house can be constructed from a box about two and one-half feet square and three feet deep. The heating tank is an old oil can or paint can fitted in the box horizontally and packed in damp sawdust until the box is half full. A hole is cut in the box to admit the mouth of the can. Strips of wood placed over the sawdust hold the plants. A sheet of glass is now put over the top. Where only a moderate heat is required. the can need only be filled once in 24 hours. —*S. L. Bastin.*



A small hot-house can be made with a box and a can for hot water, which is packed in sawdust as illustrated above.

Shaving Mirror

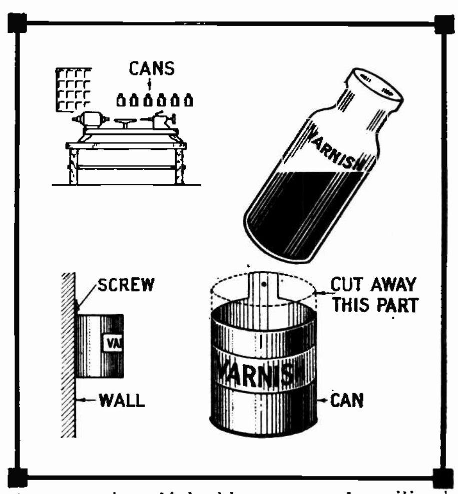


A good shaving or dressing mirror for the home can be made as shown above.

AN excellent shaving light can be had by removing the silvered surface for a depth of one inch around the entire margin of the mirror in the present cabinet. An electric lamp is placed in the cabinet behind the mirror.—*H. R. Wallin.*

Uses for Cans

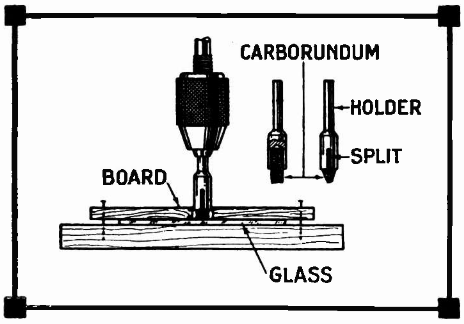
BOTTLES containing liquids may be kept safely out of the way by hanging them on the wall in old cans cut as shown. The metal may be cut with a pair of shears. A small portion is left intact for fastening to the wall. Many other uses for old cans will suggest themselves to the shop mechanic.—*J. Baker.*



One way in which old cans may be utilized has been illustrated above.

Shop Mechanics

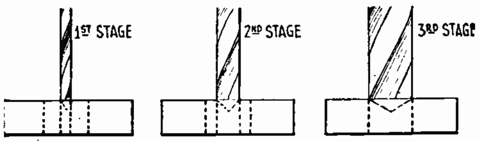
Glass Drill
FIRST PRIZE, $10.00



The above illustration shows the glass drill made from a piece of carborundum and the manner in which it is used.

A DRILL made from a piece of an old carborundum wheel, rounded and pointed as shown, makes an excellent drill for glass. Drawing illustrates manner of use.—*E. A. Seastrom.*

Drilling Kink

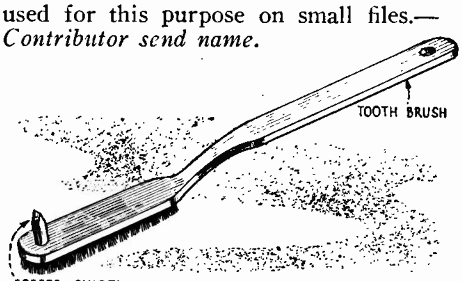


The drawing above shows a method of drilling holes accurately. Three sizes of drills are used in the procedure.

IN precision work it is necessary to have all holes accurately drilled. The hole is first started with a drill point smaller than the size required and then drilled slightly deeper with a still larger size drill point and, lastly, the correct size drill point is employed. Care should be taken to choose drill points that differ considerably in size.—*H. W. S.*

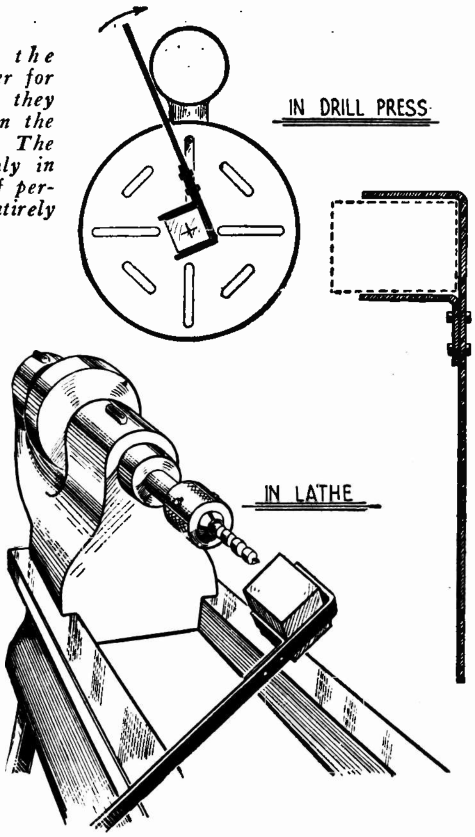
File Cleaner

AN old tooth-brush can be used for cleaning files if it is fitted with a copper chisel point, as shown. This is placed near the end and serves to dislodge the pieces of metal held in the teeth of the file. The brush can also be used for this purpose on small files.—*Contributor send name.*



A file cleaner can be made from an old tooth-brush, changed as shown above.

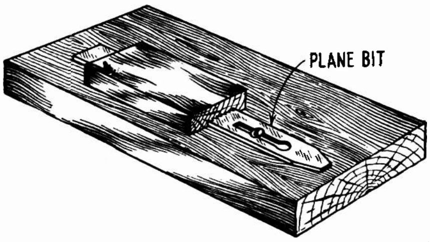
The illustration at the right shows a holder for small objects when they are to be drilled in the lathe or drill press. The work is held firmly in place and danger of personal injury is entirely eliminated.



Lathe Holder for Small Objects

SMALL pieces of work can be held in place for drilling in the lathe or drill press by means of a clamp such as that shown in the drawing. The object is held in place without danger of injury to the operator. The clamp or holder is made of metal and is adjustable. The tail stock of the lathe presses against the back portion of the holder. Leverage is obtained by pressing the arm of the holder against the bed of the lathe. When used with a drill press, the arm is pressed against the upright or standard.—*H. W. S.*

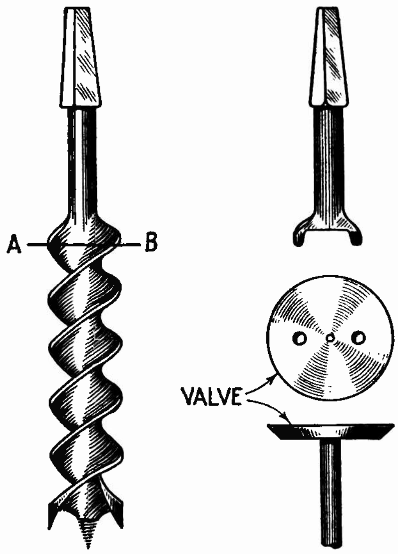
Back Stop



The tendency of small pieces of wood to tilt when being planed can be overcome by using the above expedient when planing.

SMALL pieces of wood can be prevented from moving while being planed by providing the bench with an extra stop notched at the edge. A discarded plane iron holds stop in place.—*V. V. Johnson.*

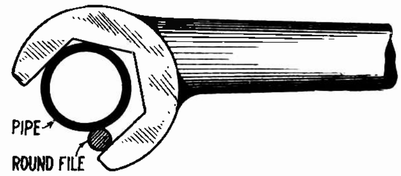
Valve Grinder



The above drawing shows the manner in which a handy valve grinder can be made from a bit and bitstock.

A VALVE grinder may be fashioned from an old bit and bitstock. The lips are cut off on AB, shaped as shown. A small quantity of emery and a few turns on the valve seat will insure a good fit. The valve grinder is easily made in a short time and will prove to be an exceptionally useful tool for the car owner.—*R. Neuenschwander.*

Pipe Wrench



A substitute pipe wrench can be made as shown with an ordinary wrench and a round file placed between the jaws.

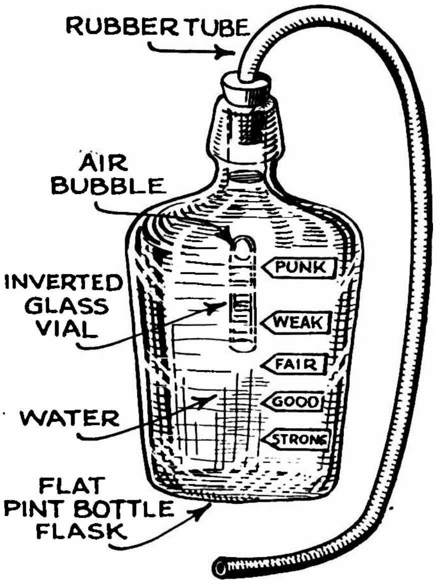
WHEN there is no regular pipe wrench at hand, a good substitute can be made by employing an ordinary wrench and a round file placed between the wrench and pipe.—*J. M. Wolfskill.*

PRIZE AWARD

Each month $10.00 will be given to the contributor of the best shop wrinkle. Shop Mechanics is a new department which first appeared in the June issue of this magazine. Garage men, shop workers, and those engaged in similar occupations will find much of interest on this page and are asked to submit their own favorite kinks to the editors.

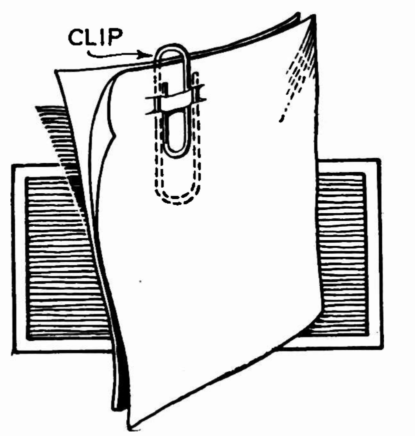
WRINKLES, RECIPES *and* FORMULAS

Trick Lung Tester



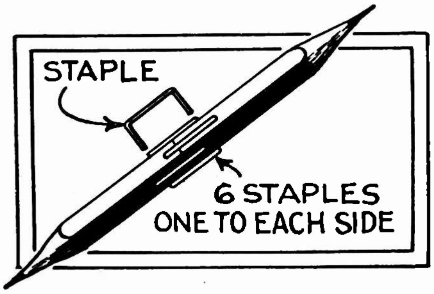
A trick lung tester can be made from a flat pint or half-pint bottle and a small vial or length of glass tubing sealed at one end, as shown. The vial is inverted quickly and placed in the mouth of the bottle so that an air bubble forms. Pressure on the flask causes the vial to rise and fall, and thus the operator can fool the audience.—E. R. Vass.

Permanent Paper Clip



The above illustration shows how papers may be fastened together permanently with an ordinary paper clip. Two slits are cut in the paper.—E. R. Vass.

Joining Short Pencils



Pencils that have become too short for use may be again put into service by joining two of them together with staple type paper fasteners.—E. R. Vass.

A Silver Fluid

A silver fluid for silvering brass and copper articles can be made by taking 1 oz. of precipitated silver and adding to it ½ oz. of potassium cyanate and ¼ oz. of sodium thiosulphate. Put all into a quart of water and add a little whitening. Shake before using. Apply with a soft rag.—*B. Heller.*

Blue Ink

Dissolve soluble Prussian blue in pure water. Then add 12 grains of gum arabic. Add about 12 grains of boric acid to every ounce of water for making the ink.—*B. Heller.*

Microscope Cement for Opaque Objects

A good transparent cement for mounting opaque objects for the microscope can be made by taking 2 parts of isinglass and adding 1 part of gum arabic. Then cover with proof spirits, cork bottle loosely and place in water. Boil till solution takes place, strain and use.—*B. H.*

Garage or Small Kitchen Chimney

A good way to rig up a chimney for garage or chicken coop, or even for a kitchen, is to use lengths of earthenware sewer pipe. After the sewer pipe is all set up, wrap a number of turns of wire around the pipe. This will prevent the pipe from falling apart, if it checks or cracks from the heat, but this is not very likely to happen.—*H. F. Smith.*

Fireproof Match

Did you ever absent-mindedly burn your fingers by letting a match burn down too far? Here's a remedy. Mix a small quantity, ½ oz. or so, of water glass thoroughly. Hold the match by the head and dip it in the water glass to a depth of ½ to ¾ inch from the end. This, when left to dry for a while, makes a fire-proof handle on the match and does away with burnt fingers. The fire goes out when it comes to the treated wood.—*E. J. Cuttings.*

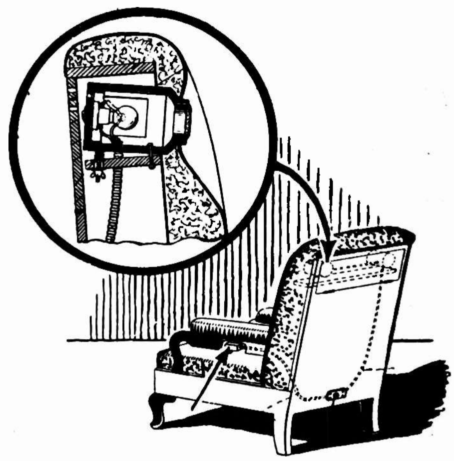
Tracing Aid

The following wrinkle will be found very useful by those skillful at drawing as well as amateurs. Moisten a piece of paper with a cloth soaked in benzine. Any picture desirable can then be traced easily. The paper will in a short while be restored to its original opaqueness.—*Frank Schmulowitz.*

Emergency Typewriter Spring

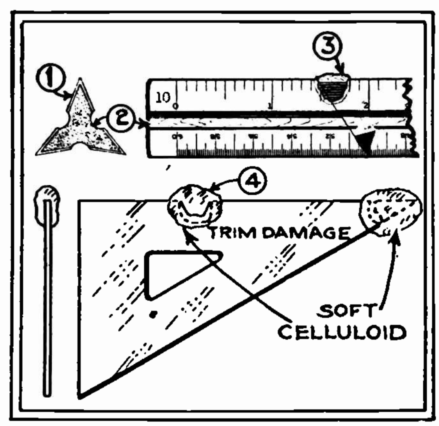
I have found that a spring from an old clock will make a very good substitute for the spring which is used to operate the carriage on a typewriter. It is necessary to make a loop in the end of the spring, and this can be accomplished by heating the spring to take the temper out before making the hole by punch or drill.—*Contributed by Leslie Carpenter.*

Reading Chair



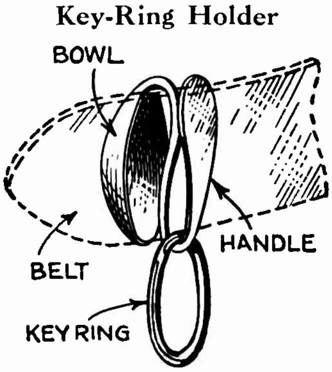
Upholstered reading chairs can be equipped with a permanent lamp, as shown. A box made of insulating material is placed within the back of the chair and contains the lamps. The portion of the back adjacent to the lamp box is hinged for ease in making repairs and replacing bulbs. A window of glass or other suitable transparent material is provided and a switch situated beneath one of the arms allows the light to be conveniently turned on or off.

Drafting Tool Repairs



Drafting scales and triangles made of celluloid can be repaired with a solution made by placing sheet celluloid in a small quantity of lacquer thinner. The repair is then given several coats of lacquer and finished with a file.—E. R. V.

Key-Ring Holder



A handy key-ring holder can be made from an ordinary tablespoon bent in the manner shown above.—Contributor send name and address.

Photo Oscillator Gives Enlarged Television Images

New Invention provides an improved method for throwing the light vibrations of a neon tube upon a screen.

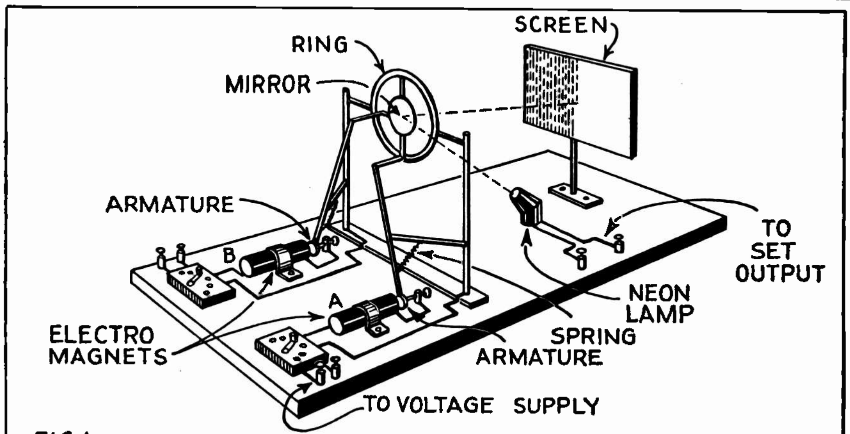


FIG. 1

The above illustration shows a diagrammatic perspective view of the photo oscillator. The light from the neon lamp is focused upon a mirror which is vibrated electro-magnetically. The reflected beam from the mirror is thrown upon a screen of transparent or translucent material.

A RECENT invention which may be termed a photo oscillator covers the production of enlarged television images. The light vibrations of the neon tube may be thrown upon a screen by means of a mirror vibrated electro-magnetically. Figure 1 shows a perspective view of the arrangement of the parts used.

Construction

A WOODEN or metal base supports a screen of transparent or translucent material. The light vibrations from the neon tube connected to the output of the radio receiver are focused upon a mirror. The mirror is supported within a ring by rods, so that it may be rotated about its vertical axis. A pair of uprights support the ring by means of rods in such a manner that the ring can be rotated about its horizontal axis. A rod is connected with the lower part of the ring and a rod is connected to an arm, which in turn is connected to the mirror, as shown in Figure 2.

A lever is pivoted between its two ends to an arm carried by one of the uprights and a similar lever is pivoted to an arm carried by the other upright. An armature is connected with the lower end of each lever and two electro-magnets, A and B, are arranged adjacent to the armatures. A spring connects the lower end of each lever with its arm and tends to hold the lever in a position with its armature bearing against an adjusting screw carried by a post on the base. The extent of movement of the armature can be adjusted by this screw.

A variable resistor connected in the circuit of each magnet permits the rate of vibration to be varied. As shown in the schematic diagram, the circuit will be closed when the armature is resting against the set screw. This screw is connected with the magnet and the armature is connected with the battery, but as soon as the armature is attracted by the magnet the circuit is broken. The spring then brings the armature back against the set screw, again completing the circuit. The vibrations of the levers will cause the mirror to rock about both its vertical and horizontal axes.

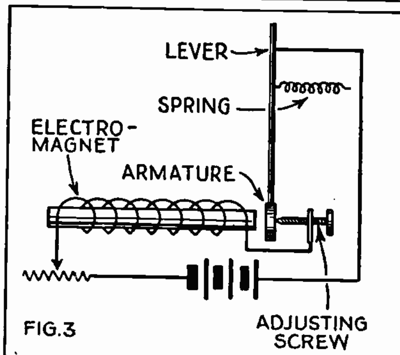


FIG. 3

The circuit diagram of the electromagnetic vibrator is shown above. The vibrations can be regulated by means of the variable resistor.

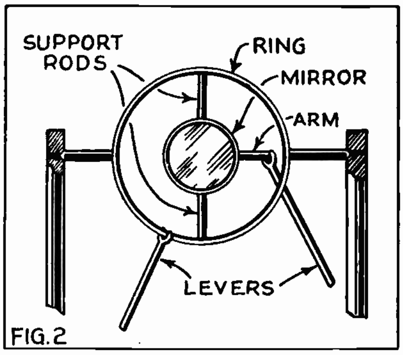


FIG. 2

The drawing above shows an enlarged view of the means for supporting the mirror.

Operation

AS an example of how the device operates we will choose an image or picture which is traced by the explorer of the sending apparatus in one-sixteenth of a second, the complete image being explored in thirty traces or lines parallel to each other. In each trace there are twenty details of the image and the number of details to be transmitted thus equals six hundred. As they are transmitted in one-sixteenth of a second successively, there must be ninety-six hundred light impulses per second. These are picked up by a photo electric cell, transmitted in the usual manner and converted back into light impulses by a neon lamp at the receiver. Thus, in order to produce the image on the screen, one electro-magnet must vibrate two hundred and forty times per second and the other eight times per second. The spot of light thrown upon the screen by the mirror will trace the screen in one-sixteenth of a second with thirty vertical lines. Of course the actual number of details necessary to produce a clear image would be in the neighborhood of two hundred thousand per second. Some experimentation will be necessary in calculating the angle of vibration, so that the spot of light is thrown upon the screen in the correct manner.

A practical manner in which to arrange the parts is in a cabinet. The screen should be placed in an opening in the front. The two variable resistors are also placed on the front panel. The mirror is located in the center of the cabinet in back of the neon tube. In this way the mirror will reflect the light from the tube to the screen at the front. The two electro-magnets are placed in the rear part of the cabinet. Another way of breaking the circuit of the magnetic vibrators consists in using a bell-crank, which dips into a mercury cup.

Readers' Opinions and Comments Will Be Welcomed by the Editors

What Our

Likes Exposés

Editor, Science and Invention:

I have seen in the March 4, 1929, issue of the *New York Evening Journal* a column about a séance.

Many other readers of your magazine, I am sure, will be very pleased when we again see the familiar articles on "Séances" and "Exposés." Why have these been so long omitted? They were a wonderful asset to your publication.

I am very glad to be able to send the newspaper clipping. It is small, but I'm sure that it bespeaks the praise for Mr. Dunninger that is really his.

Milton Travin, Brooklyn, N. Y.

(For some time Science and Invention magazine has carried a box, asking its readers to forward information on any swindle or get-rich-quick scheme, and telling them that we have an excellent department which gives information on all sorts of treating devices, both of electrical and medical nature. Some readers have taken advantage of this service and have gained much valuable information and saved many dollars which would otherwise have been spent on very obvious frauds. This publication will continue to expose all methods of flimflamming the public whenever the evidence conclusively indicates that the manufacturers are guilty of perpetrating hoaxes.—Editor.)

Ionaco Still Being Sold

Editor, Science and Invention:

Recently I was speaking to a lady friend of mine and her husband, and during the course of the conversation I told her that I was going to take a free demonstration of Wilshire's Ionaco. My friend's husband's told me that he saw in one of your magazines some time ago an article concerning this same product and that it was a fake or something like that. I did not know whether he meant that the price was a fake or the instrument itself was worthless. At any rate, he stated that the magazine claimed one could be made for about $6.00.

They are charging $45.00 for them now, the former price was $59.00 cash, but the price has come down considerably.

I would like to know if Gaylord Wilshire's Ionaco invention does what it is supposed to do, and if it could be made cheaper. My friend told me that he thought he could make me one for about $6.00. Inasmuch as he is a telegraph operator, and I think he is studying engineering, he ought to know something about electrical work. I would appreciate all advice and information on this product, because my husband thinks $45.00 is too much money for it. A lady I met through another friend told me that she bought a Wilshire's Ionaco and it cured her of high blood pressure and rheumatism. I have been suffering from a pain in my back for two years and that is why I am interested in this apparatus.

Mrs. A. Cloutier, Fort Worth, Texas.

(In the October, 1927, issue of Science and Invention magazine an article appeared which was entitled "The Ionaco Swindle." In the article it was demonstrated that an Ionaco could be built for less than $6.00 and full instructions were given for winding the coil of wire which encircles the body and which, according to the claims made for it, produces an assumed mysterious effect upon the blood of the wearer.

Practically any product can prove its value by testimonials, whether the product is put out by a quack or an organization that believes in carrying on a strictly bona fide business. It is difficult for the layman, therefore, to distinguish between the testimonials acclaiming the value of a useful product, and those which show the value of an article absolutely worthless as either a cure-all or as a specific for any one condition. The human body will often repair itself without additional aid. Imagination greatly helps in effecting this repair. If the person becomes well while using a contraption of supposed benefit, he subconsciously attributes his well being to the use of it. The Ionaco is not a specific in the treatment of rheumatism or high blood pressure. —Editor.)

Dreams

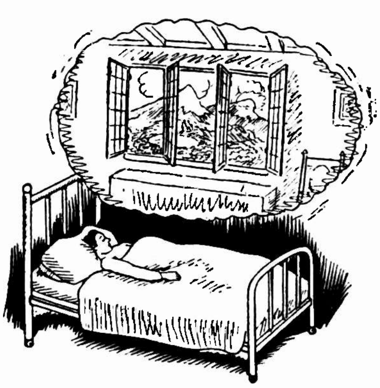
Editor, Science and Invention:

As a regular reader of your interesting magazine, I have read studies about dreams in it. I wish to explain a few facts, from my own experience, and for which I have found no real explanation, although I submitted them to different people, physicians, philosophers and psychologists.

In December 1913, I was 15 years old, I saw in a peculiar dream a part of a timber ceiling, with sacks, clothes and such things hanging from it. The scene was dully lighted. There were rays as though the light had come through a cloud of steam.

This dream, or more properly vision, as there was no action, was very clear, and struck me so as not to vanish from my memory for two or three days, then I forgot it altogether.

Eighteen months later, I was a prisoner of war in Germany. I could not have foreseen the Great War, nor my early voluntary engagement, nor my capture by the Germans, nor the inner aspect of a prisoners-camp barrack at night.



In any case, I awakened one night and I saw exactly to the latest detail that the vision I had seen was before my eyes. The mist was caused by the condensation of the breath of the 250 odd men sleeping in the confined space, their clothes and sacks hung just as I had seen them, and the remembrance of my dream struck me strongly.

It might have been a coincidence, so I decided if such a vision should again appear to note my dream.

Eight months later I was ill, and lying in the camp's hospital, I again had a dream of that kind. I saw a room, with oak planking floor, all white enameled walls, large windows, through one of which I could see a tall pine tree. I noted it carefully in a pocketbook.

No action whatever was present to give any significance to that vision.

Two months later, a commission of Swiss officers visited the hospital, and decided to pick out the sickest people to be interned in their country until the end of the War.

Four months later I was sent to Switzerland, and interned in a small hotel, "Pension Les Violettes," in Veytaux. The interned had naturally to do all the work in the hotels where they were placed. So I had to scrub floors

In the "Amazing

BARTON'S ISLAND, by Harl Vincent. In his previous story, "The Seventh Generation," Mr. Vincent just gave us an inkling of what he was capable of doing with a theme dealing with the future. He bases his ideas of the future on present political and scientific trends and draws a realistic picture of what may come.

OUT OF THE VOID, by Leslie F. Stone. A serial in two parts (Part 1). With such inventions as permalloy and the strides which are made in the field of aviation, we can look with less cynicism on the possibilities of space flyers.

THE ETERNAL PROFESSORS, by David H. Keller, M.D. Just because one member or one part of the body becomes incapacitated through disease, doesn't seem sufficient reason for the complete elimination of the entire body. Some ideas have been written on the subject before, but Dr. Keller, in his well-known manner, strikes the subject definitely and with much understanding.

Readers Think

Questions and Discussions of General Scientific Interest

some days, and as I entered a room reserved for the officers, which I never entered before, I recognized again the room seen in my dream, and confronted it with some details noted in my booklet: double windows, peculiar form of their locking device, the pine tree, everything was there as I had seen it before.

In this second case there can be no doubt I saw that place in my dream, as I never saw double windows before my internment in Switzerland. They are used there against the heavy colds of the winter.

Again, I could not have had forethought of any of the circumstances of my presence there: I was among the first men interned there; I did not think of the existence of a small town named Veytaux, and still less, of a particular room of a particular hotel there.

I did not have such dreams since, but these two cases are strange enough to puzzle the people to whom I described them. Do you see any possible explanation of them, other than that we are all wrong with our notion of time?

Jos. Mussche, Brussels, Belgium.

(It seems very difficult to try to explain a dream of the nature you described, assuming that all of the facts contained therein are absolutely authenticated. However, that is the difficulty with such dreams, even when care is taken to jot down the detail. Ordinarily one who has never seen double windows would not dream of them as being in existence, unless the party had an inventive turn of mind. But even if you jotted down the details such as double windows, peculiar form of locking devices, pine tree, etc., it would scarcely be likely that those details would be in exactly the same position as was indicated in your dream. Of course, when describing a thing of this nature on the pages of a notebook, you probably did not go to the trouble of taking any meticulous care in the positioning of the objects in the room or in their detailed description. A blind man, for example, who has been blind from birth generally dreams of odors, of touching and feeling objects or articles, and of various tastes. Never having enjoyed the faculty of sight, he rarely dreams that he is able to see, nor can he, in his dreams, visualize a city street or an elephant or any of the other animals unless he has had an extremely minute and detailed description of the object. Sometimes he dreams of seeing lights, but he does not know what a light means, and as a result, his description of the same would be vastly different than would yours. It, therefore, seems that you must have seen the double windows, and in particular, the peculiar lock on these windows, either in a photograph or in reality, before you could have dreamed them. We are quite confident that no telepathy exists here, and we know of no other force except the power of imagination which could be called upon.—Editor.)

Well, Well!

Editor, Science and Invention:

Have been a reader of your most excellent magazine for the past year.

I can think of no publication that conveys to the layman in understandable language the scientific discoveries and advancement of the present age, as does Science and Invention.

So appealing is every department of your magazine, it is difficult to think of dispensing with any one of them.

Personally being a lover of the out-of-doors, Dr. Ernest Bade's articles are most absorbing to me.

I have learned and am learning more and more of the marvels of nature from his splendid contributions.

Please thank him for me; and do give us more.

James Dawson, Engelmine, Calif.

(We hope that we will always be able to give you those articles which you so enjoy, and trust that we may be able to live up to your expectations and keep you as a constant reader of this publication for many years to come.—Editor.)

Reversed Vision

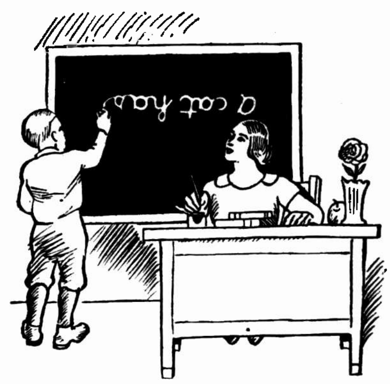
Editor, Science and Invention:

About four years ago when in the States, I remember reading an interesting article in a Sunday newspaper published in a Western State, about a boy of 12 being afflicted with "Reverse Vision"—that is, he was supposed to see things the wrong way round. This article was claimed to be quite authentic, photographs of the boy and his mother, their names and addresses being given.

Several instances illustrating the effect of reverse vision were furnished. Take the following for example. The boy orders a soft drink at the soda fountain, and the clerk hands the glass over to him to the boy's right. But the boy, instead of reaching out in the direction in which he sees the glass, knows by previous experience that it is not actually there, and has to grope around to his left before he can secure the drink!

Similarly he would sometimes accidentally bump into people in the streets through steering himself in the wrong direction.

His affliction was discovered by his teacher when he first started going to school, who found that he wrote backwards when copying from the blackboard.



On consulting a certain notable eye specialist, the reason for this reversal of vision was found to be due to the nerves leading from the retina to the brain being crossed or twisted.

What a lot of bunk! Was the paper deliberately hoaxing the public? Or did it really believe what it printed?

For all one could tell, without actual examination of the eyes and nerves, etc., every other person in the street may have "reversed" or even "inverted" vision.

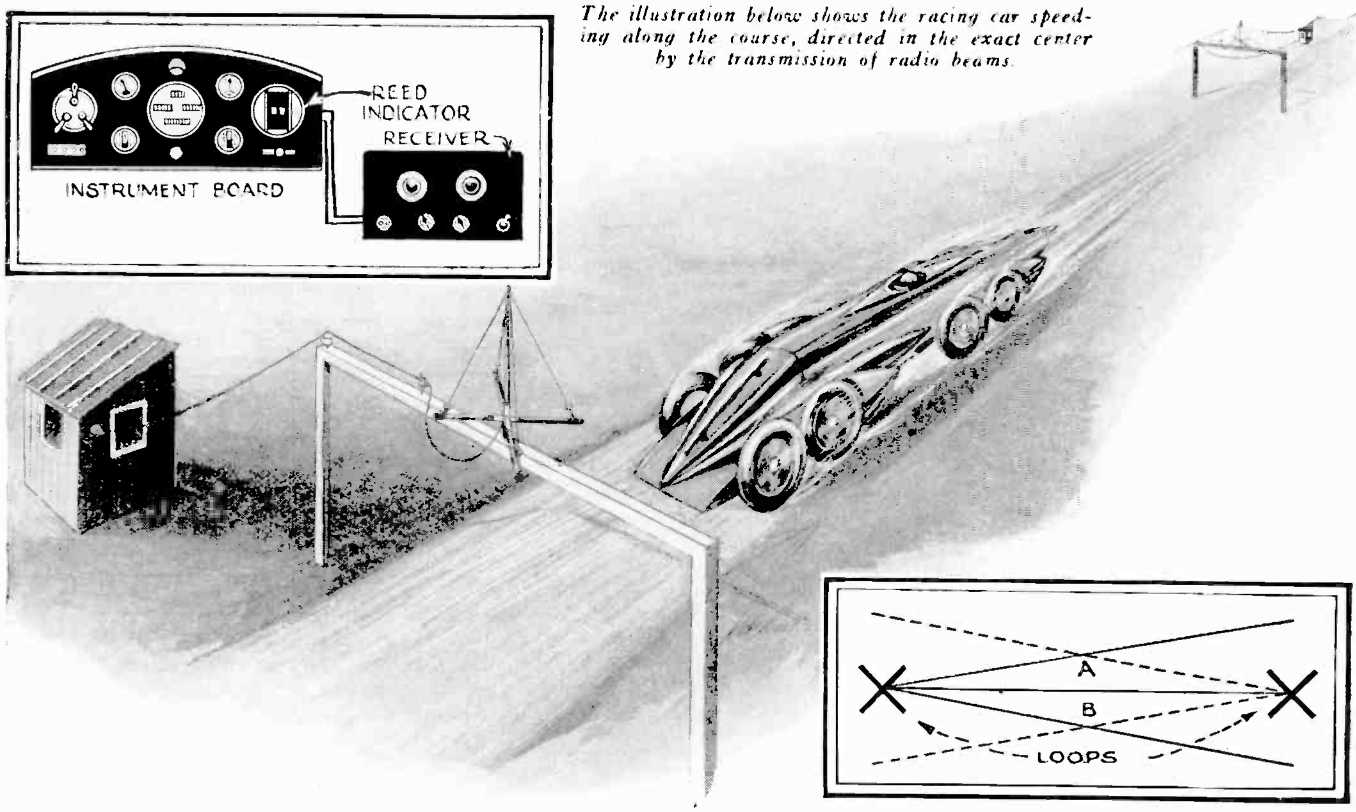
For that matter it could be quite possible for one person to see objects as being twice their normal dimensions without the person concerned being aware of it. For the eye does not measure the actual size of an object, but only its size relative to other things.

If a person had "reversed sight" since birth it would be impossible that the effect could make itself manifest in any way. Even if such a reversal of the sight were to take place suddenly, it would only be a very short time before everything would appear normal again, and the brain and the members of the body would respond naturally again.

Maybe other readers will remember this same article in more detail than I do.

Congratulate you on the series (*Continued on page 362*)

The illustration below shows the racing car speeding along the course, directed in the exact center by the transmission of radio beams.



Invisible Beam Will Guide Racing Car

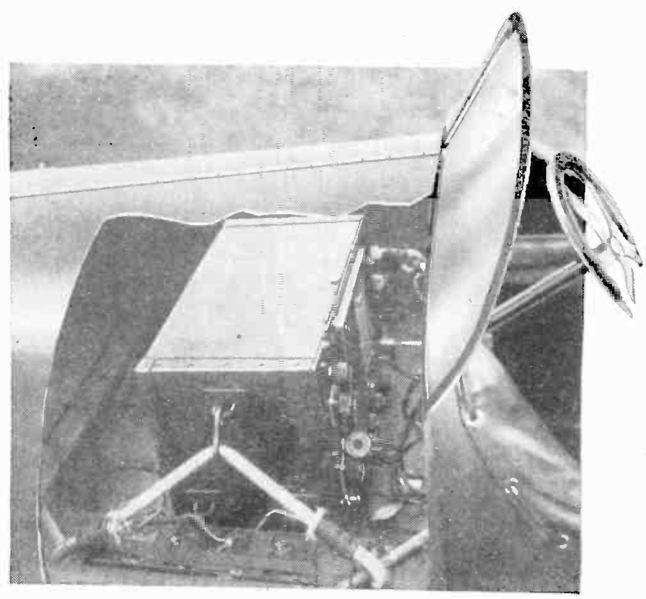
By PAUL L. WELKER

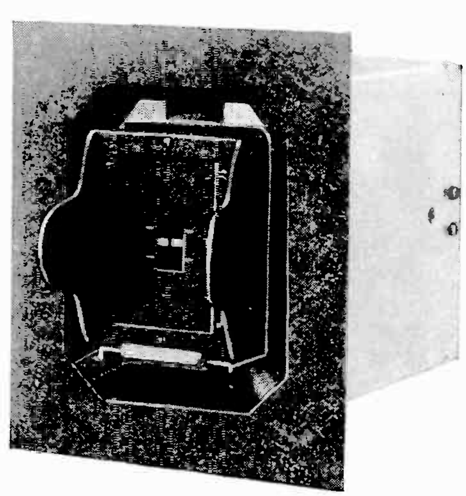
RADIO beam or beacon signals are now employed for directing ships and aircraft through the fog and the blackness of the night. Their field of usefulness will be broadened, however, when P. C. Amhurst Villiers drives his radio-directed car at Daytona Beach in 1931 in an effort to better the speed record made by Major H. O. D. Seagrave. The racing car will be powered with a 3,000-horsepower engine capable of driving the car at an estimated maximum speed of 400 miles an hour. The weight of the new racer will be four and one-half tons, and it is to have eight wheels all directly driven.

Radio Beacon Stations

SITUATED at each end of the track will be a radio beacon station with the antennas placed above the course to allow the car to pass beneath. Of course, an optional placement of the antennas would be at the two extreme ends of the track. The beacon system has been described in past issues of this magazine, but a brief explanation will be presented for those unfamiliar with the principles of operation.

The directive radio beacon station employs two loop antennas, crossed at an angle of 90 degrees to each other. (See diagram.) Each of these emits a train of waves, A and B in diagram, which is at maximum in its plane and at minimum at right angles thereto. In the type to be used, both antennas transmit (*Continued on page 367*)

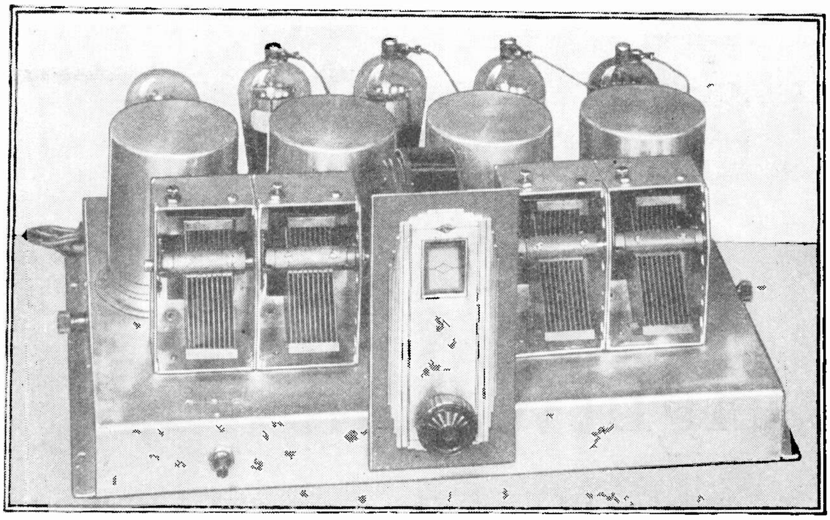




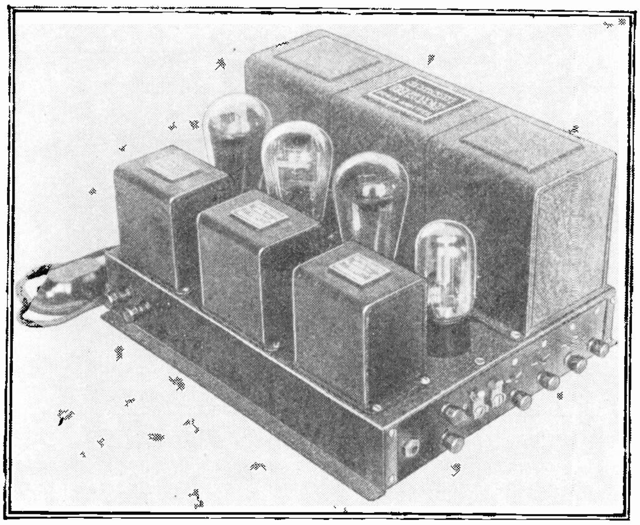
The photograph above shows a radio beacon receiver installed in a racing car. It is supported by rubber cord, which absorbs practically all of the vibrations detrimental to the set. The receiver is tuned to the transmitting frequency and the controls are then locked in place. The photograph at the right shows a visual vibrating reed indicator.

New Radio Devices

Screen Grid Tuner and 245 Amplifier

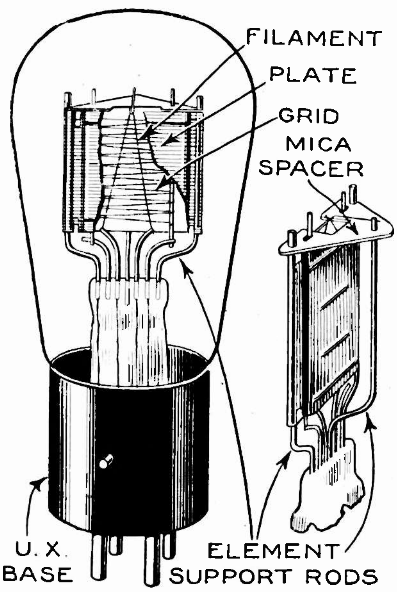


A SCREEN grid tuner kit employing UY 224 tubes and a push-pull amplifier using 245 tubes have recently been made available by a New England radio company. The tuner is entirely a.c. operated and has four stages of radio frequency. The first stage is untuned, so that single-dial control may be used. A 227 is used for the detector and four 224 tubes in the r.f. stages. The base is supplied with sockets in place and the coils are obtainable in sets of four. The variable condensers are equipped with trimmers to compensate for capacity in the wiring. The control grid lead is brought out in two places to facilitate wiring. All coils are shielded and the actual labor of construction is small.



A front view of the screen grid tuner chassis appears above. The actual assembly is not difficult, as the manufacturer supplies the base with sockets already in place. The tuner is a.c. operated and employs four UY 224 tubes in the r.f. stages and a 227 heater type tube in the detector. The new 245 push-pull amplifier is shown at the left. A 227 is used in the first audio stage and a 280 for rectification.

The push-pull amplifier employs two of the new 245 tubes in the output stage, with a 227 in the first audio and a 280 tube for rectification. This unit supplies a.c. heater voltage to the r.f. tuner and also supplies the necessary B voltage to the tuner unit. A jack has been provided for a phonograph pick-up. The combined amplifier and power supply unit is surprisingly compact and measures 12¼"×10¼"×7". A complete set can be assembled in a short time by using the two described units.



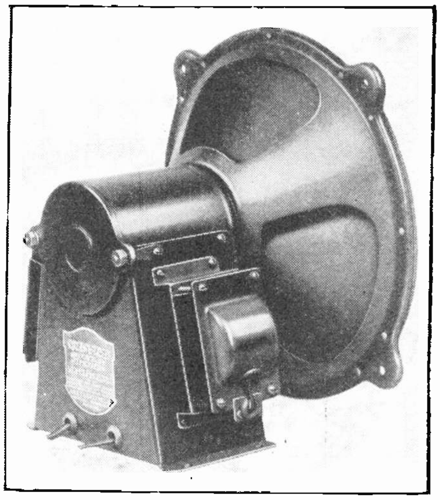
The internal construction of the new tubes is shown in the above drawing. All elements are rigidly supported and held in place by a mica spacer at the top.

New Tube Line

ONE of the Rhode Island manufacturers has announced a line of tubes available in all types, as well as photo-electric cells and neon tubes. At present 12 types of radio receiving tubes are made. The elements are rigidly held in place with heavy supporting wires. A mica triangle keeps the elements spaced apart and insures long life, as the danger of the elements touching is negligible. The five-prong base tubes are provided with a standard UY base and the four-prong base tubes with a UX base.

Under test the new tubes showed excellent characteristics, comparing favorably with standard tubes of well-known make. The photo-electric cells are made in a two-inch and a four-inch size.

Concert Dynamic



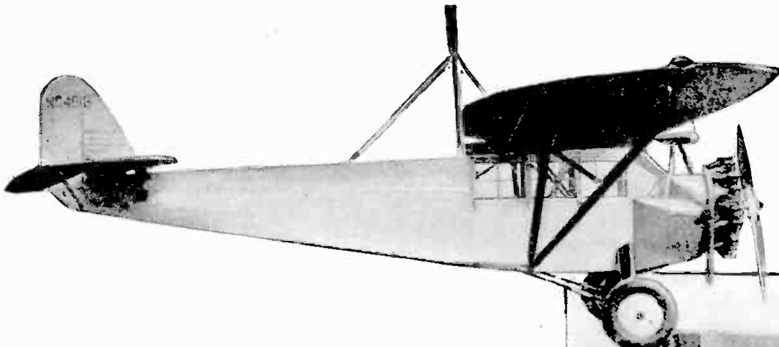
A three-quarter rear view of the concert type dynamic reproducer appears in the above photograph. Four models are available.

A WELL-KNOWN speaker manufacturer has recently brought out a new dynamic reproducer known as the concert type.

It is available in models operating from 110 volts a.c. or d.c., 220 volts d.c. and 6 volts d.c. A 10" cone is employed and frequencies as low as thirty cycles are produced with excellent volume. A new kind of paper is used for the cone and a specially drawn wire is employed for the field winding on the movable coil. Great rigidity and strength are gained through the use of the above-mentioned features, and yet they provide much lightness and freedom of movement in the actual sound-reproducing mechanism. Harshness and the so-called "barrel" effect that were noticeable in the first dynamics are entirely absent.

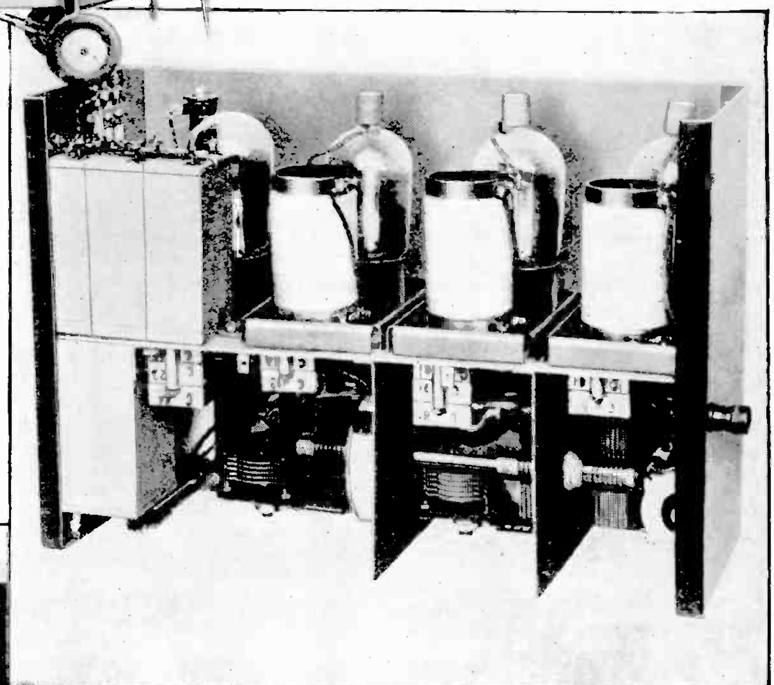
Although only the speaker chassis is shown here, complete speakers housed in cabinets are available from the manufacturer. Fine response over the entire range of voice and musical frequencies is assured by the use of the new reproducer.

Names of manufacturers supplied upon request

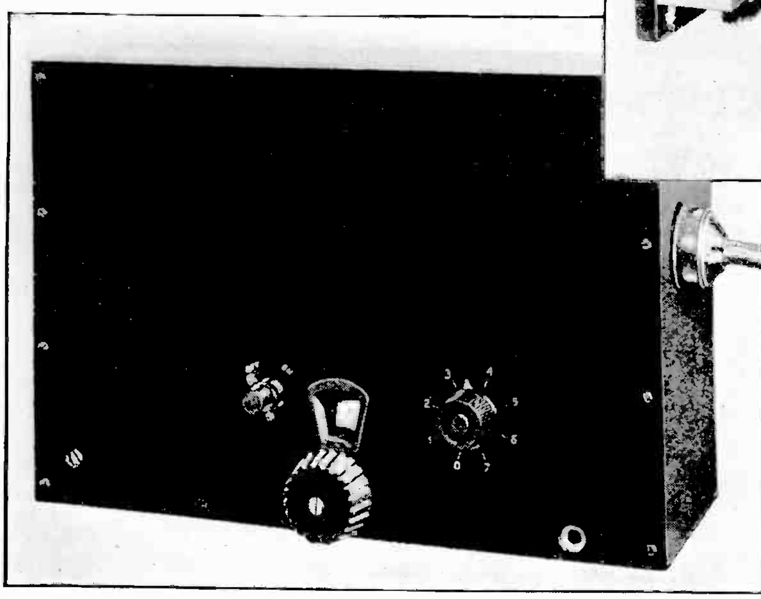


The new radio receiver was first tested in the Bell Telephone Laboratories' airplane, which is shown in the photograph at the left. The antenna used is of the rod or mast type, which does away with the trailing wire used previously. The high efficiency of the receiver makes it possible to use this type of antenna. An interior view of the airplane receiver appears below. The three shield grid tubes may be seen at the right.

Lightweight Radio Set *for* Planes



The placement of the parts in the receiver is clearly shown above. Only one stage of audio frequency is used. The set is extremely sensitive, due to the employment of a space charged grid detector circuit.



The airplane set is housed in a duralumin case and weighs only 12 pounds. A single dial is used for tuning.

A NEW lightweight radio receiver, which will pick up radio beacon signals, weather reports, and messages, has been developed by the Bell Telephone Laboratories for the Western Electric Company. The new receiver is contained in a duralumin case and weighs but 12 pounds. It is approximately 12″ long, 8″ high and 4″ deep. A single dial is used for tuning and makes the receiver extremely simple to operate. Because of the high efficiency of the set, a rod antenna can be used on the plane instead of a trailing wire.

Construction

FOUR tubes are used, three of which are of the screen grid type and the other a three-element a.c. tube. Two stages of radio frequency amplification, a detector and one stage of audio frequency are used. The screen grid tubes give an amplification of approximately three to one as compared with an ordinary 201A tube. Added sensitivity is gained by employing a screen grid tube in the detector circuit, connected as a space charged grid detector.

A small wind-driven generator weighing less than 7 pounds supplies both 10 and 220 volts to the receiver. Filters for eliminating objectionable noises are included in the set.

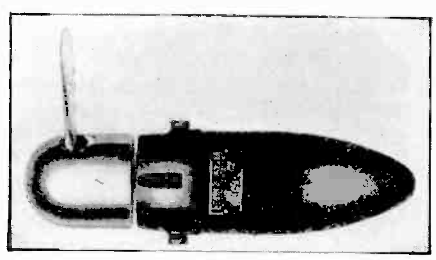
Transmitter

THE transmitter developed and used in conjunction with the set has a carrier power of 50 watts, but it is arranged for 100 per cent. modulation, so that a peak power output of 200 watts is obtained at full modulation. A frequency range of 200 to 50 meters is maintained within .025 per cent. under all conditions. This is accomplished by using a crystal oscillator, which is thermostatically controlled to maintain a constant frequency over a temperature range of from 40 degrees below zero Fahrenheit to 120 degrees above. This portion of the equipment weighs less than 9 ounces.

Power for the transmitter is obtained from a double-voltage direct-current generator geared to the airplane engine.

The lightweight radio transmitter and receiver will be employed in two-way telephone communication between airplanes and the ground. Special microphones, designed to eliminate outside noise, will be used.

Power for the receiver is obtained from a wind-driven generator, which is shown in the photograph at the right.



A Monthly Question and Answer Department Conducted with a View Toward Helping Radio Constructors and Experimenters

Radio Oracle

Grid Leaks

(720) D. B. Leibman, Salem, Illinois, writes:

Q. 1. What is the function of a grid leak in a detector circuit?

A. 1. A grid leak is a high resistor which is connected between the grid terminal of the detector tube and some portion of the filament circuit. The purpose of the grid leak is to assist in controlling the grid bias and also to allow the excess of the negative electrons that accumulate on the grid to leak away. By correctly biasing the detector tube, it is possible to obtain rectification without using a leak, but this method is not as sensitive as the grid leak detector. The value of the grid leak used depends upon the type of tube employed and on the strength of the received signal. To some extent, it is also dependent upon the tendency of the receiver to oscillate. When weak signals are being received, it is necessary to employ a high resistance leak for good volume, and when loud signals are being received a low resistance, in order to maintain fidelity. A compromise value must therefore be chosen to give both quality and sensitivity. If the leak has too high a value, the set will block and howl. If the resistance is too low, distant stations will be weak or entirely absent and it may also be found difficult to make the set regenerate. Further, when the regeneration point is reached, the receiver will suddenly fall into oscillation.

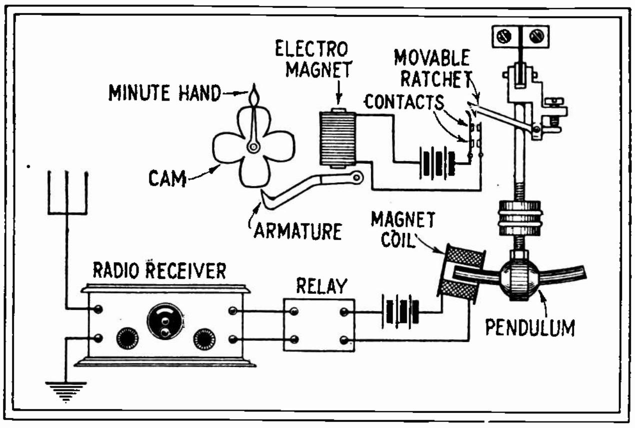
Grid leaks are also used in amplifiers of certain types. In choke coil and resistance coupled amplifiers the grid must be supplied with the correct bias. A choke coil or resistor of the correct value will keep the signal in the right channel, but will also allow the d.c. potential of the "C" battery to be impressed upon the tube grid and yet will not short-circuit the signal current.

Setting Clocks by Radio

(721) J. G. Willys, Manhattan, Kansas, asks:

Q. 1. Will you please publish a diagram showing how clocks can be set by impulses sent out over the air?

A. 1. On this page you will find a simple diagram showing how this feat may be accomplished. Any number of clocks can be set exactly upon the reception of the hour signal from the broadcasting station. A relay is connected to the output of the radio set and its contacts are closed periodically with the reception of the signals. A magnet coil and a battery are placed in series with the relay. The pendulum is of special design, similar to an inverted T with the cross piece slightly bent so as to permit one end to fit into the magnet coil. This portion of the apparatus is similar to the plunger type electro-magnet. When the magnet coil is energized, the oscillations of the pendulum are acted upon. At the top portion of the pendulum, or rather the pendulum support, is a ratchet which moves with the swing of the pendulum and closes contacts. When this auxiliary circuit is closed an electro-magnet is energized and attracts an armature which moves the minute hand by operating a four-toothed cam.



The above illustration shows the connections of the apparatus used in setting clocks by radio. Any number of timepieces can be set exactly upon reception of the hour signal from the broadcasting station.

Antenna Clock

(722) A. Burtow, Brooklyn, N. Y., writes:

Q. 1. In the June issue of Science and Invention, on the New Radio Devices page, a description of an antenna clock was published. Can you furnish me with a diagram of the internal wiring, showing how the light lines are used as the aerial?

A. 1. An illustration showing the internal connections appears at the right. The two leads from the line are led into the base of the clock, but only one of them is used for the antenna. A small fixed condenser is connected in series with the lead used and the radio set. This prevents the flow of the direct current or the low frequency alternating current. The radio frequency signals are, however, able to pass through the condenser to the set. All of the present light-socket antennas use the same principle, employing a fixed condenser in series with one side of the line. An aerial of this nature can be made at home in a few minutes' time and can be used with almost any of the present-day receivers employing two or three stages of radio frequency.

Definitions

(723) J. Berger, Altoona, Pa., writes:

Q. 1. What are the definitions of the following terms: acoustic impedance, acoustic reactance, acoustic resistance, acoustic ohm? I recently came across these terms when reading a report of electric acoustic devices used with radio receivers.

A. 1. The Handbook of Radio Standards of the National Electrical Manufacturers' Association gives the following definitions for the terms mentioned:

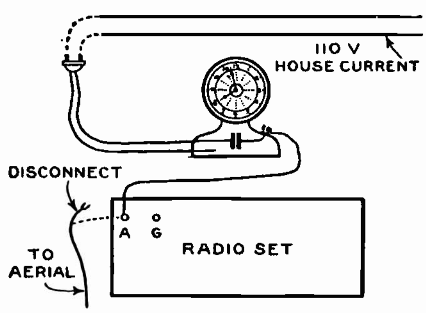
Acoustic impedance—acoustic impedance of a sound medium on a given surface is the vector ratio of the pressure (force per unit area) on that surface to the flux (volume velocity or linear velocity multiplied by the area) through that surface. The acoustic impedance may be expressed in terms of mechanical impedance, the acoustic impedance being equal to the mechanical impedance divided by the square of the area of the surface considered.

Acoustic resistance—the acoustic resistance of a sound medium is the real component of the acoustic impedance. This is the component of the acoustic impedance resulting from the dissipation of energy.

Acoustic reactance—the acoustic reactance of a sound medium is the imaginary part of the acoustic impedance. It is the component of the acoustic impedance resulting from the effective mass or compliance of the medium.

Acoustic ohm—an acoustic resistance, reactance or impedance is said to have a magnitude of one unit when a pressure of one bar produces a volume of one cubic centimeter per second. This is an acoustic ohm.

A pressure of one dyne per square centimeter is called a bar. The above definitions are from a preliminary report of the Institute of Radio Engineers.



The internal wiring of the antenna clock is illustrated above. A small fixed condenser is placed in series with one side of the line and the radio receiver.

Scientific Humor

A Monthly Fun Page for Those Who Enjoy a Laugh

DON'T BE SO SPECIFIC

HALF—There's no such thing as a useless article.

WIT—Well, how about a glass eye at a keyhole? —*Howard H. Lucas.*

ONLY TO AMUSE

PEDESTRIAN (who is nearly knocked down by taxi)—Say, don't you have any horn on that car?

TAXI-DRIVER—Yea, you wanna blow it? —*Mrs. Charles K. Berlin.*

HAD WATER ON THE BRAIN

HALF—My father died from a hard drink.

WITT—How's that?

HALF—A piece of ice fell on his head. —*Fred Erdos.*

SARGENT—DON'T COPY

PRINCETON STUDENT—Where does that boy with long hair come from?

HARVARD STUDENT—From Yale.

PRINCETON STUDENT—Oh, yes, I have often heard of these YALE LOCKS. —*Edwin Levy.*

SOUNDS HOLESOME

A professor explains how in this age nothing goes to waste, he continues: "Why, even the hole in the dough-nut is now used to stuff macaroni." —*Adolph F. Lonk.*

IN THE YEAR 2000

FIRST ADMIRAL—I'm going to blow that fleet to atoms.

SECOND ADMIRAL—Don't be so old-fashioned! Who wants to leave any *whole* atoms?

First Prize—$3.00

PERFECT

"My friend, there is no such thing as 'nothing,' and I challenge you to give me an example."

CHEMISTRY BEAR—Oh, I don't know. How about water anhydride? —*Milton Felstein.*

ALL jokes published here are paid for at a rate of $1.00 each; $3.00 is paid for the best joke submitted each month.

Jokes must have a scientific strain and should be original.

Write each joke on a separate sheet of paper and add your name and address to each.

Unavailable material cannot be returned.

THEY KILL ONE OF THEM

Mosquitoes and sheiks are alike . . . there is nothing to slap them on the back for until they go to work. —*Henry A. Courtney.*

QUITE A STEEL

CUSTOMER—I want something with lots of iron in it.

GROCER—Have you tried the chain stores? —*Henry A. Courtney.*

IS MORE THAN 500 POUNDS

SOPH—I don't see how freshmen keep their hats on.

DITTO (physics shark)—Vacuum pressure, boy, vacuum pressure! —*Walt J. Robertson.*

ONLY LOOKS, NO STAMINA

JACK—Not a bad-looking car you have there, Brown. What's the most you ever got out of it?

BROWN—Six times in one mile. —*Fred Erdos.*

THE WOMAN DOES NOT PAY

HIGHBROW FRIEND—Do you know, Mrs. Brown, that this dining-room set goes back to Louis the Fourteenth?

MRS. BROWN—That's nothing, my whole living-room set goes back to Sears-Roebuck the 15th. —*Juanita H. Squires.*

TRY THE DRUG STORE

A professor in a Chicago university has perfected an instrument to measure the intensity of a chorus girl's blushes.

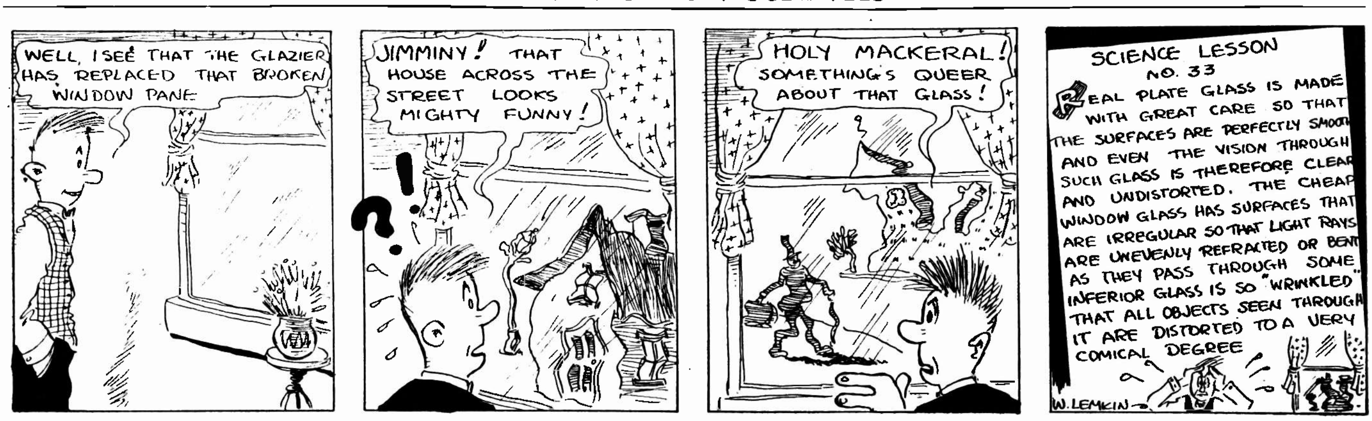
All that is necessary is something to make a chorus girl blush. —*S. G.*

NOT FROM WHENCE IT CAME

A man having dropped his wig in the street, a boy picked it up and handed it to him.

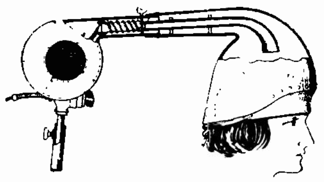
"Thanks, my boy," said the owner of the wig. "You're the first genuine hair restorer I have ever seen." —*Miss J. K. Fifrick.*

SCIENTY SIMON SCIENTIST



Latest Patents

Hair Drier

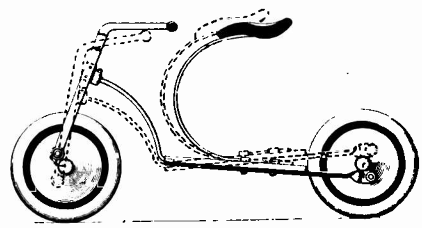


No. 1,707,554, issued to William F. Hendry. The above invention provides for a helmet which fits over the head, conducting hot air to the hair to be dried. Incorporated in the helmet is a means for blowing a stream of cool air upon a portion of the head. The smaller tube carrying the cool air is adjustable. The jet of air can be regulated by means of opening or closing a valve.

Notice to Readers:

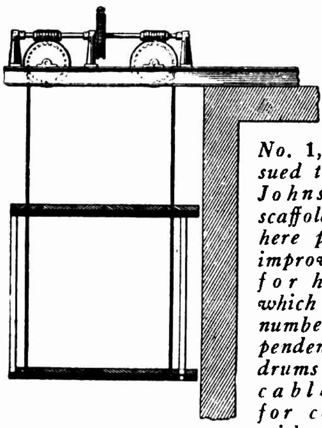
These illustrated and described devices have recently been issued patent protection but are not as yet, to our knowledge, available on the market. We regret to advise that it is impossible to supply the correct addresses of inventors of the devices to any of our readers. The only records available, and they are at the Patent Office at Washington, D. C., give only the addresses of the inventors at the time of application for a patent. Many months have elapsed since that time, and those records are necessarily inaccurate. Therefore, kindly do not request such information, as it is practically impossible to obtain up-to-date addresses.

Child's Vehicle



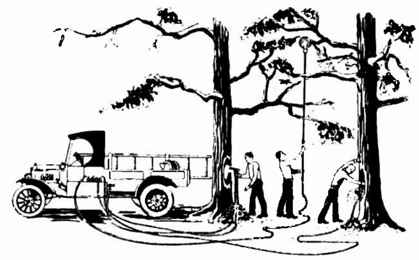
No. 1,705,540, issued to Miles W. Rumley. This invention is an improvement on a child's scooter, wherein the frame of the structure is connected to the supporting wheels at off-center points, so that an irregular up-and-down movement will be imparted to the frame.

Scaffolding



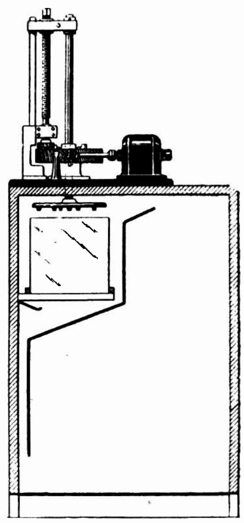
No. 1,702,509, issued to Frank B. Johnston. The scaffold shown here provides an improved means for hoisting, which embodies a number of independent hoisting drums carrying cables adapted for connection with the scaffolding at different points. A common drive is used for simultaneously turning all of the drums to raise or lower the scaffold by the use of a single motor. The hoisting devices are mounted upon the adjustable platform and may be connected together for simultaneous and equal operation, so that the scaffold may be controlled from a fixed point or from the platform itself.

Treating Trees



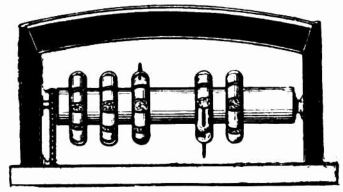
No. 1,700,030, issued to James Abram Davey. This invention provides for a method of tree surgery, whereby the tools used are operated largely by compressed air, which is compressed by a motor truck adjacent to the trees. The exhaust air may be used to blow the chips out of the cavities. Special tools are used for boring and cutting, while a sprayer is employed for applying water-proof paint.

Method of Refrigeration



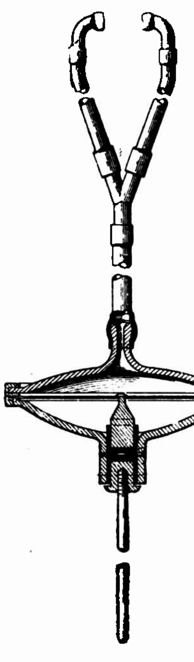
No. 1,695,292, issued to Cassius C. Palmer. This method of refrigeration uses solid carbon dioxide, from which particles are shaved and distributed over a metal plate, one side of which is exposed to the chamber to be cooled. By varying the amount of shavings, the temperature of refrigeration can be controlled. Cutting blades are operated by a motor and pass over the surface of the block of solid carbon dioxide. Means are provided for feeding the cutting blades toward the block.

Frankfurter Roaster



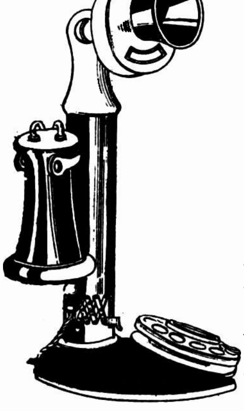
No. 1,706,225, issued to D. Goldberg, S. Goldberg and A. M. Young. The device shown above provides a roasting bar, around which the frankfurters are bent, the skin having previously been cut on one side. A tooth-pick holds the frankfurter in place. After roasting, the frankfurter will retain its circular shape.

Motor Stethoscope



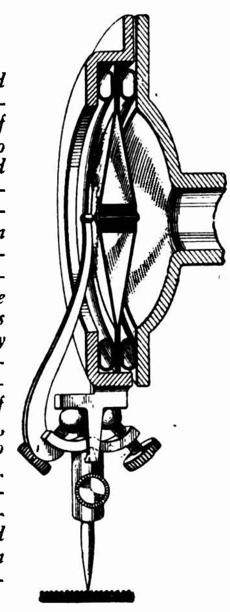
No. 1,708,992, issued to Emil O. Woekeck. The device shown at the left is a stethoscope, which is particularly adapted for locating all knocks or other noises such as occur in motors or other machinery. The diaphragm is fully protected from injury. The diaphragm is in the form of two concave discs which are placed within a case. A sound transmitting member is connected to the diaphragm. The upper portion of the case is provided with a nipple for connecting the sound-carrying rubber tubing, which ends in two ear-pieces.

Telephone Busy-Signal Device



No. 1,701,288, issued to Fred S. Wertheimer. The signal device shown is designed for attaching to a telephone. A small lamp is provided which flashes and notifies the user that a party desires a connection. Besides this, an indicator is provided for recording the number of times that the signal is operated.

Acoustic Device



No. 1,708,943, issued to Charles L. Goodrum. The object of this invention is to provide a light and relatively stiff diaphragm, the movements of which, in response to vibrations, will be approximately the same at any point on its surface; thereby simulating a piston-like action. The diaphragm consists of two dished surfaces, secured together to form a hollow body. The opposing sections serve to mutually reinforce and stiffen each other in the direction of applied vibration.

A Monthly Scientific Question and Answer Page

The Oracle

Exterminating Moths

(2318) Frank Boyle, Charlotte, North Carolina, asks:

Q. 1. I would appreciate some information regarding the killing of moths and their larvæ. Also methods whereby clothes may be protected from these pests.

A. 1. Naphthalene flakes scattered among the clothes in an ordinary trunk or tight chest will kill larvæ and will prevent the eggs from hatching. In open drawers naphthalene will not give much protection. Before putting the clothes away, they should be aired and brushed well. Another substance which can be used in place of the naphthalene flakes is paradichlorobenzene. It is used in the same manner as the naphthalene flakes and will not injure the clothes.

Cedar chests and cedar-lined closets are also useful in protecting clothes from moths. The protection is afforded by a volatile oil present in red cedar wood. The fumes will kill newly hatched larvæ, but will not generally destroy the moths or their eggs or half-grown larvæ. The cedar chests or closets should be kept closed, at all times, except when actually removing the garments.

Clothes should be hung in the air and sun and then brushed in order to dislodge the eggs and larvæ which may be on them, before they are put away. It is also well to take them out about once a month for subsequent airings and brushings. Woolen blankets can be stored away with camphor balls. It is also advisable to spray the cracks in closed closets or chests with benzine before putting the clothes away. Suits and overcoats can be stored away in cardboard boxes with all cracks thoroughly sealed by paper strips. Moth-proof paper bags are safe receptacles for clothes, and cold storage plants are very effective.

Walnut Poison

(2319) Allen Herbert, Williston, North Dakota, writes:

Q. 1. Attempts to grow potatoes in the vicinity of walnut trees have failed. What is the poison which seems to keep the ground underneath these trees bare of plant life?

A. 1. Everett F. Davis of the Agricultural Experiment Station of the Virginia Polytechnic Institute, at Blacksburg, has succeeding in isolating the poison which exudes from walnut trees. The name of the substance is penta-hydroxy-alpha-naphtha-quinone. This chemical term is unwieldy and it has been suggested to call it juglone, as the botanical name of the walnut tree is Juglans. It belongs to the family Juglandaceæ.

Corn-Cob By-Products

(2320) George Starr, Washington, D. C., writes:

Q. 1. Can you give me any information regarding the work which has been done with corn-cobs at the Iowa State College?

A. 1. Organic chemists at the Iowa State College have succeeded in producing from corn-cobs a compound approximately 300 times sweeter than sugar. The work is in a preliminary stage and it is not known at present whether this compound will harm the body. In the past year many new substances valuable as perfumes and food flavors have been obtained from corn-cobs. These compounds possess pleasant odors and one may possibly be used as a substitute for maple syrup flavoring. Apple, caraway and raisin flavorings have also been produced. Fragrant substances which may supplant the present perfumes have been extracted, and a local anæsthetic as effective as novocaine was prepared from corn-cob material.

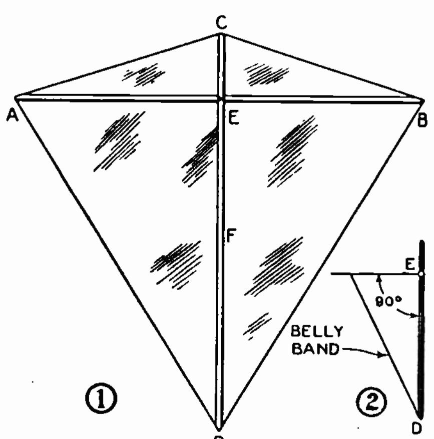
The "Oracle" is for the sole benefit of all scientific students. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be published. Rules under which questions will be answered:

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.

Tailless Kite

(2321) H. T. Hilton, Fort Worth, Texas, asks:

Q. 1. Will you furnish me with the necessary data for the construction of a tailless kite to be about five feet high?



The above illustration shows, at 1, the construction of the tailless kite, and at 2 the manner of attaching the belly-band or hanger to the kite.

A. 1. On this page, at figure 1, you will find a drawing of this type of kite. The sticks are best made of spruce, as this wood is not liable to break under strain. Each stick has a cross section of 5/16" x ½". The stick AB is 68 4/10" long and the stick CD is 60" long. The center of gravity marked at F is 35% of CD from the top of CD. CE is equal to 18% of CD in all types of this kite. Thin paper should be placed loosely over the frame. The deepest part of the bow of the stick AB is equal to 1/10 of the length of AB. The bend on each side of the junction E should be equal. The bagging of the paper on triangles AED and BED must be equal. The belly-band or hanger is shown at figure 2 in the side view. This is fastened to E and D and should make a right angle at E and an acute angle at D.

Airplane Vertimeter

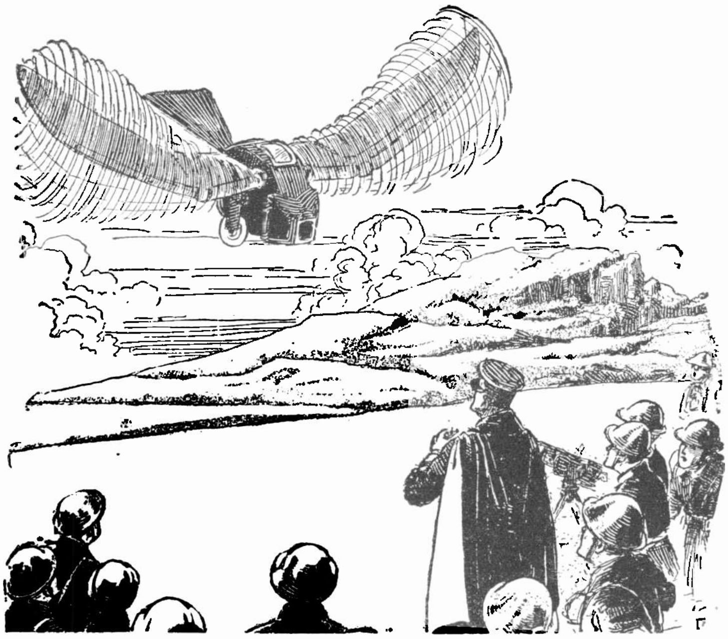
(2322) E. Verne, Crawfordsville, Indiana, asks:

Q. 1. Please give me a brief description of the various rate-of-climb meters used on aircraft.

A. 1. Rate-of-climb meters or vertimeters are employed for measuring the ascent or descent of airplanes. They assist the pilot in obtaining the maximum rate-of-climb of the plane. The most common in use are of the capillary type. These have an air chamber connected to the external air by a capillary tube and a manometer or indicator to measure the difference in pressure between the chamber and the external air. When the plane ascends the external pressure decreases and the pressure of the air in the chamber can only be equalized by flowing outward through the capillary tube, the small bore of which retards this flow and produces an excess of pressure in the air chamber, which is indicated by manometer. The reverse takes place when the plane is descending.

The manometer may consist of a liquid column or a sensitive metal or non-metallic diaphragm, the deflections of which are transmitted to a pointer by means of a multiplying system. Sensitivity of the liquid manometer is increased by inclining the tube. Mechanical indicators are generally preferred on airplanes since the rate-of-climb and descent are great.

In free balloons, the anemometer rate-of-climb indicator is used frequently. This consists essentially of a small device, similar to a windmill, mounted so as to be acted upon by the vertical air current with reference to the rising balloon. This type indicates vertical motion of the balloon relative to the air. Its indication may be affected by any distortion of the vertical air flow around the balloon. The vertical component of air-speed serves as a measure of the rate of ascent in the magnetic type of instrument. A propeller-driven armature revolves in the field of a permanent magnet, the speed of rotation of the armature and the positions of the armature and magnet give a measure of the vertical component of air speed. This is independent of air density.



The Invisible Incendiary

By F. N. Litten

(*Continued from page* 325)

down, crossed the steel network of rails that gleamed, reflecting light from the car windows.

The roadster moved off through the crowded street, still brightly lit at midnight and hectic with a flow of war transport trucks, pedestrians, pleasure cars—a hurrying traffic—all touched with the mad stimulus of those fevered days when the big push was imminent.

The Big Mystery

"HERE'S the story," began Weeks abruptly. "De Mours, as you know, are chief suppliers to the Entente of nitrocellulose explosives. We make a lot of cordite, too, for the British. And, of course, there are the by-products, celluloid, silk substitutes, and pyralin. But you may not know that for the past year we have produced three-quarters of the finished fabric for airplane wing and fuselage covering. We process a fine count Irish linen which comes to us unbleached, and turn it back for airplane assembly lighter, more pliable than silk; waterproof and of great strength and toughness." He paused. "I developed a refinement of the process in the De Mours research laboratories—making the linen fire-resistant." His harsh laugh jarred. "We revamped an old plant warehouse for my process—got into production sixty days ago. . . . O. K. at first. . . . But in the last month we've cracked open!" He speeded up the car impulsively, and Gorton strained to catch the next words. "A failure—the process. . . . Dr. Heilsbronn says it's defective solvent that is causing it——"

"Causing what?" asked Gorton irritably.

"Fires. . . . Destruction of the linen rolls in the process oven. We've had three burnouts this last week. The money loss alone is over fifty thousand, but that's incidental. . . . We're letting down the government—they can't turn out the planes. Another week the air force will be crippled on every Allied front." His hands clenched the steering wheel. "And Gorton; the big push is due!"

"Heilsbronn. The birthplace of the Hohenzollerns is a Bavarian village of that name." The dry precision in the voice contrasted with Weeks' strained utterance.

He turned to Gorton in the darkness:

"You mean you think that Heilsbronn—but that's impossible. He's a director in De Mours—research advisor—our best processes are his development. This failure has him half crazy, too. . . . Besides—I've watched at the oven night and day; and there's a sentry constantly on duty. Nothing happens that I don't see . . . no one has access. . . . It's in the formulæ; it must be, Gorton!"

The De Mours Plant

WE fell silent and the car, reaching the outskirts of Steel City, speeded up; coasted over rolling hills and toward the lights of the big De Mours plants, seen, when they topped occasional high crests, as a field of diamonds sowed in geometrical precision. They entered a wire gate flanked by a sentry shelter; a posted sign-board read, "Leave Matches Here"; and two soldiers hailed the car, saluted Weeks and stepped back. They rolled on, and between the hills stretched long, low buildings, cordite and trinitrotoluene bunks, flood-lighted, guarded each by men in khaki.

"Enough TNT in here to blow up the Atlantic coast," said Weeks with a short laugh. He went on: "That's another complication. The old building where we process this fabric is dangerously close to all this tricky stuff. Why, the nitro-glycerin kettles are just across the next hill. And the last fire threw brands that lit on the steel roof—some of them."

He turned left through the city of destruction, down a street checkered with deep shadows and alternating lights from the many windows of the crowded steel-clad buildings. Workers passed them, singly and in groups, all strangely quiet, their voices hushed. The deep chord of the midnight whistle boomed ominous, sullenly.

"Twelve o'clock." Weeks looked at his watch, replaced it, and Gorton saw his hands were not quite steady. "The midnight crew is going on. Graveyard shift—these powder jugglers call it—good name." Then he pointed. "Look in there—drying M D cordite. And the next building they cut it up in chunks, like macaroni—over-size. Breakfast food for Fritz. . . . Well, here we are."

$21,000.00 FOR SPIRITS

$1,000.00 offered by this publication for spirit manifestations which cannot be duplicated or explained by scientific means.

$10,000.00 for spiritual phenomena offered by Joseph F. Rinn.

$10,000.00 offered by Joseph Dunninger for manifestations which he cannot explain or duplicate under identical conditions.

Total: $21,000.00 now offered.

He stopped the car before a larger building, with a receiving platform at one side, on which a truck was discharging burlap-covered bales. Men loaded these on hand trucks, clattered from the platform and disappeared within the building. Weeks hastily slid out from underneath the wheel. He turned, in some relief, to Gorton.

Prof. Gorton Meets Dr. Heilsbronn

"THEY'RE getting ready for a run—was afraid they'd close the oven before we got there. Want you to see it all. . . . Oh, that's Dr. Heilsbronn. I'll introduce you."

He passed around the car and, crossing to the platform, hurried up the steps. Professor Gorton was deliberate in following. He looked up at the man Weeks had pointed out, who stood under the purple glare of the arc above the platform, absorbed in the perusal of a notebook which he held. His face was in shadow, but at Weeks' greeting he swung quickly, and the professor felt somehow a let-down, a disappointment. He had not, even to himself, confessed to a suspicion of this man. It was a fundamental of his great analytic powers to approach every problem absolutely without bias. From this came much of his success; it was clearly his work in the case of the Dardanelles-U-Boat mystery which Downing Street acknowledged as a triumph of our Secret Service. But with the press recounting daily the uncovering of plots to destroy bridges, cripple rail communications, blow up arsenals, and the information as to the sinister activities of the Wilhelmstrasse filed with our Secret Service, and to which he of course had access, it was not strange that subconsciously he should single out a man whose name plainly marked Teutonic origin for surveillance. His feeling of chagrin increased as Heilsbronn spoke. The voice, unutterably weary, only emphasized the harassed dejection in his thin, gray-shadowed face. He stepped toward Gorton; with a springless, beaten gesture, held his hand out.

"Professor Gorton. We are thankful. Yes, that is inadequate to express our feelings. This matter is more than the failure of a process. Weeks has told you," his voice dropped and he came closer, "that a drive, the major operation of our armies on the front which we have taken over from the French, is now impending. I have a message here (he unfolded from the notebook a square of yellow paper) from Washington—the Service of Supply. Two hundred planes that should be aboard transport steaming to that front are waiting on our fabric for completion. . . . And we have failed." His voice, bitter with self-recrimination, broke off and he pressed his lips together.

Gorton heard him coldly. Emotion was to him distasteful; he found no place for it in the cold mechanics of his mind.

"The ovens are being loaded? I should like to see them, please."

Heilsbronn returned a doubtful nod, as though half offended by the chill distaste in Gorton's voice. With sober courtesy he said:

"Yes, you are in time. Come!" Turning, he led the way under dotting arc lights down the long aisle. Piled high on either side, they passed vast stores of wooden crates, showing through the slats a glint of bright metal. Further on, these gave way to rows of carboys that massed far back into the gloom.

"Reserve stock," Heilsbronn waved his hand briefly, "glycerin—nitric acid. The essentials of glyceryl tri-nitrate, nitroglycerin. We receive our normal supply in tank cars. This warehouse is only for emergency use. We also carry cotton linters here. That is why a fire is to be dreaded."

He stopped before a long, steel-sided room and laid his hand on Gorton's arm.

The Scientific Process Oven

"HERE is the process oven. Mr. Weeks' development." He smiled sadly. "I do not mean to taunt him with that statement. It held wonderful promise, this development. Imagine wing fabric waterproof and fireproof, as tough as oak-tanned leather, and with the weight of sheerest silk! That no tracer bullet would ignite nor wind stress shatter. . . . Revolutionary! . . . This is the control panel on which the thermostats for regulating oven heat——" He stopped.

Gorton had turned from him. He was staring at a workman mounted on a ladder that stood before the ebonite control panel; watched with odd, intent gaze while the man placed new carbon pencils in the arc lamp hanging from the ceiling close against the board. Then he started, as if suddenly aware of his discourtesy.

"I beg your pardon, Heilsbronn," he said. And, with curious inflection, "Carbon arc lamps are a rarity in these days."

The research director's face showed that he resented Gorton's rudeness, and Weeks, to bridge the incident, broke in:

"The arc system was installed many years ago, I understand; and as this warehouse has been vacant, it has not been changed. There is an advantage, too, which Dr. Heilsbronn pointed out, in that the arc spectrum is correct for judging color of the processed fabric——"

"Cooper-Hewitt lamps would do better for that purpose," the professor interposed dryly, "and at less cost for maintenance.

Guessing Games

THEY were a lot of fun when we were youngsters, those guessing games. Guess who this is! Guess the number of beans in the pot! Guess how long the pendulum will swing! Sometimes we come pretty close to the right answer. Sometimes we were a long way off. Whichever we were, we all had a good time, and the worst guesser got as much of the evening's refreshments as the best.

How far away those guessing games seem now! And how they have lost their appeal. Perhaps it's because we learned, as we grew older, that to *know* is better than to *guess*. Guess which is the best package on the grocer's shelf! Guess which bolt of cloth is pure wool! Guess which talking machine will give us most satisfaction! No, guessing for those things wasn't so much fun. We wanted to be certain. And that was one of the reasons we turned to advertising.

Advertising takes the guesswork out of buying. It lets us *know* what is best and what is cheapest and what will last longest. It does away with unsatisfactory uncertainties. The advertisements in this magazine tell a concise, interesting and accurate story about articles you need. Reading them is the surest and quickest path to wise buying. It eliminates guessing.

How often do the carbons need replacing?"

The man on the ladder moved, frowned down at Gorton and spoke quickly, interrupting Weeks' reply:

"I make the rounds once a day. . . . The repairs are nothing compared to the breakage of the filament lamps in the other buildings."

Heilsbronn showed satisfaction at this answer, but Weeks said in sharp reproof:

"That will do, Barr."

The man turned back to his work with impassive face, and Weeks looked at Heilsbronn anxiously. From the doctor's attitude it was patent that Gorton's trivial criticism had been construed as an affront. Conscious of the unfriendly silence, he began again.

"This is the process room; the oven." He opened a thick door beside the control panel. "There is no access to it except through this door which is padlocked when we start the process. Dr. Heilsbronn and myself possess the only keys which are both required to free the lock." As he said this, his eyes met Gorton's coldly, as though to refute the other's doubt of Dr. Heilsbronn.

$5,000 FOR PERPETUAL MOTION

The editors have received thousands of different designs of perpetual motion devices, and have received hundreds of circular letters soliciting finances for the building of perpetual motion machines.

The editors know that if they receive these letters, there are thousands of others in this country who get similar letters and who fall for the claims made in the numerous prospectuses giving the earning capacities of the various machines.

Most of the shares of stock for these perpetual motion machines are being sold at a rate of $1.00 per share, although some inventors are trying to sell shares of stock at $100.00 per share.

Therefore, the editors of this publication say, "Just come in and show us—merely SHOW us—a working model of a perpetual motion machine and we will give you $5,000.00. But the machine must not be made to operate by tides, winds, waterpower, natural evaporation or humidity. It must be perpetual motion."

Then his voice continued: "See, they are placing the cloth now on the spindles."

Gorton stepped into the steel-lined room. Mounted on heavy spindles, supported from the hollow metal floor, were the bolts of linen, like rolls of news print paper, a dozen or more, placed end to end across the oven's width. Workmen were unrolling the bolts, stretching the cloth down the long room and fastening the ends to empty spindles.

"The spindles at the far end are power-driven from a chain and sprocket—the motor is outside. The linen unrolls slowly, and travels down the room like a belt, winding up on the empty spindles. These," he pointed to a set of fan-shaped nozzles in the ceiling, "spray the treating solution on the cloth as it unrolls; and steam with a high super-heat, circulating through pipe coils underneath these gratings in the floor, bakes the impregnated linen dry before it winds up.

"We control the temperature inside this room from the panel board outside. It is carried at three hundred degrees. . . . No one could live who would attempt to enter when the processing was on. And it is then that these fires start, which leave the contents so much ash and cinders." He clenched his hands impotently.

"Interesting," commented Professor Gorton. And Weeks, stung by the cool unconcern, bit his lips to keep back the indignant answer that rose to them.

An Inspection of the Formulæ

"HERE are the formulæ," he said. "I hope, Professor, you will give them careful study. It may be there are chemical combinations formed by the process-heat, which ignite spontaneously; certainly it is possible; with Amyl Alcohol, Acetone, and the volatile nature of the other solvents used. The fire-proofing agent, finely divided feldspar, would not prevent combustion until the solvent had been evaporated. . . . You see plainly that no outside source could cause these fires."

Gorton took the papers from him, stepped beneath a light insulated by a marine fitting to withstand the oven heat, and which gave a feeble, yellow glow. After a moment he looked up.

"The illumination is certainly defective here. However, I can read enough to satisfy me." He placed the paper in his wallet.

"What is most interesting," he said, turning with bland unconcern to Dr. Heilsbronn, "are these antiquated arcs which we saw outside. And in a plant with the reputation for modernity which De Mours bears."

At this direct taunt, the research director's tired face slowly tinged with red. His shoulders lifted and in his eyes glowed a faint spark of anger. The emotion died out. He said, with a dignity that made Weeks ashamed for the cold-faced Gorton:

"Professor, you are difficult to understand. I am not responsible for these lamps. And what is this trivial matter to which you constantly recur, beside the fact that Pershing's army on the western front may, as a sequence to the failure of our process, meet defeat. I am more concerned that no further time is lost in making a last effort to ferret out the cause of these disasters."

Gorton received the reproof with imperturbable composure, nodded without speaking and stepped deeper into the process room. He walked slowly to its end, inspecting carefully the rolls of linen, the brass spray nozzles pointing downward from above. He glanced about the steel walls, and at the ceiling, its surfaces blackened by previous conflagrations except where a new section replaced one utterly destroyed. Suddenly he started. Pointing at a set of brightly polished discs above the spray guns, he asked, his voice like the sharp crack of a whip:

The Mystery Deepens

"WHAT are these?"

Weeks, startled by the abrupt vibrance of the voice, swung round; his eyes followed the professor's pointing finger.

"They are deflectors. . . . To turn the spray. We found the fabric as it moved along the room swayed up and down, splashing the solution back against the ceiling, where it hardened. Waste, of course. Then Dr. Heilsbronn devised this. It has cured the trouble."

"Indeed," returned Gorton, still studying the shining discs. His dry precise intonation again made Weeks burn inwardly. He began to regret that he had called in the professor. When would he lay aside this trivial questioning and begin his work—the investigation of the formulæ?

Almost as though he read the thought, Professor Gorton slowly turned.

"If my mission here is to correct your formulæ, I should return to Mercer."

Weeks stared at him. "I don't understand——"

Gorton frowned. He had no love for the theatrical, for pose; and when his statements, always to him obvious, were interpreted as enigmatic, became quickly irritable.

"There is no flaw in the formulæ," he said, clipping off the words impatiently.

"Then, what *is* your explanation? You think the cause might be physical—a surface friction that ignites the cloth?" Weeks hazarded the guess.

The professor shook his head.

"Physical, yes; but not in the sense that you express. I am convinced," his words were charged with positive emphasis, "that there is a human agency behind these fires. . . . Who had supervision over the construction of this process room?"

Heilsbronn stepped forward.

"I am responsible," His voice rose, shrilly. "Do I understand that you accuse me of a knowledge of the origin of these disasters?"

Gorton eyed him unemotionally.

"The time for accusations has not come. I say only that there are appearances of a clever hand in this. . . . Are there any others, workmen for example, who were engaged in the building of this oven, now employed in operation of the process?"

Dr. Heilsbronn's anger left him speechless and Weeks, after a pause, broke the strain.

"Keller, who is foreman, and the electrician outside, Barr. The rest were men regularly employed on constructon about the plant."

"Keller?"

"He is fastening the last roll there." Weeks indicated a man in overalls, who, as he spoke, wrapped and fastened the last bolt of linen to its spindle at the far end of the room.

"A new man?"

"Well, he was transferred here from our Coronado plant. A good worker, but hard to get close to."

The foreman turned and came toward them. Unaware of the professor's scrutiny, he drew Weeks aside.

"I'm quitting Saturday," he said heavily, his face averted. "Give you notice now."

"What's wrong, Keller?" asked Weeks.

The foreman shrugged.

"Just quitting." He evaded further questions by stepping quickly to the door. Heilsbronn swung about and followed, and Weeks returned the professor's curious glance with puzzled apprehension.

"I see the rolls are ready," Gorton said, raising his eyes again and studying the spray guns at the ceiling absently. "And I am ready, too. In fact, I have seen all that I require—until you start the process. Interesting, Weeks."

He turned back to the fire-proof door and passed out. Weeks remained for a last nervous survey of the process room. His face was drawn. He felt the oppression of a vague alarm which Gorton's theories had stirred. . . . And the responsibility of those waiting ships; the thought that another failure presaged an army blinded, moving without sight in the big push ahead. . . . It must not happen.

But with the words came a sense of their futility. He had done all—all that he knew. But it was not enough. And Gorton, on whose aid he had built, engrossed in some vague theory. His arms dropped in a hopeless gesture.

Keller, in the doorway, called: "Ready?"

And Weeks, his voice hoarse with the growing tension, answered:

The Fabric Process Starts

"TURN on steam."

He stepped out, the door clanged shut and as he screwed down and locked the heavy tension-bar, steam crackled, whirled against the coils, and he heard the spindle motor hum in crescendo up the scale. The fabric, on which an army's fate might rest, was moving through the oven.

Outside on the ladder, the electrician, Barr, still worked with the mechanism of the arc. Beside the panel, holding in his hand a wire guarded lamp from an extension cord, Heilsbronn watched the heat gauges, glancing up with an occasional, impatient frown at the man above. Gorton stood back half in darkness.

Weeks saw Keller at the triplex pump loading the grease cups, and joined him. The foreman seemed uneasy in his presence. Weeks, after an awkward silence, spoke sharply, repeating the question he had asked the foreman in the process room.

"What's wrong, Keller?" The man turned with strange intensity.

"There's a jinx on the job. A powder plant that's always catching fire's no place for me. Everything's wrong—big and little. Look at that lamp Barr's working on. Jam against the panel; so close he had to hang a slab of asbestos to keep from scorching it. And when he was helping clean off them deflectors in the oven yesterday, one slipped loose and just missed crashing in my head. I'd rather pack a Springfield." He pointed to the sentry pacing down the aisle nearby.

"We're all up against it, Keller," said Weeks slowly. "But someone's got to see this through."

"Not me," returned the foreman with a short laugh. "I ain't that patriotic."

"Those deflectors; you attend to them?" Keller, startled by the sudden voice behind him, swung about. He nodded briefly at Professor Gorton.

"Me or Barr."

"You keep a good polish on them, Keller. Bright as mirrors."

The foreman peered at him suspiciously as though striving for the intent of the words.

"We keep the plant in shape best we can," he answered.

Gorton's voice persisted.

"And do they function better at an angle? I should say that they would stop the splash of liquid better to be placed flat against the ceiling."

Keller stared at him, incensed at the words.

"You would, hey? Well, mister, change 'em then. I figured out the idea in the first place—me and Barr—but if you can better it, O. K." He brushed past the professor, angrily passing out of sight around the corner of the oven.

Gorton said quietly: "There are some pieces in the puzzle which are difficult to fit. . . . Keller, for example." He turned back to the control board and Weeks followed him.

Barr had at last repaired the arc, and its sharp purple rays flooded down, throwing into hard relief the faces of the men beneath. The foreman snapped off the extension light and coiled the cord. Barr, dragging his ladder back to fold it, struck its end against the shield that hung down from the ceiling between the arc lamp and control panel, breaking one of the suspending wires. The foreman called out sharply:

"Watch out! You're against the shield. Set up your ladder. Here."

With the words he took the ladder from Barr's hands, extended it again and climbed up beside the light. Gorton glanced to where the shield swung, and his eyes widened.

"What is that material?" He asked the question casually of Barr.

The man shrugged without answering and after a moment Dr. Heilsbronn replied for him coldly:

"Asbestos—to protect the panel." He added with sarcastic emphasis, "No doubt we are again subject to your criticism. We should, of course, remove the arc to a distance from it. However, the wiring is in conduit and there is work of more importance always waiting for our——"

A crash interrupted. The remaining wire from which the shield hung had given way, and the rectangular slab fell, shattering on the floor beside him.

Professor Gorton bent, staring at it strangely. Heilsbronn leaned forward too. The professor's gaze swung upward to the light, returned to the Doctor, whose tired face in the pitiless beating of the arc's rays had suddenly grown white. Gorton's expression was of a man reaching out; almost to grasp solution of some mysterious intangible thing which has evaded him.

Things Begin to Happen

CONSCIOUS of a sudden tension, the men by the panel stood transfixed. A strange light in the eyes of Gorton held them. The ladder, as Keller moved his weight, creaked loud in the silence. Weeks felt the atmosphere about him grow ominous with impending crisis. Gorton and Heilsbronn, as he watched them, seemed frozen into immobility, their features outlined sharp against the darkness, as a bold craftsman might paint vividly in black and white. Above, the light purred; softly clicked as the magnet lifted up the carbon pencil. A dull hum of machines faint in the distance.

The professor's face changed. A ripple of quick comprehension flooded over it. He stepped forward, stooped to pick up a fragment of the broken shield. Barr stumbled awkwardly into his path. Weeks saw the white-faced Doctor lunge out with incredible swiftness—light flashed on a dull glinting object—a hoarse cry from Keller—The arc blinked out, then a flame-burst in the darkness, and simultaneously the crashing detonation of an automatic ploughed through the silent building and returned in harsh compelling echoes. A voice cried, high and febrile; sounds of a desperate struggle. Silence.

Then the scuffle of approaching feet, the click of breech-block as a shell snapped to the chamber of a Springfield. Weeks groped for the extension cord, and its yellow light glowed suddenly, painting a strange tableau there before the panel.

(*Continued on page* 363)

PATENT ADVICE

CONDUCTED BY JOSEPH H. KRAUS

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

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

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

Heated Window Screen

(1179) S. Berlowitz, Bronx, N. Y., asks whether we think it would be a good idea to patent an electrically heated window screen, the wires for heating the screen zig-zagging across the screen itself.

A. In some sections of the country such an electrically heated window screen might be of value, but for the majority of home owners in the United States such a product presents no marketable value. The cost of electric current is too high to make this device very practical.

You make no mention in your plan of a method for preventing shorts due to rain falling on the window screen, and the temporary fireproofing that you suggest might make the product rather hazardous to install.

It is doubtful if a patent on this article could be so protective as to prevent any other competing manufacturer from duplicating the idea. As a consequence, we would not suggest further action.

Opposed Cylinder Engine

(1180) Thomas D. Longon, St. John, N. B., Can., submits a description in diagram of an engine with opposed cylinders and requests our comment.

A. We believe that your idea is rather too elaborate to produce practical results. Many engines have been developed heretofore in which opposed cylinders produced the power. You must remember further that repairs on your system would be far more difficult to make than in those engines wherein but one piston acts in a cylinder. In the event that either cylinder stopped firing, you would lose approximately one-fourth of the horse-power instead of one-eighth, as in the case of other mechanisms.

Finger Extension

(1181) John Watt, Seattle, Wash., has designed a finger extension for the thumb of each hand and made in the form of a finger, which is to be worn by piano players, so that they could more easily reach the notes when stretching several notes beyond the octave range. He asks about the chances for patenting the article.

A. We believe that you could probably secure a patent on this idea, but that, in itself, is not the greatest difficulty. The question is "What are you going to do with it after you get it patented?" It is doubtful if even one piano player out of a hundred would care to have such a finger extension for the purpose of stretching a few extra notes. The average player can span an octave and more. There are too few players with small hands that would require such a system.

We certainly would not suggest applying for a patent on a product on which a market is going to be difficult to secure and consequently advise no further action.

Drill and Tap

(1182) D. S. Robertson, Bloemfontein, South Africa, has designed a tool which drills holes in small pieces of metal and taps them at the same time. He expects that with such a tool the work of making nuts will be expedited. He requests our opinion.

A. The drilling and tapping of nuts in one operation has been done heretofore, and while some contend that it is more practical to perform this work in one operation, most of the automatic machines such as the Acme automatic lathe employ two operations for the same work. In this way, if either tool breaks, it is replaced at a much lower cost, and the tools can also be ground more easily.

For automatic machines your tool would be useless because most of these machines permit of more than one operation at a time, and in view of the fact that the spindles must go around completely before the product is cut off by the cutting-off tool, it is easy enough to add several tools to perform such simple jobs. For ordinary work, a machinist could not use your product. We believe that you will have a difficult job selling your idea to a manufacturer or to retailers and consequently we advise no action.

Airplane Parachute

(1183) A. T. Smith, Woodward, Okla., asks whether he should patent an idea of a parachute combined with a helicopter, so that if the lifting planes have any difficulty in keeping the ship afloat the parachute could be opened and could then permit the ship to land gracefully.

A. Parachutes have been used with planes before. There is consequently no reason why they could not be mounted on helicopters. Perhaps the first time that a parachute was used in conjunction with an ordinary airplane was in the picturization of a motion picture play called "Wings." There are a number of other patents for parachutes for airplanes as, for example, the following, which were patented but recently:

No. 1,582,202, issued to S. Wiley, April 27, 1926; No. 1,597,918, issued to J. B. Mangan, Aug. 31, 1926; No. 1,587,941, issued to F. N. Doty, June 8, 1926; No. 1,509,410, issued to J. W. Ruff, Sept. 23, 1924; No. 1,523,200, issued to H. E. S. Holt, Jan. 13, 1925.

In the Next Issue—
Another valuable article on Finance, "How the Stock Market Operates," by Alfred M. Caddell.

What Our Readers Think

(*Continued from page* 345)

which commenced in the March issue dealing with Evolution.

CHARLES F. WALTON,
Sydney, Australia.

(It would be difficult for any optician to tell whether the nerves were crossed or whether they were not. In the normal human eye the nerves from the right eyeball cross over to the left and terminate in this portion of the brain; and those from the left cross and terminate in the right hemisphere of the brain.

It seems as though the facts mentioned in the article were well attested, and yet one cannot conceive how anyone could continue through life and persist in demonstrating such vision reversals.

Assume, for the sake of the argument, that you are attempting to pick up a stone from the sidewalk. According to the story you should reach up into the air for this stone, but the moment that you stretch your arm, you will see, because of this reversal of vision, that the arm is not going up, but rather it appears to be moving down. Consequently, you would change its motion and move your arm downward toward the stone, even though you believed that the stone was above you. The same is true of every effect and every action.

It is, of course, true that there are certain individuals suffering from a mental condition who will do things reversely to the way they are instructed. If a man is told to button his shoes, he will invariably take his shoes off; if told to close his eyes, he will open them wide; if told not to eat a thing, he will eat it; but these persons are generally incarcerated in some institution, and as soon as the doctor discovers that they persist in doing things reversely, he gives the individual a reverse command. If he wants the man to drink a glass of water, he will tell him not to drink a glass of water, and be sure that the invalid follows his desires.

At any rate, you will admit that the story about which you inquired made a good newspaper article. Scientifically, there are too many discrepancies which must be taken care of to make the same plausible.—EDITOR.)

That Turning Movement

Editor, SCIENCE AND INVENTION:

I am firmly convinced that "thought transference" is impossible; however, for the purpose of settling an argument—is it possible by looking at a person's back to make that person turn around? I have tried it myself, but as far as I can see, the only reason they turn around is because they subconsciously see you out of the corner of their eye. But we have agreed to settle this argument by an appeal to you—so what is your explanation of this?

ALBERT J. BAWDEN,
Hamilton, Canada.

(It is impossible to make a person turn around by looking at his back. Occasionally a person is vividly impressed by the fact that, when he turns around, someone is staring at him. He believes that that individual staring has been responsible for the turning movement. Such is not the case. If that same individual were carefully checked, he would find that he turns around dozens of times and sees no one looking at him. The coincidence, however, markedly impresses the person stared at.—EDITOR.)

The Invisible Incendiary

(*Continued from page* 359)

Barr, his face contorted in a frenzied, futile rage, struggled in the arms of Gorton. The professor's long fingers clamped about the trigger guard of the blue-barreled German Leuger which the workman held, and his face still was cold, lacking emotion; it was as though he unwillingly rehearsed a dramatic pantomime which bored him. The sentry, his rifle held at port, was staring at the two men, petrified. And Dr. Heilsbronn leaned back weakly on the panel.

"Remove the pistol, please," said Gorton, "and before I release my hold it would be advisable to make search for other weapons."

The soldier hesitated, then interrupting Barr's frantic struggles wrenched the automatic free and handed it to Weeks.

"What next, Mister?" he asked of Gorton, alertly, running through the captive's clothing.

"Take him to military police headquarters. He is an agent of the Wilhelmstrasse." He released Barr, and the man collapsed, shaking in an anticlimax of emotion. The sentry prodded him up callously.

"A Heinie spy, hey? Up, Fritz, and get your gruel!"

Barr staggered upright. Keller, descending the ladder, stared at him in awe. The professor pointed to the broken fragments lying on the floor.

"This shield, Keller—where did it come from?"

"Barr—Barr brought it from the storeroom on a requisition," the foreman stammered.

"Not from the store room," corrected Gorton. Then he turned to Dr. Heilsbronn in whose face unutterable relief and astonishment were mingled.

The Mystery Explained

"I OWE you an apology. It was too clever a scheme; the work of a scientific brain; I could not credit its inception to this man at first. We will find, I think, that he is graduated from some German university of science. . . . I saw that you recognized almost as I did, that this is not a section of asbestos, but iodized fluor-spar crystals, which block out all the visible spectrum—but permit the infra-red, the long-wave rays to filter through.

"When I stepped inside the process room, a theory of the origin of these mysterious fires began at once to form. . . . Those polished deflectors—polished like burnished shields. Why? Not to catch the spray, but to reflect light—concentrate it. They are concave, you remember, and made to focus light rays. And Keller said that he and Barr had worked them out. Then the thought of the arc lamp outside against the ebonite panel—why, it was no more than a very pretty reconstructon of Tyndall's old experiment which first proved the existence of those unseen rays of the spectrum, the Infra-red. Surely you remember, Weeks?"

He turned to the other for a confirmation, then in disappointment shook his head.

"You do *not* remember? And yet we demonstrate this in Physics 21A in the spring semester of every senior year. . . . Here, I will put it simply. The heat rays of the arc are caught on the screen of fluor-spar and pass, invisible to the eye, through the opaque panel board of ebonite into the process room. There, in the deflectors cleverly arranged by Barr above the spray guns, they are brought to a focus and concentrated on a spot of the peripheral surface of one of the linen rolls. The heat of these rays, thus concentrated, is intense, like a giant burning glass at noonday. Your series of mysterious fires were kindled, each one, by the simple lighting of this arc above us."

Weeks, as he listened, read in Barr's face the confirmation of his guilt. The soldier, at his gesture, swung the man about and pushed him through the gathering crowd of curious workmen.

Gorton smiled at Keller.

"You, too, had a part in my suspicions. But when Barr's pistol made appearance, your timely act in turning out the arc light absolved you. Perhaps it saved me from the bullet. At all events, I thank you."

Then as if in dismissal of a boresome subject, the professor yawned and scanning his wrist watch, spoke to Weeks:

"You might wire the Service of Supply advising that they may depend on shipment of the processed fabric for the two hundred waiting planes. . . . Is there an early morning train for Mercer?"

End

In the next issue—
LATEST AVIATION ADVANCES
"News," as well as construction details

Wood Turning

By H. L. Weatherby

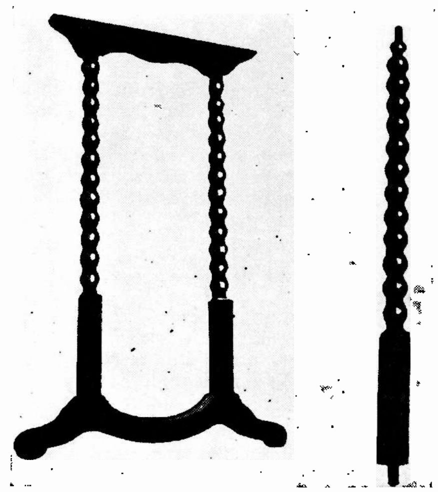
(*Continued from page 328*)

Glue, stain, finishing materials, etc.

Construction

ASIDE from the turning, the construction is simple enough. The posts should be carefully squared to 1¼"×1¼", and then centered very exactly in the lathe for turning. Tenons are turned on the ends of these pieces to fit into round mortises, bored into the top and bottom end cross-pieces. If desired by the builder, these mortise and tenon joints may be made square with a little more work. The round ones will be perfectly satisfactory when well fitted and glued.

The top and bottom end pieces are very similar, and should be made up next. Square off some blank paper, for full size patterns for these, and lay the curves out according to the diagrams given. Cut these patterns out and mark around them on the squared-up wood, and saw the parts to size and shape. Finish to the line, with file and sandpaper, and bore the half-inch holes for the mortises in the proper places.



Showing appearance of two legs assembled and also a single turned leg.

In boring for the mortises, it would be well to center the four pieces, and square across all of them at once, in order to make certain that they will line up exactly.

The construction of the top should be left until last for the reason that a wide, thin glued-up board of this sort is likely to warp, if it is not fastened down. Therefore, when the side and end rails are made, and the whole frame is glued together and set up, we are ready to lay out and shape the top. The end cross-rails may be omitted as the photograph shows, if desired.

Another pattern is carefully made for the top, and the curves are cut around the edge of the previously glued-up and squared-up piece, by the best available method: band saw, compass saw, scroll saw, or coping saw. These edges are filed and sandpapered smooth, and slightly rounded, and after making some glue blocks for the under side of the top, we are ready for the final assembling.

The top may be attached with dowels, and glued as the drawing indicates, or it may be fastened down with screws from underneath through the cross-pieces. The shelf is fastened in place by this method and both top and shelf are reinforced by rubbing triangular glue blocks to the under sides of shelf and top, and against the end pieces.

Glue may be removed easily while it is still wet by the discreet use of hot water. This will raise the grain, but a little additional sanding will not hurt the finished work, prior to staining or other finishing.

Finishing

THE finish to be used will depend upon the material used, and directions given in previous articles will apply to this job as well.

Next month we expect to give the readers of SCIENCE AND INVENTION directions and plans for making turned picture frames of various designs. Most of us have photographs, or small prints that we would like to frame, but the cost oftentimes restrains us. The turned frame is a simple method of creating a high-class article with very little expenditure of time or money.

If a Giant Meteor Hit a Modern City!

By Prof. Wm. J. Luyten

(*Continued from page* 296)

file it, and saw it with great difficulty, and one may well have sympathy for those who toiled here in the blazing tropical sun. One specimen was shown to the writer, a piece as large as a match box, but it had required three hours of continuous sawing, and had used up three dozen hacksaws. Fortunately even these partially successful attempts at mutilation have ceased now, for the administration of South West Africa has wisely forbidden the removal and exportation of all meteoric matter, as a whole or in parts.

That this meteorite is no easy customer when it comes to sawing need not surprise us, once we have made the chemical analysis. The best results thus far obtained indicate a nickel proportion of no less than 17.5%, iron taking up 81.5%, leaving just one percent for other metals, carbon, and other extraneous substances. In short, therefore, this meteor is nothing less than nickel-steel, with as fine a structure as our best man-made steel, and without any flaws whatsoever.

Before taking leave of our meteorite we again looked at its surroundings and we were struck with the fact that it appeared so unnatural here. Even if the outward appearance and the chemical analysis did not convince us that this is a meteorite, its position and the surrounding limestone structure would provide ample evidence in that direction. The mere existence of this black "rock" in the white limestone would lead one to suspect its origin; it certainly does not appear as a normal adornment of the landscape, but very strongly gives the impression of having arrived in a catastrophic manner. This impression is strengthened, even when one examines the under-lying and surrounding strata of rock. On the northeastern side where the pit is deepest, more than eight feet, inspection of the limestone layers shows that these, ordinarily horizontal, are abruptly bent and almost vertical on both sides of the meteor, while directly under it these layers are obviously crushed and greatly compressed. It is hardly surprising that a meteorite, which seems so out of place here, even appears to disobey the ordinary laws of physics: while the rocks and the hot sand surrounding it feel scorchingly hot under the blaze of the tropical sun the meteorite itself is delightfully cool to touch.

Although there can thus be no reasonable doubt concerning the reality of the meteoric origin for our new find, there is still considerable mystery left. When did it fall? Where did it come from? To the first question the geologist only can provide an answer, for, by studying closely the weathering and the decay of the rocks around it he may be able to tell more or less when the strange visitor fell from the sky. It might be possible to prove that it had fallen before a certain ice age, and thus give at least a lower limit for the time it has been on earth. All we can say at present is, that it has undoubtedly been there for thousands of years, possibly for tens or even hundreds of thousands.

The second question will never be answered in full and we shall have to be satisfied with emulating Caesar, and write on its tomb: "It came, it fell and it stayed." Whence it came? From the Great Wide Open Spaces. In all probability it originally belonged to the solar system, and was born out of the sun at the same time as all the other planets. Subsequently it may have cruised through space as part of a comet perhaps, later possibly deteriorating into a swarm of meteors. It may even have been alone all these millions of years, until it met its fate and struck the atmosphere of the earth.

An interesting possibility, that of its having belonged to a swarm, has been raised by the fact that further south, in the region of Gibeon, on the border of the great Kalahari desert, a whole field has been discovered, simply peppered with small meteorites. None of these can compare with the Grootfontein giant, representative ones are no larger than about two feet long and about a foot in diameter, and weigh only some 500 pounds. The battlefield where this army has been slaughtered is 500 miles away from the solitary meteorite in the north, but it would be interesting to investigate the possible connection between the swarm of small fragments and the single colossus from Grootfontein.

As far as we now know, the Grootfontein meteorite is the largest meteorite in "captivity." It is approached only by that of Bacubirito, Mexico, which is alleged to weigh 50 tons, but even the existence of this last one is none too certain. It definitely surpasses the Greenland meteorite from Melville Bay, brought back by Admiral Peary from one of his polar expeditions, and now resting in the great hall of the Natural History Museum in New York.

It would seem well worth while, therefore, to remove this new find to a more accessible locality where it could be admired by those interested. Few indeed will consider the reward of seeing it sufficient to brave the hardships of traveling nearly 1,800 miles from Cape Town, mostly through a barren desert on a train that runs only once a week, a journey lasting more than four days, and ending up with an 18-hour trip on a 2-foot gauge railroad, at an average speed of only 16 miles per hour.

The difficulties of removing the meteorite on the other hand, though great, are not insurmountable. The narrow gauge railway line, constructed to transport the copper, lead, and vanadium ore from Tsumeb and Grootfontein to the coast is run with engines of 45 tons, and would thus be demonstrably safe for any such loads as would be required, even if the meteor should turn out to weigh seventy tons. There are no tunnels on the line, and in the dry season no dangerous bridges. The present location of the meteorite is about four miles distant from the siding at Otjihaenene. It would thus appear entirely possible to remove the world's largest meteorite to more accessible quarters.

Make a Contract

By Alfred

(*Continued*

recently was actively identified. Back in 1917, one share of stock in this corporation could have been purchased for approximately $75. Since then there have been several capital split-ups and payments of dividends in stock as well as cash until today that one share, not including cash dividends, has a market value in the neighborhood of $1800. In other words, that one share, through split-ups and stock dividends, has grown to 22½ shares, each of which is a dividend earner.

In form, the Equity Securities Company would operate as an investment trust, and be officered by men experienced in the security world. The theory behind an investment trust is that should one of its investments prove not to be a money maker it would be balanced by an investment that yielded good dividends. In a sense, therefore, the plan embodies investment insurance. Admittedly investment experts should be in a far better position to judge values than the much-referred-to man on the street.

One of the most important angles of the proposed plan is that it will tend to do away with stock swindling—at least, in some of its phases. There is scarcely a man or woman living who doesn't want to make money. The first step toward gaining independence has usually been a savings bank account. But there comes a time when a savings bank depositor desires to obtain a larger income on his money. If luck is with him, he will probably make a good investment by himself, but the chances are just as much against him as they are in his favor.

However, it is not to be thought that Mr. Depositor has been overlooked. Swindlers are after this money as well as legitimate investment houses, and to the dubious credit of the swindler it must be said that he has at least used very aggressive and effective salesmanship to accomplish his end. Put in another way, he has paid attention to the man of small means. It has been estimated that swindlers have been responsible for upwards of $1,000,000,000 annual loss to people who were led on by rosy promises of wealth.

But will such losses deter people from making other investments? Hardly. Learning by trial and error, although costly, makes people more appreciative of sound securities, the kind and the only kind that the institution which Mr. Raskob aims to bring into being has any idea of investing in.

In the July issue of SCIENCE & INVENTION, the writer pointed out the remarkable investment structure of 17,000,000 investors, large and small, which has risen in America since the war. The day of the small investor has arrived; that is, progressive financiers have lately given recognition to the man of small means, realizing that when his investments become multiplied by thousands and millions of him that financing of industry will not only become more possible but the nation as a whole will become more healthy.

"The possibilities of this country, industrially and otherwise, have scarcely been scratched," said Mr. Raskob. "Who cannot conceive for the not far distant future even greater things than he has seen in the past? With electrical communication advancing at a tremendous rate, with the airplane opening up vast unexplored territories; with science progressing on every hand, who can possibly place a limit on American achievement?

"There is, therefore, no excuse for a man who can save a little money and does not compel that saved money to work for him. Of course, those who do not plan ahead are more or less hopeless. Their only hope is charity.

"But given widespread prosperity the need for charity will diminish. A growing population largely without financial worries will raise ambitious, contented children. A great affliction in our scheme of existence is want if not actual poverty in old age. I believe that condition can be alleviated if not actually abolished."

At various times in the history of the world Utopian dreams have come to light, dreams which were supposed to portray the highest attaintments in politics, laws, economics and human satisfaction. Can it not be said that the plan advanced by Mr. Raskob is a partial though practical realization of such a dream? Big business owned by the masses of small investors? With such an interest at stake, who can place a limit on American prosperity that lies just ahead?

Financial Questions and Answers

Edited by Mr. Caddell, Financial Editor

Will you kindly express an opinion regarding the outlook for Jewel Tea Co.? L. J. B., Brooklyn, N. Y.

Answer: Since the reorganization in 1920, the company has improved its merchandising policies. Sales for 1928 were about $1,500,000 more than in 1927, showing a gain of 21% over 1927 net. The company formerly distributed only its own line, but is now handling nationally advertised products. The company declared a stock dividend of 75% and an extra cash dividend of $1 a share and a quarterly dividend of 75 cents a share on the stock which will be outstanding following the payment of the 75% stock dividend. The business appears to be on a profitable basis with a very favorable outlook, especially for the original stockholders.

I own some Graham-Paige stock and am worried about the recent decline. Have you any information on it? F. S. H., Worcester, Mass.

Answer: We cannot suggest any special reason for the decline in the stock, other than the general weakness in the entire market. All motor stocks have been gradually selling off. For the long pull we believe the stock has good speculative possibilities, and if you hold it, no doubt you can eventually dispose of it without loss.

Would you advise me to sell or hold my hundred shares Pennsylvania Railroad, which was recently purchased? H. K. P., New Haven, Conn.

Answer: We can offer no good reason for selling Pennsylvania Railroad stock. Marketwise the stock may not be very active, but it is an investment issue held by more than 150,000 stockholders. From time to time you no doubt will be afforded the opportunity of subscribing to Pennroad Stock on attractive terms.

I am greatly concerned regarding my Acoustics Products Stock which was purchased at considerably higher prices. Can you offer any suggestion? S. S. W., New York City.

to Become Wealthy

M. Caddell

from page 300)

Answer: Late earning reports are not available. The company and subsidiaries manufacture machines and devices for sound reproduction, including a synchronizing apparatus with films. It is reported that a production schedule calls for talking pictures costing over $5,000,000. The result from this field is problematical. Recently the stockholders ratified an increase in the common shares from 1,000,000 to 1,300,000. The stock pays no dividend and therefore must be regarded as a speculation, although it has future possibilities.

Will you kindly express an opinion on Butte & Superior Mining Stock? F. L. L., Jersey City, N. J.

Answer: The mines of this company are virtually a proposition of liquidation. Earnings have declined steadily in recent years. However, owing to improved methods in reclaiming zinc and silver ore formerly abandoned, the life of the property may be prolonged and, of course, there are possibilities of new ore discoveries. The stock has a present book value of about $16 for each $10 share outstanding. It would therefore seem advisable to keep this stock.

Would you advise the purchase at present prices of Anchor Gap Corp. common? G. L. R., Camden, N. J.

Answer: For 1928 the net income was equal to $5.17 a share for each of the 176,000 common shares. This was about double 1927 net on 144,000 shares. The latest balance sheet showed a strong current financial position. The long pull possibilities for the common are good. It might be better to consider the preferred, because the yield is fairly good and it is convertible into two shares of common which would seem to make it a little more attractive.

I am a widow, although self-supporting. I have $6,000 in a savings bank, earning 4%. I would like to obtain a larger income and would appreciate any suggestion that you may offer. Mrs. O. S., New Haven, Conn.

Answer: Unless you have an income in excess of your immediate requirements, would suggest that you leave at least $2,000 in the savings bank for emergency purposes. The remaining $4,000 may be safely invested by purchasing one $1,000 New York Title and Mortgage 5½%; one Title Guarantee & Trust Co. 5½%; ten shares each American Ice preferred, Byuk Cigar first preferred, North American Edison preferred and fifteen Standard Gas & Electric preferred. These stocks would cost you less than $2,000 and yield an annual income of $120, and the bonds will yield $110 annually.

Invisible Beam Will Guide Racing Car

(Continued from page 346)

signals of the same wavelength but modulated at two different frequencies. A master oscillator feeds two power amplifiers which are modulated by two different low frequencies. The outputs of the amplifiers are led separately to the two loop antennas.

The loop antennas are tuned to the same wavelength and adjusted so that there is no coupling between them. In the plate circuit of the amplifier tubes are the stator coils of a goniometer, the secondaries of which are in series with their respective coil antennas. The plates of the amplifier tubes are connected to a source of alternating current, one tube being supplied with say 85 cycle voltage and the other with 65 cycle voltage. There are the two modulation frequencies to which the visual indicator reeds are tuned. This portion of the apparatus is described with the receiver equipment. Each power amplifier passes radio frequency current each alternate half cycle, the frequency being either 65 or 85 cycles or any other modulating frequencies which may have been chosen.

In the foregoing description the system involves the supply of plate power, direct to the amplifier tubes at low frequencies. Vacuum tube oscillators controlled by tuning forks which supply sufficient voltage to enable grid or plate modulation of intermediate amplifiers could be used and solve the difficulty of keeping the low frequencies steady.

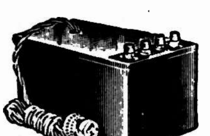
In the grid modulation method, the modulating frequency is impressed upon the grid of one of the amplifier tubes. The plate modulation method applies low frequency voltage to the grids of the modulating tubes, the plates of which are connected to the output of one of the amplifiers in a circuit which is similar to that used in broadcasting stations. Both methods are satisfactory but the plate modulation scheme has an advantage in that there is less distortion of the wave form.

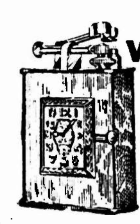
Receiver

THE radio beacon can be used with any receiving set, merely by replacing the headphones with some form of visual indicator. One form of indicator might consist of two neon glow lamps, one in each tuned circuit. The tuned circuits are attached to the output of the receiving set. When the voltage of either tuned circuit drops the lamps will give a rather sharp indication. A direct current galvanometer connected differentially to the rectifier tube could be used. When the racing car was on the course and the currents in the two tuned circuits were the same, the direct current outputs would be balanced and the galvanometer needle would remain in the center of the scale. Any deviation from the course would result in the needle moving to either side of the galvanometer scale. These forms of indicators, however, would undoubtedly be too critical and complicated for practical use.

Reed Indicator

THE form of indicator which is likely to be used consists of a device employing two vibrating reeds. Their vibration gives the visual indication and they themselves provide the necessary tuning to the two modulation frequencies. When the beacon signal is received the two reeds will vibrate and since the tips of the reeds are white with a black background behind them a vertical white line will appear. One of the reeds is tuned to a frequency of 85 cycles and the other to a frequency of 65 cycles or in other words the reeds are tuned to any modulating frequencies which may be used at the transmitter. It is only necessary therefore, for the driver to watch the two white lines produced by the vibrating reeds. If the lines are of equal length the driver will know that he is on the correct course. If the line on the right hand side of the indicator becomes longer than the other he knows that the car has run off the course to the right. The white line





on the left hand side becomes longer when he drives too far to the left. It will simply be necessary, therefore, for the driver to watch the visual indicator and see that both lines are of the same length. When this condition exists he will know that the course taken by the car is correct. Owing to the directive nature of the two coil antennas the intensity of one of the modulated waves will increase and the other decrease when the car runs off to one side of the course. A beacon indicator with vibrating reeds is shown in the photograph accompanying this article. The indicator will of course be mounted on the instrument board of the racing car, so as to be clearly visible to the driver at all times. The receiving set can be tuned, the dials locked in place, and the set placed within the body of the car. Here it will be supported by a shock-proof mounting consisting of rubber cord as shown in the photograph.

Answers to Scientific Problems

(*Continued from page* 329)

The Block Gauges

The following table shows the proper dimensions of three block gauges so that by using them in various combinations one can obtain any integral number of inches from 1 to 63.

	Length in.	Breadth in.	Thickness in.
Block A	1	2	3
B	12	8	4
C	36	32	16

While such a set of blocks is not exactly a vest pocket affair, it will actually give one the series of standard lengths indicated in the query.

The Thermometer Problem

When a thermometer is thrust into hot water, the glass bulb is heated and expands a little before the mercury gets hot. The increase in the volume of the bulb then causes a momentary lowering of the mercury column.

The Pressure Tank

In a pressure tank the volume of air will decrease even though the pressure is kept constant. This is caused by the air dissolving in the water, the tendency to dissolve being greater the greater the pressure. Hence, the water that leaves the tank contains a little more dissolved air than that which enters it, the result being that eventually the air in the tank is exhausted and escapes dissolved in the water that flows out of the tank.

The Problem of the Auto Ride

If we let X represent their usual speed in miles per hour, the distance to town will be $2x$ miles, and the distance to Uncle John's $(2x-12)$. If they double their speed going to their Uncle's, the time going out will be $(2x-12)$ divided by $2x$, and their time coming back at half speed will be $(2x-12)$ divided by $\frac{1}{2}x$. The sum of these two quantities must be four hours. Solving for x we got 30 miles per hour for their usual speed and $2x$ or 60 miles as the distance to town. That makes the distance to Uncle John's 60—12 or 48 miles.

If it is assumed that Uncle John's is 12 miles beyond town, the solution for their speed will be negative indicating that such a situation is impossible.

Sliding Down a Cycloid

A cycloid has a number of interesting properties that everyone interested in science or mathematics should know. The cycloid is called the curve of swiftest descent, for a body will slide most rapidly from one point to another lower down by following a cycloidal path. A free vertical drop is the only course that will beat it. Two bodies sliding freely along a cycloid will reach the bottom of the curve in the same time no matter from what point on the curve they start.

The Problem of the Chips

The stationary observer counts 20 chips per min. in water that passes him at the rate of 300 ft. per min. Hence, the chips are 15 ft. apart. Since the thrower of the chips is walking downstream at the rate of 200 ft. per min., it is evident that the stream gains 100 ft. per min. on him. Into this 100 ft. of water he casts a chip for every 15 ft. or 6⅔ chips per min.

Now, suppose the chip thrower stands still as he throws his 6⅔ chips per min. into the stream which is passing him now at the rate of 300 ft. per min. Is it not evident that the chips will be 300 divided by 6⅔ or 45 ft. apart? If in the meantime the observer is walking upstream at rate of 200 ft. per sec., he will pass 200 plus 300 or 500 ft. of the stream per min. and will observe 500 divided by 45 or 11 1/9 chips per min.

Hot Water—Milky White

This appearance of water issuing from hot water faucets is due to the air that is dissolving in the water. The heat tends to make the air come out of solution and form bubbles, but the pressure of the water within the pipe prevents much escape until the faucet is opened. This reduced the pressure and thus permits the bubbles to form in great clouds which give the water its milky-white appearance. In a few minutes the bubbles escape and the water is again clear.

Experiments With Acetic Acid

By Dr. Ernest Bade, Ph.D.

(*Continued from page* 330)

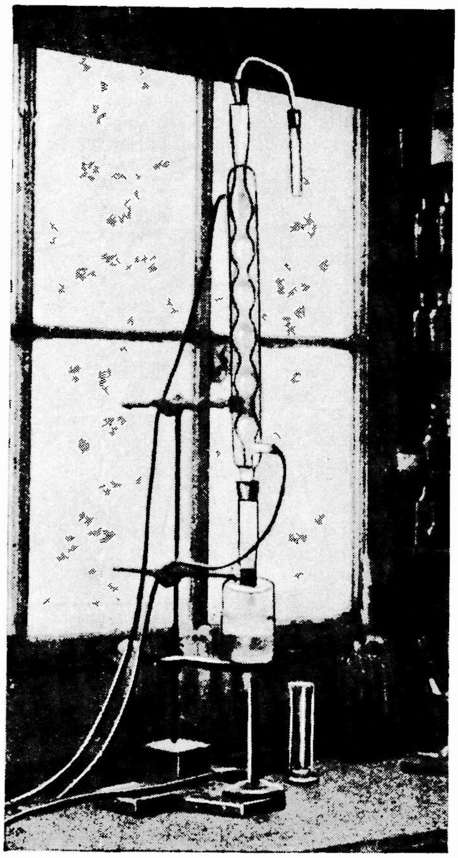
100 cc distilling flask. 24 grams are used. In a dropping funnel 20 cc of acetyl chloride are placed, the flask is surrounded with ice water and about half of the acetyl chloride is allowed to drop slowly on the sodium acetate. The mixture is stirred with a glass stirring rod and the remainder is slowly dropped into the flask. Then the flask is connected to a reflux condenser and the mixture is boiled on the water bath for half an hour to complete the reaction. The anhydride is distilled off, using a very small flame which should be kept in motion. The chemical is purified by redistilling, but before doing this about one gram of fused and powdered sodium acetate is added. The receiving flask must be protected from atmospheric moisture by a calcium chloride tube.

Acetic anhydride boils at 138° C. It has found some importance in the manufacturing of non-inflammable films. In the manufacture of such cellulose esters of the acetates, pure cellulose, usually air dried cotton, is used. The first product of the reaction gives a product insoluble in acetone but soluble in chloroform. This forms a brittle film. The di and tri-acetates gives viscose solutions in acetone and are flexible. They are also capable of withstanding 200° C without decomposition.

Cellulose acetate may be made by pressing absorbent cotton, ½ a gram, in a mixture of 20 cc of glacial acetic acid, 6 cc of acetic anhydride and two or three drops of sulphuric acid. Let the cotton remain in the liquid for 24 hours. The cotton will then have gone into solution and when this has occurred, the liquid is slowly poured into a large quantity of water, stirring vigorously. The precipitate of cellulose acetate is collected on a filter paper and the water is pressed out. A porous tile may be used. Then it may be left exposed to the air until thoroughly dry. The entire mass may be dissolved in an ounce of chloroform.

The esters, which are formed by the action of an acid on an alcohol, are found in nature as the ethereal oils of many plants and because of their fragrant odor they are used as a substitute for the natural perfumes and fruit essences. Examples of these are ethyl formate (rum), iso-amyl acetate (pear), ethyl butyrate (pineapple), iso-amyl iso-valerate (apple), etc. A mixture of amyl acetate and ethyl acetate in the proportions of one to two gives strawberry flavor. They are used diluted.

The preparation of ethyl acetate should be made with absolute alcohol. It can also be made with 95% alcohol but the yield will not be so large. Mix, under cold running water, 40 cc of alcohol and 40 cc of concentrated sulphuric acid, adding the acid slowly to the alcohol. Then add a dropping funnel and connect a condenser. Place the flask in an oil bath. A thermometer must also be provided and this should dip into the alcohol-sulphuric acid mixture. As the temperature reaches 140° C, the liquid in the flask begins to boil and the dropping funnel, which holds a mixture of 60 cc of glacial acetic acid and 60 cc of alcohol, is slowly opened so that this mixture is added as rapidly as the acetic ester distills. The ethyl acetate is purified by washing with a strong solution of sodium carbonate in water. Then wash in a solution made by dissolving 25 grams of calcium chloride in 25 cc of water. Then, after removing the acetate, it is dehydrated with a few pieces of solid calcium chloride for a few hours and the redistilling on a water bath, collecting the fraction coming over at 74° to 80° C. Ethyl acetate boils at 78° C.



The mixture of acetyl chloride and sodium acetate are boiled with a reflux condenser.

In the

SEPTEMBER ISSUE

"Hobbies of Famous People"

No. 1. Dr. Edward C. Worden, famous industrial chemist. By Alfred M. Caddell.

Owing to lack of space this article did not appear in this number.

"How Noah's Ark Was Built for the Movies"

By Edwin Schallert

Experiments with Stationary Waves

By Ernest K. Chapin

(*Continued from page* 331)

a complex manner intermediate between that of A and B in Fig. 3.

Fig. 4 shows how the same apparatus may be used to get stationary waves in a coiled spring and also in a stretched cord. The points marked N, called nodes, are points of no vibration. That is, they appear stationary while intermediate points are in vigorous vibration.

SPACE, TIME and

By Donald H.

(Continued

collapse. I do not ask you to accept either hypothesis blindly. Rather, I say, "Let us play that they are true and see what will happen. If the conclusions drawn from this start are not confirmed, I shall be the first to insist that relativity is not true."

I mercifully draw a curtain over the next act. The array of mathematical symbols, the columns of figures marching in algebraic form across the page, are a gruesome battle scene. They are the affairs of generals only, and those who hang back to prowl on such fields are only sutlers. Let this mighty army march from the barracks of our two hypotheses. Let them maneuver as they will in advanced texts of relativity, but we shall not concern ourselves with them until the battle is over. Then they return with their conclusions, which are the only things that need concern us now.

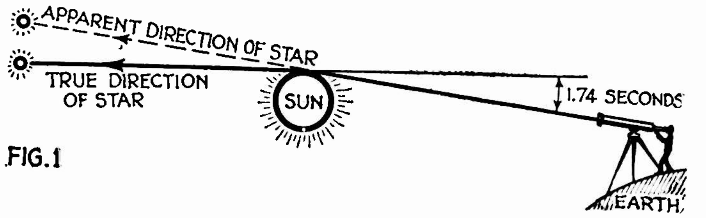


FIG. 1

The left illustration shows how a beam of starlight which grazes the edge of the sun will be deflected.

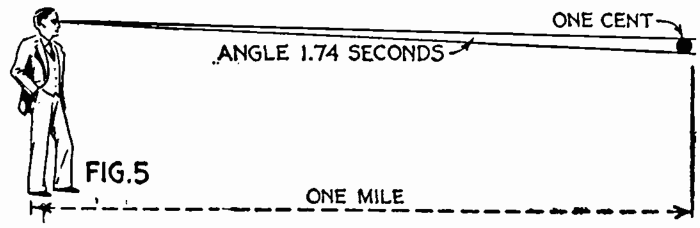


FIG. 5

The angle of 1.74 seconds is approximately equal to that subtended by opposite sides of a cent at a distance of one mile.

Four Principal Predictions

HERE are the principal predictions:

1. That a light ray will follow a curved path in the neighborhood of any great mass, the sun, for example.

2. That clocks are slowed down in an intense gravitational (using the word in its older sense) field.

3. That the orbit of the planet Mercury will be a sort of rosette rather than an ellipse.

4. That all attempts to measure our absolute speed through space will fail.

A beam of starlight, grazing the edge of the sun, will by Einstein's calculations suffer a deflection of 1.74 seconds of arc. (Figure 1.) Since the sun is ordinarily so brilliant, no star can be observed close to it, except at those rare times when its shining disk is completely covered by the moon. That is why astronomers travel to the end of the earth in order to observe these eclipses. On May 9th, last, such an eclipse occurred, total in Sumatra, the Malay peninsula, and the Philippine Islands. It is far too early to report the observations, but many new attempts to check Einstein's theory were made at the time.

The most reliable results of the relativity deflection of light that have been published up to the present are those obtained by Campbell and Trumpler, of Lick Observatory, at the Australian eclipse of 1922. One of the great cameras they used to photograph the sun and surrounding stars is shown in figure (2), while figure (3a) exhibits one picture so secured.

The eclipsed sun, with the enveloping corona, is at the center of the plate, while the positions of stars are indicated by the tiny circles.

Naturally the deflections are greatest for stars close to the sun. The heavy curved line (Figure 4) shows the predicted deflections for stars at different distances from the sun's edge. The observed deflections are indicated by the dots. While many of these points do not fall accurately upon the heavy curve, they do not deviate far from it, on the average. We cannot hope for exact agreement here. Even the maximum angle of deflection, 1.74 seconds, for a star exactly at the edge of the sun, is tremendously small. It is approximately equal to the angle subtended by the opposite edges of a penny a mile distant. (Figure 5.) Therefore, when we measure the still smaller actual deflections, our failure to fit the predicted curve accurately is no more surprising than the failure of a marksman to strike the bull's-eye every time, when his target is placed at an unusually great distance. Our observations are not infinitely accurate, that's all. The agreement of observation and theory is excellent. Prediction (1) comes through the experimental test with flying colors.

The "Clock" Problem

HOW about prediction (2), that a clock will run slower in intense "gravitational" fields? Our watches are supposed to tick five times a second. If, using my watch, I find that yours ticks but four times to my five, I conclude that your watch is running slow, with respect to mine. This must, roughly, be the procedure of the experimental test. A difficulty arises immediately. We have clocks at the surface of the earth, of course, but the question is, how can we transport them to the sun, where time should pass a little more slowly than on the earth. There, a clock should tick 500,000 times against 500,001 times here.

The physicist answers the question. An atom is a sort of clock, which vibrates trillions of times a second, sending out a wave of light with each pulse. The color of that light depends solely upon the number of waves sent out per second, the more waves the more the light approaches the blue end of the spectrum. Now if a sun atom "ticks" more slowly than one on earth, it will send out fewer waves per second, i.e., its light should be correspondingly redder. The slight difference of color is just at the limit of our accuracy to measure. Nevertheless, St. John of Mount Wilson, after years of observation, finds the effect to be just what Einstein predicted.

Astronomers have found that Sirius the brightest star in the sky, is truly double Its faint revolving companion is remarkable in many ways. For example, the force of

RELATIVITY

Menzel, Ph.D.

from page 323)

gravitation, at its surface, is 800 times greater than that of the sun. Here the slowing down of the "atomic clocks" should be greatly exaggerated, compared to Sirius, where the gravitational field is less than the sun's. The observations of Adams and St. John, of Mount Wilson, disclose the presence of such a slowing down. A more recent investigation by Moore of Lick Observatory confirms the result.

Mercury's Orbit

I SHALL not give much space to the confirmation of prediction (3), the rosette shape for Mercury's orbit (Figure 6), since I have fully treated it in the fourth article of this series. For the benefit of readers who may not have seen the complete discussion, however, I shall remark that theory and observation agree in every particular. In fact, until Einstein's theory of relativity entered the field, the curious behavior of Mercury's orbit was an unexplained anomaly. Herein was one of relativity's first triumphs.

Prediction (4), above, is not so much a consequence of theory as it is an original assumption. For if we could, by hook or crook, determine our absolute velocity or find a velocity greater than the velocity of light, our postulates would be blasted and the theory of relativity would come tumbling down upon our heads.

Relative Velocities

TWO automobiles, each traveling at 60 miles an hour, meet and pass. What is the velocity of one relative to the other? (Figure 7.) "One hundred and twenty miles," you say.

A piece of radium ejects, in opposite directions, two alpha particles traveling at 100,000 miles per second—a common occurrence. (Figure 8.) What will be the velocity of one alpha particle with respect to the other? "Two hundred thousand miles."—Hold on a minute. The velocity of light is only 186,000 miles a second—about 14,000 miles less than your reckoning. Does this example refute relativity at the very outset?

Examine carefully postulate (2)—"No *measured* velocity will be greater than that of light." The figure, 100,000 miles per second is a *measured* velocity (which, of course, is less than light, but 200,000 miles a second is a *conjectured* quantity. If you had "boarded" one of those alpha particles, and, as it receded, with tremendous velocity, measured the speed of the other, you assume, by analogy with the motor car, that you would find a speed of 200,000 miles a second. I venture the prediction that you would find a value of about 155,000 miles a second.

At first glance, my statement may appear ridiculous. In order to justify it I must remind you that we measure velocities with a clock in hand, by noting how long it takes an object to travel a given distance. If anything should happen either to the clock or the rule, our measure of velocity would be correspondingly affected.

Suppose I hurl both the clock and foot rule from me with a speed of 100,000 miles a second. What assurance have I that they remain unchanged? This is not superstition. If we could look at our clock and measuring rod with a super microscope, their apparent solidity would vanish; we should see them to be really a swarm of atoms and electrons. The wonder is that they keep anything like constant time or shape. Imagine projecting a swarm of flies into space at 100,000 miles a second.

We are able to calculate that bodies, moving with such speeds approaching that of light, experience an enormous contraction. The motion of any electrical particles, whether through a wire or through empty space, sets up a magnetic field, which induces the particles to draw closer together.

Thus, both rules and clocks are sure to behave in a peculiar manner on a moving object, and we are no longer surprised that an observer on the flying alpha particle finds a velocity of 155,000 miles, where we had figured 200,000 miles. His measures of time and space are different from ours.

Notice that I have expressly avoided saying that his measures of time and space are

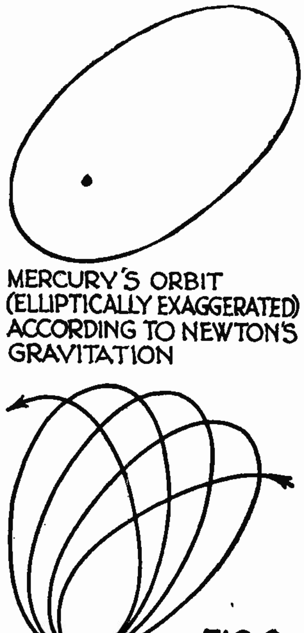


FIG.6

This illustration shows the orbit of Mercury (both the ellipticity and the angular pression exaggerated). This agrees with Einstein's theoretically predicted orbit.

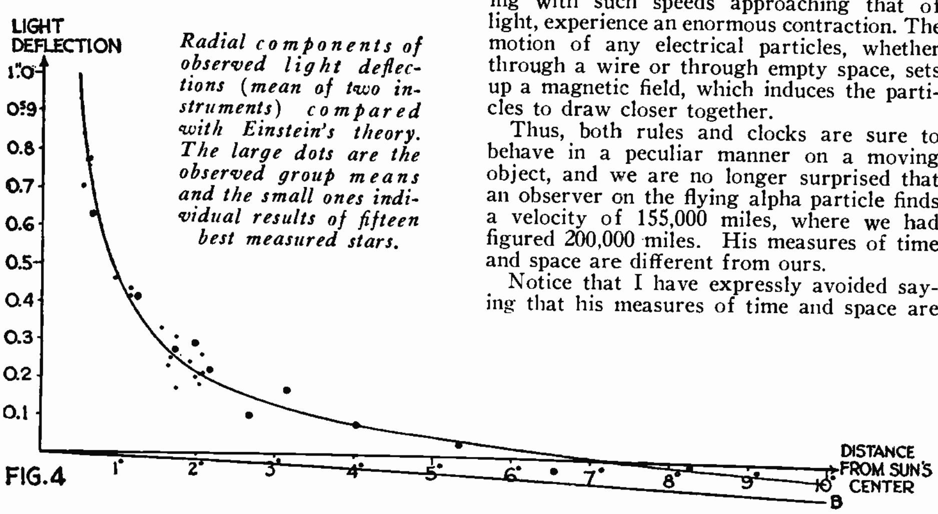


FIG.4

Radial components of observed light deflections (mean of two instruments) compared with Einstein's theory. The large dots are the observed group means and the small ones individual results of fifteen best measured stars.

erroneous. He is blissfully unconscious that anything has happened. All of his rods are shortened in the same ratio; his clocks still keep step, hence there is no standard by which he might detect any distortion. From his point of view it is we who are whizzing away from him—and he may conclude that it is our clocks and rules that are upset.

Which is right? Since relative motion, only, matters, the only answer is—each is right, for *himself*. The doctrine "Mind your own business!" is excellent relativity advice. Measure velocities relative to yourself, but be careful when you try to forecast what the other man will find, for you may go astray.

The contraction, while an integral part of relativity, was predicted many years ago by Fitzgerald. Owing to its effect, every attempt to measure the speed of the earth through the ether, such as was tried in the "Michaelson-Morley experiment," has failed. A few years ago, some inexplicable results, obtained by D. C. Miller, bade fair to upset relativity, but a recent very careful repetition of the experiment, at Mount Wilson, has led to a complete vindication of Einstein's theory. So far relativity has met every test. Everywhere opponents are surrendering to its relentless logic and I feel that I fairly express the opinion of the majority of those whose judgment is of value when I say—relativity is no longer a theory; it is an established fact!

Building a Sport Plane

(*Continued from page* 334)

spruce and spliced in the center so that they form continuous spars through the whole span of the wing, with a dihedral of 4 degrees.

Each plane is built in one continuous panel from tip to tip. The upper plane has a cutaway at the center over the cockpit, and is fastened to the center N-struts with four bolts. The lower plane, which is a single panel, is fastened to the underside of fuselage with three bolts. The ailerons are on the lower plane only, and the aileron control wires run within the lower wing. The single I-struts on each side of the interplane bracing are of built-up spruce laminations. Landing wires are single, flying wires are double, all are 3/32-inch cable. Fuselage—The fuselage is of the girder type built of spruce, the longerons being of ash forward of cockpit. The cockpit has plenty of leg-room for such a small machine. The rear end of the fuselage tapers off into a horizontal wedge, the whole being nicely streamlined with basswood false work. The cowling is of 20 gauge aluminum.

Dimensions

Span both wings, 20 ft.
Chord both wings, 34 in.
Gap between wings, 40 in.
Stagger, 15 in.
Length over all, 16 ft.
Height over all, 5 ft. 7 in.

Wings

Wing curve, U. S. A. 27.
Total wing area, 108 sq. ft.
Angle of incidence top wing, 1½ deg.
Angle of incidence, bottom wing, 0 deg.
Decalage, 1½ deg.
Dihedral both wings, 4 deg.

Tail Unit

Stabilizer area, 7½ sq. ft.
Elevator area, 5½ sq. ft.
Fin area, 3 sq. ft.
Rudder area, 3 sq. ft.
Aileron area, each 6 sq. ft.

Weight

Weight empty, 370 lbs.
Weight loaded, full load, 600 lbs.
Wing loading, 5½ lbs. per sq. ft.
Power loading, 17 lbs. per h.p.

Power Plant

Anzani 3 cyl. 30-35 h.p. (preferred).
Propeller, 6 ft. dia., 5½ ft. pitch.
Propeller speed, 1,500 r.p.m.
Oil capacity, 5 qts.
Gas capacity, 6 gal.

Performance With Full Load

Maximum speed, 90 m. p. h.
Cruising speed, 75 m. p. h.
Minimum speed, 35 m. p. h.
Range, 250 miles.
Miles per gallon of fuel, 35.
Climb, 800 ft. per minute.
Factor of safety throughout, 11.

(*Continued next month*)

Motor Hints

Conducted by George A. Luers

(*Continued from page* 324)

Flexible Robe Rails

MANY of the older cars and some of the new closed cars of the moderate price class can be made more comfortable and attractive through use of interior fittings.

One motorist used covered assist cords and robe ropes of the type shown in the attached sketch to good advantage in modernizing his car, which car was several years old.

The parts are decorative, while at the same time simple enough to make up to justify any owner repeating this construction.

Hemp, manila or cotton rope forms the body of these attachments. This rope is about three-quarters of an inch in diameter. A covering fabric is selected to harmonize with the upholstery. That is, the shade should be the same, the design of fabric need not be identical.

This is made into tubes to a size to snugly fit the rope. Leather loops are secured to the ends of the rope, binding tightly with waxed or other strong twine. End fasteners are made from brass, filed out to make them neat and drilled for screws. Robe rope fasteners can be made from brass screw eyes. However, these are not as neat as flat-shaped ends. After the leather is fastened with twine, the fabric tube covers the binding, being sewed over neatly.

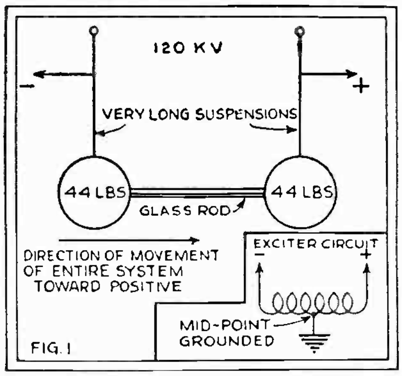
Two assist cords, one long robe rope and two short cloak ropes for the sides of the rear seat add a complete equipment to the car.

How I Control Gravitation

By Thomas T. Brown

(*Continued from page 313*)

first actual evidence of the very basic relationship. The force was named "gravitator action" for want of a better term



A simple type of gravitator is shown in the above illustration.

and the apparatus or system of masses employed was called a "gravitator."

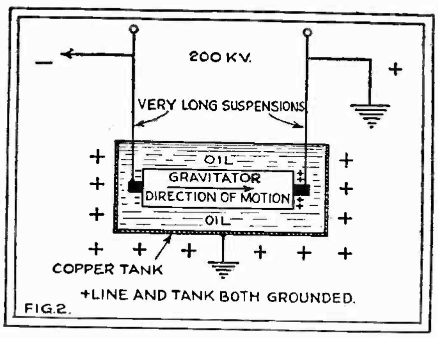
Since the time of the first test the apparatus and the methods used have been greatly improved and simplified. Cellular "gravitators" have taken the place of the large balls of lead. Rotating frames supporting two and four gravitators have made possible acceleration measurements. Molecular gravitators made of solid blocks of massive dielectric have given still greater efficiency. Rotors and pendulums operating under oil have eliminated atmospheric considerations as to pressure, temperature and humidity. The disturbing effects of ionization, electron emission and pure electro-statics have likewise been carefully analyzed and eliminated. Finally after many years of tedious work and with refinement of methods we succeeded in observing the gravitational variations produced by the moon and sun and the much smaller variations produced by the different planets. It is a curious fact that the effects are most pronounced when the affecting body is in the alignment of the differently charged elements and least pronounced when it is at right angles.

Much of the credit for this research is due Dr. Paul Alfred Biefield, Director of Swasey Observatory. The writer is deeply indebted to him for his assistance and for his many valuable and timely suggestions.

Gravitator Action an Impulse

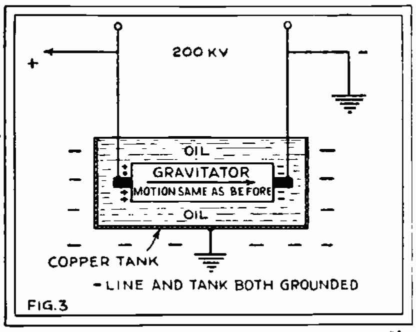
LET us take, for example, the case of a gravitator totally immersed in oil but suspended so as to act as a pendulum and swing along the line of its elements.

When the direct current with high voltage (75-300 kilovolts) is applied the



The principle of the electro-gravic pendulum is shown here. Gravitator moves in a direction opposite to that required by the laws of electrostatic attraction and repulsion.

gravitator swings up the arc until its propulsive force balances the force of the earth's gravity resolved to that point, then it stops, but it does not remain there. The pendulum then gradually returns to the vertical or starting position even while the potential is maintained. The pendulum swings only to one side of the vertical.

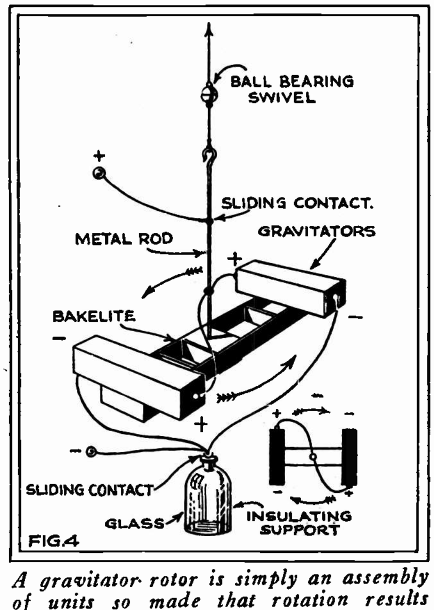


Reversing polarity does not change direction, extent or duration of gravitator impulse.

Less than five seconds is required for the test pendulum to reach the maximum amplitude of the swing but from thirty to eighty seconds are required for it to return to zero.

The total time or the duration of the impulse varies with such cosmic conditions as the relative position and distance of the moon, sun and so forth. It is in no way affected by fluctuations in the supplied voltage and averages the same for every mass or material under test. The duration of the impulse is governed solely by the condition of the gravitational field. It is a value which is unaffected by changes in the experimental set-up, voltage applied or type of gravitator employed. Any number of different kinds of gravitators operating simultaneously on widely different voltages would reveal exactly the same impulse duration at any instant. Over an extended period of time all gravitators would show equal readings and equal variations in the duration of the impulse.

After the gravitator is once fully discharged, its impulse exhausted, the electrical potential must be removed for at least five minutes in order that it may recharge itself and regain its normal gravic condition. The effect is much like that of discharging and charging a storage battery, except that electricity is handled in a reverse manner. When the duration of the impulse is great the time required for complete recharge is likewise great. The times of discharge and recharge are always proportional. Technically speaking, the exo-gravic rate and endo-gravic rate are proportional to the gravic capacity.



A gravitator rotor is simply an assembly of units so made that rotation results until the impulse is exhausted.

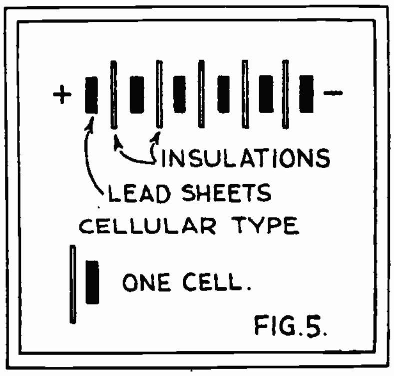
Summing up the observations of the electro-gravic pendulum the following characteristics are noted:

APPLIED VOLTAGE determines only the amplitude of the swing.

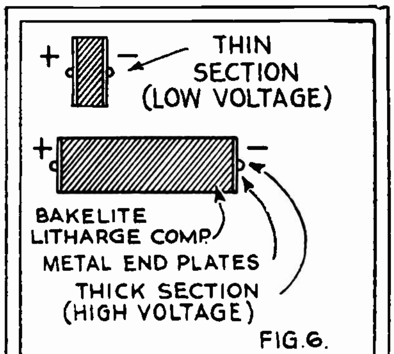
APPLIED AMPERAGE is only sufficient to overcome leakage and maintain the required voltage through the losses in the dielectric. Thus the total load approximates only 37 ten-millionths of an ampere. It apparently has no other relation to the movement, at least from the present state of physics.

MASS of the dielectric is a factor in determining the total energy involved in the impulse. For a given amplitude an increase in mass is productive of an increase in the energy exhibited by the system ($E=mg$).

DURATION OF THE IMPULSE, with electrical conditions maintained, is independent of all of the foregoing factors. It is governed solely by external gravitational conditions, positions of the moon,



The cellular gravitator is built in the form of a high voltage series condenser.



The molecular type gravitator is made with a dielectric block and metal end plates or electrodes.

sun, etc., and represents the total energy or summation of energy values or levels which are effective at that instant.

GRAVITATIONAL ENERGY LEVELS are observable as the pendulum returns from the maximum deflection to the zero point or vertical position. The pendulum hesitates in its return movement on definite levels or steps. The relative position and influence of these steps vary continuously every minute of the day. One step or energy value corresponds in effect to each cosmic body that is influencing the electrified mass or gravitator. By merely tracing a succession of values over a period of time a fairly intelligible record of the paths and the relative gravitational effects of the moon, sun, etc., may be obtained.

In general then, every material body possesses inherently within its substance separate and distinct energy levels corresponding to the gravitational influences of every other body. These levels are readily revealed as the electro-gravic impulse dies and as the total gravic content of the body is slowly released.

The gravitator, in all reality, is a very efficient electric motor. Unlike other forms of motors it does not in any way involve the principles of electro-magnetism, but instead it utilizes the newer principles of electro-gravitation. A simple gravitator has no moving parts but is apparently capable of moving itself from within itself. It is highly efficient for the reason that it uses no gears, shafts, propellers or wheels in creating its motive power. It has no internal mechanical resistance and no observable rise in temperature. Contrary to the common belief that gravitational motors must necessarily be vertical-acting the gravitator, it is found, acts equally well in every conceivable direction.

While the gravitator is at present primarily a scientific instrument, perhaps even an astronomical instrument, it also is rapidly advancing to a position of commercial value. Multi-impulse gravitators weighing hundreds of tons may propel the ocean liners of the future. Smaller and more concentrated units may propel automobiles and even airplanes. Perhaps even the fantastic "space cars" and the promised visit to Mars may be the final outcome. Who can tell?

This Glider Easy to Build

By George A. Gerber

(*Continued from page* 333)

the fuselage spreader and are attached to same with ⅛" stove bolts, to be sure that the fuselage will not spread apart from load strain while in flight.

Sections "A" "A" on both sides and at rear wing position are covered with fabric to act as rudder or vertical fin surface.

I am sure that the enthusiastic glider builder or fan has studied many drawings of different types, and so I believe this description to be of sufficient detail to enable him to build up this glider with no difficulty.

Again, let me repeat, no attempt has been made towards elaborateness; in fact, the opposite course has been followed, to make the construction of this as simple as possible for the youth only, and if he succeeds in making a number of "hill glides," learns the feel of the air, and experiences a few of the multitude of thrills which lie in store for the amateur glider pilot, he will be amply repaid for his efforts, and I will be proud indeed to have been instrumental in the realization of his dreams—Flight.

Remarks on Gliding

THE elimination of a great many "drift" wires, fittings, etc., is a feature of this little glider, due to the use of simple truss design, and to the fact that the short span and stiff fuselage give a great rigidity without the use of drift wires, and yet permit a reduction of weight to a minimum.

It should be continually borne in mind that the lighter the completed glider is, the slower will be its take-off and landing speed, both great advantages, and the greater will be its sustaining ability, but no sacrifice of weight must be made in any part or in any place which might cause a dangerous weakness.

Your glider must be staunch and rigid to carry you safely, yet "feather light"; and your workmanship must be methodical and done with great care to insure a perfect job—but show me the youth who cannot do this, if he is really sincere and with so much at stake.

The simplest method of flight and the one for which this glider was designed, is to coast down a hill on a "cushion of air" so to speak.

It is not advisable to try gliding with this plane in a wind velocity greater than 15 miles per hour, and the breeze should be steady; gusty weather is extremely dangerous to the inexperienced glider pilot.

Find a good steep slope or hill, free from trees, fences, stumps, or other obstructions, preferably with an open space or field at its base. The ideal location would be a mound or hill seventy-five or more feet in height, in the center of a large clearing, permitting flight from any side, as glides should *always* be made *into* the teeth of the breeze. This greatly reduces the ground speed of the glider when in flight and similarly permits of much slower landing speeds.

To turn and go with the breeze, unless at quite considerable height, almost always results in disaster to the plane and quite likely will give the pilot something to remember, or do away with his remembering.

The first glides should start with simply a run against the breeze, supporting the glider with the hands until its own lift draws it up against the pull of the pilot's arms and this position of support must be found by trial so that the glider will carry the pilot's weight nicely balanced and when the take-off occurs a slight shifting of the body will cause the machine to maneuver.

Once this position has been found and a certain amount of skill has been attained in controlling the plane's attitude by movements of the body, longer "hops" may be safely attempted.

It is useless to try to instruct a person to fly or glide by written or vocal schooling. Practice and persistence are the only practical tutors.

For the longer "hops" where the plane really leaves the ground for several feet or so, we may give a few little tips to remember. With body suspended freely in ship in flight, control is effected by swinging the legs sidewise to bank, or forward and backward to nose up or down.

As you approach the end of your glide (and in a glide, be sure you are maintaining your flight speed at all times) if ship gets sloppy or slow, nose down slightly to pick up more speed, or you will be in danger of stalling, and if you are an aviation enthusiast—as you must be—you are thoroughly acquainted with the results of a stall near the ground—nose down slightly to pick up a little more speed, level out about three or four feet above the ground and hold this altitude until the plane loses practically all its forward or flight speed, then just before it stalls, shift the weight firmly but not jerkily so as to force the tail down at about 10 degrees and the wings will act as an air-brake, slow up quickly and settle the remaining foot or so to your feet, which should be in position to start running immediately if the landing has been made a little fast, or thrust out to take yours and the ship's weight in an abrupt stop, if your descent has been made in a stiff breeze and is very slow.

Landing is the most delicate phase of the flight and must be practiced a great deal in short hops before the longer flights from the top of the hill are attempted.

No hard and fast rules may be set down with regard to flight. Each flight presents new problems and different attitudes in equilibrium upon "touching" and must be instantly met by the resourcefulness of the pilot.

$2,000,000

By Capt. E. P.

(*Continued*

THERE was nothing unusual about the demolition except for the quantity involved. Dynamite was ordered and used by the ton.

The aging of the trenches was accomplished by means of a fire-hose nozzle with a heavy water pressure.

After using water pressure on the trenches, they were partially repaired in sundry fashions known only to those that served on the western front.

The wire entanglements were aged by blowing them up and then partially repairing same.

The "dressing" consisted of placing the proper discarded military material and accoutrements about in seeming confusion.

The construction consumed about six weeks, and all who read this can form an estimate of the cost involved.

The Army had hoped that the battle scenes could be technically correct, but a few trial "runs" proved this to be impossible, since a film showing a correct advance or attack will not greatly interest the soldier, let alone the layman. The picture of 500 men moving up through the communication trenches in direct view of many cameras stationed on towers as high as 100 feet were so disappointing as to necessitate nearly a complete abandonment of pure tactics, and the same was true of the air shots, but justified for the purpose of making a thrilling picture that people would enjoy.

When the battlefield was completed, the entire Second Division moved out to Camp Stanley to participate in the filming of the picture. In advance of the arrival of the division, several model field camps had been prepared so that the incoming troops found their camp sites cleared; streets laid out, piped for water; latrines completed; wired for electricity and the field kitchens ready to receive the field range.

While the division was engaged in making the picture a conference was held daily with most of the following in regular attendance; division and brigade commanders, all regimental and special troop commanders and the picture staff, which usually consisted of the producer (Mr. Lucien Hubbard), the director (Mr. William Wellman) and their various assistants.

At this conference plans were perfected for the following day's work. These plans called for each unit to be at a certain place on the field at a certain time with certain equipment and very often special dress or uniforms. The action desired was explained to the troops, and some very realistic war marches, attacks, deaths, etc., were executed without picture or special direction.

A great deal of time was devoted to the problem of obtaining an explosion on the field that would resemble the detonation of an artillery shot; that would look to be real and very dangerous and yet one that would be 100% safe for the troops who would be required to advance through these explosions and at times "die" (pictorially) close to or on top of one! Various schemes were tried out, but the one adopted was worked out by the ordnance and the field artillery. This dangerous-looking fake explosion was obtained by digging a hole in the ground about 24" to 36" deep with about the same diameter. On the bottom of this hole was placed a "cushion" of carefully sifted loam and sawdust. On this cushion a pasteboard container containing normally about two sticks of dynamite broken up and mixed with sifted loam and sawdust; then the

Sham Battle

Ketchum, U. S. A.

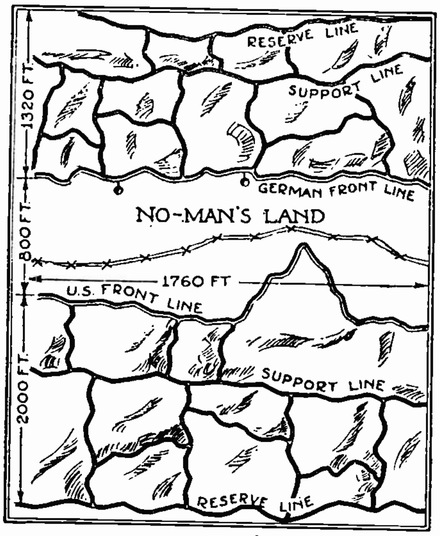
from page 299)

hole was leveled off by filling with sifted loam and sawdust (see sketch).

These fake explosions were detonated electrically from long, improvised switchboards which were nicknamed "Zip" boards. One can easily imagine the work involved in placing about 1,000 of these shots on the battlefield, wiring them up and having them arranged on switchboards so that any one or group might be fired when required.

The wiring of these shots was done under the direction of the Signal Corps, and the preparation for some of the big scenes required a week of real labor.

The Chemical Warfare Service was used to provide smoke screens to blot out backgrounds that would not harmonize with the western front. Their white phosphorous hand grenades did this very effectively and photographed beautifully.



General plan of trench system.

After the division returned to Fort Sam Houston and there remained only a composite battalion to furnish backgrounds for the medium and close-up scenes, the fake explosions, wiring and even the white phosphorous smoke had to be handled by the writer and his small civilian staff.

Some trouble was experienced with this safe fake explosion, due to moisture getting into our dry sifted loam and causing a heavier explosion. On certain occasions the charge had to be reduced to less than one-half stick due to moisture that couldn't be seen or detected.

Every day during the filming of "Wings" was made memorable by one or more happenings of interest, but all of these cannot be recorded here without unduly prolonging this article, but some of the most spectacular episodes only will be touched upon.

The First Deliberate Airplane Crash

LET it first be said that all the flying in "Wings," except for the deliberate crashes by a stunt flyer (Mr. Richard Grace), was done by the regular Army flyers from various flying fields.

Dick Grace was hired to do the dangerous, deliberate crashes, and this narrative now records his two deliberate crashes.

In his first crash Dick was doubling for Buddy Rogers, who is supposed to have a disabled plane and has to make a forced landing on the British front.

When the scene of this crash was thoroughly prepared (the preparation of necessity included an ambulance and fire truck!) and the numerous cameras were in position, Mr. Grace journeyed to Kelly Field—some 20 miles away—to fly his plane over. Just before he left I consulted him about putting mattresses in the bottom of a large shell hole that he might land or be thrown into, but was told not to as they made quite a hot fire! Also just before taking off, the regular flyers in typical fashion of their corps, were claiming Dick's paraphernalia in case the crash was more (or less) successful than planned!

It wasn't long (but to me it seemed ages) before we saw Dick above us circling the field. He was to circle three times, then crash on the spot selected and prepared, and this he did with perfect success and without a scratch to himself. After this scene his plane was found to contain about one quart of gasoline (remember he feared fire—if he knows what fear is). This demonstrated to all that Dick was not only a great and nervy flyer but a very clever and cunning one also.

I am convinced that I suffered more that day than did Dick himself.

Dick Breaks His Neck!

DICK'S second crash was more dangerous but less spectacular to the people who see it on the screen. He was called upon to be shot down from a plane above him as he takes off from the ground and before he has gained any altitude. In this crash he is doubling for a German flyer and is supposedly shot down by Richard Arlen, who has just stolen a German plane to return to the American lines.

Dick carried out the crash as planned, but was unconscious when the scene ended, but upon coming to only complained of a pain in his neck. This second crash took place on a Thursday, and the following Sunday the entire picture staff journeyed to New Braunfels to plan the third crash at a spot on the river which had been previously selected by the producer and the author. The river at the place selected was rather narrow and flanked on one side by a vertical cliff 50 feet high and on the other by dense trees. When selected it was agreed that the "shot" would have to be faked, as it could not possibly be executed by Mr. Grace or anyone else. The plan called for a flyer (supposedly Richard Arlen) to be forced down here; to land all right but to taxi into the river over this 50-foot cliff!

The staff this day included Dick, and although he was complaining of his sore and stiff neck, yet when he was shown the location and the action explained, Dick remarked, "I can do it" or words to that effect. However, Dick didn't execute this last one, as the next day X-rays revealed that he had broken his neck the previous Thursday! And so Dick spent the next few weeks in a hospital inside of a cast.

Although I haven't seen Dick since, I am informed that he is now all right and is still flying.

The Bombing of the French Village

THE art and construction departments built at Camp Stanley out of wood and beaver board a very realistic-looking French village, which was involved in the main plot of "Wings" and which had to be bombed.

It was finally decided to bomb this village from the air, using live bombs, but to insure its complete destruction four large ground charges were placed in the various buildings and one in the church steeple, and the lines were carried back about one-half mile from the village where I could take station with the producer to complete the demolition of the village upon his direction. My charges and lines were in place over a week while we waited on suitable clouds to appear to film the picture.

When a few clouds finally made their appearance one day, it was decided to bomb the village. An ordnance officer was to do the bombing, and as the bomber would have to remain at a very low elevation, so that the cameras could show the bomber and village, at the same time he would have to release the bombs by eye and without using the sights.

The bomber placed all the bombs right through the heart of the village, but each and every one proved to be a "dud," and when Mr. Hubbard (the producer with me) sensed this he asked me to blow it up, but all of my lines were fouled and nothing happened! This proved most fortunate, since a hasty conference ensued at which it was decided to try it again. So the bomber returned to Kelly Field for more bombs, and while he was gone I had our four ground shots checked and re-wired, but due to lack of time we could only run them about 100 yards from the village! At this place I had the laborers erect a semi-bomb proof of sand bags. Here again Mr. Hubbard, myself and one assistant took station, but not until I had waved at Captain Stribling in the air to show him our new location and hope he wouldn't drop any "shorts."

Again the bomber placed all of his bombs right through the heart of the village, but this time all detonated and at the proper time all of the ground shots and the church steeple were fired. It was truly a hectic day, but the results on the screen were wonderful and justified our work.

I have tried to confine my rambling thoughts to the ground side of "Wings"—the experiences of the regular flyers on duty with "Wings" is another and very interesting story, but should be told by them.

Due to the help of the Army engineers, the motion picture "Wings" is an exceptionally realistic film. The picture proved to be a huge success and no doubt aided recruiting, especially for the air corps.

How to Build a Small Outboard Boat

By William F. Crosby

(*Continued from page 337*)

the chine piece. Both of these pieces are let in flush with the stem, in order that they will not interfere with the planking when it goes on.

The side planks go on first with the one nearest the floor, the first to go in position. Be sure that the edge is nicely planed and is slightly bevelled, as shown in Figure 3, so that the seam from the outside will be somewhat wider than it is on the inside. This permits caulking and puttying.

With the second plank in place, smooth off the edge nearest the chine, so that it fits exactly to this line. The bottom planking will go over this edge, and it is necessary to make a good joint at this particular point of the chine. Putting some marine glue on the chine piece just before these two planks are placed will do a lot toward keeping the boat tight.

The bottom planks are simply laid fore and aft, with the seams arranged as shown in Figure 3. A little marine glue between each one will also help here. Figure 6 shows a detailed view of the joint between the frames at the chine.

When the boat is all planked, remove the braces underneath and turn her over. Place the seats and remove the temporary

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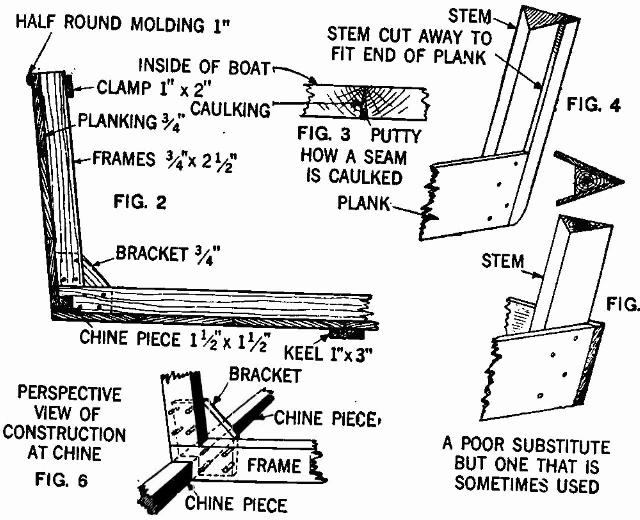
braces between the tops of the frames. It is a good plan to put in small knees of wood at each side of the transom, firmly secured to the transom and to the clamps.

Paint each seam and, while this paint is still wet, run in a thread or two of cotton wicking for caulking. Do not drive it in too hard. Paint the seams again after this and then putty them, finally painting the entire boat. Of course, you may sandpaper and plane the hull to make it perfectly smooth, but this has little to do with the boat itself.

In Figure 2 you will find dimensions of most of the material used in this boat. No specific material is given because of the variations to be found in different sections. The frames, chine piece, keel, stem and transom may be made from oak or some other equally tough wood. The clamp may be of spruce and the planking may be mahogany, white cedar, red cedar, yellow pine or cypress. These are arranged in the order of merit. For fastenings use brass screws or galvanized iron nails. When you start a plank at the side, fasten it to the stem first and bend it around. This is the easiest way to do it. It is shown in Figure 7. In Figure 5 is shown a method of building the stem, in which no grooves are cut for the ends of the planks. Here the planks simply run straight out, one overlapping the other and the two ends being bevelled off to make a sharp bow. This method may be used, but it is not as good as the one shown in Figure 4.



With one of the medium weight outboard motors, this hull should drive along at good speed and be just the thing for short fishing trips and for camp errands.

X-Ray Films Cause Disaster

By H. Winfield Secor

(*Continued from page* 307)

prevent a recurrence of such a disaster.

How Fires Can Be Prevented

ASSUMING that the inflammable films must be used for X-ray work, the following systems will prevent a repetition of a disastrous fire. First, a limited quantity of film only should be filed. These should preferably be contained in metal filing cases in the main office and the balance should be stored in a vault of fire-proof construction. Second, unexposed films should be stored in lead-lined storage cans and a small quantity only should be permitted outside of the vault. Third, the vault should be fire-proof or of fire-proof construction. Fourth, the vault should be equipped with a fire door which shall always be closed. This fire door can be so arranged that it will turn on the light inside the vault only when the door is closed. Fifth, no skylights or other opening shall be permitted with the exception of ventilating arrangements so constructed that they can be closed from the outside. Sixth, each storage room should be provided with automatic sprinklers. Seventh, the room shall be heated by hot water heating system, or if steam must be used, only low-pressure steam should be permitted with the radiators close to the ceiling and adequately screened. Eighth, lights in the room should be protected from breakage by guards, and film illuminators should be so designed that the diffusing glass cannot get hot enough to produce spontaneous combustion. Ninth, waste films shall not be allowed to be thrown on the floor, but must be put into suitable self-closing cans. Tenth, smoking shall not be permitted anywhere near the room or in the room itself. Eleventh, a storage vault should preferably be placed outside of the building limits. Twelfth, chemists might be able to devise a slow-burning film which shall not have the tendency to curl or roll.

At Last! Diesel Engines for Planes

By William F. Matthews

(*Continued from page* 311)

maximum cylinder pressure of a Diesel being absolutely fixed by its design, which are not varied appreciably by the use of a wide range of fuels, the Diesel engine cannot be abused; whereas the maximum cylinder pressures in a gasoline engine may vary considerably due to the use of a poor grade of gasoline causing pre-ignition, which results in a serious peak pressure that the engine is not constructed to withstand and which leads to engine failure due to overheating, piston seizure, etc.

9. The Diesel engine, not being dependent upon carburetor supply, can be made to function safely in any flying position with absolute dependability. The main thing is to see that no air gets into the pump suction line.

10. The lubricating oil (low viscosity, or thin body) used to lubricate the pistons, due to high cylinder temperatures following the descent of the piston on the power stroke, is completely consumed above the piston rings on every power stroke, thus contributing through combustion its small share to the efficient production of power and preventing carbonization.

While the above claims are indeed momentous and worthy of the most serious engineering thought, and notwithstanding the fact that a Diesel-powered airplane recently made a successful 700-mile flight, it must be borne in mind that the Diesel aircraft engine is still classed by engineers as an experiment. That is, weaknesses of design which are inherently possible in all things, have not had sufficient time to develop. Indeed, the elements of time and usage constitute two very important phases that must be taken into consideration before the engineering stamp of approval can be placed upon any development and the motors entrusted to the average pilot.

A review of several factors involved in the construction and operation of a Diesel engine will disclose the necessity for caution in this regard. (*To be concluded.*)

Home Movies

By Don Bennett

(Continued from page 327)

driving away from the house. Select angle that does not show who is in car. Panorama shot following car as it goes around corner and fade out.

Title 2—Our State is famed for beautiful scenery, but this shot near the State line makes us realize just how beautiful it can be.

Scene 2—Long shot of rolling land near Hicksville, view across road from rock near fork. Trees on other side of road give stereoscopic effect. Our car enters scene left foreground, slows down, then picks up speed and goes off right.

(This gives the effect that we are greatly impressed with the scenery and slow down to see it, at the same time connecting us personally with the spot, showing it to be a part of our trip.)

Title 3—The first night we stop at a quaint roadside hostelry—

Scene 3—Long shot of inn. Our car inconspicuous either among other cars or just showing at corner.

Title 4—A day of shopping in the city by the better half leaves me free to explore.

Scene 4—Shots of business section and traffic.

Scene 5—Shots of residential district with kiddies playing around.

Scene 6—Scene of wife in medium shot with arms full of bundles. She steps out of store, looks around and then discovers me, walks toward camera.

Title 5—"I ran out of money, George, and I just *had* to stop."

Continue action. As she nears camera cut to

Scene 7—From reverse angle. Wife piles packages in car, talking volubly all the time. She climbs in car and we fade out.

Scene 8—(This is a trick shot and requires careful planning. Set the camera on a tripod and hold it firmly *upside down.* Point it towards sand on beach and frame carefully these words scratched in the sand:

"Atlantic City, N. J.
Aug. 3rd, 1929."

Holding the camera very firm, shoot about four feet of this and then hold camera in same position until a wave threatens to cover the words. As the wave encroaches on the writing, start the camera and let it run until the wave recedes again. The tricky part of this is to decide when a wave is coming near you. About one in three will do the trick. By holding the camera upside down, and reversing the positive, we will see on the screen a sheet of water that will roll up, revealing our title.) (Fig. 1.)

"You see, there are certain rules under which pictures are composed. These rules govern the beauty of the picture. The forms are few and I can sketch them out for you in a moment. Do you want them? Fine. The first is composed of lines mostly horizontal, similar to the second scene of my film (Fig. 2). This covers most landscapes of flat or slightly rolling country. Then we have the vertical lines. These are mostly found in tall buildings, tall trees that stand out individually. (Fig. 3.) Next we have a combination of the two, the cross. This is like the lonely figure outlined against the sky, typical of the old western pictures, or of a boat on the sea. (Fig. 4.)

"Then we have the triangle, such as we find in the perspective of a road, the foreground, broad in its nearness, forming the base and the recession in the background forming the apex of the triangle. (Fig. 5.)

(Next month—"Fire and Smoke." The use of flares and smoke pots to get night scenes and for trick work.)

Now We Gather News by Airplane

By Joseph H. Kraus

(Continued from page 303)

particular attention to the moment of leaving, we would never have known that we were in the air. The water and land receded rapidly.

At this point the Japanese attendant who takes this trip daily handed out several small packages. These were inscribed *"With compliments of Curtiss Flying Service, Inc., for use on the trip. Plug ears lightly with the cotton. Use the chewing gum to lessen the risk of air sickness."*

The writer had heard many people who claimed to have been up in an airplane on five-minute taxi rides profess to have come down very sick. So with the prospect of an hour's flight, the outlook didn't seem so good, but so far there was not the slightest indication that either the writer or any of the passengers would suffer.

It was even more surprising to discover that when flying at any altitude one does not become dizzy when looking out of a plane. A person rarely becomes dizzy when he looks out of a window of a many-story building. The dizziness usually occurs when one leans out over the edge and looks straight down, but even people who do not enjoy high buildings are wholly exhilarated by flying.

We Get Weather Reports

"YOU see those squares on the map, those are all coast guard stations. Each of those stations signals to the plane the nature of the weather ahead. If the man moves his hands up and down, it indicates that there is fair weather ahead. Both arms up and to one side shows poor weather. Hands crossed in front of the signaller tells the pilot that the weather is very bad," explained one of the men who had made several trips as he pointed to the maps, of which we each had one. "Each coast guard station telephones to the next station, telling the man there that the plane has left his position and is proceeding to the next point. At the same time the mechanic logs the flight in detail as you can see. In another week each plane will be also equipped with radio transmitters and receivers with a range of from 500 to 800 miles."

From a height of 500 feet, which was the altitude at which the greatest portion of the flight was made, we could distinctly see every clump of grass and could see people wave to us. In all probability they did not see us in the cabin.

Before we knew it, our wheels touched the ground at Bader Field in Atlantic City. The trip down took 62 minutes! The return trip was made in 57 minutes because of a tail wind which aided our progress. On returning we were informed that there was a storm brewing in the vicinity of New York, and to be frank, we hoped that it would hit us squarely. That, at least, would have given us some real excitement. But we missed the storm; the trip was as calm both ways as an outing in a canoe on a placid lake, with the added attractions of an ever-changing panorama, beautiful estates that looked like doll houses set in the middle of wondrous miniature gardens and interesting topographic features easily recognized from the air, yet so striking that they will be long remembered.

This trip to Atlantic City and return is being made daily. It is, to say the least, a most pleasant way to travel. Ease and comfort are paramount. Each passenger, when he secures his ticket, is automatically insured for $10,000.00. The auditorium is a splendid sight, but it pales when one recalls the splendors of the flight.

Is a College Education Worth While?

(*Continued from page* 321)

The development of machines and manufacturing and the use of power require education and training, and to excel the world in those works and the sciences requires the highest scientific training; *i. e.*—college training.

America, under the wisdom of her forefathers, has for one hundred forty years sought to give every child an education, and the success of that wise plan is the reason for our leadership in wealth, comfort and the absence of poverty.

I have cited war as the supreme test of skill and leadership. If there were a general or an admiral of the World War who was an outstanding figure for his successes and who was not a college graduate, I do not know it. When the war broke, I had completed nineteen years commissioned service in the Corps of Engineers of the Army. I had commanded companies of Engineers in the United States and the Philippines, and a battalion of Engineers in the United States. I had laid out harbors and canals in the United States, built roads and bridges, and taught civil and military engineering, including warships and sea power, to young Engineer officers.

Thus I worked with and commanded civilians and Army men of every rank in varied occupations. Always I found the best educated men—other things as health, mental ability, alertness and physical vigor being equal—to be the best and most reliable men. The college man's life work is founded on the rock of broad training and therefore broad outlook. He has vision and capacity to climb to the heights. He is neither dazzled by the "fool's gold" of impossible things, nor frightened by that scarecrow of narrow or untrained minds, "it's never been done before so it can't be done now."

Eight days after landing in Paris in August, 1917, I found myself "Chief of the Gas Service" of the American Expeditionary Forces. The title was all I had to start with and I had to make up even that. I had neither officers, men, equipment, nor regulations. But I had no question about where to begin. I must have officers. Once I got the right ones and got them educated they would do the work. Without them, equipment, rules, regulations, war materials were useless, no matter how abundant they might be.

There had been no such thing as chemical warfare in the United States Army before the World War, nor, as above stated, had anything but the barest beginnings been made up to the date when I was made Chief of the service. Accordingly, there were no trained officers in the United States. There were no Plattsburgs or officers' training camps giving training in chemical warfare. Regular officers were too scarce to be able to get any considerable number from that source. But officers I must have, and quickly!

The proposition was made to me that the old line sergeants of the regular army would make excellent officers. Much as I admired those sergeants, I declined to commission any of them except in the Gas Regiment as first and second lieutenants and possibly captains. Their experience in platoon and company drill made them highly qualified to command such units. With rare exceptions, however, they had not the education and training to give them the vision for higher command.

I laid down the rule that no officer would be taken into the general Chemical Warfare Service in France unless he were a college graduate, or had the equivalent of a college education. This proved a great success. During the first six months of development work there were some things in chemical warfare that probably moved slower than if the old sergeants had been commissioned. At the end of the year the Service was tremendously better off, as the college graduate had a foundation that enabled him to take hold of whatever job he was given and follow it without limit.

The work in France covered highly technical chemical research and development. It covered complete supply from the base ports to the battle line. It included a huge purchasing organization, a highly important liaison service and the training of the entire army in chemical warfare, both offensive and defensive.

In addition, there was the office force consisting of finally fifty-five officers at headquarters where rules, regulations, policies and all manner of plans were worked out or approved. None but men with vision beyond what they knew in the past could succeed there. There were no chemical warfare precedents in America or in the American Army. English, French and German rules and regulations were only partly adaptable to American character.

The men who went into the field in charge of training had to have the capacity to deal with the soldier in the ranks and all officers from lieutenants commanding platoons, to lieutenant generals commanding Army Corps and Armies. They had to be able to give advice to Division, Corps and Army commanders as to the best use of chemicals. They had to work with the staffs of all fighting units.

In addition, the Gas Regiment, itself, had to carry out important attacks in cooperation with not only American troops but at times English and French. Adaptability, vision and broad foundation were requisite in every case. The success of the Chemical Warfare Service in meeting all demands made upon it was the success of the college man. The first group of officers obtained early in October, 1917, were seventeen young Engineer graduates from a half dozen of the principal Engineering Schools in the United States. They all made a success of the work. Of the 636 officers in the Chemical Warfare Service in France at the close of the World War, only five were regular officers and one of those came in after the war started.

I would sum up as I began that in every way and in every place a college education is an advantage to a man. I would add just one proviso to that. That proviso is that the boy before going to college and while in college be taught the nobility of work. He must be taught to believe in his soul that it is just as honorable to work under an automobile in grease and dirt as in an office with a white collar and fountain pen. He must be taught that work in the soil on the farm and in the garden—painting the kitchen or cleaning the kitchen sink—is no discredit to a college man any more than any other man, or woman for that matter.

If the college boy be taught and grows up with these ideas a college education will always make him a better man and a greater success than he could have been without it. If he feels that soiling his hands or wearing denim overalls is unbecoming his family or other connections, then a college education might hurt him, and it might not—for he probably would not be worth much anyway.

The college man must learn that "graduation" is commencement only. Whenever the college man quits studying he slips backward. But so does the successful man who is not a college man. Stagnant water becomes diseased—dies, no matter how crystal pure in the beginning. Only moving water remains pure. And only the active brain moves forward, college trained or not.

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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 fifteen 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.

Objectionable or misleading advertisements not accepted. Advertisements for the October issue must reach us not later than August 1st.

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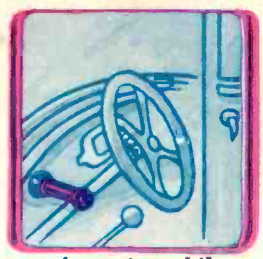

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