SCIENTIFIC AMERICAN

February
1933
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of a Subject Which Interests Everyone—Details in March

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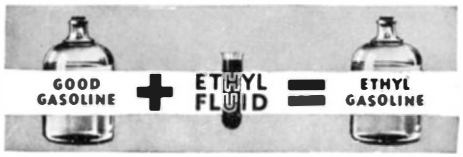

Ethyl fluid contains lead. © E. G. C. 1933

NEXT TIME STOP AT THE ETHYL PUMP

SCIENTIFIC AMERICAN

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EIGHTY-NINTH YEAR • ORSON D. MUNN, Editor

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An index of articles appearing in back numbers of Scientific American is to be found in The Reader's Guide, Industrial Arts Index, Engineering Index, and Dramatic Index. These can be consulted in any large library.

Miracle Worker, AGE 8

His little hands hold the instrument tightly; his small, confident voice speaks eagerly into the mouthpiece. And as simply as that, he talks to his friend who lives around the corner, or to his Granny in a distant city . . . achievements which, not so many years ago, would have seemed miraculous.

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ACROSS THE EDITOR'S DESK

SCIENTIFIC AMERICAN is starting another investigation. The Keeley motor, the electronic reactions of Abrams, psychic phenomena, aluminum ware for cooking, the so-called "lively" baseball—all these have been studied in the past and the results spread before our readers for their information. But this new investigation is something different—something that comes straight home to every reader—something in which every reader can co-operate for the advancement of one branch of science. We are going to follow this new research for several months, and you will not want to miss even one part of it. In our March issue will be given full details and complete information as to how you —each and every reader—can help.

●

"You are a stockholder in the corporation that employs me. At least it costs you nearly two dollars and a half a year to help keep that corporation going." With these words, a stranger who called himself a phytopathologist, deposited in the hands of the author of an article which is scheduled for our March issue, a bulletin covering the work of his "corporation." Wrath and astonishment overcame the recipient as he read therein the boasts that the corporation—the Division of Horticultural Crops and Diseases—had spent 14,000,000 dollars of the people's money in 44 years. Government waste. Disgusting! And yet, what is this? This division saves lettuce farmers 8,000,000 dollars annually; returns to tomato growers annually six times the amount spent each year by the division; saves 7,000,000 dollars annually to canners of three vegetables; saves cabbage growers 1,000,000 dollars annually; saves fruit growers of California and Florida several millions; and—but why continue? The sparkling story of this "most profitable waste" will tell the rest.

●

When the amateur microscopist wishes to pass on from the study of pond life, which is discussed in the present issue, he is often at a loss as to how he should proceed. He may wish to prepare his own cultures of bacteria to watch their growth into startling shapes, to prepare his own slides, and to make his own sterilizing apparatus without which it would be impossible to obtain pure cultures; yet the innumerable gadgets advertised by the instrument companies would have, for him, a too-professional cost and a too-professional air. To meet this urgent need, we have obtained an article for our March issue which goes into minute detail as to the sort of equipment needed by the amateur—test-tubes, glass dishes, home-made oil-tin sterilizer, glass jars, and the like—the few common and cheap chemicals needed, and the preparation of media for the propagation of bacteria from cheap ingredients.

●

When a rainbow appears in the sky and your unscientific friends—who don't read SCIENTIFIC AMERICAN—ask you why the spectrum appears as it does, and all sorts of other flattering questions about it, can you answer them without guessing too much? Understanding the rainbow involves some most interesting aspects of physical optics. One of our readers, Mr. Gaylord Johnson, became interested in rainbows but since they occurred too rarely for proper study, he home-brewed one by means of glass bulbs and some odds and ends. He succeeded in reproducing the beautiful phenomenon with scientific accuracy. Then he sat down and described the experiment for the rest of our readers. His article, "Home-Brewing the Rainbow and Understanding It," will appear in our March issue.

●

When Mickey Mouse cavorts and prances across the screen, to the accompaniment of music and all sorts of queer sounds, what person in the audience is so soured on the world that he cannot be amused? This little humanized mite has long held our fancy with his antics but how much more so since he was given a voice—since the advent of the talkies! Behind the reproduction of the Mickey Mouse sound accompaniment, there is a technique that is far more complex—in some ways—than it is in an ordinary movie of human beings. This technique has, however, been clearly and interestingly explained in a story now on hand which has been scheduled for our next issue.

●

According to the author of an article which will appear in our March issue, the next step in aircraft design—the problem of conquering the higher regions of the earth's air belt, the so-called stratosphere—is close at hand. The possibilities in this direction and the limitations from the mechanical, aerodynamic, and meteorological standpoints that are being encountered by European and American researchers in powered flight in the stratosphere, are all ably and interestingly discussed in this article.

Editor and Publisher

Outline of the Universe

By J. G. CROWTHER

THE whole universe, from electrons to stars, including life, is the scope of this book, which was written by the author of several rather recent articles in the SCIENTIFIC AMERICAN. There have been a number of books treating everything in the universe, so to speak, but we place this one on the top of the pile. One way in which it differs from many is that the author was entitled to write it. He has a broad scientific training and is in close touch with the personnel of science in Great Britain, being the liaison between the famous Cavendish Laboratory at Cambridge and the press, also scientific correspondent (in America we should say science editor) of Great Britain's "best" newspaper, the *Manchester Guardian*, and is rapidly becoming known as a leading popularizer of sound science, not as a journalist invading science but as a scientist invading journalism. This book conveys the true atmosphere of science. Not only does it cover inorganic science —modern cosmology and astrophysics and atomic physics—but the organic world as well, from the sub-microscopic viruses to apes and psychology. And it is all pleasant reading, not dull, but bright and constantly interesting.—$3.65 postpaid.

The Moon

By WALTER GOODACRE, *Dir. Lunar Sect. British Astron. Assn.*

HERE is good news for the amateur astronomer who enjoys studying the endless variety of details on the moon's surface—and what amateur doesn't! Walter Goodacre, the world's leading lunarian, has just published this new and exhaustive atlas and treatise. Roughly its 364 pages (7¼ by 10 inches) contain the following: A 50-page introduction to the study of lunar features; 25 separate chapters describing all the principal formations on the moon. Each of these chapters contains one section of the author's well-known 60-inch map of the moon, and a dozen pages of detailed descriptive matter about each individual formation. It is true, the same maps in reduced size are to be found in "The Splendour of the Heavens," but the descriptions in the new book are altogether more detailed, and in addition there are in the new book nearly 100 close-up drawings of especially interesting formations. The present treatise supersedes the two previous attempts to give a systematic survey of the markings on the moon, those, respectively, of Neison (1876) and Elger (1897) both being out of print, and is superior to anything of the kind ever published. Every amateur astronomer should add this work to his library before it too goes out of print, as it has been published privately.—$5.25 postpaid, imported.

The Curative Value of Light

By EDGAR MAYER, M. D.

THOUSANDS take sun-baths. Thousands use health lamps. Hundreds of thousands think sun-burn or excessive tan is healthful yet to this vast public the true facts are little known. Here is a book which gives the facts clearly, concisely and honestly. It tells you what light can do and what it *can't*. It tells you how and how long to take your sun bath and what dangers you run from getting excessive tan. It tells you how to use a sun-lamp and what type of lamp to buy. In fact it tells the medical truth in order to right many wide-spread misconceptions and to explode unfounded claims.—$1.65 postpaid.

Rewinding Small Motors

By D. H. BRAYMER *and* A. C. ROE

MARKED increase in the use of small motors for special services, as in refrigerators, oil burners, washing machines, vacuum machines, etc., necessitated the revision and enlargement of the first edition to give the operating characteristics and construction of the later designs. Here in detail with abundant diagrams, will be found all necessary information for the care and repair of fractional horsepower motors of every description. Included in the appendix is the elimination of radio interference due to the use of small motors. A broad, practical treatise.—$2.65 postpaid.

For Sale by

SCIENTIFIC AMERICAN

24 West 40th Street **New York, N. Y.**

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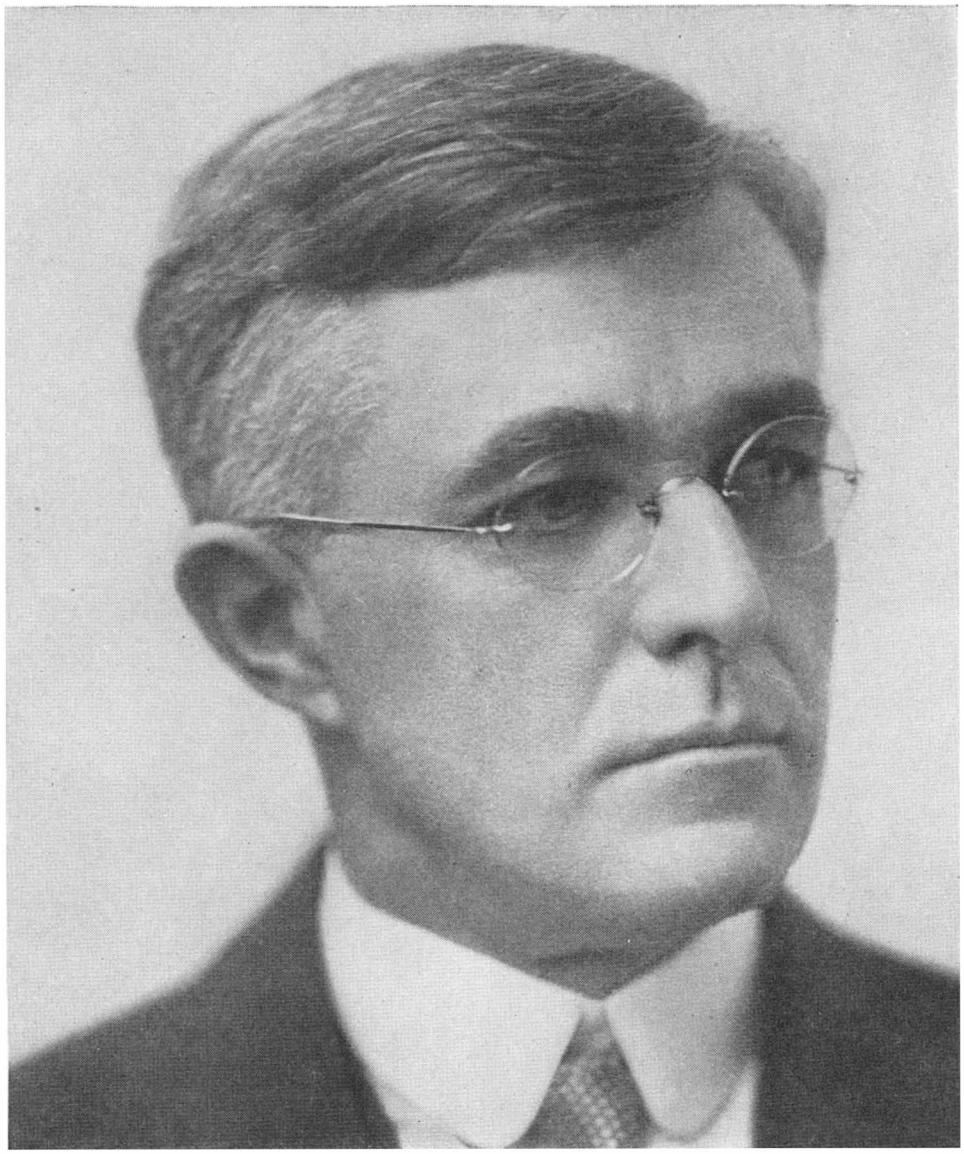


DR. IRVING LANGMUIR

A MILLION dollars a night! Dr. Langmuir, who has just received the greatest recognition any scientist can receive —the Nobel Award for Chemistry in 1932 —made possible this saving to the American people in electricity costs by his development of the high-intensity incandescent lamp, which contains small quantities of either nitrogen or argon. He is the second American chemist to have been honored by the Swedish Academy of Science in 31 years.

Growing out of his work with the incandescent lamp came momentous discoveries affecting the then new and immature vacuum tube. Dr. Langmuir's work with vacuum tubes contributed largely to the vast development of modern radio broadcasting. Equally important was his discovery of the atomic hydrogen method of arc welding. He has been particularly interested in the mechanism of chemical reactions taking place on the surfaces of solids. He is now engaged in working out the laws according to which atoms and molecules distribute themselves over surfaces to form monatomic layers—laws of great importance in understanding many simple phenomena.

To Dr. Langmuir, the Nobel Award is a distinctive honor among many previous international honors consisting of awards, medals, and honorary degrees. Educated at Columbia University and in Göttingen, Germany, he was an instructor at Stevens Institute of Technology before joining in 1909 the General Electric Research Laboratory, of which he is Associate Director.

From "The Sign of the Cross," Paramount

FAITHFUL REPRODUCTIONS OF HISTORICAL OBJECTS

SIGNIFICANT of the extent to which research is carried in the filming of an historical motion picture is the illustration above. The vase at the left is of hammered brass, and is an accurate reproduction of a vase used in ancient Rome. The jewels are not valuable, but they are exact replicas of those of 96 A.D., and on the screen give an effect that could not be any better if the originals were available and were used in the scene. The gown is of metal cloth and is patterned after one that was worn many centuries ago.

Note the "prop" tree in this scene from a talkie depicting a phase of early American history. Movie camera lines take in only the lower branches which have been inserted into holes in the "trunk"

HISTORY IN THE TALKIES

Necessitates a Vast Amount of Research for Accuracy and a Certain Amount of Legitimate Trickery

By ANDREW R. BOONE

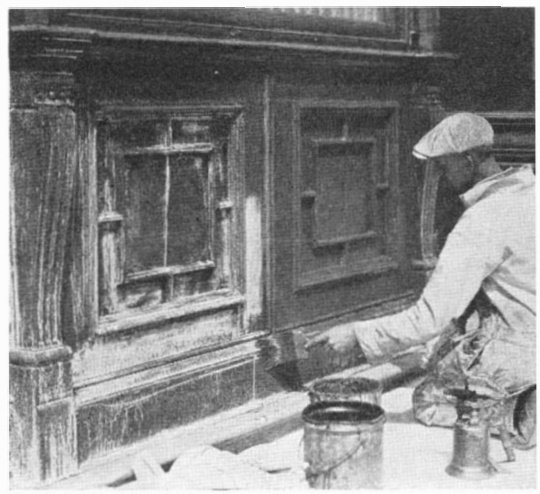
TWO thousand costumed ladies and gentlemen of old France loosed their voices in a roaring demand for "liberty, fraternity, equality"—not in Paris, but in Hollywood. They walked on a freshly paved street, parading before cameras pointed toward a large painted set that ended abruptly 30 feet above the ground.

Attached to the cameras, however, were small squares of glass which shut out the sky above the painted backings, leaving that part of the film unexposed. To the eye, the scene revealed these gorgeously dressed principals and extras milling aimlessly in front of two high painted walls, some 300 feet in length. Yet on the screen, when finally the picture was completed, one saw them in the France of 10 centuries ago, voicing their demands before stately buildings whose spires rose much higher toward the heavens than the "historical signboards" before which they actually appeared.

The magic glass fixed to the front of the camera was painted black. It "blacked out" all above the buildings on the painted backing. After the scene was filmed, a second small glass was painted to represent the tops of the buildings and, with the lower part of the film now covered with another black glass, was photographed. This gave the completed picture, accurate and authentic, but produced at a cost of many thousand dollars less than is entailed in building complete settings. This is known as a "mat shot" and double printing brought the two scenes together in perfect blending with not so much as a light streak to indicate where the large backing ended and the small painted glass began.

Art directors prescribe how these historical scenes shall be "shot." They may use miniatures, mat shots, glass shots, or sets built in forced perspective—narrowing from the camera to the background to give an impression of depth. For economy and accurate reproduction the mat shot finds particular favor since it enables large numbers of people to work in a scene, yet does not demand construction of costly sets.

Historical pictures include all those which deal with people and countries prior to 1918. The end of the World War seems to be the dividing line between the modern and the old, largely because of the vast amount of research required to procure accurate, authentic "properties" and costumes in vogue



Courtesy Fox Film Corp.

Painter "aging" a set 30 years in 10 minutes, using paint and a blow torch expertly applied

Courtesy MGM

An artist putting the finishing touches on a plaster Buddhist statue. The making of this huge reproduction is described in the text

in various countries prior to that date.

The other day I found myself at the Fox studio, on the outskirts of Los Angeles, looking across London's famous Trafalgar Square as it was in 1900. Seed soaked in formaldehyde and planted less than two weeks before had sprung up to provide a luxurious green carpet in the formal English garden. Artists at the moment were painting St. Paul's Cathedral on a backing. Carpenters were nailing in place large plaster plaques on the replica of Nelson's monument.

But they were constructing only what would be seen through the cameras' finders—nothing more. The four famous lions that have guarded the Nelson monument for a century or longer had been modeled in plaster and nailed into place. Full size plaster lions they were, but the monument ended 20 feet above the ground because the camera angle, shooting across the monument, required only that part of it to be built.

EVEN the bronze plaques commemorating Nelson's victories had been poured in plaster and painted with a brown lacquer. Tied by shredded rope to their wooden forms, at last they were nailed in place. But the monument and nearby buildings looked too fresh. The "aging" process commenced immediately after construction had stopped, and in a few days two painters had added an appearance of antiquity to the surfaces. As you know, every city presents a distinctive appearance. Coal dust marks London by settling on its buildings; then rain comes to streak them from roof to basement. Here the workmen added the touch of age by blistering and painting alternately until the composition brick-like slabs, moulded in squares four by six feet, gave that streaked, grimy appearance so characteristic of old English buildings. An air brush blowing wet lamp black across the surface produced the rain-soot effect. In a day a modern movie set was turned back to an English street three decades old.

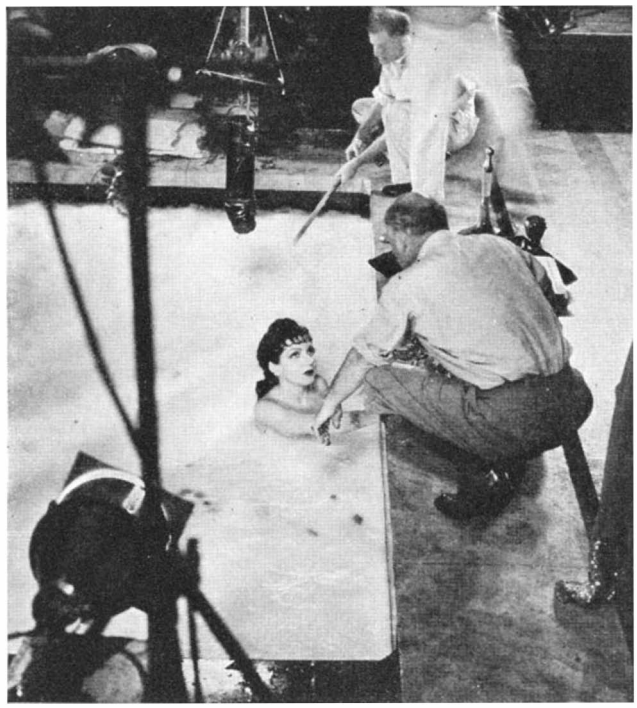
In preparing these sets for "Cavalcade," research assistants had been called upon to tell the director with pictures, sketches, cartoons, paintings, and original properties exactly how the City of London Imperial Volunteers were dressed when they departed from the Tilbury docks, Southampton, for the Boer War in 1900; how Trafalgar Square looked, not in 1899 or 1901, but in 1900; how the interior of Victoria station, the exterior of St. Paul's Cathedral and the beach at Folkestone looked when Bleriot landed near Dover at the end of his historic flight across the English channel. Not only the beach itself, but also a replica of Bleriot's monoplane, from blueprints and photographs supplied by the famous airman himself, was constructed by expert workmen in the studio carpenter shop.

In due course the C.I.V's. were ready to sail for the Boer War from a dock at Wilmington, California, aboard a Pacific coastwise passenger vessel used as a transport by the United States during the Spanish-American war. Ex-British soldiers marched down the dock. Some of them wore actual uniforms once owned by members of the C.I.V., and brought to Hollywood recently from London, while others had been provided with copies made at the studio. Two companies of C.I.V's. and two companies of the Black Watch might well have been His Majesty's subjects marching off to war, so perfectly did they learn the drill manual from soldiers who really did sail from Tilbury that day.

EXACT replicas of all properties—from uniforms to beds—must be used, for someone, somewhere, will spot an off-period costume or property. Alexander Hamilton never would have permitted a French piece in his New York home, considering the anti-French feeling then running so high. The life of this great statesman offered the moviemakers an opportunity for fine "casting" of properties. For "Alexander Hamilton" they procured from the Metropolitan Museum full data on Hamilton's New York and Philadelphia homes. The great Secretary of the Treasury had filled his Philadelphia house with furniture and trappings of French origin, while in his New York home, which stands today, all gave evidence of the Dutch influence.

But the producers went further than accepting the museum's advices. Rey W. Neville, the furniture expert who furnished properties for the picture, had copied several rare pieces sold from the Reifsnyder collection two years ago at the American Art Galleries, New York. An arm chair had sold for 33,000 dollars; a hair's-breadth reproduction, obtained from wax moulds, appeared in the movie. George Arliss, playing in "Alexander Hamilton," recognized in one straight chair the finest example of French taste existing today. Although it was manufactured in Philadelphia recently, it might well have appeared in Hamilton's Philadelphia home during the revolution.

On sets depicting more recent periods, particularly in pictures dealing with life in the United States, some original properties occa-



In the inevitable bathroom scene, dried milk supplies the suds as the property man, in the background, stirs vigorously. Note the microphone suspended overhead

sionally are found in use today. One company, needing a wood-burning railroad engine in Hollywood, made one of papier mache. Carpenters pushed it across a set as smoke from "liquid fog" poured from the funnel. Another company, needing a similar engine on location in central California, found one still running. They borrowed it for a crash scene, and soon this will appear on the screen of many theaters, smashing into a cart such as was used in 1890—but the body you will see flung to its "death" was a dummy!

IN a picture of the same period, George O'Brien, the actor, dressed in native Indian feathers, looked so much like a real Indian that the white and the reds could not be distinguished on the set. And arrows clanged into nearby wood with real authority, for Indians working in the picture had made them.

Not long ago, one director wanted to show troops sailing from a great port, but he could find no ship fitting the particular period. At the studio there was, however, a "prop" ship used in a former picture. How to film the ship moving away from the movie dock offered a serious problem, for it was a permanent structure, built on land and weighing scores of tons. At last an ingenious property man suggested that, since the ship could not steam away, the dock should be made to slip away from the ship. Accordingly it was built on rollers and when the time came for the troop ship to depart, the dock rolled slowly 200 feet down a slight incline. Gravity and ingenuity made possible a scene that otherwise could have been filmed only at great cost.

Another director needed a statue of an ancient Buddhist priest to decorate an Indian temple. None could be found in Hollywood, yet the next morning he found this important property awaiting him on the sound stage. Meantime a member of the art staff had copied a photograph of such a statue, and made an enlarged print of the full size of the statue wanted. He squared off the photograph, then planned its dimensions on paper. With the plan and picture alongside he moulded a mixture of plaster, clay and linseed oil to the likeness. This done, a quick-drying enamel supplied the finishing touches.

When in Europe last year, Cecil B. DeMille, the noted director, learned that, at the Paris World's Fair, before the World War, a model of Rome as of 100 A.D. had been shown. Someone had taken a panoramic photograph of the model. Search of old Paris newspapers revealed the name of the photographer, and soon DeMille had in his possession a picture of the great Italian city complete in detail because the model had been faithfully produced from sketches.

But he wanted to use the picture in place of a costly set in "The Sign of the Cross." So back he went to Hollywood where studio photographers copied the likeness and made an enlargement 15 feet high and 20 feet long. Then, by the simple process of hanging the picture in place of a painted curtain and lighting it with brilliant sun arcs, he again photographed it as an authentic background for the actors closer to the camera.

Director DeMille with a sketch used in preparing an elaborate set depicting ancient Rome

Parading before the director in this scene, the actors wore hundreds of jewels that looked under the bright lights like costly pieces. Seven men, working five weeks, had manufactured at the studio 800 pieces of jewelry and 1400 metallic ornaments, including rings, anklets, buckles, and even hair pins, copies of originals excavated from ancient ruins of Rome and Pompeii or replicas struck from early Roman statuary. Where originals could not be found, designers made blue prints of pieces which had been pictured in books. Later, expert costume jewelers and metal workers "interpreted" the blue prints in the form of finished pieces.

Beyond the actors clothed in reproductions of ancient costumes, is the city of Rome. The photographic background was made from a model found in France

BREAST plates, helmets, arm bands of brass and copper and tin, plated with gold and silver, appeared on the set. Here, I thought, was another evidence of profligate spending for startling effects. Why not polish the raw metal rather than plate it? Edward Gross, Paramount wardrobe head, furnished the answer:

"One man could not possibly polish a breast plate in less than three hours," he said. "We can silver plate or gold plate it by dipping for about three cents." Compare some 18 dollars for plating 600 pieces with 1800 man-hours necessary for polishing and the saving becomes readily apparent.

Considerable trickery necessarily plays an important rôle in motion picture production, but less so with historical pictures than with other types. When Mr. DeMille found the script called for Christian martyrs to be mowed down by arrows shot from an-

cient bows, he decided to use living targets. Mr. DeMille, an expert archer, assigned to himself the dangerous task of shooting steel-tipped arrows at their breasts, but to guard against accident the players marked for "death" in the Christian massacre scene had their bodies protected by heavy mail, with several thicknesses of padding between the mail and their outer robes to hold the tips once the arrows found their marks.

Of course, no picture involving the high-living blue bloods of ancient days would be complete without a bathroom scene. So the Empress Poppaea climbed down into a luxurious wooden pool, painted to resemble marble and fashioned from sketches of one discovered in the ruins of Rome. The movie bath measured seven by sixteen feet and contained five feet of water. Dried milk, stirred industriously by a property man wielding a wooden paddle, "foamed" to provide luxurious lather such as any Roman maiden well might have envied.

All these "props" are important, but none more so than costumes, which frequently fill the entire screen during a close-up of the principals. Uniforms, civilian dress, and children's clothing offer as much difficulty as even the larger sets to reproduce. An audience can detect true silks and brocades from substitutes, even when they are seen as lights and shadows on the screen. For that reason many evening gowns appearing in an historical picture cost as much as 1000 dollars.

Courtesy Universal

Mummies made to order. An actor being made up for the part just before going on the set

WHEN an actress appears in a gown supposedly worn by some ancient queen or court attendant, chances are that the garment duplicates in detail—even to the construction of petticoats—one worn many centuries ago. Recently Earl Luick, an artist who has designed costumes for many pictures, was making plans to reproduce 80 dresses and suits worn in England 30 years ago. He commenced by procuring originals wherever possible. Into his workshop he took these and ripped each one into all its parts. From these he made patterns and from the patterns built up new costumes to fit the various people.

"Cloths repeat every seven years," Luick told me. "For 1900, there's something made today which we can use to look like the silk, satin, or silk muslin then in vogue. When we go back to, say, 1730, we find cloths very stiff, but drapery fabric usually serves to reproduce them. Whatever the cloth, however, we must use the best we can get; otherwise it would not tailor correctly.

"Fortunately for us, most period pictures represent either the United States, France, or England. Fashions generally start in Paris and soon their influence appears as copies or adaptations in the other two countries. Seldom do we go back further than 1800. With earlier periods more research usually produces something we can copy or sketches from which we can design."

Of course, not all the several hundred people appearing in the Trafalgar scene wore dresses and suits costing large sums. Only those near the camera wear "authentic" silks and woolens. Others were sufficiently out of focus to permit "cheating" in costumes. Yet, except as to materials, all were authentic in pattern.

LUICK and other movie designers take their ideas from cartoons, the line drawings offering them exact interpretations of the dress of the day; paintings; magazine reproductions; books; and originals. Recently Luick, requiring old English costumes, searched old clothing stores from Paris to San Francisco, and he found more garments to copy in those two cities than in London itself.

Even weird costumes, such as those worn by ape-men and mummies, must be correct. You might think a make-up artist would be embarrassed by a call for a mummy, yet a living "mummy" walked onto a set recently, complete even to rotting cloth covering his body, yellow and dirty hair, and "dead" eyes. The artist had found a description of a mummy that suited him. From this he worked out a combination of colors, which, when applied to the actor's face and hands in combination with fuller's earth, gave the actor the ghostly, dried appearance of one dead nearly 40 centuries. Fifteen hundred feet of cheese cloth, "rotted" over a gas flame, encased his body.

You may rest assured, though, that insofar as it is humanly possible, every detail in an historical drama is correct. Historians have recorded in word and picture types of people and cities of nearly all times. Taken together, mixed in the crucible of a director's imagination and an artist's conception, these combine to produce authentic plays of the past.

Courtesy Radio Pictures

A real, honest-to-goodness wood-burning locomotive was obtained for filming this scene of an early grade-crossing accident, but the "actor" is a dummy

OUR POINT OF VIEW

Beer

PROSIT!

Perhaps it *will* benefit you. At least it is expected to benefit you—should we say directly?—by helping your country balance its budget. But what is this Babel that assails our ears, these sophomoric cries of victors and vanquished, of Wets and Drys? Through the uproar, we hear also the voices of scientists, taking sides.

"Is not!"

"Is!"

"I say it is not!"

"Is too!"

And so on, far into the next administration. Four percent beer, 2.75 percent beer, 5 percent beer—any one of them is intoxicating. Is not! Is! Back and forth the battle rages so that we on the sidelines, looking like the movie shots of the audience at a tennis match, sway back and forth until blessed dizziness overcomes us; we lose consciousness and hear no more.

Apparently this is not a question of opinion but one of fact. Obviously each side can prove its case incontrovertibly; otherwise why the vehemence? It is not a question of the drinker's physical condition—oh no; whether he is fresh or is dog-tired after a day's hard work—oh no; whether he takes a glass, a stein, or quarts into his stomach—by all means no! Beer is intoxicating, and that's all there is to that. Is not! Is!

Let us see what scientists say on the subject:

In the words of *Science Service*, "It would be arbitrary to draw a line at any point and say that here intoxication begins. For a tight-rope walker it might be one thing, for an automobile driver another, and for a peaceful pedestrian still another."

Professor Yandell Henderson told the House Ways and Means Committee that it is virtually impossible for a person to get drunk on 4 percent beer. Dr. Harold T. Hyman, of Columbia University, says that from two to four glasses of such brew would be presumably non-intoxicating, but he conditioned this with "according to the individual's tolerance for alcohol." Professor John J. Abel, of Johns Hopkins University, would permit a pint of beer a day (percentage not given), but Dr. Howard A. Kelly, of the same institution, says that, since alcohol is a toxic substance, *any* amount of it will intoxicate! Others hold various opinions, for and against, and throughout the scale of percentages of alcohol usually found in beer.

What, then, is the answer? Simply this: Where scientists disagree, legislators cannot presume to decide. The question is relative—relative to many things. Until some standard of intoxication is set up as a yardstick, only common sense can define the intoxicating power of beer.

Naval Economies

"THE Navy is a public servant and if reductions are made, we will buckle our belts a little tighter and go ahead as always," said Admiral William V. Pratt, Chief of Naval Operations, recently in commenting on the question of naval appropriations. This "going ahead" is, however, not as easy as it sounds for, as Admiral Pratt says, "If you don't supply fresh blood, you can't keep anything in tip-top shape."

Far from supplying fresh blood, we have, according to the report of Secretary of the Navy Charles Francis Adams, practically emasculated this vital arm of the national defense, though he does not say so directly. Let us admit frankly that some measure of economy has been necessary during the depression. Still, Great Britain and Japan have been hit harder than we (and owe us great sums of money, in the bargain) and yet both these powers have recently built and planned more war vessels than we and have kept their navies in a stronger position. Comparison with their navies makes the United States Navy look sick indeed!

We have 15 battleships but, of these, one is in "reduced commission" and three are out of the line of duty being modernized. Great Britain's 15 and Japan's 10 are in commission and are fully manned. We have nine heavy cruisers in commission while Great Britain has 17 and Japan has 12. We have 10 light cruisers in commission; Great Britain has 25; and Japan has 20. Of destroyer leaders, we have none; Great Britain has 10; and Japan has 24. We are about on a par with Great Britain in destroyers and submarines but inferior to Japan. Our inferiority to Japan is seen to be even more pronounced when it is noted that Japanese ships "in commission" are fully manned while ours are "operating with only 85 percent of their enlisted complement." Our Navy is stronger and more efficient than these two powers in the air.

It is useless to repeat here the "how and why" we need a navy built up to treaty limits; this problem has been thoroughly discussed in past issues of SCIENTIFIC AMERICAN, notably those of May, 1932, and July, 1932. Granted that present economies may have been necessary, "further reductions in ships' allowances in enlisted men," Secretary Adams says, "should be avoided if possible by provision by Congress for additional men as required." And, unless we are content to fall back to third place as a naval power by 1936, now is the time for the nation to develop a far-sighted naval building plan which will give us once more a respected place in the councils of the world.

Soulless Machines

IT is said by reputable press correspondents that when a machine breaks down in Russia or for some reason is "cranky," the erstwhile peasant who operates it belabors it with a hammer as a brutal mule-driver would beat a balky mule; the peasant invests the machine with a soul. Strangely, there are in this country many people who, in a sense, feel the same way about machinery; they blame the machine for accidents occurring in connection with its operation. But we do not die nor are we hurt because of inherent machine faults.

In a recent paper, H. W. Heinrich, of the Travelers Insurance Company, made this very clear. Of the several examples he cited to show where the blame belongs, we shall quote but one: "A workman—an oiler—lost his life in a steel-rolling mill. Not understanding the value of protective devices, he removed a portion of one of the gear guards of a machine, reached in, and was caught and killed. Four other workers and a foreman were close by. Were industry and the machine responsible?" Obviously, the answer is: No! Man was responsible, as man's carelessness and recklessness is almost always responsible for accidents in industry, in the home, on the highway. Abuse of the machine, errors in judgement, inattention, lack of knowledge or training—these are man's faults that cause the trouble.

The machine *may* be a Frankenstein monster so far as its revolutionizing effect on our social and economic scheme is concerned but it is dangerous to man's physical self only when man becomes negligent in operating it.

TELEVISION IN ENGLAND

A Brief Survey of Events of 1932 That are Indicative of the General Trend

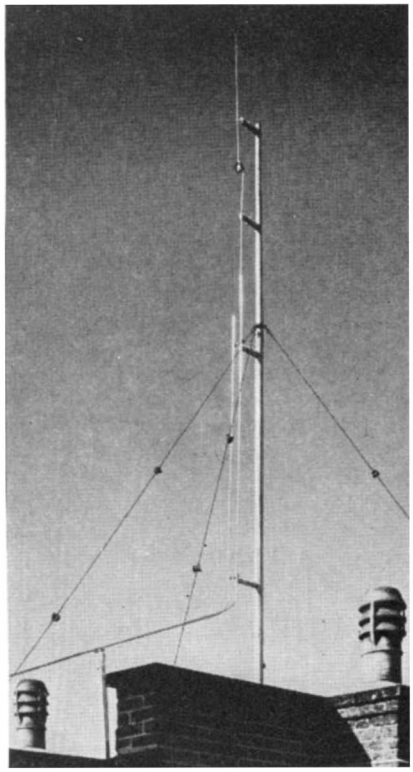
FROM every point of view, the past year has been of outstanding importance in television. The following report of the progress made in England is presented by courtesy of *Television*, (London), and serves to show what is being done on the other side of the Atlantic.—*The Editor.*

EARLY in 1932 it was known that big developments were expected. In February, Mr. J. L. Baird predicted that 1932 would see television come into general use, and he announced that his company was developing a receiving apparatus which could show "television images upon a screen, so that they can be seen by a roomful of people at the same time." This new apparatus, he hoped, would be available before the end of the year. Actually it was shown in July, when the remarkable advance resulting from screen projection was at once appreciated. There has been some delay in marketing the model but a further announcement is expected shortly.

In March came the news that the B.B.C. [British Broadcasting Company] were hoping to extend regular facilities to television. Hitherto the broadcasting authorities had maintained a very cautious attitude, believing that the public for this latest branch of radio was too small, compared with the millions of listeners, to justify attention in program hours. No doubt the prospect of being able to provide better facilities in Broadcasting House had much to do with the change of front at the B.B.C., while on behalf of the Baird interests the successful negotiations were largely due to Mr. Sydney Moseley.

The advantage of the B.B.C. co-operation at the transmitting end was foreshadowed in *Television* by Mr. T. Thorne Baker, who emphasised the immense importance of studio technique. "It can," he wrote, "accomplish so much for the improvement of existing television, that all physical calculations on the basis of the number of lines or areas to the square unit of surface can be entirely upset, and the eye can be made to see modeling and definition that by theory are impossible. It is very important that due emphasis be laid on this point. While amateurs continue to build up the television set and increase its potentialities, let studio experts with the experience of modern picture-making concentrate on improving the transmission. Television, like 'the pictures,' and like wireless broadcasting, is one of those peculiar mixtures of art and science, of stage management and academic engineering, that demand a true versatility of mind and generous blending of talent if we are to make quick progress."

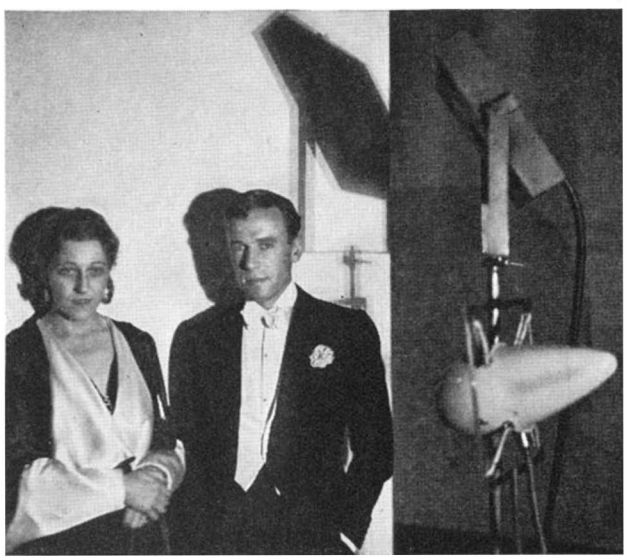
This view has been amply justified by the new B.B.C. transmissions, and skeptics who still base their criticisms on theoretical factors would do well to see the actual programs.



The vertical ultra-short-wave antenna used by Baird for television

THE possibilities of television by ultra-short waves were demonstrated publicly for the first time in May, when transmissions from the Baird studios in Long Acre were picked up on the roof of Selfridge's in Oxford Street. The demonstration not only represented an important development at the transmitting end, but an entirely new experimental receiver was also employed, in which the image was shown on a screen instead of in a lens. The size of the image was considerably larger, so that a number of people were able to see it simultaneously. A wavelength of 6.1 meters was used.

It was explained at the demonstration that the ultra-short waves—those below 10 meters—formed an alternative method of television broadcasting which did not in any way interfere with the B.B.C. service. Advantage had been taken of this to erect an ultra-short-wave station at Long Acre in order that transmissions might eventually be made at any hour of the day. The ultra-short waves had the additional advantages that they allowed television pictures of much finer detail to be transmitted, and they provided a reliable local service free from fading and atmospheric disturbances. The present transmitter had a radius of five to ten miles, but in due course it was hoped, with the collaboration of the B.B.C., to extend the system to cover a wide service area.



Amy Johnson, famous British flier, and her equally famous husband, Captain J. A. Mollison, being televised

Popular imagination was roused in June by the televising of the Derby, which was

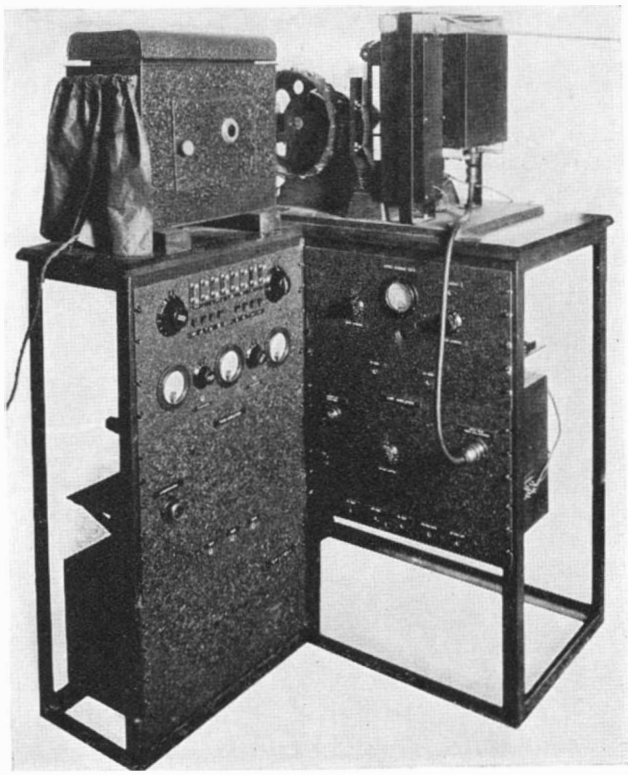
watched on the screen of a London theater by over 2000 people. The signals were relayed over the public telephone cables under difficult conditions, and although the images were very crude, the audience was able to see the horses flash across the screen as they passed the winning post at Epsom 14 miles away. An attempt to televise the race had been made in the previous year but this was the first time that the ambitious experiment had been made of projecting the images on a theater screen.

THE Baird daylight television apparatus was housed in a trailer at Epsom near the winning-post. Inside was a large drum with 30 mirrors, revolved at a speed of 750 revolutions per minute, which split up the whole scene into 30 strips. A succession of images thrown by a lens on to the drum was made to move over three apertures, which admitted the different degrees of light and shade to three photo-electric cells. In this way the scene was split up into three adjacent zones and the separate signals passed to amplifiers, whence they passed by telephone lines to the control room at Long Acre. From here they were relayed to the stage at the Metropole Cinema, and after being further amplified were passed to the vision reproducer.

The receiving apparatus comprised three small arc lights set at the three points of a compass, each being responsible for one zone of the resultant picture. Three light valves (each a specially developed form of Kerr cell) modulated the beams from the arcs, and the resultant modulated light was thrown on to a single mirror drum geometrically identical to that at the transmitting end, and automatically synchronised. [See page 379, June, 1931, SCIENTIFIC AMERICAN.]

In July, first particulars of the "news" transmitting apparatus of the Marconi Company appeared in *Television*. This great company has always specialized in the commercial applications of radio and its engineers therefore approached television from a different angle from that of broadcasting pictures. One point that appealed to them was that if television is to be employed for commercial purposes, it will not always be able to claim a special frequency channel, and the use of the normal commercial wavelengths and frequency bands would have to be considered. Wavelengths, for instance, at present in use in telephony may be the only ones available for a particular television service, and the frequency band provided for the telephone channel may have to be accepted for the purpose of television.

The "news" transmitter requires only a narrow frequency band and can be used, with certain limitations, on any wavelength up to 3000 meters without creating more disturbances in other than good quality broadcasting.



The Marconi news transmitter, showing, upper center, the message tape passing before the scanning mirrors

Orthodox methods of scanning are employed, and the number of scan lines and other constants of the apparatus are so chosen that, although just sufficient detail is transmitted, only a comparatively narrow band of frequencies is used for transmission. This frequency band is comparable to that employed by the average broadcast transmitter. To enable a continuous message to be televised, the tape is pulled past the scanned area at a low speed, thus giving an effect at the receiver similar to the news bulletin electric signs which exist in London and elsewhere. The transmitter is intended to be used in conjunction with a receiver giving a neon tube picture of about 5 inches in length by about 1 inch in height, or other suitable method.

The tape is arranged to be fed at two alternative speeds, either 6 feet per minute or 12 feet per minute. It will be seen that these speeds give word speeds at 60 and 120 per minute, allowing five letters and a space to each word.

The biggest event of the year in England was, of course, the beginning of regular television programs from Broadcasting House. The installation of the apparatus took longer than expected and there was general disappointment that the date originally announced for the first night had to be deferred. However, on August 22 a successful program was transmitted from the television studio in the new B.B.C. headquarters.

From the outset it was obvious that the facilities available in Broadcasting House would be of the greatest assistance to the development of television, both from a theatrical and technical standpoint. The first night opened modestly with singing and dancing, but within a few weeks a sea-lion was included in the program. This was naturally "featured" in every newspaper in the country and attracted great attention to television. A few nights later Joe Young gave a demonstration of Yo-Yo; conjurers, cartoonists, and jugglers followed in quick succession. The serious intentions of the B.B.C. toward television were shown when the famous airman, Jim Mollison, was televised during the broadcast which he gave after his latest Atlantic flight. He was accompanied by Amy Johnson, who thus had the distinction with her husband of being a pioneer in another great development of modern communication.

A sign of the times was the fact that the gold medal at the International Exhibition of Inventions was awarded for a new television apparatus. Many inventors are working quietly on the problems of television, and not only private individuals but some of the biggest radio companies are engaged in this research. At the annual meeting in November of Electrical and Musical Industries, Ltd., the big combine which now includes the H.M.V. and Columbia interests, the Chairman said that whatever the future holds for radio the company would do its share. "Broadcasting of sound, although comparatively new, has already become part and parcel of our daily lives. Television, or the broadcasting of sight, is to come. To-day it is still in the research laboratories, to emerge only when perfected to a point which will give the public pleasurable entertainment. I will not predict the date of its completion, but when that date arrives we can look forward to a further expansion of our interest in the field of home entertainment and education."

THIS is good news with which to conclude this review of 1932 and to look forward to even bigger developments in television which may be expected in 1933.

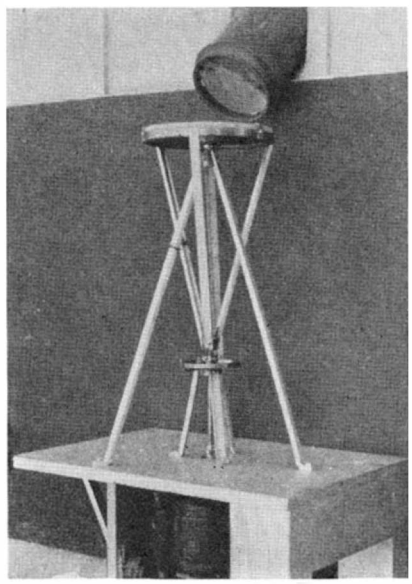
More About Meteors

By HENRY NORRIS RUSSELL, Ph. D.
Chairman of the Department of Astronomy and Director of the Observatory at Princeton University
Research Associate of the Mount Wilson Observatory of the Carnegie Institution of Washington

THE astronomer is often supposed to have to do only with things that are vast and almost infinitely distant. Yet a few weeks ago many observers were concentrating their attention on bodies no farther away than the width of a few counties and no larger than tiny pebbles or grains of sand. The Leonid meteor shower was due again and it almost failed us. The "falling stars" of 1799 and 1833 are described by competent observers in amazing language—"as thick as snowflakes in a snowstorm." They came far too fast to count, the estimated rate being 50,000 per hour! In 1866 and 1867 there were grand displays, though not equal to the earlier ones, but in 1899 and 1900, after the next interval of 33 years, nothing extraordinary happened; and now another opportunity has also been missed.

THERE is nothing theoretically disturbing about this—we know just what has happened. There is a great swarm of tiny particles moving around the sun with a period of 33 years, and following the same orbit as a faint comet observed in 1866 and not seen since. The orbit formerly passed very close to the earth's—indeed, practically intersected it at the point which our planet reached every year on about November 14. Every year at this time a few stragglers, scattered thinly along the rest of the track, entered the earth's atmosphere and, heated intensely by friction, shone for a moment as shooting stars. Once in 33 years we reached the rendezvous when the dense part of the swarm was there, and a great shower of meteors occurred. The showers of 1866-1867 showed that we met the head of the procession one year and the tail the next, so that it must have been strung along several hundred million miles of the orbit. If the orbit had remained the same, great showers would inevitably have recurred in 1899 and 1932. But, unluckily for us, Jupiter's attraction, always at work, shifted the orbit during the next revolution so that, when the meteor swarm returned, the "grade crossing" intersection with our path had been replaced by an overhead crossing and the swarm went by without event. A few stragglers, pursuing paths a million miles or so below the main path, hit the earth. On November 16 they came at the rate of about 30 an hour—or, at least about this number would have been seen had it not been for the bright moonlight.

This is much more than the average number of sporadic meteors which can be seen on a random night, so that we may still speak of this meteor shower as a reality. But the glory has departed. One of the most splendid of celestial spectacles has disappeared. It was lost to our generation and for we know not how many generations to come. Sooner or later Jupiter or Saturn may swing the orbit back and restore the intersection and the shower; or their influence may widen the gap and lose us even the little that is left. It would be possible, though very laborious, to calculate these effects for a century or two ahead. But, in turn, the computer would get into trouble, for we do not know the present period accurately enough to predict just where the swarm will be so far ahead. Moreover, the head and tail of the long stream at each approach to Jupiter pass at different distances from it, and their future tracks are differently affected. The advance guard, a year ahead of the main body, gave a better display last year than the skirmishers, far on one side, did this time. Whether the rear guard next year will do the same we must wait to see.



All photographs courtesy Prof. S. L. Boothroyd

Conical motion mirror used by the Cornell observers for determining angular velocities of telescopic meteors. Note motor drive beneath

Perturbations of this sort not only shift the tracks of different parts of the swarm laterally; they speed up some parts and slow others down. Though these changes may be small at first, their effects are cumulative and, in turn, the swarm will spread out lengthwise so that it takes two years to pass a given point; then three; and so on, till at last the head catches up with the tail and the fairly compact swarm ends as a thinly scattered ring of meteors spread all along the orbit, giving a tolerable display every year but no great exhibitions. This has actually happened with the Perseid meteors, which follow the orbit of the bright comet of 1862 (period 120 years) and appear regularly about August 12. They have been scattered sidewise as well as lengthwise and occupy so wide a belt that it takes the earth several days to pass through it.

THE meteors of a given shower move in parallel lines, so that their tracks appear to diverge from a definite radiant point in the sky. The more important swarms are named from the constellation in which their radiant appears.

Observing meteors is still essentially a task for the unaided eye. They appear so unexpectedly that it is doubtful if anybody ever trained even a field glass upon one deliberately, and they go by so swiftly that only the brightest of them leave perceptible trails on a photograph, even with the fastest lens.

Once in a while a casual bright meteor is caught by accident on an astronomical photograph, but systematic photography, even with specially designed instruments, means taking dozens of plates in vain for every one on which a meteor appears. The advantage of the eye over the camera of which we spoke not long ago, (January, page 20.—*Ed.*) is here near its maximum.

To find the radiant we must plot the paths of individual meteors. After a little practice this can be done with fair accuracy if the observer has a suitable star chart before him as he sits outdoors, and draws on this the line of flight immediately after the meteor has vanished. But the errors of the record are likely to be at least a thousand times greater than is usually the case in astronomical work.

Half a dozen meteors observed on the same night should fix their radiant within a degree or so. Interlopers not belonging to the shower will also be

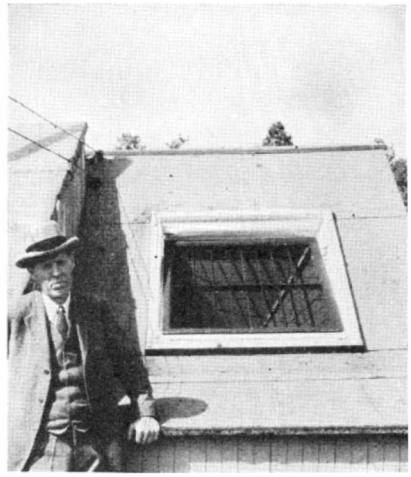
observed, but the chance that one will have a track which, if carried back, passes near the radiant, is too small to worry about. Enthusiasts, studying feeble showers, who attempt to combine observations made on several successive nights may be led astray by accidental coincidences of this sort.

To find the real position of the meteor, or rather of its path, observations by two observers miles apart are necessary. If both have made careful determinations of its apparent track it is a mere matter of geometry to locate the true path in space. When the observations are rough the problem is rather one of psychology than geometry. This is usually the case with the great fire balls—huge meteors which sometimes light up the whole landscape. Inquiries through local newspapers often bring in dozens of reports on one of these—perfectly honest and straightforward but coming from wholly untrained observers. The computer has then to find what track in space would make the meteor as seen from a given locality appear "about southeast, half way up the sky and moving downward to the right." To extract numerical data from a mass of records like this, or not so good, requires both skill and patience.

OBSERVATION of meteors is one of the fields of study peculiarly suitable for the amateur astronomer, particularly if he should be of the type who prefers gazing upon the heavens to machine-shop work. Leaving it to his brothers of other tastes to make, equip and operate their telescopes and observatories, he may dispense with all such aids. All he needs is an ordinary watch, a set of suitable star maps, a chair to sit in, a table to hold his map and a faint red light to illuminate it, a clear sky, and patience. With no more costly equipment he may make contributions of real scientific value.

Within the last few years interest in this topic has greatly increased and "Notes from the American Meteor Society" now appear regularly in astronomical periodicals. Any of our readers who find the subject attractive can obtain further information about the method of observation from Professor C. P. Olivier of the Flower Observatory, Upper Darby, Pennsylvania, who is president of the society.

Visual observations of this sort often lead to satisfactory knowledge of the true path of a meteor, and valuable data are steadily accumulating. But, to find the velocity with which such a body moves, is a much harder matter. We could determine it by noting the exact interval of time which the meteor took to pass from one definite point on its path to another. But, except in rare instances when a meteor suddenly becomes brighter or bursts, the only recognizable points on its path are the beginning and the end. The end may be fairly definite, but the observed beginning is the point where the object was first seen—not where it began to shine. A lag in the record, varying from one observer to another, is inevitable. The whole time of flight is but a very few



Upper: **Prof. Samuel L. Boothroyd of Cornell University and the iron bar reticle described in the text.** ***Lower:*** **Within the same house the observer looks through a tapered box which accurately delimits and places the visible field of view**

seconds, so that even a small error is a serious matter. The only timepiece that would be of the least use is a stopwatch actually in hand, and this could be ready only in the case of a deliberate vigil by a prepared observer.

More accurate methods of observation are to be desired and the most promising campaign is under way by co-operation between the Harvard College Observatory and the Fuertes Observatory of Cornell University. On the observatory grounds at Lowell Observatory, where the work is being performed, a little house has been built in which the observer sits looking out through a window in the roof at a definite area in the sky. A system of iron rods across the window opening, heavy enough to be seen dark against the night sky, marks out the lines of equal declination and hour-angles in the heavens. Whenever a meteor is seen, its track can be plotted on a diagram, showing these reference lines with an error not exceeding half a degree. The time of appearance is noted, to the nearest second, with the aid of a stop-watch; also the apparent brightness.

A SECOND observing cabin 20 miles away provides data for the duplicate records from which the real paths of the meteors as they traverse the uppermost parts of the earth's atmosphere may be accurately calculated.

To find the speed of motion an additional observer watches the same region of the sky, not directly but as reflected in a horizontal mirror. By gearing connected with a small motor this mirror is set oscillating in such a way that the image of a star describes a little ellipse about a degree in diameter, at the rate of ten times per second. By persistence of vision the stars thus appear as thin rings of light. Seen in the mirror a fast-moving meteor will appear to describe a wavy curve, the distance between the successive crests corresponding to one tenth of a second's motion. For a slow meteor which moves through less than the diameter of the ellipse in this time, the apparent path will be looped. Thus, both from the shape of the observed track and the distance between successive waves or loops, the rate of the meteor's apparent motion can be found. Knowing its distance (from observation at the second station) the real speed can be ascertained.

Two other observers about two miles apart, with four-inch telescopes, watch the same point in the heavens—or, to be exact, the same point in the upper atmosphere—a hundred miles or more away, at the level where meteors are to be expected. In this way (and with the aid of similar auxiliary apparatus) many meteors may be observed which are far too faint for the unaided eye. More than 2000 meteors were observed during the first month's work under this program. When the full results come in, and when the long calculations are completed, the world will know much more about these smallest of astronomical bodies than it does now.—*Princeton University Observatory, December 5, 1932.*

LEVELING OUT HILLS WITH MORE PRECISE MOLECULES

How a Study of an Automobile's Digestion Points the Way to More Power

By

WHEELER G. LOVELL

General Motors Corporation, Research Laboratories

The ability of an automobile to climb hills depends upon a reserve of power. The right arrangement of atoms in the molecules of knock-free fuels can add to the power an engine may be made to deliver

THE combustion chamber of an automobile engine is its stomach, and therefore one of its most important parts. It is into this space that amounts of air and gasoline go, and are there burned or digested to produce the power that makes the automobile run. The motor car, like an army, travels on its stomach. And since this digestion business in the stomach of an engine is the only thing that makes the automobile go, it is certain that the more that is known about this digestion the better can automobiles be built.

No ordinary stomach is this, where the pressures go to 400 pounds per square inch and the temperatures up to 4000 degrees, Fahrenheit. Unusual methods have to be used to study this digestion. No ordinary stomach pump would do, but engineers and chemists have devised a different kind which takes samples from an engine's stomach while the burning of air and gasoline is going on at high temperatures and pressures. This is one way of studying the digestion of an engine.

Windows have been put into an engine's stomach, too; not ordinary windows, but thick ones of quartz. Through them the digestion or combustion has been watched and photographed. The light coming through the windows has also been sent through spectroscopes which analyze it, to determine what kinds of compounds are making the light, and how the digestion is getting along.

SOMETIMES, if the wrong kind of fuel is fed to an engine, its digestion does not get along so well. When an engine has a belly-ache, it tells about it; it knocks. A belly-ache in an engine is a very serious business, and many of the methods for studying this digestion have been used to find out what causes it. The knock is simply a too rapid burning of the latter part of the charge of fuel and air in the engine cylinder. One of the things that most profoundly influences the knock is the fuel; and fuel- or food-testing for engines is of the greatest importance. The methods of investigation include that of trying the fuel on a sort of guinea-pig engine, or a definite standardized test engine, and seeing what happens. The knocking quality of a fuel can be measured by comparing the fuel with known standardized fuels or foods in the guinea-pig engine. From this has arisen the "octane number" method of rating fuels for knock.

All of these methods of studying combustion or engine digestion can give some information about how to use and control this thing called combustion which makes the automobile go. What occurs in the combustion chamber is of great concern to both the builder of automobiles and the manufacturer of fuels. Their two different products work together in this combustion chamber, and they must there be made to fit in order to produce the joint product of power in the best way.

THE engine itself is essentially a space surrounded by metal in which a certain amount of a certain kind of gasoline is mixed with air and burned. A problem of the automobile engineer, then, is to make the best use of that space, and the best distribution of the metal accompanying it. In particular, the problem is to get a greater amount of power out of that space. Just increasing the space does not help much. In that case a greater amount of metal is required to surround the space, the engine gets heavier, and, although there is more power to drive the car about, still there is more weight to be driven, so the net gain is not great. But more net power in automobiles is something that is in great demand. More power can certainly be obtained from the combustion space if more fuel and air are put into it to burn but with conventional engines there is a limit to the amount of charge that can be put into the cylinder.

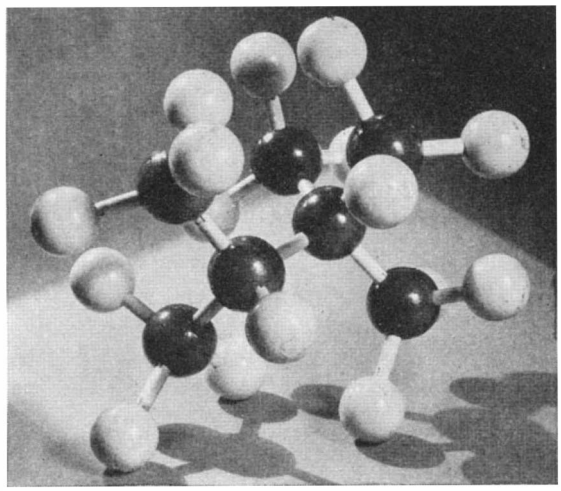
There is a way, however, to get more power out of the space, and to do that without using more fuel. That way is a very simple one if, and only if, the digestion can be made to go on without the indigestion or knock. If the pressure to which the gasoline-air charge in the engine is compressed be in-

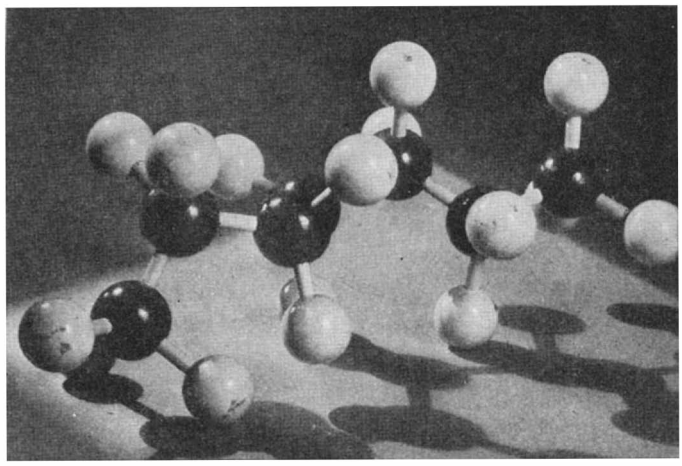
creased, as may be done simply by making the relative clearance volume above the pistons smaller, then the same amount of fuel will produce a greater amount of power in the same engine. The engine does more work with less fuel; and these increases may amount to as much as 50 or 75 percent—very considerable gains. The trouble is that when this compression is increased, the fuel begins to knock, depending upon the particular fuel, and the engine's digestion goes decidedly wrong.

THE study of this digestion in these guinea-pig engines using pure fuels, however, has shown a way out of this trouble. This investigation has been carried out using individual pure hydrocarbons prepared in the laboratory, since gasolines are composed of mixtures of very many different hydrocarbons or compounds of carbon and hydrogen. These and other investigations have shown that although not much can be done to the engines except to adapt them to take advantage of better fuels if available, a great deal can be done to the fuels so that they will digest properly without knock. If this is done, then the power which can be obtained from a suitable combustion space is greatly increased, and the ability which an automobile has of leveling out hills is correspondingly increased.

Thus, this matter of leveling out hills becomes a matter of securing great precision in the structure of the gasoline fuel. Ordinarily, power is thought of as being associated with large things—in the living world with an elephant lifting great logs, or in the mechanical world with huge locomotives or a great power plant. In the automobile, however, this is not so. More power to level out hills does not necessarily come with great weight or size, but more often with great precision in very small things. A few angstrom units, or a few hundred millionths of an inch in the location of a carbon atom in a hydrocarbon molecule is very intimately related to hills hundreds of feet high. This is so because a very small distance in the location of the atom determines whether the fuel will or will not digest properly in the engine without the knock, and whether 100 or 160 horsepower can be obtained from the engine when adjusted for this fuel.

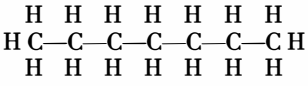
It is a very subtle thing, the property of promoting digestion in the engine. Fundamentally, it isn't related at all to any of the ordinary properties of the fuel, such as the heating value or density or volatility or even the general chemical nature of the molecules of the fuel. Extensive and elaborate researches with special engines burning individual ones of the hundreds of different hydrocarbons or compounds of carbon and hydrogen which go to make up gasoline have shown how the knock of a fuel is related to the way the separate individual molecules are made up. And it depends entirely on the space arrangement of the atoms which make up a molecule, not their number or size.



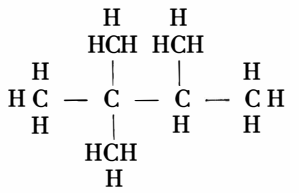


Static models of two kinds of heptane. As explained in the text, these are "the same but different." The difference in the arrangement is that in one a carbon atom has no more than two other carbon atoms attached, while in the other as many as four may be attached. The latter provides 60 percent more power

The differences in the fuel are very subtle, but the differences in the power to be obtained in a suitable engine from the fuels are enormous. For instance, we can consider two hydrocarbons both called heptane which may occur as components of gasoline. If they are burned separately in an engine with adjustable compression and at the highest compression which they will stand without knocking, one will produce 60 percent more power than the other. But they are both heptanes and both produce the same amount of heat when burned. They are both composed of the elements carbon and hydrogen in the same proportions; they both have about the same volatility; the molecule of each one is composed of seven carbon atoms and 16 hydrogen atoms; the ordinary chemical properties of both are very similar. But the difference is that in one of them the atoms are joined together like this:



and in the other one like this:



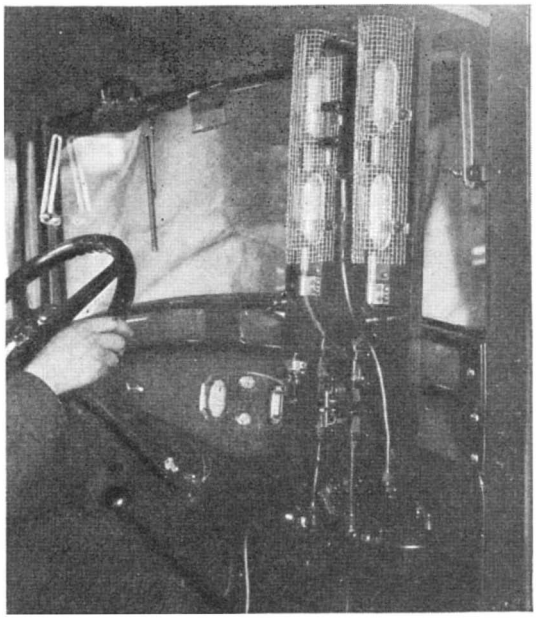
Actually of course, the atoms are arranged in three dimensional space, and if little balls are used to represent atoms, the molecules would be like the models shown in the photographs. As a matter of fact, a molecule does not look like that; the atoms are not stationary but are in a continual state of vibration. No one has seen a single molecule, of course, since these are only about 15 angstrom units long or about a ten-millionth of an inch. But from indirect evidence and the way they affect light waves and X rays, we know how they are made up and arranged.

This is the domain of molecular physics, often called an abstruse and impractical branch of science. But it is a very practical thing. These seemingly slight differences in the arrangements of atoms in fuel molecules make all the difference between getting 100 horsepower out of an engine or 160. How much work can be gotten out of a fuel does not depend so much on how much energy it contains as on how that energy is distributed in the separate molecules. Because of their influence on knock, these differences in molecular structure bring themselves to the attention of the driver of an automobile every time he attempts to level out a hill and his engine knocks. Though he is unaware of it, this is an indication of the most intimate relation between the science of molecular structure and every automobile.

These relations between molecular structure and knock, or between mole-

cular structure and the power which can be obtained from a fuel when burned in an engine, have been worked out for scores of individual compounds, and the consistent and regular relations can be arranged into a few simple rules for different chemical classes of hydrocarbons such as the paraffins, olefins, naphthenes, and aromatics which are components of gasoline.

These slight differences in molecular arrangement which make such great differences in the potential power represent a necessity for precision of the highest order. Control of the structure of gasoline hydrocarbons is bound to open up great developments in automobile engines. The problem for the chemist, of course, is how to achieve that control in practical large-scale cracking operations. Present knowledge of the chemistry of hydrocarbons is very inadequate, but it is not reasonable to expect that this should always be so. Research which aims at a better knowledge of how materials behave, must ultimately result in securing a greater amount of service, or a greater satisfaction of human desires. A degree of precision of the order of making the precise space arrangement of atoms in molecules exactly what we wish, can level out hills and make a gallon of gasoline drive an automobile many more miles. It can do this only because such fuels digest properly in the engine's stomach.



This ingenious instrument which records accurately the amount of gasoline necessary to operate a car, is used for testing automobiles

WITH this greater precision in making fuel molecules of the right structure, there must come, of course, more precise engines suited to these fuels. The advantage of one fuel over another which comes about because of lessened tendency to knock, can *only* be utilized when the fuels are burned in engines of different relative compression. The best use of the fuels represents mechanical arrangements which the engine builder should be only too glad to use, even though they require much greater precision in manufacture.

The greater precision required is considerable. For instance, most automobile engines are built with removable cylinder heads with the tops of several cylinders made in a single piece. This piece must be more than a rough part of metal which keeps the explosions in. If the combustion chamber volume is too great, the compression will be too low, and the fuel will not be used as effectively as possible. If the volume is too small, even in one cylinder, then the engine will knock too much when using the fuel for which it was designed. In an L-head engine, for instance, as little as two tenths of an inch in the machining off of the cylinder head will make as great a difference in knock as changing from "regular" to "premium" gasoline. The gasket which seals on the cylinder head must, also, be of the right thickness in order to have the compression of the engine suitable to the fuel. The space taken by the heads of the valves must be allowed for, and the spark plugs and the distance between the electrodes must be carefully adjusted if the engine is to take full advantage of the better fuel. Partly for these reasons many cars have the cylinder heads machined to precise dimensions.

This greater precision required in both the fuel and the engine is only a means to the end of greater power and economy in automobiles. All along this path of progress, as improvements are made in fuels, engines must keep pace, always avoiding the knock which indicates that the fuel is not good enough for the engine. Engines cannot advance faster than the available fuels will permit. Engineering progress is usually a gradual evolution, and this may be no exception. The future fuels and engines must always be fitted to each other so that their joint product, power, will be produced in the most effective way and most economically.

THE knock is a very definite signal to the car owner, and is one which he cannot miss if it is of more than slight intensity. It is a signal that the fuel is not good enough for his particular engine. The compression ratio of the engine may or may not be significant, depending upon the particular engine design, but the presence or absence of knock on a given fuel is the important thing. If a car of good design and in good condition knocks on a gasoline which is of low anti-knock value, then it is a car which has made some progress on this pathway to more power and economy through the use of better fuels. And for such a car, of course, the driver should use a fuel possessing a satisfactorily high anti-knock rating, if he desires the beneficial effects which cannot be obtained at all times from the lower grade fuels.

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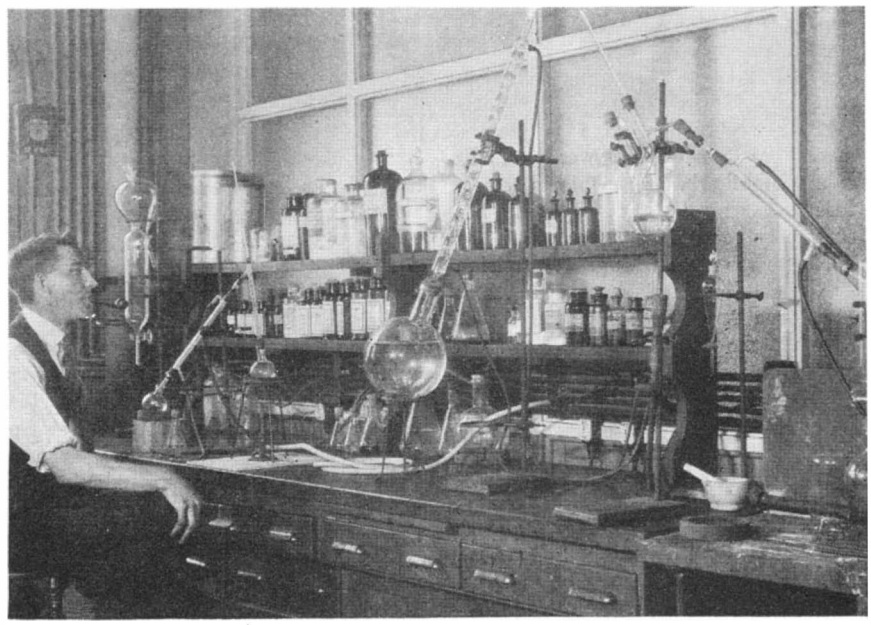
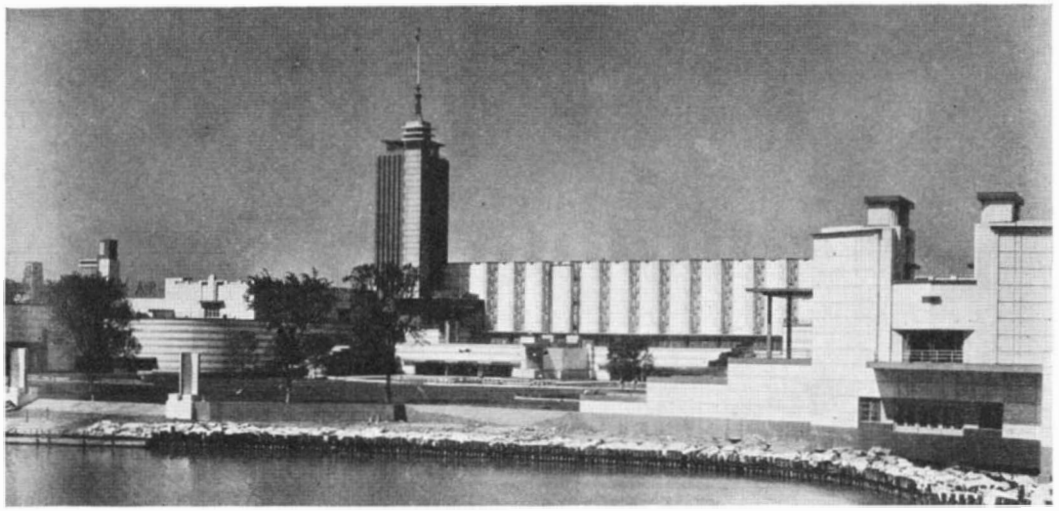
Big dividends for all of us, on an almost infinitesimal investment—that is the theme of a sparkling and most informative article which we have scheduled for the lead position in our next issue.—The Editor.

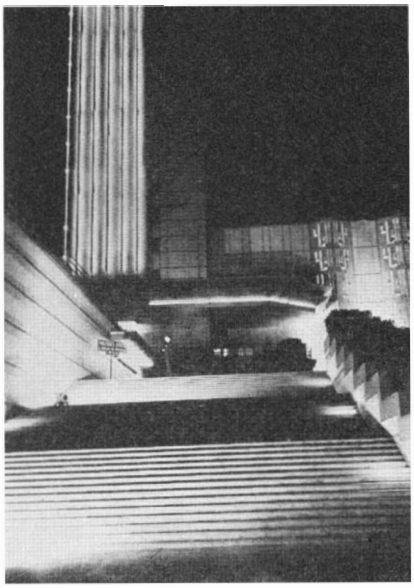


The most exacting chemical processes are carried out in this laboratory which is used to prepare pure hydrocarbons for experiments with automobile engines



The Hall of Science of the Century of Progress Exposition at Chicago is a U-shaped structure measuring 700 by 400 feet, facing a lagoon. The Science Exhibits will be opened by light which left the star Arcturus 40 years ago, the actual time of the World's Fair of 1893. A telescope will receive the light which will actuate a photoelectric cell circuit. In the tower is a carillon

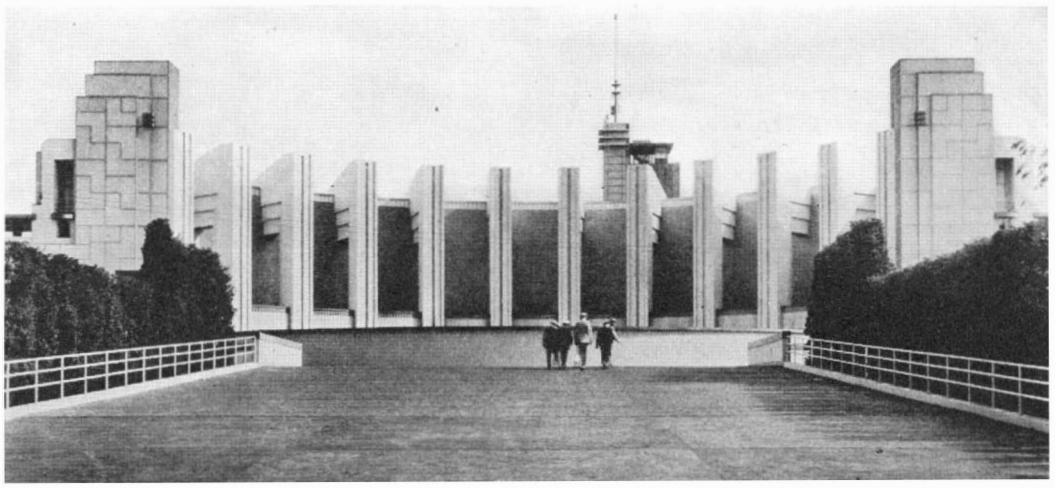
A World's Fair in the Making



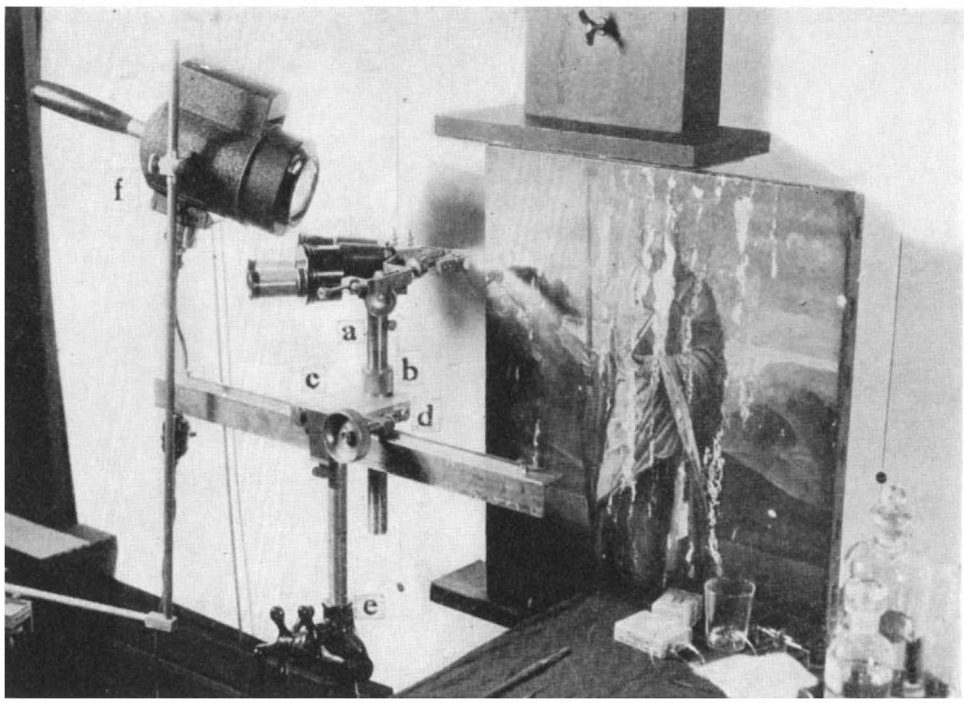
Night at the Century of Progress Exposition at Chicago will be gorgeous. For example, the walls of the tower of the Hall of Science will be lighted with gaseous tubes

Right: The Wigwam is one of the many historical reproductions at the exposition. It was in a similar rambling frame convention hall that Abraham Lincoln was first nominated for the presidency in 1860 at the city of Chicago

Left: Model of the golden pavilion of Jehol which will rise to a height of 60 feet; the roof will be covered with gilded copper shingles. The 20,000 parts are all dovetailed. The replica is built under direction of Dr. Sven Hedin



North façade of the Hall of Science is a symphony in color. At night the 12 pylons arranged in a semicircle about an electric fountain are illuminated in red. The carillon tower shown in the distance is lighted by blue lights. The Chicago 1933 "World's Fair" sets up a standard in modernistic architecture with many unusual color effects



An artistic "operating table"; the microsectioner takes minute cores from painted panels. A binocular microscope is secured to the post *a*, the collar *b*, and the block *c* and the rack and pinion *d* permit of adjustments. *E* is the attachment to stand and *f* is the lamp. Instrument table is shown at the right

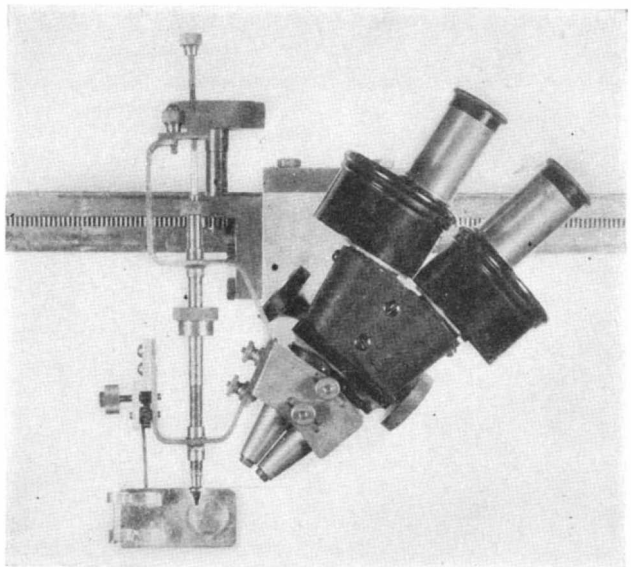
UNDERNEATH THE ARTIST'S PAINT

IN the Fogg Art Museum at Cambridge, Massachusetts, there is one of the strangest laboratories in the world. Here works of art, and particularly paintings, are examined with the aid of all the resources provided by modern science. Fabulous prices brought by examples of Rembrandt, Velasquez, or even the moderns such as Corot and Blakelock, have induced clever but otherwise dishonest painters to go to great lengths in the art of forgery. Also, since the advent of painting as one of the fine arts, students have copied the "old masters" as the best means of training themselves technically to do original work. Many copies exist in galleries where they are properly labeled.

The producer of spurious masterpieces is so devious in his ways that any attempt to circumvent him is well worth painful study. Our art heritage is so important from a cultural point of view that we are justified in going to great lengths to substantiate even minor points.

Occasionally works of art get into the courts for one reason or another. There was a ludicrous exhibition a few years ago of a jury being asked to decide whether a painting was by Leonardo da Vinci or Boltraffio—a question which would strain the abilities of the leading picture experts of the world. Another amusing case was where the "expert," who was also a bit of a wit, was asked how many paintings had come off the easel of the French painter Corot, in his lifetime. The answer was: "2500, of which 7800 are in America." Another witness at a previous art trial who had spoken of a Titian was asked by a juryman whether he meant an "optician."

Dr. Maxmilian Toch, a celebrated paint chemist, who has devoted a lifetime to the study of pigments used by the old masters, was quite naturally appealed to by a reporter of a metropolitan daily after the theft of the Mona Lisa. The reporter stated that the consensus was that the painting after it was cut out from the frame and rolled up would be so dry and brittle that it would be cracked beyond repair. Dr. Toch suggested that as it was painted on a ¾-inch wooden panel and weighed 30 pounds that it would possibly be difficult to "roll it up."



Top view of microsectioner showing the adjusting devices and how it is mounted on the binocular microscope

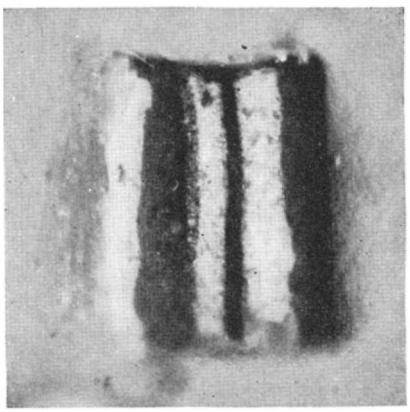
It is necessary to have a competent knowledge of the works of a master before an intelligent opinion can be offered and that is the reason why real art critics are so rare and why the resources of science should be appealed to when the importance of the work justifies. A fine memory and marvelous gifts of intuition in an art critic should be backed up by a close observation of the forms peculiar to a master in his representation of the human figure. In other words, a true painter who has a style of his own will always paint the same kind of ears or noses or hands and the examination of a great many authenticated examples will in time enable the would-be

art critic to become really uncanny in his deductions. This is the so-called "Morellian system" based on the researches of Giovanni Morelli who flourished in the latter part of the last century. Such a knowledge may be of the greatest importance if we can be certain that the painting we actually see is as the painter left it, but in many cases it is not and there is where science as applied to paintings, in the hands of experts at such institutions as the Fogg Museum, is of the most value.

The examination of paintings by X rays is carried out with great success at the Fogg Museum and the results show that the process is, within certain limits, infallible. Minute optical examinations add their quota of information. The painting is photographed with the aid of a spot light and color filters. The microscope is also called upon and adds its bit to the total.

THE use of slanting-ray photography is a new development in museum technique. The picture is placed in a dark room, illuminated by a ray of light striking it at an angle, and photographed. The photo is then enlarged and the contrasts give testimony of the manner of painting by the artist. The use of ultra-violet light has already been explained in detail in our issue for April, 1932.

One of our editors recently paid a visit to Cambridge to see the latest method of studying paint films devised by Mr. Rutherford J. Gettens, the chemist on the staff of the Fogg Museum and for the following description of his microsectioner we are indebted to



Photomicrograph showing a core section taken from a wood surface painted with eight layers of paint

Mr. Gettens' paper in "Technical Studies in the Field of the Fine Arts," a new publication on the field of artistic exploration. He writes:

"The usual method of taking samples from pictures and other painted surfaces, for microchemical analysis, is by means of a small needle or harpoon. These instruments may be made sticky with Canada balsam to facilitate removal and transference of the sample. It is frequently desirable to have samples which show, in their true relationships, the various varnishes, paint layers, and primings. Such occasions arise:

"(a) When it is necessary to have more exact information about the underlying paint film in repainted areas, before cleaning or restoration can proceed, than surface examination or radiographs will afford.

"(b) When surface examination or radiographs fail to give indications as to existing underpainting.

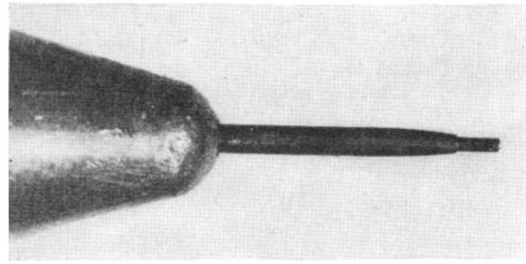
"(c) When it is necessary either for purposes of restoration or for evidence about methods of painting to know the relative thicknesses and exact composition of various superimposed films.

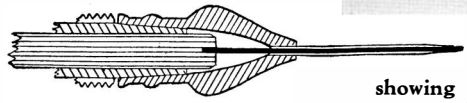
"It may be well to emphasize here that the taking of micro samples from pictures must not be done indiscriminately. It must be done only as a last resort, when all other methods of settling a certain question fail or when no other method is applicable. The samples taken must be of such size that they are hardly visible to the naked eye, yet they must be intact as to structure and composition so that a single sample from one locality will furnish all the information that is desired."

Laurie (an investigator of pigments and mediums of the old masters) was the first to take a sample through the panel with a cut-off hypodermic syringe needle sharpened as a miniature cork borer. The core is pushed out by means of a fine wire affixed to a handle. It is difficult to manipulate the needle accurately during the cutting operation. Carrying out such work under a microscope is still more difficult.

MR. Gettens has devised a microsectioner which is attached to the right side of the nose of a binocular microscope in such a way that the point of the needle is at the focal point of the microscope. The illustrations show how the instrument is used to take a section or core from the picture. The working part consists of concentric tubes and an inner rod which fits in the inner tube. The purpose of the rod is to bear the wire which is used to eject the section cut by the hypodermic needle.

When using the microsectioner, the picture is mounted on an easel and the instrument is placed directly in front of the picture. Adjustments are made so that the point of the needle is opposite the locality to be sampled. The needle, which is carefully cleaned, is perpendicular to the surface and the microscope is inclined to the picture at an angle of approximately 45 degrees. The operator carefully watches the point of the needle through the microscope. The section is cut by thrusting the needle into the paint film by turning a knob which serves to rotate the externally threaded outer tube.





Above: **A photomicrograph of the cut-off hypodermic needle showing the square-tapered cutting edge and wire to eject the section.** ***Left:*** **Detail showing inner rod and wire for forcing out the core**

The needle, sharpened with a tapered point, cuts out a perfect core. The internal diameter is .011 inch and this is likewise the approximate diameter of the core section that is delivered.

THE needle is now withdrawn by reversing the knob and the apparatus is moved away. The section, ejected by the wire which fits in the needle tube, falls onto an object slide provided with a cover. The sample is now cut in two and is mounted in paraffin which rests on a wood block. Then a microtome is used to prepare thin sections which are photographed. The cylindrical core section, when clearly cut, shows any stratification that may exist in the paint film. Our photomicrograph, at slightly under 100 diameters, shows a longitudinal section of a core that was taken from a piece of wood covered with eight layers of paint of different colors. This particular specimen is not from a picture but from a made-up specimen to test the possibilities of the instrument.

Mr. Gettens says: "It is almost needless to say that the samples are taken from a place on the picture where they will mar it as little as possible. Very often satisfactory ones may be procurred along the edge and under the rabbet of the frame. If it is necessary to go to the interior, special pains are taken to get the sample from an inconspicuous place, along a crack or blemish in the paint film, or at the edge of the area of a certain color. The point from which the sample has been taken may be covered and made invisible with a touch of solvent or thin varnish applied with a pointed brush."

It is hoped that this instrument will be of material assistance in solving many problems that arise in the routine examination and restoration of paintings.

SEEING AN UNSEEN WORLD

By WILLIAM D. GRIER
Fellow and Past-President, New York Microscopical Society
Fellow of the Royal Microscopical Society of London

THIRTY-FIVE or forty years ago, before we had movies, radios, and all the other pastimes which are available today, many amateur scientists in the United States and England were engaged in the fascinating study of microscopy. As in the sister science of photography and in some other sciences, most of the important discoveries and advances in the construction and application of the microscope have been made by amateurs.

During the period referred to the microscope was passing through a period of development, and its principal use outside of the medical profession was in the studies of zoology, botany, and to some extent mineralogy. But today this instrument in one form or another finds a practical use in almost every industry: for the inspection of raw materials and finished products, in order to detect imperfections; in the study of metals and alloys; in the examination of all sorts of medicinal and food products, textiles, paints and oils; for the detection of adulterations or inferior grade of goods. Even the ice-cream manufacturer and cold storage warehouseman find a use for the microscope in the investigation of the texture of ice-cream or other frozen foods, and of ice crystals in frozen meats and fish.

THERE is a widespread idea that the microscope hobby is expensive, calling for a considerable financial outlay for the instruments. It is true that the instruments used for very exact research work are expensive, but such instruments are used only for the most refined and delicate observations which lie far outside the field of the average microscopist and, in fact, are of little interest to anyone except the specialist working along some particular line of investigation which calls for the greatest accuracy in measurements and the like.

A good serviceable microscope can be purchased for not much more than the price of a good camera, that is, anywhere from 35 to 100 dollars, and there is practically no overhead or maintenance cost. The cost of the slides, mounting material, with the few articles needed, is moderate; a supply can be procured for a very small sum. A thoroughly serviceable outfit can be purchased for much less, for example, than the cost of a good amateur type of moving picture camera and projector.

An advantage lies in the fact that a microscope outfit can be procured gradually, so to speak; objectives, oculars, and accessories are nearly all standardized, so that the objectives or oculars of one maker, picked up here and there and now and then, can be used without inconvenience on a microscope stand manufactured by another. Several reputable concerns also provide used instruments at low prices.

BEFORE selecting a second-hand or used instrument, or before purchasing any instrument at all, it is a very great advantage to have the advice of a friend who is thoroughly posted about microscopes. They are made in many special forms often intended for special purposes, and one that would be suitable for a zoologist or a botanist would be of little use to a chemist or anyone interested in the study of minerals.

Having become possessed of an instrument, the next thing is, what to do with it. Prepared microscope slides in great variety may be procured from a number of sources, at prices running from 25 cents to several dollars each, but the examination of these prepared mounts, except as they may be required to illustrate some special investigations, soon loses its novelty.

A fascinating part of the hobby is the collection and examination of living organisms, and for this purpose any roadside ditch or slow-moving brook will prove to be an inexhaustible source of material. The apparatus required for this study of "pond life," as it is called, consists of a few glass slips costing about $1.20 a gross, some square or circular cover glasses costing about 60 cents for 40 or 50, a clean tumbler, two or three four-ounce wide-mouthed bottles, a couple of medicine droppers, and a clean linen or cotton cloth such as an old handkerchief.

A popular impression is that all water will be found to teem with various strange creatures when examined under a microscope. This is incor-

FOR use in connection with the amateur microscope hobby the following books are recommended: On the microscope as an instrument, both in theory and practice, Gage, "The Microscope" is a widely known standard treatise. On the study of pond life—the forms described so vividly by the author of the accompanying article—Plaskitt's "Aquatic Microscopy" and Shipley's "Hunting Under the Microscope" are beginner's books. A standard reference book which describes the many forms of microscopic life found in pond water is the large 1100-page "Freshwater Biology" by Ward and Whipple. Several other works, more advanced and specialized, are either readily available or, being out of print, must be sought from dealers in second-hand books—for example: Needham and Lloyd's "Life of Inland Waters"; Carpenter's "Life in Inland Waters"; Morgan's "Field Book of Ponds and Streams." For those who read German, Stehli's "Mikroskopie für Jederman" is an excellent introduction to the hobby. An article on amateur bacteriology will be published in the next number. —*The Editor.*

Ponds and sluggish streams and scummy bayous provide the best source of fascinating material for microscopic study

rect. Tap water, for example, as supplied for domestic purposes is or should be practically free from anything visible under a microscope, and it is usually necessary to let many gallons of such water pass through a filter before any visible organisms are obtained; in fact the presence of such organisms, either vegetable or animal, in ordinary drinking water is an evidence that something is wrong.

Occasionally public water supplies are contaminated for a short time by minute vegetable organisms which give a peculiar fishy or so-called cucumber taste to the water. This happened to the water supply in New York City some years ago when a small vegetable organism known scientifically as Synura appeared in it for a short time, giving a peculiar and disagreeable taste to the water, although it was quite harmless.

Drinking water may also be contaminated at times by pathogenic bacteria, or disease-breeding microbes, but these would be invisible in the water even with a microscope, under ordinary conditions, and their presence could be demonstrated only by proper bacteriological methods. This, however, is not the case with brook or pond water, which usually contains much animal and vegetable life, readily visible even with low magnifying powers, and affords many objects of interest.

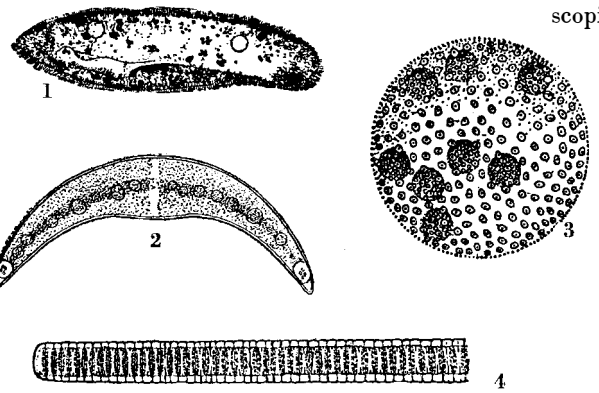
TAKE, for example, a little water from a pond or slow-moving brook, one sample being chosen from, say, a quiet portion along the edge and one from the current. Place a drop or two containing a little of the greenish scum thus obtained on a clean glass slide, place a cover glass upon it and bring it into focus, using a magnification of from 60 to 100 diameters. The first thing noticed probably will be a network of clear glassy threads containing a number of bright green cells arranged in a spiral pattern. This is a plant known as Spirogyra and is exceedingly common.

Suddenly a curious slipper-shaped creature dashes across the field, apparently animated by a mad desire to get somewhere in a great hurry. This is called Paramœcium, and is a unicellular animal, a good representative of the class Protozoa. This animal swims by the aid of very fine hairs or ciliæ which cover its body and vibrate with great rapidity. It may be seen only under high magnification, best after the animal has been killed and stained.

As the Paramœcium goes on its way a green globe appears, rolling slowly along. This contains smaller globes which are the young organisms. In scientific parlance, it is called *Volvox globator* and is now thought to be an animal, although for a long time it was considered to be a plant.

Next we see some small objects, perhaps star-shaped or like a green crescent. These are desmids, unicellular plants of which there are many known species.

The desmid is pushed out of the way by a green thread-like object which comes writhing into view. This may at first be mistaken for some sort of Spirogyra, but is soon seen to be quite different. It is called Oscillatoria and is a plant, though once thought to be an animal.



1: Paramœcium (x170). 3: Volvox perglobator (x50)
2: Closterium, a desmid (x200). 4: Oscillatoria (x465)

Suddenly an object which we have mistaken for a drop of dirty jelly is seen to extend a prolongation of its own shapeless body toward a tasty looking diatom or other appetising morsel, which it proceeds to eat by the simple process of flowing around it. This is the famous Amœba, probably the lowest form of animal life. It consists of nothing but a drop of protoplasm, has no permanent organs and simply exists.

Even the lowly amœba, however, possesses a certain method in its movements, which are very peculiar. It seems to move about without the aid of limbs or ciliæ. This is done simply by flowing along in the direction it wishes to go, continually changing its shape and extending portions of its body toward food particles. A well-known scientist has said, "No one knows what an amœba is going to do next." Perhaps the amœba subsides into motionless "contemplation," but suddenly, however, a great commotion is raised in the "neighborhood," and what appears to be a giant serpent 50 feet long comes lashing and twisting across the field of view. This is one of the many kind of "nematodes," so-called thread worms, and is actually only about one one-hundredth of an inch in length. Compared with the objects we have been seeing this is a very highly organized animal.

Other common denizens of pond water are Rotifers with their wheel-like crowns of ciliæ kept in constant motion, and the diatoms in an infinite variety of shapes and sizes, with beautifully sculptured valves or shells.

The many varieties of singular appearing larvæ of aquatic insects are interesting objects for low magnifying powers; in fact, many of these may be studied with a common hand magnifier. It is quite possible with a little care to keep some of these creatures alive for a considerable period and many hours of pleasure are to be derived from observing them.

A number of books on these microscopic forms of pond life, couched in language intelligible to the beginner, are available, and by means of them many of the interesting things seen in a drop of ditch water may be identified. Sometimes a small quantity, a pint or a quart of this water, can be kept in a glass jar such as an ordinary preserve jar, preferably near a window, and covered with a piece of glass. This will serve as small-scale aquarium, and the beginner will be amazed at the number of organisms, both animal and vegetable, which will develop from time to time in it.

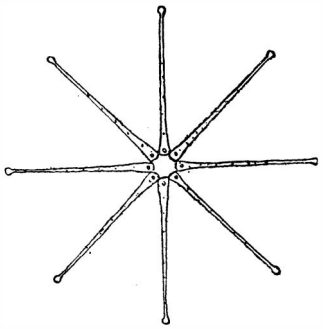
Another good way to obtain material for examination is to place a handful of hay or grass clippings in a jar of water and allow it to stand from one to ten days. Matter of this nature almost always carries spores or invisible eggs of various organisms, which will develop after a time. Interesting material may often be obtained by placing in similar jars some of the dead leaves or vegetable matter floating in ponds.

PRACTICALLY all of the things which may be seen under the conditions just described are within the compass of a 50-dollar microscope outfit.

There has been little fundamental change in the general features of the compound microscope for many years, most of the changes having been in such minor matters as the design of the mechanical portion or in the development of forms for special purposes. There is little or no essential difference between a high-grade compound microscope as manufactured today and one made 25 or 30 years ago. The optical part has probably reached its highest development, as far as visual observation is concerned, unless some entirely unlooked for discovery of an optical nature is made in the future.

The primary part of the modern compound microscope consists of what is known as the "stand." This is the mechanical portion, and it consists of a body tube *A* (see photograph) which

slides vertically in a dove-tailed channel at the end of the arm *B* and is made to move up and down for the purpose of focusing, by a means of a rack and pinion, *C*, known as the "coarse" adjustment. This is for the purpose of rough focusing, the final sharp focus being made by means of the fine adjustment *D* which may be either on the



Asterionella, a diatom common in pond water. Magnified 188 times

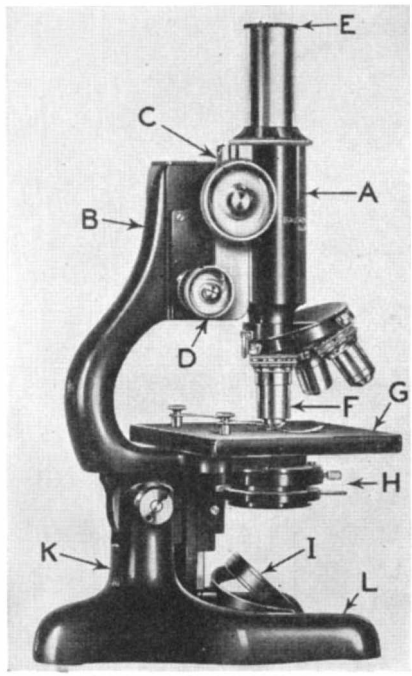
top or side of the arm. This adjustment consists of either a very finely cut screw operating on a lever, or some form of cam adjustment; or it may be made by means of a train of gear wheels geared or figured in such a way as to move the body of the instrument almost imperceptibly up and down in order to secure the final sharp focus. At the upper end of the body tube is located an ocular or eye-piece *E* which is exactly comparable to the eye-piece or ocular of a telescope. At the lower end of the body tube is another system consisting of from one to six lenses, depending upon the magnification desired. This is known as the objective, *F*. Objectives and oculars are both made in many different types and magnifying powers. The purpose of the ocular is to magnify the real image formed by the objective, hence the term "compound microscope."

BELOW the body tube is a platform or stage *G*. This may be either rectangular or circular, with an opening in the center. The purpose is to support the material which is to be examined. Sometimes the stage may be revolved around its axis or be provided with a so-called "mechanical stage" for moving the object about with great precision.

Beneath the stage is some form of diaphragm *H*, usually an ordinary iris, with a system of condensing lenses whose purpose is to concentrate light on the subject. Below the condenser and diaphragm is a mirror *I* which serves to illuminate the object by reflecting on it light from some outside source. The arm of the instrument, which carries all of the apparatus described above, is usually hinged to a short pillar *K*, an arrangement which permits the microscope to be used either vertically or horizontally. The pillar is supported by the foot *L* which is approximately the shape of a horseshoe and is made very solid and heavy in order to stabilize the instrument and prevent vibration.

These are all of the essential parts of a complete compound microscope, although there are very many variations and special forms, depending on the ideas of the manufacturer and the purposes for which the instrument is to be used.

The field of microscopy is almost infinite in size. The beginner generally will attempt to cover a very extensive



Courtesy Bausch and Lomb Optical Co.

A typical microscope suitable for the general needs of the amateur

territory and, if he is interested at all, he will run some risk of becoming lost in the vast new world into which he has entered. Before adopting any particular branch of the hobby as a specialty, he should make himself acquainted with the subject generally. One of the first things to investigate is the appearance of common objects, many of which occasionally turn up in preparations or mounts as accidental intruders. The student should become acquainted with the appearance of wool, cotton, silk and other textile fibers, threads of which always float about in the air; also the different sorts of starch, such as potato, wheat, corn, and so on.

The examination of dust from various locations frequently reveals some surprising results. The worker should become perfectly familiar with all of these things; also with the appearance of air and oil bubbles in water, and water bubbles in oil. Frequently the first thing to attract the attention of the novice is the appearance under the microscope of a few air bubbles (which have no business there). Sometimes these absorb his attention to the exclusion of the principal subject.

Many interesting objects may be obtained from the insect world. Parts of plants, such as leaves, petals, pollen and so on, as well as cross-sections of the stems and roots, will be found of great interest.

Those who are already interested in photography can very profitably combine these two hobbies, as they go hand in hand; in fact, the first photographs ever made were photo-micrographs, which were available long before it ever occurred to anyone to take a portrait. Here again the essential requirements are very few and simple, and very creditable work may be done with an ordinary camera from which the lens and shutter have been removed.

MOST of the work with a microscope will be done by artificial light because few amateurs have much time available during daylight hours. However, artificial light is actually the better of the two, because it is uniform. If it is desired to work by daylight, direct sunlight should be avoided, the instruments being placed on a table two or three feet from a window with a good unobstructed light. For the major portion of the work which the beginner will do an ordinary 25-watt frosted electric bulb is ample. The tendency of the beginner is to use too powerful a light, which is not only very

A common amoeba, very changeable in form (x100)

All line drawings reprinted by permission, from "Manual of Freshwater Biology" by Ward and Whipple, published by John Wiley and Sons, Inc.

injurious to the eye, but drowns the image in the glare.

Some entertain the belief that work of this nature is injurious to the vision, but this is not the case. Many thousands of people observe continually for hours at a time, and there are very few cases on record of injury to the sight. The observer should sit in an easy and natural position, without cramping the neck, and endeavor to cultivate the habit of keeping both eyes open and not screw up the left eye (assuming that he uses the right one). After a little practice it will be found quite easy to concentrate the mental attention on the eye which is in use. It is better to work in a spot which is not too brightly lighted, in order to reduce as much as possible the extraneous light other than that passing through the instrument. If any annoyance or strain is felt in the eyes, or if there is a feeling as if grains of sand were in them, work should immediately be stopped and the eyes rested.

THE AMATEUR RIDES A NEW HOBBY

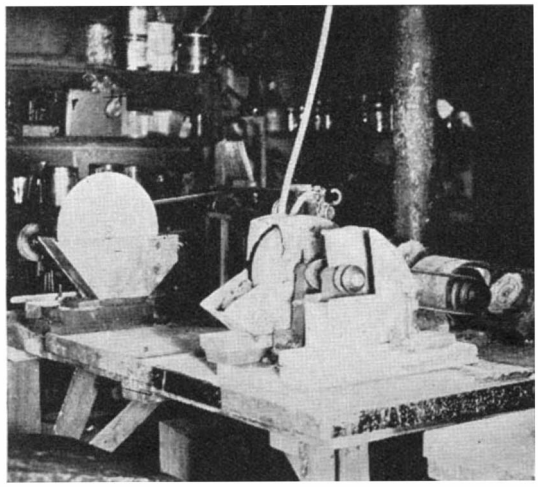
By ALBERT G. INGALLS

AN unanticipated by-product of the depression has been a remarkable expansion of home hobbies. A possible explanation, for which there is in fact some evidence, is that many men who are out of work have kept themselves occupied and sane, as well as "out from underfoot" while at home, by setting up a hobby shop in the cellar or attic.

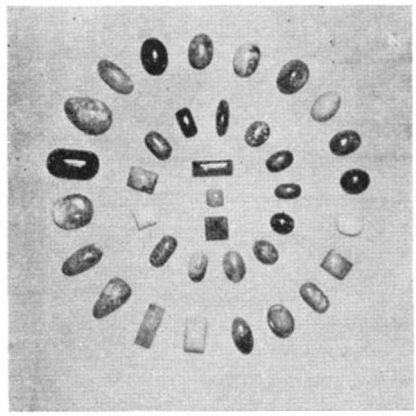
Amateur gem polishing is a hobby which contains interesting promise. This was introduced to SCIENTIFIC AMERICAN readers eleven months ago by J. H. Howard, in a three-page article entitled "Gem Stone Cutting for the Amateur" and in a small practical instruction book, "The Working of Semi-Precious Stones." The gem stones shown in the accompanying illustrations were made subsequently by SCIENTIFIC AMERICAN readers, from the same instructions.

Arthur Knapp of Woodbury Heights, New Jersey, made the collection displayed at the top of the page, using the equipment shown in the central photograph. "I can recommend the cutting and polishing of gems as an exceptionally interesting hobby," he writes, "and I have had a lot of hobbies in my day. It requires considerable mechanical ability in order to get the equipment into satisfactory working order, and it requires considerable skill, dexterity, and patience to get good results. However, the results are worth the effort."

The equipment consists of a mail-order-house bench grinder and quarter horsepower motor, two Carborundum wheels and some Carborundum grains, two felt wheels and powdered pumice, a few small gadgets, a strong thumb and—patience. The material is low-priced mineral in the rough—moss agates, rose quartz, carnelian, jasper, chalcedony, tiger eye and so on—obtainable from mineral dealers, or often is most unpromising stones simply picked up while on country walks.



Melville M. McBride of Monroe, Michigan, writes concerning the picture of gems at the bottom of the page: "I send a photograph of precious and semi-precious stones cut by me during my spare hours, according to Mr. Howard's instructions and the article published in the March 1932 number of the SCIENTIFIC AMERICAN. This is a great hobby. The picture gives evidence of what anyone can do if he has a little mechanical ability.



Above: **36 gem stones made by Arthur Knapp of New Jersey.** *Left:* **The home lapidary shop in which they were cut**

"I did not think there were more than 40 or 50 different kinds of stones in the world until I started to read books on mineralogy. Now I find it quite a study. The display case shown, which measures 11 by 24 inches, contains about 190 stones, all of which are catalogued as to name and locality.

"The estimate of time given by Mr. Howard was very fair and the cost estimate—50 dollars—even a little high. For example, I made a good saw and 12 sawing disks for 65 cents and the supplies cost less than the estimate."

A collection of about 190 stones polished by Melville M. McBride of Michigan

Reinforcing a Weak Spot in Our Diet

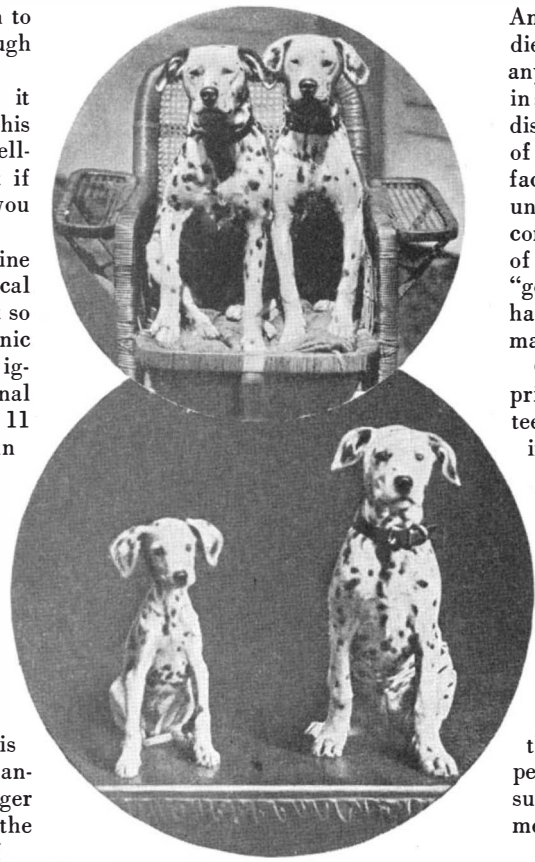
By H. V. MOSS
Chief Chemist, Provident Chemical Works,
Division of The Swann Corporation

DO you know what would happen to you if you did not eat enough cobalt?

Well, neither does science. But it suspects that minute amounts of this element may be essential to the well-being of the human body and that if you were totally deprived of it you would suffer some direful disease.

Much research work along this line is being carried out in bio-chemical laboratories all over the country. Not so long ago the small amount of inorganic matter that exists in our foods was ignored as unimportant, but nutritional experiments have shown that at least 11 inorganic elements play vital parts in maintaining our health, and scientists are busy checking up on several more which may also prove to be indispensable to our existence.

The serious consequences of a deficiency of any needed element are well illustrated by the well-known case of iodine. The amount of iodine in the average human body is estimated at about four hundred-thousandths of one percent. This is indeed an almost infinitesimal quantity, and yet without it there is danger of simple goiter. People living near the sea, which is a great reservoir of iodine, get their needed supply automatically. They not only eat iodine in sea food but, because the dried sea salts blow over extensive areas, they also drink it in water and breathe it in from the air. But those who live inland, especially in regions where the rocks are deficient in iodine-bearing minerals, have to guard against goiter by adding iodine in some form or other to the diet. The use of iodized salt is considered especially efficient for this purpose.



Photographs courtesy Bond Bakers

How diet affects growth. *Below:* Twin brother and sister dogs. Brother (left) was deprived of certain minerals and vitamins. The sister (right) lived on a normal diet, also in the country. *Above:* Later the brother (right), on a normal diet, is as tall as the other dog but lacks full skeletal development (note both head and chest)

IRON and copper also furnish interesting examples of the nutritional effects of inorganic elements. The red color of the blood is due to an iron compound and, with a diet too low in iron, the blood becomes pale and anemia results. But one can become anemic on a diet abundant in iron salts—for a second metal, copper, must also be present. In some mysterious way, copper helps in the transfer of iron from our food to the blood stream, and we cannot have good red blood without it.

Recent work by Dr. Elsa Orent in Dr. E. V. McCollum's laboratory at the Johns Hopkins University has brought out some curious facts about manganese. Rats fed on a manganese-free diet develop normally to maturity. Then the males become sterile, and the females, though retaining their fertility, lose all their maternal instincts and allow their young to perish.

Equally disastrous results attend dietary deficiencies in calcium, phosphorus, magnesium, sodium, potassium, chlorine and sulfur, and possibly also cobalt, nickel, fluorine, silicon, zinc, and even arsenic as well.

WITH the exception of iodine, calcium, and phosphorus, the normal American living on an ordinarily varied diet need not give the slightest thought to any of these elements. They are required in such small quantities and are so widely distributed that troubles due to the lack of them rarely occur naturally, and in fact can be produced experimentally only under carefully controlled laboratory conditions. On the other hand, iodine is of dietary importance in the so-called "goiter districts" and, as recent research has disclosed, calcium and phosphorus may be deficient in anybody's diet.

Calcium and phosphorus, being the principal constituents of the bones and teeth, are needed by the human body in far greater quantities than any other inorganic elements. Dr. H. C. Sherman, of Columbia University, estimates that while the average adult needs only 0.015 gram (0.0005 ounce) of iron a day, he should have at least 0.68 gram (0.0243 ounce) of calcium and 1.32 gram (0.047 ounce) of phosphorus. Children require twice these quantities during the entire period when their bones are developing; and expectant and nursing mothers, who must supply from their bodies the requirements of their offspring, should have three times the normal quota. Diets too low in calcium and phosphorus may lead to rickets in the case of children, and to decayed teeth and to disorders that may bring about premature old age in the case of adults.

Nature has been generous to us in the matter of calcium and phosphorus supplies and, if we eat plenty of whole wheat, eggs, cheese, cabbage, turnips, carrots, lettuce, and spinach, and drink over a pint of milk a day, we shall get all we can possibly need of these two elements.

Unfortunately, however, these desirable foods do not figure in sufficient quantities in many American dietaries, and foods which are conspicuously low in their calcium and phosphorus content appear abundantly on our tables. Hence it is a fact that many Americans are not getting enough calcium and phosphorus to maintain perfect health.

This problem, and it is a very im-

portant one, has been given a great deal of thought on the part of both scientists and food manufacturers. A great deal of educational work has been carried on, emphasizing the advantages of a completely balanced diet, and this is excellent and should be continued and extended. It also seems possible, however, to attack the problem at its root by adding calcium and phosphorus to sugar, flour, and other foods.

It happens that we have the means at our disposal to do this easily, because certain of the calcium phosphates are unquestionably assimilated by the human system. Dr. V. K. LaMer, Associate Professor of Chemistry at Columbia University, in an address recently presented before the American Association for the Advancement of Science, sums up our knowledge on this subject as follows:

"IN 1907, McCollum undertook an exhaustive investigation of this question: Are inorganic phosphates foods? His results and those of later investigators favor the view that the body can use inorganic phosphates to meet all its phosphorus demands.

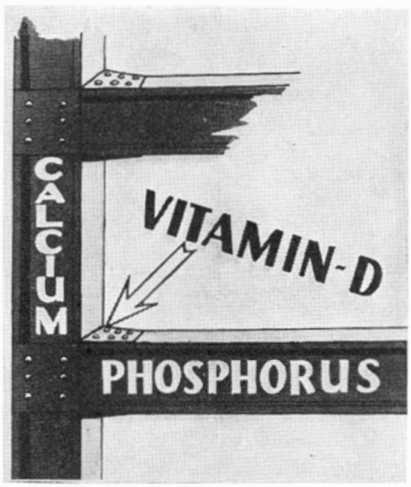
"In McCollum's experiments, every organic component of the ration was free from phosphorus. The only source of phosphorus was finely ground tricalcium phosphate. One rat was fed the ration for 127 days, during which time he doubled in weight, before he was killed. Analysis of the body showed it to be of normal composition.

"Steenbock, Hart, Sell, and Jones state that no difference in the growth of rats was observed when the dietary calcium was mostly calcium lactate, carbonate, phosphate, silicate, or sulfate, if these were fed in liberal amounts. . . . From metabolism balance experiments on two young women, Potter and Kramer claim that when the calcium and phosphorus of the diet was supplied mostly in inorganic form the retention was as good as when these elements were supplied by raw milk. . . .

"Certain inorganic salts of calcium and phosphorus can, therefore, function as well as organic forms in meeting deficiencies of these elements."

There is nothing radical in adding calcium phosphate to flour—it is already common practice. Calcium phosphate is one of the important constituents of much of the baking powder now in use and it is also added in the manufacture of self-rising and phosphated flours. Foods made from these materials, therefore, contain calcium phosphate, and feeding experiments by C. A. Hoppert, of the Department of Chemistry, Nutrition and Home Economics of the National Soft Wheat Millers Association, show that the calcium phosphate residue in foods made from self-rising flour has a definite bone-building value. Therefore, to increase the dietetic value of all white flours by adding to them small amounts of calcium phosphate would merely represent further progress in a movement already under way.

Another food product in which calcium phosphate is used is salt. Salt tends to become damp in humid weather and to form hard cakes on drying out. A number of different fillers or conditioners have been used to overcome this objectionable tendency, but in recent years calcium phosphate has been found to be especially efficient for this purpose. About half of the table salt now used in this country is rendered free-flowing by means of calcium phosphate, but salt manufacturers using it have not as yet emphasized the improved health value of their product.



In the human framework calcium and phosphorus provide the structural materials for the skeleton. Vitamin D serves to fasten these essential materials in position

As is the case with salt, calcium phosphate is a very satisfactory conditioner for sugar. One percent of tricalcium phosphate completely prevented the formation of lumps in XXXX powdered sugar on standing for 53 days under the normal summer weather conditions prevailing in St. Louis. It also imparts unusual free-flowing properties to the sugar. Tests show that the phosphated sugar flows more freely than does pure sugar and much more freely than sugar conditioned in the ordinary manner with 3 percent of starch. There is no tendency for the sugar to cling to the container and it can be measured and mixed more easily.

Bakers' tests prove that cold icings made with sugar containing tri-calcium phosphate set up rapidly with good grain and texture and maintain their original consistency better than those made with starch-conditioned sugar. Moreover the slightly uncooked taste due to the starch is eliminated. Other tests demonstrate that the turbidity of solutions of phosphate-conditioned sugar is less than that of solutions of starch-conditioned sugar and that the elimination of the starch would probably prevent molding. Quite apart from the health-giving properties of calcium phosphate, therefore, its use in sugar is advantageous.

Because nutritional science has been studying intensively the weak points in our diet, the polar explorer no longer fears scurvy; beri-beri and simple goiter need no longer afflict great groups of people; certain forms of rickets and anemia have been conquered; and the span of the prime of life is being definitely extended.

BUT even more important than these highly dramatic accomplishments is the work that is being done to improve the every-day diet of the average citizen. Food manufacturers are following with intense interest the progress of our knowledge of the essentials of our diet. With a vitamin or two added here and some mineral salts added there, the food that is deficient in important particulars today will become the perfect food tomorrow.

Take, for example, the most popular single article of food in America and probably in the whole civilized world—white bread.

White bread made with water is an excellent food in itself, but if eaten in too great quantities it crowds out the use of foods containing greater quantities of vitamins and mineral salts.

But when white bread is made with milk, vitamins A, B, and G, and possibly C are added. If irradiated ergosterol or a cod-liver oil concentrate is mixed with the dough, as certain bakers are now doing, vitamin D is introduced; if phosphated flour is used, the calcium and phosphorus content is greatly strengthened. Such a bread provides a fairly well rounded diet, especially when spread with butter, an excellent source of vitamin A.

Similarly, candy is deficient in practically every food element except the energy-creating sugar. But make it from phosphated sugar and add yeast to it, and it becomes rich in vitamins B and G and in the bone and tooth building inorganic elements.

If research finds it desirable (though the probabilities are that it will not), iron and other inorganic elements can be added to commonly-eaten foods in the same simple way, and as our knowledge of the vitamins grows we shall undoubtedly discover other inexpensive methods of increasing our consumption of these vital substances.

At all events, a movement to reinforce the weak spots in our diet has been started, and the result should be a definite increase in the health, vigor, and longevity of the human race.

WATER CONSERVATION—

By CALVIN V. DAVIS

CONSERVATION ordinarily means preservation from loss or injury. In the case of our water supplies, the term carries an exactly opposite meaning than it does when applied to most of our other natural resources. To conserve our supplies of coal, for example, means curtailment in the use of coal; to conserve our water resources means the development and use of them.

The waters constantly flowing in our streams and rivers represent a continuous waste of wealth unless they are made to supply us with power, irrigate our lands, or serve other useful purposes. It is not overstating the case to say that much of our future economic progress will depend upon our development and use of these vast potential sources of wealth. While this fact is appreciated more in some of the western states, where the continued growth of cities and the development of agricultural and industrial areas in desert country are made possible only through water conservation, it is nevertheless true to a great extent for the country as a whole.

It is timely, therefore, to weigh and consider certain economic aspects of water conservation. We cannot fully appreciate the influence that the development of our water resources will have on our future economic progress unless we have first a broad picture or a survey showing what water conservation really is and the advantages that have been already obtained through it.

Recent technical advances in the engineering arts relating to water conservation must also be given consideration as these in some cases will cut the cost of development in half. These technical advances will have a far-reaching effect on our future industrial structure as they will make financially feasible a number of projects, the development of which has heretofore been considered uneconomical.

THE results and benefits attained in the past through water conservation indicate in a measure what may be accomplished in the future. Lowering the cost of projects, through the use of the technical improvements referred to, will be a factor in increasing the importance of water conservation to our changing industrial structure for which the key to future development lies in the advantages that may be obtained from this conservation of water resources.

Water may be conserved by utilizing the power developed at dams and falls, by storing it in reservoirs, or by improving the channels of rivers and waterways so that they may serve for water transportation or other useful purposes. Storage in reservoirs may be used to insure adequate water supplies to cities and municipalities; to augment the hydro-electric power plants on a river and make more uniform their power production; to irrigate arid lands and turn desert into wealth-producing country; to afford protection against devastating floods by retaining the waters in times of flood and releasing them gradually during the drier seasons; and to make our watercourses more navigable through regulation of their flow.

Most of us are familiar enough with the great reservoirs that have been constructed for the purpose of storing our water supplies. The Croton and Catskill systems supplying New York City are outstanding examples of the storage reservoirs that are required to meet the needs of metropolitan districts. Considering the country as a whole, the outstanding characteristic of the storage developments for water supplies is their complete inadequacy to meet the requirements of the cities which they serve. This is particularly true of a number of southern cities which suffered severe economic losses as well as actual physical discomforts during the almost nation-wide drought of 1930. The unfortunate experiences of this drought have revealed that there now exists a most drastic need for new storage reservoirs in many sections of this country. Getting caught up with our storage and other water supply needs, during the reconstruction period which we are now entering, will offer a profitable outlet for idle capital as well as substantial relief to the unemployment situation.

Irrigating a large field, broken into sections by means of miniature diversion dikes, from a concrete-lined ditch on the Salt River Project in Arizona

STATISTICS show that stability of the waterworks industry has been proved during the depression. According to the *Engineering News-Record*,[1] the earnings of the New York and Chicago water supply systems in 1931 were but slightly under those of 1930 but were still greater than the receipts for 1929 or for any previous year. The inherent stability of earnings, such as illustrated by the foregoing, combined with a steadily increasing demand for water, should furnish the incentives to finance the deferred waterworks construction which have been estimated by engineers and other authorities to aggregate from one half billion to a billion dollars. The immediate prosecution of this work would be an important step toward economic recovery.

Aside from supplying water for domestic and industrial purposes the next most important use of our water

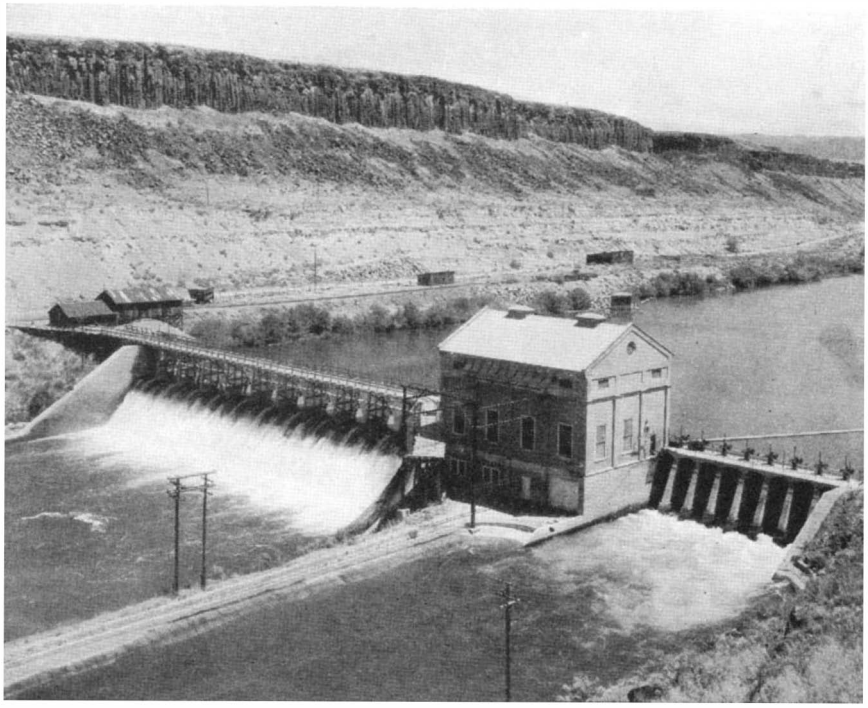
[1]April 28, 1932, P. 609.

THE KEY TO NATIONAL DEVELOPMENT

resources is for the development of hydro-electric power. During the past few years this phase of water conservation has been developed less rapidly than before owing to the mechanical improvements which have greatly lowered the cost of power produced by steam generating stations. While the number of hydro-electric developments per year has been steadily decreasing, the magnitude of individual projects has increased. This trend is indicated by a comparison of recently developed and projected hydro-electric plants. For example, the capacity in horsepower of the proposed St. Lawrence development will be over twice that of Hoover Dam, now under construction, about six times that of the huge Conowingo plant on the Susquehanna River, and nearly nine times that of the Wilson Dam at Muscle Shoals.

WHILE it is true that there has been some slackening in the rate of hydro-electric development, sight must not be lost of certain factors that will eventually reverse the trend in this type of water conservation. These factors are: first, improvements in dams which will lower the cost of certain projects from 25 to 50 percent; second, the possibility that large industries will migrate from congested areas in cities to rural districts, thus making valuable as factory locations some of the widely scattered, small water-power sites which heretofore have been considered uneconomical for development; and third, the dual savings effected by this type of conservation. The first two of these factors will be discussed more fully later on. In respect to the third factor it should be further noted that a cubic foot of water helping to turn the turbines of a hydro-electric plant is not only producing energy but, in addition, is helping to conserve our rapidly diminishing supplies of fuel.

Many projects, such as the Hoover Dam, combine several of the types of water conservation outlined in the foregoing with the irrigation of arid lands, while others are devoted only to irrigation. Irrigation will play an important part in the development of the southwest where the Bureau of Reclamation has converted into farms and communities millions of acres of desert lands that otherwise would have lain waste. As a result of this work during the past 30 years, 41,000 farms have been made available to people of limited means who were inclined to turn to agriculture for a livelihood.

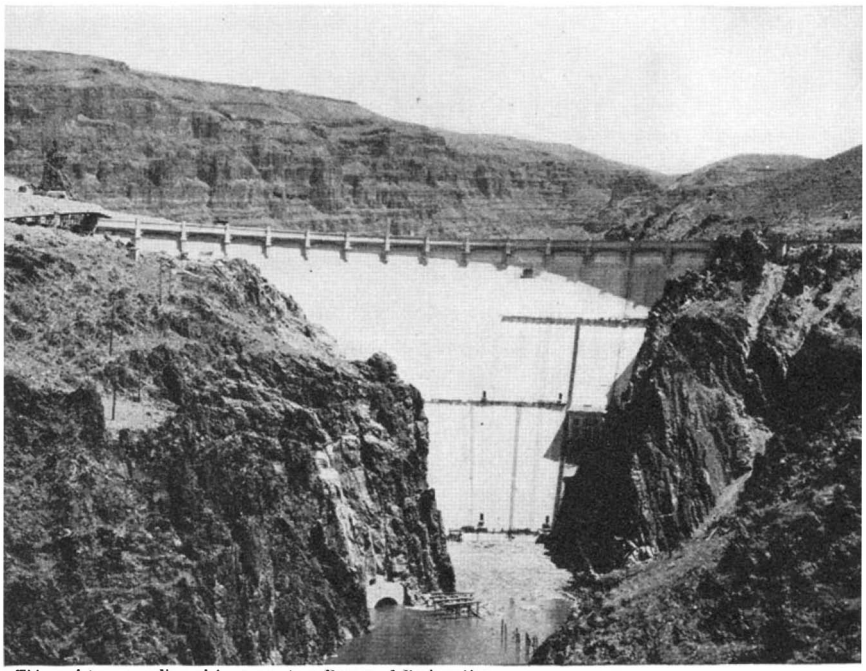


Boise River diversion dam, power plant, and intake to irrigation canal, Boise Project, Idaho. The large irrigation canal is at the nearer end of the dam

It has been argued by some that the further development of irrigation projects is uneconomical owing to the surplus of agricultural products that already exists. An examination of the facts will show the fallacy of these arguments. According to the May, 1932 issue of *The Reclamation Era*, "Federal irrigation projects afford an ever-increasing market for the sale annually of thousands of carloads of automobiles, farming implements and machinery, furniture, and other articles manufactured in the east and south and valued at 1,000,000,000 dollars annually." Again quoting from the same issue: "Land reclaimed from the deserts of the west contributes nothing to any surplus farm output; but even that is not all. Development of the natural resources of the west in any and all ways is the only right solution of the national problem that has been created by the unbalanced and unnatural development of mechanized industry in the east. We need not think of western developments in terms of more farms only. More farms would be incident to even greater achievements and the whole nation would be helped."

The federal irrigation projects that are scattered over the entire west constitute an important step towards the correction of the unbalanced state of industry and agriculture referred to in the foregoing quotation. The influence of irrigation on our national life at present, however, is relatively minor in comparison to the part that it will play in the future according to the predictions of some of our outstanding industrialists and economists.

CLOSELY allied with the development of hydro-electric and irrigation projects is the regulation of rivers by storage reservoirs which impound the waters in times of floods and release them gradually during the drier seasons. This flattening out of the flood peaks of a river not only insures at all times an adequate quantity of water for the operation of hydro-electric plants below the reservoir but also protects the property adjacent to the river from damage by flood. An excellent example of a project which accomplishes both of these functions is the recently completed Sacandaga Reservoir, constructed by the Hudson River Regulating District near Conklingville, New York. This vast reservoir, which has an area of 27,000 acres and a capacity of 224 billion gallons, is capable of trebling the minimum flow of the Hudson River at the Spier Falls hydro-electric plant, a short distance below the storage dam. This hydro-electric plant has recently been enlarged to take advantage of the additional power made possible by the increased flow which is released from the Sacandaga



This and two preceding pictures courtesy Bureau of Reclamation

The Owyhee Dam, of the Owyhee Project which serves both Oregon and Idaho, is the highest dam in the world at present. The power plant stands at its base

Reservoir during the dry seasons.

In the past, the conservation of water has been severely hampered by the high cost of the dams and other hydraulic structures necessary for water storage. Fortunately certain recent improvements in dam design have increased the safety and in certain instances have greatly reduced the cost of these important structures.

IN effecting improvements in any engineering structure, absolute safety is a prime requisite and sound economy cannot be obtained without it. The failure of the great St. Francis Dam with its attending loss of life and property, and other disasters of this character, have taught us forcibly that only the most conservative designs should be tolerated in hydraulic developments. In this respect there should be noted the splendid record of the Bureau of Reclamation for the construction of safe dams. No failures have marred their 30 years as dam builders.

Along with refinement in designing methods, certain improvements of type have been effected which have increased the safety of dams and at the same time greatly reduced their cost. Two factors have contributed to the development of these improved types of dams. The first of these is the rapid increase in the demand for water which, in the western states, has necessitated the development of some of the power sites containing faulted or otherwise defective foundations. This tendency has resulted in the more widespread use of a hollow flexible type of masonry dam, commonly known as the Ambursen dam, which is capable of adjusting itself to foundation movements without injury to the structure. This property of flexibility is of great importance in dam construction, particularly in earthquake countries. The Bureau of Reclamation recognized the importance of this in constructing the Stony Gorge Dam, an Ambursen dam 140 feet high, which is located at a faulted site in an earthquake zone.

The government of Mexico is also encountering similar problems in constructing the Rodriguez Dam near Tijuana. In commenting on this work in his column "Today," Arthur Brisbane stated: "The Mexican Government is building it, putting a wall of concrete, slanting outward according to the Ambursen plan, to store the river's flow in a vast natural reservoir, with high mountains for its sides. That dam, visited this morning, proves that Mexico is not discouraged by any depression. It will cost many millions and provide water enough to irrigate a vast territory even though there should be no rainfall for five years." This dam has other features which make it of unusual interest. At the section where the dam attains its maximum height (250 feet) there is a badly faulted area of foundation about 100 feet wide which is entirely unsuitable to take the loads from the structure above. To overcome this, an arch, resting on a solid mat of concrete below, was spanned across to the sound rock on each side of the faulted area. This arch is capable of safely supporting the entire load from the dam above.

The second factor contributing to these advances in dam design is the demand for the more economical development of water resources. The financial conditions of today call for a re-examination of engineering practices in water storage development with a view to attaining the utmost economy in the design of the structures. As a result of this demand on the engineer for economy, improvements have been effected that have nearly cut in half the cost of storage development by the conventional methods. For example, at Clinton, Oklahoma, a hollow dam was constructed to serve both as a dam for impounding water and as a filter plant for purifying it. The slabs and walls comprising the dam serve as the sides of the various tanks which perform inside the dam the functions of purifying the water. This composite structure saves the costs of the exterior basins and buildings required by a filter plant of the conventional type.

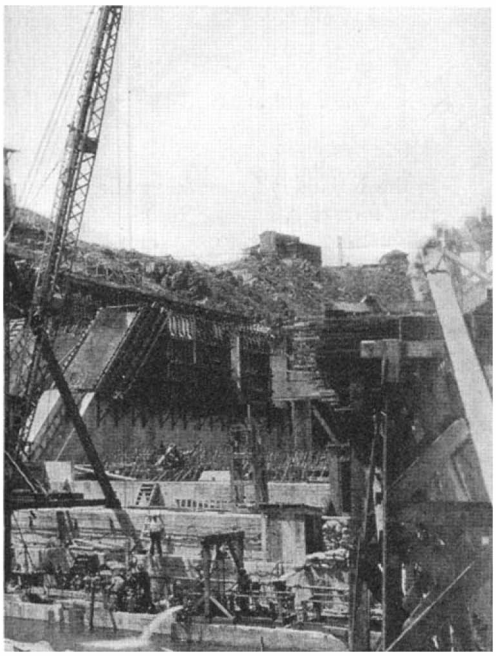
Finally, the conservation of our water resources will be a vitally important

Rodriguez Dam, Tijuana, Mexico—a structure of international importance in-

factor in our future industrial and social development. The results obtained by the Bureau of Reclamation and other organizations engaged in the construction of storage works have indicated to a degree the close relationship between the conservation of water and the social and economic growth of certain sections of this country. Even if no major changes in our industrial structure were pending, the benefits of conservation already attained and the economic advantages incidental to the technical improvements previously discussed in this article would furnish the incentive for increasing the rate of hydraulic project development. These viewpoints, however, do not enable us to visualize fully the future influence that water conservation will have on our national life; we must relate them

to the social and industrial changes that are now taking place in order to see that the development of our water resources may be the very foundation of future economic betterment.

The fog of depression has made it difficult to see that we have any trend at all economically other than vertically downward. Even if our horizons are clouded, however, it is encouraging to note that some of our most eminent industrialists and economists are actually discerning certain constructive movements that may lead us out of this depression and help to keep us out of others. These movements may be broadly classified as follows: first, the trend towards the decentralization of industrial operations or diffusion of a large number of small industrial units over wide areas heretofore used for agricultural purposes only; second, the possibility of creating a partnership between industry and agriculture as recently suggested by Mr. Henry Ford; and third, the possibility that both of these trends will move the center of manufacturing towards the southwestern states, perhaps locating it definitely in these states. These possible economic changes are related to water conservation in that each will make material increases in the demand for water and each will be dependent to a large extent on the development of water resources.



stigated by President Abelardo L. Rodriguez while governor of Lower California

The widespread and ever increasing use of electricity will be the principal factor in bringing about the decentralization of our economic structure according to Mr. Virgil Jordan, Economist, McGraw-Hill Publishing Company. In an article in the *Electrical World* for January 2, 1932, Mr. Jordan contrasted the early development of steam power, which had to be used at its source, thereby causing congested industrial centers, with the development of electric power which is almost universally distributable. Mr. Jordan concludes, as a result of this wide distribution, that the outcome "is certain to be a continuous decentralization of our economic structure, with greater local self-dependence, smaller scale enterprise, less urban congestion, less long distance transportation, relatively diminished international trade, narrower market areas, increased stability of the business structure."

Mr. Henry Ford likewise predicts such decentralization. Mr. Ford, however, goes a step further and advocates a partnership between agriculture and industry as a basis for stability. Mr. Ford states: "With factory and farm as partners, with one foot on the soil and one foot planted on industry we should be in a position to hail the new epoch without fear."

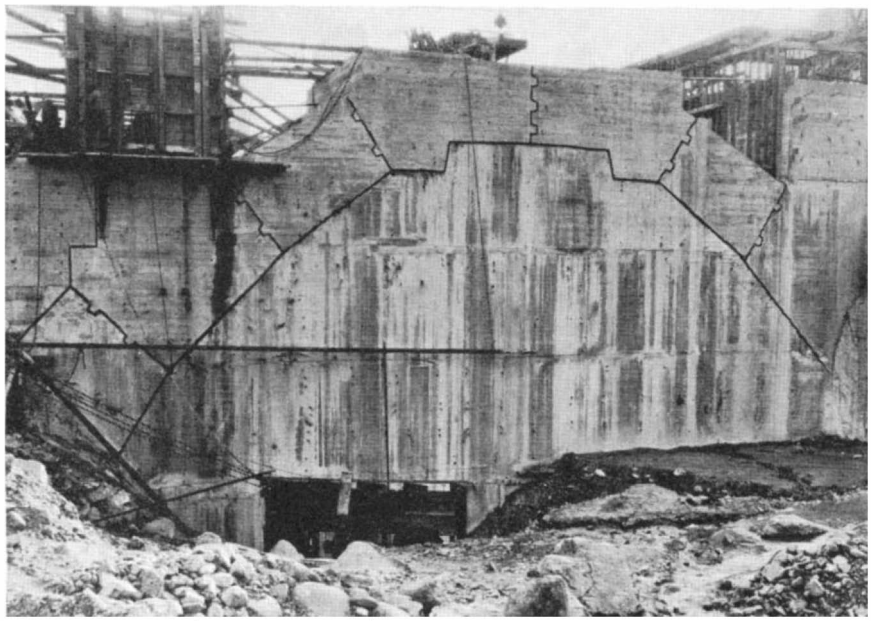
What will be the effect on the conservation of our water supplies if the predictions of Mr. Ford and Mr. Jordan are true? In the first place the migration of industry to suburban and rural areas will create an increased demand for new water supplies, hydroelectric power, flood protection, river regulation, and water transportation.

THE second effect of these changes will be an increased demand for locations where industry and agriculture may be developed economically as parallel or joint ventures. This again will increase the importance of water conservation as the irrigable lands distributed over the west will offer exceptional opportunities to plan scientifically the joint or parallel operation of various industries and agriculture.

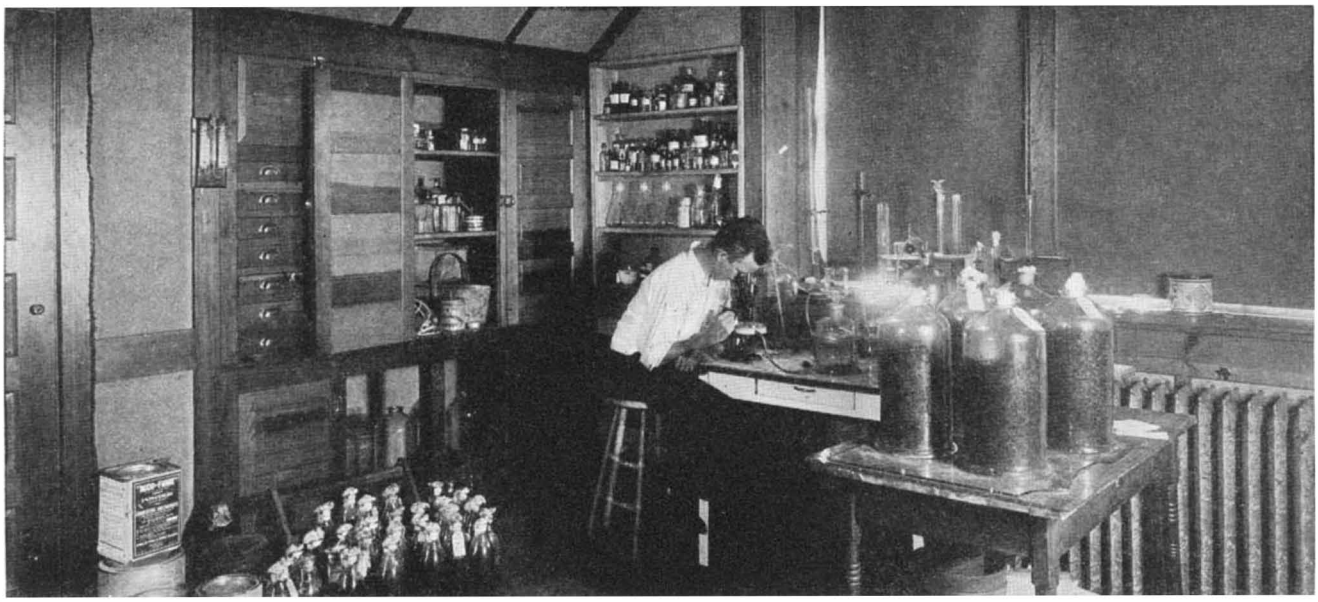
The predictions outlined in the foregoing are already foreshadowed by the anticipated economic benefits from the water to be stored by the great Hoover Dam now under construction. In an article entitled "The Colorado River—Economic Development of the Basin,"[2] Dr. Elwood Mead, America's foremost authority on irrigation and land settlement, stated of the Colorado River Basin: "Every state in the basin has plans for more irrigated acres, for more dams and storages. The known industrial needs are immeasurably greater than was thought possible a quarter of a century ago." Again quoting Dr. Mead: "The basin is rich in deposits of precious metals and useful minerals. Cheap power will do much to bring them into use. Nevada dreams of great mills hung on the canyon walls of Boulder (now called Hoover) Dam. Utah hopes to see the industries of Salt Lake Valley duplicated along the Colorado."

The construction of the Hoover Dam takes the predictions of Mr. Ford and Mr. Jordan out of the realm of conjecture; it offers tangible evidence that industry will be drawn into the widespread agricultural areas of the southwest and such a movement will undoubtedly pave the way for the partnership between agriculture and industry suggested by Mr. Ford. Such developments will stabilize employment, build new markets, create a new agricultural and industrial empire out of our desert lands and increase the demand for transportation facilities. In other words the future stabilization and growth of our economic structure should be founded on the conservation of our water resources.

[2] *Engineering News-Record*, February 6, 1930.



A great masonry arch in the 250-foot-high Rodriguez Dam carries the entire dam load from four buttresses to solid rock on each side of a faulted zone



The Pennsylvania State College maintains laboratories at the cannery for studying mushroom pests and spawn

A Vegetable From the Dark

By A. A. HOPKINS

QUITE off the beaten track at Kennett Square, Pennsylvania, is the mushroom center of the United States. If you were born some 60 years ago you may remember Kennett Square by Bayard Taylor's best seller, "The Story of Kennett." Within a ten mile radius over 500 growers deliver their mushrooms to a co-operative organization which furnishes motor transport so that the easily injured vegetable arrives in New York and other cities in prime condition.

Commercially grown mushrooms are usually of the variety of fungi known as *Agaricus campestris.* The mushroom has no root. This function is performed by what may be likened to a system of minute vegetable strands—the mycelium. The mushroom consists of the stem and the cap on the under side of which are the gills. As the mushroom matures, the gills turn brown due to the formation of thousands of spores. It is said that there are approximately two billion spores in one mushroom. Under natural conditions these spores drop off and are broadcast by the wind.

Commercial spawn is produced by selecting cultivated mushrooms, dropping the spores under special sterile conditions, germinating the spores, and inoculating bottles of sterilized horse manure from the cultures thus made. The bottles grow full of the mycelium which reaches the grower in a pure stage.

There is a new development in the mushroom industry which, while in an experimental stage, is already giving excellent results. The Pennsylvania State College has patented a new process, if it may be so called, of inoculating sterilized whole grain (rye) with spores; under proper treatment the bottles become full of mycelium. The spawn appears to be uniformly vigorous, and the units for insertion in the beds may be made smaller than formerly.

The mushrooms form on the surface of the earth covering the compost and when of proper size are picked

Mushrooms are grown in manure beds in unlighted buildings about 60 feet long and 18 feet wide. Several tiers of beds are usually employed by the commercial grower and the buildings are often two stories high, allowing for a duplication of units. A walkway divides the usual three tiers and there is also room for a person to walk around the outside of the beds. The walls are insulated with about six inches of sawdust. From motives of economy wooden buildings are usually put up but tile structures are more lasting.

THE beds for the growing of mushrooms are composed of cured manure called "compost." It is a curious fact that the almost universal use of the automobile has had a pronounced effect on the mushroom growing industry for manure is both scarce and costly. This has resulted in experiments on manure substitutes which are being carried on by the Department of Botany of the Pennsylvania State College. (See *Mycologia,* Vol. XXII, No. 1.) It is not necessary here to dwell on the preparation of the compost except to say that it must be so manipulated that it is of maximum value as food for the mushroom which lives on the products of the decomposition of the compost. The beds are

filled to a depth of six to eight inches and are well tamped down. The temperature induced by fermentation is allowed to rise to as high as 140 degrees, Fahrenheit, and is then allowed to drop to 80 degrees when it becomes right for the beds to be spawned. The spawn, if of the manure inoculated variety, is broken up into pieces the size of a walnut and these pieces are planted about 10 inches apart, each way, about two inches deep in the compost. The spawn is then covered and the processes of nature are allowed to proceed. These are of an undercover nature for about a month. Meantime fresh air must be provided and moisture and temperature must be controlled.

WHEN the spawn gives indication of coming through the compost the grower is ready to "case in" the bed. This rather cryptic term only means that a layer of about one inch of good soil without clay or humus is spread over the surface of the beds. The mushrooms develop in a temperature of from 54 to 58 degrees, Fahrenheit. The white heads pop up through the dirt and the grower can expect to begin picking mushrooms in from six to ten days. Great attention must be paid to watering, temperature, and ventilation. Here the skill and knowledge of the growers come into full play.

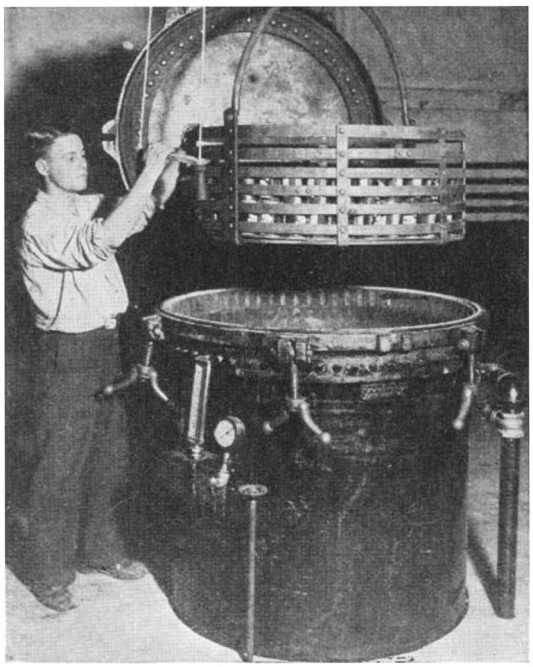
All of the growers have hot water heating plants in connection with the growing houses and in order to extend the duration of the crop and to overcome the possible menace of abnormal high temperatures, some large growers have introduced artificial refrigeration with good results. A wise grower tries always to have some beds in full bearing so that his production cycle will be nearly uniform.

The men who do the picking carry two baskets and a paring knife. The butt to which the earth adheres is cut off and put in one basket while the mushroom proper as we know it goes in the other. The beds are picked over once or twice a day as new mushrooms attain their full size. The beds continue to bear for a period of from three to six months.

Mushrooms are separated into grades by color and size. The first grade includes the largest mushrooms which are free from blemishes. The second grade is of medium size. The third grade is the smallest or "button" variety. The fourth grade is made up of all kinds of "seconds." The shipping baskets are lined with thin parchment paper and usually the quantity of mushrooms in each weighs three pounds. The Mushroom Growers Co-Operative Association has a fleet of 27 motor trucks, each holding from 1000 to 3000 baskets and which ensure early morning delivery in New York, Newark, Philadelphia, Baltimore, and Washington. We are indebted to Mr. Walter W. Maule, Secretary of the Association for many courtesies during the writer's visit to Kennett Square last summer.

The freshly picked mushrooms are delivered to the cannery daily where they are trimmed and sorted into canning grades

The washed, blanched, and cooked mushrooms are weighed in cans before filling with brine



The sealed cans are lowered into the clavier or retort for final cooking under steam pressure

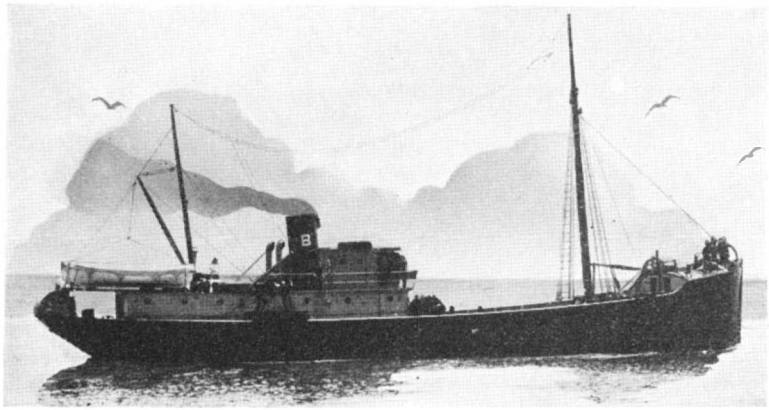
Canned mushrooms, usually imported, have long been one of the pillars of the housewife's pantry shelf, but since 1918 the domestic product has steadily progressed in public estimation and now competes with the products of France and Italy. In 1931 there were five canneries in Pennsylvania and four elsewhere. The canneries remove from the market a considerable part of the surplus crop during warm periods in the autumn and spring. The domestic canning of mushrooms was started for two reasons, both of which are fundamentally sound. First, it secures a wider distribution of the mushrooms. Second, canning affords an outlet for the smaller sizes desirable for canning.

MUSHROOMS were originally packed in two grades: first, "buttons," a small whole mushroom; second, stems and pieces cut from mushrooms too large to can. In recent years a very fine grade has been added. This consists of whole mushrooms cut into thin slices which are ready for serving without further cutting. Mushrooms are delivered daily in the canning season direct from the growers' mushroom beds to the cannery; hence they are in prime condition. Girls immediately trim and sort them into the three grades noted above. They are then washed and blanched and receive their initial "cook." Inspections are constant. Finally girls weigh the mushrooms out in two, four, or eight ounce cans. Brine made from salt is added and the cans are sealed. The contents then receive a final cooking under steam pressure in a clavier, or steam retort.

THE TELEPHONE GOES TO SEA

Phoning From The Fishing Fleet Is Now As Easy As Phoning From Your Own Home

By C. W. TUCKER



The trawler *Flow*, one of the first of the fishing boats to be equipped with radio telephone apparatus for communication with land phones

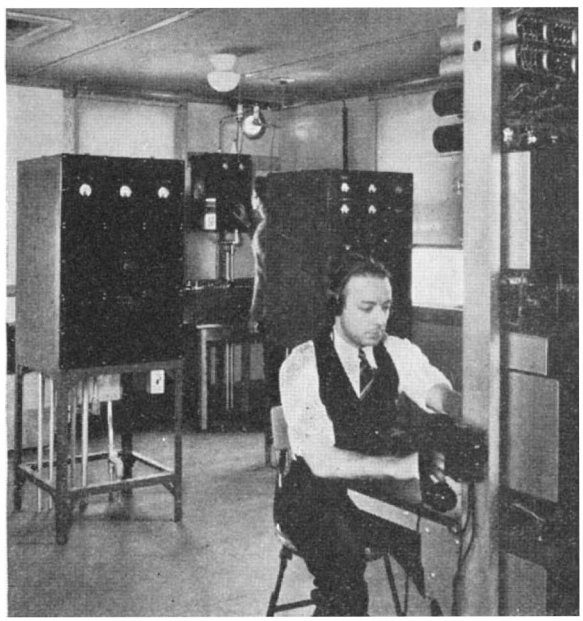
THE traditional picture of the fisherman usually shows him fighting wind and wave with his comparatively small craft, or grappling with a tremendous haul. The romantic view of him is true, but the fisherman, at the same time, is, and has been, a business man with the usual problems that go with business. Like any other dealer in a perishable commodity, or like the trader in stocks and bonds, he faced a fluctuating market. But he had no ticker tape to tell him where he stood.

The market for the fish he expected to bring in might rise to unexpected heights, but until recent years there was no means of communication to appraise him of that fact and to bid him to return while his catch might be worth more than a greater catch at a lower figure. An accident might happen to the machinery of the boat—a broken propeller, a cracked cylinder head, a disabled water pump. When the boat came limping into port, days late, it was necessary to lose more time from the fishing banks waiting for parts to be ordered, delivered, and installed. In case of storm and shipwreck the crew had to fight their way to safety as best they could. There was no way to summon help. A chance ship happening along was their only hope.

THEN came the wireless telegraph to add safety and efficiency to the fisherman's life. Then radio stations began to broadcast market prices which could be picked up by boats having receiving sets on board.

Now Bell Telephone Laboratories have developed a system which not only makes communication possible and practical between the small fishing boat and land, but actually puts this communication in the form of regular telephone service. The New England Telephone and Telegraph Company has recently installed such a system and has opened a marine telephone service at Boston which makes available to the fishing ships at sea the entire telephone service rendered on land. The equipment is extremely simple and needs only occasional supervision. No trained operator is required and the necessary license is issued upon passing a very simple test.

Already several trawlers have been equipped with radio telephone apparatus. With ships so equipped, the fish dealer on land may communicate directly with them while they are at sea any time he wishes to do so. If anything happens to the ship's engine or the fishing gear, the captain can telephone the office on land and have replacement parts brought out to him by a light boat. Repairs can be made while the fishing continues. This not only spares the expense of having the big boat journey back to the shore but also avoids interfering with its time at the fishing grounds.



Operating room at Green Harbor, Massachusetts, where calls pass to and from the fishing fleet

THE land equipment consists of a radio transmitting and receiving station connected to the regular land-line telephone system through a nearby central office. This gives the members of the crew access to the whole telephone system. Just to demonstrate the efficiency of the marine telephone, several long distance calls were made from the trawler *Flow* on its first trip after radio apparatus had been installed. One of the engineers called up a friend in Seattle, Washington. He found it extremely difficult to convince her that he was actually talking from the fishing banks off New England.

C. F. Fauci, of the Fauci Oil Company, operates two Diesel trawlers in the offshore fishery, one the *Gertrude M. Fauci* and the other the *Francis C. Denehy*. In June, 1932, he had the trawler *Fauci* equipped for radio telephone service and shortly afterward made the following statement:

"We use the telephone not only for routine reports to and from the trawler at sea, but also for weather conditions, market information, time of arrivals, delays or other changes in plans."

While the equipment aboard ship must obviously be more extensive than the telephone instrument and bell-box with which the telephone user on land is familiar, operating the equipment is little different from the act of making a telephone call on land. To a great extent, the system works automatically and requires only casual attention. The equipment for the system is manufactured by the Western Electric Company.

A loudspeaker in the pilot house takes the part of the telephone bell in the land telephone system. The receiver, left on a fixed setting, is tuned to the transmitter on shore. Consequently when a boat is called, its name or number issues from the loudspeaker with sufficient volume to be heard in the pilot house. When the pilot hears the name of his own boat, he merely removes the hand telephone set from its hook and is ready to start talking. The only difference between talking over the marine radio telephone and an ordinary telephone on land is that the person on shipboard presses a button when he desires to talk and releases it when the other party to the conversation is talking.

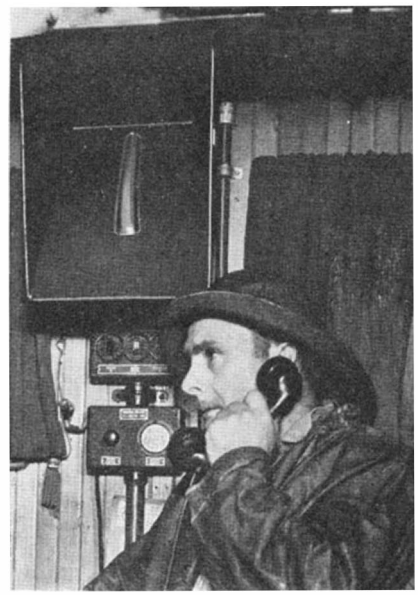
A MASTER switch on the control apparatus in the pilot house controls the power circuits. When this switch is put in the "on" position, it places the radio receiver and the loud speaking telephone in circuit and actuates the crystal heater circuit in the transmitter.

When the boat is called, the person answering lifts the handset from the hook. Releasing the hook removes the loudspeaker from the circuit and transfers the output of the radio receiver to the telephone receiver or ear-piece of the handset. Two-way conversation is then carried on by means of the handset. When the user presses the button in the handset, the radio receiver is cut off from the antenna. This action operates the carrier control relay of the transmitter and places the carrier wave on the air. Consequently the system on shipboard is then set for talking instead of receiving.

When the conversation is ended, returning the telephone handset to the hook removes all power from the radio transmitter with the exception of the heater supply which maintains the quartz crystal in the radio transmitter at the proper temperature and ready to operate without any delay. The loud speaker is also returned to the receiving circuit and the equipment is again ready to receive another call. Red and green signal lights are provided to indicate visually the conditions of the circuits.

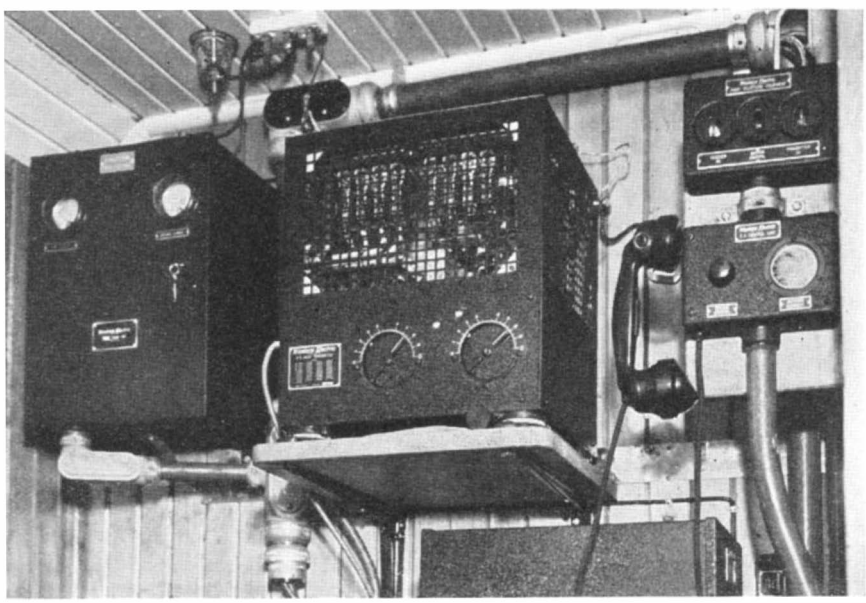
Filament and plate current for the transmitter and receiver may be provided in several different ways to suit the conditions aboard the vessel. In one case the filament current is furnished by a 12 volt battery which also provides current to operate two dynamotors, one of which generates current at 220 volts for the receiver vacuum-tube plates and the other current at 1050 volts for the transmitter vacuum-tube plates. In another arrangement this current is provided by a motor-generator set operated from the electric plant on the boat. In a third method a steam turbine operates a turbo-generator. In still another setup an automatically controlled gasoline engine drives a generator producing current at 1050 volts and 12 volts which in turn operates a dynamotor generating current at 220 volts. The engine is automatically started when the handset is lifted from the hook in the pilot house.

While the transmitter is rated nominally at 500 watts, it is capable when modulated of a peak power output much greater than its rating. It may be adjusted to any frequency in the range of 1500 to 6000 kilocycles (200 to 50 meters), adequately covering all channels assigned by the Federal Radio Commission for harbor radio-telephone service. A quartz crystal keeps the transmitter on its frequency within limits of plus or minus 0.025 percent.



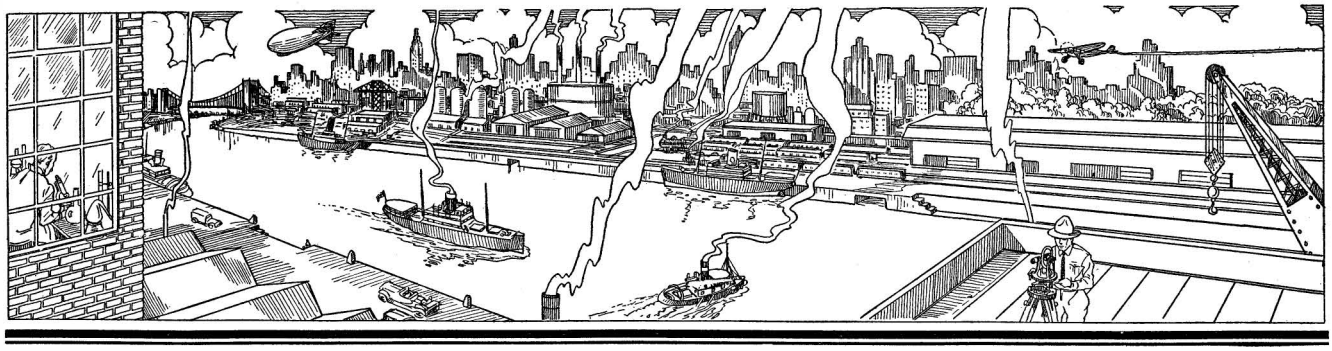
The "telephone booth" on a fishing boat, showing (top) the loudspeaker that replaces the phone bell

The receiver is of the super-heterodyne type. It is capable of satisfactory loudspeaker volume on signals of very low intensity. No external variable tuning controls are provided as the tuning operation is performed by setting the tuning elements to the operating frequency when the apparatus is installed. This is equivalent to locking the receiver and reduces the possibility of its becoming detuned by accidental changing of tuning controls.



The radio telephone equipment on a fishing boat. The controls of the tuning apparatus are locked at a certain wavelength to prevent accidental detuning

THIS latest application of the radio telephone gives aid and comfort to those who spend their lives on the water. No longer need the operator of a fleet of boats whether they be fishing or tug boats, oil barges, or what not, sit in his office and wonder what has become of one of his fleet and why it does not come into port. When the fleet is equipped with a marine telephone he has but to lift his telephone and he learns the exact conditions, he directs operations, and satisfies himself that the decisions made by his subordinates are in keeping with his best judgment. The master of the boat knows that his chief on land is aware of his decisions, approves and stands behind them. The adventure, the heroism, the hard work of the fisherman's life are still there. But as a business, it has been put upon a better business basis by the radio telephone.



THE SCIENTIFIC AMERICAN DIGEST

Conducted by F. D. McHUGH

Contributing Editors

ALEXANDER KLEMIN

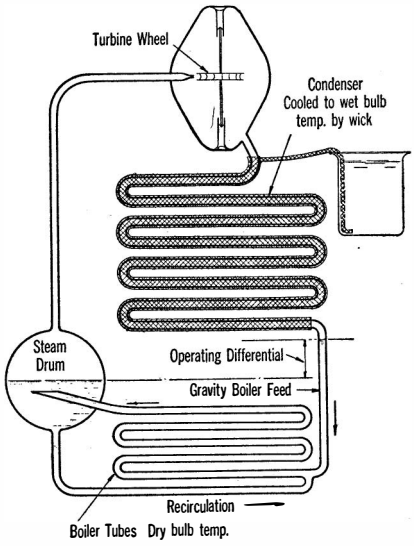
In charge, Daniel Guggenheim School of Aeronautics, New York University

A. E. BUCHANAN, Jr.

Lehigh University

Germs More Harmful from Active Cases

AMOEBAE, tiny parasites that cause one type of dysentery, have more disease-producing ability when they are taken from active cases of the disease than when they are taken from symptomless carriers. Likewise, these parasites are more potent for producing disease during an epidemic than when the infection is less active. These conclusions, based on studies of the parasite in kittens, were reported to the American Society of Tropical Medicine by Drs. Henry E. Meleney and William W. Frye of Nashville, Tenn.—*Science Service.*



Perpetual motion? No—the interesting vapor turbine described below

Perpetual Motion—Almost

AT the Power Show in New York City recently, a novel power plant made entirely of glass except for the turbine wheel, was exhibited by the Cochrane Corporation of Philadelphia. Depending wholly on the difference between the temperature of the atmosphere, as shown by an ordinary thermometer, and the temperature of a wet bulb thermometer, the turbine wheel of this small unit rotated at high speed without drawing power of any kind from any other outside source. In a sense, therefore, we might say that this is perpetual motion so long as the condenser—that is, the wet bulb—is supplied with water and the surrounding atmosphere is below the point of saturation.

The vapor turbine plant consists of a boiler in which steam is generated by the heat of the surrounding atmosphere, a nozzle through which this steam jets upon the buckets of a turbine wheel mounted on jeweled bearings, and a condenser cooled by a continually wetted wick. The condensate returns to the boiler by gravity as in mercury boiler operation. In an ordinary atmosphere the turbine wheel will spin indefinitely so long as the wick is kept moist.

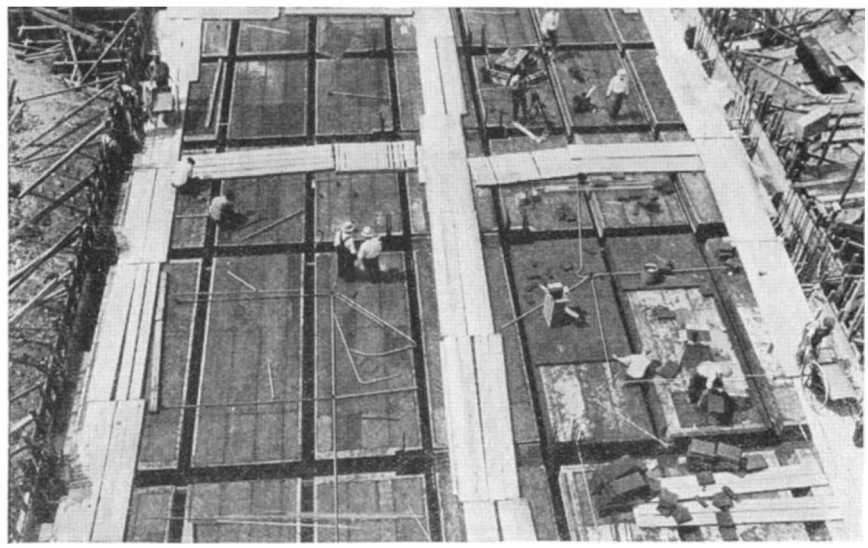
A diagram of this power plant is given in the accompanying illustration and it may be noted here that the plant itself is as simple as the diagram. In operation there is no movement or action of any kind except the whirling of the tiny turbine wheel, no stream or flow of water being visible.

It may be interesting to note further a few dimensions of this plant. The boiler heating surface is 1.88 square feet, the condenser surface 1.25 square feet, diameter of nozzle .002 of an inch, the spouting velocity of the steam at the nozzle 600 feet per second. The temperature difference assumed between wet and dry bulbs is surprisingly high, being 10 degrees Fahrenheit. In view of the fact, however, that the horsepower of the jet is .000016 and the Rankine cycle efficiency is 1 percent, this power plant can hardly be considered as anything more than a novelty demonstrating certain physical laws. It could not do useful work.

In this connection it may be well to state that perpetual motion in its generally accepted form still remains a dream which physicists say is impossible of achievement. SCIENTIFIC AMERICAN does not, therefore, invite the usual flood of perpetual motion ideas by publishing the above note.

New M.I.T. Laboratory

A TEN-ROOM building, built like a refrigerator, where temperature is controlled to within one tenth of one degree, Fahrenheit, a floor slab six feet thick designed to eliminate all effective vibration, laboratory rooms so well insulated that without added heat their temperature would not drop more than one degree during three weeks of cold winter weather—these are some of the unusual features of the new spectroscopic laboratory recently completed at the Massachusetts Institute of Technology. The laboratory is designed to provide the most favorable conditions possible for experiments of unparalleled delicacy in spectroscopy, which is the investiga-



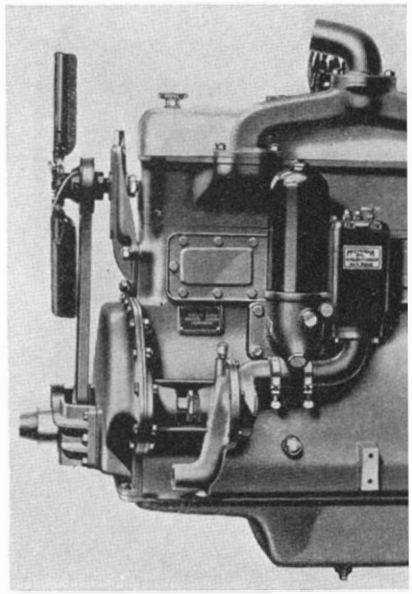
Heavy corkboard insulation is used in the new M.I.T. laboratory

tion of matter by study of the light emitted when electrons are hurled into the atoms of which it is composed.

Humidity and temperature within the building are controlled by an air-conditioner and an electric heating system. The air-conditioner guarantees a year 'round humidity ranging between 35 and 45 percent, while the thermostat-controlled heating system maintains a temperature within the experimental rooms varying no more than one tenth of one degree from 60 degrees, Fahrenheit, and no more than three degrees from that temperature in the corridors.

These close limits must be maintained during any given test period of a number of hours or weeks, and cork insulation was selected as being the material most capable of aiding in the maintenance of these temperatures for as long as the laboratory stands.

The outer protecting building is 95 feet long, 54 feet wide, and 24 feet high. Two large rooms are the giant spectrum laboratories and in them light is broken into the colors of the spectrum. These rooms are known as the grating rooms, since the light beam of the substance being studied enters through a small opening and strikes what is known as a diffraction grating. This instrument is in effect a metal mirror six inches in diameter. Upon its face are 90,000 diamond-ruled lines, 15,000 to the inch. The light strikes upon this grating, is broken up into the colors of the spectrum, and is reflected at various angles to the photographic plates which stand about the room playing their part in what might well be termed a scientific round table of light.—*A. E. B.*



The manner in which the new oil conditioner is installed on the engine

"Cheap" Light Bulb Fallacies

Low Cost Bulbs May Mean High Electric Light Bills

RIDING along on the depression tide, a motley collection of so-called "cheap" incandescent lamps are invading American homes to the extent that our electric manufacturers and public utilities are rising up in arms against this conquest which sends 3,000,000 inferior lamps into this country every month.

Cheap foreign labor, assisted by a low American tariff and difference in exchange, permits the Oriental manufacturer to place incandescent lamps on our counters at a price much below that of the domestic product—often, in fact, below the American manufacturer's actual cost. In all appearances like the American product (purposely made that way), these lamps are sold to the public without guarantee or responsibility, and the public continues to buy them, not realizing they are grossly inefficient in light output for the current used. These are "wolves in sheep's clothing."

Fooled by the general appearance of the "boot-leg" lamps, the average citizen does not realize his mistake. Incandescent lamps manufactured in this country have been developed through constant research to a point where they save something like 200 million dollars a year in cost of current consumed for the light given as compared with what they did 10 years ago. The careless buyer has so long experienced only *good* lamps that he assumes all lamps sold in this country are sold on the principle of giving the most light for the least money. Unfortunately, the buyer doesn't suspect deception.

Of the millions of lamps imported into this country every month, a percentage should be wrapped in a dollar bill before they are sold to the customer, because they will consume that much more current for the light they give than a lamp of standard American manufacture which sells at only a few cents more.

The initial cost of these lamps is about 10 cents. This price represents low standards of living in foreign countries. The wage paid to the girls engaged in their manufacture is but little over 10 percent of the wage paid by American manufacturers for the same type of work. Practically all the lamps made under these conditions are shipped into the United States. Most of the lamps manufactured for home consumption in those countries are of a higher standard.

Tests conducted under the auspices of the lamp committee of the Association of Edison Illuminating Companies indicated such lamps to be a menace to the excellence of American lighting.

The great testing laboratories maintained in behalf of the light and power companies and the standard lamp manufacturers, however, are constantly at work determining the facts about all lamps, good and bad. For example, one group of 48 of these imported lamps was thus purchased through various retail outlets and tested. Twenty-five percent of them failed or burned out during the first few minutes of operation!

Just why such wide variances in performance should occur in an electric light bulb is understood when it is realized that the hundreds of millions of lamps which light our homes, factories, offices, and stores are not common objects at all but precision instruments of the most delicate caliber. The filament, for example, used in a 40-watt standard American lamp is only about half the thickness of a human hair. Now, if the diameter of this delicate wire should be fifteen hundredths of one percent less at any point, the life of the lamp would be shortened by as much as 23 percent.

The length of time a lamp will burn is not a measure of its value. Its life must be accompanied with brightest output of light at the least consumption of electric energy. Some of the imported lamps, for example, may actually outlast standard American lamps, but the longer a wasteful lamp burns the more costly it is. So the inefficiency of such lamps results in unduly high current consumption which appears in higher electric light bills for the user.

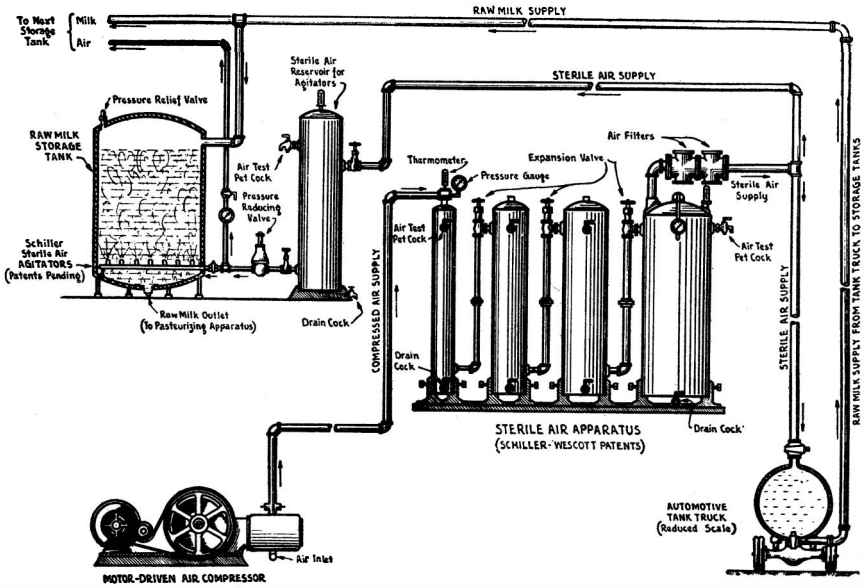
To illustrate this point, a case can be cited of a 50-watt lamp which was tested in one laboratory. It burned nearly three and one half times as long as a lamp of standard American manufacture but it operated at such low efficiency that it used $3.90 worth of electricity for which no value in light was received.

People should not be fooled by the size of lamps. Small lamps can waste as much and more than larger lamps. A test made on a small lamp marked "5 watts" such as might be used in a night light, proved that, judged by American standards, the user should have received the lamp free and 73 cents in cash to compensate for the extra 73 cents this little lamp added to the light bill.

Oil Conditioner

MEANS for maintaining the predetermined and most desired lubricating oil system in an automobile engine have long been sought by engineers. The ideal, assuming first that proper distribution and pressures are assured, would be an oil of constant viscosity, freedom from contamination and loss from causes other than actual work done. While there will be loss from seepage, capillary attraction and vaporization due to high crankcase temperatures, the major loss has been and at present is the oil which is thrown away after a relatively short mileage, due to contamination resulting from operation. In other words, the oil is discarded due to particles in suspension which result from dust and dirt taken into the breather and products formed within the crankcase. Contaminated oil heats faster and vaporizes more and is less viscous than clean oil. It is therefore obvious that proper filtering is of major importance.

The general adoption of oil filters on internal combustion engines prove their value. Up to the present time most oil filters used on passenger cars have been installed as shunt type installations; that is, part of the oil from the pump was forced through the filter and returned to the crankcase. There is an increasing trend in present day design to improve on this condition and to place the filter in series between the pump and the bearings and to attach it directly to the crankcase so as to avoid exposed oil lines. This is the H-W filtering principle, developed by Michiana Products Corp. This filter is designed so that the contamination, grit, dirt, metallic particles,



Schematic diagram of the air compressor used in agitating milk

colloidal carbon, and water can be easily removed from the filter.

Recent developments in engines have resulted in higher engine speeds, higher compressions and more power per cubic inch and have created the need for an oil temperature control which would permit the use of oil of low enough viscosity for easy starting and which would maintain a high enough minimum viscosity for proper lubrication. This requires cooling the oil.

The Michiana Oil Conditioner was evolved to meet these dual conditions. It is designed for series installation and direct crankcase application, and the cooling unit is interposed between the radiator and engine. The oil passes through a cleaning filter within the unit and its temperature is brought down to that of the radiator water because the water is also flowing through a chamber of the unit. The cast iron base forms the sump of the oil filter and also the housing for the oil temperature control.

The filter element may be either the standard felt compression element or of the micro-mesh design. The cooling unit is the standard Harrison Viscon Oil Temperature Control. In tests this unit has shown capacity to hold the oil temperature down to within about 15 degrees of the top tank temperature of the radiator.

Agitating Milk with Sterile Air

WITH the advent of the tank car and tank truck method of hauling milk in bulk from country receiving stations to city dairies, it became necessary to unload the milk as quickly as possible. The first method used—the mechanical or electrical pump which emptied the tanks slowly—was costly and wasteful, and churned the milk so that the fat globules were broken up and its creaming ability was impaired. This method was wasteful in that some of the milk was left in the tank truck and discharge line from pump to storage tank.

The obvious disadvantages of the pump method of transferring and agitating milk led investigators to experiment with methods of forcing compressed air into the tank truck or tank car. This led the investigators to develop a means of cooling, purifying, and sterilizing compressed air.

The result was a new and sanitary method of unloading, transferring, and agitating milk by means of clean sterile air produced without the use of chemicals or heat, except what heat is generated in the process of compressing with the simple method and apparatus shown here. This is the Schiller air sterilizing apparatus, invented by Joseph F. Schiller, of the American Pure Air Company.

It consists of a series of four tubes of different diameters with needle expansion valves on the inlet pipe of each tube. The air, in passing through the first expansion valve, expands as it enters the first tube. It is again expanded when passing through the needle valve into a still larger tube. This process continues until the air finally passes through the fourth and largest tube. The air leaving the compressor is immediately cooled by expansion to 70 degrees, Fahrenheit, as it passes through the first expansion valve and each expansion further cools the air until it leaves the last tube at about 65 degrees, Fahrenheit. This process renders the air cool and sterile.

At present milk that is received in tank trucks is being unloaded and transferred by means of this apparatus; also the apparatus is being used for agitating the milk while in storage for two of the largest dairies in Philadelphia. This is a great saving in time and costs over the old method of transferring the milk by means of pumps and agitating it with propellers which, in beating the milk, weaken its creaming ability and leave a heavy foam in the tank.

By means of this system sterile air not only blows all the milk out of the tank trucks, but cleans the lines and coolers, leaving them dry and in a more sanitary condition than when pumps are used.

In agitating milk in storage tanks the pure sterile air rolls the milk gently with very little foaming, taking out grassy and feed odors, making it taste sweeter, and leaving no fatty foam in the bottom of the tank. Experimental work done with this apparatus indicates that it is easily adaptable to other industries such as biological and pharmaceutical products, bread baking, fermenting processes, film production, and other processes where sterile air is employed.

Floating Pump

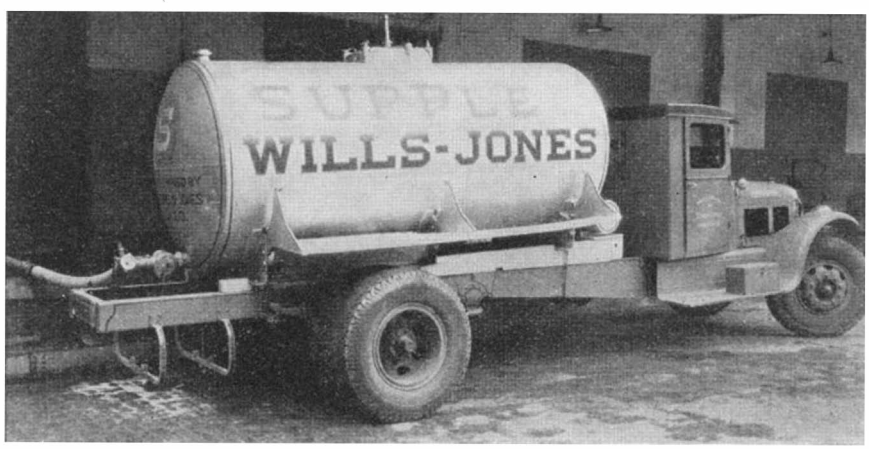
HAILED as an idea as simple and original as Columbus' egg, a pump that floats on the surface of the water or other liquid it is to deliver, has appeared on the German market. The electrically driven pump is carried by two hollow metal pontoons, and sends its discharge up to the ground surface through a hose.—*Science Service.*

Heart Favored by Evolution

EVOLUTION, in the course of the millions of years since animals first developed a heart, has so favored that all-important organ that today, in man and the higher animals, resistance to disease is a tribute to what nature can do when she sets out to develop a special organ, Dr. Carl Vernon Weller, director of the University of Michigan Pathology Laboratories, told the National Academy of Sciences recently.

To insure that the life-giving blood stream will not fail, the heart muscle has developed several protective qualities which seem to be inherent and are not shared in the same degree by any other single tissue in the body, said Dr. Weller. Some of these qualities are difficult to explain except on the ground that they have great biological significance and evolved to maintain the integrity of this vital organ.

Most striking is the fact that young trichinae, the slender worm parasites which enter the body during the eating of poorly



Air from the compressor-sterilizer enters through a pipe at the top of the milk tank, and the air pressure forces the milk out through hose at the rear

cooked meat, find it impossible to form their cysts in the heart muscle, though they succeed with almost every other. Again, the heart is remarkably free from metastasis, or transfer of malignant tumors by way of the blood stream; the heart muscle resists visceral syphilis to a high degree, although it may be extremely active in the aorta, and, following the lesser "occlusive" or closed lesions, the arrangement of the arterial blood supply results in an admixture of living and dead tissue rather than a continuous area of necrosis, or tissue death.

Sponge Rubber

RECENT investigations have shown that the addition of 15 to 20 percent of urea to rubber mixes gives a highly uniform sponge rubber. At the temperature of vulcanization, the urea decomposes to a mixture of ammonia and carbon dioxide, which acts as the inflating gas. If the urea content of the mix be reduced to 10 percent, a very finely pored rubber results.—*A. E. B.*

Nation's Health is Good

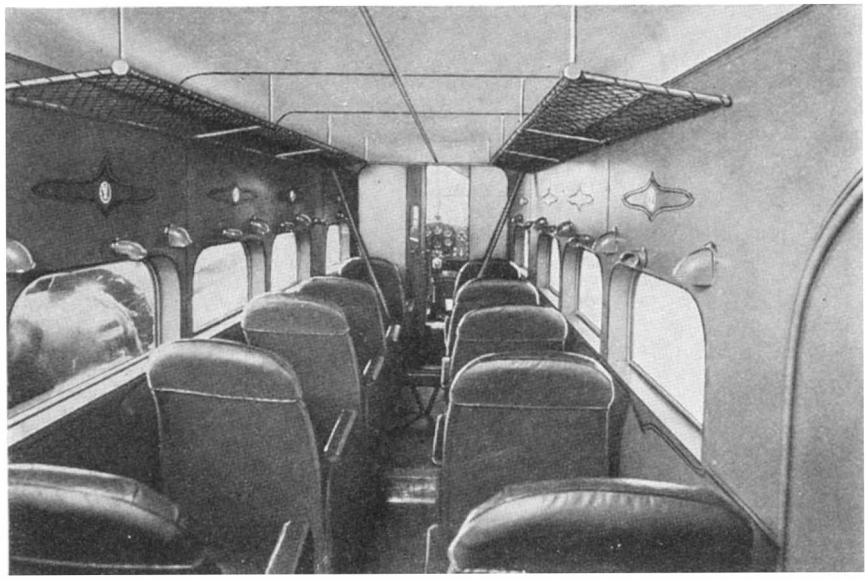
THE health of the people has continued generally good, despite economic depression and unemployment, Surgeon General Hugh S. Cumming declared in his annual report to Congress made public recently. He warned against making any predictions as to future effects of the depression on the nation's health.

A new low record for the tuberculosis death-rate was established and a low diphtheria death-rate was also recorded for 1931.

Scientific achievements of the research staff of the United States Public Health Service included discovery that cultures of plague germs could cause disease after being stored for nine years and that the causative virus of endemic typhus fever remained alive in rat fleas for 52 days. It is thought that fleas once infected remain infected throughout life, an important point since it is this insect that transmits the disease to man.

Vaccination for smallpox should be done before baby's first birthday or else after he has had protective doses of diphtheria toxoid, other scientific studies of the service showed.

About one fifth of all planes arriving from tropical countries were found to bring one or more species of mosquitoes with them. While there is danger of introducing yellow fever by airplane, the greater danger is the introduction of new species of insects not indigenous to the United States which may prove harmful or dangerous.—*Science Service.*



Comfortable chairs, individual reading lights, individual ventilation scoops, ample windows for vision—these are important features on the plane shown below

"Selling" Flying to the Public

NO one as far as we have heard has ever studied the railroad time table with any degree of romantic pleasure. On the other hand, steamship pamphlets are often read with excited attention and may provide as much pleasure in anticipation as the actual sea voyage itself does in actuality. We think that the leaflets now being issued by the great transport organizations such as the United Air Lines, Transcontinental & Western Airways, and American Airways are as attractive and interest arousing as any of the steamship booklets.

While the number of air travelers is growing steadily and rapidly, there are still millions of Americans who do not know just what air travel has to offer. The pamphlet tells the story and tells it honestly. A telephone call to one of the 4000 agents located in hotels, travel agencies, and Postal Telegraph offices is all that is necessary to make reservations. Scheduled buses or cabs bring the passenger to the airport terminal. The average time from the center of town to the airport is about 25 minutes, which is not at all bad considering the ensuing time saved.

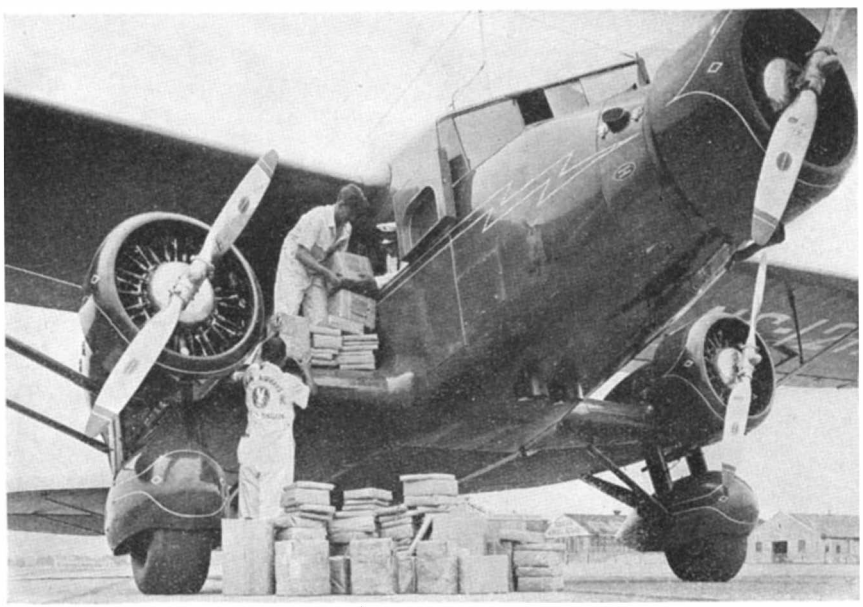
Regular terminals at the airports have uniformed employees, and provide for easy checking of baggage and easy exchange of reservations for tickets. Passengers taking their first flights are impressed by the terminal building with its ticket windows, telegraph offices, comfortable lobbies, plane announcers, arrival and departure boards, and so on.

The dispatcher, watch in hand, waves the plane down the runway, from which it taxies into the take-off position heading into the wind. The engines are carefully checked by the pilot to be sure that they are in perfect working order. A field starter displays the "all clear" flag, the plane takes off and climbs to a predetermined altitude and the whole proceeding is as smooth and workmanlike as the start of the *Twentieth Century Limited.*

The interior of an airliner cabin is comfortable, well lighted, and well ventilated, and the noise is far less than expected, due to the sound proofing and engine mounting. Toilet and wash-room facilities are complete. The modern planes are so large and so stable that reading and writing are very easy. The lines provide the latest magazines and newspapers and, on long trips, excellent light meals.

These flights are conducted nowadays by a remarkable ground organization, including operation managers, radio operators communicating at frequent intervals with the pilot on the plane, beacon lights guiding the plane at night, complete overhaul and inspection engineers constantly studying the problems of the line.

We need not enlarge on the obvious time saving possibilities of the airplane. A very good case is made out by the airways com-



One of the huge Stinson tri-motor planes on the New York to Boston route

A type of glider for auto-towing in which the pilot is protected by an enclosed cockpit, and by wing structure

A German training glider. The wheels, slightly behind the center of gravity, help to prevent nose-over tendencies

panies for lessening cost of air travel. While actual fares are about the same for railroad and air travel, living expenses saved give the airline operator legitimate reasons for claiming that air travel is actually cheaper.

Our photographs show one of the new ten-passenger Stinson tri-motor planes which American Airways have put into operation between New York, Hartford, Providence, and Boston. One picture shows the plane being loaded with a variety of express packages. The baggage compartments are so designed and provided with such doors that loading is simple and fast.

The interior of the cabin speaks for itself. Comfortable chairs, individual reading lights, individual ventilation scoops, ample windows for vision (always closed against drafts and noise), baggage racks, and so on, combine to give the passenger every comfort.

The new planes, of high-wing monoplane design, are powered by three air-cooled Lycoming engines each producing 240 horsepower. They are equipped with two-way radio telephone apparatus and the landing gear and tail wheels have the new low pressure airplane tires.—*A. K.*

Gum Inhibitor for Gasoline

A LIQUID gum inhibitor has been developed for use in the refining industry generally. One gallon or less of this new compound will effectively treat 100 barrels of gasoline and prevent the formation of harmful quantities of gum in cracked gasoline during extended storage. Other advantages claimed are that it reduces treating costs, avoids volumetric losses, and preserves anti-knock values. The new inhibitor vaporizes with the gasoline and prevents gum deposition in the manifold of the motor and on valves.—*A. E. B.*

Will Gliding Revive?

GLIDING is a scientific sport. It is inexpensive, and with proper precautions, it is safe. Gliding is a natural introduction to powered flight and to practical aerodynamics. In Germany, this sport has never ceased to grow in popularity.

Why then is gliding in the United States at such a low ebb?

A. C. Haller, of the Haller School of Soaring Flight, has done his best to give us a fair picture of the situation, and the following paragraphs are based on the information thus obtained.

In Germany, it is estimated that over 40,000 glider pilots have been trained during the past 14 years, and there are over 10,000 licensed glider pilots actively practicing this sport. Yet to date there have been only three fatal accidents in training all these thousands of students, and only two fatal accidents in soaring contests.

In the United States, it is estimated that 5000 glider pilots have been trained to various degrees of proficiency, but only 339 hold student permits and only 251 hold active glider pilot licenses. And there have been over 20 fatal gliding accidents in the United States since 1928.

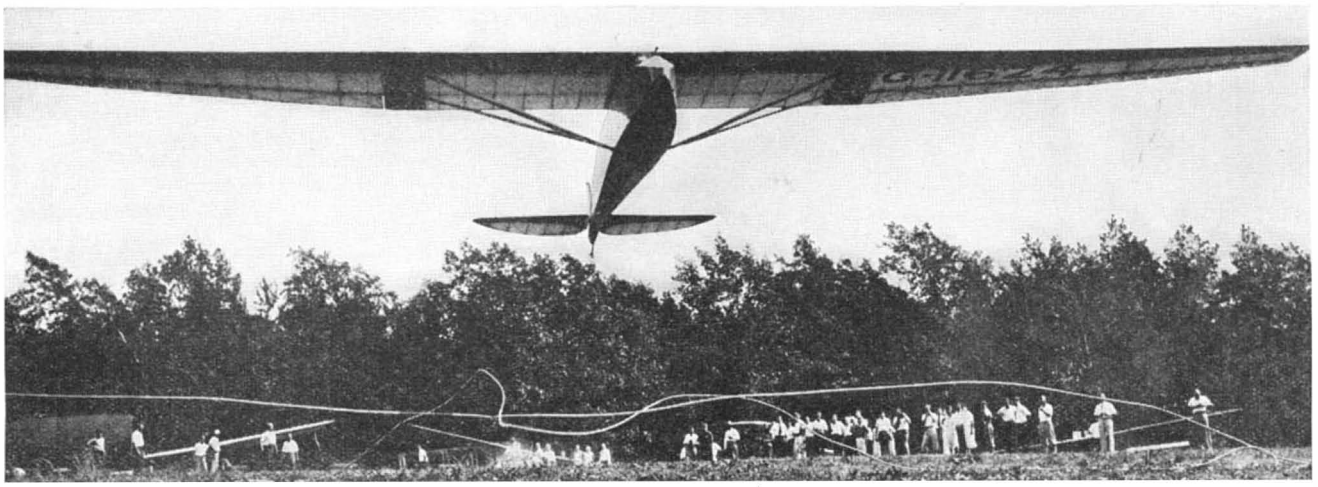
Besides the fact that gliding is an arduous sport, it is the number of these fatalities which, in Mr. Haller's opinion, has been the cause of the decline of the glider movement.

During the happy times of 1927-1928-1929, there was an over-production of gliders. It was generally held that anyone could learn to fly a glider by just being told how, and then teaching himself without the supervision of an experienced instructor. Pilots of powered airplanes were thought to be glider pilots by virtue of their experience behind an engine. The surprising fact, however, is well established that 10 of the 13 people killed flying gliders in 1929 were powered-plane pilots.

Another reason for accidents was that a German primary glider was adapted to American use, and was balanced for a pilot weight of 150 pounds. These training gliders were then used by boys between 16 and 18 years of age, with weights ranging from 115 to 130 pounds. The static balance of the gliders was therefore wrong.

The Department of Commerce did its best to rectify matters by setting forth easily applied and simple rules. But these could not be enforced because gliding did not come under the heading of interstate activities.

Mr. Haller maintains that gliding should be taught in a definite sequence. A start should be made in the primary trainer of comparatively low span and poor gliding



A magnificent soaring plane, with an enormous wing span, just after launching. Note the launching ropes falling to the ground. This is a Haller-Hawk soarer, in which the skilled glider pilot Schemp attained an altitude of 8000 feet

angle. This training should proceed on a well planned airdrome, clear of powered traffic, and smooth and level. Primary training should be carried out both by cord launching and by automobile towing, conservatively and under supervision. Soaring should only come later, after thorough primary training.

In a well organized school, at low expense, in simple but healthy lodgings, a young man can in a very few weeks learn enough to give himself a new and lasting source of pleasurable activity, without the slightest risk.—*A. K.*

Sky Advertising

OUR readers may remember that a number of years ago a form of "sky-writing" was introduced for advertising purposes. In this sky-writing chemically produced smoke is emitted from a tank; the pilot guides his plane in the air so that the streams of smoke spell out one or two words. This form of advertising is highly effective, but there are a number of difficulties. The chemical smoke is specially designed to maintain the outline of the letters as long as possible; nevertheless, on a windy day the letters tend to become distorted. Also, the pilot has to practice writing a particular set of letters for some little time. Expenses are apt to run high in consequence.

Sky-writing is still employed, but now another form of aerial advertising has appeared which promises to be even more practical. This is the "Sky Ad," developed by the Kellett Autogiro Company. The idea is extremely simple. Behind the autogiro, flying near its slowest speed, is towed a tremendous banner, 150 to 200 feet in length, bearing as many as 20 letters, each 9 feet high. The banner is towed some 400 feet behind the 'giro, and has a specially developed structure so that it will fly properly from an aerodynamic point of view. The two open ended rubber bags or wind socks at the rear end of the banner also help to keep the system flying properly, since they tend to pull the banner back and out, and to keep it approximately vertical. A very effective siren sound apparatus attracts the attention of those on the ground without causing annoyance. With this system, wind does not matter very much and no great amount of practice is required on the part of the pilot.

Many business houses have already employed this novel form of advertising and express satisfaction. There is no reason to doubt its success and utility.—*A. K.*

A Reasonable Criticism

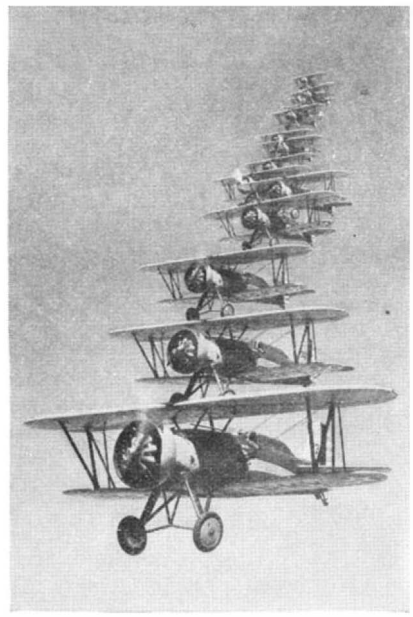
IN our recent description of the new Boeing transport, which had its inception in a bomber design, we stated that any sort of transport airplane could be converted into a bomber and that, conversely, an army bomber might be transformed into a suitable passenger plane.

In a reasonable criticism just received, we find that Boeing engineers are inclined to differ with this statement. These engineers hold that a bombing plane must be specifically designed for the job to which it is to be assigned, and that under no circumstances can it be turned into a transport. In the bomber design, loads are strictly localized and there is difficulty in distributing these loads through a structure not designed to take them. In the transport design the loads are distributed rather generally and to localize them as in a bomber, so these engineers hold, can only be done at great expense and at sacrifice of payload or bombing efficiency.

These criticisms are excellent. Still, much could be done in an emergency.—*A. K.*

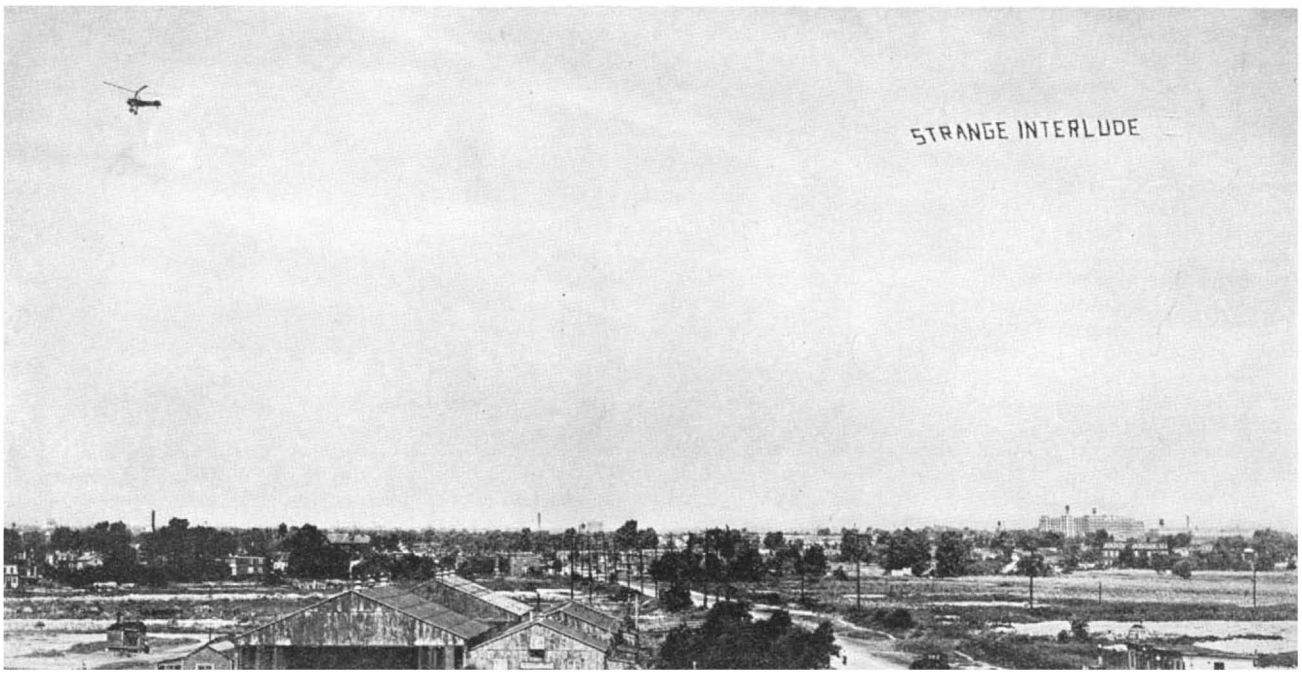
An Impressive Group

IN the next war, which we hope will not come soon, the adventurous pilot of a single-seater fighting plane probably will never have the thrill of fighting on his own. He is more likely to form part of a long thin line, or of a V-formation. Our army and navy pilots have attained remarkable skill in formation flying. Their wing tips seem almost to touch in some of the maneuvers they execute. The formation shown in our photograph is quite as thrilling as any, though we doubt whether it has any military significance.



The "Staircase in the Blue": an impressive group of army pursuit planes in unusual flight formation

In this "Staircase in the Blue" is a group of Boeing P-12 pursuit planes of the 27th Pursuit Squadron of Selfridge Field, Michigan. These planes are powered with the Pratt & Whitney Wasp engines, and are exceedingly fast. Now similar planes have been equipped with the 620 horsepower, double-row Wasp engines. The double-row engines have two rows of seven cylinders each, instead of the conventional nine cylinders all in one row. The great advantage of the double-row engine is that the power is greatly increased without increase in diameter and air resistance of the engine. Therefore the speed goes up to a high degree. Recently, some of the double-row engine pursuits were tested at Roosevelt Field, Long Island. While no



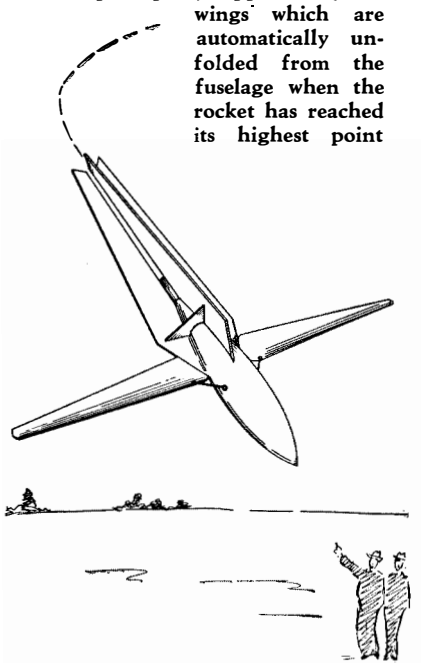
The autogiro adapted to sky advertising, trailing a huge banner with letters nine feet high

official figures are yet available, it is known that well over 200 miles per hour was attained in these neat and businesslike machines.—*A. K.*

The Tilling Rocket

THE rocket may some day become a very dangerous military weapon. In fact, many authorities think that its utilization in warfare is apt to come much sooner than its application in aerial navigation, and they visualize a powerful rocket, guided by wireless and capable of destruction at long range. Perhaps one reason why the

The Tilling rocket returns to earth in a spiral path, supported by the wings which are automatically unfolded from the fuselage when the rocket has reached its highest point



Germans are so interested in rocket development is because they are debarred from the construction of military aircraft. At any rate, more rocket experimentation is carried on in Germany than in all other civilized countries put together.

The latest German rocket design is that of a young engineer named Tilling, of Osnabrück. Tilling recently gave a striking demonstration at the Tempelhof airdrome in Berlin, and our artist has given a conception of the design of the rocket.

The Tilling rocket is made entirely of aluminum and consists of a central shell body to which are attached four long tail fins. The overall length is about three yards. The rocket motor is inserted into the shell between the fin roots; this motor is filled with a special powder which is relatively slow burning. Tilling uses a powder rocket because it is cheap and easy to construct, although for reasons stated below a liquid fuel motor is far superior. The powder motor is capable of functioning for almost two minutes, and thus gives an impulse of sufficient duration for experimental purposes.

The rocket which was tested at Tempelhof can take a powder charge of 48.5 pounds, and calculations show that this charge could drive the rocket to a height of 23,000 feet. As Tilling wished his craft to alight within the airdrome, he only employed a 12 pound charge in his experiment. The powder was ignited from a distance by means of an electric spark, and the reaction of the exhaust gases drove the rocket upward to a height of about 2600 feet. The two wings shown extended in our sketch were hidden in the hollow fins until the rocket had reached the maximum altitude of its flight. Then a simple automatically acting hydraulic device gradually moved the wings out from their sheaths. The wings were not set at exactly the same angle on either side; therefore the rocket, now converted into a glider, did not glide in a straight path to earth, but made its descent in a fairly tight spiral. The landing was made only 400 yards from the starting point. The machine demonstrated had a wing span of a little over 12 feet, and weighed 22 pounds without its powder charge. The wing loading was only 2.5 pounds per square foot.

Herr Tilling is now building a much larger machine of duralumin, which will be guided by wireless from the ground, and will be landed at any desired point. The application to military purposes follows logically from this point.

The larger machine will be equipped with a liquid fuel motor, which is more complicated but at the same time more efficient and better adapted to long distance work.

Our readers familiar with the power of explosives may reasonably enquire why liquid fuel is preferable to powder. Powder has an uncontrollable tendency to explode, because it contains its own oxygen and therefore needs no external element for combustion. But just because it carries its own oxygen, powder is inferior in energy content to a fuel such as gasoline which must receive its oxygen from some external source. Gasoline fed into a combustion chamber into which liquid oxygen is appropriately admitted gives a much more efficient and also a much more controllable motor. Of course, the gasoline-liquid-oxygen motor is more complicated, requiring piping, valves, and so on, while the powder motor involves just powder packed in a tube, an opening at one end, and a means of ignition.

The design of a gasoline *cum* liquid oxygen motor is quite an art, and we hope at a later date to deal with this new phase of combustion engineering at some length. —*A. K.*

Phosphorus, Vitamin D, and Tooth Decay

LACK of phosphorus and vitamin D in the diet is the chief cause of dental decay, according to a report of Dr. R. Gordon Agnew of West China Union University. Dr. Agnew's report summarized his four years of research in which he analyzed 3000 diets.

Depriving animals of these two food elements produced tooth decay in almost one hundred percent of the cases. Experience with the diet of 450 children of a Toronto institution bore out the results of Dr. Agnew's studies on animals. "Our extensive experiments on laboratory animals and humans indicate that phosphorus and vitamin D are the important nutrient elements in the prevention of dental caries. With the laboratory animal, phosphorus assumes a major rôle, but in humans, vitamin D becomes of great importance."

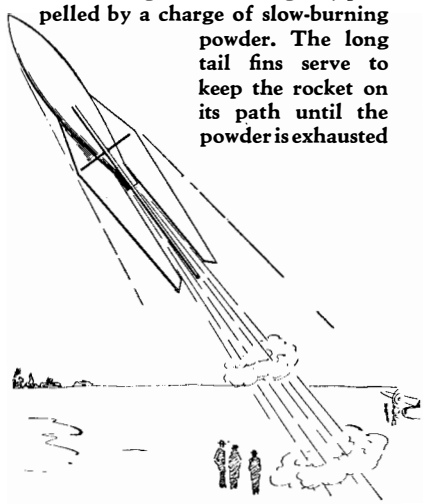
Dr. Agnew's findings check with observations made in the laboratories of Dr. E. V. McCollum of the Johns Hopkins University. Dr. McCollum and associates found that definite proportions of vitamin D, phosphorus, and calcium were needed in the diet in order to prevent tooth decay. They explained this on the theory that the phosphorus was needed in the saliva to enable this secretion to act as a buffer solution, keeping enamel-destroying acid from accumulating. Without the proper amounts of calcium and vitamin D, however, they believed the phosphorus would not get into the blood and then the saliva.

Commenting on Dr. Agnew's work, Dr. McCollum called it one of the more important chapters in the history of nutritional research. "The inference drawn from the research," he stated, "shows that if we get an adequate supply of vitamin D, plenty of milk, vegetables and other foods rich in phosphorus, we can nearly all prevent dental caries. In that event attendant diseases attributed to caries will be materially lessened. It so happens that the average American diet is built around the protective foods rich in phosphorus and calcium. With a little care we can obtain the elements necessary to nutritional well-being, with the exception of vitamin D which is found chiefly in fish oils. Its natural source is found in the skin when activated by the ultra-violet rays of the sun. Unfortunately the sun in northern latitudes is seldom strong enough, so the natural source must be supplemented."—*Science Service.*

Liquid Soap That Won't "Jell"

HAVE you ever jiggled a liquid soap dispenser, only to find that while the glass container is obviously full, the outlet valve is stopped up? Then you have shared the annoyance that has harried the manufacturers of liquid soap. Recently,

The Tilling rocket taking off, propelled by a charge of slow-burning powder. The long tail fins serve to keep the rocket on its path until the powder is exhausted



however, they have discovered that the addition of an organic chemical, ammonium thiosulfate, to their soaps prevents the jelling that causes the trouble. This chemical may be added either dry or in solution, or it may be formed right in the soap by the addition of suitable reacting chemicals. The soaps obtained do not gelatinize, are clear, very fluid, lather well, and are cheap.

One example of this product may be obtained by using 500 parts by weight of

cocoanut oil and 65 parts by weight of caustic alkali of 38 degrees, Bé. After saponification is complete a warm solution of 250 parts by weight of ammonium thiosulfate in 1750 parts by weight of water are stirred into the soap. The mass is then cooled and filtered to remove impurities. When the ammonium thiosulfate is made right in the soap mass, sodium sulfite and ammonium carbonate are added. This chemical takes the place of glycerin, alcohol, sugar, and potash solutions which are normally used in the preparation of liquid soaps and which increase the cost of manufacture considerably, the product obtained not always being suitable or convenient for use in soap dispensers.—*A. E. B.*

Injury at Birth May Cause Mental Deficiency

BIRTH injuries must be blamed for the unfortunate plight of about one tenth of the cases confined to institutions because of mental deficiency, it was revealed by a survey conducted by Dr. Edgar A. Doll, of The Training School at Vineland, New Jersey, in collaboration with Dr. Winthrop M. Phelps, and reported by Dr. Doll at a meeting of the American Psychological Association.

A total of 435 institutionalized cases of mental deficiency were studied, and with 44 of these the mental trouble was caused by an injury at the time of birth. Motion pictures were shown by Dr. Doll which indicated that a peculiar stiffness of the body and spasms or wriggling, particularly of the hands and feet, are characteristic of these birth-injured mental defectives.—*Science Service.*

Horizontally Opposed Bus Engine

IN order to satisfy the major requirements of low floor height and maximum percentage of floor area available for passengers, a new bus developed by the White Motor Company is equipped with a unique engine. This engine, of White company design, is a horizontally opposed 12-cylinder L-head type engine, the bore of which is 4½ inches and the stroke 4¼ inches. The piston displacement is therefore 811 cubic inches and the brake horsepower delivered to the rear wheels is 225.

This engine is mounted in a 3-point suspension using rubber for insulation of the engine from the body and with specially designed mountings to permit easy removal of engine for overhaul. Its flat design permits installation under the floor of the bus so that the maximum of passenger space is available inside the bus. By the manufacturer it is claimed that this engine has unusually high acceleration and silence and smoothness of operation.

The bus is neat in appearance, seats comfortably 44 passengers, and is said to have very high horsepower-weight ratio for faster operating schedules.

Will Extract Soda from Lake

THE waters of Soda Lake, located 14 miles south of Monahans, Texas, are to be commercialized on an extensive scale by the Ozark Chemical Company, of Tulsa, Oklahoma. Contract has been let for the construction of a plant, to cost 350,000 dollars, for the extraction of sodium sulfate from the lake. The company has been making tests and experiments during the past few months to determine the best method of handling the water, and has found that the sodium sulfate can be precipitated in practically its pure state by a freezing process.—*A. E. B.*

Engineering—A Career, A Culture

WE often receive letters from parents requesting information as to what branch of engineering their boys should take up that would promise the greatest profits or the greatest opportunities for success. This, of course, is a difficult problem even for those closely acquainted with the individual boy in question, and naturally a solution by an outsider would be impossible. To solve this problem properly a long and careful analysis of all branches of engineering should be studied by the parent and perhaps by the boy himself.

A new booklet recently published by the Engineering Foundation of New York, under the title appearing at the top of this item, is designed to give this kind of information. In this booklet the professional functions of the engineer are stated with the precision which accompanies intimate knowledge of engineering in theory and practice. The major advantages of engineering are dealt with from this standpoint, the text being descriptive of the profession of engineering, of its sphere of action, of the training and the qualities required for its successful pursuit, of the obligations which it imposes, and of the rewards which it affords.

The pamphlet is being made available through the local sections of the National Engineering Societies, through colleges and their alumni organizations, and the Society for Promotion of Engineering Education. Copies can be obtained also from the Engineering Foundation or from the headquarters of the Engineering Societies in the Engineering Societies Building, 29 West 39th Street, New York. In lots of 50 or multiples of 50 the price is 10 dollars a hundred; for single copies and for lots less than 50 the price is 15 cents a copy.

Cotton Cloth Stationery

KING Cotton, the commodity on which a large percentage of our people depend for a livelihood, has recently shown signs of life in the commodity markets, its price having jumped upward despite large supplies on hand and a new crop just harvested. In order that those who cultivate, spin and weave, and fashion it into consumer's products, may be assured a fair return for their efforts, much research has been carried out to find new uses for it.

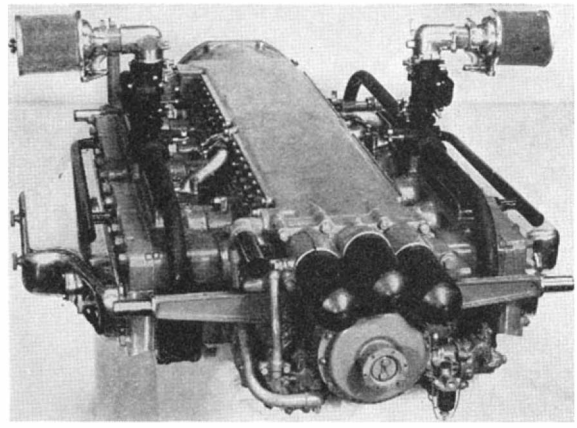
A most interesting new use for it is as stationery for letterheads in the form of a sized cotton cloth. This cloth is the product of a Memphis, Tennessee, mill which treats the raw material according to a formula perfected by S. C. Toof and Company, of that city. The result is a "starched" sheet of cloth having sufficient "body" to take pen and ink writing, typewriting, steel die embossing, lithographing, and type printing equally well.

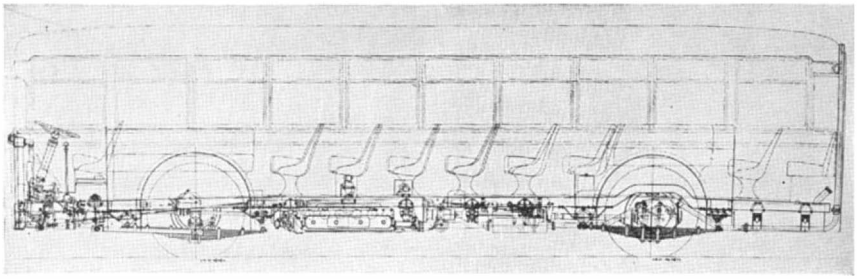
The price of this cotton cloth stationery is, of course, somewhat higher than that of average letterhead bond paper, but it is more distinctive and far less perishable.

The Cost of Medical Care

THE Committee on the Costs of Medical Care, composed of 48 experts headed by Dr. Ray Lyman Wilbur in his capacity of private citizen, has just finished its five-year study of one of the serious social problems of the day and rendered its report which included certain recommendations.

As a result of the 26 scientific studies made by the Committee, a vast body of facts concerning medical service is for the first time available, says *The Yale Alumni*





Right: **The horizontal, opposed-cylinder bus engine.** ***Below:*** **A sectional view of a bus with the new engine installed, showing how this type of engine conserves space. The engine is mounted under the second passenger's seat, just behind front wheels**

Weekly. The data reveal the magnitude of the problem. The people of this country spent in 1929 a total of 3,656,000,000 dollars for medical care in all of its forms. This amounts to about 30 dollars per capita, or 4 percent of the average per capita income. Over 1,000,000 persons, or one for every 123 in the total population, are engaged in rendering medical and health service. The investment in medical equipment and buildings amounts to more than six billion dollars.

At the same time, the data show, in the face of the great aggregate cost, medical service does not reach all who need it. The cost, too, is unevenly distributed, and serious illness still comes as an economic calamity to most families. Much of the expenditure is wasted, as for example, a large proportion of the 360,000,000 dollars spent annually for patent medicine. Physicians generally are inadequately paid, and the future of the profession is not safeguarded, because the status of the physician is by no means always dependent upon his professional knowledge and ability.

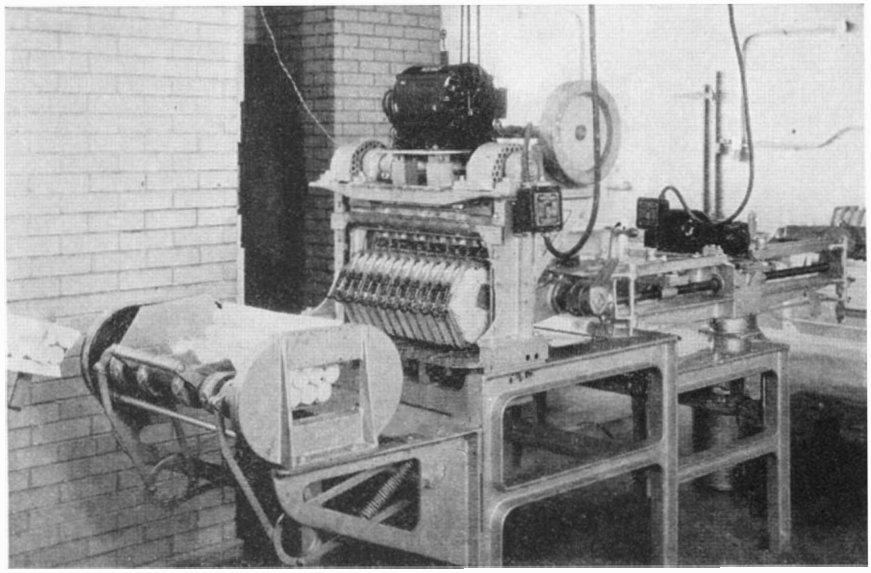
The studies indicate that there is a marked tendency in the direction of "organized" medicine. Sixty-three percent of all hospital beds in the country are now government-controlled, and they render 73 percent of all hospital service, measured in terms of "patient days of care." One seventh of all the physicians in the country are in public service, as distinguished from private practice. Numerous experiments in "group" practice are in process throughout the country. Certain of these experiments seem to indicate that a complete medical service, including hospitalization, dentistry, and every type of care needed by the individual, could be rendered on a group practice plan, with cost evenly distributed, at a per capita expenditure very little larger than that which obtains today, when only a small proportion of the medical care actually needed is provided.

Nickel in Coinage

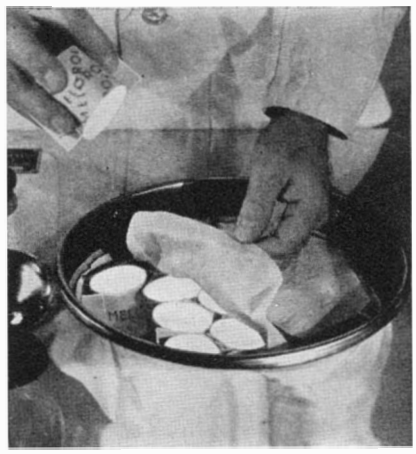
ALTHOUGH nickel was used in coinage as long ago as 235 B.C., it was not until the second half of the 19th Century that its value as a coinage metal began to be fully recognized. Since that time, however, some 24 countries have issued about 3,000,000,000 pure nickel coins; while, if the nickel-copper coins are included, the number of countries is increased to well over 70. New nickel coinages have been issued during the last four or five years by Belgium, Irish Free State, Vatican State, Poland, Greece, and Ecuador.

Ice Cream by the Mile

A NEW way of making and packaging ice cream which eliminates the old-fashioned dipper has been developed by Clarence W. Vogt, president of Vogt Instant Freezers, Inc., and is being adopted by large manufacturers throughout the country. In the new process, air is incorporated into the mix before it is frozen —a desirable, although not essential accomplishment—and the cream leaves the freezer in a stiff, moldable condition, rather than with a "soupy" consistency. The ice cream is extruded as a continuous cylinder and is wrapped in a continuous paper cylinder. This continuous cylinder passes through a freezing chamber, case-hardening the ice cream and freezing it to the wrapper. The cylinder is then cut into 14-foot lengths which are hardened at a temperature of –5 to –10 degrees, Fahrenheit. The 14-foot bars are then cut into shorter sections ready for distribution.—*A. E. B.*



Left: **In this machine, ice cream "by the mile" is cut into individual portions.** *Below:* **The portions being served from a standard container**



300 Trillion Stars

A UNIVERSE of imagination-staggering size, with 300 trillion stars already within the range of the astronomer's largest telescopes and unknown numbers still unseen, was described by Professor Harlow Shapley, of Harvard University, at the autumn convention of the National Academy of Sciences meeting at the University of Michigan.

In only a portion of the sky, 76,000 galaxies of stars, of which our Milky Way is a typical example, have been charted, said Professor Shapley. He expects that eventually 300,000 galaxies will be mapped in the heavens, with an estimate of about a billion stars of which our own sun is an average sample, in each galaxy.

Stars which appear reddish in color have been thought to be very far away, but now Dr. Joel Stebbins, of the Mt. Wilson Observatory, California, reported to the Academy that some red stars located in the Milky Way are four times closer to us than has been estimated. A layer of "cosmic dust" which splits the Milky Way makes the stars on the far side appear red, just as our sun appears red at sunset, when its rays come to the observer through a longer distance of the dust-filled atmosphere of our planet.

Free Employment Service

TO meet the problems brought about by the continued lethargy of business, as it affected the professional technical worker then and now unemployed, "The Engineers' Club of Philadelphia," in January, 1932, sponsored the Philadelphia Technical Service Committee. This group consist of representatives from 12 national engineering societies, and the association of the State Employment Commission of Pennsylvania has been secured. Thus all requests for technical men are handled through the Committee for the Philadelphia Metropolitan area.

The work of the Committee, consisting at present of six office workers and 15 field callers, is divided into four main divisions: Placement, Field Contacts, Publicity, Research. The primary object is to secure placement for the registrant, at the same time securing for the employer the best talent available. Since volunteers from among the registrants do the work, this valuable aid to industry is available to employer and employee alike, without any charge whatsoever.

On file are the applications of over 1300 men who have given their personal, educational, and professional qualifications. Copies are submitted to the prospective employer and include photographs of the applicants.

A system of status returns insures that applicants that are referred are definitely known at the time to be seeking employment.

Additional information will be gladly given anyone. Address the Philadelphia Technical Service Committee, % The Engineers' Club of Philadelphia, 1317 Spruce

Men who "know it all" are not invited to read this page

THIS page is not for the wise young man who is perfectly satisfied with himself and his business equipment.

It is a personal message to the man who realizes that business conditions have radically changed in the last few years, and that there is a whole new set of rules to be mastered. He feels that he ought to be earning several thousand dollars more a year, but simply lacks the confidence necessary to lay hold on one of the bigger places in business.

We should like to put into the hands of every such man a copy of a little book that contains the seeds of self-confidence. It is called "What an Executive Should Know" and it will be sent without obligation.

It contains the Announcement of the Institute's new Course and Service for men who want to become independent in the next five years. Among the contributors to this new Course are:

ALFRED P. SLOAN, JR., *President*, General Motors Corporation.

FREDERICK H. ECKER, *President*, Metropolitan Life Insurance Company.

HON. WILL H. HAYS, *President*, Motion Picture Producers and Distributors of America, formerly U. S. Postmaster General.

BRUCE BARTON, *Chairman of the Board*, Batten, Barton, Durstine & Osborn, Inc., Advertising Agents.

DR. JULIUS KLEIN, *The Assistant Secretary*, U. S. Department of Commerce.

JOHN T. MADDEN, *Dean, School of Commerce, Accounts and Finance*, New York University.

HUBERT T. PARSON, *President*, F. W. Woolworth Company.

M. H. AYLESWORTH, *President*, National Broadcasting Company.

THOMAS J. WATSON, *President*, International Business Machines Corporation.

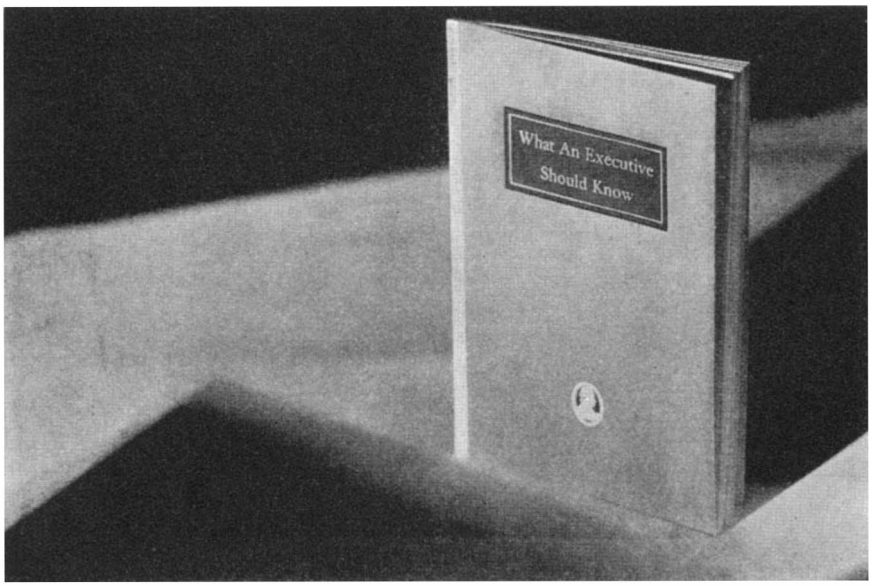
DEXTER S. KIMBALL, *Dean, College of Engineering*, Cornell University.

Can any ambitious man fail to get something of value from contact with minds like these? Here are a few examples, selected from many hundreds, showing how this organized knowledge is translated into added earning power:

CASE 1. Works Engineer, salary $6,000; now Vice-President and General Manager, salary $18,000.

CASE 2. Local Manager at $5,200; now Regional Manager, salary $15,000.

CASE 3. Production Manager, salary $6,000; now President, salary $21,600.



For the Man who wants to be Independent in the next 5 years

THE little book pictured above should be read by every man who expects to win a secure place for himself in the next five years. It explains some of the changes which are taking place in the business world today. It tells how you can equip yourself to take your place in the new business structure with confidence and increased earning power. It contains the condensed results of 20 years' experience in helping men to forge ahead financially.

Send for this Booklet

For the man who is perfectly content with himself and his job, the Alexander Hamilton Institute can do nothing. But there are thousands of men who could double their incomes if they believed in themselves and had the solid business knowledge to back up their belief.

Why not investigate *now?* The booklet pictured at the left costs nothing and places you under no obligation.

To the Alexander Hamilton Institute, 693 Astor Place, New York City. (In Canada, address Alexander Hamilton Institute, Ltd., C. P. R. Building, Toronto.)

Send me "What an Executive Should Know," which I may keep without charge.

NAME.....

BUSINESS ADDRESS.....

BUSINESS POSITION.....

Street, Philadelphia. Mr. Renshaw Borie is in charge of the Committee's activities, as Manager, and the Publicity Division, from whom this data has been secured, is under the direction of Mr. Charles B. Weiler.

Depression Lowers Milk Bottle Mortality

GLASS milk bottles, always a serious item of cost to a dairy, give greater service during a depression than in a boom period. Many firms normally average but 10 to 15 round trips per bottle. In 1931 the cost of new bottles to one large company was 4,500,000 dollars. A mid-western concern, which habitually has obtained 25 to 28 round trips per bottle, was getting 40 round trips in 1932 because it has almost no sales to industrial or construction jobs. —*A. E. B.*

Streamlined, Gasoline-Powered Rail Car

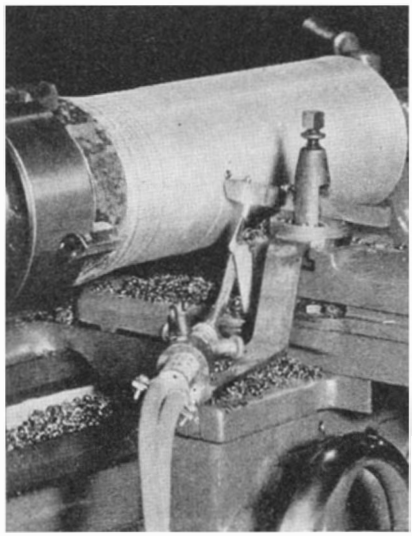
A CHALLENGE to the railroads in the shape of a torpedo-like aluminum vehicle appeared recently in Battle Creek, Mich. Seating 42 passengers and capable of operating on fast schedules over the standard railbeds, it embodies new and radical changes in the design for rail equipment. It is the product of the plants of the Clark Equipment Company at Battle Creek, Buchanan, and Jackson, Michigan.

This vehicle is termed the "AutoTram" and is approximately 60 feet long. The body is fully streamlined, having a rounded front end and a wedge-like rear end. Not only has the contour of the body been designed to reduce wind resistance to a minimum, but airplane practice has been followed to the extent that all exposed struts and guards have been made of the shape which is conducive to minimum wind resistance.

The body is of aluminum. This metal is favored not only by reason of its light weight but because of its high strength per pound of weight and its capacity to absorb stresses and strains. A massive but light aluminum alloy center beam forms the backbone of the frame. Structural aluminum members developed for use in dirigibles form the body; sheathing and interior finish are of heat-treated alloy aluminum plates: the vehicle thus has the strength of steel with the lightness of aluminum. The total weight, empty, is 26,000 pounds, and, loaded to capacity, 32,000 pounds. This is approximately one quarter the weight of a modern steel railroad coach. It is powered with a 16-cylinder gasoline engine.

A "Red Hot" Demonstration

ONE of the most interesting as well as spectacular demonstrations at the recent National Metals Exposition at Buffalo, which might well be taken as a subject



A striking demonstration of a red-hot tool cutting a billet of steel

for Ripley's "Believe It or Not," was that of a red-hot cutting tool in actual operation. Each day, crowds of interested onlookers watched the performance of the tool, which was kept constantly at a bright red heat by an oxy-acetylene flame. So exceptional was the performance, that more than one curious spectator was heard to ask, "Does the tool *have* to be heated to give such results?"

The demonstration was not given as a life test of the tool, but rather to demonstrate the important property of red hardness of Haynes Stellite J-Metal, a non-ferrous alloy of cobalt, chromium, and tungsten. The accompanying illustration clearly shows the set-up which attracted such wide attention. The material machined was a hot-rolled steel billet, 5 inches in diameter and 16 inches long, with 0.15 to 0.20 percent carbon and 0.30 to 0.60 percent manganese. The depth of cut was 0.025 inch, the feed 0.004 inch, and the speed 130 surface feet per minute.

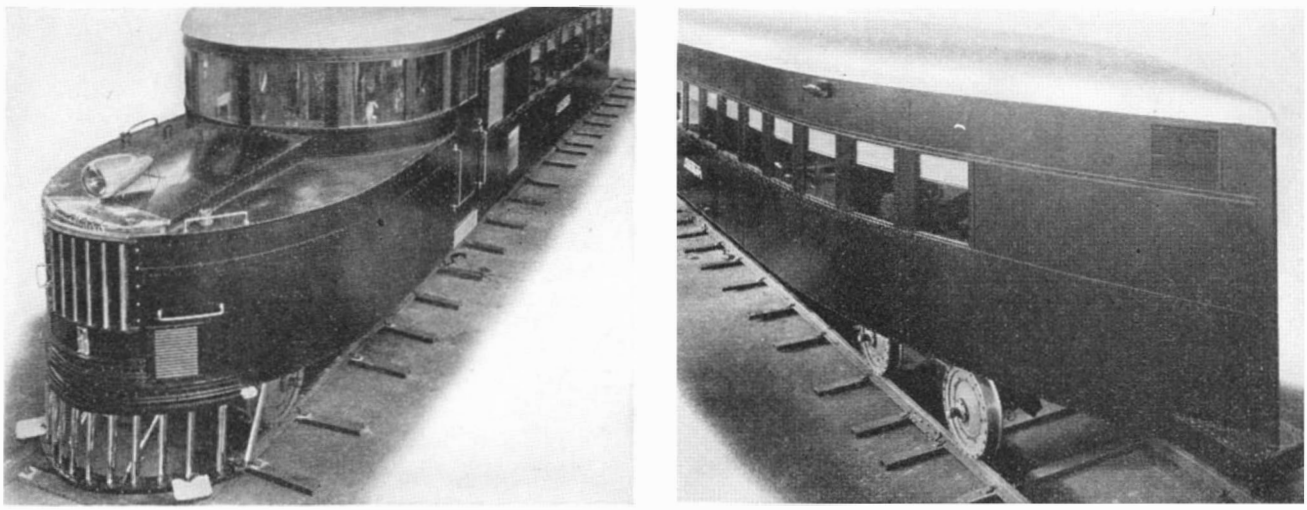
Australia's Rabbit Pest

"THE problem facing Australia at this time is the great army of rabbits with which the continent is infested," said the Hon. T. S. Gordon, of Sydney, passing through New York recently. "We are trying in every way to cut down their great numbers, but they multiply so quickly that our efforts to decimate them make no noticeable reductions in the furry tribe. There are still hundreds of millions of them. A pair of rabbits will produce six litters of young ones in a year and each litter will average five rabbits. As soon as the bunnies are six months old they begin to breed. In five years a single pair of rabbits will increase to ten million pair. Seven rabbits eat daily as much food as would keep one sheep."

Rabbits were first brought to Australia by a farmer near Melbourne, according to Mr. Gordon. He wanted something to remind him of home and the good old English sport of chasing the hare. He sent to England for a pair of rabbits and in due course they arrived. He turned them loose. In a year or so he could go hunting with considerable success. He soon found however, that the rabbits multiplied so rapidly that his section was overrun. His pasture disappeared. He sought to wipe out the destructive rodents, but they increased by hundreds, then by thousands. There was nothing left for his stock to feed on, so he had to get rid of it, many of his cattle perishing on the bare fields nibbled to the earth by the rabbits. Thus rabbits ate him out of house and home.

Many methods of killing them have been tried. Poisoned food and water kill many of them. Rabbits killed in this manner are skinned and then the bodies are burned. One dry year as many as three million rabbits were killed by poison at one water hole. The payment of bounties proves effective and gives a good living to many men.

Rabbit-proof fences are proving successful. Some of these fences are hundreds of



Front and rear views of the new streamlined gasoline rail car described above

miles long with gates at intervals of a mile or more. There is a heavy penalty for leaving one of these gates open. The rabbit fences of Australia would reach several times around the earth.

Two hundred cats—foes of rabbits—were turned loose in western Australia to combat the pest in that part of the country. The cats fraternized with the rabbits, living with them on the friendliest of terms. Foxes were introduced with the same purpose in view, but they multiplied and killed sheep instead of rabbits. They are now fenced against.

New South Wales once offered a reward of 125,000 dollars to any one who would suggest or invent a means for the extermination of rabbits throughout that state. It was never claimed.

(One of the editors bewails the fact that since there is little game in New Jersey and the hunting population is enormous, there is no way to transfer thousands of these rabbits to New Jersey. Now, if a scheme for such transfer could be worked out, two birds could be killed with one stone—or was it rabbits we were discussing?)

Soap from Locusts

AN announcement from abroad states that soap can be made from locusts, which are one of the plagues of North Africa. The locusts are dried in the sun and treated with carbon disulfide or ethyl chloride, according to their degree of dryness. The oil thus obtained is then purified by steam and used for making soap, according to *Chemical Markets.*—*A. E. B.*

"Is Raw Milk a Raw Deal?"

SOME months ago (April, 1932) we published an article under the title quoted above, pointing out the superiority of pasteurized (heated) milk over raw milk. This article aroused no small amount of comment, some from ordinary readers and some from persons connected with the milk producing industry, who do not all agree that pasteurized milk is better than raw milk. Some say an as yet unknown factor is destroyed or impaired in the milk when it is heated.

The following comment on the milk situation, quoted from the *Health News* of the New York State Department of Health (Albany, N. Y.), bears directly on this much-debated question. The article is entitled "Do Children Thrive Better on Raw than on Heated Milk?" "This question," *Health News* goes on to say, "is discussed in the September 23, 1932, issue of *Public Health Reports* on the basis of an extensive survey by Leslie C. Frank and five other milk specialists on the staff of the United States Public Health Service.

"The purpose of this study was to determine from actual past experience whether heating milk really has a sufficiently adverse effect to reduce significantly the growth-promoting capacity of the average American child diet. Through arrangements made with the state health departments of Alabama, Mississippi, Florida, Georgia, North Carolina, Kentucky, Texas, Missouri, Oregon, and Washington, surveys were made in a total of 39 cities in these states. From the data

Good Health Information for *You* in the February HYGEIA

DO you know how to select a well balanced meal? Do you have health examinations periodically? Are you afraid that you have rheumatism? Are you trying to reduce by dieting? These are only a few of the health problems on which you will find helpful information in the current issue of HYGEIA.

"Why Think about Eating?"

Dr. Henry Gerstenberg tells you why in a most entertaining two-part article, beginning in the February HYGEIA. He also explains what a faulty diet has to do with dental caries, why so many fat people enjoy eating, and what to do for a child with nervous anorexia. You'll agree that proper eating requires some intelligent thinking!

"Sixty Years—What They Have Taught Me about Doctors"

What is good health worth to you? Anna Steese Richardson warns against gambling with your health. Her article gives a clear-headed evaluation of a business proposition: the extravagance of indulging in the pernicious habit of self diagnosis and the economy of undergoing periodic health examinations.

"Quelling the Quacks"

"Who are the quacks? What is their game? Is it legitimate?" Here is the first of a new series of articles by Dr. Solon R. Barber, exposing an age-old racket and discussing various cases in which the government has been instrumental in "Quelling the Quacks."

"Forty Years Old—or Forty Years Young"

Dr. F. W. Scott discusses some of the factors that have long been regarded as significant to the cause of arteriosclerosis, "the most perplexing and most important unsolved problem in the field of medicine today."

"The Heart of a Child"

In this article Dr. Paul Dudley White deals with both the physical and the spiritual heart, and offers constructive measures for preventing children with heart disease from becoming imbued with fear and thus growing helpless and hopeless.

"Training for Athletics and Health"

Growing boys will find much to interest them in Alfred E. Parker's serial. In fact, it will inspire boys of all ages to emulate the Men of the Ages.

"Is It Rheumatism or Arthritis?"

A distinction without a difference is reassuringly discussed by Dr. Maurice F. Lautman. Read about the causes of this condition and the measures to be taken for its relief or cure.

"The Final Illness of Washington"

"Next in interest to the manner in which a great man lives is the manner in which he dies," writes Dr. Walter A. Wells, after which he describes the last days of Washington and discusses various theories of the cause of his sudden death.

Every month HYGEIA, The Health Magazine of the American Medical Association, is filled with entertaining and enlightening articles on practically every phase of health. For *authentic* information on this all important subject, read HYGEIA. If you are not already a subscriber, mail the coupon below. It will pay you to get acquainted with HYGEIA!

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Enclosed is $1.00 for an introductory 6 months' subscription to HYGEIA, The Health Magazine. I am a new subscriber.

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obtained, it was possible to prepare age-weight and age-height curves for each of two large groups of children, one of which had consumed raw milk and the other heated milk.

"Studies of over 3700 children are summarized as follows for children of ten months to six years of age:

1. There is no significant difference between the average weight of children who have received no milk except heated milk, and the average weight of children who have received raw milk for more than the latter half of their lives, the respective weights being 33.6 and 33.2 pounds, the insignificant difference being in favor of the children receiving heated milk.

2. There is no significant difference between the average height of children who receive no milk except heated milk, and the average height of children who have received raw milk for more than the latter half of their lives, the respective heights being 37.5 and 37.4 inches, the insignificant difference being in favor of the children receiving heated milk.

World's largest chandelier being installed at Rockefeller Center, New York City. Three hundred flood lamps consuming 104,000 watts will require a special ventilating system to carry off the heat

3. There was no significant difference between the two groups of children from the standpoint of the relative percentage of life during which various supplementary foods were included in the diet, except in the case of cod-liver oil, which was included during an average of 41.6 percent of the lives of the children receiving heated milk, and an average of only 27.6 percent of the lives of the children receiving raw milk.

4. This difference in the percentage of life during which cod-liver oil was fed did not, however, affect the relative positions of the two age-weight curves significantly, since the average weight of the 636 children in the heated-milk group who received no cod-liver oil at all was 33.5 pounds, as compared with 33.8 pounds for the 794 in the heated-milk group who received cod-liver oil during more than half of their lives.

5. The parents of children receiving predominantly raw milk reported a higher incidence of diphtheria, scarlet fever, intestinal disturbances, and rickets than did the parents of the children receiving heated milk only.

"The conclusion drawn from these observations is that the growth-promoting capacity of heated milk plus the supplementary diet received by the average American child of ten months to six years is not measurably less than the growth-promoting capacity of raw milk plus the supplementary diet received by the average American child in the same age group."

World's Radium Production

ACCORDING to *Chemiker Zeitung*, the production of radium totaled 205 grams between 1899 and 1922. Between 1922 and 1931 a further 350 grams were produced, while during the last two years production has amounted to 70 grams. The price of this extremely valuable metal has fallen by almost 50 percent since the year 1922.—*A. E. B.*

Many Uses for Chromium Metal

AT the mention of the word chromium, two thoughts usually come to mind to the average person. If it were used as part of the well-known word-association psychology test, probably the first reaction of the majority of persons would be "chromium plating," and the second, "chromium steel." These two uses of chromium metal are undoubtedly the best known, but there are many other applications which are important.

Many special non-ferrous alloys, particularly those designed to be resistant to chemical corrosion and to oxidation at high temperatures, contain chromium as an essential constituent.

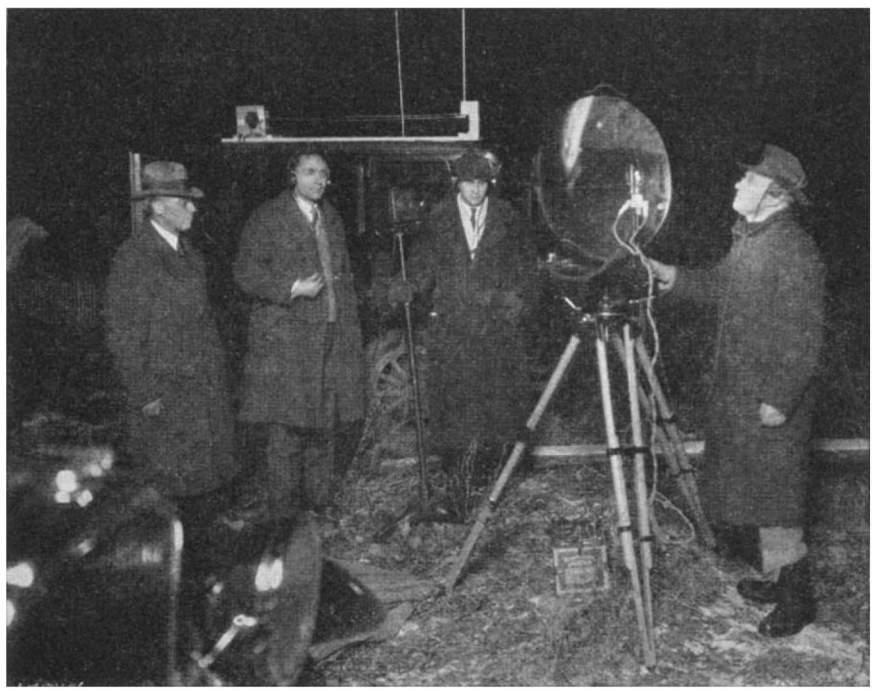
Probably one of the greatest uses of this metal is in the manufacture of non-ferrous heat-resisting alloys. Alloys of chromium and nickel in various proportions have been found to be especially advantageous for parts exposed to high temperatures. Sold under various trade names, these alloys are used for carburizing retorts, hearth plates, enamel racks, tube supports, and hangers, where resistance to oxidation at elevated temperatures is the prime requisite. The composition of these alloys varies, but they usually contain at least 15 to 20 percent chromium, occasionally some iron and manganese, and the remainder nickel. The range of analyses for such material is about as follows:

	Percent
Chromium	15 to 40
Nickel	60 to 85

A two-ton carburizing retort made of an alloy of chromium and nickel

A recently developed alloy containing from 80 to 97 percent chromium and from 3 to 20 percent aluminum is said to be extremely resistant to oxidation even at temperatures in excess of 3000 degrees, Fahrenheit.

Another important use of chromium in the non-ferrous fields is in Haynes Stellite, a cobalt-chromium-tungsten alloy noted for its hardness and wear resistance even at a red heat. With a base metal of cobalt



Talking 22 miles on a light beam. At the transmitter, engineers of the General Electric Company set up an arc, modulated by a microphone circuit, and concentrated the rays with a reflector. At the receiver shown, another reflector picked up the beam, focused it on a photo cell, and the sound was reproduced

instead of iron, this alloy has established enviable records in machine tool and hard-surfacing applications where long life under the adverse conditions of heat and abrasion are of paramount importance. It will not rust or tarnish and it is resistant to the attack of many acids and other chemicals.

Chromium-nickel alloys are also used extensively for the elements in thermocouples because of their favorable thermoelectric properties and their ability to withstand high temperatures without oxidation. The heating elements in many types of electric furnaces and electrical appliances are made of chromium-nickel alloys because they also have a high electrical resistivity. An alloy containing 70 percent chromium and 30 percent nickel is used where a non-magnetic, high-resistance material is required.

Chromium is sometimes used in the manufacture of brasses and bronzes when special physical properties are desired. The addition of chromium and silicon to copper gives hardenable alloys in which the hardness is obtained by precipitation of chromium silicide. When high strength and abrasion resistance are required in copper for electrical conductors, the addition of a small amount of chromium is very beneficial.

Small percentages of chromium are also added to a number of aluminum structural alloys.

A recent development in the power field is the use of an alloy containing chromium, cobalt, and nickel for steam turbine blades. This alloy has proved very satisfactory in a number of installations.

A chromium-nickel alloy has been developed recently for use in the dairy industry and related fields, which is resistant to the corrosive action of the many dairy products. This alloy takes a high polish and is highly resistant to atmospheric oxidation and corrosion.

These are but a few of the many uses of chromium in addition to chromium plating and the production of an almost endless variety of chromium steels. Chromium has been aptly called the "key metal," and the high rank that it has attained in industry has justified this title.

Iodine Extracted from Well Water

DID you ever wonder, as you dabbed tincture of iodine on a cut, where that valuable antiseptic comes from? The commonest source of iodine is Chile saltpeter, but it occurs in a great many unsuspected places. On the island of Java, iodine is extracted commercially from certain well waters by a unique process reported in a recent issue of *Chemiker Zeitung*. The method used consists of running the water into a trough where it is well agitated with bundles of copper wire. Cuprous iodide is formed which precipitates out. The wire bundles are removed and kept in a slightly acid solution of copper sulphate.

The precipitate is washed with water containing a little sodium bisulphite to prevent oxidation of the cuprous iodide, then filter-pressed and dried. The material at this stage is of a yellowish grey color

(*Please turn to page* 117)

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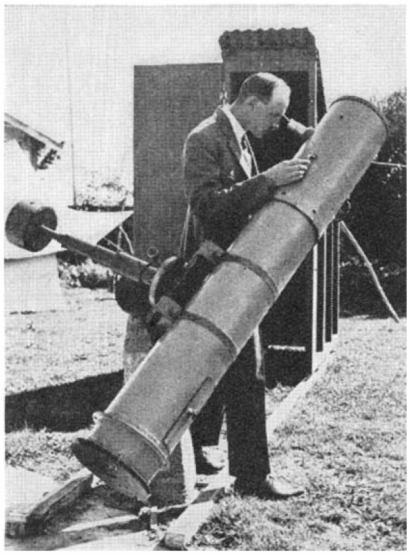
THE AMATEUR ASTRONOMER

Conducted by ALBERT G. INGALLS

FROM New Zealand, where it is summer when it is winter here and the sun is in the north instead of the south and the moon all turned around as if you stood on your head, comes the following letter written by Allan Bryce of 276 Victoria Street in the city of Hamilton:

"The amateur telescope makers' column



Mr. Bryce—New Zealand

in the SCIENTIFIC AMERICAN has interested me for a long time, but it was only last year that I really got the hunch that perhaps I could make a telescope myself and enjoy the wonders of astronomy apart from picture books. Now I enclose two snapshots of my eight-inch equatorial reflector successfully constructed during spare time from the rules of the game laid down in that invaluable tome, well known in your page as 'A.T.M.' A friend, Mr. Alchin, also made an eight-inch mirror with me but has not yet got it mounted.

"The mounting is the H.F. type (Henry Ford) with circles. I find that the Ford axles, while probably strong enough to carry a much larger instrument with ease, are too light and elastic. This causes undue vibration (Ford all over!) in light winds.

"The run-off shed was constructed very cheaply out of some old three-ply material nailed on the inside of the light battens which form the framework. The rails are three by two scantlings nailed to pegs, driven into the lawn, and the shed runs on four ball-bearing furniture castors. It is kept on the track by wooden lugs screwed to the bottom battens and projecting down inside the rails. The shed can be run off and the telecsope put in use within a minute.

"My telescope, since its completion, has started a third eight-inch mirror on the rougey road (not finished yet) while a fourth amateur is definitely sickening for the trouble. He has bought 'A.T.M.' I would be glad to hear from any others in New Zealand who have taken up telescope making in earnest. Greetings from N.Z. to U.S.A. I have very happy memories of two years spent in your country, 12 years ago."

EQUALLY distant (on great circles) with New Zealand from our own land is India, where P. J. Chinmulgund of 383 Sadashir, Poona 2, Bombay Presidency, has made a six-inch reflecting telescope from the instructions in the SCIENTIFIC AMERICAN book "Amateur Telescope Making." Here is what he writes:

"The mirror is a six-inch of 57.5 inches focal length. I had some trouble in obtaining the materials, as they are of an out-of-the-way type in this country. As I could not get the very grades of Carbo stipulated, I used Nos. 90, 220, FFF; and finished off with emery. This greatly curtailed the time required for polishing, which was complete in three and a half hours. Though my lap was a bubbled one and the grooves irregularly cut by a saw, I obtained a beautiful and even polish.

"Finally I parabolized in six minutes by overhang. I worked for two minutes each time and waited for half an hour to allow the disk to return to the room temperature. The shadows looked exactly like those shown in the book. The mirror was left a little under-corrected, as advised.

"I required just a month to finish the mirror. I never worked for more than an hour at a time, and at times I left off working for a couple of days on end.

"I did not succeed in silvering at the first attempt but finally I did succeed in securing an adequate coat. I had to use ice to keep the temperature of the solutions down.

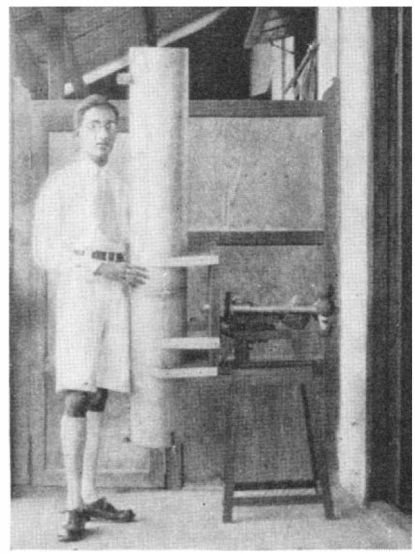
"Pipe fittings are used in the mounting and they work very smoothly. The counterweights are a pair of heavy old dumbbells, which serve their purpose admirably. As there is no suitable place for mounting the instrument permanently, I have mounted it temporarily on a vise.

"The total cost was surprisingly low—about rupees 40 at the most, *i.e.* 13 dollars, approximately.

"The diagonal is a piece of flat plate glass, and functions excellently. I could not get a suitable eyepiece at any shop here, so I constructed one myself. I had some small lenses and assembled them with the necessary separations. The eyepiece contains three lenses—two double-convex and one plano-convex; and is of about one inch *e.f.l.* It gives a flat and colorless field.

"There are many advantages that nature offers to the amateur in India, especially in Poona. The temperature is always quite uniform. Hence I could work in a living room, and a cellar was unnecessary. The skies also are quite clear nearly all the year 'round, and the constellations shine with unusual brilliancy.

"I don't know, but I think this is the first home-made telescope in India—at least in Bombay Presidency. Some idea of the slow pace at which I had to work may be had from the following: I ordered the book

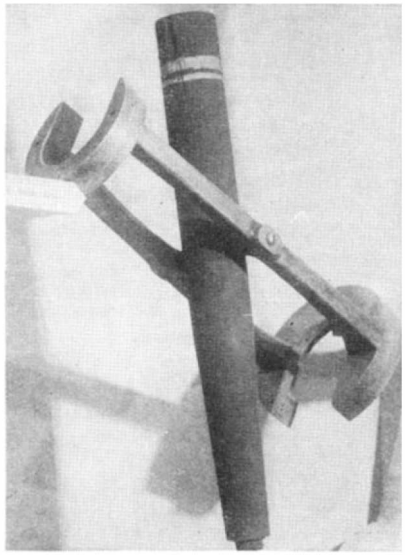


Mr. Chinmulgund—India

in August, got it in November, began the job in June and completed the mounting in October! A whole year from start to finish!"

DR. H. PAGE BAILEY, the Riverside, California dentist who designs and makes a new telescope every morning before breakfast, has constructed for M. Nagata (discoverer of Nagata's Comet) a neat nine-inch electric-clock-driven reflector of the split ring equatorial type. This type of mounting is unusually trim, compact, and mechanically superior, its operation being very smooth. Note the neat, acces-

A strip across Dr. Bailey's plate showing the Nebula in Orion and star images at edge of the field

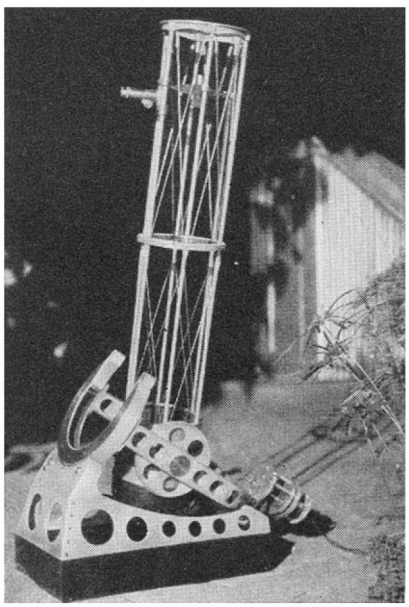


Dr. Bailey's up-and-down mounting

sible hour circle on the face of the ring.

Dr. Bailey has originated a unique mounting for a refractor or reflector, shown in the illustration above (model only) in which there are two split rings, each on rollers, one bearing down on its exterior, the other up on its interior. The tube is self-balancing. As no pier is in the way there is no reversing, and there are no blind spots in the sky. Russell W. Porter says he believes this mounting is wholly original with Dr. Bailey. The split equatorial ring principle itself was first embodied in a telescope by Mr. Porter when he made, in 1922, about 50 of the well-known "Porter Garden Telescopes" having this feature, the ring turning on rolls. It is a pleasing design and might have been embodied in the 200-inch telescope, but it was found there was no way to get the big mirror in and out!

A photograph of the Orion nebula made by Dr. Bailey with a similar telescope (an eight-inch of *f*/3.6) is reproduced. The photograph, which was made by placing a plate-holder in the primary focus and exposing 18 minutes, covers a field about a quarter degree in width; note the absence of coma at the edge of the field! Those star images are round.



Split ring mounting by Bailey

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ARTIC, THE REFRIGERANT contains information on the physical, physiological, and thermal properties of Artic (methyl chloride); performance data; refrigeration uses; and efficient methods of handling and servicing. *The Roessler and Hasslacher Chemical Company, 350 Fifth Avenue, New York City.—Gratis.*

THE DURABILITY OF PREPARED ROLL ROOFINGS (Bulletin No. 109, Iowa Engineering Experiment Station), by Henry Giese, H. J. Barre, and J. Brownlee Davidson, records the efforts to find information on the durability of prepared roll roofing. The reasons for the undertaking of the project were (1) the use of such material was expected to increase, and (2) the users had no assurance other than the reputation of the manufacturer as to the qualities of the material. *Iowa State College, Ames, Iowa.—Gratis.*

PAINT FOR PRIMING PLASTER SURFACES (Bureau of Standards Miscellaneous Publication No. 137), by Percy H. Walker and E. F. Hickson, represents the results obtained by experimenting with 40 priming paints. *Superintendent of Documents, Washington, D. C.—5 cents (coin).*

THE GEOLOGICAL HISTORY AND EVOLUTION OF THE HORSE (Geology Leaflet No. 13, Field Museum), by Elmer S. Riggs, is a beautifully illustrated monograph. *Field Museum of Natural History, Chicago, Illinois.—40 cents.*

CHEMICAL UTILIZATION OF WOOD (National Committee on Wood Utilization), by Henry K. Benson. Dr. Benson in this report gives a condensed yet complete story of the processes and economic factors involved in the modern wood chemical industry. In common with many other of America's primary industries, the wood industry is gradually changing into a series of co-ordinated industries, resulting in economy in the use of raw materials. Diversification of operation and close utilization of raw material, the report points out, are the keynotes to the success of our forest industries, and the chemical utilization of wood is the latest development in this field. *Superintendent of Documents, Washington, D. C.—15 cents (coin).*

HOW TO JUDGE A HOUSE (U. S. Department of Commerce, National Committee on Wood Utilization) deals with good and bad points in house construction. The reader is taken on a tour of inspection throughout the house from basement to attic; all types of building materials that go into the construction of the house are treated in this bulletin. *Superintendent of Documents, Washington, D. C.—10 cents (coin).*

TO make this page of greater value to our readers, the editor shall be glad to consider for review papers and bulletins on any phase of science, engineering, or industry. However, we do not wish ordinary catalogs, and we will not mention what is obviously propaganda.

Material submitted should give full information as to where obtainable and the price, if any, so that the reader may obtain copies directly without unnecessary correspondence. — *The Editor.*

THE INTERNATIONAL SYSTEM OF WEIGHTS AND MEASURES (Miscellaneous Publications No. 135, Bureau of Standards) gives in small compass all the facts, tables of comparison, and so on, in relation to the metric system, together with the present status of the international metric system in the United States. *Superintendent of Documents, Washington, D. C.—5 cents (coin).*

ANNUAL REPORT OF THE DIRECTOR OF THE COAST AND GEODETIC SURVEY (Coast and Geodetic Survey, Serial Number 552) reviews the accomplishments of the survey over a tremendous area. Among the principal activities are chart making, geodetic control surveys, tide and current work, and earthquake studies. *Coast and Geodetic Survey, U. S. Department of Commerce, Washington, D. C.—Gratis.*

CLAY PRODUCTS MACHINERY AND ITS LUBRICATION (*Lubrication*, Vol. XVIII, No. 11, November, 1932) gives valuable information on the subject. *The Texas Company, 135 East 42nd Street, New York City.—Gratis.*

AERONAUTICS TRADE DIRECTORY (Aeronautics Bulletin No. 3, Aeronautics Branch, Department of Commerce) is based on reports from the organizations and individuals listed. It deals with both commodities and activities. *Aeronautics Branch, U. S. Department of Commerce, Washington, D. C.—Gratis.*

STAINLESS STEELS AND THEIR USES. Undoubtedly the best-known and most widely used of the alloy steels is the comparatively large group of chromium and chromium-nickel steels, generally called stainless steels. These steels contain from 12 to 20 percent chromium, with or without additional alloying elements. Of these, the 18 percent chromium, 8 percent nickel steel is probably the most widely used at the present time. *Electro-Metallurgical Company, Technical Publicity Department, 205 E. 42nd Street, New York City.—Gratis.*

BOTANICAL MAP OF THE UNITED STATES is an immense sheet beautifully lithographed in colors showing the principal drug plants of the United States. It is intended primarily for window display by druggists and is sold below the cost of production. *National Wholesale Druggists' Association, 51 Maiden Lane, New York City.—50 cents.*

HOME MADE SAUERKRAUT describes how sauerkraut can be made in the home. An abundance of cheap cabbage and a growing fondness for sauerkraut are believed to be largely responsible for the very marked interest on the part of housewives in making kraut at home. *New York State Agricultural Experiment Station, Geneva, N. Y.—Gratis.*

THE INTERNATIONAL LABOUR ORGANIZATION (International Conciliation, No. 284, November, 1932), by Professor Francis G. Wilson, deals in scholarly fashion with the International Labour Organization at Geneva, working side by side with the League. *Carnegie Endowment for International Peace, 144 Portland Street, Worcester, Mass.—5 cents.*

THE NITRIDING OF IRON AND ITS ALLOYS (Reprint from Volume 24, July, 1932, *Industrial and Engineering Chemistry*), by A. W. Coffman, describes the nitriding process as applied in producing very hard and somewhat corrosion-resistant surfaces on steel. *Mellon Institute of Industrial Research, Pittsburgh, Pa.—Gratis.*

CARE AND REPAIR OF THE HOUSE (Building and Housing Publication BH15, Bureau of Standards), by Vincent B. Phelan, is one of the government's "best sellers." This handbook is written to assist those who are sometimes faced with vexing problems in the care and repair of the house. It aims to point out the more common conditions of disrepair arising in the house from time to time, to describe their causes briefly, and to prescribe the tools, materials, and methods to be employed in their correction. It is a 121-page pamphlet. *Superintendent of Documents, Washington, D. C.—20 cents (coin).*

STANDARD TIME THROUGHOUT THE WORLD (Circular of the Bureau of Standards, No. 399) gives a brief historical sketch of the development of the standard time system, a map showing the time zone boundaries in the United States and a list of the official stations sending out radio time signals. The legal time in nearly every foreign country and in most of the more important islands is also given, compared with both Greenwich time and with noon, eastern standard time. *Superintendent of Documents, Washington, D. C.—5 cents (coin).*

THE SCIENTIFIC AMERICAN DIGEST

(*Continued from page* 113)

and contains about 52 to 55 percent of iodine. It has the advantage of being a non-hygroscopic substance which is a great point in a damp tropical climate such as that of Java. The process is said to be cheap and the cost of copper relatively low.—*A. E. B.*

Noble Prize Awarded to F. M. Starr

F. M. STARR of the central station engineering department of the General Electric Company at Schenectady has been awarded the Alfred Noble prize for his paper "Equivalent Circuits," presented at the winter convention of the American Institute of Electrical Engineers in New York City last January. The prize, which is an

Noble prize winner

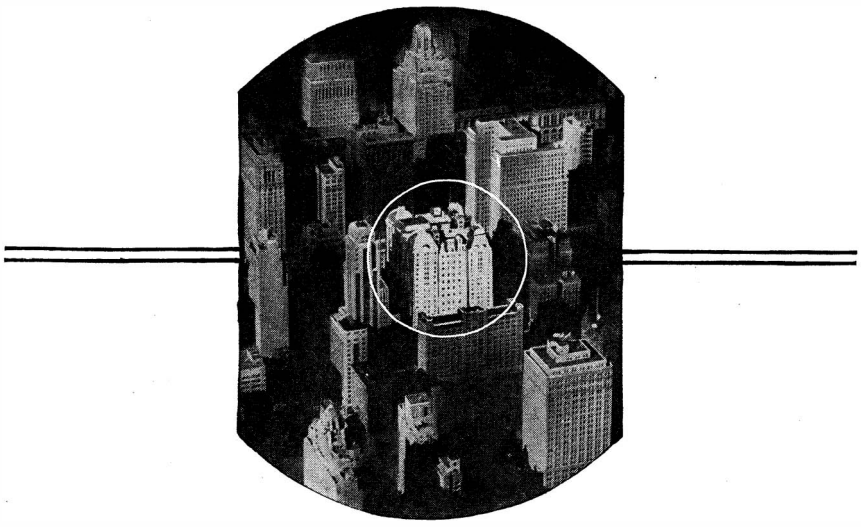
award of $500, was established in 1929 in memory of Alfred Noble, a prominent civil engineer in the half century preceding 1914. (It has no connection with the Nobel awards.)

The award is made to a member of the American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers, American Institute of Electrical Engineers, or Western Society of Engineers for a technical paper of particular merit accepted by the publication committee of his society. The recipient, who must be under 30 years of age, is selected by a committee including one representative of each of the five societies.

Removing Grease Stains

CARBON tetrachloride is a favorite solvent for grease stains because it involves no fire risk and never makes the color run. It can be bought by the pound tin can at any drug store at a reasonable price, says the Bureau of Home Economics, United States Department of Agriculture.

In dealing with stains made by automobile grease, first rub lard or white vaseline on the spot on the wrong side. Use a clean rag to remove this, with as much of the



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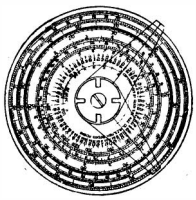

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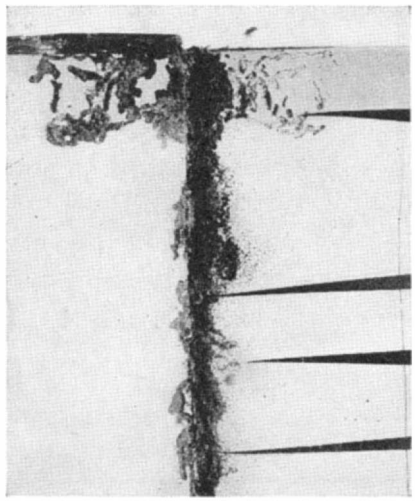
black grease as possible, lay the spot face down on a clean pad, apply the carbon tetrachloride on the wrong side, to push the dirt out, rather than rub it in from the right side. Brush lightly or "feather" the edge of the spot so there will be no ring.

Spots of salad oil or other pure fat on light-colored goods sometimes respond to talcum or French chalk, left on for several hours to absorb the grease.

Fumigating Books to Kill Bookworms

INSECTS of various kinds take a yearly toll in book destruction that amounts to millions of dollars. Perhaps the worst offenders in this respect are bookworms, the larvae of an insect known generally



Above: **Top indicator points to a beetle; others to bookworms at work.** *Right:* **Vacuum fumigator used in war against destructive bookworms**

as the "drug store beetle," and scientifically as *Sitodrepa panicea*. It seems to have a particular fondness for practically everything, and thrives on arsenic, lead, pepper, and other poisonous and irritating substances with which attempts have been made to combat it.

Once this beetle lays its eggs in a library and the larvae begin feeding, librarians are likely to age overnight, for the larvae feed voraciously on all parts of books whether they be cheap modern editions or priceless ancient volumes. Many poisons have been used, by various methods of application, to defeat this foe of books. Mr. Thomas M. Iiams, of the Henry E. Huntington Library and Art Gallery, San Marino, California, in a recent issue of the *Library Quarterly*, told of several infestations of the larvae in that library and the attempts to destroy them.

Acting on the advice of Dr. Tracy I. Storer, of the University of California Agricultural College, hydrocyanic acid gas and several other powerful fumigants were used but with indifferent success. It was then decided to resort to vacuum fumigation. This would give perfect penetration into every crevice of books, of which large numbers could be fumigated simultaneously. Also, this method would destroy the microscopic eggs of the beetle, as well as the larvae, by rupturing the thin membrane at one end of the egg and permitting entry of the poison gas.

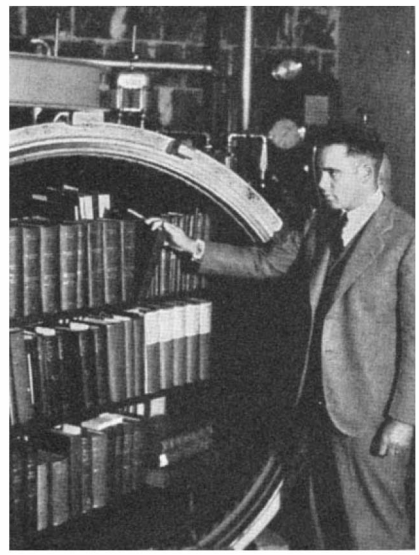
The problem of an ideal fumigant was solved when Dr. Arnold O. Beckman, of the California Institute of Technology, discovered that ethylene oxide and carbon dioxide could be combined in a liquid that is neither inflammable nor explosive. This new fumigant is now being marketed under the trade name "Carboxide."

A fumigator five feet in diameter and ten feet long, sufficiently large to accommodate five or six library trucks full of books, was then built. Since its construction, the Huntington Library has, without the services of a trained engineer or expert fumigator, satisfactorily fumigated numbers of rare books as well as foreign shipments showing the least signs of infestation.

Alcohol as Auto Fuel

THE use of pure alcohol is impractical in our present automobile engines, although special engines can be built to use it. However, mixtures of gasoline with 15 to 25 percent of alcohol work very well in our present cars, with no change in carbureter adjustments.

Alcohol is about twice as effective as benzol for anti-knock purposes, and is safer than lead tetraethyl. It also has a cleaning effect, and motors which are run on fuels containing alcohol remain freer from car-



bon deposits than motors run on other fuels. The presence of alcohol improves the volatility of gasoline, due to the formation of azeotropic mixtures. Because of the higher latent heat of alcohol, the vapors entering the cylinder are cooler, and the charge taken into the cylinder is greater.

The question of costs depends to a considerable extent on taxes and legal requirements. The manufacture of absolute alcohol for the gasoline mixture is not difficult or expensive. The question of the relative costs of absolute alcohol and gasoline varies from place to place. For example, in Australia and South Africa, where there is almost no petroleum and where there is an abundance of vegetable materials to make alcohol, the alcohol is cheaper than the gasoline. In the United States, where there is unlimited petroleum and very exacting alcohol laws, the cost of gasoline will be far lower than that of alcohol. Apparently alcohol can hardly be considered

as a replacement for gasoline, but rather an extender. Alcohol is not the only possible replacement or extender for gasoline, but is one which has been carefully tested in actual commercial use and found satisfactory. Synthetic methyl alcohol may later be of use in a similar manner to that in which ethyl alcohol is now used.—*A. E. B.*

Mental Hygiene in Schools

IF half the teachers in our schools, from kindergarten to college, were specially trained to recognize and give proper attention to mental and personality defects among their pupils, literally thousands of children might be saved from the criminal and insane classes which together annually cost the nation five times more than the cost of running its schools.

The practical advantages of increasing mental hygiene efforts in the schools are pointed out by Professor Howard Y. McClusky in the *University of Michigan School of Education Bulletin.* Most people have only a faint notion of the magnitude of the problem of proper mental and social care and direction, he says. In 1930, half a million persons were social liabilities because of mental disease, and as many more were in prisons and reformatories. During 1931 it cost 207,896,479 dollars to maintain the nation's insane asylums, while the crime bill was about 13,000,000,000 dollars on American Bar Association figures.

We must face several facts if any real attack is ever to be made on mental disease and crime, declares Professor McClusky. First, that the future criminal who will terrorize society is now in school, as are the potentially or actually mentally sick who will bring sorrow to friends and expense to the nation. Second, that while some of these, through very bad heredity, are incurable or incorrigible, 50 percent or more can be made useful citizens instead of burdens through correction of wrong mental twists arising from personal temperament or bad living conditions. Third, that the previous statement is not a scientist's dream but proved in 80 to 90 percent of the cases where a genuine program of child mental hygiene and social-sense development has been tried. Fourth, society owes it to itself and to these young people to begin this program in kindergarten days, because the school system is the only organization which gets all children of all classes, and which can, with very moderate changes in teaching points of view and class adjustments, attack the problem at its root.

Japan Bids for Chemical Trade

AMERICAN chemical producers foresee Japan as an active competitor in world markets. Japanese chemical expansion has been rapid in the past few years, and the Japanese consumption of chemicals has been sharply curtailed. The yen, normally worth 50 cents, has depreciated a little more than half.

During September, 1932, 560 tons of Japanese potassium sulfate for fertilizer purposes arrived at Jacksonville, Florida. Late in August, on the Pacific Coast, 2714 tons of super-phosphate and 67 tons of miscellaneous fertilizer material were received. In New York City late in September, Japanese producers offered bicarbonate, caustic, and acetic acid at low prices. From the Pacific Coast came similar reports, with confirmation of actual bicarbonate sales.

Japanese alkali production has grown rapidly in the past three years and projected plans, not yet wholly abandoned, call for almost a doubling of present ash and caustic outputs in 1933. Japan has bid boldly for complete independence in chemicals and recent developments indicate an intention of capturing the chemical markets in the Orient. For years these markets have been dominated by the British.

The fertilizer industry particularly is aroused by the threat of a Japanese invasion of fertilizer materials. Small shipments of mixed fertilizers are reaching the Pacific Coast with frequent regularity. In addition, small shipments of ammonium sulfate (synthetic) have been reported.—*A. E. B.*

Damage to Grain Fields by Wild Fowl Overrated

DAMAGE to winter grain by migratory wild fowl is often not so serious as supposed, says W. L. McAtee, of the United States Department of Agriculture. Each year in the early spring the Bureau of Biological Survey receives many reports telling of damage to grain fields by birds, chiefly ducks and geese.

The clatter of iron horse-shoes and the rattle of wagon wheels and milk containers has been eliminated in the case illustrated by the use of Jumbo tires on the wagon, rubber shoes on Dobbin, and rubber-insulated milk containers

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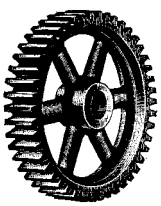

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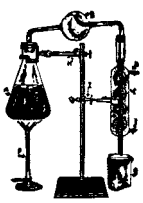

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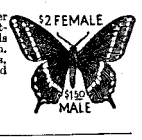

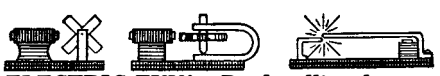

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When the soil is moderately firm, Mr. McAtee explains, wild fowl in most cases merely nip the grain plants and leave the roots in place—a process well known to result in stooling and the production of a larger number of stalks. The crop, therefore, is likely to be improved rather than injured. In many localities Biological Survey representatives found that the actual production of fields fed over by wild fowl had not been reduced.

In some places where complaints of damage by wild fowl had been made, investigators found cattle or sheep grazing in the fields. If feeding in winter grain fields by these animals can be tolerated, says Mr. McAtee, it would seem that farmers should not protest against the less destructive wild fowl.

When the soil is very soft, however, as it is when thawing, the birds sometimes do considerable damage by pulling out some of the grain and spoiling more by trampling. Under these conditions, says Mr. McAtee, farmers often patrol their fields.

Where birds visit the fields at night farmers have resorted to many unusual methods to drive them away. Field workers of the Biological Survey report that some farmers have gone so far as to use fireworks to scare them away. A farmer in Arkansas improvised a revolving searchlight which he mounted on a platform in the center of his grain field. This method gave satisfactory results.

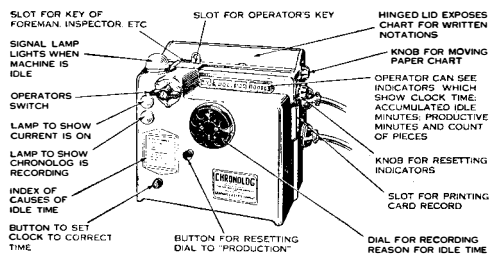
A Watch-Dog on the Machine

A NEW recording instrument called the Chronolog which is adapted for use on practically any kind of factory machine and when so used is an effective watch-dog on running and idle time and production, has recently been put on the market by The National Acme Company. Time study and rate setting work in shops, and more efficient general control of production is possible because of the accurate information supplied by the Chronolog.

This instrument gives a continual printed record of the productive minutes, the idle minutes, and the pieces produced. This is supplemented by a detailed report showing when the machine shut down, for how long, and why. Additional reports, called Chronocards, can be printed for other departments interested, such as the paymaster, or the production or time-study departments.

The Chronolog is in a case about 12 inches in its greatest dimension, and may be attached to the machine at some point where it does not interfere with regular production. As shown in the accompanying illustration, indicators behind a window show the operator at all times the accumulated idle minutes, productive minutes, and the count of pieces. On the front of the case is a dial, similar to that used on modern telephones, by means of which the operator may mark into the record a code symbol which shows why the machine was shut down, whether it be for tool grinding, inspection, repair, personal, or other reason.

More efficient general control of factory production is possible with the device shown at the right and described below



Leather Waste as Chicken Feed

THE leather industry has for many years furnished the glue manufacturers with millions of pounds of raw material each year, and from this certain technical gelatins and animal glue have been processed.

With conditions as they are at present, due to the economic situation, the glue manufacturers are affected like all other industries. The glue industry has further met with reduced demands during the past year or so, due to the trend in furniture—steel or other metal furniture supplanting wood furniture to an appreciable degree. Radio cabinets which formerly were of some size and thus used much glue in their assembly have been replaced to a great extent by smaller cabinets. Automobile bodies formerly with wood frames using glue are now made largely of metal. With all these conditions there was no demand for the raw material from which to manufacture animal glue.

When it became apparent that huge quantities of this raw material were accumulating all over the United States, the Department of Leather Research of the University of Cincinnati undertook the problem of finding ways and means of utilizing this material. Many research problems were started and the one which to date has given most promise is the processing of this raw stock into a protein concentrate food material. This they have been able to do in a manner which appears to be economically sound, says Professor Fred O'Flaherty, Director of the Research Laboratory.

The process involved is simple. By the fine subdivision of the material and an intimate heating, the moisture is reduced to a low percentage. Simultaneously, the grease content is lowered and the heat used partially cooks the material. After the moisture and grease content have been reduced, this material is ground, and is then ready for use as a protein concentrate in conjunction with grain rations for chickens and hogs.

This food, when fed under circumstances and in a manner recommended for chickens by leading poultry men, was found in tests to be equal or slightly superior to standard meat scrap. In quantities five times in excess of the amount of protein concentrate generally recommended, it exerted no harmful effects.

This special food is comparable in many

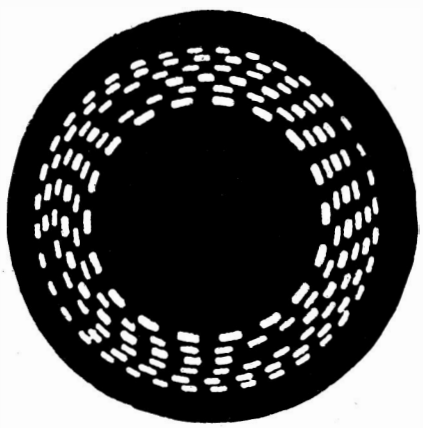
ways to meat scrap and tankage, and the usual standard on this material is its protein content. Meat scrap is usually sold on a 50 percent protein basis. The new food should compete with these materials, for its protein content has been found to be from 60 to 67 percent.

Preventing Spoiling of Cheese Spreads

CHEESE spreads for sandwiches are becoming more popular all the time, but manufacturers have not been able to give them good keeping qualities. The chemical environment is too close to neutrality to prevent spoilage. Templeton and Sommer, writing in the *Journal of Dairy Science*, show how increasing the acidity by adding citric acid to Cheddar cheese spread did not change its flavor but doubled and tripled its keepability—a very practical example of the application of principles of bacterial physiology.—*A. E. B.*

Blind Can Read by Ear

BRAILLE, the system of writing by which the blind can read with the fingers, has long been known and is in wide use, but a new invention promises to outdo Braille in speed and ease of reading for blind people. This is the Optophone, a device small enough to rest upon the library table, with which ordinary



print is translated into musical tones. The inventor of this instrument is Dr. E. C. Fournier d'Albe, of France.

The page of a printed book is placed face downward in the machine and the machine started. The blind person, who has already studied the relative tones and tone values, adjusts telephone receivers to his ears and listens to the chord that is sounding. These notes are produced by the use of a small metal disk containing six concentric circles of holes situated above a small lamp within the instrument. The object of this disk is to break up into six luminous spots a narrow shaft of light coming from the lamp. A small electric motor revolves the disk rapidly so that each of the six spots of light is broken up rapidly. By an appropriate arrangement of the number of holes in each circle, the number of flashes per second corresponds to the vibration numbers of given musical notes so that when the flashing spots act upon a selenium cell which is in the electrical circuit, the result is to cause electrical pulsations to be sent through to the telephone receivers. These pulsations correspond to the vibration numbers of given notes so that these notes are then heard in the receivers.

The fundamental principle of the device is that the light reflected from the white portion of the page to the selenium cell is of an unvarying quality but as soon as each spot of light is reflected from the black body of any part of a type letter the decrease in the reflected light causes the pulsation in the selenium. Thus as the six concentric rows of holes pass over an individual letter the change in the reflected light of the six spots as a unit gives a particular musical note.

The manufacture of this instrument has been undertaken by Barr and Stroud, Ltd. of Glasgow and it is now rapidly coming into use. The accompanying photograph shows an English girl, Miss Mary Jamison, who

Above: **A demonstration of the Optophone with which the blind can read by ear.** *Left:* **The pierced disk which "scans" the printed page**

has recently written an interesting article on the Optophone in the publication *And There Was Light* of the American Braille Press, Inc. In her discussion she explains that it did not take her long to master the new technique necessary with this machine and she has already read a number of books in ordinary print.

Concrete Hardened by "Electrocution"

"ELECTROCUTED" concrete hardens much more rapidly than the ordinary kind, according to the claims of two Swedish inventors, A. Brund and H. Bohlin of Harnosand, Sweden, who have taken out a patent covering a method of accelerating the hardening of concrete castings by means of direct electric heating. The mortar is cast in ordinary molds or lathings which, however, must be provided with electrode plates. Steel reinforcement may be used as one electrode. Alternating current is applied through the mass. By proper regulation of the current density with regard to the temperature and the electric resistance of the mass, it is possible to control the hardening process exactly.

The resistance of the mass increases during the hardening, and consequently the value of the electric resistance at any definite point of time will indicate the stage of the hardening process. The increase of the resistance will also contribute

TALLY

From the Early Method of Counting

Tally goes back to the time when things were commonly counted by cutting notches in a stick of wood. The word was borrowed in Middle English as *taille*, from Old French *taille* "a cutting," and also "a tally," connected with French *tailler* "to cut." It was formerly customary for traders to have two sticks and to mark with a notch on each the number or quantity of goods delivered, the seller keeping one stick and the purchaser the other. When such records came to be kept on paper, the same word was used for them; and it now means almost any kind of count or score. There are thousands of such stories about the origins of English words in

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Erosion Cuts Acre Yields

LOWER crop yields per acre with resulting higher production costs are among the chief dangers of land erosion, says the United States Department of Agriculture.

Despite the fact that this country is letting its soil waste away faster than any other nation, there is little threat of an immediate land shortage. There is danger, however, in land reaching the point where farmers can not gain a respectable living from it, the department says.

In the face of improved methods and machinery, improved varieties, and increased use of fertilizers, average yields of some crops have dropped. The average yield of cotton for the 10-year period 1871–1880 was 186.4 pounds per acre, compared with 152.9 pounds for the period 1921–1930, a reduction that can not be charged entirely to insects or to use of marginal land. The average yield of corn for the 10-year period 1871–1880 was 27.04 bushels per acre, while from 1921 to 1930 the yield was 26.13 bushels per acre. That the yield of corn has declined in spite of all the improvement in growing the crop must have some relation to eroded land, since the crop has not spread out extensively into dry regions and has not been devastated by insects or disease.

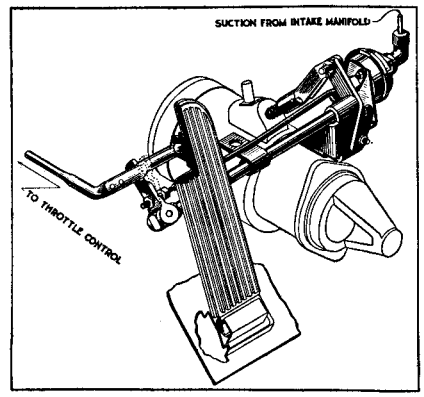
Erosion is being checked in many parts of the United States through terracing, sodding, and similar practices. Work of the United States Department of Agriculture proves that excessive erosion can be controlled.

Chevrolet's Starterator and New Engine Suspension

RECENTLY Chevrolet presented its 1933 cars at dealers' showrooms throughout the nation.

Longer wheelbase, new "aer-stream" styling, more power and speed coupled with greater economy, larger and lower Fisher bodies with new Fisher "no-draft" ventilation, shatterproof glass in windshield and ventilators, cushion-balanced motor mounting, improved free wheeling plus syncromesh transmission with silent second gear, and a "starterator" for simplified starting are all listed as new standard features.

The starting button has been eliminated, and a "starterator" added. This is a unique device by means of which the motor starter is engaged simply by depressing the accelerator pedal. It is provided with an automatic cut-out, so that with the motor operating, the pedal performs only as an accelerator. The motor may be re-started without removing the foot from the accelerator, the hands from the steering wheel, or the eyes from the road ahead.

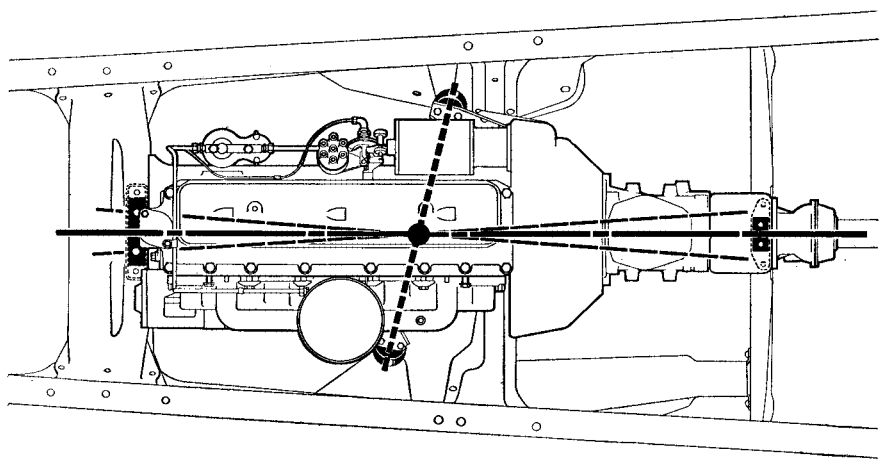


In a new car the starter button and accelerator pedal are combined. The starter switch is automatically disengaged when engine starts

Outstanding among the new features is the "cushion-balanced" motor mounting, or "sta-namic balancer," as engineers designate it, since the new mounting is said to dampen out all vibrations set up by both static and dynamic residual forces.

The engine rests entirely on a new sub frame, with four points of support, and the whole of its weight is carried on two lateral supports, so located that the motor is balanced on its center of gravity. This method anchors the engine to the frame at its point of minimum movement, as against the practice of attaching it at front and rear.

On the new Chevrolet, each lateral support consists of a rubber "biscuit," or a layer of rubber sandwiched between two flat metal surfaces, one surface attached to the motor and the other to the frame. Through the rubber, the engine is securely bolted to the frame and the rubber dampens out even the small amount of vibration



A new motor-car engine suspension which is claimed to eliminate all vibration

that occurs at points of attachment. Front and rear supports carry no engine weight, and function mainly as stabilizers of static movement, or engine "pitch."

Concentrated Vitamins

IF you don't like spinach you can now get your vitamins without bothering to eat the greens, for vitamin A is being produced commercially in concentrated form by S. M. A. Corp., Cleveland, which announces that the vitamin is available at a reasonable price. It is offered in three forms, as crystalline carotene sealed in vacuum to prevent oxidization, as a solution of carotene in oil for therapeutic purposes, and as a combination of carotene and cod-liver oil. Any one of the three forms is to be used under medical supervision.

Carotene occurs in nature with xanthophyll and chlorophyll in alfalfa, spinach, leaf lettuce, and similar plants, and it is believed to be the principal pigment in such plants as squash, pumpkin, carrots, and sweet potatoes. The usual laboratory methods of preparation involve extraction of carotene with a fat solvent such as chloroform or petroleum ether and evaporation of the solution to the point of carotene crystallization. Throughout the process, it is necessary to work in the presence of non-oxidizing atmospheres, since the minute concentration makes it imperative to check losses in manufacture. —*A. E. B.*

Will it Come Back?

WHAT has become of the electric launches we all remember—if we are more than 40 years old—and where have all the electric motor cars gone? Will either of these ever come back?

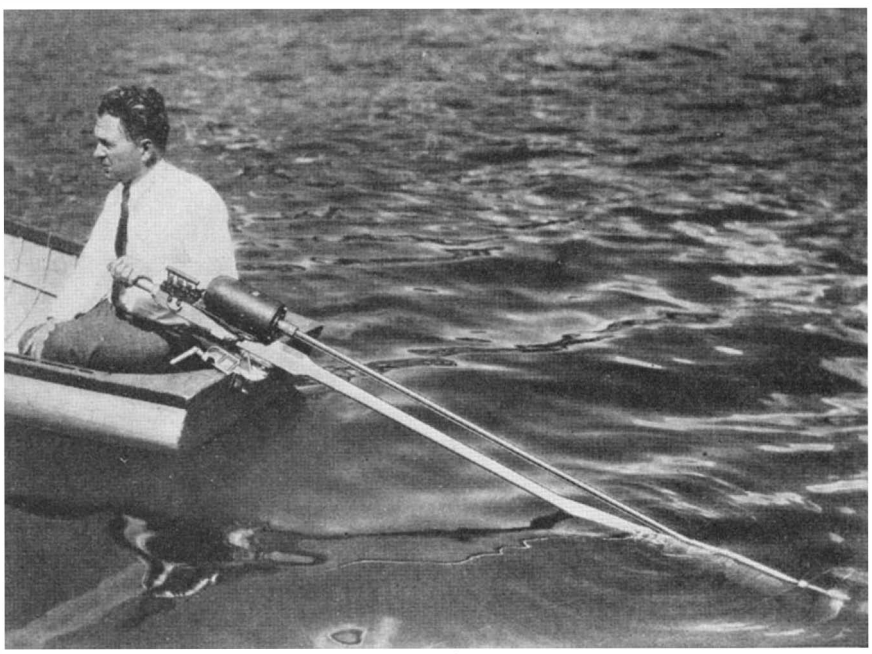
From the electric launch we jumped rather precipitately to the outboard gasoline motor and from it derived speeds which no practical electric drive can ever hope to attain. Speed, however, is not everything, and Charles P. Grimes of Syracuse, New York, believes there is room, even in 1933, for an electric drive for small boats under some special conditions.

By mounting a propeller at the end of an oar (which then serves both as support and partly as rudder) and attaching to the inboard end of the same oar, a storage-battery-driven electric motor, Mr. Grimes derives a kind of service for fishing and other special purposes which he asserts explosion engines cannot give: smooth quietness, for example. It is possible to restrain an explosion motor sufficiently to permit trolling but, Mr. Grimes contends, few will assert that such a rig can possibly give the even, quiet, velvet controllability of an electric motor. He has experimented with various units and finds best a 38-pound rig connected to a 57-pound storage battery. This permits peaceful trolling for 16 hours without recharging and does not send noisy advance word to the fish that trouble is coming. It is absolutely silent and has other advantages. A 67-pound battery will troll 45 miles or "row" 20 miles on a single charge.

Whether there is a place for a return to the electric boat, either in fishing, for boat liveries, or in other situations which may not at first be considered, is a question we shall leave to Mr. Grimes and to our readers.

Chemical Towns

THE current issue of the United States Postal Guide reveals the following post-offices bearing chemical names, as compiled by W. E. Rice, Jr., in *Industrial and Engineering Chemistry*: Antimony, Utah; Calcium, N. Y. and Pa.; Carbon, Ind., Iowa, Okla., Tex., and W. Va.; Cobalt, Conn.; Gold, Pa.; Iron, Minn.; Krypton, Ky.; Lead, S. Dak.; Lithium, Mo.; Mercury, Tex.; Neon, Ky.; Radium, Colo., Kans., Minn., and Va.; Silver, Ark. and Tex.; Sulphur, Ind., Ky., La., Nev., Okla., and S. Dak.; Tungsten, Colo.; Vanadium, Colo. and N. Mex.; Zinc, Ark.; Bromide, Okla.; Chloride, Ariz., Mo., and N. Mex.; Bauxite, Ark.; Hydrate, Colo.; Lime, Colo. and Ore.; Nitro, W. Va.; Ozone, Ark. and Tenn.; Potash, La.; Soda, Tex.; Silica, Kans. and W. Va.; Telluride, Colo.



An "electric oar." Will it revive interest in electric drive for boats?

Men Past 40!

MAKE THIS AMAZING TEST

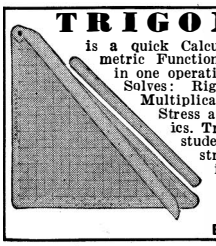
An Ohio scientist's latest book now tells vital facts that may explain many mysterious and often frightening symptoms, which appear in many men past 40. In millions of cases, doctors say, the vital prostate gland (found only in men) starts to degenerate in the years between 40 and 50. This gland is not even known to many laymen—but its symptoms are easily recognized. When "hypertrophy" of this gland sets in, the victim's first warning is usually a need to get up several times a night. Often he complains of other "bladder" symptoms, sometimes of aching back and legs, pains in the feet, or of unexplained "blues" and lack of ambition and strength. If neglected, this condition may reach the stage where dangerous gland surgery is necessary.

This book, called "Why Many Men Are Old At 40" not only explains about this common gland condition but tells how thousands of men have banished these symptoms through a simple, drugless treatment, used a few minutes each day right at home. No medicines—diets—massage—violet rays. This "Thermalaid" method uses the same principle so widely advocated by leading doctors. Tested by over 100,000 men.

Write now for your copy of this book, and also get details of generous Test Offer. Find out why thousands say: "I felt ten years younger in a week!" No obligation—but write quick if you want to be sure of getting your copy.

Address W. J. Kirk, President, 9662 Morris Ave., Steubenville, Ohio. *Western Address,* Dept. 96-S, 500 Wm. Fox Bldg., Los Angeles, Calif.

TRIGONOGRAPH



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COMMERCIAL PROPERTY NEWS

Conducted by SYLVESTER J. LIDDY
Member of the New York Bar

Protection of Industrial Designs*

By T. HART ANDERSON
New York Bar

TO devise and secure the enactment of a law to protect industrial designs at the time that articles embodying such designs are offered for sale to the public is a problem that must be solved. The protection should be based on originality and novelty alone and not, as at present, under the Design Patent Law, on novelty plus invention. The Design Patent Law has been found ineffective mainly because of the delay between the filing of the application and the issuing of the patent, during which period the design may be copied by others with impunity. This delay is due to the requirement that the Commissioner of Patents shall make an investigation to determine the novelty of the design. He must also determine whether the design for which a patent is sought constitutes an invention. We must do away with this requirement of a novelty search prior to granting protection and also eliminate the question of invention.

While the grant of copyright protection should not be delayed by the necessity of determining novelty beforehand yet, the validity of any registration must in all fairness rest on originality and novelty in the registered design, and while affording effective protection to the originator of a new design the law must relieve an alleged infringer from all liability where it subsequently appears that the design was not new and original with the registrant.

The Commissioner of Patents is reported to have endorsed at the hearing before the House Committee on Patents, a copyright law affording quick protection for the silk manufacturers and the textile industry for what he refers to as "flat designs," but not for contour or mechanical designs. Apparently, Mr. Robertson believes in starting with a law for the copyright protection of flat designs in the textile art only. He says: "Copyright of a design is an opportunity for quick registration, which will give the silk manufacturers and the textile manufacturers the relief they need, and that appeals to me very strongly." He further suggested that Congress could require the Copyright Office to make a novelty search prior to registration, just as the Patent Office is now doing, and which is largely to blame for the delay in securing patent protection.

With regard to the Commissioner's suggestion that a novelty search prior to registration might be made by the Copyright Office, Mr. Brown, the Registrar of Copyrights, at the hearing before the House Committee on Patents, pointed out that while it was the intention of the Registrar to try to make such a search, yet, that that procedure merely transfers the difficulty from one office to another rather than curing the difficulty. Obviously, the Registrar is right. A search in the Copyright Office will mean the same delay as a search in the Patent Office. No such search should be required.

My own belief is that no Bill limited to any particular classes of industrial designs should receive our endorsement; that no Bill which does not afford copyright protection for all industrial designs, and which does not repeal the Design Patent Law will be effective; that we should not advocate a law simply because the textile industry desires it, or disapprove such a law because the bottle manufacturers, perhaps, do not desire it.

We should not propose a law which will provide for both copyright and patent protection, the latter to be nullified in the event of certain contingencies arising under the copyright registration. We should present a Bill affording copyright protection for all designs by mere registration as under the present Copyright Law, under which registration could be effected without a preliminary determination of the novelty of the design, and which would simply require the applicant to swear in his application that he believes the design to be original or new with him, and which will also provide that in the absence of novelty such a registration shall be held to be invalid. It should protect innocent infringers who sell an article embodying the design, without notice that the same has been copyrighted, and that the design had been embodied therein or applied thereto without the consent of the copyright owner, following a similar provision which is now found in the Design Patent Law.

It should further provide that in any litigation seeking to enforce the right secured by copyright registration, the prevailing party shall recover from the other party not only the taxable costs of the suit but shall also be reimbursed for the expense incurred in such a suit, including a reasonable attorney's fee. This provision for an attorney's fee to the prevailing party is a part of the present law of copyrights, and a similar provision is found in the so called Sherman Law. Under such a law the certificate of registration should be *prima facie* evidence in the courts, but suit thereon would be instituted at the peril of the owner and with full knowledge that should the registration be held invalid because of lack of novelty he will be required to make good the expense to which the defendant has been put. The creators of industrial designs need such a law and I feel confident that one favorable to both the registrant and the public can be secured.

*Extracted from a paper read before the National Alliance of Art and Industry.

Furnace Patent Valid and Infringed

THE Supreme Court of the United States recently denied the petition in the case of Rust Engineering Co. v. Chapman-Stein Co., for review of a lower Federal court decision which upheld respondent's suit for alleged infringement of Stein Reissue Patent No. 16826, for a recuperative furnace.

The alleged infringing device is a preheater or heat exchanger of "regenerator" reversing type, but which by reason of improvements since the Stein original patent provides continuous air flow.

The district court held the patent is valid and had been infringed. This decision was affirmed by the Circuit Court of Appeals for the Third Circuit.

Registration of Corset Trademark Refused

IN *ex parte* the H. & W. Company (Inc.), First Assistant Commissioner Kinnan held that the company is not entitled to register, under the Act of 1905, the notation "Sta-Down" as a trademark for corsets, girdles, and so on.

The ground of the decision is that the mark is descriptive of the goods and therefore not registrable.

In his decision, after noting that applicant had obtained, under the 1920 Act, registration of the same mark for brassières and that, his attention being called to that fact by the examiner of trademarks, he cancelled that class of articles from the list of goods for which registration under the 1905 Act is sought, and noting the suggestion of the examiner that the goods in the present application are so closely akin to brassières that estoppel likewise applies, the First Assistant Commissioner said:

"However all this may be, the notation is merely a slight misspelling, as to the first part, of the words 'stay down' and would be interpreted by purchasers to be merely descriptive of the character or quality of the goods in that they would stay in place or stay down during the bodily movements of the wearers."

The New British Patents Act

THE British Patents and Designs Act, 1932, which came into force on November 1st, effects certain changes in the law relating to inventions and industrial designs. The alterations are numerous, and it is not possible to deal with all of them here; but it is proposed to consider only those likely to be of interest to our readers who are inventors, or prospective ones.

The period of provisional protection un-

der the new Act is extended by three months, so that the Complete Specification may now be left at any time within 12 months from the date of the application.

This period is the same as that allowed in which to fill applications abroad under the International and Inter-Colonial Arrangements, so that if the Complete Specification is not left until the end of the period allowed, and if foreign patents are contemplated, then the foreign applications will have to be despatched before the Complete Specification is on the file in this country. Further, unless the Complete Specification following the Provisional Application is left well before the expiration of the 12 months, the search on novelty made by the Patent Office, the result of which very often influences the applicant's decision with regard to foreign patents, will not be available.

An applicant may now request the Comptroller to treat a Complete Specification filed with the application as though it were a provisional one, or may ask that an application for a patent be post-dated, any time before acceptance, for a period not exceeding six months.

A very important change concerns the search made by Patent Office officials to determine to some degree whether an invention sought to be patented is novel. Formerly, the official search was directed to the investigation of previous British Patent Specifications filed on applications for patents during the past 50 years. Under the new Act the search may be extended to Foreign Specifications and other documents. This procedure brings the English practice more into line with that prevailing in Germany and the United States of America.

The time for obtaining acceptance of the Complete Specification has been extended to 18 months from the application date. The Government fees on filing a Complete Specification have also been increased.

The time in which a patent must be sealed has been extended from 18 months to 21 months, so that under the new Act the maximum time within which the Patent must be sealed, including extensions of time which are obtainable, is 28 months.

Further, this period may be extended by such an amount as appears to the Comptroller to be necessary, if it is proved that hardship would arise in connection with a patent application outside the United Kingdom.

Many new grounds upon which application may be made by petition to the Court for revocation of a patent have been added. Formerly, if in an action for infringement of a patent it was found that some claims of the specification were valid and that others were invalid, the Court was directed to grant relief in respect of the valid claims without regard to the invalid ones. By the new Act the patentee has to furnish proof that invalid claims were framed in good faith and with reasonable skill and knowledge if he wishes the Court to grant relief in respect of valid claims without regard to invalid ones. If the patentee does not furnish such proof the Court will not grant any relief by way of damages or costs, but may grant other relief such as an injunction in respect of any valid claim which is infringed.

During the past, patents have been granted for so-called perpetual-motion machines and such like contrivances which obviously would not work. The new Act deals with this matter, and empowers the Comptroller to refuse to grant a patent upon what he regards as a frivolous application. This is a wise alteration because, unfortunately, ill-informed inventors and purchasers have sometimes wasted money on patents of this kind.

Amongst other changes made, the following may be mentioned: tightening up of the law in cases of groundless threats of legal proceedings, provision for the granting of a patent to the assignee of the applicant, the hearing of appeals from the Comptroller's decision by an Appeal Tribunal and amendments in the law dealing with British Applications which are based on applications filed in other countries.

In general, the new Act applies to applications filed before, as well as after, the passing of the Act.—BERTRAM T. KING, *in* English Mechanics.

MR. LIDDY will be pleased to answer the inquiries of our readers who may desire information relative to the various subjects reported in his department.
—The Editor.

Trademarks Protect the Buyer

TODAY as never before in the history of American shopping is a "trusted trade name or mark so necessary in identifying dependable goods," according to Ernest Elmo Calkins, New York advertising man, writing in the December issue of *The Atlantic Monthly*. Mr. Calkins' article, headed "False Bargains Betray Us," flays the rise of the "schlager," who is described as that type of manufacturer who produces merchandise at below par standards. After several examples, showing how and where the "schlager" skimps on his goods, Mr. Calkins declares:

"To protect himself, the customer should look for the name of the maker. He should not buy anything, however low the price, unless he knows that it is made by a manufacturer with a reputation for integrity. Generally the shoddy goods have a name, but it is a name of which one has never heard before. . . . If the consumer knew what she was buying, she would not buy it; but she is not an expert in much that she buys. She must depend upon a store or manufacturer's name or trademark. When she abandons these trademarks, trades at a store that takes advantage of her confidence, or buys goods of whose origin she is ignorant, she takes chances and will regret it."

An Unusual Trademark Case

IN a recent decision, First Assistant Commissioner Kinnan held that the interference which involved the application by The Methodist Book Concern, of New York, New York, of the name "The Christian Advocate" as a trademark for a periodical and an application by Lamar & Whitmore, Book Agents, Publishing House, M. E. Church, South, of Nashville, Tennessee, for the registration of the term "Christian Advocate" as the name of a religious periodical, should be dissolved and both of the trademarks passed to publication.

In his decision, after noting that a motion for dissolution was filed by both parties in which it was set forth that the publications have been published in different sections of the country for nearly three quarters of a century without confusion; that the publication of Lamar & Whitmore relates to the Methodist Episcopal Church, South, while the publication of The Methodist Book Concern relates to the Methodist Episcopal Church, and that each party has consented to the registration of its mark by the other party, the First Assistant Commissioner said:

"While the goods are the same and the marks are substantially identical, yet the situation is quite unusual. In view of the record made in this proceeding it is fair to presume there is such a community of interest involved as would justify a dissolution of the interference. The primary purpose of denying registration of substanially the same mark to one second to adopt and use it on the same class of goods is to avoid confusion in trade and consequent damage to the first user. In the instant case there is not alleged to be any damage to the first user nor any material confusion in trade, and under the special conditions set forth this Office is unable to find there would be probable confusion in trade."

He further stated that the somewhat liberal practice in connection with registrations for trademarks for publications having their origin in widely separated sections of the country finds support in the case of Pulitzer Pub. Co. v. Houston Printing Co., 4 F. (2d) 924.

Hades in Trademarks

IT was recently held by First Assistant Commissioner Kinnan that Associated Parts, Inc., of Toledo, Ohio, is not entitled to register, as a trademark for vehicle heaters and parts thereof, the notation "Red Head" in view of the prior adoption, use, and registration by Liberty Foundries Company, of Rockford, Illinois, of a mark consisting of the representation of a "devil's head colored, except for the horns and face, red."

In his decision, after noting that the opposer also relied upon certain registrations of the term "Hā-Dees," which term it was stated was used in connection with the "devil's head," and further noting that in lieu of testimony a stipulation had been filed that opposer was first in the field and the goods were of the same character and stating that it was only necessary to consider the registration of the "devil's head," the First Assistant Commissioner said:

"The applicant's notation 'Red Head' is fairly descriptive of this mark of the opposer. The words and the pictorial representation are, to the extent they convey the same information, equivalents. Customers do not always see the marks and goods side by side for comparison. The opposer's picture of a devil's head has marked and specific differences over the applicant's notation, but confusion by oral description seems probable. One familiar with opposer's goods might well describe them as having a mark of a red head or a devil's red head upon them."

Books SELECTED BY THE EDITORS

MODERN CIVIL ENGINEERING

By Richard S. Kirby and Philip G. Laurson, Asso. Profs. Yale

AN entertaining story of the early years, presenting material relating to the pioneers and pioneering work in engineering in Europe and America during the 18th and part of the 19th Centuries. Early sources frequently quoted in their quaint phrases are freely used and such use stimulates the desire for further reading. Engineers of other days and of many nationalities live again in these pages; the history of the last two generations is largely left to other hands. A little background of civil engineering interest or knowledge is assumed. 324 pages—149 illustrations.—$4.20 postpaid.

THE FORD

By G. B. Manly

COMPILED by an experienced automobile engineer, all the facts it was possible to obtain about the V-Eight, "B" Four, and the "BB" truck have been elucidated and explained. The Ford Engineering Staff, important dealers, salesmen and garage mechanics have all contributed their knowledge of the construction, adjustment, upkeep, care, and repair of the new models. It is a handy, thorough manual fully up to date.—$2.15 postpaid.

THE MODEL MAKER

W. Edmunds Spon, Editor

VOLUME IX contains the twelve 1932 issues of this very practical little magazine and as ever covers the entire field of working models. The descriptions are clear-cut and concise while the working drawings can be read without the slightest difficulty. It would be hard to praise too highly this splendid magazine. Even for one who does not have the "bug" it is mighty interesting.—$2.40 postpaid.

PLANNING AND BUILDING THE CITY OF WASHINGTON

SINCE the year 1791 when L'Enfant went to Georgetown after being brevetted a Major by Congress for his voluntary sacrifices during the Revolutionary War, down to the present authorized plans for the enlargement of the Capitol grounds, the entire scope of the beautifying of our capital city is clearly and interestingly placed before the reader. Edited by the past president of the Washington Society of Engineers, the material was drawn from official and authentic sources to constitute the first real history from an engineering standpoint. All who are interested in city planning, architects, civil engineers and those who would read solely for information, will find this little book full of absorbing details, hard to find elsewhere.—$2.20 postpaid.

MODERN COMMUNICATION

A COMPILATION of seven papers that were delivered in the form of lectures for a Lowell Institute course in Boston. The first, dealing with the social aspects of the development of communication, touches lightly on the historical side of the subject and then brings it up to the present day. The following papers deal with research in the communication field, researches in speech and hearing, trans-oceanic radio telephony, talking pictures and other products of communication research, utilizing the results of research, and picture transmission and television. The book is just the one to bring the layman up-to-date in what has been accomplished in the field. The authors are all authorities in their particular branches.—$2.90 postpaid.—*A. P. P.*

ELECTRONICS

By Ralph Gorton Hudson

A SPLENDID text for anyone interested in vacuum tubes, photo cells, rectifiers, and any other application of electronics. The arrangement is a happy one, allowing the reader to progress through theory to practice without tiresome references back and forth. The method in which the material is presented presupposes that the reader knows something of electricity and mathematics, but, as the author states, the mathematical content has been reduced to the lowest possible point.—$2.15.—*A. P. P.*

POORMAN'S MODERN GOLD MINING AND PROSPECTING METHODS

By Robert M. Perry

ALTHOUGH this edition is in reproduced typewriter type, there is so much valuable material in it, we unhesitatingly recommend it, for many points like dry mining, rockers, self-made stamp mills, and so on, are covered more comprehensively than any other book we have seen. Prospecting, too, is fully treated in a way that the average person wholly unfamiliar with tools, geologic formations and what to look for and where, can by careful study learn enough to go out and search for himself. Another edition in finished book form is under way but this one includes all fundamentals.—$1.10 postpaid. Future edition, $2.20 postpaid.

PHYSICS OF THE EARTH—V, OCEANOGRAPHY

By Heck, Littlehales, Marmer, Schuchert, Vaughan and other prominent men of science

THIS is the fifth volume of a set of works prepared under the auspices of the National Research Council and reviewed in our September, 1932, number, page 190. It is the largest volume of the series, containing 557 pages and covering the properties and movements of sea water, the ocean bottom, and oceanographic instruments. The ablest oceanographers have contributed to this authoritative work.—$5.25 postpaid.

CULTURAL NATURAL SCIENCE FOR THE JUNIOR HIGH SCHOOL

By Paul Ammon Maxwell, Prof. Educ. Peru State Teachers College, Nebraska

THIS is a book for science teachers and others who are interested in "the work of adjusting public education to the rapidly evolving body of scientifically determined educational theory." It gives the objectives and procedures for revising the curriculum with regard to increased stress on popularized science. —$2.15 postpaid.

THE SEX FACTOR IN MARRIAGE

By Helena Wright, M.B., B.S.

THIS book is addressed to those who are about to be married, particularly men, but we see no reason why others should not read it, and many reasons why they should. Its main purpose is to forestall marriages wrongly conditioned and perhaps ruined at the outset by inexperienced, inept blunderers. It tells what to do and what not to do. There are more things to do and not to do than many think, a fact which all consulting specialists know full well after dealing with the intimate problems of humanity, wise, half wise, and unwise, in the mass.

Men are the chief blunderers. Cynics may question this reflection on the wisdom of young men in these pre-sophisticated times, but we hazard the guess that many who have thought they "knew everything" will discover a few refinements in this book, even if it is not a large one. This is a very practical, serious, scientific book on a subject which deserves as much attention as any subject of major importance in life. It has been read and commended widely in England.—$2.00 postpaid.—*A. G. I.*

THE STORY OF MEDICINE

By Victor Robinson, Prof. History of Medicine, Temple University

NOT with the pedantry of a history nor yet with the flippancy of a best seller, Dr. Robinson has told the variegated story of our most important science down from the days of the stone age. The various eras have been divided into twelve chapters, encompassed within 527 pages, so that while details have not been denied in some important cases, it is obvious brevity must predominate in order to attain thoroughness of coverage. Just this has been done and regardless of whatever of the history of medicine may already be on the reference shelves, this book must find a place because of its authority and its compactness.—$5.25 postpaid.

FADS AND QUACKERY IN HEALING

By Morris Fishbein, Ed., Jl. Am. Med. Ass'n.

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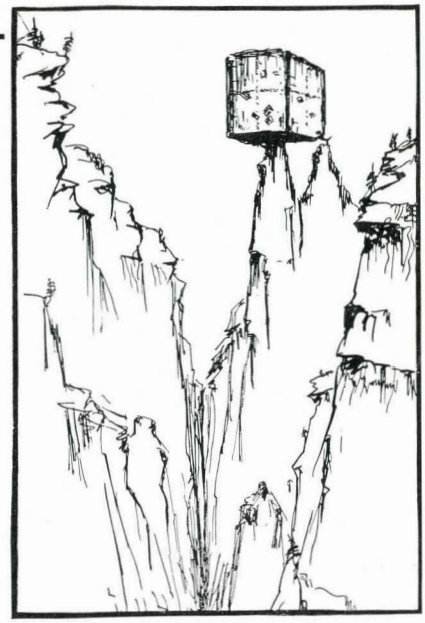

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IT SOUNDS incredible, but nevertheless it is true. If everybody in this world of ours were six feet tall and a foot and a half wide and a foot thick (and that is making people a little bigger than they usually are), then the whole of the human race (and according to the latest available statistics there are now nearly 2,000,000,000 descendants of the original Homo Sapiens and his wife) could be packed into a box measuring half a mile in each direction. That, as I just said, sounds incredible, but if you don't believe me, figure it out for yourself and you will find it to be correct.

If we transported that box to the Grand Canyon of Arizona and balanced it neatly on the low stone wall that keeps people from breaking their necks when stunned by the incredible beauty of that silent witness of the forces of Eternity, and then called little Noodle, the dachshund, and told him (the tiny beast is very intelligent and loves to oblige) to give the unwieldy contraption a slight push with his soft brown nose, there would be a moment of crunching and ripping as the wooden planks loosened stones and shrubs and trees on their downward path, and then a low and even softer bumpity-bumpity-bump and a sudden splash when the outer edges struck the banks of the Colorado River.

Then silence and oblivion!

The human sardines in their mortuary chest would soon be forgotten. The Canyon would go on battling wind and air and sun and rain as it has done since it was created. The world would continue to run its even course through the uncharted heavens. The astronomers on distant and nearby planets would have noticed nothing out of the ordinary. A century from now, a little mound, densely covered with vegetable matter, would perhaps indicate where humanity lay buried.

And that would be all.

SO Van Loon opens his epic story of Mother Earth — a book that will make an Olympian of its every reader, old and young; but Olympians chastened to humility by what it so magnificently unfolds. For from its first pages we realize how babyish are our present notions of Mother Earth; we conceive of it now, if we do so at all, as a vague extension of the familiar section of field or street we know, or as a hazy flat colored map. Marvelously, with both brush and text, (the book contains 163 characteristic drawings by the author), Van Loon lifts our limping imaginations into a full cosmic outlook. We see the Earth in its actual size, a huge ball with the moon circling about it, the two together speeding unimaginable distances through space, but with a finer precision than any instrument

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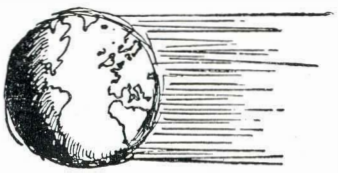

man can contrive. We see it relatively, immense to our little selves and yet itself a grain in a world of universes. We see it, remarkably, not as a simple surface, but in its three full dimensions—and what an unexpected difference that simple change in conception makes! For Van Loon shows immense mountain ranges hidden deep in the oceans; the continents themselves plateaus above the water; the tide—"all day and all night a broad strip of water several hundred miles wide following in the wake of the moonlight"—the crust of the Earth so full of holes it is comparable

to a sponge; and so on! We see the stages it has passed through, which explain its present form and phenomena, its multiform creatures, our own history, and how even the piffling politics we waste our breath upon may be determined by the course of one of its winds or the temperature of a little part of its water.

Finally, in growing awe, we come to realize that what it now is,— this ancient Mother of us all, this huge revolving ball of gas and matter,— it will not be tomorrow.

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There are several other advantages like these, not readily measurable in money, that cannot be outlined here for lack of space. Surely, within the next year, the distinguished judges of the Club will choose as the book-of-the-month or recommend as alternates, *at least a few books* that you will be very anxious not to miss and which you will buy anyway. Why not—by joining the Club—make sure you get these instead of missing them, which so often happens; get the really substantial advantages the Club affords (such as the book-dividends mentioned, if nothing else), and at the same time get a copy of VAN LOON'S GEOGRAPHY, free. Send the postcard below, for more complete information as to how the Club operates.

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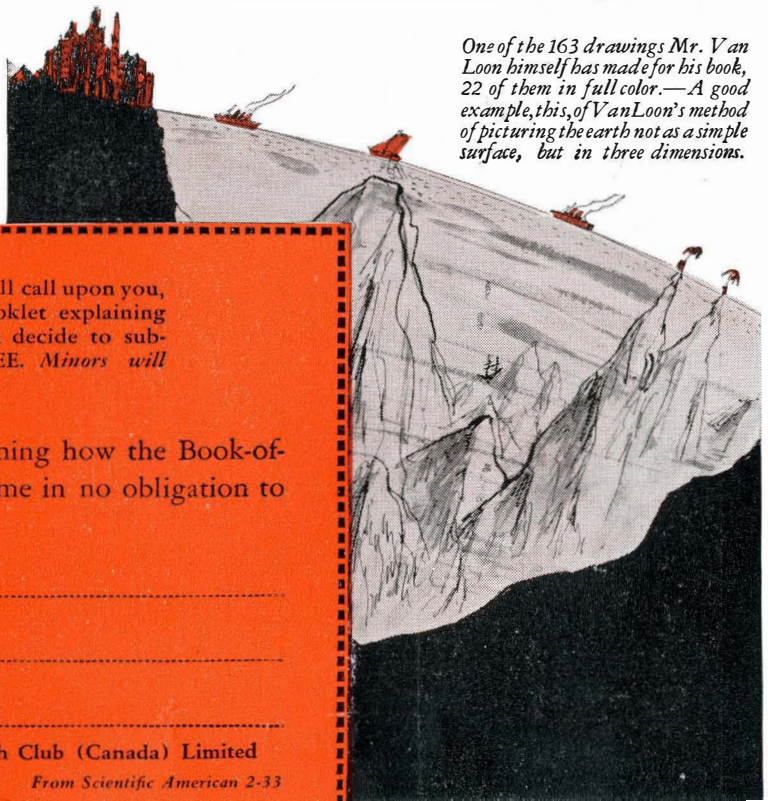

One of the 163 drawings Mr. Van Loon himself has made for his book, 22 of them in full color.—A good example, this, of Van Loon's method of picturing the earth not as a simple surface, but in three dimensions.

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