SCIENTIFIC AMERICAN

SEPTEMBER · 1931 ★ 35 CENTS

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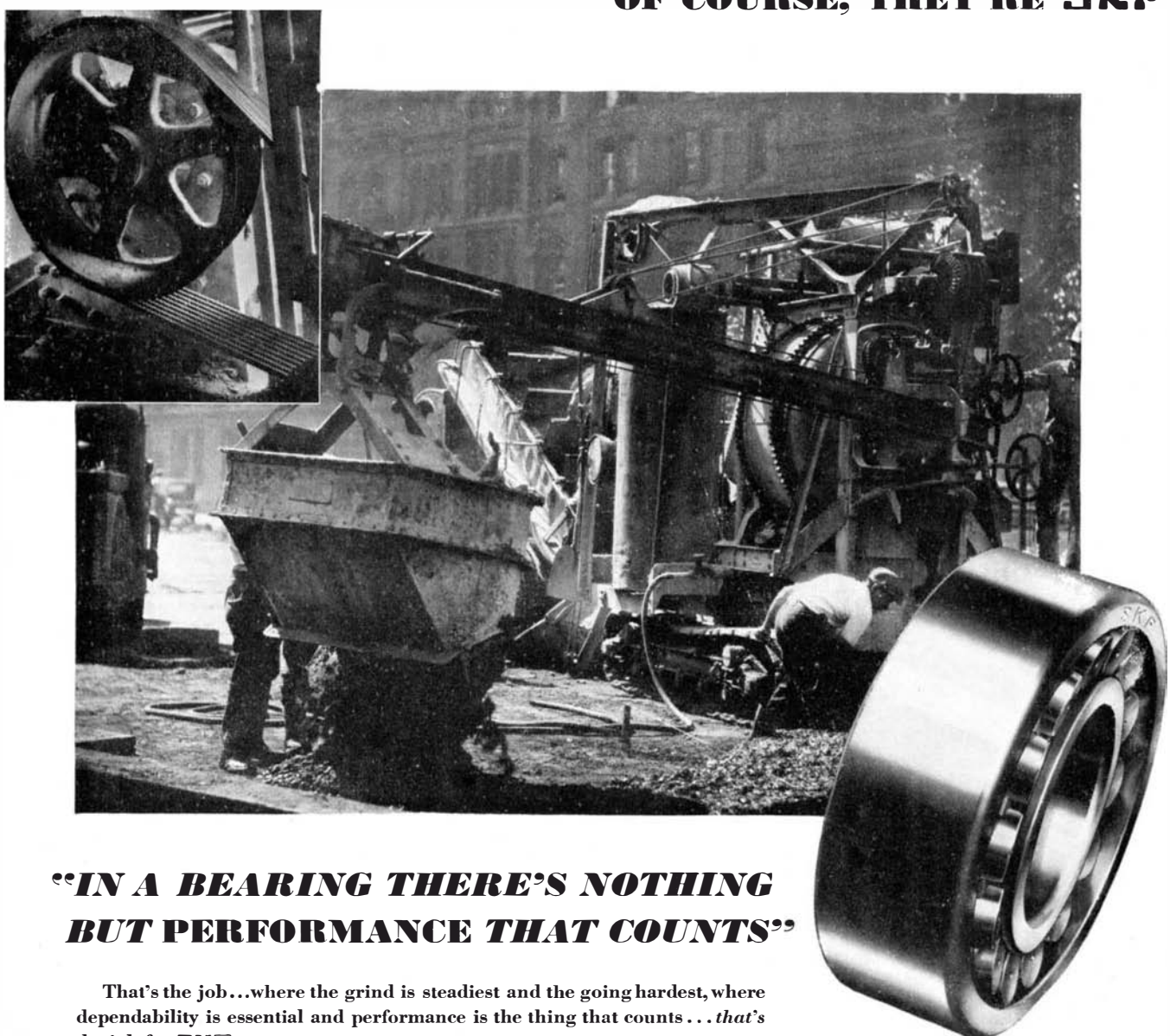

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EIGHTY-SEVENTH YEAR • ORSON D. MUNN, Editor

CONTENTS · SEPTEMBER · 1931

ACROSS THE EDITOR'S DESK

ASK the average man to tell you something of the materials which are used in varnishes, and nine times out of ten he will start off with linseed oil, turpentine, and some kind of natural resin. Ten years ago he would have been correct, but since then the paint and varnish industry has undergone a series of rapid changes that lend an entirely new aspect to the situation. With the development of cellulose lacquers, with which everyone is more or less familiar, paints and varnishes were dealt a severe blow. Lacquers are convenient to use, and have the decided advantage of quick drying. Old style varnishes and paints must be carefully applied if good results are desired, and they are slow drying. But the synthetic chemist has entered the field and shown the struggling industry how to produce paints and varnishes that can compete with other finishes by presenting the same desirable qualities, including quick drying. D. H. Killeffer tells the whole story of this industrial development in an article soon to be published.

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Some time ago the SCIENTIFIC AMERICAN presented what was probably the first authoritative detailed story of the development of airways between North and South America, and on the latter continent. The author of this article, Miss Anne Peck, by the way, has since toured South America, doing practically all of her traveling by plane. Developments since the publication of that article have been rapid, and we have had prepared another survey which presents a word picture of air travel between North, Central, and South America as it stands today. According to the author, "America boasts the largest air-transport system in the world, the routes of which link every country but two in the three Americas"—something to think about and to talk about when the conversation turns to the "superiority" of European nations over this country in the matter of aviation.

●

The ether, once the basis on which was built the whole background of physics, has received some severe blows since the end of the 19th Century. The Einstein theory, in which the ether has no part, has among its supporters a majority of living physicists who are firm in their belief that there is no ether. On the other hand are those whose belief is unshaken in the existence of an all-pervading medium that is necessary to explain phenomena of light and electricity. This last mentioned group has received another serious setback in the results of highly refined "ether drift" experiments repeating those first performed by Michelson in 1887, and affirming his negative answer to the question of the existence of an ether. A discussion of this recent work, which has been carried on by the University of Jena, with the aid of the Zeiss Works, and a description of the elaborate equipment employed have been prepared for publication in our October issue.

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The cryptic (AP) which appears so often in the first line of newspaper stories is usually passed over with little or no thought of its meaning or significance. Behind those two letters is a fascinating tale of big-business as applied to the gathering and dissemination of news on a scale that baffles the imagination. Think of one man through whose hands pass 100,000 words of "copy" daily; think of thousands of miles of telegraph wires devoted solely to bringing the news of the world to the pages of your daily paper; think of automatic telegraph transmitters and receivers by the hundreds and of constant endeavor to improve and perfect these machines so that they may operate at higher speed or with greater efficiency; and then think that the two or three cents that you pay for your daily paper brings to you the results of the work of the gigantic organization behind it all—the Associated Press. The story of this far-flung network of news gatherers who operate at the tempo of our modern world will appear next month.

●

It has been said that in the stock yards they utilize everything but the noise, and now the same degree of efficiency has been applied to rock drilling for building foundations and the like. The noise is still there, unused, but a method has been developed for removing the dust which causes the deadly disease silicosis, and conveying it to a settling chamber, from which it is removed and sold. Thus at one stroke has been accomplished two results: Unhealthful dust has been abolished, and a new source of revenue has been opened. An article soon to appear will tell of this work.

●

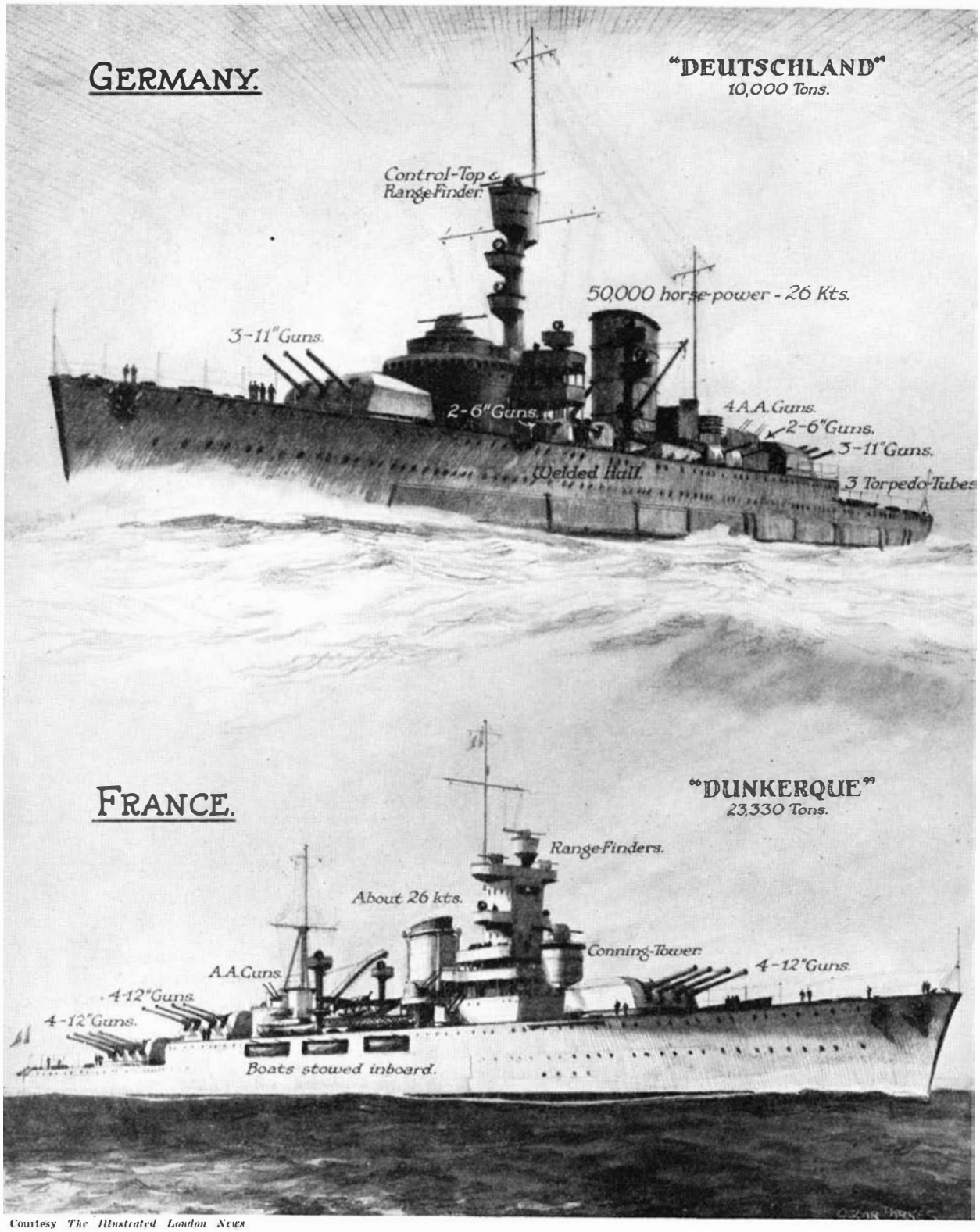
Just as chromium plating revolutionized certain phases of many industries, so is it expected that tungsten plating, newly developed, will find its place in the industrial world. Both types of metal depositing are due to the untiring researches of Prof. Colin G. Fink, of Columbia University, and from him we have obtained the story of his latest work. The article is scheduled for publication next month, and the results that grow out of the work as developments take place will bear careful watching for their influence on metallurgy.

Courtesy
Tech Engineering News

MICHAEL FARADAY

ON AUGUST 29 of the present year it will be exactly 100 years since a simple experiment in electricity was performed in a laboratory in London, an experiment which was seen later to have been probably as significant and as fruitful in a practical way as any experiment ever performed. On August 29, 1831, Michael Faraday, then in his fortieth year and working at the Royal Institution under Sir Humphry Davy, after a period of profound reasoning wound two coils on a ring of iron, connected one coil with a battery and the other with a galvanometer, closed the circuit, and discovered that the needle of the galvanometer moved. This, in principle, was the first dynamo and in the space of 100 years since Faraday's brilliant inspiration the electrical industry, valued at about 100 billion dollars, has grown squarely out of it. What Faraday had discovered, not accidentally but by deliberate experiment after deliberate thinking, was the basic principle on which dynamos work.

This year the Faraday Centenary is being celebrated throughout the world of science. Steadily the fame of the self-educated Irish blacksmith's son whom Davy took under his aegis has grown and grown, and Faraday is regarded as one of the first few great scientists of all time. When someone asked Sir Humphry Davy to name his own greatest discovery he instantly replied, "Michael Faraday."



Courtesy *The Illustrated London News*

FRANCE'S REPLY TO GERMANY'S "POCKET BATTLESHIP"

IN GERMANY'S "Pocket Battleship," launched May 19 and named *Deutschland*, the designers have achieved the unheard-of in combining the gun-power of a small battleship with the speed of a cruiser in the tonnage of 10,000 allowed by the Versailles Treaty. Since she can out-hit at long range vessels of her own size and out-run more powerful ones, she is termed a threat to France. The *Dunkerque*, France's reply to that threat, will be heavier but just as speedy and much more powerful.

Courtesy Metro-Goldwyn-Mayer

Natives of Tahiti diving for ocean pearl, the iridescent mother-of-pearl shell of a bivalve living in these waters. This photograph was taken during the filming of "White Shadows of the South Seas"

A BUTTON INDUSTRY FROM OCEAN PEARL

By GRACE LOCKHART

WEARY of plainness, of severity, of simplicity in dress, Fashion called for a return to the picturesque, to feminine styles. And Paris said, Let there be buttons: buttons on suits, buttons on coats, buttons on dresses, buttons on hats, buttons here, there, everywhere. And Paris said, Let there be ocean pearl buttons, with the beauty of the deep sea, the brilliance of the sun's rays, and the iridescence of the rainbow, and it was so.

Exactly when buttons first made their appearance we do not know, but it was long, long ago. Certainly, they have been with us either as dress ornaments, or dress fasteners, or both for thousands of years. There are references to buttons in the literature of the ancients, and buttons have been found in the ruins of cities upon which the curtain of history fell centuries before Christ.

In the beginning, buttons were used mainly for ornamentation, loose and flowing garments not calling for them in a utility rôle. When modern clothing came into vogue, however, they became an indispensable dress accessory, combining utilitarian and decorative purposes.

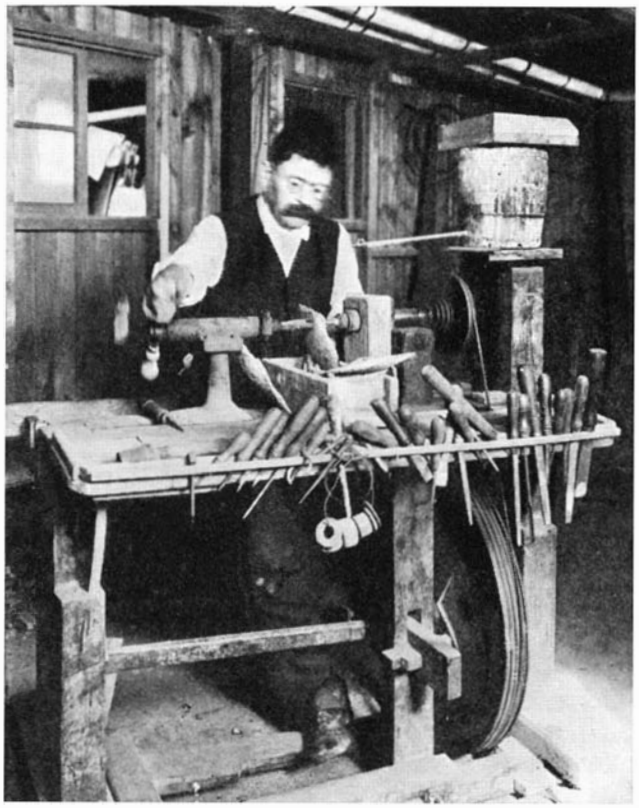
In various periods of history and in various lands, buttons have been made of every conceivable material capable of being cut or turned or pressed, and styled in all manner of bizarre and beautiful patterns and colorings. At different times in accordance with the changing cycles of fashion, they have been pressed from casein, from potatoes, from seaweed, even from blood. They have been made of diamonds and rubies, of satin and velvet, of porcelain and jade, of every metal and with every alloy of every metal, and always of ocean mother-of-pearl.

While buttons have come and buttons have gone, the pearl button has remained a constant theme in the history of dress ornament. Through the ages, mother-of-pearl has been regarded as a supreme raw material by button makers, for in the ocean pearl shell two essentials are combined: beauty of appearance and strength of fiber. Its loveliness is lasting, and its rich luster and delicate colorings are inherent and therefore permanent.

Semi-civilized natives packing and weighing pearl shell in the Torres Straits off Australia

In deep rock or coral caverns on the sea-bottom, or on the sandy beds of still lagoons, the pearl shell is found—in those localities where can be found certain kinds of sea weed. The sun bathed waters of Australasia provide ideal conditions, and today the greatest volume of most valuable shell comes from the Australian fisheries. These fisheries, discovered only in the last 50 years, produce what is known as white shell. Because of its pure white coloring and great strength, this shell brings the highest prices, and is much sought after by manufacturers of high grade buttons.

Originally the only sources of pearl shells were the Red Sea and



Cutting pearl button blanks during the days—not so long ago—when button making was an individual enterprise

the Persian Gulf. It is interesting, and not widely known that the precious gem pearl is the product of the same marine mollusk which creates the ocean pearl shell; is, indeed, chemically and structurally the same. The difference is simply one of growth. The formation of the jewel is occasioned by the presence of some foreign object in the body of the animal against which it strives to protect itself by covering the intruder with layer upon layer of the infinitely fine tissue with which the shell is lined.

THE familiar pearl button, then, on your fine undergarment or shirt and the matched string of moon-white pearls at your jeweler's are of identical raw material. Producers of ocean pearl are more interested in the harvest of shell from which ocean pearl products are gleaned than in the numbers of jewels found. In his turn, the pearl diver is less interested in the jewel than in the shell, upon which his livelihood primarily depends.

In addition to the shell taken from the Red Sea, which is known as Egyptian, there is yellow shell found in the Sooloo Archipelago, a small dark shell found in Panama and Costa Rican waters, black shell from Tahiti, a variety of shells from the Dutch East Indies, and the abalone shell found along the Pacific coast of the United States. All these shells have different qualities and gradings, the pure white Australian shell being pre-eminent.

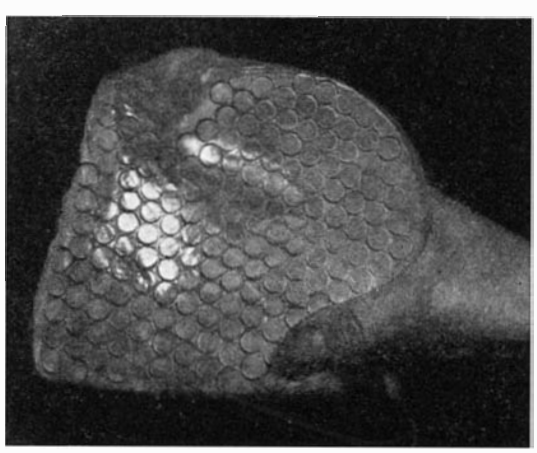
The ocean pearl shell which oftentimes measures 10 to 12 inches across — the individual shell frequently weighing as much as four or five pounds—is formed through long years of building. The material with which it is lined is a combination of calcium carbonate and a special material called conchiolin secreted by the pearl mollusk. The shell structure is made up of a large number of very fine layers of this chemical combination, each layer being 1/4000 to 1/6000 of an inch in thickness.

Under the microscope, the thin layers of pearl appear to curve and overlap in minute undulations as waves curl on a beach. The reflection of the minute undulations of the layer edges through these transparent waves produces the soft, rich luster, and rainbow iridescence peculiar to ocean pearl, while the unique laminated structure provides extraordinary strength.

These characteristics distinguish ocean pearl shell from the freshwater pearl mussel found in riverbeds, which is also used for buttons, but which by the nature of its structure—being of a different chemical composition, and formed in a solid mass instead of being built in layers—is inclined to brittleness and is lacking in permanent luster or iridescence.

Methods of ocean pearl fishing are different in the various localities. In the South Seas they are much the same as they always have been. A naked, black body poises on the edge of a tiny craft, in one hand a basket, in the other a sharp iron tool with which to pry the shells loose from their anchorage or to battle the sharks, plunges through the blue tropical waters, 30 to 50 feet downward, and rises with the prize, to rest, to breathe, and plunge again.

The machine age method of cutting pearl button blanks. Much skill is required to cut these properly so that there will be the least possible waste. Below is shown a large shell with the button blanks cut partly through



Many of the natives will descend only when protected by the incantations of shark-charmers, important members of the South Seas expeditions. Sometimes a rock is carried in the hands to make the descent less arduous, or the diver may stand on a stone to which a rope is tied and so be lowered to the treasure ground. In Australia, modern diving

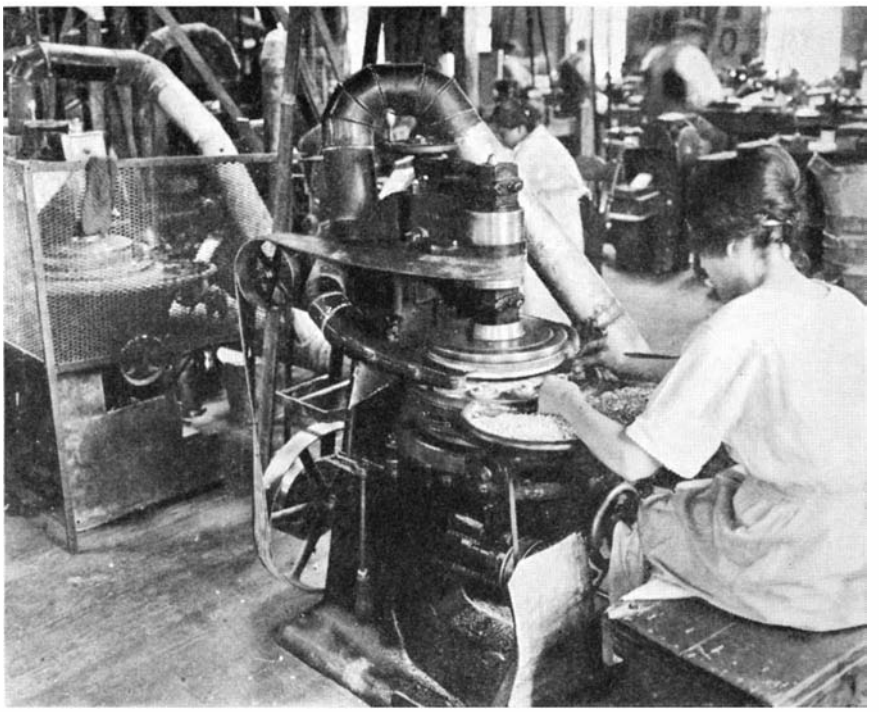
equipment is used. The pearling luggers stay out practically the eight months' season, receiving their supplies from supply schooners.

The most important product of ocean pearl shell is, of course, the pearl button. America today is the center of the pearl button industry, and consequently the major market for pearl shell. Between five and six million gross of buttons are produced annually at a value of approximately 6,000,000 dollars, this production constituting a large percentage of the total output of buttons in the United States.

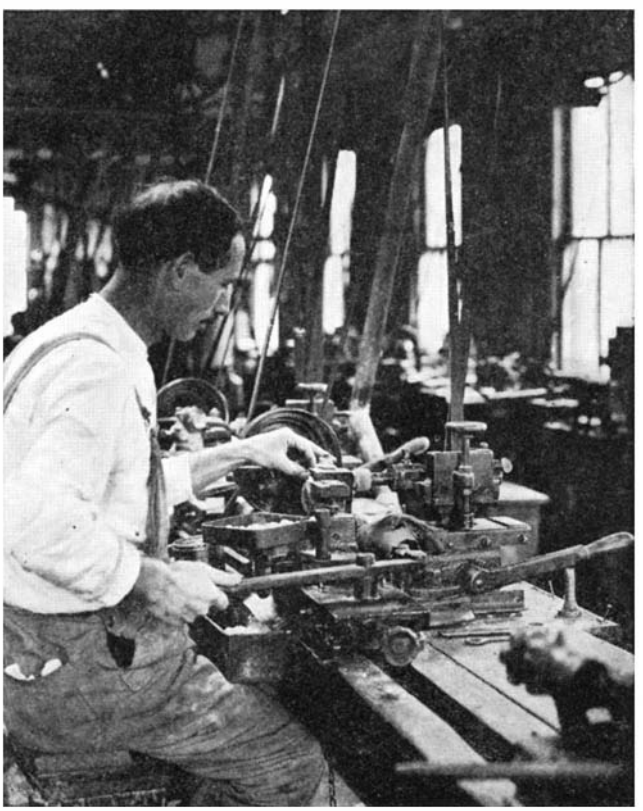
IT was not until 1855 that the trade in ocean pearl buttons was introduced into this country, the shells coming at that time mainly from the Far East. Thirty-five years later, the importation of pearl buttons had almost ceased, and in 1900 over a million dollars' worth of ocean pearl shells from Australian beds were imported.

The declared value of pearl buttons exported from Austria to the United States in 1886 was over a million and a half dollars. In 1900 it had fallen to 36,000 dollars, and Consul General Hirst reported: "The pearl button industry of Austro-Hungary which, in former years, occupied a prominent place among the flourishing industries of the Monarchy, has dwindled of late to such a figure that the pearl button can no longer be regarded as one of the principal exports to the United States. This may be attributed to the development of the industry in the United States."

Competition of foreign labor, which had once seemed a vital factor in an industry which in its European homelands called for hand labor, had, after all, proved of little consequence in America. An inventive nation had early begun the replacement, even in this industry, of men by machines.



A nimble fingered worker feeds this modern convex backing machine. Blanks are placed, one at a time, into the chucks which pass under the grinding head



***Above:* The machine which cuts the "fisheye" and drills the holes in buttons. *At left:* Hand button-turning lathe**

Ocean pearl is essentially a material which calls for real craftsmanship. In central Europe and also in Birmingham, England, operators in the pearl button industry existed almost entirely independently. The trade was carried on by individuals working for the most part in their own homes, their equipment being a deft pair of hands and a lathe, but in a Twentieth Century New World, multiplicity of hands and lathes was not enough. Highly specialized machines were developed to meet the demand. Through advances in method, beauty of design and coloring have kept pace with volume, and from the decorative point of view, pearl buttons have

Part of the equipment necessary for the button polishing operations. Finished buttons are agitated in various solutions to bring out their luster

never been more varied or more ornamental.

Our knowledge of pearl button manufacture was inherited from Birmingham, England, originally the center of the pearl button trade of the world, a city, we are told, the very foundations of which are waste mother-of-pearl—the debris of pearl button manufactories; and from Austria Hungary from which country the old Bohemian button maker took himself and his lathe to our shores.

IN the old days with the old foot lathe which called for 12 separate operations, a skilled operator working from 10 to 14 hours a day could produce about 40 gross of buttons a week. Today the mechanical process is divided into five parts—cutting, splitting, grinding, facing, and drilling, each operation being handled by special operators. A well-known button manufacturer estimates that if one man could operate the machines now used, he could produce 650 gross of buttons in a week—an increase of over 1500 percent in production efficiency in less than 30 years!

However, although standardized manufacturing methods have made for phenomenal progress in the industry, deft fingers have by no means been entirely discarded. Considerable hand work is still necessary. In fact the button blank is handled individually in each process from start to finish.

After the shell has been graded, it is soaked in water for a period of one to two weeks. Then it goes to the cutting lathe. A high speed tubular saw, or drill, is used to cut the blanks.

The blanks, which vary quite a bit in size, shells from which they are cut varying from one twelfth of an inch to an inch and a quarter in thickness, are then classified for splitting into the proper thicknesses for the pattern desired. This work is done by hand with a splitting knife and steel hammer, some blanks being split into as many as six buttons. Here again skill must be used so that the maximum number of perfect blanks may be obtained. Mechanical means have not yet replaced the experience of the accomplished splitter.

After the blanks are reclassified, lathes equipped with abrasive wheels grind the face and back of the blanks to smooth, even surfaces. They are then fed into revolving chucks in which the pattern is made and the required number of holes drilled. This machine contains 20 chucks in an endless chain, in which the buttons are held. These open automatically to receive the blanks and close automatically in a continuous motion. The chucks pass under two separate turrets, the first one containing the tools for the facing of the pattern, the second one the drills for making the holes. An indexing attachment spins the chuck a quarter turn for four-hole and a half turn for two-hole buttons. When the last hole is drilled, the blanks are released at an average rate of 150 gross each eight-hour day.

THE next step is the polishing. Where formerly each button was polished individually by hand, bulk lots are now polished in tumbling barrels. A series of solutions is used, the first of which is water and pumice stone, the second water into which sulfuric acid is dripped at the rate of 10 to 15 drops per minute for the purpose of giving the buttons a hard lustrous finish, and the third hot water to which a solution of hydrochloric acid is added to bring out the pearly finish. Finally they are washed in soap and water and put into a last tumbling barrel containing sawdust where they are tumbled until they are dry.

Assorting is then done by hand, again by skilled workers who grade the buttons according to color and perfection.

Millions of ocean pearl buttons pass through this assorting room where keen eyed inspectors sort them out according to style, quality, and iridescence

OUR POINT OF VIEW

A Nine Days' Wonder

IF any one of us should be inclined to forget that we live in an age of speed, the amazing flight of Wiley Post and Harold Gatty in the *Winnie Mae* around the world in less than nine days would certainly bring us to our senses quickly. This flight, which is discussed in detail in the SCIENTIFIC AMERICAN Digest of this issue, set so many new records as to leave us well nigh breathless.

Called a "sporting proposition" by the pilot, Post, and the backer, F. C. Hall, the flight so stirred the imagination of the world that it has been called "the greatest since that of Lindbergh." Men high in governmental positions having to do with aviation, famous fliers, and executives of aviation manufacturing companies acclaimed it as "epoch-making," "an extraordinary tribute not only to the ability, fortitude, and endurance of the men themselves but also to the aircraft and engines of today," and as "another testimonial to the courage, dash, and daring of American aviators; it will have a far-reaching effect on the future of aviation." A display of sheer grit and determination, we add, and we extend our sincere congratulations to the intrepid Post and Gatty for their great achievement.

Much credit is also due the owner of the *Winnie Mae*, F. C. Hall, for the splendid spirit of unselfishness he has displayed in remaining in the background from the beginning of the flight on. Indeed, the whole performance was notably free from selfish aspects, noisome ballyhoo, and commercialism. For this fact, a world grown weary of publicity-seekers and raw exploitation, renders up its thanks.

More Speed in the Air

THE Schneider Cup races will be run on the Solent, in England, in September, and the United States will not be represented. That bare statement should be enough to shame every American who has the least sporting blood, patriotism, or business sense about him. If more is needed, however, it is necessary only to remind him that this country now holds two legs of the trophy, that a third victory would give it to us permanently, and that our best air speed, made by Lieutenant Alford Williams, is only 266 miles an hour against a world record of 357 miles an hour!

It is the contention of experts that great air speeds will never be attained except as the result of lessons learned in such experiments as those which culminate in the Schneider races. Sir Alan Cobham is quoted as saying that "Improvements in streamlining, diminution of air resistance, and superior engine design can be developed in no other way." That these factors are important, no one can deny, for all now recognize the necessity for air speed.

Some months ago it was reported that an association, the American Speed Foundation, had been formed to restore the United States to the Schneider contest. Its avowed purpose is to build a plane and train racing pilots for a supreme test at the next Schneider races in 1933. We wish them success but if, by any chance, they should run into difficulties, we hope, in fact we expect, that some other group or individual will take up this important problem of speed. We believe with Alford Williams that "without an immediate development of speed in the air, almost all American achievements in aviation will mean nothing!"

Chasing a Rainbow

SIR OLIVER LODGE is worrying again about the ether. Modern science believes there is no ether and never was, but Sir Oliver and some others still believe in it and want it diplomatically recognized by science. He now suggests an experiment which will restore the ether to "its inevitable place in the scheme of Nature."

The proposal is to set up an interferometer in an exceptionally intense magnetic field and measure the velocity of light with it. According to the classic ether theory the ether ought to be caused to flow along magnetic lines of force. Therefore light, which on the classic theory flows in the ether, would take a new velocity under the influence of the magnetic field. "A positive result," Sir Oliver says, "would break the prevailing monotony of negative results yielded by all recent attempts at bringing the ether to book. . . ."

There is not and never has been any evidence for an actual ether. To begin with, the ether was simply a convenient mathematician's hypothesis, a postulate, which in some way took root and grew into a tree without real excuse. Logic required an ether and the mathematicians, always facile, made one "out of some nothing," as God was supposed to have made the universe, according to Genesis.

Sir James Jeans likens the ether to the earth's equator—purely imaginary. Now no scientist ever has performed serious experiments with a view to laying hands on the earth's equator, tieing knots in it, seeing what it smells like, and so on. Further experiments to detect the ether seem almost as naive. Nevertheless it would be fun to see how Sir Oliver's experiment would work out. Somebody ought to try it, and then, if the ether is caught at last, perhaps a way can be found to catch some equally imaginary spooks and cut an identification mark in their ears.

Voices Across the World

WITH receivers clamped over his ears, President Hoover listened to discussions, questions asked, and answers given in connection, not with some momentous national problem but with what is perhaps a much more important international one—and across the Atlantic, at that! In such wise did the newspapers play up the use of the transatlantic radio-telephone during the international debt suspension talks early in July. In this particular case, the telephone served to awaken European diplomacy from its ages-old sleep, and the negotiations were speedily completed.

As explained in the article on page 182, the overseas telephone service has been in operation for only a little more than four years. But in this short time the service has been tremendously improved and extended; and business and commerce have adopted it as another link—and a vital one—in the "community of interests" chain that is rapidly bringing the nations together.

Right now when the whole world is discussing the possibility that the United States will modify her attitude of isolation, when people at home are urging a wider participation in international affairs, when the interdependence of nations is beginning to be recognized by the most hard-shelled "isolationist," it seems that the telephone is to play a large part in the period of better international understanding that is just around the corner. If the debt moratorium talks—via the radio-telephone across the sea—are any indication, the telephone is going to help a lot in promoting a neighborly spirit among nations.

WILD LIFE IN A FIRE*

By DUANE H. KIPP
Of the Wisconsin Conservation Commission

OSCAR WILDE'S thought-provoking line, "Yet each man kills the thing he loves," is nowhere more graphically illustrated than in three paradoxes of the outdoors. The first of these is the person who appeals frequently to the Humane Society to stop cruelty to animals, and yet who through carelessness with fire, will cause untold and extreme suffering to the creatures of the wild. The second is the hunter who devotes time and money to game propagation and protection activities, and yet who will carelessly flip a cigarette into brush, or leave a campfire burning, destroying by many thousands more game than he can produce. The third is the fisherman whose interest induces him to work faithfully and long at the frequently cold and unpleasant tasks of rearing and planting, and yet whose carelessness wrecks watersheds and poisons streams. It is the thoughtless and careless user of woodlands who destroys the thing he loves. Forest fires, for the most part, are not inevitable. They can and must be controlled. Figures compiled by the Conservation Commission indicate that barely 1 percent of the forest fires in Wisconsin are started by lightning, the only natural cause of forest fires. All others find their origin in human carelessness or maliciousness and are preventable.

Coot (mud hen) burned to death as fire swept over its marsh home

A story is told of a tenderfoot, watching a forest fire for the first time at close range, who wrinkled up his nose and commented on the unpleasant odor. His query to an old-timer working near at hand brought the laconic reply that it was "burnin' meat." If more of the causers of fire could visualize the effects of their carelessness, could smell "burnin' meat," the number of fires would soon diminish. They should hear the tales the fighters of fire can tell; they should know of the countless does that re-enter fresh burns and vainly search the hot ashes for fawns which had been safely concealed from all enemies but man's carelessness. Fire-fighters can tell of thousands of bird eggs baked crisp and lifeless in spring fires, and of mother birds seared and dead from heroic but vain efforts to protect their nests of eggs or young.

Fire's economic loss has been stressed for years. The public has been informed repeatedly of the destruction of forest growth, endangering of water resources, and the despoilation of natural beauties by fire. But so far, perhaps because of a lack of pictorial evidence, comparatively little has been said of the terrific and appalling slaughter of living things, large and small. Let one man be killed or even injured while fighting fire, and the news is spread broadcast, but in every forest, marsh, or field fire, death and destruction are dealt to uncounted lives and little is said or thought about it. Indeed, there is somtimes even skepticism as to whether game is actually killed.

During the summer of 1930, the worst forest-fire year Wisconsin has ever experienced since there has been organized forest protection, the State Conservation Commission made good use of several extremely bad situations and secured a most unusual series of pictures telling the story of forest fires and game. It is a lurid, horrible story of extreme suffering, agony, and death. Many of the pictures are revolting; none of them is pleasant. But in this they are true to the subject they portray. The extremely doubtful beauty of fire has received far more attention than it merits.

Fire burned off the roof of the main room of this beaver house

A FIRE destructive to game and fish occurred in September in parts of Wood, Juneau, and Jackson Counties in central Wisconsin. More than 120,000 acres of excellent game country were burned over in this single fire, which at its greatest extremity measured 97 miles in circumference. Much of the land in the fire area was open, grassy, dry marsh interspersed with ridges of oak, aspen, jack and Norway pine. These marsh lands had suffered from too enthusiastic and unintelligent drainage. Much of the country in this part of central Wisconsin has been so overdrained that irrigation is necessary.

The fire started in the center of a drained marsh area, in which there were no through roads. Many of the streams and drainage ditches in the district were dry. The peat soil which underlies most of these marshlands burned so readily that plowing furrows to check the fire was useless.

Before the fire, deer were very abundant in this part of central Wisconsin. During recent winters herds of 60 to 70 animals have been seen. The abundance of deer was due to the excellent character of the cover and a plentiful supply of food, a closed season for 15 years or more, and efficient enforcement.

*Text and photographs courtesy *American Forests* and the Wisconsin Conservation Commission.

Killed by warmed water, lack of oxygen, and excess carbon dioxide

More than a score of deer were found after the fire. Undoubtedly, these were only a small percentage of the number destroyed. Surveys made by the Conservation Commission determined that 60 percent of the deer surviving the fire had badly burned feet. One deer was found walking on its knees, and when put out of its misery it was found that both front legs had stiffened in a bent position and that the hoofs and foot bones had broken off. A dog was shot when caught in the act of killing a fawn which had badly burned feet. Another fawn was found dead in a ditch. A trap set near this fawn caught a coyote when he returned to his kill next day.

For several months following the fire, freshly dead deer were reported both in the fire area and in the district surrounding it. In November a lame deer was gored to death by a herd of cows. Disease resulting from the weakened condition of the deer, due not only to burning but to suffocation from gas and smoke, took its toll during the succeeding winter.

The most abundant game bird in this region was the sharp-tailed grouse. At first it was thought that most of these birds had died in the fire, but according to later checks, it has been determined that probably not more than 25 percent of the total population were actually killed. Prairie chickens, ruffed grouse, and quail suffered great losses.

Few rabbits were killed by the fire as they escaped into holes outside the peat beds. But the rabbits suffered particularly from hawks and owls following the fire, due to the lack of protective cover.

In this fire, as in most other fires, lack of oxygen, warmed and ash-poisoned water combined to kill thousands of fish. Dead fish were found in all parts of the drainage ditches and in the Yellow River, which flows through the burned area. Pickerel were hit the hardest. Many dead wall-eyed pike were observed. Dead suckers and minnows were seen in most of the ditches. In the Yellow River black bass and sunfish were found dead. Dogfish, ordinarily one of the hardest fish to kill by lack of oxygen, were found in a helpless condition, although not dead. Even frogs and crayfish died in large numbers.

The damaging effects of forest fires on game might be classified as direct and indirect. The direct includes the game birds, animals, or fish killed during the time of the fire, or dying as a result of injuries suffered. The indirect results are frequently more disastrous than the direct.

Fires cause dangerous concentration of game. In an area approximately three miles square on the eastern edge of Wood County, adjacent to the burned area, 93 deer were counted in a single afternoon early in the winter following the fire. This concentration was not the "yarding-up" as deer do not congregate in "yards" in mild winters. Sharp-tailed grouse, prairie chickens, and ruffed grouse have concentrated by the thousands along the ditch banks and in the few unburned "islands." Rabbits and other small animals have likewise concentrated.

THE very presence of large numbers of game animals or birds attracts predators. The predator situation becomes particularly serious after a fire because the mice and other normal food of foxes, coyotes, hawks, and owls are practically exterminated in burned districts. This makes the predators turn more than ever to game animals and birds.

Another disastrous indirect effect of forest fires is the destruction of food and cover. The beaver situation in this area is typical. Few beaver were actually killed in the fire because of their ability to escape by their water routes, but their food has been entirely consumed.

The Conservation Commission has established many feeding stations for birds in the burned area, equipping every station with automatic feed hoppers.

The burned feet of this dead doe tell an eloquent story of her sufferings in a forest fire

Fires have a serious effect on game reproduction. Many birds and animals, while not actually killed, are rendered impotent or inefficient because of weakened condition. Large concentrations of game, caused by fire, likewise have a harmful effect on reproduction because the individuals do not pair.

This one fire which burned in such excellent game country in central Wisconsin in 1930 may have been more destructive to animal, bird, and fish life than normal forest fires, but the results which have been related here tell the story of what happens in greater or lesser degree in every forest, marsh, or field fire.

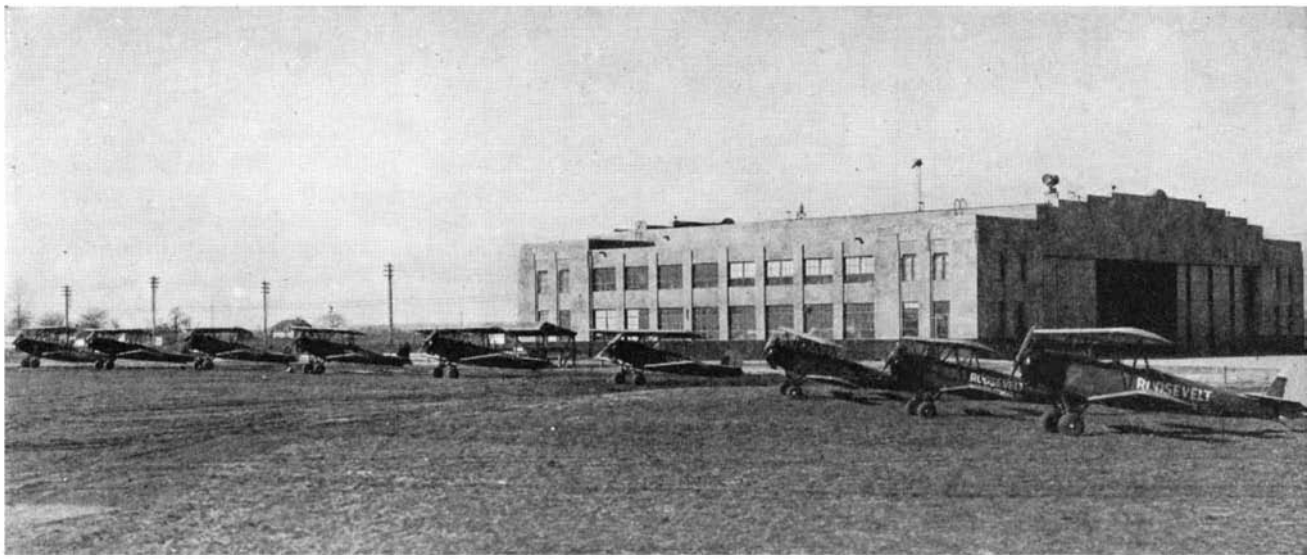
The effect of fire varies according to the season in which it burns. Early spring fires are particularly disastrous to the mating activities of game birds. Fires later in the spring destroy nesting

Baked body of a sharp-tailed grouse, after the fire had swept on

birds or young birds and animals. Fall fires play havoc with the food and cover necessary for the game to survive the approaching winter. Fires always do more damage to game than to game's predators, as these latter animals and birds are better able to take care of themselves than are the game animals and birds.

Statistics on fire causes show that a comparatively small percentage result from logging activities, indicating that men whose livelihood depends on the woods are more careful of them. Similarly there are usually fewer fires on Indian reservations than surrounding them. America's oldest outdoorsman is careful. Carelessness with fire in the woods marks the tenderfoot.

The whole effect of forest fires is probably more destructive to game than the sum total of all hunting and fishing law violations. Sportsmen can do nothing which will do more to perpetuate their sport than to prevent forest fires. America's out-of-doors is a heritage to keep, protect, and enjoy.



The field at Roosevelt Aviation School, showing the modern concrete and steel building housing classrooms, shops, and hangar

FLYING INSTRUCTION AS IT SHOULD BE

By GEORGE W. ORR
President, Roosevelt Aviation School, Inc.

THAT there has been remarkable progress in aviation is common knowledge to most people, but that there has been equal progress in flying instruction is not as generally realized. Proper education of the flier, however, contributes quite as much to the safety of flying as all other factors combined. There is little wonder then that continual study has been given to this phase of flying, and that the methods of instruction have become as scientific as other specialized fields in education, and subject to the closest scrutiny and regulation by our government.

In the earlier days of aviation the pilot was trained either by the government for one of the service branches, or the person desiring instruction attached himself to some operating organization and picked up such instruction as was at hand. Then a pilot here and there would manage to get the use of some kind of plane—anything that would fly—and advertise himself as an instructor, often dignifying such an operation by the name of a flying school.

This method of instruction is still practiced even in the light of modern school development. The practice is able to continue because such instructors have no organization expense, practically no facilities, and are, therefore, able to charge less than a properly organized, equipped and administered institution. Satisfactory results are sometimes obtained, because of the ability of instructor and pupil, but in general a sad list of accidents and fatalities has followed in the wake of such unorganized and haphazard methods.

A good flying school is just like any other good school, and the degree of proficiency of its graduates depends upon the facilities offered. Some of our most illustrious characters graduated from the old log school house and some of our excellent pilots are the product of "catch-as-catch-can" instruction, but it is no more logical to recommend such instruction for the student than it is to continue the log school house method of education. Under such conditions it is a matter of the survival of the fittest, and in flying this takes on a serious significance. There is little or no risk involved in the course of flying instruction by a properly administered school.

Realizing the significance of the above statements, the Department of Commerce, through its Aeronautics Branch, has given careful study to the problem of flight instruction and has issued detailed regulations (Aeronautics Bulletin No. 7-B). A certificate of approval is awarded to schools meeting government requirements. The work of such approved schools is carefully supervised. [See May 1930 SCIENTIFIC AMERICAN for details of these regulations and certificate awards. *Editor.*]

SINCE the writer is more intimately in touch with Roosevelt Aviation School than any other, he must be pardoned for using this school as an illustration of the modern flying school in action. Realizing the advantages both to the public and to the school of accepting the regulation of our government, Roosevelt Aviation School was one of the first approved schools and holds the highest license available from the government. This license includes all instruction necessary for private, limited commercial, and transport pilots.

There are three elements absolutely necessary to make safe flying, and these same elements may well be applied to safe instruction. These important factors are: A good pilot, a good airplane, and proper maintenance.

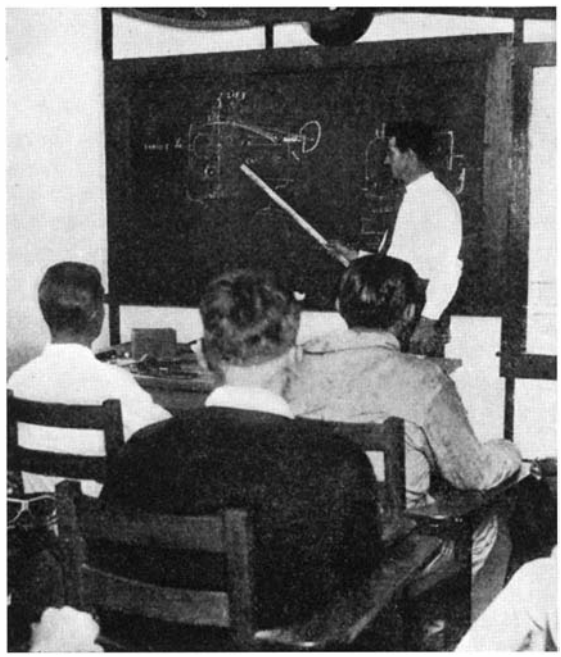
Perhaps the most interesting way to tell of the actual working of a flying school is to follow a student as he comes out for instruction. After enrolling, he is informed that he must pass a medical examination before a doctor appointed by the Department of Commerce for this purpose. This medical examination entitles him to receive a student's permit and also is sufficient to entitle him to a private pilot's license, when the test for this license has been passed.

Upon arriving at the school, he is delighted to find that while there is a great field set apart for instruction, it is also a part of commercial Roosevelt Field, the largest commercial airport in America, with more runways, more hangar space, and more resident commercial ships than any other field in the country. There are, in fact, two distinct fields, each comprising approximately 250 acres, one being on a lower level than the other but adjoining and connected by a ramp, so that planes

may taxi from one field to the other. The school field being reserved for instruction gives the necessary safety for the inexperienced pilot, and the close proximity of the commercial field gives the atmosphere and experience in regular aviation, which is of inestimable value to the student.

When the student is ready for his first flight, he is assigned an instructor who continues with him throughout the course of instruction, and who is chosen not only because of a special aptitude for instruction and long experience in the air, but because of his ability to enter into this close companionship of instructor and pupil with sympathy and understanding.

When the instructor and student are seated at the dual controls, the engine is "reved" up to see if everything is working properly. All ready? We close the throttle for a moment and signal to the mechanic to pull the chocks from in front of the wheels. Take it easy as we taxi our plane to the end of the runway and into the wind, which is the proper position for taking-off. Now then, "give it the gun!" We open wide the throttle and push straight forward on the control stick, in order to raise the tail and place our ship in a natural flying position. Our **air speed indicator** dials sufficient speed for the take-off, and soon we will learn to know by the feel of the ship just when the right moment arrives. Keep the ship straight with the rudder. We have our flying speed—pull back slowly on the control stick. Easy now, we're in the air! You scarcely know we left the ground at all. Six inches, five feet, ten, twenty, fifty feet. We continue with the control stick still slightly back until our altimeter indicates about a thousand feet.



Instruction in theory as well as practice is essential to rounding out the education of the fledgling

LOOK straight down. You won't be light headed. Many people get dizzy when they look down from a tall building, but there is little sensation of altitude in an airplane, just as there is very little sensation of speed, except when you are close to the ground.

We now have sufficient altitude, so we throttle down the engine to the proper cruising speed. It shortens the life of a motor to run it wide open too long. We take a glance at our instruments—altitude about right, speed about right, oil gage shows the proper pressure. Good. Let us fly level and straight—it's easy. Pick out some point on the horizon and point the nose of the plane towards it. As far as we are concerned the position of the horizon never changes regardless of our altitude. If the nose swings off to the right or left, bring it back gradually with the opposite rudder from the side to which the plane swings. It's like steering a boat.

Do not make hard work of flying. It is not necessary, for you'll only over-control as you did when you were learning to drive an automobile. Watch the nose of the ship. It is above the horizon. We are through climbing, so ease the stick forward and bring the nose down. That's it. The right wing is a little low, so "trim ship", as they say in the navy. That's the idea. Ease the control stick to the left—the aileron levels up the wings.

Now we are ready to try a turn. First, place the nose in a level position and bank and steer to the right by easing the control stick to the right and give it a little rudder at the same time. Now return the stick to neutral so that the bank won't increase. Our airplane is now turning. Now watch as I give it too much right rudder and not enough bank for this amount of turn—the tail of our machine skids around like an automobile skidding on a wet pavement, but there is so much room up here that little occurs. Feel that draft on the side of your face? You can always tell a skid that way. If we give it too much bank and not enough rudder for the bank, our airplane slips on the turn, slides down sideways, and we lose altitude. Feel the draft on the other side of your face? That's the side slip. You can always tell a slip by that draft. It takes practice to make perfect turns. It's simply a matter of co-ordination of the controls. It will come in a very little while, like learning to balance yourself on a bicycle. We come out of our turn to the right, we ease our rudder back to a neutral position and apply slightly opposite rudder and bank, if necessary, to bring our airplane back on a level keel. Coming out of a turn is just as easy as going into one.

WE have been up for about 20 minutes now, which is long enough for the first try. Now, let's go back home. Follow closely what we do. We get into position so that we will come in against the wind. We close the throttle. Our motor will not stall, it runs idle, but we keep our hand on the throttle in case of emergency. Push the control stick forward, so that the plane goes into a glide, not too far forward so that it dives, and not too far back so that the glide is too shallow. That is about right—now just a nice gentle glide. We keep our wings level and steer directly into the wind.

As we approach closer to the airport, we look around carefully below and ahead to make sure that the field is clear for landing. As we approach the field, we look forward and to the right of the nose about a hundred and fifty feet ahead to judge our height from the ground. When we are about 15 feet from the ground, we begin to flatten out, as we are now, by easing back gradually on the control stick, keeping just above the ground as we decrease our forward speed. Watch now; this is important. We continue to pull back on

Working on real planes, the students are instructed in rigging

In dual flight, the instructor talks to the student through a speaking tube—but the student can not answer back!

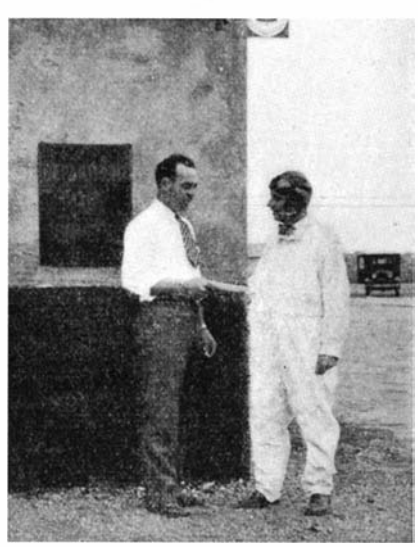
The big thrill. The student, after thorough instruction in dual flying, is ready to take off on his first solo flight

our stick—back, back, back slowly to get the tail down, and our airplane lands itself on the wheels and tail skid at the same time. This is known as a three-point landing. We keep the stick back and the ship comes to rest, the tail skid acting as a brake. So ends our first flight! Thrilling, to be sure, but not with the anticipated thrill of danger—rather a thrill of exultation.

The student is always immediately supervised by his instructor. The training planes are equipped with dual controls, so that not only the student but the instructor has the controls at his command, and through a speaking tube the instructor can give directions all through the dual flights. From the very first flight, the student begins to gain experience at the controls, the first work being in straight and level flying. Next, climbs are attempted and then through gentle turns to glides. This is all very simple and is mastered quickly. Then, the most important part of the instruction begins; that of taking-off and landing. Each landing is different and the student spends as much time on this work, perhaps, as on all other training combined. As the student progresses, he is taught what to do in stalls and spins until the big moment arrives when he goes for his first solo flight. Three of these solo flights are made, with a check by the instructor between each. Then comes more instruction for 180-degree and 360-degree turns. More solo work on these turns, and then further instruction in figure eights and spirals. More solo work on these figure eights and spirals, and then the final check by the instructor before being ready to take the Department's test for the private pilot's license.

DURING this course of instruction, the student has taken the necessary amount of class work in ground school instruction so that by the time he has finished his flying training he is all ready for the examination. The approved school officials are very careful not to present any flier for examination, unless they are pretty sure that he has properly mastered his art, because it is necessary in order that approval may be retained that nine out of every ten students pass this test and receive the license for which he has applied.

Now the question is always asked, "How long does it take to learn to fly?" This is purely a matter with the student and depends upon how much time he can give to the work and how he applies himself in his studies. An interesting demonstration was made by Roosevelt School when it trained three young ladies, a matron, a business girl, and a college girl, to solo in one day. This is, of course, a stunt and is really too fast to proceed. The ideal time is about 21 to 28 flying days, which gives the applicant for a private license sufficient time to assimilate properly the instruction given and to do the necessary ground school work along with it. The time may be shortened to, say 14 days, and is often spread out over a number of months, which gives the student, if he has the time and money to sustain himself, the added advantage of more practical experience in mechanics and operations.



Flying school is over. The graduate pilot receives his license to fly

Behind the scenes of an aviation school everything is systematized for safety. A complete record is kept of the dual, solo, and ground-school time of each student. The planes and engines used in training are thoroughly inspected every 15 hours of flying time and the engines are thoroughly overhauled every 200 hours. After 300 hours the fabric is stripped from the fuselage so that every part may be thoroughly inspected. A complete log is kept of every engine and plane, showing time of flight, and work done.

MANY of the students now enrolled in the better schools are interested in aviation only as a sport. Flying is a thrilling and absorbing sport and is just as safe as any other, when the flier has been properly and adequately taught the essentials of safe flying. These men, depending on their means, either purchase planes for themselves or in company with a group of private pilots as a flying club. Many commercial operators furnish space for storing and servicing these planes just as a garage does. Considering the space occupied by a plane, in comparison with an automobile, and the use of the costly airport facilities which go along with it, the charges are most reasonable, running usually upward from 25 or 30 dollars a month, according to the size of the plane. Other students are learning flying as a profession. Even though there is an abundance of graduate pilots available at present, the thoughtful young man or woman realizes that as in any other profession, graduation is not all that is necessary in securing a good position. It is just the beginning. The inexperienced graduate of today will be the experienced pilot of tomorrow when the expanding demands of a growing industry require their services.

HOW YOU ARE INFLUENCED BY COLOR

By SOLON R. BARBER

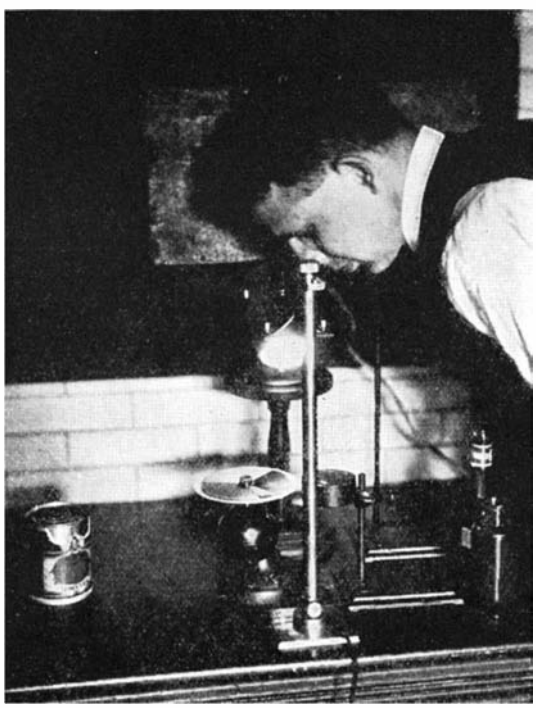
IN no other age has color played so important a part in buying and selling. The modern woman wants her frock to match the color scheme of her motor. She chooses dresses to suit her mood. She achieves color harmonies in the foods she serves and the dishes she serves them in. Even men have surrendered to the newer spirit and are now using more color in their clothes, homes, and offices. Our skyscrapers are built in such a manner as to give a distinct color effect, even to blend or contrast with their surroundings.

Modern shops are designed to appeal to the buyer's increasingly active color sense. Wise merchants, in tune with their time, are studying the science and art of color so as to compete successfully with their modern business rivals. Show-case displays are often masterpieces of color design and harmony.

Color is particularly important in the case of foods. The average housewife buys much of her food in cans, but she has not forgotten what to expect in the way of color in canned foods.

So distasteful are abnormally colored canned foods to the discriminating, color-conscious housewife that the Federal Food and Drug Administration, in its enforcement of the national pure-food laws, has established minimum color standards for certain of these products. Few like to eat grey or brown canned peas or brownish canned apples and most of us have certain ideas about what other foods should look like. But of all canned foods, the tomato probably ranks first so far as the color desired is concerned. There are yellow tomatoes, wholesome and nutritious, but the average American consumer prefers his tomatoes, whether canned or fresh from the vine, to be just the right blushing red. Due to the enactment recently of the Canners' Bill, an amendment to the Food and Drugs Act, it is incumbent on the Administration to set a minimum color standard for canned tomatoes and perhaps for other products as well, if they are not to fall below the United States standards, the establishment of which is provided by this amendment.

The Canners' Bill provides that the Secretary of Agriculture may establish and promulgate definite standards of quality, condition, and fill of container for all canned foods except canned milk, meat, and meat products. Now, color is a very important factor in the quality of a food. The Secretary has already promulgated the "normal color" definition for canned peaches as "a general effect of yellow," for canned pears as "a general translucent, yellowish white color," and for peas as "a general effect of green, with not to exceed four percent by count of discolored peas, such as brown or brown-spotted peas."



A government chemist measuring the color values of tomato catsup with Munsell disks

Setting color standards for these three foods was comparatively easy, but tomatoes are "something else again." The Administration is about convinced that the following wording very nearly describes a minimum color standard for this fruit: "The fruit shall be considered normally colored when a sample, at least one inch deep, of the homogeneous pulped meats shows a red color containing at least 58 percent red and not more than 37.3 percent green, in terms of the three primary color distribution curves of the Optical Society of America, referred to Abbot-Priest standard white light." This standard is subject to change, however. These percentages do not, of course, refer to the proportion of red to "green" (unripe) tomatoes, in the popular sense. They are rather the precise physical terms necessary to define color accurately in a legal standard.

It is, however, out of the question for every canner and food broker to purchase a color-measuring instrument costing between 1000 and 2000 dollars, and requiring the services of a trained physicist for its operation. Fortunately, there are available certain commercial devices for measuring color which are sufficiently accurate for practical purposes, which can be purchased for a reasonable sum, and which can be operated by a person who does not hold a Ph.D. degree in physics. Among such devices, the Munsell system of color disks has been found useful in judging whether a certain can of tomatoes does or does not meet the minimum color requirement of the standard. The device consists essentially of a horizontal circular table, which can be revolved rapidly by means of an electric motor. A multiplicity of colored cardboard disks are available bearing various cabalistic devices which, to the initiated, describe their particular color value. The rapid revolution of the table causes a blending of the various exposed colors into a single color sensation. By a proper selection and arrangement of color disks, the color of any material may be matched with considerable exactitude if it is brought close to the revolving table in such a manner that the two surfaces lie in the same plane and are equally illuminated by standard white light striking at an angle of 45 degrees. An eye-piece comparator brings the two color fields to the eye as the two halves of a circle, so that an accurate comparison is made easy.

After a satisfactory match has been obtained the operator has only to read off at the graduated circumference of the table the percentages of the disks.

For rapid, every-day cannery use, no doubt an even simpler method of color comparison will be employed. It seems probable that for practical purposes, the canning trade will obtain for itself color cards which reproduce the minimum color called for by the standard, which can be used in making reasonably accurate comparisons.

When the clouds roll in at low level around the base of Mount Wilson, completely cutting off the world below, those who work at the Observatory on the mountaintop experience the feeling of being suspended in space beneath the stars. But at night, if there is no fog to hide the lights of the communities of Pasadena, Los Angeles, and Hollywood, these

IS INTERSTELLAR SPACE WHOLLY EMPTY?

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

NEARLY 30 years ago Hartmann, while studying the spectrum of Delta Orionos, one of the stars in Orion's belt, made a surprising discovery. The star is a binary with a period a little less than six days and its orbital motion caused the lines of the spectrum to shift alternately to the red and to the violet in the familiar fashion. One line, however, the *K* line of calcium in the violet, behaved quite differently from the rest. While the other lines were broad and hazy, it was sharp; and while they shifted to and fro, it remained unaltered in position. The sharpness indicated that this line was absorbed by a more rarefied gas than that which produced the others, and its fixed wavelength that this gas did not share the motion of the star.

Evidently a gaseous mass of low density must be somewhere between us and the star, and not so near it as to be churned into motion by the revolution of the star and its companion in their orbits. This gas must consist of, or at least contain, calcium vapor and it was therefore supposed at first that it must be fairly near the stars so that their radiation kept it hot.

But a few years later Slipher, who had detected similar "stationary" lines in the spectra of several other stars, pointed out that the "calcium clouds" did not share the motion either of the sun or of the stars, but that their observed velocities showed that they were in almost all cases practically at rest in space. He suggested that the atoms which absorbed the lines formed part of exceedingly rarefied clouds in interstellar space.

A FEW additional lines of the same sort were soon discovered—the other violet line of calcium (*H*, which is often obscured by strong hydrogen lines close by) and the yellow lines of sodium. All these can be observed only in the hottest stars, for the spectra of the rest contain strong calcium and sodium lines of their own which quite drown out the narrow though sharp "detached" lines.

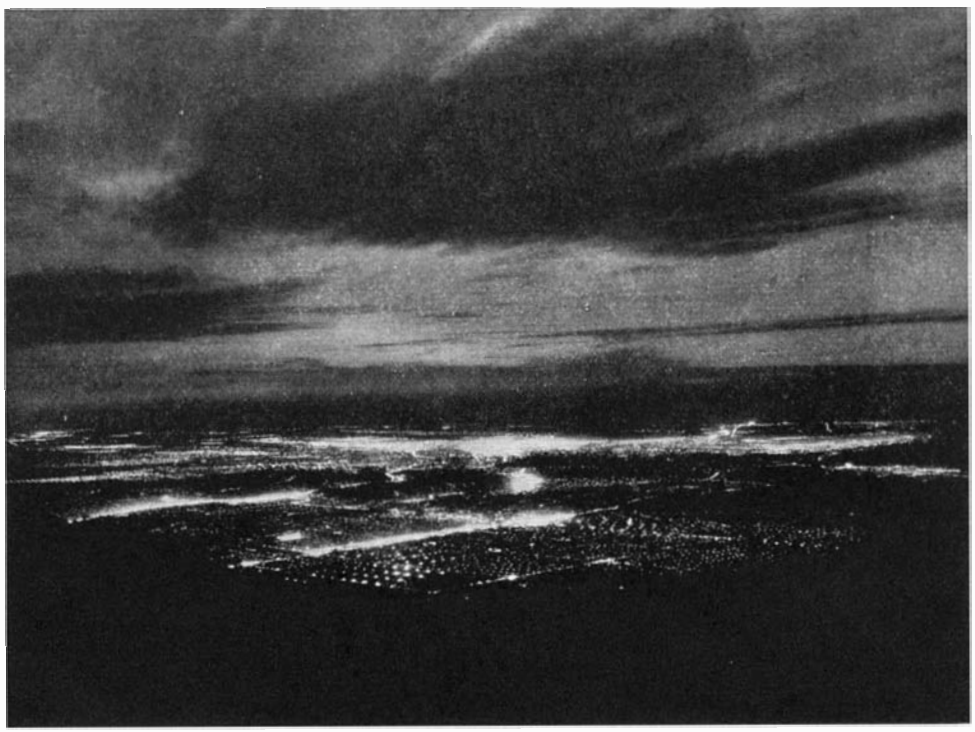
Extended investigations by many workers have fully confirmed the explanation and there is no longer any doubt that interstellar space is occupied, at least for thousands of light years from the sun, by metallic vapors of very low density.

This raises another difficulty. The sodium atoms which absorb the yellow lines are neutral, but the calcium atoms which produce *H* and *K* must be ionized. There is a strong line of neutral calcium in the blue but this does not appear as a "detached" line in the stars.

Why should the calcium atoms be torn apart in this fashion? For each ionized atom there must be a free electron. Sooner or later these wandering electrons must collide with the charged atoms and, since there is a powerful attraction between them, they will recombine. Even if the interval between collisions was many years, a century or so would see practically all the atoms back in the neutral state unless something kept splitting them up again.

This is one of the many puzzles which have been solved by Eddington. What does the trick is ultra-violet light from the hotter stars. Such light, falling on an atom, can tear one electron off and send it flying away at a high speed. Out in interstellar space far from any particular star the light is very faint but its atom-splitting power is as great as ever. The number of atoms per million which are ionized in a given minute will be small, but the process will still go on till it is balanced by recombinations at chance encounters.

It is very easy to pull one electron off a sodium atom and very hard to remove the second. So most of the sodium atoms will be minus one electron (singly ionized). Practically none will lose



lie spread out below in a vast sparkling panorama visible clear to the Pacific Ocean. To some extent the city lights now interfere with astronomical photography, the diffused illumination reflected from the sky affecting the plates during long exposures. These pictures were taken by Dr. Ferdinand Ellerman of the Observatory, whose hobby is fine photography

a second electron and few will be neutral. But for calcium it is pretty easy to remove a second electron after the first is gone, and very hard to get the third off. The great majority of the calcium atoms will be doubly ionized and a few will be singly ionized (and absorb the *H* and *K* lines). An atom in this state is far more likely to be torn apart again by starlight than to pick up another loose electron, hence the absence of the lines of neutral calcium is explained.

A number of other elements—hydrogen, magnesium, silicon, and perhaps iron—may behave in the same way but their characteristic lines are in the far ultra-violet where the opacity of the earth's atmosphere keeps us from learning anything about them.

How these metallic atoms got loose in space is another problem. We know that masses of gas are sometimes blown clear away from the sun as eruptive prominences, and calcium is the most prominent constituent. But whether all the interstellar gas has been ejected from the stars or whether much of it was there in the first place, no one knows.

An important series of papers by Struve of the Yerkes Observatory has greatly extended our knowledge of this interstellar gas. He has observed detached calcium lines in the spectra of more than 300 stars and finds that they are always present when there are no stellar lines to block them out and when the star is far enough away. For the nearer stars—that is, those which are only a few hundred light years away—the "interstellar" lines are faint. For remoter stars they grow stronger and stronger. For example, stars of the seventh and eighth magnitudes with B-type spectra must on the average be much remoter than third magnitude stars of the same spectral type and they show much stronger calcium lines.

To put these results into numerical form is still difficult, for it is hard to find any good way of estimating these great distances. But Struve's discussion indicates that the stars in which the detached lines are strongest may be as much as 20,000 light years away.

It may be possible in future to use the strength of these lines to find the distances of remote stars. There is only one serious difficulty: the clouds of calcium atoms appear to be very widely spread through space but they may be thicker in some regions than in others. There is already some evidence that this is the case and it may be that future studies will enable us to map out these clouds of almost inconceivably thin gas.

ONLY rough estimates of the actual density of this gas can yet be made, but these are remarkable enough. The latest study by Unsöld, Struve, and Elvey, indicates that within a few thousand light years of the sun there is on the average one absorbing calcium atom in every two or three cubic meters. Only a few small fractions of the atoms are in the singly ionized state which absorbs the observed lines. Existing calculations indicate that the proportion is something like one in a hundred thousand. This gives (closely enough) about one calcium atom per cubic inch.

It is very hard to realize what this infinitesimal density means. If there was nothing else but calcium, then it would require 60,000 cubic miles to contain one milligram of material, and more than a million cubic miles to weigh as much as a cubic inch of air!

How many atoms of other sorts are present we can only guess. Probably enough to make a total density ten times as great. This estimate would make the total quantity of matter in interstellar space greater than that which is concentrated into the stars, and is likely to be too high rather than too low. In such a gas, according to Eddington, an atom would on the average move in a straight line for about seven years before being deflected by collision, and during this time would travel farther than the distance from the sun to Jupiter.

Strangely enough the gas, though in the depths of interstellar space, would be hot and not cold. The temperature of the gas depends on the average velocity with which its molecules or atoms move. In the present case this motion is caused mainly by the impacts of the free electrons. These are torn from their apparent atoms by the influence of ultra-violet light and set moving at a speed which depends on the quality and not the brightness of the light. Calculation shows that it will be high, and that when the impacts on the atoms have done their work their average rate of motion will correspond to a temperature about 10,000 degrees Centigrade. The gas is so excessively rarefied that a solid body immersed in it would not be perceptibly affected. The extreme infrequency of impacts of gas atoms on its surface would more than compensate for the violence of those which occurred, and no trouble would follow.—*Princeton University Observatory.*

The locksmith's shop is filled with a million or so blanks and keys. The exceedingly ingenious machines duplicate warded, pin, and single and double bitted keys. Every worker is an expert

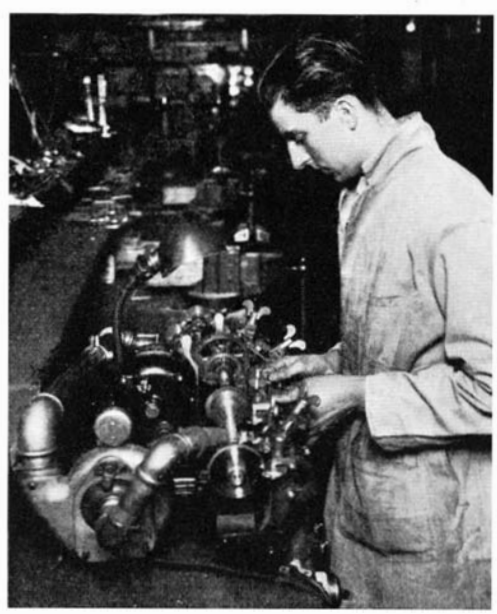
A DAY WITH A LOCKSMITH

By ALBERT A. HOPKINS

Author of "The Lure of the Lock"

As soon as the human race began to acquire property of any kind, the "stick-up" man and the racketeer entered the picture and people began to devise methods of safeguarding worldly goods. Eventually the lock was invented and we find references to both locks and thieves in both the Bible and the Odyssey of Homer. Where there is a lock there is a locksmith. Unfortunately, we do not know who was the first locksmith, but we can visualize him as a good mechanic and an honest man. The locksmith of today has suffered from his contact with the machine age. There are still, however, a few hundred men in the United States who are in reality master locksmiths. The true locksmith does not depend altogether on key duplicating machines and he must be able to pick a lock or open a safe. The writer has been fortunate in having been associated with a master of his craft in the examination and repair of the only large lock collection in the world and some of the angles acquired will probably be interesting to our readers.

The store of the locksmith does not look unlike that of the hardware merchant, for he sells locks as well as services. The shop is rendered rather picturesque by the immense festoons of blanks. In the shop shown on this page there are more than a million blanks in hundreds of shapes. If a proper blank cannot be found, it must be made by hand. A duplicating machine for making keys may cost only a few dollars or two or three hundred dollars.



This unique machine makes four types of keys at one time and removes cuttings

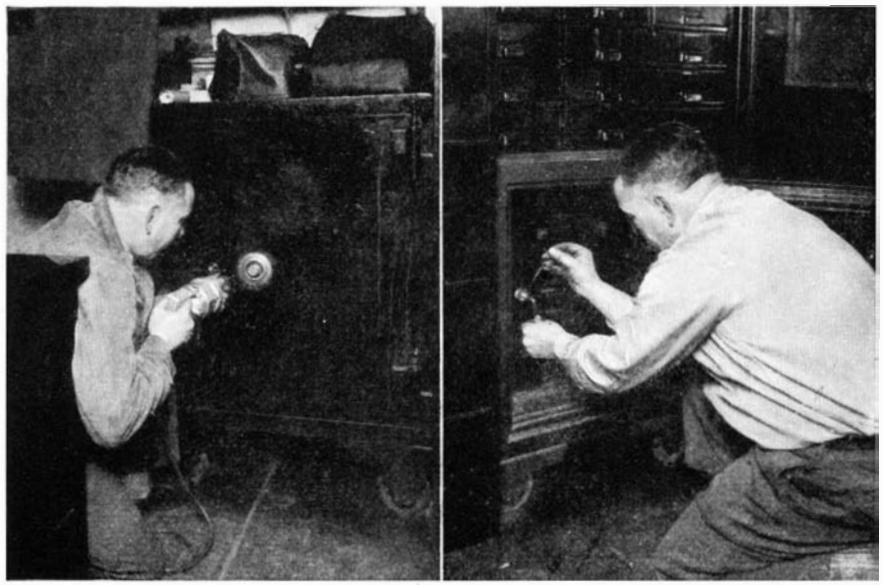
One unique type which we illustrate makes four different kinds of keys at one operation on the various "set-ups." In a large shop four or five different machines are in constant operation. Mr. Charles Courtney's lock store which we illustrate is almost a show place in West 125th Street, New York City. It is crowded all day with customers who have "lock trouble" or are "key shy." A census of one day's business was made for the writer and the facts are as follows:

Made 264 keys for 43 customers, installed four concealed locks on money cars, changed combinations on ten house locks, made keys for six trunks, opened up two store door locks where keys had been lost, changed combinations on two safes, fitted keys to locks or repaired locks on 45 cars, installed or repaired ten door closers. In addition scissors and skates were sharpened, saws were filed, and a few other odd jobs were done.

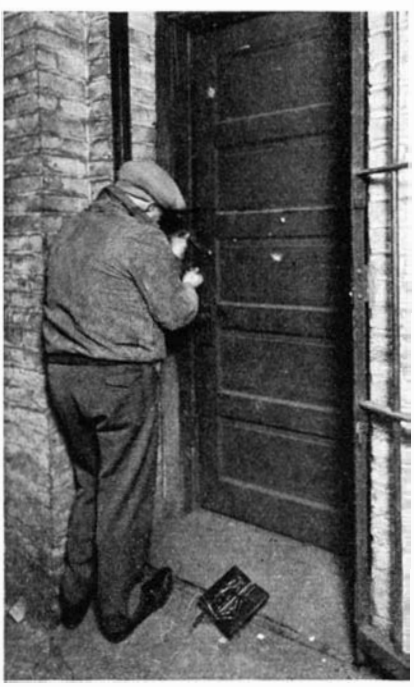
Mr. Courtney is fond of getting up lock statistics and he recently made a computation for us of the numbers and types of keys carried

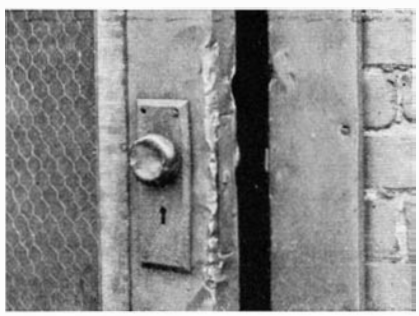
by the people of Greater New York. The number of keys is 21,440,654 weighing 525,455 pounds, while 12,755,371 keys are kept at home and 6,788,368 kept in hotels, clubs, et cetera. What shall we say about 23,000 handcuff keys? Some of the mystery is taken out when we recollect that New York has 19,661 policemen.

The locksmith is often asked to do questionable jobs but it is rarely indeed that he succumbs to temptation. The tools used by locksmiths are often made for the job and every one of the specialized mechanics have their own little pets which they are fond of showing to their fellow craftsmen. We illustrate two groups of such tools which show clever adaptations of mechanical principles and after looking at them we wonder if there are any "Raffles" in reality.

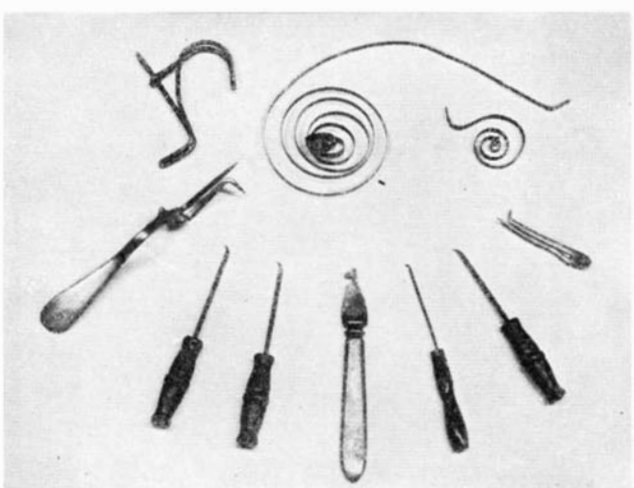


Above: **Mr. Courtney is showing how to drill a hole so as to get at the tumbler of a combination lock. An electric drill is often used by an up-to-date cracksman.** *Upper right:* **It takes two hands and plenty of skill to pick any good lock**





Left: **The right way to open a door is to get an honest locksmith to pick the lock. It requires great skill and experience and special tools and no amateur need apply.** *Upper:* **The trail of the "jimmy."** *Right:* **The wrong way to open a door—jimmying a loft door is also very hard work**



Regular lock picks and emergency picks made out of knives and forks. Clock springs are often useful in picking locks. Even the coat hook as a lock pick once saved a woman's life. She had a seizure behind folding doors. A locksmith may use more than a dozen "picklocks"

At left is a depth gage. At top will be seen a "tumbler rattler" for raising pins in a pin-tumbler lock. The "gear" belongs to it. Upper right hand device is an extemporized key to open a "bull" pen. Key is pick lock, metal ribbon being fed through barrel to locate the tumblers

THE PERSPECTIVE OF MODERN PHYSICS*

By PAUL R. HEYL

Physicist, National Bureau of Standards
Author of "New Frontiers in Physics"

FOUR years ago an English clergyman, the Bishop of Ripon, perhaps not altogether humorously, suggested a scientific holiday, a closing of all laboratories for ten years to permit catching up with discovery. His suggestion was received in scientific circles with proper amusement, yet it was recognized that the Bishop had expressed perhaps more aptly than he could in any other way the situation in which physical science found itself.

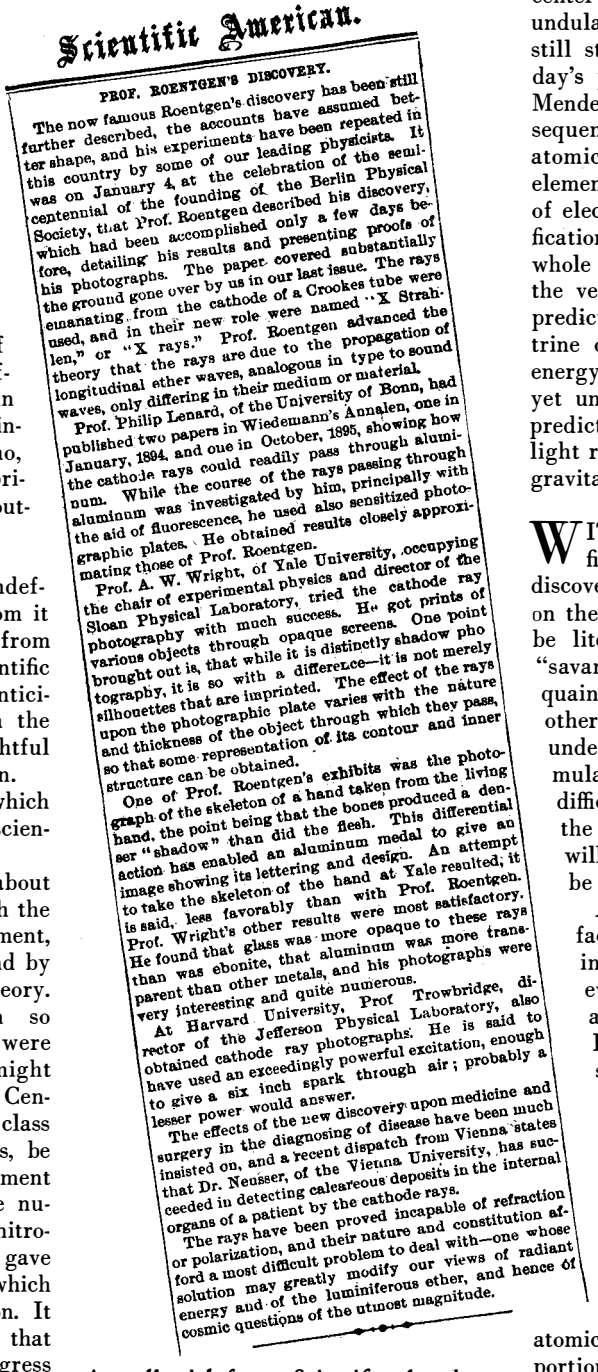
For a third of a century, starting with the discovery of X rays in 1895, there had been such a rush of discovery as physical science had never before experienced. So rapid was the accumulation of fact and theory that it became difficult for most persons to maintain the pace, and the procession dwindled down to a few leaders who, whatever may have been their private state of mind, showed no outward signs of distress.

SUCH a situation cannot last indefinitely. Like a commercial boom it must sooner or later reach a term from natural causes. In suggesting a scientific holiday the Bishop was merely anticipating in a rather extreme form the outcome which he and other thoughtful persons saw must inevitably happen.

What natural causes are there which may act as a brake on too rapid scientific discovery?

Scientific discoveries may come about in three ways: by accident, as with the X rays; by induction from experiment, as with the discovery of argon; and by suggestion or prediction from theory.

Accidental discoveries happen so rarely that if scientific progress were to depend solely on these its rate might be something like that of the 18th Century. Discoveries of the second class must also, in the nature of things, be rather infrequent. Years of experiment were necessary to accumulate the numerical results on the density of nitrogen from various sources which gave to Rayleigh and Ramsay the hint which resulted in the discovery of argon. It is to discoveries of the third class that we are chiefly indebted for the progress of physical science since the opening of the 19th Century. It is true that in the early stages of the development of a science, when theory is weak and has but little experimental basis to direct it, progress must depend principally upon accidental discovery; but when theory has reached a certain stage of perfection it takes hold, and thereafter sets the pace.



Scientific American.

PROF. ROENTGEN'S DISCOVERY.

The now famous Roentgen's discovery has been still further described, the accounts have assumed better shape, and his experiments have been repeated in this country by some of our leading physicists. It was on January 4, at the celebration of the semi-centennial of the founding of the Berlin Physical Society, that Prof. Roentgen described his discovery, which had been accomplished only a few days before, detailing his results and presenting proofs of his photographs. The paper covered substantially the ground gone over by us in our last issue. The rays emanating from the cathode of a Crookes tube were used, and in their new role were named "X Strahlen," or "X rays." Prof. Roentgen advanced the theory that the rays are due to the propagation of longitudinal ether waves, analogous in type to sound waves, only differing in their medium or material.

Prof. Philip Lenard, of the University of Bonn, had published two papers in Wiedemann's Annalen, one in January, 1894, and one in October, 1895, showing how the cathode rays could readily pass through aluminum. While the course of the rays passing through aluminum was investigated by him, principally with the aid of fluorescence, he used also sensitized photographic plates. He obtained results closely approximating those of Prof. Roentgen.

Prof. A. W. Wright, of Yale University, occupying the chair of experimental physics and director of the Sloan Physical Laboratory, tried the cathode ray photography with much success. He got prints of various objects through opaque screens. One point brought out is, that while it is distinctly shadow photography, it is so with a difference—it is not merely silhouettes that are imprinted. The effect of the rays upon the photographic plate varies with the nature and thickness of the object through which they pass, so that some representation of its contour and inner structure can be obtained.

One of Prof. Roentgen's exhibits was the photograph of the skeleton of a hand taken from the living hand, the point being that the bones produced a denser "shadow" than did the flesh. This differential action has enabled an aluminum medal to give an image showing its lettering and design. An attempt to take the skeleton of the hand at Yale resulted, it is said, less favorably than with Prof. Roentgen. Prof. Wright's other results were most satisfactory. He found that glass was more opaque to these rays than was ebonite, that aluminum was more transparent than other metals, and his photographs were very interesting and quite numerous.

At Harvard University, Prof Trowbridge, director of the Jefferson Physical Laboratory, also obtained cathode ray photographs. He is said to have used an exceedingly powerful excitation, enough to give a six inch spark through air; probably a lesser power would answer.

The effects of the new discovery upon medicine and surgery in the diagnosing of disease have been much insisted on, and a recent dispatch from Vienna states that Dr. Neusser, of the Vienna University, has succeeded in detecting calcareous deposits in the internal organs of a patient by the cathode rays.

The rays have been proved incapable of refraction or polarization, and their nature and constitution afford a most difficult problem to deal with—one whose solution may greatly modify our views of radiant energy and of the luminiferous ether, and hence of cosmic questions of the utmost magnitude.

An editorial from *Scientific American*, February 8, 1896, one month after the announcement of the discovery of X rays. Note closely the final paragraph

As instances of discoveries of the third class we may mention conical refraction and the bright spot at the center of a shadow, predicted by the undulatory theory of light when it was still struggling for recognition; Faraday's production of induced currents; Mendelejeff's periodic law and its consequences, notably in the correction of atomic weights and the discovery of new elements; the prediction by Maxwell of electro-magnetic waves, and its verification by Hertz, upon which rests the whole of modern radio communication; the verification of light pressure, also predicted by Maxwell; Einstein's doctrine of the equivalence of mass and energy, generally accepted, though as yet unverified by experiment, and his predictions of the curious behavior of light rays and spectral lines in intense gravitational fields.

WITH the possible exception of the first class these different modes of discovery call for special qualifications on the part of the discoverer. He must be literally what the French call a "savant," a knowing man, well acquainted with what has been done by others, with a good perspective and understanding of our store of accumulated knowledge. And the more difficult it is to acquire this grasp of the past and present, the less likely will it be that new discoveries will be forthcoming in the future.

An accumulation of undigested fact and theory is an ever increasing drag upon progress which must eventually reduce its pace to that at which assimilation is possible. I think that there is evidence that such a slackening in pace is now beginning.

Not that there is any diminution in the amount of scientific activity; the volume of publication shows no apparent decrease. It is the nature of the articles published that is significant. In the journals of today we find less attention paid to atomic physics and an increasing proportion of articles dealing with a general refinement of our knowledge, a filling in of outlines previously sketched, rather than with explorations in new

*Publication approved by the Director of the Bureau of Standards of the United States Department of Commerce.

territory. The atmosphere is suggestive of 1890 rather than of 1920. This movement seems to be even more strongly marked abroad than in this country.

As a consequence of these changing conditions we find ourselves, if not exactly in such a scientific holiday as suggested by the Bishop, at least in the initial stages of something which may serve equally well. For the first time in a generation an opportunity offers to set our accumulated knowledge in order and to improve our perspective of it.

Perhaps the most striking feature of modern physics, both from its strangeness and its ubiquity, is the radical change in the nature of the concepts with which we deal, a change away from materialism and toward the insubstantial. The realities of today were the intangibles of the last century. Matter itself, that cornerstone of physical science since time immemorial, has lost its individuality, and is now regarded as merely another aspect of that Protean concept, energy.[1] The atoms of which matter is composed are, as de Brogile and Schrödinger tell us, nothing but little bunches of vibration in something the nature of which is not yet clear.[2] We look in vain over the province of physics for something tangible and substantial. Nothing remains but the shadows of former realities.

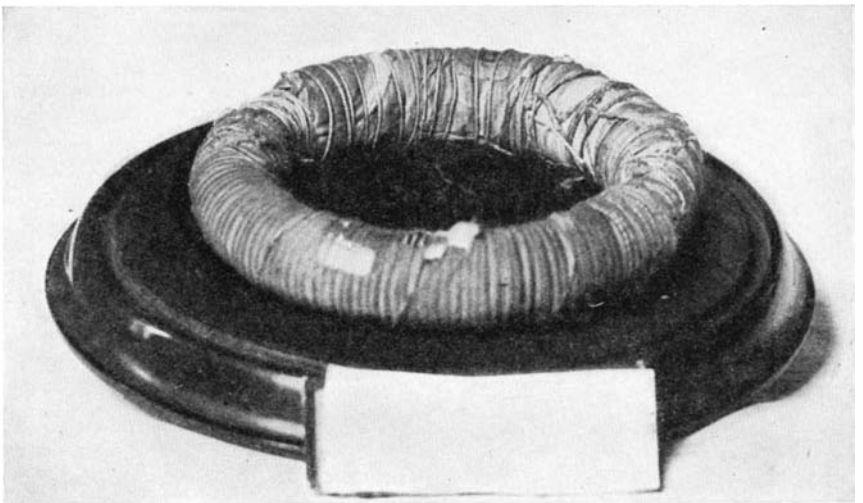
HOWEVER, we must make the best of the situation in which we find ourselves, especially since we have brought it upon ourselves by our own curiosity. Shadows may be insubstantial, but at least are they not definite and sharply defined?

At this point Heisenberg, seconded by Bohr, says "No!" They tell us that our concepts are not only insubstantial but vague and indefinite as well; that, for example, we can never hope to know accurately how large an atom is *and* how rapidly it is vibrating. We may know one or the other to any reasonable degree of accuracy, but not both; and the curious fact is that an attempt to improve the precision of our knowledge of one of these attributes of the atom automatically interferes with our obtaining a like knowledge of the other.

A conventional model of the wave atom, an exact model not being available as in the case of the familiar Bohr atom

To understand how this can be we must consider the Schrödinger atom in some detail.

One way of representing this atom conveniently is as shown just above.



Courtesy *Tycos-Rochester*

The original iron ring and coils used by Faraday in working out the principle of induced currents, "one of the most fruitful concepts of the human mind"

The atom consists of a small group of waves whose amplitude diminishes as we pass outward in any direction from the center of the group, but never disappears permanently and entirely. In other words, the atom, strictly speaking, has no definite boundary. For practical purposes, however, the amplitude becomes insignificant at a moderate number of wavelengths from the center of the group.

THIS dying out of the waves is due to interference. The group consists of waves of a number of different lengths and vibration frequencies, constituting what is called a frequency band. By their mutual interference these waves cancel each other out more or less completely at a moderate distance from the center of the group. The diminution in amplitude is more rapid if the frequency band is wider; that is, if the group contains a greater variety of waves. This more rapid diminution in amplitude shows itself in an increased sharpness of definition in the boundary of the atom.

But it will be noted that this increase in precision of size is accompanied by a corresponding decrease in precision of frequency of vibration. To make the boundary sharper we must widen the frequency band by including waves of longer and shorter lengths than those in the original atom. In the spectroscope, the less definitely bounded atom would give the sharpest lines, while the more sharply bounded atom would give a spectrum made up of rather wide, fuzzy bands whose wavelength could not be accurately determined.

This see-saw relation has been shown by Heisenberg to hold good between other pairs of properties of atoms and electrons, such as position and velocity. The general law thus developed is known as the principle of indeterminacy. It asserts that in general we can measure to any desired degree of precision only one half of all measurable quantities, and that the precise determination of this half automatically renders less precise our knowledge of the other half.

This indeterminacy is most noticeable in measurements involving atoms and electrons, but theoretically it holds for large bodies as well. To determine the motion of the moon we observe the light reflected from its surface. But in the act of reflection the light exerts a very small pressure. In consequence, the motion of the moon must be accelerated or retarded as it is illuminated on one side or the other by the light from the sun. Only in perfect darkness would the motion of the moon be unperturbed, and then we could not observe it at all.

THIS indeterminacy, though utterly negligible for large bodies, becomes of importance when we are dealing with atoms and electrons. Though we do not observe them by reflected light we do depend for our knowledge of their behavior upon their interactions with other similar bodies, which process, of course, involves mutual disturbances in both parties to the action. And it is quite possible that an atom or an electron may be seriously perturbed by even a single quantum of energy.

The importance of the principle of indeterminacy is undeniable, but we must be careful not to read too much into it. In some quarters it has been regarded as overthrowing the philosophy of determinism.[3] This, I think, is going farther than is warranted.

Determinism is an old philosophy, and pages of polemic have been spent upon it and its opposite, free will, until

[1] Heyl: *Scientific American*, June 1929. "The Strangest Thing in Physics."

[2] Heyl: *Scientific American*, July 1928. "What Is an Atom?" November 1928. "Wave Atoms."

[3] Eddington: "The Nature of the Physical World," page 228.

the stock arguments pro and con have been worn to tatters. But the interest in the subject is perennial, and any chance of a new argument is eagerly seized upon. Briefly speaking, determinism asserts that nothing is due to chance, but that there is a definite cause for everything that happens, and that this series of cause and effect runs back

Science Service Photo

Dr. Werner Heisenberg of the Theoretical Institute of Physics

in an endless chain, so that if it were possible for us to acquire a perfect knowledge of the universe at any instant we could (at least in theory) predict its state at any future time.

This doctrine is generally regarded as harmless as long as it is limited in its application to inanimate Nature, but when the determinist attempts to include the actions of sentient beings in his philosophy he inevitably arouses active opposition on the part of some of these beings, who maintain that their actions are governed by free will, and that they can make an independent decision as to their course of action which could not have been predicted from past conditions.

The issue thus raised has been a source of contention for centuries. The principle of indeterminacy has lately been dragged into the conflict on the ground that it denies the possibility of our ever attaining a sufficient knowledge of everything necessary to predict the future. The fallacy of this argument is that it quietly and unwarrantedly shifts determinism from an objective to a subjective basis. Historically, determinism is objective; that is, independent of the presence of an intellect to follow up the process of cause and effect. It loses all meaning as a general principle of Nature when placed on a subjective basis. The principle of indeterminacy, on the other hand, is essentially subjective. Its name is perhaps unfortunate as suggesting the older philosophy. It might perhaps better be called the principle of complexity. In the case of the Schrödinger atom the more definite the diameter the more complex is the constitution. When this complexity reaches a certain degree we call it, subjectively, "indeterminate;" but no matter how complex the result, it is objectively perfectly determined by a more or less complex set of causes.

We have seen that, thanks to de Broglie, Schrödinger, and Heisenberg, our concepts of physical entities have become not only insubstantial but ill defined and vague, from our point of view. But though matter may have been merged with energy, and though position and velocity interfere with each other's measurement, can we not still find something unalterable in the concepts of space and time?

BUT even here we meet with disappointment, for Minkowski tells us that these concepts have gone the way of matter and energy. "From this hour, space in itself and time in itself sink to mere shadows, and only a kind of blend of the two retains an independent existence."

This blend of space and time is essentially four-dimensional in its nature. Time was (and not so very long ago) when interest displayed in four-dimensional geometry by any one but a pure mathematician was sufficient to render him an object of suspicion; but safe in the 20th Century, Minkowski could utter the foregoing words, and Einstein, Jeans, Eddington, and a host of others can safely give expression to that which the late C. H. Hinton thought but dared not say, save in a strictly limited esoteric circle.

But perhaps there is still one spot that no radical dare profane—our number concept. Have not shadows their numerical measure, though perhaps not as precisely as we might wish? And must not even four-dimensional space conform to measure and number even more richly than its three-dimensional shadow? Is not number fundamental and eternal?

And then comes Dirac to deprive us of this last standing ground. Here it behooves us to walk warily, lest we darken counsel by words without knowledge, for this aspect of modern theory is both new and difficult of assimilation. Perhaps we may say that Dirac's contribution to modern physical thought is the idea that the really fundamental things of Nature may be absolutely inexpressible by numbers, and that numerical relations begin to appear only when we reach combinations of these fundamentals of a certain degree of complexity.

An illustration? I hesitate; but perhaps a principle familiar to mathematicians may not be too far-fetched.

Infinity is a concept that is incapable of numerical expression. Not because it is too big; the difficulty is qualitative, not quantitative. An infinite by its very nature transcends numerical expression, yet the difference of two infinites, or their ratio, may be expressible as an ordinary finite number.

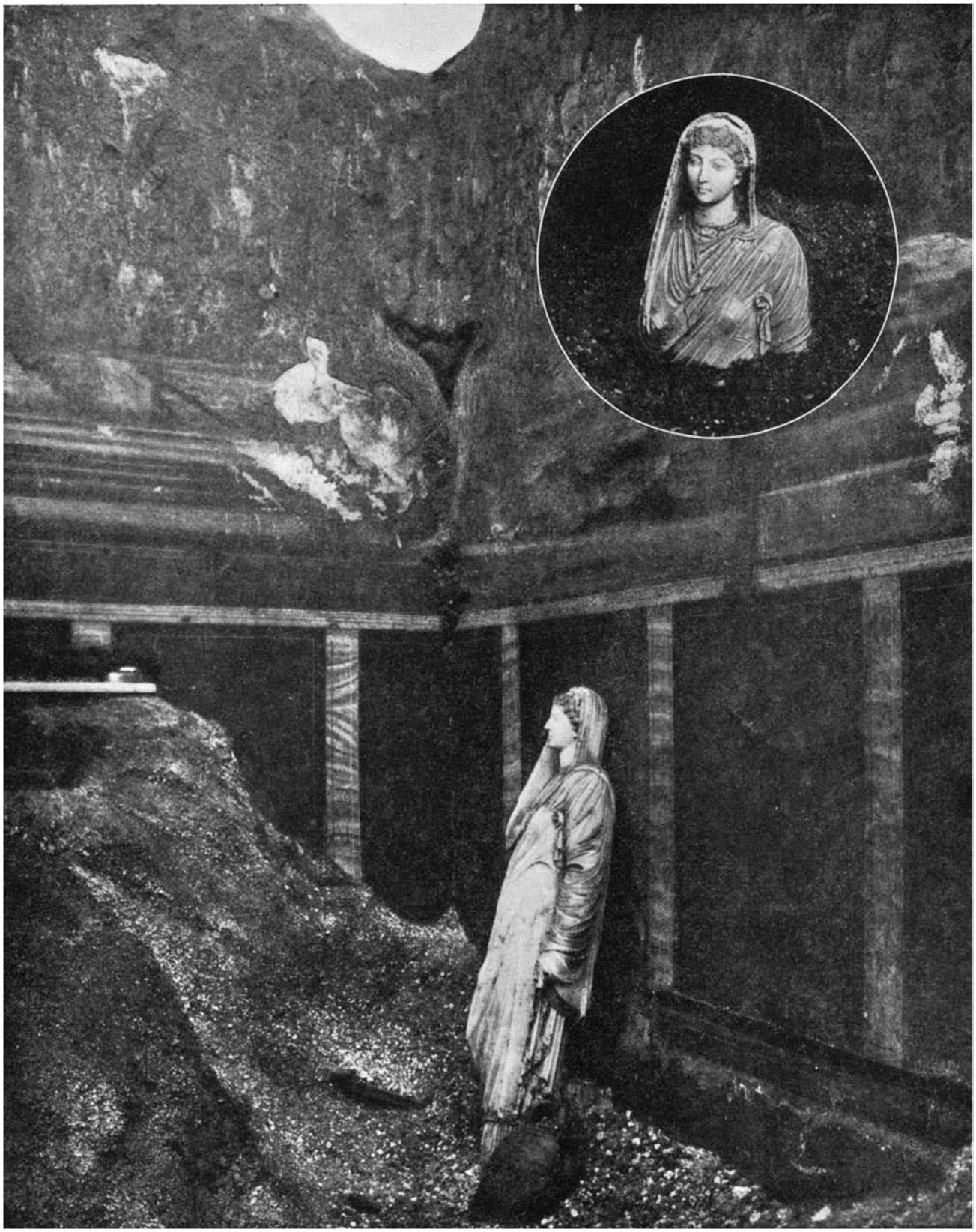
What fitting title may we apply to the realm of physics as we view it today, and how are we to characterize those curious persons who spend their lives working among its insubstantial and ill-defined shadows? Perhaps (with apologies to Aristophanes) the phrase "cloud-cuckoo-land" may fulfil both requirements. And yet such a designation hardly does justice to physicists, for though they have to deal with things apparently far removed from reality they are, as a matter of fact, very practical fellows; for out of this welter and confusion of insubstantiality the physicist is able to extract some very practical and substantial results. We are able to do better work, to cut more closely to Nature's lines, to give better explanations of natural phenomena on the basis of our modern intangible concepts than were the physicists of other days with

Science Service Photo

Schrödinger. Like Heisenberg and Dirac (of Cambridge) he is young

their materialistic ideas. We are not responsible if Nature decides to be what we call unreal. Perhaps it is our definition of reality that is at fault. And ever and anon, to the physicist surrounded by what he still calls insubstantialities, there comes to mind that often quoted glimpse of poetic insight:

"We are such stuff
As dreams are made on, and our little life
Is rounded with a sleep."



A TINTED STATUE FROM POMPEII'S ASHES

POMPEII continues to give us archeological thrills. One of the notable discoveries of last year is a sculptured portrait of Livia, the wife of Augustus and mother of Tiberius. The statue was found amid volcanic ash from Vesuvius in the villa of Dionysiac mysteries. The villa was named from the wall paintings depicting rites in the cult of Dionysus (Bacchus). When the eruption which overwhelmed Pompeii occurred in 79 A.D., the place of worship was apparently being transformed into a farm. The head is a separate work applied to a torso to which it did not originally belong. The body is probably that of a goddess or priestess. The head is tinted and the original coloring of dark brown eyes, carmine lips, and fair, slightly reddish hair and eyebrows remain. The circular inset shows the body partially excavated.

IT PAYS TO BE A PIONEER

By MILTON WRIGHT

A FEW years ago George C. Hannam was a salaried employee. Today he is president and principal owner of an industrial corporation said to be worth a million dollars. He has his own factory, offices in five cities, and distributors of the product he manufactures in all the principal cities of the country. He even has added a new word to the flooring industry—Hanotile.

George C. Hannam

I knew George Hannam as a boy, I remember that he started to attend two high schools in Brooklyn at about the same time I did, and that he was asked to leave both of them because he wouldn't study. If you had asked anybody in the neighborhood what George Hannam's prospects were for making his mark in the world, you wouldn't have received very flattering predictions.

And yet he has climbed fast and far. There must be, I was thinking when I visited him the other day, some secret of success he has found that I can pry out of him and pass on to other inventors and business men. I determined to ask him about it.

"What is it," I asked, "that makes a man a success in industry?"

"There is no formula," he replied. "So far as I know, nothing has ever been found to take the place of common sense and hard work. If, however, you can apply those two factors to an industry that is in its infancy, and, because it supplies a real need, is bound to grow rapidly, then success is assured."

The place in industry that George Hannam occupies is two-fold. He is an authority on acoustic treatment and on asphalt flooring, both of which have developed tremendously in the last decade.

"Just what was it that started you on the course that finally resulted in your being president and principal owner of the American Asphalt Tile Corporation?" I asked.

"I should say," he answered, "that it was the realization that most men in executive positions seemed to be college graduates. I was a stenographer—and not a particularly good stenographer at that—and as I looked at the men above me, it dawned upon me that what I needed was a specialized education. I quit my job—it was the sixth I had held in a short time—and studied day and night to enter college. I entered Cornell in 1909. I earned part of my way, selling aluminum cooking utensils and magazine subscriptions in the summer time and waiting on tables, tending furnaces, and even playing the piano in a club dining room during the school terms."

He laughed when he said this; he knows I have heard him play the piano.

"When it came time to graduate I listened to the blandishments of a representative of an iron foundry in Ohio, one of those men who visit technical colleges in June to induce young men to enter their particular establishments. I took a job in the foundry, but quit it three days later. I could see no future in it.

"It seemed to me that the money to be made in business lies in the selling end. I came to New York and applied to the H. W. Johns-Manville Company for a job.

"We have nothing for you," said the employment manager. "If you only knew stenography we could find a place for you."

"That's fine," I answered. "I do know stenography."

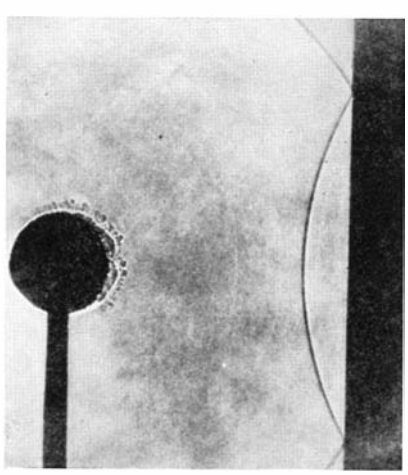
There was nothing for him to do but give me a job. I was assigned to the acoustics department. Three weeks later they found an opportunity to send me out on some installation work. I was on my way.

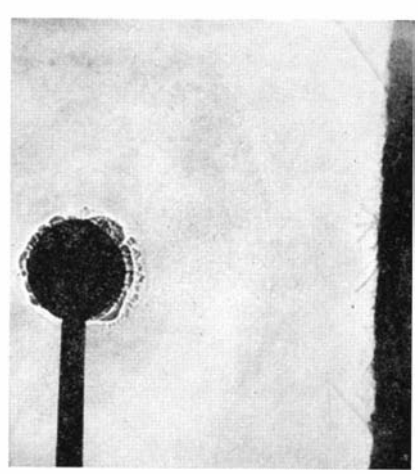
"Pretty soon I began to bring in new jobs to be done. I was a sort of volunteer salesman, so in about five or six months I was made a regular salesman. Increase in the acoustical treatment of offices, schools, churches, and other buildings was rapid, and after a time I was made a sort of supervisor over the acoustical work of the Boston and Montreal offices.

"IN Boston I consulted constantly with Professor Wallace Clement Sabine, Dean of the Graduate Schools at Harvard. He was the greatest authority of acoustics the world ever saw, and by the time I was transferred to the Cleveland district, a little less than a year later, I had acquired a foundation in this specialized subject that was invaluable. In less than another year I was made manager of the New York acoustical department."

"Now just what was this acoustical work?" I felt called upon to ask at this point.

"It's doctoring up rooms to quiet them," he answered. "You take a large office with 50 typewriters going at once, and nobody can hear himself think. Or take a poorly designed auditorium; echoes and reverberations get so bad that the remarks of the speaker are all jumbled up by the time they reach the audience."





Spark photographs of sound waves showing, *left,* a sound wave being reflected (an echo) from a smooth hard surface, and *right,* sound waves being absorbed by a surface that has been treated by the method described, to prevent reverberation

"And how do you correct it?"

"You apply a layer of felt to the walls or ceiling. Then over that, separated from it by an air space, you stretch a thin cloth. The sound waves pass through the cloth and air space and are absorbed by the felt, instead of reflected back in the form of echoes by the hard walls."

"But isn't this cloth rather unsightly?"

"It used to be. That provided me with the opportunity for my first invention —an acoustic paint. Ordinary paint on the cloth would reflect back the sounds —especially high pitched sounds like those of a typewriter—almost as much as would the bare walls. If you painted over the acoustic treatment cloth there was little improvement over the condition before the treatment was applied. Men had been seeking for years for a paint that could be used, but, for some reason, none of them had found it.

"IT could be done, I was convinced, and I made up my mind to do it or get out of acoustical work. For months I devoted all my spare time to gathering information about paint from all sorts of places. Then, for three months, I concentrated on the subject with the cooperation of a paint company. At last I had it."

"Did you patent the formula?"

"No; I didn't know as much about patents then as I do now. I was interested in selling and applying acoustic treatment and a patent never occurred to me.

"Shortly before this, Junius H. Stone, who had been manager of the cork insulation department of the corporation, had left to establish his own company, and he asked me to go with him to form an acoustical division of the business. I now found myself in keen competition with my former employer. Every point of advantage I could gain was worth striving for. Remembering what a stimulus had been given to acoustic jobs by the acoustic paint, I believed that history could repeat itself, so I set to work on a new and better acoustic paint. I got it.

"Meantime, Mr. Stone, whom I consider one of the foremost industrial scientists of the country, had developed an asphalt tile flooring. He also, by the way, was the originator of cork tile flooring. I was placed in charge of the flooring department in addition to the acoustical. This new type of flooring was something large buildings like schools, hospitals, offices, churches, and gymnasiums were looking for, to replace mastic flooring.

"It was left to me to go ahead with this pioneer type of flooring, for Stone's business had so developed that he decided to devote all his time to cork insulation, in which he saw a great future. I formed a separate corporation, taking over the acoustic and flooring ends of the business.

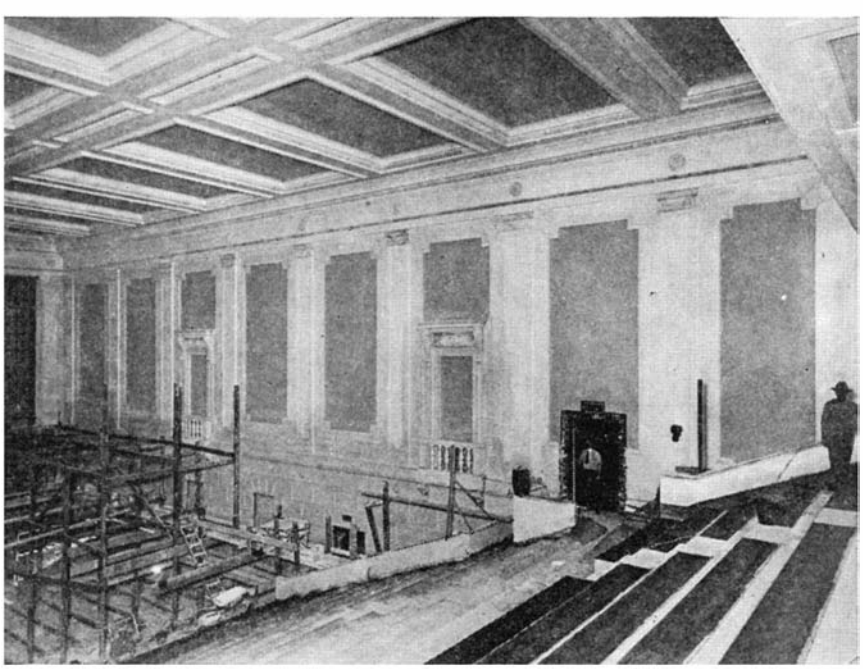
Mining gilsonite, the asphalt from Utah used in making an improved floor tile

"There was a real need for such a flooring and our business developed rapidly. Competitors began to appear and inevitable price-cutting followed. Any lead that we might have had due to being the pioneers was in danger. There was only one thing to do, as we saw it, and that was to keep on pioneering.

"Constantly we kept testing and experimenting, carrying on research work, until we had evolved a better asphalt tile, using gilsonite, an asphalt common in Utah. We took out a patent on it, but our competitors were right on our heels. We kept on working out new ideas, and at last got a tile that was as near the ideal as it was possible to make it, from the standpoints of wear, comfort, freedom from denting, and the like. We took out another patent.

"Every improvement was accompanied by an increase in business. Today, I should say, we have laid more asphalt tile than anybody else in the world and our product is recognized as the standard. For the particular type of flooring that we do the future is remarkably promising; the majority of the flooring in all large buildings—schools, offices, institutions of all kinds —will be asphalt tile; more and more it will be used in the home. And somebody—either our corporation or somebody doing the type of work that we are doing—is going to have a lot of work to do.

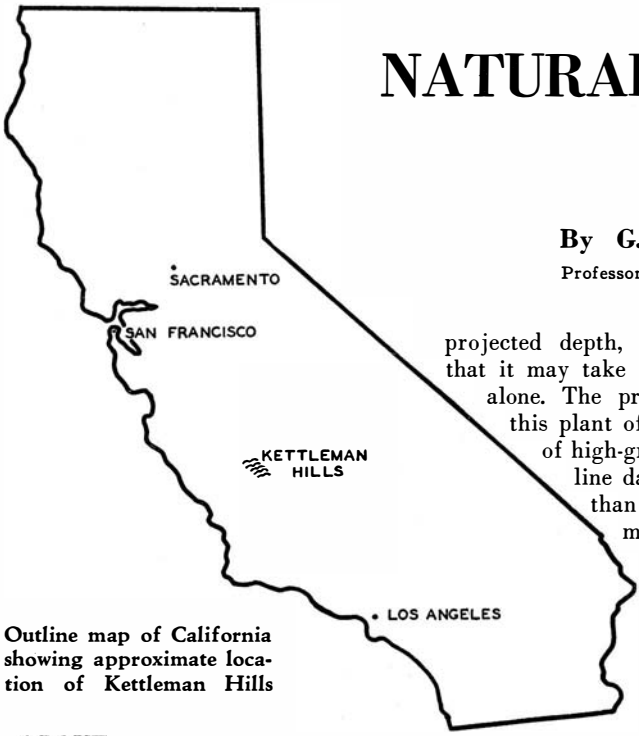
"I think I'll revise that statement I made to you a little while ago about the secret of success in industry. One way to gain success, I should say, is to be a pioneer. Get in at the start of some industry—something that fills a modern need—and then keep constantly perfecting your product or your service; keep a little bit ahead of the procession in the matter of ideas, if that is possible. Do that and you don't need to worry about success."



Both the ceiling and side walls of the auditorium of the Masonic Temple building in Birmingham, Alabama, being treated to improve acoustics and reduce echo

NATURAL GASOLINE FROM OIL WELLS*

By G. ROSS ROBERTSON
Professor, University of California at Los Angeles



Outline map of California showing approximate location of Kettleman Hills

ABOUT seven years ago, certain renowned but pessimistic geologists predicted a dire shortage of petroleum in the United States within 10 years. They still have three years' grace in which to fulfil expectations. There are, on the other hand, three substantial elements of doubt attached to that prediction. These are, respectively, Texas, Oklahoma, and California. Just at present the greatest of these seems to be California. At least may it be said that the Kettleman Hills were not on the oil map in 1923.

The false prophets have done us no harm. They probably frightened us into a speedy development of Ethyl gasoline, cracked petroleum, and various other commendable economies. One of these economies is that of stripping volatile gasoline from wet natural gas, a process that is carried out on a large scale in the Kettleman Hills field in California.

The limited demand for kerosene in recent years has made it desirable to throw an increased fraction of heavier hydrocarbons into motor fuel. Such heavy distillates need enrichment with a special supply of volatile material. Thus has arisen the modern natural-gasoline absorption plant which salvages the desired fuel.

There was a time when an absorption plant took care of 40 or 50 wells in its neighborhood but two Kettleman wells are sufficient to serve the plant described herewith. When one of these is drilled to the full projected depth, it is quite possible that it may take over the whole duty alone. The present production by this plant of over 80,000 gallons of high-grade absorption gasoline daily means that more than 500,000 gallons of motor fuel may be marketed after blending with straight distilled gasoline.

The Kettleman field is a wide stretch of rolling hills far out in the midst of the barren, sun-baked valley of central California, a few miles south of Coalinga. Literally hundreds of square miles of bare clay loam surround these hills. Any one of these square miles is a perfectly good airport, and oil magnates with private planes visit their property without much concern as to their skill in selecting a landing place. Near the western edge of the hills, the shack town of Avenal has suddenly sprung out of nothing. The town is not substantial, but it is clean. This is a new idea in oil towns, and there's a reason.

After experiences in old-fashioned oil fields, the visitor expects to find a succession of grimy derricks, ill-smelling black oil sumps, and an atmosphere soaked with crude oil mist. Not so. Instead of muck and mire, one finds at a Kettleman well a spick-and-span outfit, resplendent in aluminum paint, with gas valves done in vermillion and oil valves in a beautiful apple green. In these arid hills there is little rusting and no grime.

The well doesn't deliver "crude oil" in the ordinary sense. Rather it pours out a mammoth stream of native, ready-made raw gasoline, accompanied by vast quantities of high-pressure gas. By some remarkable provision of nature, Kettleman "oil" is composed almost entirely of volatile hydrocarbons. In some cases the liquid is almost water-white as delivered from the casing-head. At other wells the product, while as free-running as commercial gasoline, is colored in varying shades of brown.

ONE enterprising Kettleman operator subjects the oil to a slight purification, not involving distillation, and markets it directly as motor fuel. The trade seems to be satisfied with its performance, and likes the cut price.

The visitor to Kettleman is invited to hold his hand under the discharge valve on the oil trap at the well. A light liquid pours over his hand. One or two shakes of the hand in the air and the liquid has evaporated, leaving only a slight smell which suggests that nature did not refine her product quite well

Clyde Sunderland, Oakland, California

By some process known to herself alone, nature has cracked the crudes in the earth beneath Kettleman Hills field so that the wells produce gasoline and great volumes of gas

*Text and photographs courtesy *Industrial and Engineering Chemistry*

enough to pass a city motor-fuel ordinance.

The following may be taken as a normal or composite picture of a mature, full-grown Kettleman oil well:

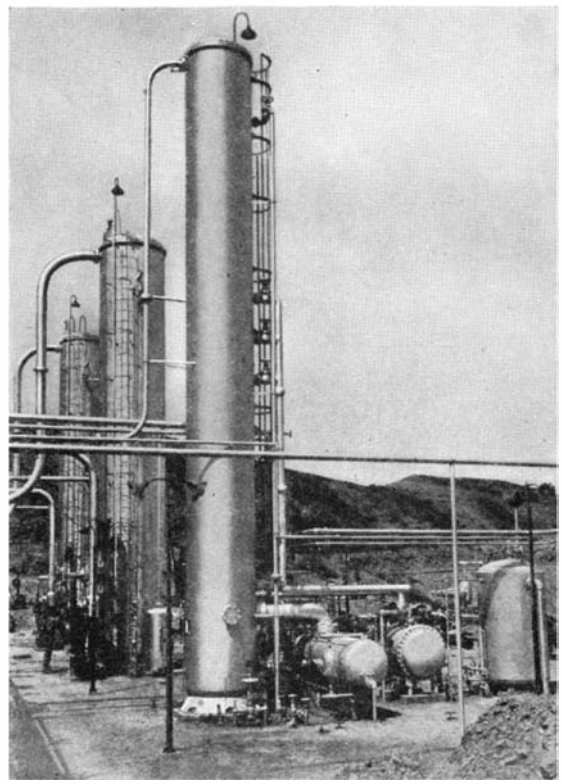
It is about 8000 feet deep. It probably cost about 200,000 dollars to drill or, if there was bad luck in the last thousand feet, add a couple of hundred thousand more. It pours out daily, in a foaming and roaring stream, 5000 barrels of volatile petroleum, marketable at double the price of common crude oil. Without further treatment this "oil" is already slightly superior to some of the "bootleg" gasoline sold by minor concerns outside the cities. If the well has reached a particularly deep oil sand, there may be a small but important fraction of lubricating oil in the crude product.

OUT of the foaming stream come 100 million cubic feet of wet natural gas daily, at a pressure of 1000 pounds per square inch. This gas goes through an absorption plant, and gives up about 90,000 gallons of high-test gasoline. The remainder, mostly methane, is thrown away.

Rising spotless and shining in the brilliant California sunshine, the new absorption plant is a beautiful sight by contrast with the drab and barren clay hills round about. Only the offices, laboratory, and a few pieces of minor equipment are housed. Rains come seldom and sleet never. Everything takes the fresh air—the more air the better, should natural gas choose to leak out at some unsuspected point.

At the present writing the two connected wells nearby deliver daily 92 million cubic feet of wet gas through a 14-inch main at a regulated pressure of 450 pounds. Quite naturally the oil which has just been separated from its equilibrium contact with the high-pressure gas contains a large proportion of the much-desired intermediate hydrocarbons, such as the pentanes and hexanes. Accordingly a second and third quota of gas are taken from the oil, each at reduced pressure. The final withdrawal of gas is made at a slight vacuum, leaving the liquid product relatively stable in tank storage. The whole supply of wet gas is sent to the absorbers.

The plant consists of two absorption units, each having a capacity of 50 million cubic feet of gas a day; a stabilizer taking care of both units; a boiler plant with four operating units and one stand by; a cooling tower serving several devices; gasoline storage tanks, centrifugal and piston pumps, compressors, and so forth. Briefly summarized, it operates to extract most of the hydrocarbon content of the gas from propane up the series; then to reject by fractionation some *n*-butane and everything below butane from the crude distillate produced.



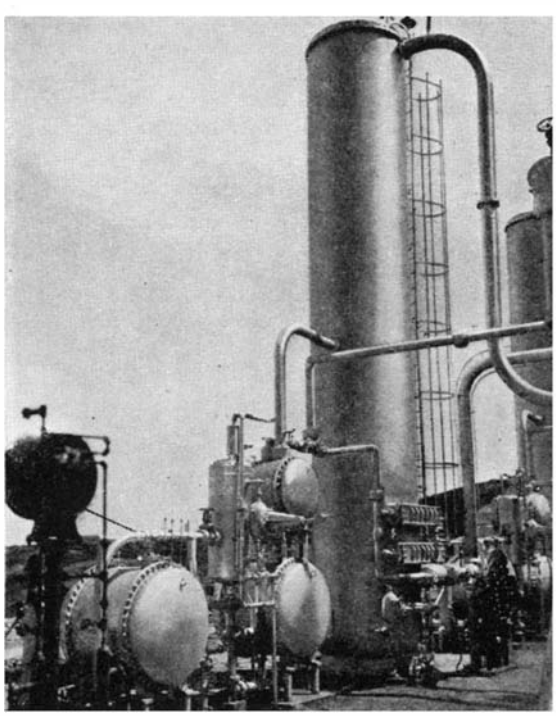
Resplendent in aluminum paint: Stabilizer and fractionating units of the absorption installation

A chemical concept of the absorption problem may be gained from a typical analysis of Kettleman wet gas:

	Percent by volume	Gallons liquid per M cu. ft. gas
Methane	83.26	
Ethane	8.34	
Propane	4.70	
Isobutane	1.06	0.35
n-butane	1.54	0.49
Pentanes-plus	1.10	0.47

From the absorption standpoint methane and ethane are worthless. They dissolve slightly in the absorber oil at high pressure, but soon escape the apparatus. Propane (boiling point —45 degrees Centigrade) is equally worthless, since it is too volatile to remain in appreciable quantity in a motor fuel as commonly stored. It is, however, sufficiently condensable to make trouble farther on in the plant process. It is accordingly eliminated completely only after careful fractionation. The isobutane is almost worthless, and goes largely with the propane. The *n*-butane is a normal component of absorption gasoline, but there is nearly 50 percent more of this hydrocarbon in Kettleman gas than the final product can stand. There must accordingly be a substantial rejection of butane.

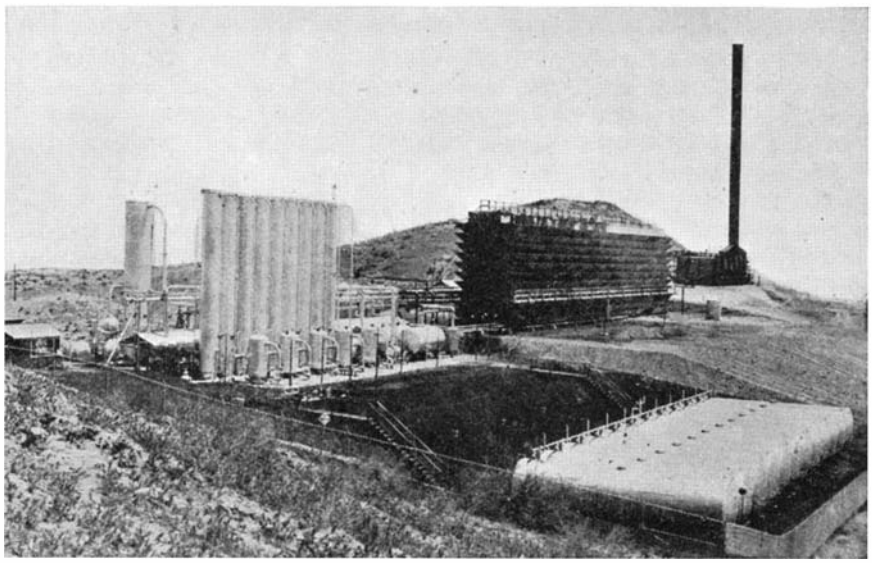
"Pentanes-plus," meaning all higher hydrocarbons, are the most desired, and the plant is designed to give practically complete recovery of such material. Undoubtedly there is a large amount of hexanes and heptanes, with dwindling percentages of a few higher members of the series and possibly cyclo compounds of unknown quantity. Practically no other gas is present.



One of the two fractionating units for recovering the raw gasoline from the absorption oil

THE wet gas, at 450 pounds pressure, enters the absorbers, where the soluble components dissolve rapidly in the oil which partially fills the towers. This oil is a relatively non-volatile refined petroleum of the "mineral seal" type, somewhat heavier than kerosene. In it are combined a high boiling range with minimum molecular weight. In this way a high gas solubility is attained, and at the same time a low loss of oil in distillation of the gasoline from the absorbed mixture, or "fat oil." About 675,000 gallons of oil circulate normally through the plant cycle.

All the desired hydrocarbons, and many more, are now absorbed in the foaming, dripping mass of oil in the absorber columns. The "dry gas" escaping absorption is promptly diverted.



General view of Los Nietos Plant, showing nine absorber units to the left, water tower and boiler plant to the rear, and gasoline storage tanks in foreground

The fuel value of this gas is practically identical with the gas fuel which is now standard in domestic service at Los Angeles. Absorption reduces the volume of the gas only about 8 percent, so that more than 80 million cubic feet must now be disposed of.

A portion of the dry gas is put to novel use in driving turbines which serve the necessary pumps of various kinds. In the face of dubious comments of turbine engineers, the builders of this plant have succeeded in driving standard steam turbines on high-pressure gas with even less damage to interior parts than occurs with steam itself. For this purpose the gas is reduced to 185 pounds pressure, heated with exhaust steam to forestall the formation of ice in the turbines, and then put to work.

THE existence of casing-head pressures up to 1100 pounds has suggested the use of gas in electric power plants, in which the energy would be derived merely from the expansion of the gas, after which the expanded but undamaged gas would be sold as fuel. Unfortunately the gas occurs at a distance of more than 200 miles from the nearest industrial center, and a large part of the 1100 pounds pressure would be needed to boost the fuel to its destination without allowance for electric power production. Not all has been said on this subject, however.

A small amount of the dry gas is reduced to very low pressure and used as fuel under the boilers. The remainder, which is nearly the whole supply, is led out a safe distance up a hill and blown off to the atmosphere as waste.

The "fat oil" from the absorbers, saturated with all the hydrocarbons, passes through tanks, where a slight relief of pressure vents a large part of the methane, ethane, and propane. It then passes to the pressure heat exchanger, an outstanding feature of the plant. Here by application of the counter-current principle, piped streams of "fat oil" pass a distance of about 60 feet counter to the returning "lean oil" from which the gasoline has been stripped. The contact is of course thermal, not an actual liquid contact. In this way the lean oil is partially cooled, with great saving in precious water. The "fat oil" in turn becomes heated, thus saving much steam.

The fat oil is still further heated in the second or gravity heat exchanger, and thence passes to the pre-heater, where it receives a temperature boost with the aid of boiler steam. The oil then passes to the fractionator, where it is subjected to steam distillation.

The vapors emerging from the fractionator pass, in turn, through a primary water-cooled condenser, a primary dehydrator, and then a secondary condenser and dehydrator. Automatic separatory devices permit a continuous flow of raw gasoline and re-condensed water. The dehydrators are merely tanks with weirs, and play the rôle of separatory funnel.

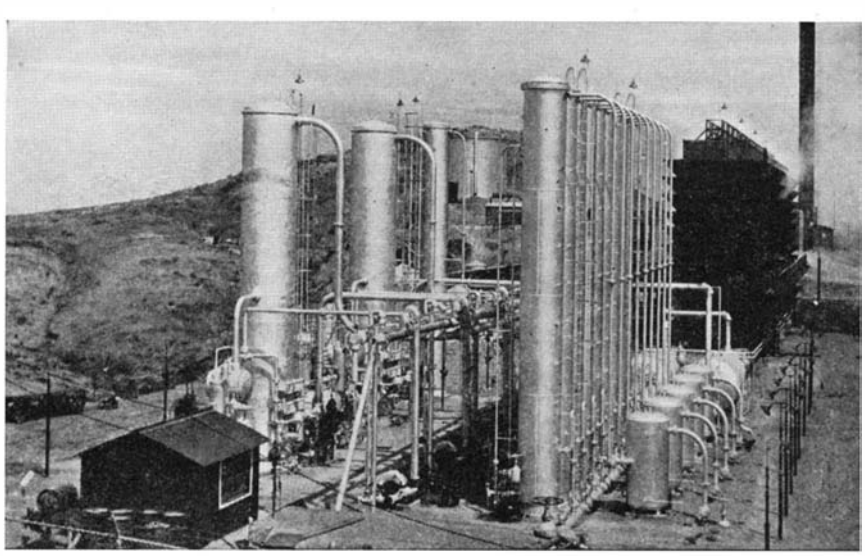
The hot oil—now lean—returns through the heat exchanger, yields a part of its heat energy, and is ready to do business once more at the absorber.

The hot, stabilized gasoline is now cooled and sent to short time storage in local tanks. It is then pumped at high pressure for a distance of 90 miles to the San Luis Obispo coast region, where it is received by a major company for blending purposes.

OF course no experienced oil operator dares predict the life of his field, but in the case of Kettleman Hills it is apparent that a supply vastly beyond conception has barely been tapped. The major supply is deep. Levels from 7000 to 8000 feet are furnishing the present flow. Recent drilling to extreme depths is encouraging in the production of oil containing more lubricants.

One may speculate freely over the existence of lower hydrocarbons rather than heavy oil. Has the original carbonaceous matter all been cracked into material of low molecular weight? Or is the present production merely nature's first fraction in a cosmic distillation of stupendous magnitude? And may we find the really great supply of heavier oil by drilling yet deeper?

Fortunately Kettleman Hills was not subdivided into town lots, as was Signal Hill. As a result there will be no forest of useless derricks erected by a horde of small operators hustling to outdo each other. There are no free lunches, bus rides, or curb markets crying "oil units." Furthermore, drilling at 7000 and 8000 feet is not an operation for small private finance. As a result it is hoped that there will be a controlled and economical exploitation of the field.

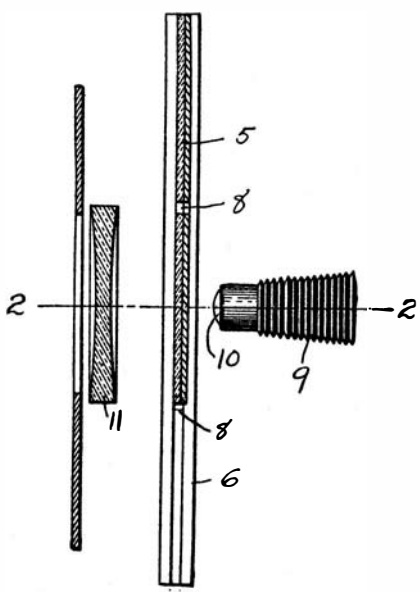


View from the west end, showing fractionators and stabilizer to the left, the absorbers to the right, and the water tower to the rear. Note neat appearance

POSE YOURSELF FOR YOUR PORTRAIT

IT is a far cry from the iron head clamp and "Watch the birdie" of the late 19th and early 20th Century photographer to the equipment and tact of the present-day portrait specialist, but the psychological effect on the sitter is still much the same. No matter how the average person may try to compose himself, no matter how reassuring the admonitions of the photographer to "just relax, and look natural," the ordeal of having a portrait taken is one from which that average person would like to escape.

A new portrait cabinet, the invention of Luther G. Simjian, director of the photographic department of the Yale School of Medicine, has been perfected in an effort to remove the mental hazards of portrait photography, and make it possible to produce high-quality portraits in natural poses with the least wear and tear on the subject. This device is no quarter-in-the-slot, ten-pictures-in-a-strip amusement resort affair, but is designed as an adjunct to the equipment of the professional photographer. It handles five by seven inch film and produces negatives of such quality that enlargements can be made from them to any required size.

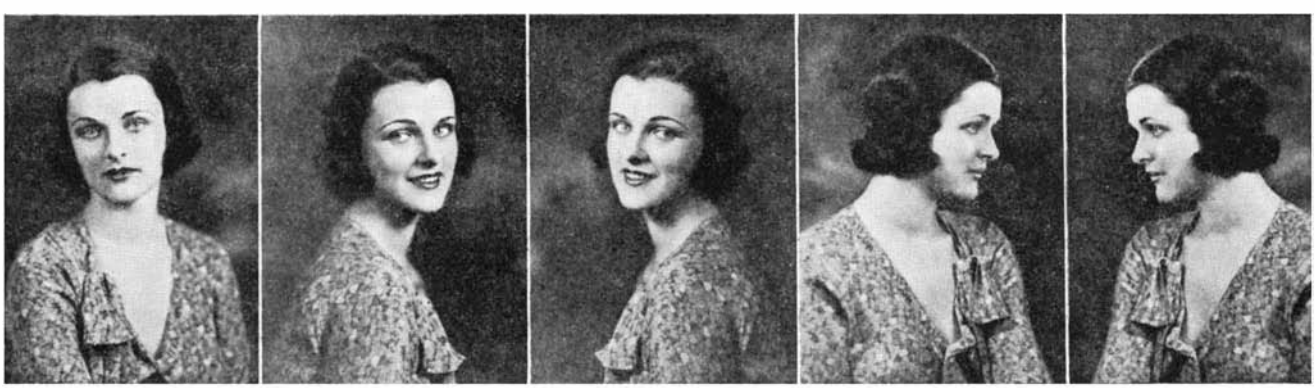


The camera, 9, is focused on the subject through the large lens, 11, but the mirror, 5, is interposed. When the sitter presses the final button the mirror is drawn rapidly down by hydraulic means and the exposure is made through the slot 8

THE subject enters the booth in which stands the cabinet, is instructed as to what to do, and is left alone. She can take as much time as she desires in selecting her pose or poses. Comfortably seated, she looks straight ahead and sees a reduced image of herself in a mirror in the center of the cabinet. This image is just the same size as will be the finished film. Looking to one side or the other she sees additional openings in the cabinet, under each of which is a button. Pushing one of these, she sees an image of herself in another mirror, but this image is the *same as that which will be seen by the camera located behind the center mirror.* There being five such openings, she can study herself from all angles and proceed to take from one to five different portraits of herself. All she has to do after selecting the desired pose is to press a second button which she holds in her hand.

Essentially, the PhotoReflex operates as follows: The center mirror, in front of the camera, is arranged to slide vertically when operated by a hydraulic arrangement actuated when the second button is pressed. In front of this mirror is a large condensing lens, which serves to reduce the image seen to the proper size, and also to give greater depth and definition to the negative. The center mirror is slotted horizontally so that when it slides down the exposure is made through this slot. By a mechanical linkage the center and side mirrors are turned so as to give the effect described, when the first button is pushed. At no time is the subject "camera conscious," nor is she aware of the exact instant at which the exposure is made. The exposed film is developed and fixed by a professional photographer, any necessary retouching is done on the film, and prints or enlargements are made in the usual manner by expert technicians.

Through a system of mirrors, the sitter sees the same view before her that we see in the center



Five views taken by the photographic method described here. The original prints from which these reductions were made were five by seven inches. The views that the sitter sees in the various mirrors are of the same size, due to the lens used

INTO A HIDDEN WORLD

By M. C. SWINGLE

ONE of the most fascinating of all amateur scientific hobbies is the observation of the microscopic life which may be found in almost endless variety and profusion in common ponds and muddy streams, ditches and even puddles, the world over. Now that mass production methods have made available suitable microscopes, magnifying from 50 to 200 diameters, at remarkably low cost—ten or twenty dollars—the hobby is relatively inexpensive. Several splendid treatises on this hobby are obtainable. The accompanying article gives just a peep into the microscopic pond-life world.—*The Editor.*

FOR the student and lover of natural history there is no more fascinating field of study than the microscopic plants and animals in a drop of stagnant water. To those who would give vent to a cherished desire to explore, to have adventure, or merely to admire things that are beautiful, this little world offers itself for their consideration.

The scientist, the nature lover, and the philosopher, each can find material for his fondest dreams. Thanks to the microscope we are permitted to gaze upon this world of rare beauty, but with all our power and great wisdom we are not able to enter and become a part of it. But, just as astronomy is none the less interesting because we cannot visit the places we see through the telescope, likewise, the study of a drop of water makes strong appeal to our curiosity. Through the large reflecting telescopes of modern science we watch the planets and stars; imagination leaps from the soul of little man and travels in the

***Figure 1:* Two specimens of *Paramoecium*, the one at bottom dividing. The object at top is a bubble**

solitude of the heavens. From this splendor we turn to the small ocular of our compound microscope, and visually, at least, we enter into a fairyland of busy creatures, hurrying in every direction, bumping into one another, and again scurrying on their way. Gay colored, microscopic plants come floating by. Their structure rivals the patterns of snowflakes. Thousands of busy creatures are seen living the life that is given to them to live.

The only equipment necessary for the journey into this strange world is a compound microscope, a few glass slides, a pipette, a small bottle, and a pond of stagnant water. A small bottle of water collected from the edge of the pond, among the dead and rotting leaves and grass, will contain countless numbers and generally a wide variety of these tiny living individuals.

As we walk into our laboratory holding millions of living creatures in the palm of one hand, we cannot help being impressed with the relativity of life. Where a moment before we were so insignificant among the planets and stars in space, now we are a mammoth creature carrying a strange world in our hands in which are millions of living individuals.

A single drop of water is placed upon the glass slide on our microscope and we slowly open the window of this strange realm which we may watch but cannot enter. As we peer through the little round window, a large, slipper-shaped individual comes floating by, poking its nose into everything that comes in its path. The *Paramoecium*, as this inquisitive being is called, is an animal of the very simplest construction (Figure 1). It has no bones, nor any special organs, but is a single cell carrying on all the processes necessary to maintain life. The surface of its body is covered with fine hairs which may be moved in an orderly manner so as to produce locomotion and thus facilitate the acquisition of food. This food is composed of smaller animals and plants which are swimming freely in the water.

The *Paramoecium* reproduces by simply constricting through the central region and dividing into two individuals, each of which swims away as a new unit to grow to normal dimensions. This division and regrowth may take place from two to five times in 24 hours, depending upon the temperature and food available. Barring any catastrophe, these simple creatures realize the human aspiration to eternal life. Theoretically they do not die, but merely divide and each half continues living.

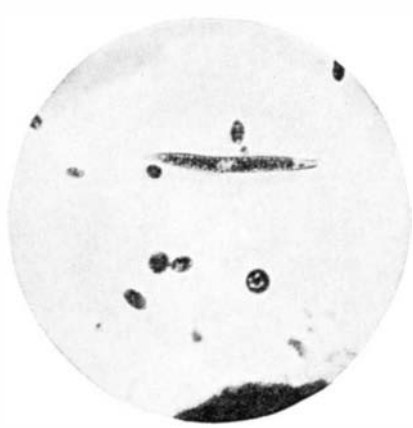


***Figure 3:* *Euglena* swimming through a cluster of microscopic plants. Its propelling appendage does not show in the photograph**

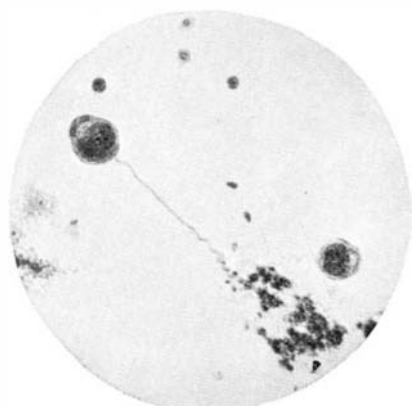


***Figure 2:* *Vorticella*. The one on the right is contracted, while the tube of the other one is extended**

Before our aided eye passes a great number of little creatures similar in habit and general construction to *Paramoecium* but slightly different in appearance. Massive grains of sand glittering like diamonds are scattered about the scene. Here and there is a large mass of decaying leaf or other fragment of plant. On close examination we can see a strange animal resembling a bell, fastened to a mass of debris by a long, spring-like stalk. This strange creature is a *Vorticella* and has many

peculiar adaptations (Figure 2). Its mouth is wide and is surrounded by a row of strong hairs which are moved in such a way as to produce a constant current of water down through the mouth and gullet. This current of water sweeps large numbers of small animals and plants into the stomach of the *Vorticella*, thus supplying the food. As we watch the strange creature a violent current is set up in the water and all small plants, animals, and debris are swept into the mouth. The current is so strong that a large mass of debris is drawn toward the creature from a distance, finally striking the delicate animal. This causes it to contract its long, spring-like anchor tube and the animal is drawn quickly away from the danger zone. On examining the little creature we find that it has so contracted itself that it resembles a sphere, having closed its mouth and drawn in the row of surrounding hairs. After a few seconds the anchor tube slowly relaxes and the animal is pushed out to its original position and form.

FROM behind a large grain of sand comes a beautiful, green individual which has one peculiarity that is almost

***Figure 4: Phacus,* a near relative of *Euglena,* is always ready to go**

unique. Human observers, with their customary desire to name everything, have long been in doubt as to whether this strange individual is a plant-like animal or an animal-like plant. They have named it *Euglena* (Figure 3), but its position on the family tree is still somewhat indefinite. Its beautiful green color rivals that of many of the strange plants floating about but this individual does not float about aimlessly as they do. Its body is continually turning on its long axis in a manner similar to that of an auger. In front is a long, whip-like appendage which is moved in a regular manner in the water to aid in locomotion. In direct contrast to the *Paramoecium*, the *Euglena* seems always to be going somewhere and is doing so in a straight line without delays. Toward the anterior end of the body is a bright red "eye" by which light is distinguished from darkness. The *Euglena* has a relative called *Phacus* which is very similar in general structure, being somewhat shorter and deeper (Figure 4). These two yellow-green individuals with their red eyes and long, whip-like appendages present a striking sight as

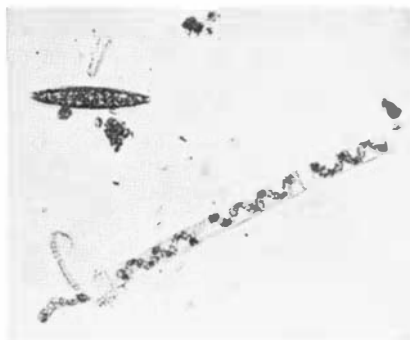


Figure 5:* One of the diatoms and, below, a fragment of *Spirogyra

they wend their way in and out among the grains of sand.

We have met the *Paramoecium* with its fickle personality, *Vorticella* with its destructive, bullying personality, cringing and cowering when struck by something its size, *Euglena* with its business-like determination to go somewhere, and now we come face to face with the most treacherous personality of all. Slowly and stealthily it approaches like a great octopus, in its precaution barely moving along. We recognize the *Amoeba*, the demon of this water world. Like a mass of jelly it quietly flows along and engulfs the unsuspecting microscopic animals and plants in its path. From its jelly-like tentacles there is no escape. Those who would survive must be continually on the watch for the stealthily crawling *Amoeba*.

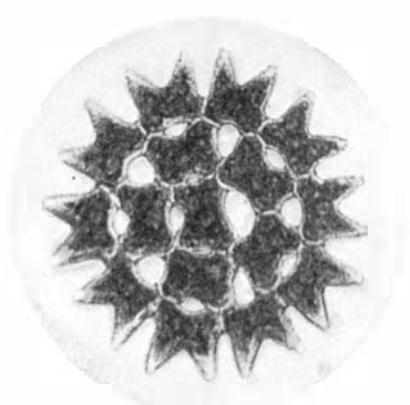


***Figure 6: Pediastrum,* a beautiful plant composed of sixteen sections arranged with geometric precision**

From these hard realities of life we turn our attention to the beautiful plants that float about in fairyland gardens. Vast numbers of beautiful, yellow-green plants cover the entire field. The great majority are simple plants composed of a single cell and commonly called algae. Some are round, others are square, oblong, diamond-shaped, or have very complex forms. The free-living plants are often of very beautiful designs. Across our field of vision floats a large, cigar-shaped diatom (Figure 5, upper left hand corner) of a beautiful green color with extremely delicate striations or ribs running from the center toward each side. If we approach closer to this floral spectacle by swinging our microscope into higher magnifications, we are amazed by the intricate design of the surface and the exactness of its form. A greater hand than ours must have been at work!

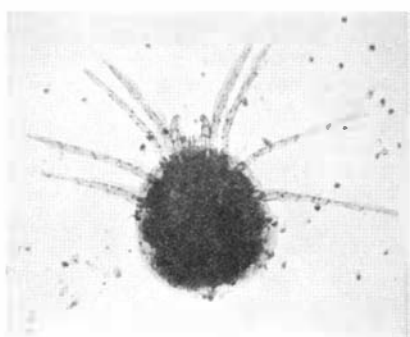


***Figure 7:* A water mite, the "giant" which broke up the performance**

Swinging our vision again into lower magnifications, we are surprised at the strange plant that has floated into view (Figure 5, below). Several cells can be seen in this plant, a beautiful green spiral braid enclosed in the center of each cell. This plant belongs to the genus *Spirogyra*, which includes a large number of species. This genus includes long, thread- or filament-like plants composed of a number of cylindrical cells attached end to end. The cells are in no way dependent upon each other but carry on their own life processes individually. The species that we see before us is one of the larger ones.

AS we gaze in admiration at the colors and amazing forms of these beautiful plants, a great commotion is set up in the water nearby. Little animals scurry for the protection of a clump of debris. Plants are forced to and fro by the "great" currents set up in the water. Grains of sand come rolling across the field like boulders in a mighty whirlpool. *Vorticella* is torn from its stalk and washed away with all the other strange creatures that we have seen. Giant, spider-like legs have come racing into our view carrying a mammoth body which blots out the entire scene beyond. A great water mite (Figure 7) has obstreperously entered this settlement of peaceful residents and beautiful plants, destroying the entire scene and scattering the inhabitants of our microscopic world.

ASQUITH AND KITCHENER

By CAPTAIN W. D. PULESTON*
United States Navy

(Concluded from August)

AMONG other precautionary measures taken during the period of uncertainty, Asquith detained in England Kitchener who was on leave from Egypt. On August 5, with considerable misgivings, he installed Kitchener at the War Office for the duration of the emergency. Asquith and Kitchener agreed that, in taking this civil post, Kitchener was to have no politics and he would return to Egypt as soon as the war ended.

When these two Englishmen, Asquith and Kitchener, each pre-eminent in his own sphere, took their posts for the impending struggle, the whole British Empire was content to leave the conduct of the war in their experienced and capable hands. Asquith, though primarily concerned throughout his career with domestic matters, had kept close touch with foreign affairs and the relative condition of the European armies and navies; he knew the usefulness of the Committee of Imperial Defense, was well acquainted with the leading Army and Naval officers, and had supported Haldane in his efforts to provide an effective expeditionary force and Churchill in building up the Navy.

KITCHENER, with an unbroken record of successes, administrative, diplomatic, and military, also inspired the confidence of his Allies; his reputation was international. Even Kitchener's personal appearance was helpful, for he looked the part the British people expected him to take in their war drama; his massive stature, his martial carriage and his grim, almost forbidding countenance united to give anxious observers the feeling that here was the strong, silent man upon whom they could depend. In the early war days crowds stood around to watch him enter and leave his office, but as he habitually ignored their presence, they quickly ceased to gather.

Kitchener's first official statement, that the war would probably continue three years, although at variance with all other expert opinion, was accepted at once, and the British people nobly responded to his call for a maximum military effort, although a narrow interpretation of their duty to the Entente might have limited their liability to maintaining the Expeditionary Force and controlling the seas. The almost Puritanical tracts that he had placed in the soldiers' knapsacks pleased the majority of his countrymen; and, although these tracts furnished some merriment to his Gallic allies at this evidence of British prudery, his attitude fitted into the crusading spirit with which England entered the war.

He was less fortunate in other decisions; he knew little of General Staff methods; he did not realize the complexity of modern mobilization or the intricacies of troop movements; consequently he did not hesitate to change the carefully prepared railway schedules to the detriment of the embarkation plan. He also delayed the dispatch of two divisions of the Expeditionary Force to France. He had a distrust of the Territorial System which Lord Haldane had created, so he immediately began creating a third army—the New Army, popularly called Kitchener's Army. Thus he committed Great Britain: first, to maintaining the Regular Army, most of which was in the Expeditionary Force; second, to bringing the Territorial Army to war strength; and third, to creating and maintaining the New Army. The attendant difficulties would have appalled a smaller man, but Kitchener with well-founded confidence in the British character, serenely commenced his task, fixed 70 divisions, approximately a million and a half men, as a tentative goal, with the firm resolve that though England entered the lists with the smallest army of any of the Great Powers, the end of the war, which he thought would come in 1917, would find her with the largest army in Europe and able to dictate the peace.

Kitchener also predicted correctly the line of advance of the German Army through Belgium into France and pointed out that it would thus outflank the British Army about to advance to Mons and probably force its retreat. When this retirement took place, Kitchener had to intervene to prevent Lord French from separating the Expeditionary Force from Joffre's Army and falling back to the Channel ports. He next reinforced French's Army to the limit, but very wisely held in England a bare military nucleus with which to create the New Army. He had to resist the importunities of General French and the whole staff of the Expeditionary Force, who insisted that they could win the war by Christmas if only given the men and officers then in England. Thus in his major decisions early in the war, Kitchener abundantly justified his countrymen's confidence; his one large decision open to question was his abandoning the Territorial System for his New Army. Competent judges believe the existing system would have yielded quicker results. Nor did he at this time anticipate the enormous amount of munitions necessary for modern armies.

AS the war continued into 1915 with the balance inclining to the Germans, Kitchener became puzzled; all estimates of expenditures of munitions based on previous wars proved inadequate; the factories of England and the United States were unable to equip and munition his new divisions; the expenditure of men and material on the Western Front had to be made good, while Lloyd George and Winston Churchill began to advocate an offensive in the Near East.

Kitchener then confronted his first important strategical decision: should he commit the British Armies being raised to a major campaign in the Balkans and Turkey, or deliver them to General French to employ against the Germans then established in France and Belgium? The Central Powers were able to transfer men from the Eastern and Western Fronts more readily than the Allies, so Kitchener was to a certain degree obliged to conform to German movements; except for this necessity, thanks to the Allied command of the sea, Kitchener could employ his New Army in Flanders and the Near East.

(*Please turn to page* 209)

READERS who desire to inform themselves more thoroughly on the activities of the two great Englishmen treated in this and the foregoing article will find much of interest in the available books listed below.

Life of Lord Kitchener,
By Sir George Arthur
Speeches,
By Earl of Oxford and Asquith
Twenty-five Years,
By Edward Grey
Before the War,
By Viscount Haldane
The Crisis—Vol. 1,
By Winston Churchill
Recollections,
By Viscount Morley

This list was compiled by Captain Puleston, and other titles are available for those who desire them. —*The Editor.*

*The opinions and facts in this article are the personal ones of the writer. They are not to be construed as official or reflecting the views of the Navy or the Naval Department.

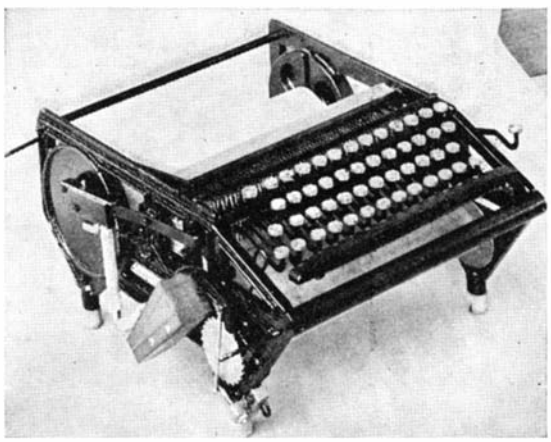
"FORM" LETTERS WITH A PERSONAL TOUCH

HAVING shown recently a typewriter which is operated by electricity we now illustrate the Auto-typist which can write approximately 117 words a minute. With it, form letters can be given the personal touch so desirable in direct-mail advertising in that the name and address at the head, as well as personal remarks and so on in the body of the letter can be inserted manually in the same type, so as to be indistinguishable from the rest. The system comprises two machines, one of which is a perforator which has a standard keyboard. The operator punches a record roll like that of a player piano. This record is introduced in a space back of any typewriter of standard make attached to the specially built typewriter desk. The paper record passes over a tracker bar and when a perforation is over any of the apertures in the tracker bar the corresponding key in the typewriter is depressed through the medium of small individual bellows (45 in all) as shown to the front and below the typewriter. Upper case letters are struck after a larger bellows depresses the shift key. There is a tube connection between each bellows and the tracker bar. The principle and even the material is exactly the same as is used in player pianos. Another larger bellows shifts the carriage automatically when the end of the line is reached.

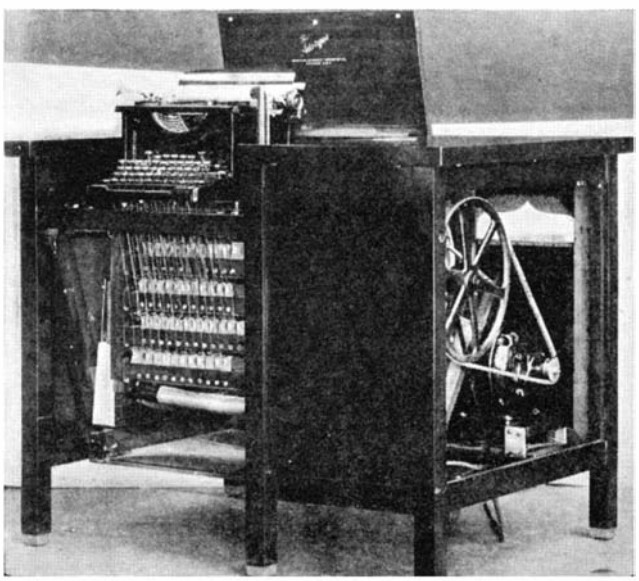
The power plant consists of a 1/6 horsepower, 1140 R. P. M., electric motor which drives a four-cylinder pump bellows. This bellows develops a suction of about 10 pounds per square inch, sufficient to give the proper "touch" to the typewriter keys. The suction is conveyed through a governor which regulates the suction used to operate the typewriter. By increasing or decreasing the amount of suction a heavier or lighter stroke can be given to the key so that impressions can be matched with that of the manually operated keys. There is a screw valve in each tube so that the keys can be adjusted independently of each other. A simple wire hanger serves to depress the key. When the record finishes typing the letter it automatically rewinds.

The greatest economy is effected when a battery of four machines is used. One operator can take care of them, typing in the salutation or putting in individual names or special wording in the body of the letter.

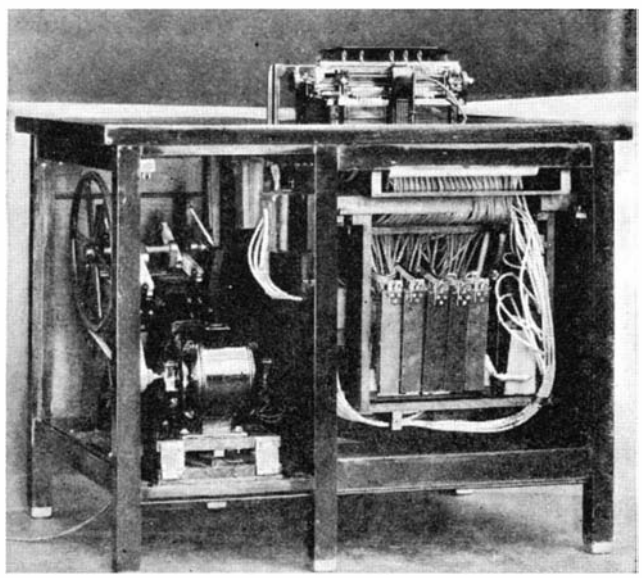
One girl does the work of 12 typists in writing personalized letters. This typist operates four pneumatic typewriters with perforated rolls



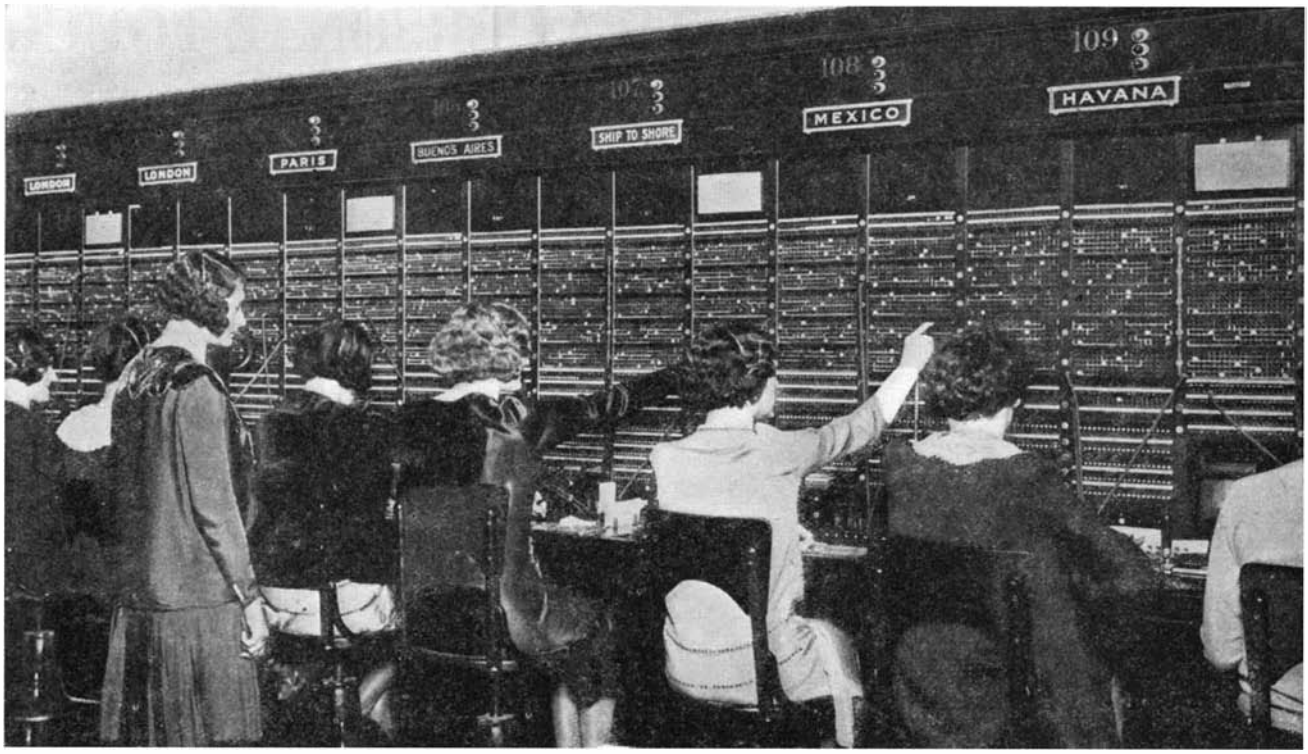
Perforator is driven from the pump-bellows. It has a standard keyboard and punches the record



The typewriter is driven at high speed by pneumatic mechanism. Bellows actuate type bars, shift key, and carriage



Rear view: *left;* power plant driving a four-cylinder pump. *Right;* an air motor for operating the record paper



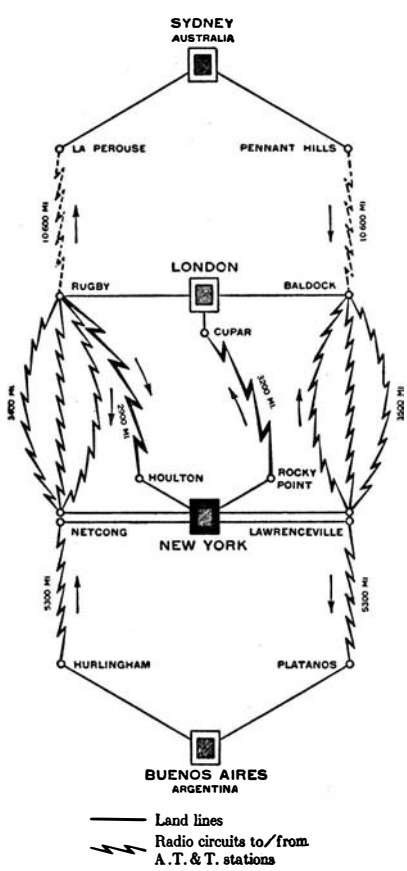
Upon superficial inspection, the uninitiated might say that these are ordinary central office boards, but there is a world of difference. These constitute the foreign service switchboard in the A. T. & T. Company's office in New York

WORLD AFFAIRS AND THE TELEPHONE

WITH the inauguration of transatlantic telephone service in January 1927, sanguine hopes for its good effect on international relationships were expressed by many who believed that the warmth of the spoken word would help to bring about a feeling of international friendship and would create better understanding. Whether this has followed after four years of the service is a moot question, but there has been at least one instance where it has probably helped to speed an important international agreement.

During the negotiations relative to the war debt moratorium plan proposed by President Hoover, the success of the whole plan seemed to hinge upon a perfect understanding of the various phases of the question. Speed also seemed to be a prerequisite to its success. Therefore, rather than depend upon an endless stream of wordy cablegrams, American diplomats in Europe used the telephone to discuss with the President certain angles of the plan which needed untangling as the discussions, particularly with France, became more and more involved. European diplomats were amazed at this entirely new form of diplomatic action, and an accord was speedily reached.

Prior to 1927, it was possible for a Bell System subscriber to lift his telephone receiver from its hook and call any one of 18,000,000 subscribers in this country and Canada. On January of that year, the opening of the first transatlantic voice channel by linkage of the telephone and radio made it possible for any subscriber in the metropolitan or suburban area of New York to connect with any telephone in a like area of London, England. The service was rapidly extended during the year to cover all of Great Britain and, on this side, the entire Bell System, Cuba, and eastern Canadian cities.



Schematic diagram of the radio channels linking Bell System telephones with those of the world

AT the present time a total of 32,500,000 telephones out of the 35,750,000 in the world are interconnected for service, the Bell System in this country being connected with all countries in the world having more than 100,000 telephones, with the exception of the following:

Japan	940,000	telephones
Russia	370,000	"
Brazil	170,000	"
New Zealand	165,000	"
China	155,000	"
Union of South Africa	110,000	"

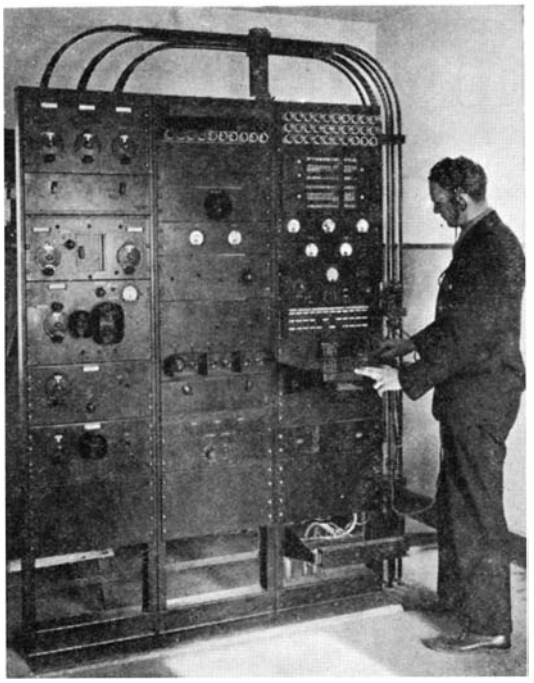
Arrangements are now being made for connecting us with Japan and Brazil. Connections with New Zealand will be made by the Australian telephone system when warranted by the demand; connections with China will necessarily await a more stable Chinese govern-

ment; while those with the Union of South Africa will doubtless be made by the British from England. Russia has no telephone system.

A voice from any telephone in North America to one in a country across the ocean follows a devious path. First it is brought by wire to the overseas control switchboard in New York City where it is partially prepared for its journey. Still on wires, it travels to one of the American transmitting stations where the voice currents are amplified many million times and then sent out in the form of radio waves. If the call is for Europe or Australia these waves, weakened by their long jump, are picked up at a receiving station in England, amplified to proper strength again, and the voice currents put back on wires and sent to the London Trunk Exchange. Calls for Europe proceed by land wire and submarine cable; but those for Australia go from the Trunk Exchange by wire to the transmitting station at Rugby, England, where they are again put on the air as radio waves for the passage to Sydney, Australia. Connections for messages going westward to New York, or between New York and South America are made in a similar manner.

THE connection across the Atlantic in 1927 was established by means of long-wave radio using a wavelength of about 5000 meters between a transmitting station at Rocky Point, Long Island, and a receiving station at Wroughton, England, and a transmitting station at Rugby, England, and a receiving station at Houlton, Maine. The European long-wave station was changed to Cupar, Scotland, during 1927, the reception being better in that latitude.

Four radio channels now handle transatlantic conversations: One long-wave, at about 5000 meters, and three short-wave channels in the band between 15 and 44 meters. These are operated jointly by the American Telephone and Telegraph Company and the British Post Office. Another long-wave channel is planned. Connection to Australia is established by another radio circuit from England, while Java is reached through radio stations in Amsterdam or Berlin. One short-wave channel using wavelengths between 14 and 28 meters handles the traffic to South America. This latter is operated jointly by the American Telephone and Telegraph Company and the Compania Internacional de Radio of Buenos Aires.

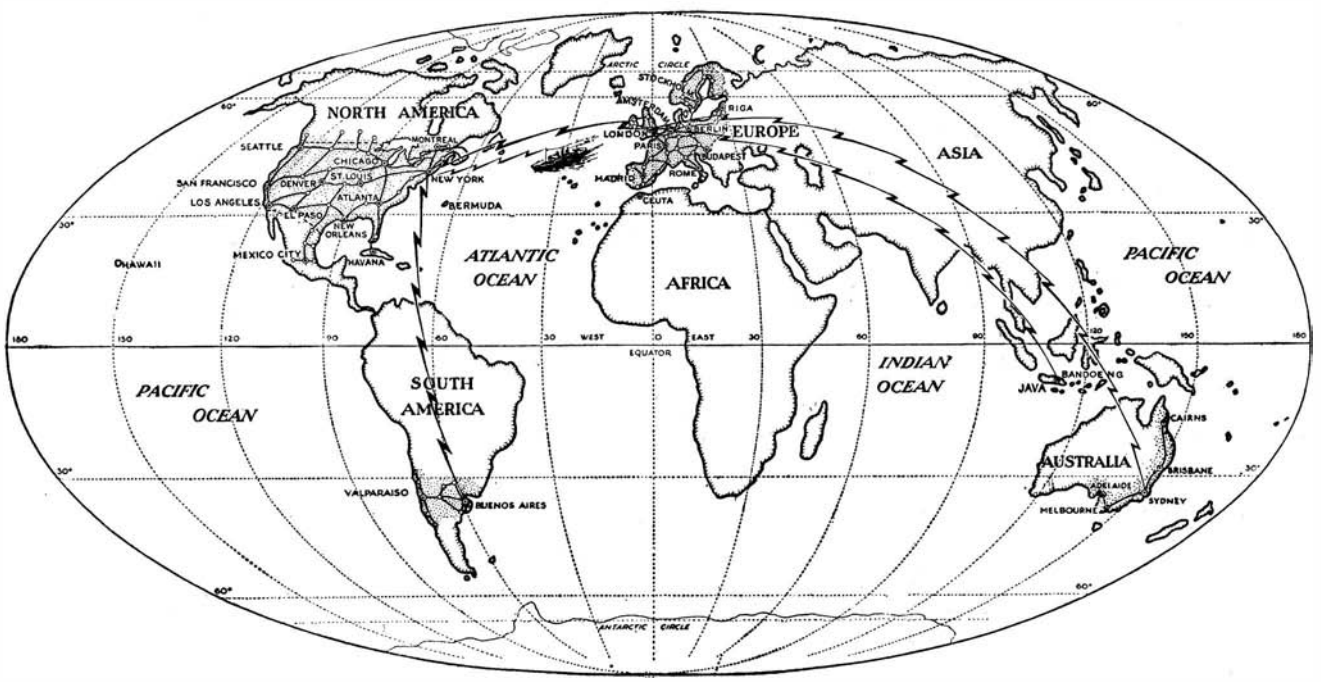


Short-wave receiving set on European and South American circuits, at Netcong, N. J.

When transoceanic telephone service was first inaugurated most of the calls were made for the novelty of talking across the ocean, or for publicity reasons. The tide of these, therefore, rose and fell with each major extension. Commerce and industry rapidly recognized the value of this service, however, and have employed it to extend foreign sales, to take advantage of favorable conditions abroad for the purchase of materials or commodities, for keeping in touch with European representatives, and so forth.

Practically every important city in the two continents has been involved in the traffic. The prevailing language is English, although others are used with increasing frequency. Naturally, there are numerous "peaks," notably at the Christmas holiday season. The greatest peak occurred at the time of the stock market break in October, 1929.

The volume of calls of a social nature has been large: greetings exchanged between relatives or friends; plans for meetings and the thousand other things that enter into the social life of the individual. From the beginning American people in the United States and abroad have been the largest users of this service, perhaps because they have become more telephone-minded than other nationalities.



Overseas telephone connections of the principal cities of the world and ship-to-shore service

HOW ANCIENT IS MODERN MAN?

By J. REID MOIR

Fellow of the Royal Anthropological Institute and Past President of the Prehistoric Society of East Anglia

Figure 1: **Estuary of the River Orwell in eastern England, below which the skull on the opposite page was discovered. The country is low-lying**

IS it possible to furnish an answer to the important question as to how far back in geologic time the modern type of man can be traced? As is well known, toward the close of early paleolithic times large areas in western Europe and elsewhere were peopled by a remarkable race of human beings possessing in their bodily form marked and fundamental differences from that of *Homo sapiens*. These primitive hunters, the Neandertalers, with their large though simian-like skulls and strange limb bones, were practising a culture known as the Mousterian, and the deposits in which the remains of this epoch are found are in many places immediately succeeded by beds containing the industrial relics of another and quite distinct civilization—the Aurignacian. In the accumulations of this last-mentioned epoch a number of human skeletons have been discovered, and when these are compared with the bones of the Neandertalers who immediately preceded the Aurignacians it is obvious even to a novice in such matters that the two races of men represented differed fundamentally in their physical characteristics.

NOW it is to be remarked that the lapse of time between the Mousterian and the Aurignacian cultures cannot well have been, geologically speaking, very great. The Aurignacian deposits are often found lying actually superposed upon those of the Mousterian and, even if it were physically possible for a Neandertal type of man to develop into that of the Aurignacian (*Homo sapiens*), which many skilled anatomists deny, it does not seem credible that such a marked transformation could have taken place in the comparatively short period of time intervening between the Mousterian and the Aurignacian epochs.

Taking these matters into consideration it would appear probable that the genesis of modern man must be looked for in some period pre-dating that of the Mousterian, and the question at once arises as to whether, up to the present, this supposition has been found to be correct. There is, of course, no doubt that numerous claims have been made to the discovery of human remains of the "modern" type, and of a pre-Mousterian antiquity.

Perhaps one of the best known discoveries of this order is that made a number of years ago of parts of a human skeleton embedded in one of the deposits of the 100-foot terrace of the River Thames in England at a place called Galley Hill. These remains, which clearly represent an individual of the modern type, were seen in place by several reputable people. The bones rested at about eight feet from the surface, and appear to have come from stratified and undisturbed beds which are known to be older than those of the Mousterian period when Neandertal man lived.

Then again, there is in existence in the Museum at Bury St. Edmunds, Suffolk, England, a portion of a fossil skull found at Westley near Bury, at some depth in brick-earth and associated with the remains of the mammoth. This skull fragment is certainly not of the Neandertal type, and as flint implements of late Acheulean forms occur in the brick-earth from which it was recovered, it would seem that the Westley individual, though to be classed as an example of *Homo sapiens*, nevertheless lived prior to the Mousterian epoch.

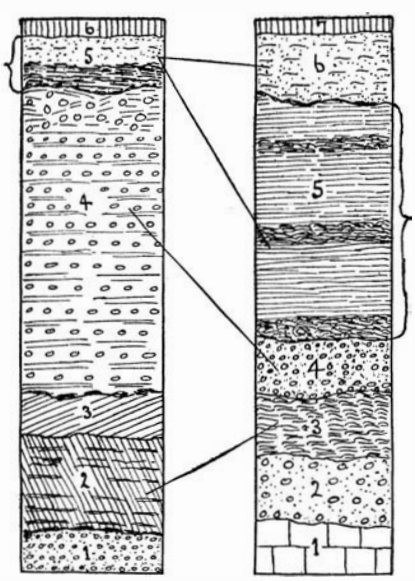


Figure 2: **Old land surface in East Anglia. The section at left is from the Gipping Valley, and that on the right from the Orwell estuary**

Other discoveries, such as those made at Clichy near Paris, Denise in south France, and Olmo and Castenedolo in Italy, appear to support the evidence afforded by those made at Galley Hill and at Westley in England, and it is plain, therefore, that there is in existence a considerable body of evidence in favor of the view that long before Neandertal man overran western Europe people of the modern type existed there.

I WOULD here wish to state frankly that I have never been able to accept the notion that the remains of *Homo sapiens* are to be found only in deposits later in age than those containing the bones of *Homo neanderthalensis*. This seems to be an intrinsically improbable supposition and one not to be made otherwise by the easy method of refusing to accept as authentic any remains of man of the modern type discovered in beds of a pre-Mousterian antiquity. I have endeavored, therefore, to preserve an open mind upon this important matter and to take due cognizance of any discoveries seriously claiming to support the conclusion that *Homo sapiens* is of great antiquity.

During the last two or more years I have been investigating the low-lying and deeply buried deposits of the River Gipping and its seaward and tidal extension the Orwell at Ipswich, England. These investigations have brought to light certain evidence having a distinct bearing upon the problem outlined above, and it is the main purpose of this article to lay this evidence before the readers of the SCIENTIFIC AMERICAN. Hitherto, the archeological contents of the beds in question—owing to their water-logged condition and general in-

Illustrations by permission of the Prehistoric Society of East Anglia.

accessibility—have been practically unknown. But, through a series of commercial undertakings in the Gipping Valley and by the dredging operations carried out recently in the Orwell estuary, it has been possible to unfold a truly remarkable picture of early man in East Anglia. I propose in this article to confine myself to a description of the archeological remains found in the lowermost implementiferous horizon of the deposits mentioned.

These remains come from an ancient land surface inhabited by early paleolithic man at a time when East Anglia stood much higher above the sea than it does today. The old land surface to which I refer is now buried deeply beneath a succession of beds in the upper non-tidal part of the Gipping Valley (Figure 2, at left) while in the Orwell estuary it is sealed in by upwards of 38 feet of compact peat, gravel and silt submerged by a considerable depth of water at high tide (Figure 2, at right). In the Gipping Valley the old land surface has yielded large numbers of flint implements, flakes and cores, and the hand axes of this group without question are of the same heart-shaped or cordate type as those found at the well-known site of Combe Capelle in France (Figures 3 and 4). This industry links the Acheulean with that of the earliest Mousterian and is in date definitely prior to that of the late Mousterian where Neandertal man lorded it in western Europe.

ACCOMPANYING the Combe Capelle specimens in the Gipping Valley have been found the remains of a mammoth of the broad-toothed variety such as Depéret claims to be of an early type, while in the compact and deeply buried peat of the Orwell estuary numerous fine examples of the same kind of elephant molars have been recovered. Further, an examination of the fossil plant remains from the two horizons, which moreover are geologically comparable, shows that there is no great divergence between them, and it may be claimed that in all probability the compact peat of the Orwell estuary and the peaty clay of the Gipping Valley represent but different parts of one and the same deposit (Figure 2).

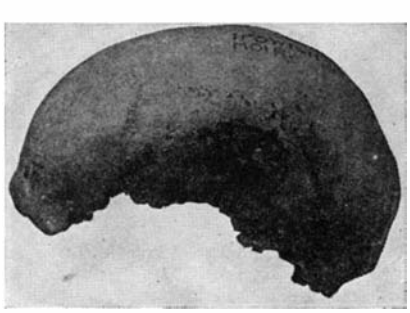


Figure 5: **The Orwell skull, which is probably of early stone age date**

Now there has been preserved in the Ipswich Museum for many years a human skull (Figure 5) which has every appearance of having been derived from a bed of peat. Unfortunately when this specimen was acquired no exact data were recorded as to its provenience and it bears a label stating "probably dredged from the river"—the river indicated being the Orwell (Figure 1). When the skull was first brought to my notice, I was at once impressed by its weight and appearance. The general color is grey while in places the outer layer of the bone is preserved and is of a chocolate brown color due almost certainly to staining by peat. In order to have a chemical analysis made of the bone, a small part was excised and it revealed the fact that the cancellous or spongy appearing structure exhibits throughout its thickness the same grey color as is shown by the outer surface of the skull. In one of the frontal sinuses traces of a fine silt-like material, such as is found in peat, are present. The piece of skull removed for examination, together with another from the

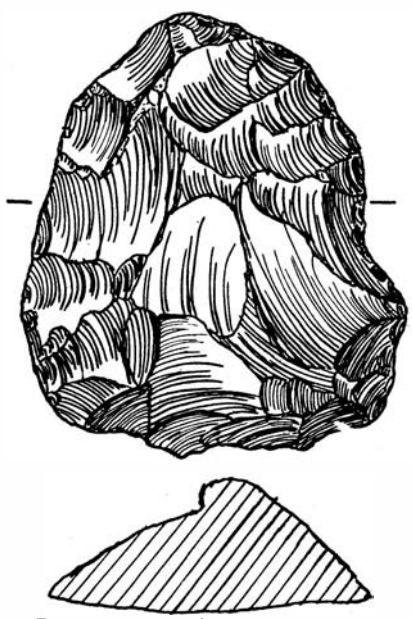


Figure 4: **Another Gipping cordate ax of the type shown above**

limb bone of a mammoth recovered from the compact peat in the Orwell estuary, have been analyzed by expert chemists, and the amount of organic matter contained in both specimens found to be almost coincident. On the other hand, an analysis of different bones from the Orwell estuary, of later date than those in the compact peat and also of "green" or fresh examples, shows that these contain a much higher proportion of organic matter. These results have made it clear that the skull in question is without doubt in a fossil condition and taking all the evidence into consideration, is probably of Combe Capelle, that is, early Paleolithic age.

In view of this conclusion I submitted

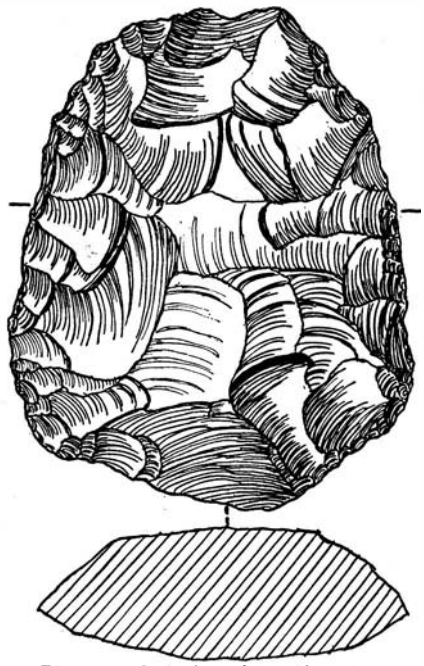


Figure 3: **Hand ax from the River Gipping, like Combe Capelle type**

the specimen to Dr. W. L. H. Duckworth, the well known anatomist of Cambridge University, for examination. Dr. Duckworth, to whom I am very grateful for his kindness, reports that the skull stands out quite definitely as an example referable to *Homo sapiens*, the modern type of man.

Dr. Duckworth also draws attention to the close agreement in form of the Orwell skull to one found many years ago at a considerable depth when making a dock at Tilbury in the Thames Valley. The Tilbury skull occurred, in fact, at a similar horizon to that occupied by the compact peat in the Orwell estuary. The Tilbury skeleton was described by Sir Richard Owen, F.R.S., who claimed for it a paleolithic antiquity and ascertained, by means of chemical analysis, that the bones were fossilised. Moreover, at Tilbury and at other places in the bed of the Thames, there have been dredged up examples of Combe Capelle hand axes quite comparable in form with those found in the Gipping Valley, and it is therefore possible that the Orwell and the Tilbury skulls are of the same age.

AS I have endeavored to show, both of these skulls may be of the Combe Capelle Lower (early) Paleolithic period, and if this opinion should turn out to be well founded then two more specimens of the type of *Homo sapiens* must be added to the growing list of such examples from pre-Mousterian deposits. In any case I am strongly of opinion that it is necessary to place on record any discovery which seems to point seriously to the great antiquity of modern man, and it was with this end in view that the above article has been written.

COTTON CLOTH FIT FOR A KING

By DONALD A. LAIRD, Ph.D., Sci.D.
Colgate University

SILK purses may not be made from pigs' ears, but industrial science performs daily almost as great a miracle in finishing cotton fabrics. From the identical strip of greyish-tan weave, the finisher can produce a soft nainsook, a rough muslin, a smooth and polished cambric, or a lustrous mercerized fabric. From the same fiber, sateen is produced by a few variations in the finishing processes. Startling and unexpected results are a matter of daily routine in the preparation of practically every cotton fabric for the consumer.

The cotton fiber becomes fit for a lady or a king by being subjected to hard knocks which produce softness, luster, or smoothness. The cloth is burned, passed through vinegar, caustic, or even through sulfur compounds. The hard knocks are literal in some types of finishing, particularly when a softness is obtained by passing the cloth between two dozen wooden rollers, each of which is studded with more than a hundred brass knobs which beat the fibers into softness.

WHEN one admires a particularly soft and fluffy blanket it is probably not the actual beating process that has produced the delightful softness, but the use of sulfonated castor oil in the finishing processes. Each fiber absorbs only an infinitesimal amount of this oily compound, but an olfactory examination of the fluffy goods will betray the cause of its unusual softness. The use of oils, however, is essential to textile manufacture for other reasons than giving the finished product the appealing virtue of softness. In order that yarns can be woven readily and accurately, tallows, oils, starches, and glues have to be added, depending upon the nature of the fibers.

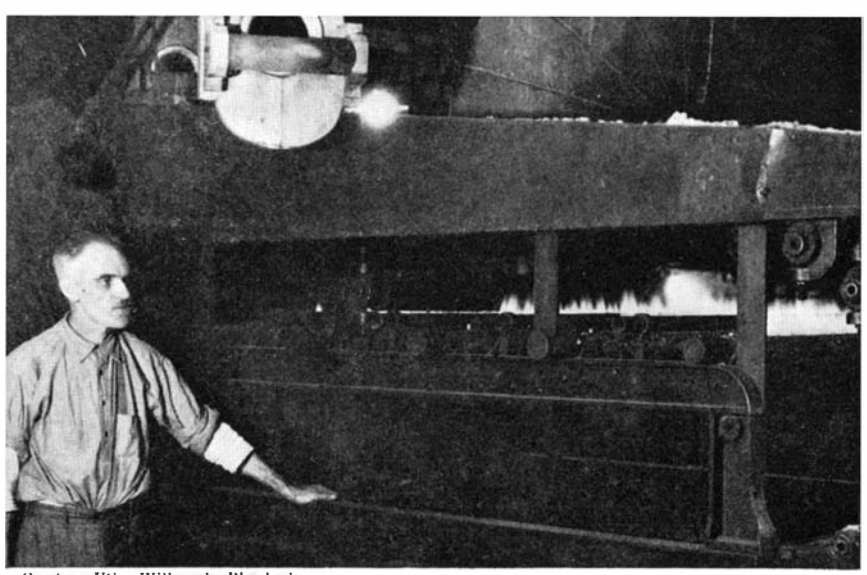
The virtue of applying diverse finishes to the same piece of cloth has resulted in the peculiar profession of the convertor. The convertor will purchase thousands of yards of unfinished fabrics from weaving and spinning mills and will arrange with finishing mills and bleacheries to finish the fabric in the way the convertor thinks will best satisfy his customers. The weaving mill may be in the South and the finishing mill a thousand miles to the north, but the finish of the cloth is so important that it is often hauled almost the depth of the country.

This is a part of the price that is paid to satisfy man's desire for the beautiful and comfortable, but usually it amounts only to a fraction of a cent a yard. The textile world awakened to the sales values of finishing goods long before soap manufacturers, for example, realized that a shapely, smooth textured, fragrant, and carefully colored cake would sell better than the same soap not "dressed up." Now practically every manufacturer is interested in effective means of dressing up his products.

There is nothing especially modern or civilized about finishing textiles to yield added beauty and comforting softness to the wearer. Our grandmothers were adept at beautifying the unbleached goods they purchased. The goods were boiled again and again in hot suds, but this was not enough to make them white or soft. Then the material would be spread on the grass, on sunny days, and sprinkled from time to time. Frequently the pieces were turned over and shaken vigorously. Sometimes lye would be used. Then—hoping for the best—she would try dyeing them. The bleachery and dye house and finishing plant have taken over the task and do a much better job than grandmother did, despite all the patience and labor she put into the effort.

The Chinese coolie in British Malaya has his own primitive procedure for finishing his fabrics so that he will be proud to display them. First he boils the material in oyster shell lime to remove starches and other impurities, and then rinses it in clear water. Then it goes into a glue solution made by boiling water buffalo skins until they have dissolved; and again it receives a rinse in clear water. Then the fabric receives an aromatic bath in water in which pineapple skins have been soaked for two days, following which the glue odor is further offset by being dipped in a solution in which mangrove bark has been cooked. In the final step in the finishing process, the fabric is wrapped firmly around a small smooth log which fits into a smooth wooden trough and the calendering polish is given by a stone weighing from 700 to 1000 pounds.

IN a modern American finishing plant, we find much the same processes, although many variations and refinements have been devised. One of these, for example, is the singeing process, the first used on most smoothly finished goods. The cloth is whirled close over burning gas jets which burn off the excess woolly fiber. This singeing, directly in contact with the open flame, takes place while the fabric is traveling at the rate of a rapid trot, too rapid usually for the material to burst into flame; but in case it does, negligible damage will be done because, three feet from the flame, the fabric passes into a liquid malt bath which also facilitates the process of dissolving the excess starch.

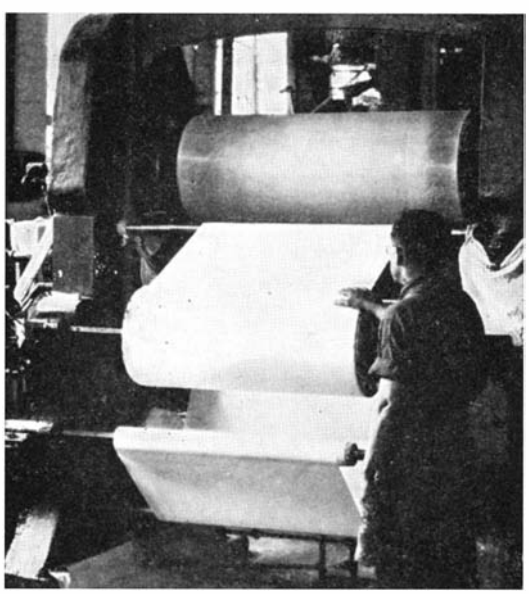


Courtesy Utica-Willowvale Bleacheries

A singeing machine which burns the nap from cloth as it passes rapidly over a flame. Material passes through large eyelet, in upper left, after wetting

Still at a good speed, the apparently endless fabric passes from its brief wetting-down dip in the malt solution, through large eyelets the size of a small life preserver to a large kier which has been filled with caustic soda, ash, and lime. Sometimes strong liquid soap is used; and in case the goods have already been dyed, they are passed into a peroxide kier so the color will not be changed.

For the last operation, the modern bleachery uses large steam kiers under 10 pounds pressure, giving a temperature much above that of boiling water. To facilitate cleansing, some bleacheries mix pine oil with the soap for "wetting out." More recently they have begun using terpineol, which accomplishes the same results and also impregnates the fabric with a scent suggesting lilac or lavender. One manufacturer is actually selling sheeting under the name of "lavender" due to the use of synthetic fragrances to yield this scent in the finished product.



Schriener process machine, the grooved roller of which produces an "artificial" mercerization

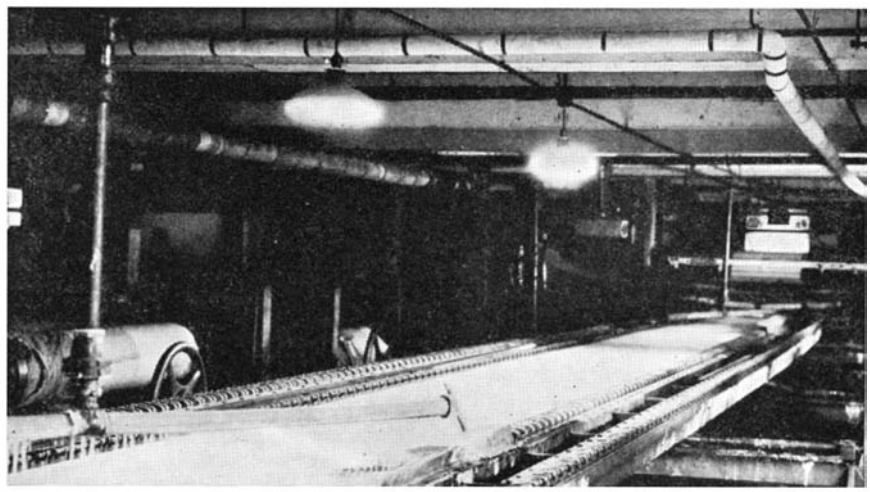
Following the boiling in the steam kier, goods that are to be sold as white are passed through a chloride solution and allowed to soak until white. These solutions are used at a strength so weak that they will not injure the fibers but still strong enough to produce the bleach. When the bleach is satisfactory, the goods are passed through the life preserver rings again and into a bath of sulfurous acid, to neutralize the chloride solutions. This acid has to be thoroughly washed out to offset the later development of sulfurous odors. Washing the goods after the various steps in the finishing process is so important that a medium-sized finishing plant will use as much as 3,000,000 gallons of clean water daily.

When animal fibers are being finished, alkalis cannot be used since they tend to destroy the animal fibers. The excess of natural fats must be removed, however, to prevent souring of the material. In some of the fat-removing processes, the extracted fats are carefully saved and sold as a by-product, since the lanolin they contain is used in beauty creams and ointments, with the odor of the animal fat scientifically disguised.

One of the most interesting processes may be observed in the production of a mercerized cotton fabric. Just what produces the luster of mercerization is unknown; that is a secret the silk-worm has, but man can now make the luster artificially. A permanent mercerization that will withstand severe laundry treatment is produced by shrinking the woven cloth in caustic soda and then gradually stretching it for a minute or two while the excess caustic is dripping out. As the fabric emerges from this solution it is seized at the edges by hundreds of mechanical fingers on endless belts; these hold on firmly, stretching the width until the material is ready to have the remaining caustic washed out in clear water.

The theory of mercerization is that the curl is taken out of the fibers, although authorities are in dispute on this point; but at any rate it produces a permanent finish. A similar finish is sometimes produced when the original yarns are stretched as they are spun.

An artificial mercerization which will wash out is the result of the demand for appearance and cheapness. The cleansed goods are moistened and passed between the rolls of a Schriener calender under a pressure of about 80 tons. One roll is smooth, the other has from 200 to 300 fine lines per inch engraved on its surface. These make minute cuts in the surface of the goods which give it a sheen or luster but do not give it a polish. Polish, independent of mercerization, is achieved by having one roll go faster than the other, using both heat and pressure. This, obviously, simply duplicates household ironing.



The edges of table cloths, shrunk to 36-inch width, are grasped by automatic fingers on this belt, and given a mercerized finish by stretching to 42 inches width

In the dyeing processes, the utmost skill is required, not only to keep the colors under accurate control but to guard against the development of undesirable odors. Most blacks, khakis, and dull colors, for example, are obtained by the use of dyes for which sodium sulfide has to be used as a carrier. These fabrics are carefully processed and washed to avoid developing the sulfurous odor of old eggs.

THE fastness or permanency of dyes now gives but little bother, but the color and odor are still of great concern. Ever since William Henry Perkin started the use of aniline dyes "that dye odor" has been a laboratory phrase and in some instances it is possible for experts to tell the color by the smell of the goods. Dr. Eric C. Kunz, an American chemist, is now at work adding to the finishing touches of fabrics by neutralizing the dye odor. In one plant, artificial wintergreen has been used in some of the processes, and these departments quickly became the most popular among workers, indicating the merits for building worker morale as well as adding sales value to the merchandize.

This appears to be in line with the growing desire on the part of fashion leaders in quest of "something different" and completely appealing to the senses to have dress goods delicately scented. Early this year frocks appeared on Bond Street which were impregnated with permanent scents as a triumph of applied research. From Paris we learn that this is considered more than a venturesome fancy and has been seriously taken up by several famous arbiters of fashion.

THE SCIENTIFIC AMERICAN DIGEST

Conducted by F. D. McHUGH

Contributing Editors

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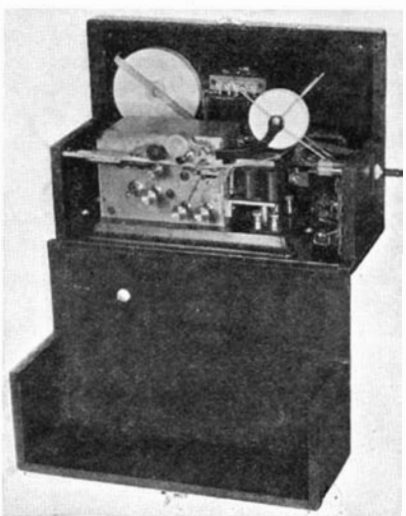
A. E. BUCHANAN, Jr.

Lehigh University

New Soap Has No Taste

A SOAP that has neither taste nor smell has recently been developed by synthetic chemists. Not only is it harmless when taken internally but it has a food value very similar to lard. Chemically it is known as glycol stearate.

Since nearly all tooth pastes and powders contain a large proportion of soap, it is necessary to mask their taste. This is done by the addition of sugar or saccharine and oils like peppermint or wintergreen. If glycol stearate is used these masking agents are unnecessary.—*A. E. B.*



The Strowger telephone call recorder makes a note on tape of calls to a 'phone from dial telephones

A Telephone Call-Recorder

A RECENT development in "dial" telephone equipment comes to the aid of doctors, lawyers, and other professional men who have no assistants and have to leave their offices unattended during their absence. This development is a call-recorder which provides a much-needed service not practical with "manual" operation.

This call-recorder consists of a pen-register which is installed at the subscriber's telephone with a switching key to throw it into service when the subscriber leaves. When ringing current is put on the line by an incoming call, it starts the pen-register and sends a distinctive tone to the calling party, indicating that the called party is absent but has a call-recorder ready to record his telephone number.

The calling party then proceeds to dial *his own* number, and the pen-register records it as a series of short dashes on a tape. If the call number includes letters, these are recorded as figures, but as the number may be called again by these same figures, there is no confusion. After the last digit is completed, the register feeds out about three inches of tape, to separate this number from any which may follow.

Bran and Constipation

AVOIDANCE of constipation, which he describes as "one of the most prevalent American diseases," is best secured by including a sufficient amount of bulky food in the diet to stimulate the intestine to normal activity; and bran, recently criticized by some doctors, is a perfectly suitable food for this purpose, according to Dr. L. H. Newburgh, Professor of Clinical Investigation in Internal Medicine in the University of Michigan.

"The muscles of the large intestine where food refuse accumulates must contract in a definite way to insure normal action. These muscles will not contract, however, until they have been stimulated by stretching to a certain degree, and this stretching can only be brought about by a sufficiently large mass in the intestine."

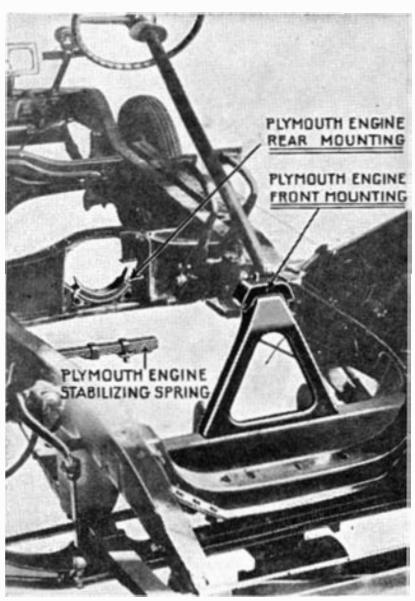
Before 1870, when modern milling processes were introduced, the large intestine was assured of an adequate amount of bulk because the bran or chaff was included in the flour. With the coming of the roller mill at this time, the public was offered white flour, a product from which all bran was removed. At the same time there was a general tendency toward other highly refined, soft, smooth foods, largely eliminating all roughage except certain green foods such as lettuce.

"Striking examples of the effect of eliminating bulk from the diet were frequently furnished when large groups of immigrants were entering this country," stated Dr. Newburgh. "In treating a large number of constipation cases among immigrants from southeastern Europe at the Massachusetts General Hospital, we made a special study of their food habits. In their native country, we found, they had lived largely on coarse rye bread, made from the whole grain, and green vegetables. As soon as they arrived in America they adopted a white bread and beef steak diet, and were much opposed to giving up what were to them food luxuries. As a result, a large number soon developed very severe cases of constipation which were corrected by a return to a diet containing bulky foods.

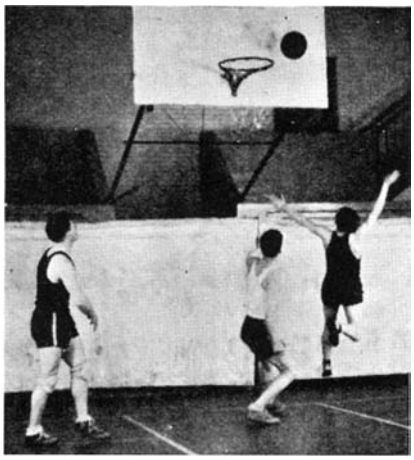
"It seems necessary that human beings, because of the nature of the muscles of the intestine, must include a considerable amount of bulk or roughage in their diet to be well. Bran is a convenient form of making this addition, and unquestionably does promote normal bowel movement."

Two-Point Rubber Mounting of Automobile Engines

SINCE the early days of the motor car, engineers have sought to eliminate roughness and vibration from the four-cylinder automobile engine. While cylinders have been added and the industry has sponsored sixes, eights, and other multi-cylindered engines, Plymouth engineers



Two-point suspension of the engine in the new Plymouth car, showing rubber mountings and the stabilizer



With good lighting, indoor movies may be made with the new panchromatic film—lens opening f.1.9

have worked on unceasingly for a perfected four. They realized that the four is the most economical and the simplest of all gasoline engines. The four has been accepted as the ideal car at the lowest price—except for vibration.

Under the direction of Fred M. Zeder, vice-president in charge of engineering of the Chrysler Corporation, floating-power, a new method of mounting the engine, has been developed for the purpose of eliminating the last vestige of engine vibration from body and frame. A new line of Plymouth cars, with the complete power plant literally floating in the chassis has recently been announced.

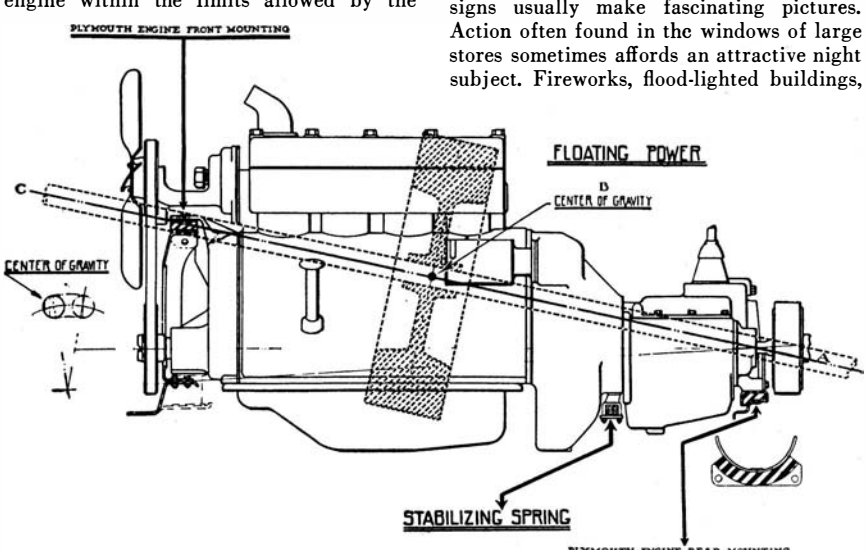
Floating-power involves the use of only two rubber engine-mountings as compared with three or four ordinarily used. The rear rubber mounting is located in the cross member at the rear of the transmission. The front rubber mounting is located just under the water pump and is supported on a specially constructed triangular bracket attached to the front cross member. A line connecting the rear and front mounting points would pass through the center of gravity of the power plant, like the shaft through a balanced fly-wheel as shown in one of our drawings; thus the entire power plant is suspended in perfect balance.

To preserve the proper alignment of the engine and to hold the movement of the engine within the limits allowed by the rubber mountings, a built-up cantilever spring is used between the rear of the engine and the frame side member. The built-up end of this spring is attached rigidly to the engine and the other end is embedded in rubber in the frame side member.

A glance at the Plymouth engine while running at various speeds shows very clearly the "float" of the power plant. By permitting the power plant thus to rock freely on its natural axis, the vibrations normally transmitted to the frame and body are dissipated.

Combined with floating-power in the Plymouth is another of the industry's latest innovations—free wheeling in all forward speeds. This free-wheeling unit was developed by Plymouth engineers and differs in design from other such units now in use. Its operation is controlled by a button on the instrument panel and it may be locked out simply by pulling out this dash-control.

In addition to floating-power and free wheeling, the new Plymouths have an easy shift transmission of the constant mesh type; safety-steel bodies of heavy steel, shaped on giant presses with each body electrically welded into one rigid unit; double-drop frames, to provide exceptional lowness, excellent roadability and ease of control; and internal hydraulic, self equalizing brakes.



The "fly-wheel" effect in the new Plymouth car. The engine is suspended so that a line through the points of suspension passes through its center of gravity

Supersensitive Panchromatic Home-Movie Film

THE recent introduction of Ciné-Kodak Supersensitive Panchromatic Safety Film enables the home-movie maker to take motion pictures of subjects that could not be photographed satisfactorily before. Pronounced sensitivity at the red end of the spectrum makes the emulsion of this film particularly efficient when exposed to rays of artificial light—especially the light of incandescent lamps. As a result, the range of Ciné activities is signally extended.

With supersensitive panchromatic film, it is now possible—in fact, easy—for amateurs to photograph indoor subjects by the light of ordinary electric lights. The increased range of picture taking provided by this film actually embraces night scenes on brilliantly lighted streets, or theater districts in large cities. Animated electric signs usually make fascinating pictures. Action often found in the windows of large stores sometimes affords an attractive night subject. Fireworks, flood-lighted buildings, camp-fire scenes, are all now within the scope of night movie making.

The new film is valuable for daylight photography as well as for pictures at night. The increased light-sensitivity of the film is not confined altogether to the red end of the spectrum. It is nearly twice as responsive to blue and ultra-violet light as regular panchromatic film, permitting successful pictures to be made under very adverse weather conditions. Unusual shots can be made during a downpour of rain with super-sensitive film, and the Ciné camera now becomes an efficient instrument during the early hours of the morning or in the weak light of the late afternoon.

Cancer Survival

MORE than half of the women given radium or X-ray treatments after operation for cancer of the breast had no recurrence of the disease for five or more years, Dr. George E. Pfahler of Philadelphia has announced in a review of 1022 cases of cancer of the breast reported to the American Radium Society. Physicians require that patients be free from cancer for at least five years after treatment before concluding that the treatment has been successful. For this reason Dr. Pfahler's report was received with great interest.—*Science Service.*

Remarkably clear outdoor night picture made with the new film

"Butter" in Rainbow Colors Next?

OLEOMARGARINE of rainbow hue, supercharged with extra vitamins, is an experiment that may be tried out to extend the market for that butter substitute. Frustrated by recent enactment of the law imposing a 10 cent per pound tax on yellow margarine made from palm oil, manufacturers are said to be giving serious consideration to adopting a new distinctive color for the product.

This may be red, green, amber—any color that is recommended by a study of the technical and psychological factors involved. Whether the public will respond to a spread for bread that is not of the traditional yellow color is the question to which the margarine makers are seeking a definite answer. They may get it by marketing various colored samples in one or more small communities.

Margarine richer in vitamin A and D content than butter, made by adding deodorized cod-liver and other fish oils,

vegetable oils, oils from beef liver and other substances, is being produced by certain manufacturers in Germany, Holland, and England. Domestic manufacturers now are engaged in research along this line.

Results of the 1929 distribution census for oleomargarine and other butter substitutes were released by the Census Bureau recently and show that 41 plants in the United States produced 46,522,000 dollars' worth of oleomargarine and other butter substitutes.—*A. E. B.*

After the record-breaking flight around the world: Gatty (left) and Post (right) holding commemorative plaques awarded them by the Aeronautical Chamber of Commerce

Trout Digests Hook

A LETTER received recently from C. E. Hagie, of Western State College of Colorado, Gunnison, recorded such an unusual incident that we thought our readers would be interested in hearing of it. He wrote:

"While fishing last evening in the Gunnison River just below the town of Gunnison, Colorado, I caught a Loch Leven trout about 12 inches long. As I drew my hand along his side I felt a sharp point protruding just beyond the surface of the skin. Upon cleaning him I found a half inch of the barbed end of a fish hook protruding through the side of the stomach. I pulled on it and found that the part of the hook which remained in the stomach had been entirely eaten away by the digestive fluids, except for a short thread-like stem about a quarter of an inch long. The hook was of the tempered steel, snelled type which originally had a shank about an inch and a half long and a distance from barb to shank of about one half inch. The fish was in fine condition and put up a strenuous fight against being landed."

Viosterol Found Beneficial to Radium Poisoning Victims

ALMOST simultaneously with the news of the 20th death from radium poisoning among the unfortunate watch factory workers, comes the announcement of a promising method of treating the condition. Viosterol, now often given infants in place of cod-liver oil to prevent or cure rickets, has benefited a number of victims of radium poisoning, Dr. Frederick B. Flinn of Columbia University has reported to the American Medical Association.

Dr. Flinn does not consider that he has a cure for the condition, but merely reports a method of treatment that has given promising results.

"Our experience so far suggests a method of treatment that will eliminate radium salts from the organism as well as improve the condition of the bones if continued for sufficient time," he stated. "It is a matter of months and not days. Care should be taken that fresh preparations are used," he cautioned.

Most conspicuous among radium poisoning victims were the dial painters in the watch factory whose habit it was to put their radium-paint brushes in their mouths to point them. In this way radium got into their bodies and in about one fifth of them the radium was deposited in the bones instead of being eliminated from the body. While the amounts of radium absorbed in this way were small, the activity of radium is so great that these small amounts were sufficient to destroy bones and tissues and to cause fatal illness.

How to get the radium out of the body before it had caused irreparable destruction was the problem which Dr. Flinn and other scientists attempted to solve. Because radium is related to calcium, it was supposed that any treatment that would affect calcium might have a similar action on the radium deposits, Dr. Flinn explained. So he first tried treatment with an extract of the parathyroid glands. These small glands, located behind the thyroid in the neck, are thought to regulate the calcium of the body.

Parathyroid treatment had been moderately successful, when Dr. Flinn suggested the use of viosterol. Vitamin D, calcium utilization in the body, bone formation, and the parathyroid glands are all linked together, so viosterol, which is a potent source of vitamin D, was a logical selection.

The results of this treatment in eight cases have been good. In two cases, radium was completely eliminated from the body; in the other six, the amount of radium was materially reduced. Improvement in general health, such as freedom from pain, gain in weight and improved condition of the blood, followed the treatment, and one of the patients was able to resume her former housekeeping activities. In most of the patients the destruction of bone was checked.—*Science Service.*

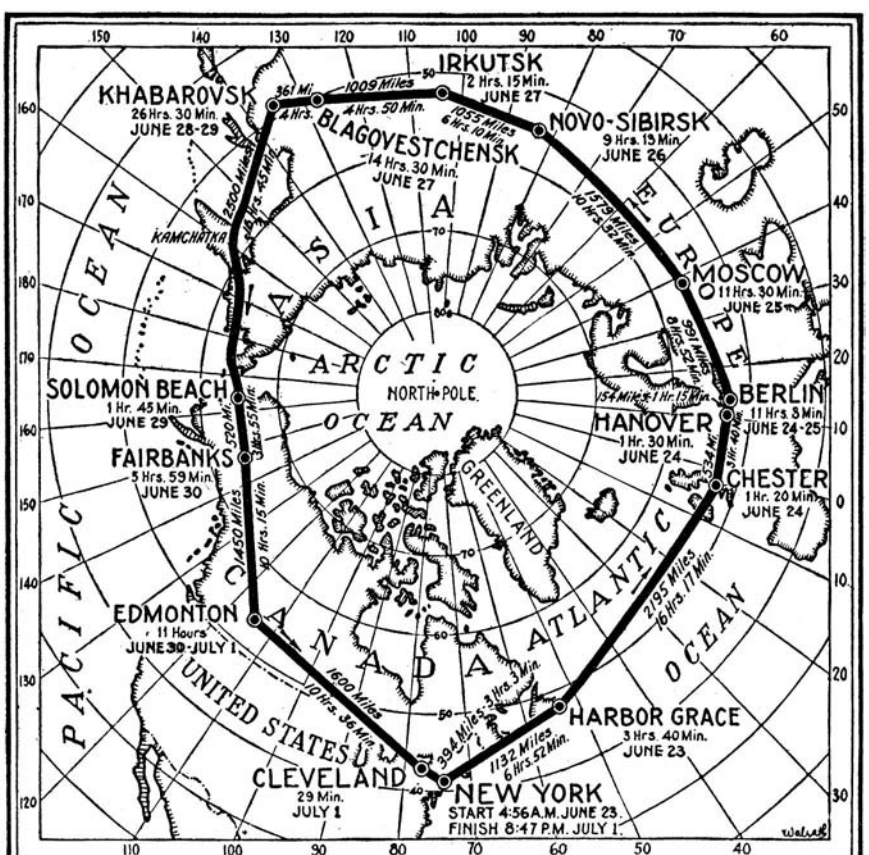
Cold Storage Use Expands

THE broadening place which cold storage occupies in food preservation as a result of the accurate control of temperature, humidity, and circulation now possible is shown by the growing list of products for which it is used, says J. Leo Cooke in a recent issue of *Food Industries.*

Of course you are all aware of the fact that meats, fish, butter, eggs, poultry, apples and pears, and green vegetables go into cold storage. But this does not exhaust the list by any means. Fresh cream is now stored successfully and cake, candy, and nuts also go into storage.

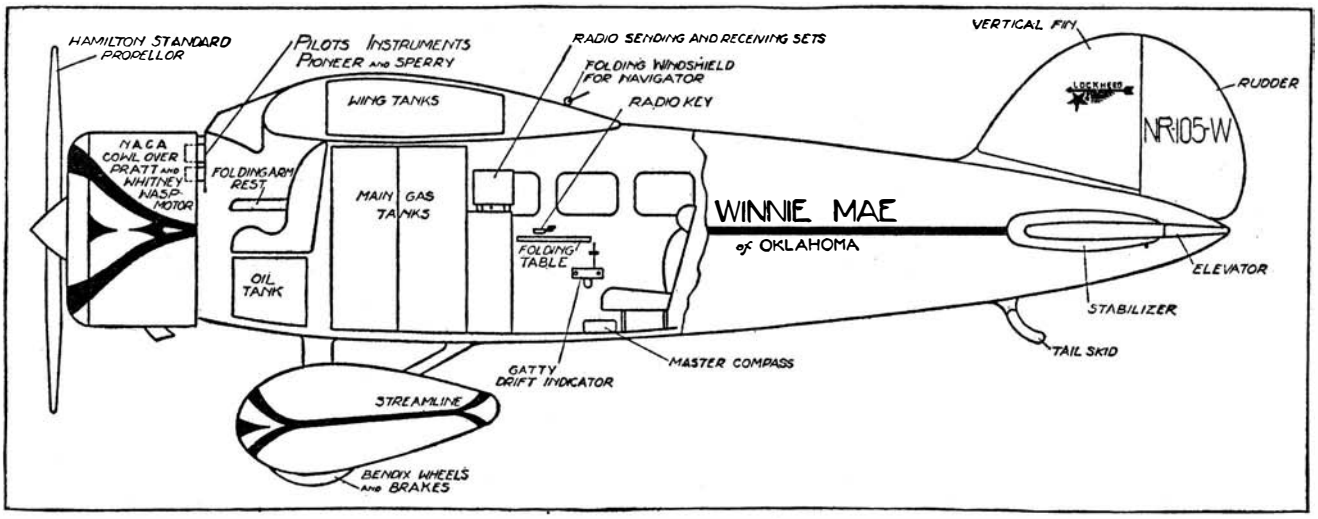
One large restaurant puts its watermelons in cold storage during hot weather to chill them. This saves a lot of ice when the melons are placed on the counters. Dried mushrooms are another product found in storage.

Tests have been made recently in keeping sponge cake and pound cake in cold storage. It works perfectly. Fruit cakes



Courtesy *The New York Times*

The route of Post and Gatty around the top of the world. The time of take-off from each airport, distances, hours in the air, and hours in port are all shown



Partially skeletonized view of the *Winnie Mae* showing general arrangement

and plum puddings are sometimes aged in cold storage to give them the proper flavor. Suitable storage facilities not only arm us against the onslaught of famine but also act as a leveler of the peaks and valleys in the price curves. It is, in short, insurance against shortages and against soaring prices.—*A. E. B.*

Around the World in Nine Days

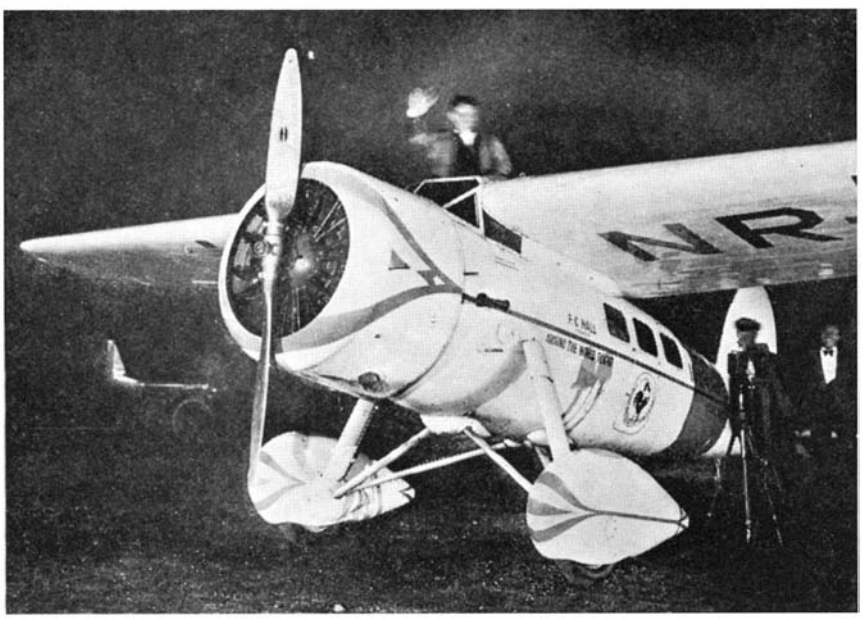
AVIATION history of the kind that takes into account pluck and physical endurance, skillful piloting, perfect navigation, and a dependable plane, was made when Wiley Post, pilot, and Harold Gatty, navigator, flew the airplane *Winnie Mae* around the top of the world in 8 days, 15 hours, 51 minutes, completing the trip at Roosevelt Field, New York, on July 1. Post is 35 years old, a former Texas farmer and oil driller who took up flying after losing an eye in the oil fields. Gatty is 30 years old, a former navigator on a merchant vessel—having graduated from the Royal Australian Naval College at 17—and a former operator of an air navigation school in Los Angeles. F. C. Hall, the owner of the plane and backer of the flight as a "sporting proposition," is an oil man of Oklahoma in whose employ Post has been for several years.

In its dash eastward from New York across the Atlantic and thence across Europe, Siberia, the Bering Straits, Canada, and back home again, the *Winnie Mae* made many records. Post and Gatty broke the transatlantic time record for air crossings that has stood since the flight of Alcock and Brown, the first airmen to make this hazardous non-stop trip. They cut the *Graf Zeppelin's* 'round-the-world flight record to one third, and beat the dirigible's time to Germany by 31 hours, 14 minutes. According to calculations, the total mileage of the *Winnie Mae* was around 16,000 miles, and the average speed for the entire distance was 145 miles an hour. It is said that hitherto no human beings have ever maintained such a speed for so long a time or so great a distance. No airplane had ever before traced the full circumference of the northern hemisphere, and none had ever been around the world at so great a speed. Finally, no schedule so involved had ever before been carried out with any success.

The record-breaking ship is a high wing Lockheed monoplane built by the Lockheed division (Los Angeles) of the Detroit Aircraft Corporation. The fuselage contains the cockpit, cabin, and extra fuel tanks. Under a special cowl in the nose is a supercharged Pratt and Whitney Wasp engine of 525 horsepower at 2200 revolutions per minute. It is a nine-cylinder, air-cooled radial model similar to those used in military service in the United States.

The *Winnie Mae* is equipped with a large number of the most up-to-date instruments available today. Dials showing operating oil pressure, temperature of oil, fuel, cylinder heads, and of the leading edge of the wing, and pressure and contents of each compartment of the fuel tanks clutter up the dash board to such an extent that only a pilot such as Post proved himself to be could understand them all. An airspeed indicator, a rate-of-climb meter calibrated in feet per minute, gyroscopic bank-and-turn indicator, a double set of compensated compasses, and a Sperry "artificial horizon" are some of the other instruments used to assure correct piloting and safety.

The plane also is equipped with a radio set which provides for short-wave transmission of messages in code, and long- and short-wave reception. On the 'round-the-world flight, Gatty, who was in the cabin with his instruments, communicated navigating directions to Post, who was in the high cockpit forward, by means of a telephone.



At the beginning of the flight, Post waves good-bye at Roosevelt Field

A Land Catapult

IT is interesting to learn from *The Aeroplane* (London) that the British Royal Aircraft Establishment has been experimenting with a catapult for the launching of landplanes.

In this device a steel cable is wound on a drum and the drum is geared to a compressed air engine. The cable is connected by quick-release hooks to the underside of the fuselage of the plane to be catapulted. This cable is carried forward to a four-foot pulley anchored in the ground at the end of the run, about 100 feet in front of the airplane. It then goes round the pulley and back to the catapult drum.

As the drum turns, the airplane is pulled toward the pulley and at the end of the run the retarding mechanism in the catapult releases the cable hooks and the trolley on which the tail end of the airplane has been supported. Meanwhile the engine has been running at full power and the propeller delivering its full thrust. The whole operation takes about three seconds and there is very little danger of failure. The

A novel single-wheel plane designed by Charles Ward Hall

engine is driven by air at 1800 pounds per square inch; it develops 3000 horsepower for the short period it is in use; and its speed rises from zero to 2500 revolutions per minute in two seconds. While the new apparatus is somewhat cumbersome, it may have its uses in launching a heavily loaded bomber, or in sending one of our transatlantic flyers off on his journey.—*A. K.*

Airports for Small Cities and Towns

AT a recent meeting of the American Society of Mechanical Engineers, E. L. Wheless discussed comprehensively the airport problem for small cities. There is no doubt that the popularity of flying is increasing and that almost any city or town is all the better off for having an airport. The reason that small cities are apt to fall behind in this respect is because there is difficulty in obtaining information both as to costs and procedure. All the published information deals with the ambitious plans of large cities. The results of airport design competitions, when described in the press, are apt to give an impression of magnificence and large expenditures. As a matter of fact, an airport adequate for all private flying, for feeder line operation to the great air routes, and for emergency landings of large, heavily loaded transports, is not such a difficult undertaking.

The requirements for a small city airport may be roughly summarized as follows:

Good meteorological conditions, particularly freedom from smoke and fog.

Good approaches to the field.

Since artificial runways are expensive, a firm level surface where tough sod can be grown is important.

Accessibility and utilities are needed, just as in the large airport.

The minimum size of field is 40 acres.

Runways 2500 feet long in the direction of the prevailing winds, at least, are essential.

Drainage is expensive, and selection of terrain from this point of view is advisable.

Lighting is likely to be nearly as expensive for the small airport as for the large one, with a minimum cost of about 10,000 dollars.

Hangars should be steel. It is unwise to invest in expensive masonry.

The waiting room may, at a pinch, be a simple lean-to adjoining the hangar proper.

A filling station is a necessity.

If a committee of pilots, engineers, and business men can be made to work; if sites are advertised for and not secured by private barter; if the Department of Commerce is consulted; if a competent airport engineer is employed at least to check plans; if hangar manufacturers and airport lighting companies are freely consulted; if the community as a whole participates heartily, then the small city can readily and cheaply secure an airport for itself. This may not pay at first, may even appear as a "white elephant," but in the long run, the possession of an airport will be a great help to the development and continued prosperity of a small town.—*A. K.*

A Novel Plane

A NOTED airplane constructor, Charles Ward Hall, of Buffalo, is original in appearance, (he is nearly six and a half feet tall among other things), and always original and generally successful in his ideas. Just to please himself he has built the peculiar looking plane shown in one of our photographs.

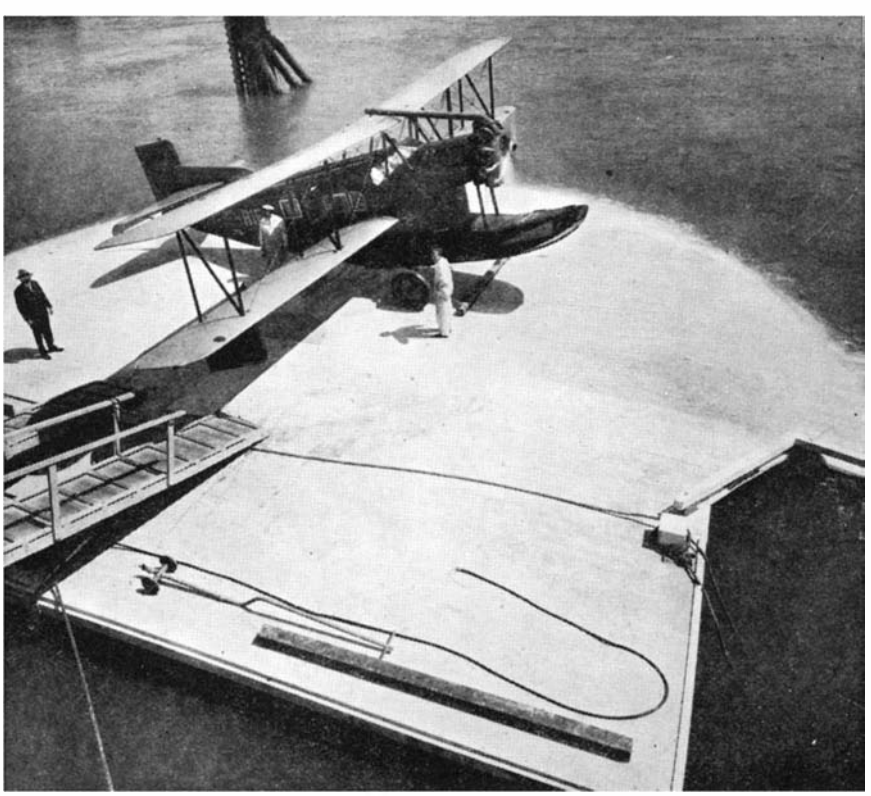
For want of technical detail it is interesting to speculate on what the characteristics of the craft may be, by closely studying the photograph. There is but a single main wheel; two tiny rollers on either side merely serve to steady the plane. This allows the head resistance of the undercarriage to be decreased. The main wheel is very near the bottom of the fuselage. We will wager that the fuselage is waterproof, that an emergency landing can be made in water, and that because the wheel is so near the bottom of the fuselage the land plane will not turn over when striking the water.

Mr. Hall has often stated that if there is to be any external bracing in his designs, then this bracing must serve a more useful purpose than just to hold the wing. Hence the horizontal brace shown between the fuselage and the junction of the wing struts, is a *lifting* section, more than paying for its head resistance. Again, the large strut running toward the tip of the wing is also a *lifting* section.

The joy-stick or control stick is suspended from the ceiling, instead of being mounted on the floor. To explain this, let us offer the following hypothesis. The joy-stick controls the ailerons, which are in the wing and the wing is on top of the fuselage. Therefore the joy-stick suspended from the ceiling provides a more direct connection to the ailerons which it actuates. If we are in error, these columns are open to Mr. Hall for correction!—*A. K.*

Seaplane Bases

A SEAPLANE base in the heart of a large city may be extremely useful. It may serve as the starting point for a convenient service between one city and another, as between Cleveland and Detroit, for example. Or it may be the home of an air ferry across a bay, as in San Francisco. Or it may attract visiting airmen to a sum-



The deep water "button airport" of Air Ferries, Ltd. at the end of pier at San Francisco. A Loening flying boat is seen stationed on the low platform

mer resort located on the water. Compared with a landing field, a seaplane base is a very simple matter.

Earl D. Osborn, writing in *Airports*, presents an illuminating study of various phases of this subject. There should be a clear space of water in front of the seaplane base, three quarters of a mile in length in its shortest direction if possible. Waters crowded with a multitude of small boats should be avoided; small boats are to be feared more than large ones because they so often steer erratic courses (there would be no fun with a small boat were it not erratic!)

The question of hangars is not dissimilar from that of hangars on a landing field. The main problem is the design and construction of a suitable ramp. The ramp or sloping platform can be built in a number of ways, and can cost anywhere from 50 dollars to as many thousands. In general the ramp should run some two or three feet below water. Its angle of slope should be about one in seven. If many passengers are to be discharged, the ramp should extend all the way up to the top of the dock or shore.

If cost is an important consideration, the width of the ramp need only be 15 feet, which is a little more than the width of the largest hull or amphibion gear. But since seaplanes are more affected by wind than power boats, and cannot always be maneuvered with the same nicety, a 75-foot width is not too much for handling traffic speedily.

Where the tide is powerful and rises and falls several feet, the ramp has to be considerably longer than where the tide is negligible, since at least a good portion of the lower end of the ramp must always be under water. Amphibion planes can put down their wheels and run up on a concrete ramp, but flying boat hulls or seaplane floats require a wooden ramp—which is also cheaper. With a concrete ramp it is necessary to lower a dolly on wheels into the water, place the hull on the dolly and haul the ship up with a tractor or winch. This means men with waders and is a long and annoying process.

With large rise of tide the expense of a seaplane base is considerable; sometimes it is found necessary to build a marine railway, or two sets of tracks extending under the water. A wooden platform is then let down on the tracks, the seaplane taxis on to the platform and is again somewhat slowly hauled up.

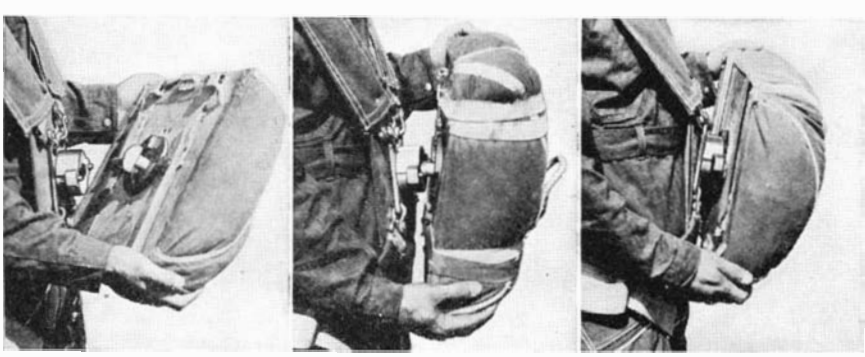
In this case of a large tide, or where land is expensive, there is another alternative—a floating shore ramp. The floating platform or raft has the advantage that it can be built on dry land and then launched into the water. The ramp of a floating platform is short, and as the raft rises and falls with the tide, there is no need to taxi up a long runway at low tide. The float ground crew are not forced to walk on the slippery part which is exposed by the tide, but passengers must walk down a sloping gangway on to the raft. Such a floating terminal is shown in our photograph. It is built in semi-circular fashion so that the seaplane can approach it from any direction. Such a semi-circular or "button" floating terminal has been used with great success by the Air Ferry in San Francisco, and is infinitely preferable to a barge.

We wish that a great many small cities and towns located on the water would consider this question of seaplane bases, which on a modest scale need neither millions nor bond issues.—*A. K.*

A Convenient Parachute Attachment

IN a closed cabin plane, where quarters may be cramped, it is not always possible to wear a 'chute. In Army planes, the observer or gunner may be required to stand up to operate a machine gun or to attend to photographic apparatus, and he may be even harder put to it to wear a parachute than the occupant of the enclosed cabin. For such a gunner or observer, Major E. L. Hoffman of Wright Field has developed two devices of real utility. A series of photographs show the operation of these two devices.

Close-up of the parachute harness showing the small female fitting



Using the quick-attachable parachute holding device. The airman is ready to jump after placing the fittings together and giving the pack a quarter turn

In the upper photograph, the gunner is shown in an open cockpit wearing the "quick-attachable" harness. He is anchored to the floor of the plane by the "monkey-tail" safety strap, which allows him perfect freedom of motion. The "quick-attachable pack" is shown fastened to the side of the cockpit. Other photographs show a close up of the harness; an airman preparing to jump, who has grasped the pack and is about to attach it to the harness; fitting the pack into the harness and giving it a quarter turn to lock it securely into place; and the airman all set for his jump.

The observer or gunner may stand when held by the "monkey tail"

The flier can quickly release himself from the "monkey tail" by simply pressing on a collar.—*A. K.*

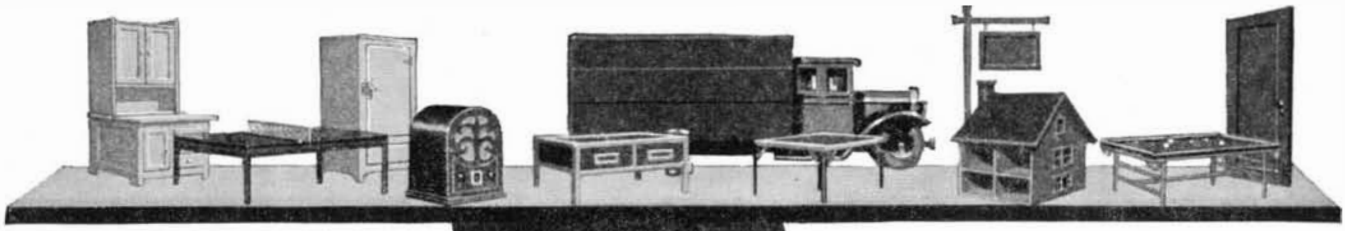
Will Flying Invalidate a Life Insurance Policy?

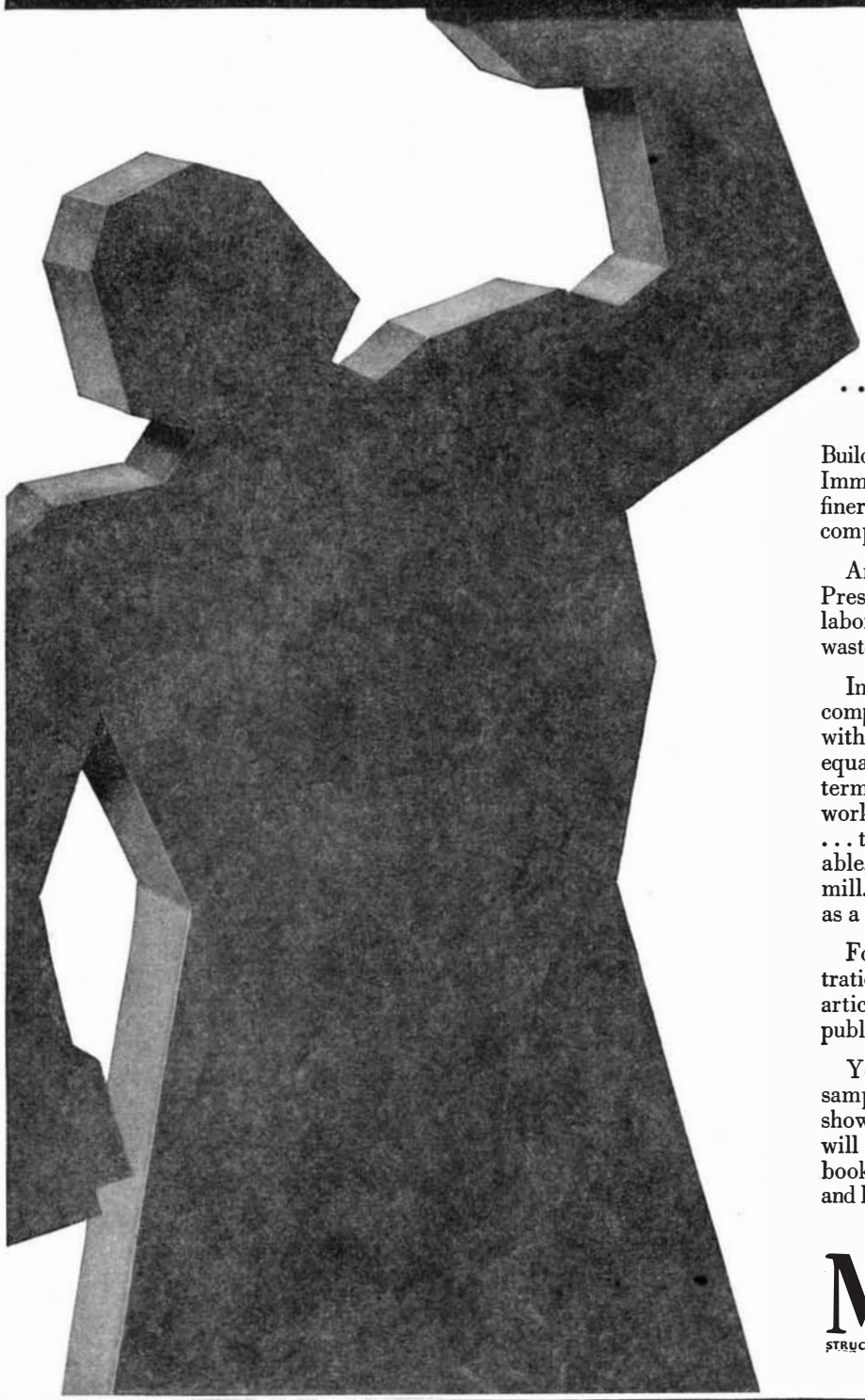
NOW that flying is becoming more and more a matter of course, the head of a family is apt to inquire as to the effect flying will have on his life insurance policy. Barber & Baldwin, aviation underwriting agents, have recently conducted an investigation in this regard, and announced that for old life insurance policies at present in existence, flying does not invalidate the contract—but if a provision exists for double indemnity in case of death by accident, the double indemnity will not be paid if the accident is a flying one.

In new policies "occasional flying" is permitted. The term "occasional flying" is variously defined by different companies. Thus the number of flights a year permitted when a new policy is granted is set at two by one company; three by two companies; five by four companies and so on until we find that 12 flights a year are considered "occasional" by seven of the 45 insurance companies to whom a questionnaire was sent. Though this is quite reassuring, persons taking out new life insurance policies are advised to look into this particular point if they intend to use the ever spreading net-work of passenger airlines.—*A. K.*

Nitrogen is Abundant

NITROGEN, which enters into the composition of so many useful products, constitutes four fifths by volume of the earth's atmosphere, according to a report by Bertrand L. Johnson, of the United





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Kellett Autogiro with side-by-side seating, high rotor, and large fixed wing

States Bureau of Mines. Estimates made by various authorities as to the total amount of nitrogen in the air go far toward dispelling any possible fear of a shortage of this element. One scientist states that the earth's atmosphere contains 4,000,000,000,000,000 tons of nitrogen, while another declares that the air over each square mile of the earth's surface carries 20,000,000 tons of nitrogen, a quantity sufficient to last the world for about 10 years at the present rate of consumption. When the 196,950,000 square miles of the globe are considered, the magnitude of this enormous supply can be appreciated.

As nitrogen is slightly soluble in water, it is found dissolved in sea water, river water, rain water, and mineral waters. It also occurs in gases of volcanic origin, in gases from springs and geysers, in gases from inclusions in certain rocks, and in the occluded gases of meteoric iron. It is reported in small quantities in a variety of rocks and minerals. All living matter contains combined nitrogen, which is a necessary constituent for the growth of living organisms. Fossil organic matter, preserved in beds of coal and oil shale, is likewise nitrogenous. Ammonia and ammonium compounds occur in the soil as a result of the bacterial decomposition of nitrogenous vegetable and animal matter. Ammonia is also present in the air, and some volcanic waters contain ammonium compounds.

Electrical discharges in the atmosphere cause the formation of oxides of nitrogen. These oxides dissolve in rain to form nitrous and nitric acids which are carried down to the earth's surface and washed into the soil. It has been estimated that lightning results in the fixation of 100,000,000 tons of atmospheric nitrogen annually.—*A. E. B.*

The Kellett Autogiro

THE Autogiro is now licensed for manufacture in the United States to three or four firms, and it is believed that others are also applying for licenses. This means that there will be competition in the Autogiro field, and the evolution of the type is therefore likely to be more rapid than were its development concentrated within a single group of engineers and constructors. The latest model to be built is the Kellett K-2, which, while designed on orthodox Autogiro lines, brings several new ideas to the fore.

It is claimed that the Autogiro is *par excellence* the craft for the private owner. Since, in private flying, the ability to be sociable is an asset, side-by-side seating has been adopted in the K-2 for the first time in an Autogiro.

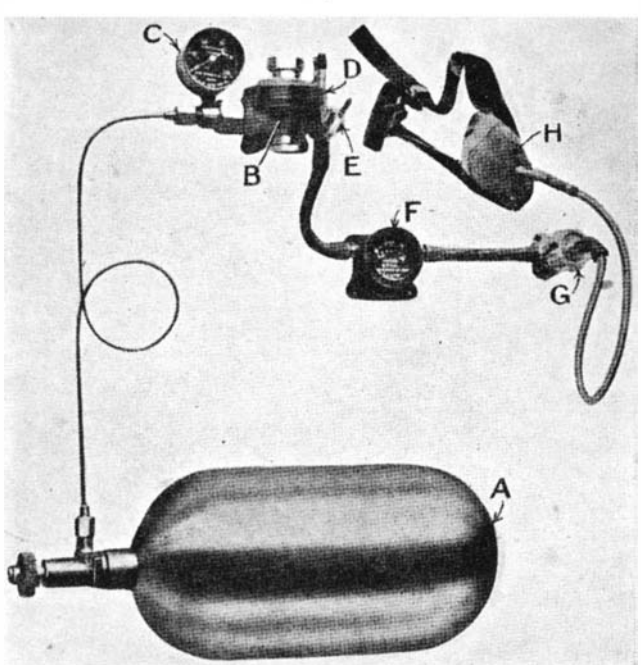
In previous designs, the criticism has been made that the rotor was placed too low in relation to the cockpit, making parachute jumping difficult, and giving some uneasiness to the occupants. In the K-2 the rotor is placed unusually high.

The fixed wing has been made very much larger than before in proportion to the size of the rotor. The Kellett Company announces a top speed of 100 miles per hour, and some of this extra speed may be attributed to the use of a large fixed wing. The rotor is a splendid medium of high lift and for slow descent, but it is not nearly as efficient as a fixed wing in normal flying. By using a large fixed wing, more of the load is transferred from the rotor to the fixed wing at high speeds. Since the fixed wing is then more efficient, better performance is the result.—*A. K.*

Comfort at High Altitude

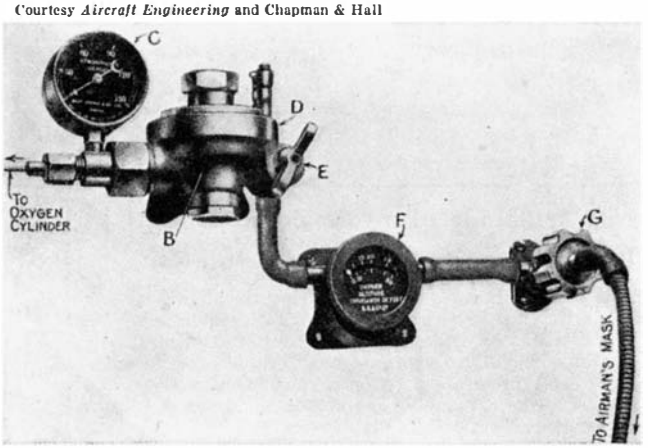
THE record for altitude flight was held until quite recently by Lt. Soucek, U. S. N., who on June 4, 1930, in a Chance Vought Apache airplane flew to a height of 43,166 feet. The record still stands as far as airplanes go, though Professor Piccard in his "stratosphere" balloon is said to have mounted to a height of 50,000 feet. Professor Piccard himself made some very optimistic statements regarding "stratosphere" flying. The Junkers Company of Germany is actively preparing a plane for flight across the Atlantic at great altitude and at enormous speed.

To a limited extent the argument that flight at very high altitudes may be exceedingly rapid is justified, but there are many difficulties for the personnel in high altitude flying. The Junkers Company proposes an airtight cabin, with air at sea-level pressure to be supplied by a compressor. Electric heating of the cabin will no doubt be resorted to. Little reliable detail has reached us yet, but our interest in the flights of Army airmen at tremendous heights always increases as we read of the possible commercial uses of altitude flying. An article by Major C. J. Stewart in *Aircraft Engineering*, entitled "High Altitude Flying" is therefore most timely.



The oxygen apparatus for fliers at high altitudes. At the left is the complete equipment, and at the right below is a close-up of the controls. The text describes lettered parts

Courtesy *Aircraft Engineering* and Chapman & Hall



How does it feel to be up 40,000 feet, in a temperature of 90 degrees, Fahrenheit, below freezing?

Tissandier, giving an account of his famous balloon ascent of 1875, (in which his two companions perished)—gave an illuminating statement:

"At 24,600 feet the condition of torpor which comes over one is extraordinary. Body and mind become feebler little by little, gradually and insensibly. There is no suffering. On the contrary one feels an inward joy. There is no thought of the dangerous position; one rises and is glad to be rising."

Even at 15,000 feet the pilot's judgment and perception are apt to be dulled, while at the same time he is likely to feel the exaltation of a man who has imbibed somewhat too freely.

It is not the drop in pressure which is to blame, although the low pressure does produce discomfort. The gases in the air spaces of the nose and the eustachian tubes leading from the throat to the middle ear do indeed distend (the orifices of these tubes are too small to permit equalization of pressure with the surrounding atmosphere) and many airmen complain of discomfort in the frontal sinuses. But this discomfort is not important or dangerous. What is dangerous is that, with decreasing pressure, the blood is insufficiently oxygenated, and the whole bodily mechanism is put out of gear. Even in the ordinary atmosphere, sedentary man does not oxygenate his blood properly.

Since these effects of poor oxygenation appear even at a low altitude, and since they are not appreciated by the pilot, the proper thing is to feed oxygen from the very start of an altitude flight.

The requirements of the oxygen apparatus are most exacting. The smallest quantity per minute must be supplied at ground level, and this quantity must be automatically increased as altitude is gained. There must never be excess supply. Vibration and intense cold, down to 60 degrees below zero, Centigrade, must not affect the apparatus; there must be no leaks; the delivery to the mask must be such that no freezing of moisture or saliva can block the supply pipe; and finally a flow-meter must be provided so that the pilot is immediately warned of a restriction in supply. The most frequently used form of oxygen apparatus is illustrated in our photographs.

The oxygen, compressed to 1800 pounds per square inch and carried in the light steel cylinder, A, is led through a pressure gage, C, to the regulator or reducing valve, B, and then to a control valve, D. From there it passes to a flow-meter, F, graduated in thousands of feet. From the flow-meter, the gas passes to a bayonet-union, G, which permits the flexible pipe leading to the mask, H, to be readily connected or disconnected.

Space will not permit us to deal fully with the self-clearing reducing valve, the automatic regulator, and the other ingenious parts of this apparatus. Though they are simple in principle, they are worked out with exceeding care.

Besides a sufficient oxygen supply, there are many other precautions to be taken. Cockpit heating has not yet been satisfactorily achieved. Therefore the airman has to wear a complete suit, carefully padded with kapok, and having padded

The first life-size restoration of prehistoric titanotheres

rubber-soled flying boots permanently attached to the legs. Electric heating elements consisting of steel wire wound in close spirals are sewed inside the lining of the body, arms, legs, gloves, and feet, and a socket is attached to the breast of the suit to take a lead to the heated goggles. The glasses of the goggles are set in metal frames inside a fur-lined mask. Without these precautions, frosting of the goggles is inevitable.

Cockpit heating is being actively experimented with by the British. Special training and testing chambers simulating high-altitude conditions are in constant use. It is extraordinary to what refinements man will go in order to extend his conquest of his environment, or rather, to extend the confines of his environment.—*A. K.*

Aid to Tuberculosis Study

THE rare and expensive biochemical product, asparagin, formerly obtainable only by importation from Europe, can now be produced in the United States on a commercial basis, according to an announcement by the Department of Agriculture. M. Dorset, chief of the Biochemic Division of the Bureau of Animal Industry, reports the successful production of asparagin in the division's laboratory and the receipt of a shipment of the chemical as produced by the first firm to undertake its manufacture commercially.

The product is classed as an amino acid. It contains the elements nitrogen, hydrogen, carbon, and oxygen combined in a complex chemical group.—*A. E. B.*

Mechanical Chemist Analyzes Flue Gas

A ROBOT named Ranarex which uses no test-tubes and no chemistry, does the work of a chemist and does it quicker and better than could a human being. Ranarex analyzes flue gas for carbon dioxide, reporting constantly to the fireman just how efficiently he is operating his boiler.

The Ranarex principle is based on the fact that the specific weight of flue gas increases in proportion to its carbon dioxide content, carbon dioxide being about 50 percent heavier than the other constituents of flue gas. The instrument contains two chambers, the upper an air chamber and the lower a gas chamber. Gas to be analyzed passes continually through the gas chamber. A motor-driven impeller rotates at one end of the gas chamber, imparting a whirling motion to the gas, which transmits a turning motion to an impulse wheel at the other end of the gas chamber. The extent of this imparted rotation is proportional to the percentage of carbon dioxide in the gas.

Indicating and recording meters of the equipment which determines the percentage of CO_2 in flue gas

Exactly the same thing happens in the air chamber, except that it contains air instead of flue gas, and the impeller is driven in the opposite direction. The two impulse wheels therefore tend to rotate in opposite directions, but they cannot rotate because they are coupled together by means of two levers and a connection link. This coupling system prevents complete rotation of the impulse wheels, but the difference in the two opposing torques causes a limited movement of the system which is transmitted to a pointer which travels over a scale calibrated in terms of CO_2 content of the flue gas. At the same time a clear continuous record of the results is made on a circular 24-hour chart eight inches in diameter.

The use of the air chamber eliminates the influence of changes in impeller speed, temperature, humidity, and atmospheric pressure.—*A. E. B.*

Sex Hormone Gives Promise

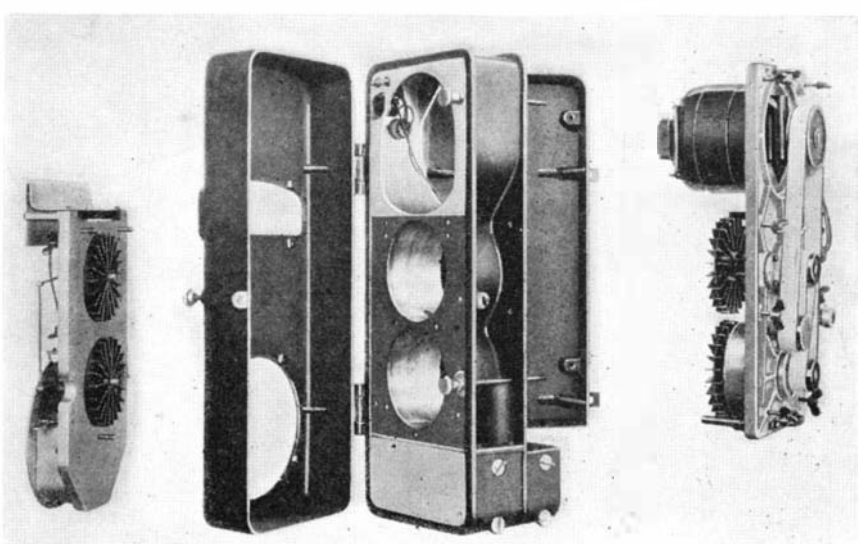
FOUR active substances, probably hormones, have been isolated from the placenta, part of the female reproductive organs, Dr. J. B. Collip of McGill University and one of the famous Toronto group that gave insulin to the world, has reported to the Association for the Study of Internal Secretion. These substances act as sexual stimulants in both males and females. One of them is valuable in treating disturbances of the reproductive cycle in females. It is the first preparation of this type which is effective when given by mouth.—*Science Service.*

Titanotheres

THE first life-size restoration of gigantic titanotheres—prehistoric animals resembling rhinoceroses, but as tall and bulky as elephants—has just been placed on exhibition at the Field Museum of Natural History.

The group, a gift from Ernest R. Graham, is the work of the noted sculptor, Frederick A. Blaschke, of Cold Spring-on-Hudson, New York. A background reproducing the natural habitat of these huge beasts has been provided, this being the work of Charles A. Corwin, staff artist of the museum.

The titanotheres were great two-horned beasts which were abundant in the bad lands of Nebraska and the Dakotas about



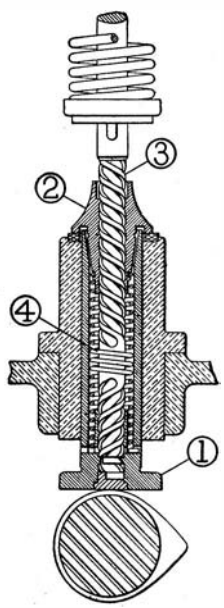
Ranarex, the apparatus which analyzes flue gas for carbon dioxide

30,000,000 years ago, according to the estimates of scientists. The animals, as restored in the museum's exhibit, are modeled to show them as studies of fossil skeletons indicate they must have appeared in life.

The titanotheres lived in wet, marshy lands and fed upon plants, according to Professor Elmer S. Riggs of the Field Museum. Their two horns were placed side by side on the nose. They were related on the one hand to the horse family, and on the other to the rhinoceroses, but they differed from both of these families in many ways.

Automatic Valve Tappet

EVER since the advent of the automobile, engineers have worked incessantly on the problem of perfecting a valve tappet that needs no adjustment, that will



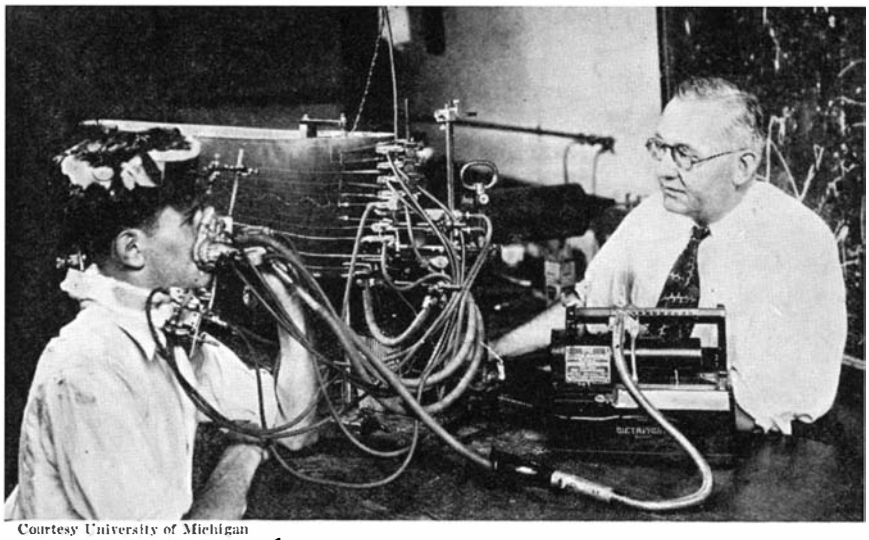
Composed of only four parts, the new valve tappet described in the column below is very simple, exact, and fully automatic in operation

be automatic in operation. The first success in this direction has been attained by R. H. Hamilton, of Christchurch, New Zealand. His valve tappet is shown in an accompanying illustration.

It consists of a tappet body, 1, with a quick female right-hand thread at the base and a female taper at the head; a tappet spindle locking nut, 2, with quick female left-hand thread and male taper to engage with that of 1; a tappet spindle, 3, with right and left hand threads to engage with those of 1 and 2; and a torque spring, 4, with light torsion action between 1 and 2.

During the period when the valve is seated, there is a slight clearance between tapers allowing the torque spring, 4, to maintain the spindle, 3, in contact with the valve stem, forcing the body, 1, on the camshaft and the locking nut, 2, on the guide. The spindle, 3, is supported by the torsional stress applied to the opposed threads. The cam lifting the tappet body, 1, interlocks the tapers by its normal action. On the downward stroke, simultaneously with the seating of the valve, the flange of the locking nut, 2, strikes the top of the guide, allowing the tappet body, 1, and spring, 4, to unlock the tapers.

While designed primarily for automobiles, this new tappet may be adapted to



Courtesy University of Michigan

The complicated Immel apparatus for registering the muscular movements in speech which is being used in researches to determine the cause of stammering

a wide variety of industries where cams are in use and it is necessary, in present practice, to keep them in adjustment manually.

Enzyme Clarifies Cider

AN enzyme decomposing soluble pectin is proposed as an agent for assisting in the clarification of apple cider, by Z. I. Kertesz in the New York State Agricultural Experiment Station Bulletin No. 589. This enzyme acts on pectin and produces no changes in starches or proteins.

During the decomposition of the pectin of the apple juice by the enzyme, some insoluble materials are formed. These insoluble substances, together with other substances responsible for the cloudiness of cider, are easily removed by filtration or centrifugation, leaving a crystal clear product which may be pasteurized and bottled within 24 hours after pressing the cider. The product is very palatable and possesses no cooked taste.—*A. E. B.*

New Apparatus for Stammer Study

PROBABLY never in the history of the world has a given spoken sound been uttered twice exactly alike. This very great variation in the spoken word has been indicated by a new apparatus devised to detect and record the muscular action in speech, and which it is hoped will reveal the true nature of the muscular "tangles" which cause the stutterer to hesitate before getting out certain sounds.

This new technique for the study of normal and abnormal speech was developed in the psychological laboratories of the University of Michigan by Dr. Ray K. Immel, Dean of the School of Speech in the University of Southern California.

"Most stuttering is functional and not organic; that is, the organs of speech are intact, but do not act properly," says Dean Immel. Every sound uttered involves an adjustment of lips, tongue, and throat muscles which must be correct before the air can be allowed to pass up through the throat and mouth; if some of the muscles are out of time with the rest, or air is expelled too soon, stammering ensues.

The Immel apparatus attempts to study the external manifestations of this inner movement by means of tambours which attach to the lips, over the "Adam's apple," and below the tongue. Each movement changes the air pressure in the tubes running from the skin to a small drum-head arrangement, to which is attached a delicate pen which makes a record on a roll of smoked paper.

So far Dean Immel has registered the speech of normal persons only, but even here he finds great variations. Not only do different persons manipulate their muscles differently to make the same sound, but they may even use different muscles. Variations in manipulation as great as 100 percent in some sounds are possible, with the result still being understandable.

Most surprising is the discovery that while the mouth is actually uttering one sound, other muscles of the throat and mouth are getting ready to form the next sound, so that speech is a continuous, interlocking physical and mental process. In uttering the sound "k," for example, the preparatory adjustments are going on during 51 percent of the time that the preceding vowel is being sounded.

Although the timing of the speech muscles may have wide variation and still sound normal to the ear, there are limits beyond which faulty co-operation of the muscles results in unintelligible sounds; or one muscle or set of muscles may inhibit the action of another with the result that no sound at all is uttered, a common occurrence with stammerers. By study of thousands of normal variations, Dean Immel hopes to set up pictures of normal muscle behavior, and then by comparing the records of stammerers with these, to find what error in co-ordination is responsible for various degrees and types of stuttering.

Synthetic Wax Mixes with Water

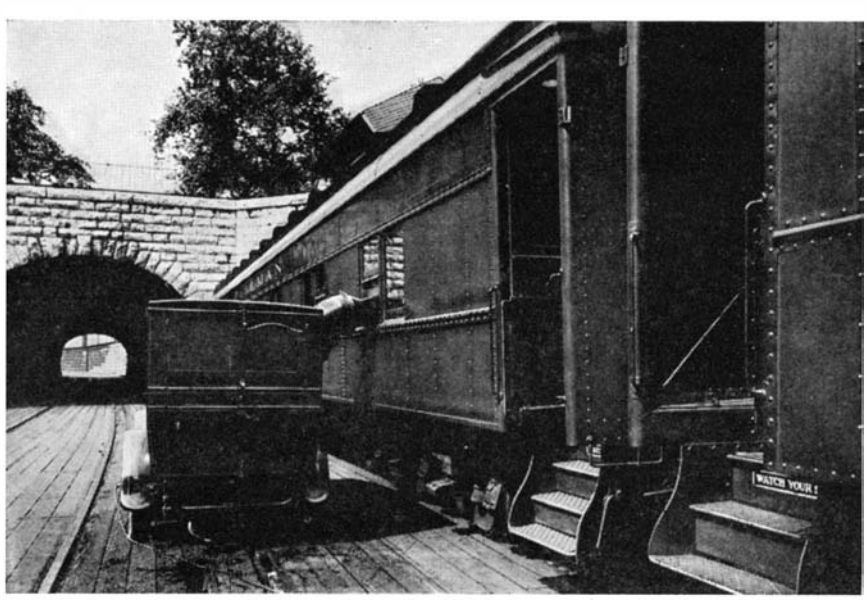
A WAX that can be mixed with water is the latest curious product of the synthetic chemist's art. This substance, known as glycera wax, has been put on the market recently where it should find ready acceptance by makers of polishes and cosmetics. In its pure state, glycera wax is light tan in color, odorless, tasteless, and melts at 140 degrees Fahrenheit. It is more readily soluble than any natural wax.

Although not soluble in water, glycera wax can be melted by heating in water and if the mixture is stirred while it cools, the wax is dispersed through the water to form a white, creamy emulsion. When this cream is applied as a polish, the water dries out leaving a transparent film of wax instead of the usual white film which results from ordinary so-called liquid-wax polishes.

The new product should be useful in making water-proofing compounds, shoe creams, water-colors, and water-inks, and in glazing felt, fur, and textiles.—*A. E. B.*

Lead Preparation Said to Prevent Rust

APPARENTLY authentic reports from London bring news of a new form of liquefied or colloidal lead, which, it is claimed, when applied to iron and steel, makes these metals permanently impervious



In several large cities, the Baltimore and Ohio Railroad uses this equipment to pre-cool sleeping cars for night runs. A large fan in the motor car draws outside air across cakes of ice, also in the motor car, and discharges the iced air through a window into the sleeping car. Warm air passes out overhead

to rust. The substance, to which the name "Nust" has been given, is being manufactured by the Non-Rust Liquid Lead Co., Ltd., London, at their Bristol factory.

A Swiss scientist, it appears, some seven years ago, after long experiment in smelting lead with other metals, succeeded in producing it in a form equivalent to molten lead, and in preserving it in that state by the aid of oils as conveyors. From the description given, the lead appears to be reduced to an extremely fine powder or dust; mixed with oil this becomes a stiff paint that can be applied with a brush. The claim is that the lead penetrates the iron and steel, and becomes so completely amalgamated with it that it can only be separated by some metal separation process, while the oils merely dry off and disappear.

A new flashlight which, in compact form, combines the features of a more bulky one. It is equipped with a three-way switch; permanently on or off and flashing. The milled ring on its face is for focusing. Standard batteries are used

Another advantage claimed is that while ordinary paint will not stand the stretching of the steel or iron by more than .05 percent without scaling or cracking, this substance has successfully stood a stretching test of 1 percent. "Nust" is applied thinly, exactly as an ordinary paint.

Possibly the preparation may have other applications, but experiments so far have been limited to iron and steel.—*A. E. B.*

Further Honor

IN our July number comment was made concerning the unusual honor recently paid to Dr. R. W. Wood, Professor of Experimental Physics at the Johns Hopkins University, by the University of Berlin. *Nature*, the leading journal of science in Great Britain, now makes the following comment on the same honor, ranking Professor Wood's researches with those of Michelson:

"The philosophical faculty of the University of Berlin has conferred upon Professor R. W. Wood, of the Johns Hopkins University, Baltimore, the degree of Doctor of Philosophy (*honoris causa*). This is the highest honor which the faculty has in its power to give, and is a recognition of Professor Wood's contributions to physical optics.

"In announcing the award, Professor

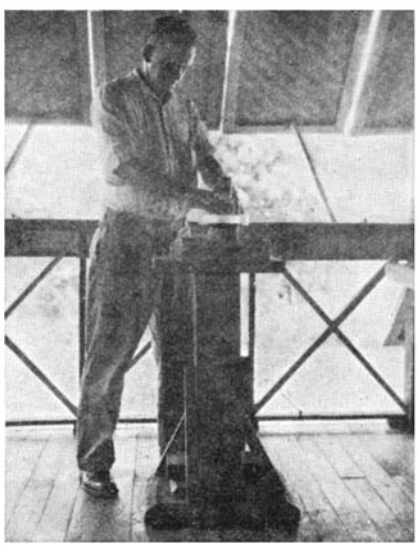
(*Please turn to page* 205)

THE AMATEUR ASTRONOMER

Conducted by ALBERT G. INGALLS

"AND now out of the wilds of Burma come several photographs of the little telescope made from the plans of Porter and which is giving me many moments of pleasure."

Thus does A. B. Stephens open a letter written from Negya, Chauk, Burma, where



Drilling away in Burma—Stephens

he has been drilling oil wells. He continues:

"The glass is of six-inch aperture and was furnished by John Pierce of Vermont, along with the prism and eyepiece. Grinding and polishing the glass required several months, working a few minutes each day, and the figuring took another long period of time as I overshot the mark while parabolizing it and got a nice deep hole in its center. After the hole was finally removed, a comparatively short time was necessary to bring the surface to a good figure. My greatest trouble was in finding a lap to stand up in this warm climate but finally one made of tar and rosin served very well. The silvering was a complete success the first time.

"Let all those who are eager to make mirrors but do not have the ideal conditions as set forth by Ellison, take heart for, as one of the photographs shows, all of the grinding and polishing of this little mirror was done on the veranda of my bungalow, with, of course, all of the shutters closed. While the glass, no doubt, falls far short of the standard of Ellison and Porter, yet it gives a wonderful view of the heavenly bodies. Not only are the rings of Saturn sharply defined but also several of its moons; two in particular, perhaps Hyperion and Titan, with momentary pin-point flashes of two of the closer moons.

"I leave here shortly and thereafter my address will be 816 East Mayne Street, Bellflower, California."

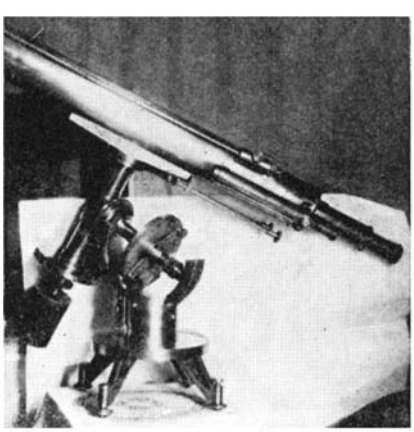
ALL over the world, in the most out-of-the-way places, in homes, on library tables and in the reading rooms of clubs

Burman boys and (right) a teacher

you will find the SCIENTIFIC AMERICAN. Here is a letter which reached us from New Zealand, written by Robert Bruce of 33 Vincent Street, Auckland:

"I have read with interest of the many ingenious astronomical telescopes made by amateurs. The humble efforts of a grocer might interest your readers. I enclose a photograph of my three-inch home-made refracting telescope. Having a 3½-inch Drummond lathe I may have an advantage over some amateurs. The telescope and equatorial mountings are in brass and gun-metal throughout, except the declination axis, telescope cradle, and R. A. axis, which are of mild steel. As the photograph shows, the polar axis is adjustable to all latitudes. There are slow motions in R. A. and declination. The R. A. circle is divided into 11/12-degree divisions and declination circle likewise. The R. A. circle is a rebated ring which for adjustment rotates on a central rebated disk which is firmly clamped to the polar axis. The circle is read by one fixed vernier and one movable one.

"To adjust telescope to R. A. of star, first place it in the meridian position, rotate R. A. ring till desired R. A. is read off fixed vernier, then clamp ring to disk and move telescope till correct sidereal



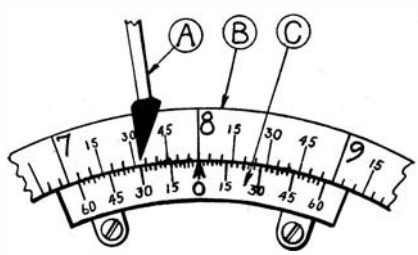
Made in New Zealand by Robert Bruce

time is read by the same vernier, and there you are. Then, while the star is still in the field, put movable vernier to correct time by your watch and clamp it. For the rest of the evening, to find other stars, turn telescope to meridian, adjust circle as before to desired R. A. at fixed vernier, consult watch and set telescope to read correct time of your watch from movable vernier. Thus you will be able to find your star without again calculating sidereal time."

A SIMILAR idea has been submitted by A. V. Goddard, 282 Northeast 49 Street, Portland, Oregon, whose 16-inch reflector was described in our number for last January. Though original with these workers the idea is not a new one, but it is a good one, nevertheless. Here is how Mr. Goddard describes it:

"I have worked out a simple plan for using circles without the use of an expensive sidereal clock or calculations. Large observatories have used a system of three circles for calculating right ascension for years, but it is necessary to use a sidereal clock.

"You will note on the enclosed drawing three elements, *A*, *B* and *C*. *A* is a pointer fixed to the tube of a telescope. This moves on the hour circle when the telescope is moved. *B* is the hour circle but is movable on the polar axis, and may be locked by



Goddard's convenient wrinkle

means of a thumb-screw. *C* is an ordinary vernier with zero point, fastened permanently to the mounting of the telescope. This is all the equipment necessary, except for an ordinary cheap alarm clock or a watch that will keep fair time for a few hours and can easily be set.

"Here is the procedure: Look for any first magnitude star or object with a known right ascension. One near the zenith is best as this avoids refraction. Take Regulus, for example, at R. A. 10 h 4 m. Loosen the thumb-screw on the hour circle *B*, and revolve the circle on the polar axis until the pointer *A* indicates 10 h 4 m. Now lock the circle with thumb-screw. Line up the crosshairs in your finder exactly on Regulus and set your clock for the exact time indicated on your vernier *C* and the hour circle *B*. The clock will now take care of all difference in time for the remainder of the night. Now that the clock is set, it is a simple matter to find anything you like.

"This may sound complicated but if once

tried you will be surprised at the simplicity. The drawing indicates 8 o'clock as shown on your clock. The pointer *A* may be placed in any convenient position relative to the tube, as long as the R. A. circle *B* can be revolved under it. I have used this system for a long time and find it very satisfactory."

HERR SASCHA CHAGUN sends us the following note from Schwäb Hall, Schuppach Str. 1, Canstatt, Germany:

"I enclose a photograph of my telescope, which in part was made according to your

This one was "made in Germany"

book 'Amateur Telescope Making.' The mirror has a diameter of 24 centimeters and a focal length of 2.2 meters. It was polished on a paper lap, using tripoli. In as much as this method of polishing is simpler and safer than the wet process (the polish is never as perfect which, however, does not decrease the optical efficiency) I am surprised that you did not mention this method in your book. Maybe you will consider it in a later edition. I think your book is excellent and I hope it will enjoy the widest dissemination."

We cannot agree with Herr Chagun about the paper polisher or about the optical efficiency. Also, we did mention this matter in the instruction book "Amateur Telescope Making." On page 255 Professor Elihu Thomson correctly says, concerning the paper polisher, "It cannot be expected to yield the high accuracy that may be obtained with pitch." Bell, in "The Telescope," page 71, says, "Cheap lenses are commonly worked on a cloth polisher . . . or sometimes on paper worked dry. With care either may produce a fairly good surface, with, however, a tendency to polish out the minute hollows left by grinding rather than to cut a true surface clear down to their bottoms. All first class objectives and mirrors are in fact polished on optician's pitch." For years Dr. Woolsey Blacklock of England has been using and urging the use of the paper polisher, his letters in *English Mechanics* being answered chiefly by Ellison who takes the position that this kind of lap is distinctly inferior to the pitch lap, mainly because it permits of no accurate contacting and lacks the "spring" and life of pitch. We vote for pitch or HCF.

CURRENT BULLETIN BRIEFS

Short Reviews of Bulletins and Papers on Scientific and Allied Subjects, and Where to Get Them

BODILY POSITIONS IN RESTFUL SLEEP by H. M. Johnson, Ph.D., describes intensive studies carried on at the Mellon Institute for a period of six years. Some of the apparatus used is of great interest. *The Simmons Company, 230 Park Ave., New York City.—Gratis.*

FARM WATER POWER (Bulletin 1658-F, U. S. Department of Agriculture) describes a number of successful plants, and gives costs. *Office of Information, U. S. Department of Agriculture, Washington, D. C.—Gratis.*

WHITE GOLD—THE STORY OF THE HOOVER DAM is an epic story of a great national achievement told a popular way. It is charmingly illustrated. *American Steel & Wire Company, 208 South La Salle Street, Chicago, Illinois.—Gratis.*

STRAIGHT LINE CONTINUOUS ELECTRIC FURNACES deals with the uniform heat treatment of ferrous as well as non-ferrous strip metal and wire. The accurate performance of razor blades, sawblades, surgical knives, et cetera can be expected only if they are prevented from oxidation while being heat treated. *H. O. Swoboda, Inc., 3400 Forbes Street, Pittsburgh, Pa.—Gratis.*

AN EXPLANATION OF AMERICAN LUMBER STANDARDS (Miscellaneous Publication No. 107, U. S. Department of Agriculture) by C. V. Sweet gives grading rules as adopted by the various soft wood lumber manufacturers' associations of the United States. *Superintendent of Documents, Washington, D. C.—5 cents (coin).*

ECONOMIC ASPECTS OF LAND SETTLEMENTS IN THE CUT-OVER REGION OF THE GREAT LAKE STATES (Circular No. 160, U. S. Department of Agriculture) by W. A. Hartman and J. D. Black describes the fundamental conditions affecting the development of this cut-over region and summarizes briefly the possibilities and opportunities for agricultural development. *Superintendent of Documents, Washington, D. C.—20 cents (coins or money order).*

SURVEY OF LAND-GRANT COLLEGES AND UNIVERSITIES (Office of Education Bulletin, 1930, No. 9, United States Department of the Interior) is a two volume work aggregating 1919 pages. It was directed by Arthur J. Klein. Readers who are interested only in certain phases of the subject such as "student relations and welfare"; "home education," "alumni and farmer students," and so on, can obtain the 21 parts separately at prices running from 10 to 25 cents. A list of the parts and the prices can be obtained from the Office of Education, Washington, D. C., free, or the two volumes can be secured of the *Superintendent of Documents, Washington, D. C., for $1.50 each (money order).*

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.*

SERVICE MANUAL FOR ARTIC, ARTIC N, METHYL CHLORIDE A, AND METHYL CHLORIDE AN, gives a brief summary of the physical and chemical properties of Artic and the new Artic mixtures. The servicing and installation of refrigeration units using the refrigerant Artic brings up general problems in the use and handling of this product which are discussed in the manual. *The Roessler & Hasslacher Chemical Company, 350 Fifth Avenue, New York City.—Gratis.*

STANDARD TIME ZONES OF THE UNITED STATES AND ADJACENT PARTS OF CANADA AND MEXICO (Miscellaneous Publications No. 111—National Bureau of Standards) is a large map showing the time zones in red. *Superintendent of Documents, Washington, D. C.—10 cents (coin).*

HOW TO MAKE ENLARGEMENTS (Practical Photography No. 5) by Frank R. Fraprie and Arthur Hammond has stood the test of time, 34,000 copies having been printed. *American Photographic Publishing Company, Boston, Mass.—40 cents.*

BALL AND ROLLER BEARINGS is a handbook for designers and engineers. The diagrams, printed like blue prints, give a wealth of valuable information when used in connection with the tables. *Aetna Ball Bearing Manufacturing Company, Chicago, Illinois.—Gratis.*

NEW AIRWAY BULLETINS DESCRIBING RADIO FACILITIES will be sent on request by the *Aeronautics Branch, Department of Commerce, Washington, D. C.—Gratis.*

WILD GAME—ITS LEGAL STATUS attempts to answer such questions as "who owns game?" "Under what conditions?" It is a reprint of a report made to the Massachusetts Game and Fish Association by its attorney. The text defines game and traces the story of its ownership through the ages to the present day. *Smokeless Powder Division, E. I. du Pont de Nemours & Company, Inc., Wilmington, Delaware.—Gratis.*

GENERAL ELECTRIC PHANOTRON TUBES gives technical information relative to Phanotron and Thyratron tubes. The name "Phanotron" is the General Electric trade name for a gas or vapor content vacuum tube. *General Electric Company, Schenectady, New York.—Gratis.*

USE OF BISMUTH IN FUSIBLE ALLOYS (Circular of the Bureau of Standards No. 388) describes one of the essential constituents of the readily fusible alloys. The literature and uses of fusible alloys are reviewed in this paper. *Superintendent of Documents, Washington, D. C.—5 cents (coin).*

PATENTS AND RESEARCH by Joseph Rossman, Ph. D. describes the relation between industrial research and invention. Patent protection is without doubt one of the greatest incentives in the development of an art. *Dr. Joseph Rossman, United States Patent Office, Washington, D. C.—Gratis.*

FORMULAE FOR FLAVORS, SYRUPS, EMULSIONS, JELLY, JAMS, ETC. are given in a leaflet which also deals with meringue and marshmallow preparations, also foam and froth producers. These are new and up-to-date formulas, which if carefully followed, will give uniformly good results. *Glyco Products Company, Inc., Bush Terminal Building, No. 5, Brooklyn, N. Y.—Gratis.*

AN UP-TO-DATE LIST OF THE SHORT-WAVE BROADCASTING STATIONS OF THE WORLD is probably the most recent and accurate compilation of its kind. *Pilot Radio and Tube Corporation, Lawrence, Mass.—Gratis.*

DUBILIER CATALOGUE is an interesting piece of literature covering condensers, transformers, and other radio equipment. *Dubilier Condenser Corporation, 4377 Bronx Boulevard, New York City.—Gratis.*

FLOW OF LIQUIDS IN PIPES OF CIRCULAR AND ANNULAR CROSS SECTION (Bulletin No. 222) by Alonzo P. Kratz, Horace J. Macintire, and Richard E. Gould gives a report on the continuation of the work the results of which were published in the same series of bulletins, No. 182. *Engineering Experiment Station, University of Illinois, Urbana, Illinois.—Each bulletin 15 cents.*

THE USE OF LOGS AND POLES IN FARM CONSTRUCTION (Farmer's Bulletin No. 1660, United States Department of Agriculture) by T. A. H. Miller shows how logs and poles can be employed advantageously in the building of dwellings and farm conveniences by settlers or others establishing themselves in regions where timber is plentiful. There are 31 illustrations. *Superintendent of Documents, Washington, D. C.—10 cents (coin).*

THE SCIENTIFIC AMERICAN DIGEST

(*Continued from page* 201)

Jaeger, the dean of the faculty, singled out as of particular importance Professor Wood's researches on the resonance radiation of gases and vapors. These have certainly called for the exercise of the utmost experimental skill, and although initially conceived and carried out at a time when our knowledge of the structure of atoms and molecules was practically nothing by current standards, have contributed in no small degree, and continue to contribute, to our present ideas on 'the exact nature of the piece of machinery which we call the molecule,' to use Professor Wood's own words.

"With the study of resonance radiation, however, one is tempted to associate Professor Wood's allied work on magneto-optics, and to quote as an example of his ingenuity the separation of the *D* lines of sodium for work with intense beams of monochromatic light by the difference in their rotations.

"More recently, Professor Wood has been interested in the Raman effect, where he has devised methods for reducing the time of exposure needed for recording the feeble spectra of modified radiation, and has also developed rapid methods for measuring up the Raman spectra.

"In addition to his many experimental contributions to physical optics, Professor Wood is the author of two books on the subject, and has ruled gratings for other laboratories. His work, although naturally carried out on rather different lines, is in every sense worthy of being ranked with that of Rowland and of Michelson."

Professor Wood is also a contributing editor of the SCIENTIFIC AMERICAN. Readers will recall his article, "Sounds that Burn," on the super-sonic wave, in the number for March, 1928, and his article on the Raman Effect, in the December, 1930, number.

Warns Against Diabetes Nostrums

"PERSONS suffering from diabetes should not rely on the curative claims made by manufacturers of worthless nostrums, since there is no drug or combination of drugs known to medical science which can cure this disease," said Dr. J. J. Durrett, chief of drug control, Federal Food and Drug Administration, recently, in commenting upon a government seizure of a product, Insurol, shipped by the Deutsche Vital Gesellschaft, Berlin, Germany, to a New York concern. "The only safe and reliable treatment for this disease is the continued hypodermic injection of insulin together with a suitable diet, and this is not to be considered a cure. Insulin is now recognized by medical men in the leading nations of the world as being an effective treatment, when used in conjunction with a regulated diet, but not as a cure for the disease. At the same time, every country has its favorite herb, superstitiously believed to have curative value for diabetes. None of these herbs has cured the disease."

Analysis by Federal chemists and pharmacologists showed that the preparation Insurol contained no ingredient or combina-

tion of ingredients capable of producing the effects claimed upon the label, and thus became liable to seizure under the Federal Food and Drugs Act, which has jurisdiction over imported goods as well as those entering into interstate traffic in the United States. The pills consisted largely of some clay-like material, yeast, reducing sugar, a dried glandular substance, and smaller amounts of other material.

Sun Operates Dead Sea Potash Plant

ONE of the most picturesque modern chemical industries in the world is located on the Dead Sea in ancient Palestine, where a plant for extracting potash salts from the sea by solar evaporation was recently put in operation.

The plant involved in the production of potash and other products by this method includes large, open, shallow pans, erected on the land bordering the sea, in which the water from the sea is rapidly evaporated through exposure to the influence of hot sun rays and winds; pumps for pumping the water from the sea into the various pans; plant for collecting or harvesting the precipitated salts and transporting them to the refinery; pumps and pipe lines for fresh water supply from the Jordan for the needs of the refinery, for cooling the engines, and for general purposes of the undertaking; potash factory or refinery for working up the crude salts into the final product for marketing; bromine plant for extracting the bromine concentrated in the final brine and preparing it for marketing; and a power station.

The main part of the orders for machinery and apparatus was placed in England in January, 1930. On April 1 the operation of pumping the water from the Dead Sea into the pans started, using one large pump. These operations were considerably increased two months later by the installation of two more pumps. With the arrival of engines, pipes, and other machinery at the Dead Sea, the erection of other plants—fresh water supply, power house, and workshops—was taken in hand, and the greater part completed by the end of July. By that time a pan area of about 120 acres was filled with rapidly evaporating sea water and the precipitation of large quantities of common salt forming layers a few inches thick in the pans was already in progress.

Soon after the greater part of the common salt had separated out, the precipitation of crude potash salt (carnallite) began, and by the end of August a few thousand tons formed loose layers in the lower evaporating pans designated for this purpose. The collection and harvesting of this salt into piles was in progress at the beginning of October and proceeded up to the end of December. A certain amount of common salt of good quality was also collected into piles. The operations of the first working season were thus completed, having fully confirmed the results obtained by the experimental work of the preceding years, and proved the possibility of manufacturing the potash from the waters of the Dead Sea by applying the sun's rays as heat for evaporating and precipitating the chemical salts.

In view of the satisfactory results of the first year's operations (when both quality and quantity of the crude potash salts produced, as well as the cost of production, fulfilled expectations) it was decided to increase the plant, to create a unit capable of producing up to the limits of the existing means of transportation from the Dead Sea to one of the Palestine seaports, Jaffa or Haifa.—*A. E. B.*

Easy to Handle the Bee Sting if You Know How

THE sting of the honey bee is painful, but interesting. If the victim understands the structure and operation of the bee's defense weapon, he can prevent much of the pain and swelling. J. I. Hambleton, in charge of the bee culture laboratory of the United States Department of Agriculture, gives this cheering information.

When a bee prods its victim it tears itself from its sting, a sacrifice which costs the insect its life. But the sting left in the

Designed by the U. S. Department of Agriculture to prevent soil erosion, this machine uses sets of shovels which alternately operate to dig holes at regular intervals. The machine digs about 10,000 holes per acre. Rain water stays in these holes, two or three gallons in each, and soaks into the ground instead of running off

skin has just started on its way, for it and the poison sacks attached are equipped with muscles which tend to drive it deeper and deeper.

The sting is composed of two lancets, each provided with a series of sharp barbs pointing backward similar to those of a harpoon. The reflex action of the muscles attached to the sting mechanism is such that first one lancet is driven into the flesh, where it anchors, then the other, and so on, each lancet going a little deeper and becoming more firmly lodged. During this time the muscles are also squeezing the poison sacks in such a manner that poison is constantly being pumped into the wound.

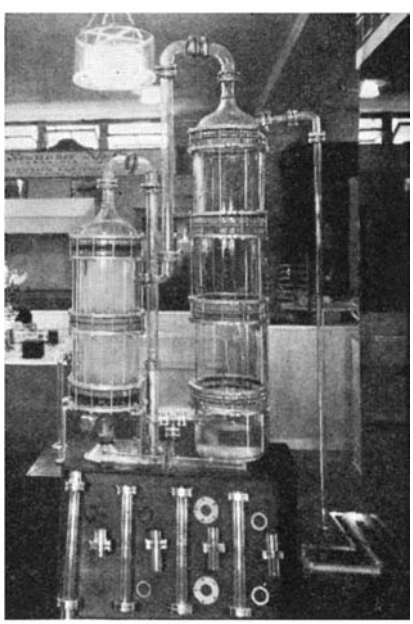
Most persons make the mistake of trying to pull out the sting. When this is done the pressure of the fingers empties the poison sack into the flesh. The sting should be immediately scraped or scratched out, and since no time is to be lost looking for a knife or even in opening one, the fingernail is the best thing to use in the emergency, says Mr. Hambleton, who has

frequently made the demonstration before interested visitors at the bee culture laboratory.

Zinc Sulfide Removes Surplus Luster From Rayon

WHILE silk is admired partly for its natural luster, too much of a good thing is bad, as makers of rayon, particularly the cellulose acetate variety, well know. Cellulose acetate rayon is too lustrous to look like silk and therefore has to be de-lustered before it is marketed. A new process for the permanent de-lustering of cellulose acetate rayon precipitates within it a small proportion of zinc sulfide; this substance is sufficiently white to allow its use without yellowing the rayon. It is to be noted that the de-lustering thus obtained is much more permanent than that produced by the older process of boiling the rayon in a solution of soap, and at the same time the rayon gains an affinity for cotton dyes. This change in dyeing properties is not due to saponification, since this does not occur, but rather to the fact that the cotton dyes form lakes with the zinc sulfide.

The method adopted consists of treating the rayon with a solution of zinc salt (zinc chloride) and a swelling agent such as acetic acid or acetone, and then passing the



An all-glass distillation column, designed to bring the cleanliness and convenience of the laboratory to the factory. Tower sections and pipe lines of a size suitable for commercial use have been developed by the Corning Glass Works

rayon without previous rinsing through a solution of sodium sulfide; afterwards the rayon (de-lustered) is washed and soaped. —*A. E. B.*

Technical Tests Used in Grading Farm Products

MECHANICAL and chemical tests are rapidly replacing human judgment in measuring the quality of farm products. Ten years ago, says the United States Department of Agriculture, only a few such tests were used successfully. To-day many products are tested chemically or mechanically by methods that give to particular quality factors a specific value in commodity standards.

One device recently developed measures the moisture content of grain by recording the resistance offered to an electric current passed through it. This method requires only 30 seconds, as compared with the 40 minutes necessary under the old method.

Technical tests are employed in measuring certain quality factors in fruit. The sugar content of grapes is determined by the saccharimeter. A sugar acid test is used to ascertain the maturity of citrus fruits. A specific gravity test shows the maturity of cantaloupes.

In grading canned fruits and vegetables a pressure gage indicates the vacuum condition of the can. The density of sirups is tested with hydrometers. Salinometers are used in testing brine solutions, and penetrometers in determining the consistency of such products as canned pumpkin. Mechanical devices measure the maturity of canned corn. A fruit pressure tester has been developed to determine the maturity of plums, apples, and pears. The colorimeter measures color in hay, cotton, and honey, in which products color is an important quality factor.

Cotton fiber lengths are measured with a high degree of accuracy by an improved cotton fiber sorting machine. The strength of cotton fibers may be ascertained by the bundle fiber test.

Some quality factors, such as flavor and odor, are naturally difficult to measure by technical tests, though means for doing so may some day be developed. Research on this problem is under way. The progress already made in the measurement, by technical means, of specific quality factors suggests that dependence on personal judgment or skill, though still necessary to a considerable degree, may eventually be largely eliminated. This elimination will make grading increasingly uniform throughout all seasons and areas.

Nickel-Barium Makes Better Spark Plugs

HOW the mistaken impression that pure nickel was the best material for spark plug points eventually led to the discovery of a barium-nickel alloy which gives a stronger and more regular spark than any before known, is the story of the roundabout way which science sometimes takes to make her discoveries, according to a report of work done by the University of Michigan Department of Engineering Research.

Years of experience had taught spark plug makers that nickel wire was the best for spark plug points. One manufacturer, however, thought that the quality might be improved and commissioned Professor O. S. Duffendack and Dr. R. A. Wolfe of the University of Michigan physics departmen to investigate. Assuming that very pure nickel might give better results, the scientists made tests of this only to find it much poorer than the commercial product. Spectroscopic and microscopic study showed that the nickel contained small portions of magnesium which had originally been added to remove sulfur while the nickel was molten, and which was supposed to have evaporated away entirely before cooling.

When occasional bits of the magnesium

worked to the surface of the sparking points, and just before they evaporated in the heat of the arc, they created an electrical condition which allowed a strong spark to jump the gap much more easily than when no magnesium was present at the tip. Thus, fortunately for plug makers, this portion of magnesium allowed them to make satisfactory spark plugs—almost in spite of themselves.

Despite its value, however, magnesium has faults. It does not make a true alloy with nickel, but distributes itself in microscopically small bits haphazard in the metal; enough of it cannot be added to produce the best results; and it evaporates faster than the nickel, thus leaving a tip of nickel only, at which time firing troubles may ensue. Hence the search was started for a substitute which was found in barium.

This metal alloys with nickel very well and so becomes evenly distributed. It may be added in large amounts to nickel and so make possible a strong spark with a relatively low voltage. Compared with pure nickel the barium alloy reduces needed sparking voltage by 50 percent and by an average of 25 percent compared with commercial magnesium-bearing nickel. In the heat of the spark, it evaporates away at the same rate as nickel, insuring a point of regular character and quality, producing a generally long-lived and dependable sparking point. The barium alloy has also proved advantageous as a base metal for oxide cathodes in radio tubes and experiments indicate distinct possibilities for use in electron devices of various kinds.

Electric Hammer Does a Chemist's Job

THE time required to determine accurately the amount of moisture in lumber has been reduced from a week to a few seconds, and no longer is it necessary to spoil a board by cutting analysis blocks from it. Apparatus developed by Dr. C. G. Suits of the General Electric research laboratory and M. E. Dunlap of the United States Forest Products Laboratory at Madison, Wisconsin, makes it possible for a workman to check any or all boards in a consignment speedily and exactly.

A tap with a special hammer, a turn of a dial, a flashing red light or a buzz in earphones—and the analysis is made. With all the equipment contained in a portable metal carrying case, it is easy for the inspector to move around the lumber pile or yard.

It has long been known that the electric resistance of wood changes with its moisture content. With a circuit having two neon glow lamps, the moisture content of wood is now determined by that resistance change. One of the neon lamps is connected across a fixed condenser, so adjusted that when the condenser builds up current to a certain point, the neon tube discharges with its characteristic red flash. This rate of flashing is adjusted to about once per second. The other neon tube and its condenser are in series with the hammer's knife-edged electrodes which are driven into the wood. By means of a variable condenser, the circuits are adjusted so that the two tubes flash simultaneously. Then the dial of the variable condenser shows the percentage of moisture in the lumber. The adjustment can also be made by listening to a buzz in the earphones, a method that has advantages when working in bright sunlight which makes it difficult to see the flashes of the neon tubes.

The hammer with which the lumber is struck is double-faced and of treated wood. Small, knife-shaped, stainless metal electrodes, about one inch apart, project from each face of the hammer. From the instrument case a long, rubber-insulated, water-proof cable passes through the hammer handle to the electrodes. Those on opposite faces of the hammer are at right angles, making it easy for the operator

The knife edges on this "electric hammer" sink into the wood and make possible the test described

to work at the side or at the end of a pile of lumber. Since the electrodes are knife-edged and only slightly penetrate the wood, the lumber is not damaged by the tests.

The instrument reads between 7 and 24 percent moisture content. A lower figure, which can be attained with special kiln-dried lumber, is difficult to hold because of the humidity of the atmosphere, and is not regularly used in lumber analyses; lumber with more than 24 percent moisture is usually too wet for industrial uses. Most lumber with 30 percent moisture has gone beyond the fiber saturation point, so that the moisture is present as water between the wood cells.

The strength and dimensions of wood depend on the moisture content; the lower the moisture, the better the wood. Considerable wood has been sold on moisture content specifications; but so complicated has been the method of determination that adoption of such specifications has not been universal.—*A. E. B.*

Our Production of Copper, Zinc, and Lead in 1930

THE copper industry in 1930 was severely affected by the general worldwide industrial depression. Production and consumption, which made new high records in 1929, dropped sharply, according to the United States Bureau of Mines. Although production and consumption in 1930 both were at a rate far below 1929, the decline in production lagged behind that in consumption, causing a substantial increase in

stocks. Estimated stocks of refined copper at domestic refineries at the end of the year were the largest on record.

The smelter production of copper from domestic ores in 1930, as determined by the Bureau of Mines from reports of the smelters showing actual production for 11 months and estimated production for December, was 1,375,000,000 pounds, compared with 2,003,000,000 pounds in 1929. The 1930 production is 31 percent lower than that of 1929, and is the smallest production recorded since 1922. The production of new refined copper from domestic sources, determined in the same manner as smelter production, was about 1,485,000,000 pounds, compared with 1,983,000,000 pounds in 1929.

Production of primary zinc from domestic and foreign sources, and apparent deliveries for domestic consumption in 1930 were also lower than in any year since 1922. Stocks of metallic zinc at smelters and at electrolytic refineries were nearly doubled during 1930 and at the end of the year they were the highest on record. The output of primary metallic zinc in 1930 was about 499,300 tons. In comparison with 625,447 tons in 1929, the decrease in total primary production for 1930 amounted to 20 percent.

The domestic lead industry was less severely affected by the worldwide industrial depression of 1930 than either the copper or the zinc industry. The output of lead from domestic sources was 15 percent lower than in 1929, while copper and zinc showed decreases of 25 and 20 percent, respectively. The output of primary lead from domestic sources was the smallest recorded since 1924 and that from domestic and foreign sources the smallest since 1923. The output of primary domestic desilverized lead in 1930 was about 324,000 tons; of soft lead about 200,000 tons and of desilverized soft lead about 45,000 tons, making a total output from domestic ores of about 569,000 tons of refined lead. Corresponding figures in 1929 were 381,487 tons of desilverized lead, 235,345 tons of soft lead, and 55,666 tons of desilverized soft lead, making a total of 672,498 tons.

—*A. E. B.*

ASQUITH AND KITCHENER

(*Continued from page* 180)

It must be recorded that he vacillated, inclining first to one front and then to the other, and he gave neither General Hamilton enough men to threaten Constantinople seriously, nor General French reinforcements sufficient to prevent the Germans from reinforcing Ludendorff's army in Poland. The result was Allied failure at the Dardanelles, in France, and in Poland. With the existing German superiority in the Spring of 1915, the Allies were due for a bad year, no matter what course they pursued, but by failing to concentrate their efforts on the Western Front, they turned a difficult situation into a critical one.

In the early days of the war, Asquith held a cabinet meeting almost daily. He has left us in his diary brief but finely drawn sketches of his colleagues as they met around the council table, and his own account of his methods of handling a Cabinet during a great war. He extended Cabinet ministers full authority in their own departments, gave them strong support, listened sympathetically to their woes, forgave their errors, and gave them generous credit for their achievements. When two members clashed, he lent himself fully to finding a means of reconciling their views. Under the pressure of war, wise men frequently differed widely. When a compromise solution acceptable to both members could not be reached, Asquith was apt to postpone decision in the hope that time would reveal the answer; on many occasions postponement effected a compromise but Asquith soon acquired the unenviable reputation of being a "wait and see" man.

He had no fear of being displaced as Prime Minister and disdainfully ignored frequent reports of intrigues against him. He once confronted Lloyd George, his only possible rival, with reports of intrigues, but accepted in full the vehement denials that Lloyd George immediately offered.

In his manner of dealing with his civilian colleagues, even a hostile critic can find few occasions to blame Asquith. He did not come to Haldane's assistance when that devoted Minister, who had created the British General Staff and reformed the War Office, was unjustly struck down, but in the existing public hysteria he could have done Haldane no real service and he might have jeopardized his own position. It was a cruel decision, but probably a wise one, to sacrifice Haldane, and that philosopher preserved a patriotic silence.

IN handling the Admiralty and War Department, Asquith was less fortunate; his long peace-time parliamentary and cabinet experience, his superior intellect, even his large theoretical knowledge of military matters gained by faithful service on the Committee of Imperial Defense did not save him from committing error after error. He permitted Churchill to over-ride Fisher on purely naval questions, such as the disposition and movements of naval forces. He sided with Churchill against Fisher on the Dardanelles Expedition, and then used his immense influence to prevent Fisher from resigning.

In May, 1915, Fisher finally insisted upon his resignation being accepted, and Bonar Law, leader of the Conservatives, on May 17 wrote Asquith: "Lord Lansdowne and I have learnt with dismay that Lord Fisher has resigned . . . we cannot allow the House to adjourn until this fact has been made known and discussed. . . . In our opinion things can not go on as they are, and some change in the Constitution of the Government seems to us inevitable if it is to retain a sufficient measure of public confidence to conduct the war to a successful conclusion. . . ." This suavely drawn note was an ultimatum to Asquith to accept a Coalition Cabinet or a debate in the Commons on the conduct of the war.

Asquith capitulated at once but his party loyalty caused him to deal grudgingly with the Conservatives. He replaced Churchill by Balfour, gave Austen Chamberlain the India Office, made Lord Birkenhead Attorney General, but only allowed Bonar Law, the leader of the opposition, the Colonial Office. This political error led to Asquith's undoing for it threw Bonar Law and the leading Conservatives into the arms of Lloyd George in 1916.

The Unionists aimed their blow at Churchill who, they knew, was over-riding Admiral Fisher, his technical adviser at the Admiralty; but it coincided with Northcliff's attack in the London *Times* on Kitchener for failing to supply the British Army with high-explosive shells, so when Asquith commenced to form the Coalition Cabinet it was intended to drop Kitchener.

But the British public had more confidence in Kitchener than in all his critics and their open hostility to Kitchener's removal secured his place in the Coalition Cabinet. Churchill was not so fortunate, and despite efforts of his friends, he was dismissed from the Admiralty. Kitchener had no suspicion that his place was in jeopardy, and it is doubtful whether he suspected at this time that some of his colleagues, notably Lloyd George and Churchill, had lost confidence in his abilities.

Kitchener revealed his innate sincerity by paying a formal call to Churchill at his downfall when he was abandoned by his other colleagues; Kitchener took this step at a moment when none of Churchill's cabinet colleagues dared lend him any political credit and when Churchill would have driven Kitchener from the Cabinet.

ASQUITH had greater confidence in Kitchener than he did in Fisher; as a member of the Cabinet, Kitchener received the loyal support that Asquith extended in such full measure to his colleagues. And Kitchener repaid Asquith by a supreme loyalty and faith; when the Field Marshal, unaccustomed to discussion, unable to answer the questions hurled at him by Lloyd George and Churchill, took refuge in sullen silence, Asquith could always thaw him out, for with correct instinct Kitchener divined that Asquith was essentially straightforward and dependable. Many harassing days were in store for Kitchener; Lloyd George and Churchill frequently disagreed with him, and their keen minds enabled them to discover any weak points in Kitchener's explanations.

Kitchener was probably at his worst in these oral duels with such expert controversialists as Lloyd George and Churchill; his mind worked rather slowly and he was reluctant to state all the facts in the presence of a score of Cabinet officials for he soon learned from bitter experience that highly confidential military secrets leaked out through these distinguished sources. At times, however, Kitchener scored heavily for he had a clear idea of the war panorama, and of some of these discussions even Lloyd George was forced to say that Kitchener's explanations occasionally "lit up the whole field of war, like a revolving beam of a gigantic lighthouse." Lord Birkenhead also appreciated Kitchener and undertook to interpret his ideas to the Cabinet when Kitchener failed.

Supported by Asquith and Birkenhead, Kitchener survived the Cabinet ordeals although he had made himself vulnerable to attack by permitting various side-shows such as Saloniki, Dardanelles, Mesopotamia, and Palestine to absorb men and munitions that could have been more effectively employed on the Western Front. Nor did he, at first, appreciate the importance of an abundant supply of ammunition. The fact that Kitchener was only partly responsible for the side-shows and entirely blameless for the original shortage of machine guns, heavy artillery, and high explosive shells could not be explained without compromising the entire Cabinet. The fact that civilian contractors in Great Britain and the United States were completely unable to make the promised deliveries on schedule could not be published without informing Germany. So Kitchener and Asquith became the targets for the inside critics and intriguers, of whom there was an abundance in London and with the Army in France.

Asquith in October, 1914, appointed a Committee on Munitions under Kitchener's chairmanship. In April, 1915, he made Lloyd George Chairman of the Committee in place of Kitchener, and in a few weeks the Committee was turned into the Ministry of Munitions with Lloyd George at the head of it. During this evolution, Lloyd George and Kitchener frequently disagreed sharply, but Asquith was usually able to soften their disagreements, and when the final arrangement was made Kitchener loyally accepted the new situation. In speaking of Lloyd George after one of their frequent differences, Kitchener said: "The little Welshman is peppery, but he means to win —which is what matters." Kitchener took the same high ground with Churchill, assuming that his criticism was of a constructive nature and answering it accordingly.

AS the war dragged through the fall of 1915, the Cabinet, the Army, and the Navy split over the evacuation of the Dardanelles. Finally, Asquith sent Kitchener to inspect the situation on Gallipoli, and when he reported that evacuation was inevitable, Asquith acquiesced. He telephoned his approval to Kitchener and suggested he remain in Egypt until the full shock of the evacuation should be felt in the Near East. It is openly said that Asquith was paving the way for Kitchener's removal from the Cabinet by making him Commander-in-Chief in the Eastern Mediterranean; if so, and there is some sustaining evidence, this is the only occasion on record where Asquith did not act in a straightforward manner with Kitchener.

General Birdwood, who had served with Kitchener in India, was in command of the evacuation. After its successful accomplishment, he wrote a personal letter to Kitchener describing the event, beginning "My dear old Chief." Throughout this whole letter there is evident an affectionate devotion that only the worthy great ever inspire. Birdwood writes "Though I was . . . determined to do my best to see this thing through successfully for its own sake . . . yet I have felt very much indeed about you all the time, my dear old Chief. I quite realized that had we made a failure of it, . . . there would have been an outcry at home . . . people would have begun to abuse even you for the Dardanelles policy . . . and I was determined that this should not be the case. . . ." To the stranger, Kitchener may have appeared forbidding but among his military family he inspired an almost religious devotion. This devotion Kitchener took for granted and rarely returned the affection he inspired; one striking exception indicating that he could feel deeply, was his bursting into tears when he first learned of the death of General Hubert Hamilton.

In December, 1915, Kitchener was relieved of many of his duties by the appoint-

ment of General Sir William Robertson as Chief of the Imperial General Staff. Robertson was a favorite of Kitchener and his experience as Quartermaster General and Chief of Staff of the Expeditionary Force was excellent preparation for his new position. He was alarmed at the prospect of serving as Kitchener's aide for he was familiar with the service-gossip that Kitchener extended little authority to his subordinates. Accordingly, he attached certain conditions to his acceptance of the position, which Kitchener, with some slight amendment, accepted and these two thereafter worked in harmony.

There is an abundance of evidence that Kitchener did tend towards over-centralization, but Robertson bears witness that he did not invade the domain of the Chief of Staff. Sir John Cowans, an exceptionally capable officer, who was Quartermaster General of the British Army throughout the war, was another subordinate on whose department Kitchener never encroached. Friends of Kitchener assert that once he found a subordinate dependable, he would allow him ample initiative, that he only intervened when a subordinate was incapable.

Kitchener's critics took the appointment of Robertson as their justification, continued their attacks, and finally assailed him in the House of Commons. Kitchener made an exceedingly effective reply in a confidential meeting of members of the Commons, in which he answered his critics in detail. This was Kitchener's personal triumph for he bared himself before his accusers, gave reasons for his actions except where the operations of England's Allies were involved, and convinced the majority of his hearers.

This was his last public appearance before he undertook the journey to Russia which ended in his dramatic death when the cruiser *Hampshire* was mined. His last effort for Britain emphasizes the influence he exercised abroad; no person in England enjoyed as much prestige in Europe as did Kitchener and he always placed it at the command of his country. He could urge King Constantine to join the Allies, chide the Russians for their inefficiency, encourage the Italians, or rebuke the French with equal assurance. Asquith held him in reserve for their difficult negotiations; and, describing a conference with Joffre and Gallieni about Saloniki, Asquith says Kitchener "played his part of the sullen, morose, rather suspicious but wholly determined man with good effect."

SO firm was Kitchener's grip upon the imagination of his countrymen that among those matter-of-fact people arose a belief that Kitchener was not dead but was held as a prisoner in Germany. This legend persisted despite official denials, until the armistice revealed the truth, so that in his death Kitchener continued the legendary figure he had been throughout his life. This legend suggests Kitchener's answer made in the early days of the war to the Prince of Wales, who, very anxious to get to the front, asked, "What difference does it make if I am killed? I have three brothers." Kitchener slowly replied, "If it were only a question of your death, I would not be justified in refusing your request, but if you should be captured it would be a great triumph for Germany." Had Kitchener been captured it would have been a considerable triumph for Germany, whereas his death placed a seal upon his services and he continued, as in his life, to be the symbol of his country's determination to win the war.

In September, 1916, Asquith's eldest son, Raymond, was killed in battle in France. This was a grievous blow, for Raymond had had an even more brilliant career at Oxford than his father, and much was expected of him. Asquith had jealously guarded his inner family life, but he could not conceal his enormous pride and affection for his brilliant first-born, nor could he hide the crushing effect of his death. He found solace in his labors.

HE was reserved for still another trial: there had been increasing dissatisfaction in the conduct of the war; there were critics in and out of the Cabinet, and by November, 1916, various members of the Cabinet were submitting memoranda on the conduct of the war. This is a danger-signal in Cabinet circles, for it is evidence that members are anxious to get their views on record, so that if future events are unfortunate, the precious memorandum can be produced to absolve the individual from any of the collective blame, but if the future turn out happily, the memorandum can be conveniently forgotten.

There was agitation about compulsory service, for speeding up the munitions program, for a more active prosecution of the war. Lloyd George gradually came to personify the discontented element, with Bonar Law as his first assistant. In truth, there was much to criticize. Asquith, alone, seemed unaware of the plan to displace him but when he was confronted with two alternatives by Lloyd George, both of which actually deprived Asquith of all authority in the conduct of the war, he sent his resignation to the King and advised that Bonar Law be sent for. After several days of conference, Bonar Law was unable to form a government and Lloyd George accepted the premiership and, with Bonar Law's assistance, formed the Second Coalition Cabinet. Asquith bore himself well during the crisis, made no reference to the ingratitude of his former colleagues and eventually took upon himself the duty of leading the opposition. Invited to take a minor position in the Cabinet, he hesitated for a while and before coming to a decision, consulted his friends. Thus in the end as the beginning, Asquith stopped for a conference with his friends before making a decision. This ruling trait enabled him in the quiet days of peace to find a meeting place for minds, to pool the mental resources of his colleagues, to compose the incessant difficulties that continually arise in a cabinet and to round the sharp corners without upsetting his political cart. But this method worked badly in war, and his patience with his colleagues finally became a positive menace to his country.

It is easy to point to various mistakes made by Asquith and Kitchener; but it would be difficult to suggest two substitutes who would have stood the test of war as did this pair of eminent Englishmen: the Statesman, the product of England itself and the parliamentary system, the Field Marshal developed on the outskirts of the empire into a soldier, administrator, and proconsul.

COMMERCIAL PROPERTY NEWS

Conducted by SYLVESTER J. LIDDY

Member of the New York Bar
Registered Patent Attorney

Single Court of Patent Appeals

A PROPOSAL for a single court of patent appeals has been put forward in very lucid form by Edwin J. Pringle, Esq. Although similar suggestions have been offered in the past, we feel that Mr. Pringle is to be congratulated in formulating the present outline so that its many advantages can be easily understood by both the layman and the lawyer. We present below the essentials of his plan.

BECAUSE of the peculiar nature of the patent monopoly, the present system of appeals in patent infringement suits in the United States is the most inefficient, expensive, and wasteful to be found anywhere. It is a deterrent to the production of inventions, and to the investment of capital in patents. Correction of this condition is by far the greatest need of our patent system.

For the first century of our patent system, there was a single court of patent appeals, —and that was the Supreme Court of the United States. But this court became so overburdened with work that, in 1891, the appeal to the Supreme Court was taken away; and the country was divided into nine circuits (now ten), each of which was provided with a Circuit Court of Appeals, which has final jurisdiction of all patent appeals in its circuit.

These courts are independent of each other. While, under the doctrine of comity, unless they see substantial reasons for not doing so, they follow a previous decision by the court of appeals of another circuit on the same patent, still they are at liberty to decide oppositely, and frequently do so. Each court of appeals is supreme in its own circuit, so that there are, in effect, ten independent supreme courts for patents.

As stated, there is no appeal to the Supreme Court. The only right is that of petitioning the Supreme Court to grant a writ of certiorari ordering the case to be sent up to it. The Supreme Court has such an enormous volume of work that it does not take up a patent case unless there is some question of public importance or of interpretation of law, or unless the Circuit Courts of Appeals of two Circuits have decided the same question concerning the same patent in opposite ways.

The decision of a single circuit court of appeals is final in most branches of the law (practically the only other exceptions being copyright and trademark matters); but it is not so as to patents.

The monopoly which a patent grants is a negative one. The patentee is not granted the right, himself, to make, use, or sell the patented invention—a *positive* monopoly. He already has that right because of his inventorship, unless in doing so he would have to use that which has already been patented to another. The patent merely grants him the *negative* right to exclude all others throughout the United States, from making, using, and selling the patented invention. To be of any value to him, his monopoly must be maintained inviolate. If there is one infringer anywhere in the United States who has been rendered immune from the patent by a final decision, it will greatly impair and may largely destroy the value of the patent. One hole that cannot be stopped may sink a ship.

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.

Under these circumstances, to make it necessary that the patent shall have been adjudicated oppositely in two separate circuit courts of appeal, before the mere right shall exist to petition the one court which can render a final decision, the Supreme Court, to take it up, is a shocking economic waste.

A patent may be valid in one circuit and invalid in another. It may have been given a broad, inclusive interpretation in one circuit, and a narrow one in another. It may be infringed by a given construction in one circuit, and not infringed by the same construction in another. A defendant in whose favor a patent has been held invalid, or not infringed, in one circuit, is free to make, use, and sell in every other circuit; and the patentee cannot even enjoin his agents or customers. Thus, in a single circuit, a patent may be invalid as to one person or corporation and valid as to everyone else, or *vice versa*. Even if a patent has been sustained in two circuits, there are still eight circuits, any one of which could decide to the contrary; so that the standing of the patent still is in doubt and infringers still may be tempted to take the risk.

If the first of two decisions by a different circuit court of appeals is against a patent, and the Supreme Court decides in favor of the patent, it almost invariably is too late for the decision of the Supreme Court to affect the first case; and the defendant in that case is free to infringe the patent throughout the remainder of its life, and throughout the whole country.

Furthermore, the statute provides that where the patent covers more than the patentee invented, he must, with reasonable promptness, file a disclaimer in the Patent Office, disclaiming that which is not his invention. Where in the first suit under the patent a Court of Appeals holds a claim to be invalid, it must be promptly disclaimed, under penalty of the patentee losing the right to bring other suits under the patent. The law provides that the disclaimer becomes a part of the patent. It is effective throughout the United States in all circuits. Therefore, if another Circuit Court of Appeals in a second suit on the same patent holds the claims to be valid, which were disclaimed in the first suit, and the Supreme Court then, on Writ of Certiorari held the said claims to be valid, it almost invariably would be too late, under the statute, for the Supreme Court to afford relief. Thus the patent irretrievably would have been emasculated, because of the plurality of Courts of Appeals; while, with a single Court of Patent Appeals, the validity of the claims could be finally determined before any disclaimer was filed.

Moreover, by the time the patentee has obtained a favorable decision in a second circuit in any of these cases, a large proportion of the short life of the patent (seventeen years) usually has expired, with no substantial reward to the inventor.

The expenses of these repeated litigations make them impossible to the individual, and constitute a burden from incurring which even the large corporations shrink.

With ten courts of appeals, there are unavoidable differences of opinion on various points of law and differences of tradition as to the liberality or strictness of construction to be applied to a patent under the same circumstances. But, under a single court of patent appeals, the administration of the patent law would attain completeness and certainty and uniformity of application in these and other respects, which it now lacks.

Patents also involve many difficult questions of science and engineering, upon which judges may and often differ; thus it is impossible that the decisions of the various circuit courts of appeals on the same patent shall always be uniform.

Quite as many of the patents that are adjudicated are held to be invalid as are sustained. Both the public and the patentee, therefore, need to know, early in the life of the patent, whether or not the patent is valid, and what is its scope. If the patent is invalid, the public should know it, and not be kept in uncertainty for years, during which it would have been free to use the alleged invention described in the patent, if a single final decision could have been obtained. On the other hand, if the patent is valid, the patentee, early in the life of his patent, should have a single decision which applies throughout the United States and which would hold against all subsequent defendants, unless they set up defenses which are substantially different from those considered in the first suit, or unless they use a structure which does not come within the monopoly of the patent as determined in the first suit.

The patent should be adjudged as to validity, scope, and infringement, on the same principles and policy throughout the United States, both for the sake of the public and the patentee.

The head of the patent department of one of the largest corporations in this country said to the writer recently, "Whether a patent is valid or invalid, we want, early in its life, to know definitely, so that we may shape our course accordingly, and

with confidence that the situation will not be changed during the life of the patent, except for substantial reasons."

Therefore, the only solution of the difficulty is a Single Court of Patent Appeals.

Inventor Convicted of Fraud

CLARK W. PARKER, 69-year-old inventor, and his son, Wyman C. Parker, were found guilty recently of using the mails to defraud by a jury in Federal Judge John M. Woolsey's court, in connection with the promotion of the Automotive Royalties Company, Inc.

Two employees, H. E. Seymour and H. S. Vail, who for three weeks stood joint trial with the Parkers, were found not guilty.

The Parkers, it was charged, defrauded 700 prospective investors in the automotive stock of 1,100,000 dollars in the last four years. Clark Parker is the inventor of a rotary engine, which, according to pamphlets sent through the mails to further stock sales, was to "revolutionize the automobile and airplane industry."

Fruit Mark Registered

IN a recent decision, First Assistant Commissioner Kinnan held that the Sun-Maid Raisin Growers of California, of Fresno, California, is entitled to register, as a trademark for canned fruits and other food products, a mark consisting of a representation of the sun having within its circumference a picture of a young girl and the words "Sun-Maid" appearing therebelow, notwithstanding the prior adoption and use on similar goods by the California Packing Corporation, of San Francisco, California, of the term "Sun-Kist."

The ground of the decision is that the marks are not confusingly similar.

In his decision, after stating that there was in the record a contract between the parties involved, made as a basis for the dismissal of an infringement suit, and that each party had sought to construe that contract in its favor, the First Assistant Commissioner said:

"It will be sufficient to here note that this contract, the construction of its terms, its effect as an estoppel and, in fact, any effect which it may have upon the instant proceedings, is not before this tribunal to determine. The sole question here is whether the registration of the applicant's mark would damage the opposer by reason of probable confusion in trade."

With reference to the marks he said:

"The marks alleged to be in conflict have nothing in common but the word 'Sun,' and in each instance, it is connected by a hyphen with a second and wholly dissimilar word. The applicant's mark includes many other more distinctive and fanciful features totally absent from the opposer's mark."

Naval Officer Loses Suit

REAR ADMIRAL BRADLEY A. FISKE (retired) recently lost a suit for 198,000 dollars against Rear Admiral William A. Moffett, Chief of the Navy Bureau of Aeronautics, for alleged infringement of patent on a torpedo dropping device.

The District of Columbia Court of Appeals reversed the judgment of the District of Columbia Supreme Court a year ago awarding to Admiral Fiske that amount. The retired officer contended that the Navy used the device on 397 planes without his authority. The Appeals Court held that Admiral Fiske's patent was inoperative and that the government was entitled to an irrevocable license to use the inventions made while Fiske was a naval officer.

Colored Film Mark Upheld

RECENTLY, Assistant Commissioner Moore held that Consolidated Film Industries, Inc., of New York, is entitled to register, under the Act of 1905, as a trademark for motion picture films, the term "Magnacolor," notwithstanding prior registration by another (registration No. 264,952) of the term "Magnafilm" as a trademark for motion picture photoplays, the ground of the decision being that these marks are not confusingly similar.

In his decision the Assistant Commissioner stated that the marks do not look alike, sound alike, nor have the same signification and that the registered mark conveys the idea of a great film while the applicant's mark conveys the idea of a great color. He then, after noting that applicant had called attention to a number of registrations consisting either of the word "magna" alone or "magna" used as a prefix in a compound word, said:

"The word 'Magna,' when used as a part of a trademark, being generally regarded as an adjunct to the noun which it qualifies, it may not properly be held to be the dominant part of the mark.

"In view of the above, I am of the opinion that the reason advanced by the examiner is not sufficient to justify the refusal to register the applicant's mark."

"Dog Remedies" Not Remedies

THE government scored a victory in a contested court case involving four veterinary drug preparations when the United States District Court at New Orleans, Louisiana, upheld seizure of misbranded "dog remedies," sold by the S. A. Crisp Canine Company, Blacksburg, South Carolina, to a New Orleans firm, said W. G. Campbell, Director of Regulatory Work, U. S. Department of Agriculture, in a comment on reports of the case which have reached the department. This company contested Federal seizure of shipments of Crisp's Tung-Tone, Crisp's Distemperte, Crisp's Black Tongue Remedy, and Crisp's Hot Shot, held by the government to be misbranded under the Federal Food and Drugs Act.

Analysis of Crisp's Tung-Tone Black Tongue Preventive, made by government chemists, showed the product to consist largely of calomel, baking soda, and a small amount of charcoal. Crisp's Black Tongue Remedy, in capsule form, was found to consist principally of calomel, soda, and charcoal, while the liquid was made up principally of milk of magnesia, precipitated chalk, charcoal, and water. Analysis of Crisp's Distemperte proved the preparation to be made up largely of kerosene oil, spirit of turpentine, and pine tar. Government chemists found Crisp's Hot Shot Running Fit Remedy to contain considerable amounts of spirit of turpentine, petroleum oil, tarry material, water, and milk of magnesia.

"Some of the leading veterinarians of the United States testified at this trial," said Mr. Campbell, "and it was their opinion that there is no drug nor combination of drugs known to veterinary science which can truthfully be offered as a treatment for distemper. The same holds true for blacktongue, save that feeding substances which supply a satisfactory dosage of vitamin G may prevent the disease or cure it in the early stages. When shipped interstate, dog medicines, accompanied by labels or circulars in which the products are described as effective treatments for ailments now considered incurable by the use of drugs, or in which appear statements going beyond what may be properly promised for the products, violate the Federal Food and Drugs Act. Such products are subject to seizure and such misbranding renders shippers liable to prosecution under the law."

Courts Disagree on Film Copyrights

THE Federal Courts for the Districts of Massachusetts and Maryland have recently handed down contrary decisions on the question of whether an unauthorized exhibition of a copyrighted motion picture film constitutes an infringement of the copyright, reports *The United States Daily*.

Judge Morton, of Massachusetts, concluded that provisions of the copyright statutes, either expressly or by implication, do not give to the owner of a copyrighted film a right of action for infringement based on the unauthorized showing of the film.

Judge Coleman, of Maryland, decided that the general provisions of Section 1 of the Copyright Act were applicable to a situation where a film is exhibited without authority, on the ground that a motion picture photoplay is a "dramatic work" within the meaning of that term as used in the statute.

"Cine-Tone" Refused Registration

IN the case of Powers Cinephone Equipment Corporation *versus* The De Vry Corporation, First Assistant Commissioner Kinnan held that The De Vry Corporation, of Chicago, Illinois, is not entitled to register, as a trademark for "unitary apparatus for synchronous reproduction of light and sound effects," the notation "Cine-Tone," in view of the prior adoption and use by the Powers Cinephone Equipment Corporation, of New York, New York, of the term "Cinephone" as a trademark for talking motion picture films.

The First Assistant Commissioner said:

"It is clear enough that the films employed by the opposer and upon which it uses its mark are to be used in connection with the general class of apparatus upon which the applicant applies its mark. It is considered, especially in view of the recent holdings of the Court of Customs and Patent Appeals relied upon by the opposer, that the goods belong to the same class within the meaning of the trademark statutes.

"The marks are deemed confusingly similar. They are spelled somewhat alike, sound somewhat alike, and have the same general significance. The applicant, it would clearly appear, should have selected a mark, since it had an unlimited field from which to make its choice, which is not so nearly like that of the opposer."

Books SELECTED BY THE EDITORS

THE NAVIGATION OF THE AIR, AND METEOROLOGY

By Capt. Leslie S. Potter

THE most complete text on the subject now available. From elementary principles—use of instruments, reading maps, and so on—to detailed exposition of how to plot courses, allow for variation and deviation due to weather or instruments, all the practical considerations are given for cross-country or night flying. There is also an entire section on navigation by radio and another on meteorology and weather forecasting. Because of its completeness and up-to-dateness it is an ideal reference also for older pilots.—$4.20 postpaid.

AERIAL AND MARINE NAVIGATION TABLES

By John E. Gingrich, Lieut. U. S. Navy

TABLES for the use of the aviator, practical navigator, and yachtsman in solving the line of position problem with the use of only simple computation. When used with the Nautical Almanac no other books are necessary for navigation purposes. The tables can be used with either sea horizon or bubble sextant, and are carefully designed for simplicity and accuracy, and ease and rapidity of use.—$2.65 postpaid.

AIR TRANSPORT OPERATION

By Wesley L. Smith, Ch. Eng. "N.A.T."

A THOROUGH analytic study and a practical handbook of commercial aviation. Every aspect of the work—the whole physical system, from airways to instruments, and the procedure of operation—is covered in detail from two angles; (1) What has already been accomplished, what must yet be done and probable avenues of future development in lowering costs and establishing safety and efficiency; and (2) The relative advantages of various types of the several parts of the system and their operation and maintenance in practical use. —$4.20 postpaid.

WINGS OF TOMORROW

By Juan de la Cierva and Don Rose

THIS story of the Autogiro related in an easy conversational style by its inventor, carries the reader through the various stages of the development of this fundamentally safe aircraft from the days of the first "ugly ducklings" to the present when it is proclaimed by many as "the aircraft of the future." "Wings of Tomorrow" tells in simple terms of the development of the flight theory of the "flying windmill," of the early experiments with it, and of how the modern, efficient offspring works. It contains a wealth of human interest anecdotes relating to the inventor's persistence in the face of difficulties and will therefore interest the merest dabbler in aviation as well as serve as a reference for the more advanced student.—$2.65 postpaid.—*F. D. McH.*

A TEXT-BOOK OF PHYSICS

By L. B. Spinney, Prof. Phys. Iowa State College

THIS is an introductory physics and is in wide use in colleges. It is not so well adapted to the average outside student or reader as certain others, being less explanatory and somewhat more mathematical. For those who like the latter kind of work, this is the book. —$3.90 postpaid.—*A. G. I.*

MECHANISM

By R. McA. Keown. Revised by V. M. Faires, Prof. Mech. Eng., Texas Agric. and Mech. College

THIS work fits right in with Jones' "Ingenious Mechanisms" for it gives the sound and simpler elements upon which the latter is built. Cams, centros, linear and angular velocity, gearing of all kinds including trains, intermittent motions, and an appendix giving gear-tooth construction, adequately cover the fundamentals. An up-to-date revision of a standard text in the field for a long period of years and a reference essential for designers or inventors.—$2.65 postpaid.

BRIDGE ENGINEERING

By F. O. Dufour and C. P. Schautz

ESPECIALLY adapted for home study, utmost care has been used to keep the treatment within the range of common understanding for the beginner and self taught practical man. For this reason it also makes a quick, ready reference for the technically trained man who is brushing up generally or who desires to clear up some rusty point in his memory—as we all have occasion to do from time to time. The first author is well known for his technical knowledge as evinced in previous works, and the second is Asst. Engr. of Bridges, Penna. R. R.—$3.20 postpaid.

RADIO ENCYCLOPEDIA

Edited by S. Gernsback

FROM "'A' Battery" through to "Zones, Radio Licensing," this large volume, (9 by 12 inches), bound in loose leaf form with flexible covers, provides the traditional mine of information on all things radio. Replete with circuits, explanatory diagrams of all kinds, and half tones, it deals with the various phases of radio in a manner that has been kept as non-technical as is consistent with clarity and accuracy. Appendices give call letters, vacuum tube socket charts for standard sets, and a radio set table listing data on all receivers. This second edition has been revised and brought up-to-date in every respect, and is a book that should find a ready welcome in the hands of everyone who is at all interested in radio.—$4.20 postpaid.—*A. P. P.*

RADIO RECEIVING TUBES

By James A. Moyer, Director, and John F. Wostrel, Instr. Radio Engr., Univ. Extension, Mass. Dept. Education

ESSENTIAL principles underlying the operation of vacuum tubes are explained in as nontechnical a manner as is consistent with accuracy. The construction, action, reactivation, testing, and use of vacuum tubes is covered as well as specifications for vacuum tubes and applications for distant control of industrial processes and precision measurements. This revision covers latest improvements in types of tubes and new devices for utilizing radio receiving tubes.—$2.65 postpaid.

CINEMATIC DESIGN

By Leonard Hacker

ADDRESSED to the serious minded amateur motion-picture photographer, this volume deals with the modernistic and artistic side of cinematography, stressing the esthetic and depreciating the realistic. Essentially it is a handbook which strives to lead the amateur

through form, rhythm, and color, to a series of typical scenarios designed to stimulate the imagination to a point where originality will take charge. "Cinematic Design" may prove a boon to those artistic souls who feel that they have exhausted the possibilities of their movies cameras on children, friends, and relatives, and who will welcome a new source of expression via the screen. —$2.65 postpaid.—*A. P. P.*

MAKERS OF CHEMISTRY

By Eric John Holmyard

THIS is an out-and-out history of the science of chemistry, from the earliest times to our own age, intended for the average intelligent non-specializing reader. It is not technical on the one hand, nor a light-weight, sugar-coated story book on the other, but a good straightforward survey written without frills, but equally without the deadly droning style of some books we have seen. It is neatly produced, is especially well illustrated from the point of view of interest, and contains 302 text pages. —$2.65 postpaid.—*A. G. I.*

NEW DISCOVERIES RELATING TO THE ANTIQUITY OF MAN

By Sir Arthur Keith, Prof. Royal College of Surgeons

SINCE the author's famous work "The Antiquity of Man" was last revised in 1925 a remarkably large number of important finds of ancient man have been made. The present volume brings the subject down to date, including detailed discussions of the Taungs skull (*Australopithecus*), the Springbok skull, the Galilee (Neandertal type) skull, Peking man, the Ehringsdorf find, the new Neandertal finds in Spain, Italy, and Russia, the great Moravian discoveries, the London skull of high antiquity, the puzzling Neandertaloid skull from Greenland, and others. Sir Arthur Keith is known not only as a brilliant scientist but as an equally brilliant writer. His books drive the sandman away. All who are interested in our rapidly expanding view of ancient man should possess a copy of this outstanding work.—$5.20 postpaid.—*A. G. I.*

THE STORY OF SCIENCE

By David Dietz

WITHIN its two covers this book contains in readable yet thoroughly reliable form about all the science the average adult individual is likely to want to absorb. In plan this work covers systematically almost as much ground as a textbook—or rather four textbooks, since it deals, seriatim, with astronomy, geology, physics, and biology—but it has none of the stereotyped earmarks of the textbook, being written in simple language. Its author has had plenty of experience in writing entertainingly about science and knows the mind of the average reader. As the four sciences treated represent the bulk of modern science the reader who carries away the contents of this book may consider that he has a pretty good amateur background in general science.—$3.65 postpaid.—*A. G. I.*

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By Pupin, Huxley, Thomson, Haldane, Eddington; also Dean Inge and several other divines

WHETHER the reader favors the rather recent trend in which science and religion appear to have made peace, or whether on the other hand he is in agreement with Professor Pearl who regards much of this trend in the light of a "sickly mysticism now emitted in such great volume by eminent physicists," this small book (172 pages) will set him thinking and possibly stir him up. It is not, however, disputatious in tone but quite the reverse, the warfare of science being mainly with theology, not religion as such. Thinkers who like to keep up with philosophic matters should read these collected essays by eminent men.—$1.90 postpaid. —*A. G. I.*

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By F. R. Moulton

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PLANT LIFE THROUGH THE AGES

By A. C. Seward, F. R. S., Prof. Botany, Cambridge Univ.

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FACTS AND FETISHES IN ADVERTISING

By E. T. Gundlach

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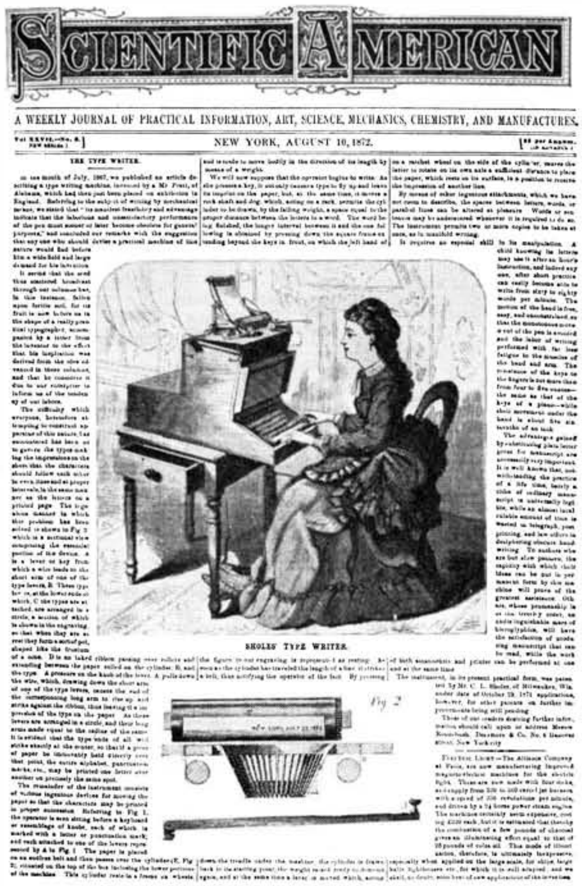

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