Are Nordics Superior?

By MALCOLM H. BISSELL

SCIENTIFIC AMERICAN

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Air Transport Becomes Luxurious (See page 264)

Scientific American's

AMATEUR TELESCOPE MAKING

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TO PRESENT OWNERS OF "AMATEUR TELESCOPE MAKING":

THE new edition contains what was in the old, plus the following: A new ten-chapter part entitled "Contributions by Advanced Amateurs," which contains the Hindle monograph (Cassegrainian and Gregorian), and chapters on flotation systems for larger sized mirrors; flat making; solar spectroscope making; celestial photography; accuracy in parabolizing; new Ronchi test (clearly explained); new test for Gregorians; simple clock drive. In Part IX, Dr. Hale's instructions for making a solar observatory (spectroheliograph) have been included. The Miscellany has been greatly extended by notes both short and long, based on actual difficulties reported by workers—especially on lap making and silvering. The new detailed instructions and digest of scattered literature on silvering represent an attempt to cover all of the fine details of the process and anticipate all of the pitfalls, and are the longest ever published anywhere. Other notes cover: the diffraction ring tests (long); slit test; test for strain (polarized light); new strokes in grinding; whipping pits; Hindle's method of testing at zonal foci; calculating size of diagonal; conic sections; binocular telescopes; turret telescopes; eyepieces; finders—these are only a few. Many new drawings by Porter, and selected photographs of telescopes already made, are included. Errata in earlier editions corrected. New book lists, new materials list, new directory, 496 pages, but the price remains the same three dollars. Keep up with the advances in the art—Possess this new edition!

"AMATEUR TELESCOPE MAKING"

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EIGHTY-NINTH YEAR • ORSON D. MUNN, Editor

CONTENTS · DECEMBER · 1933

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

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ACROSS THE EDITOR'S DESK

"THEY are making ice cream by the mile now, instead of by the gallon. Revolutionary changes have succeeded in making an exact science of the manufacture of America's favorite dessert, instead of merely an art with all the vagaries to which an art is subject." This is the opening of an interesting and informative story by Milton Wright, which is scheduled to appear in our January number. Mr. Wright goes on to describe not only the manufacture of ice cream by this new method but also to tell something of the inventor of the system and of his method of procedure in developing a large industry around his invention after it had been reduced to practice.

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"Mortar test pieces to which have been added from five to six pounds of sugar to each hundred pounds of lime have shown an increase of tensile strength up to 60 percent. . . . The increase in the strength of mortar has been interpreted by specialists as meaning that stronger buildings . . . are possible with the general acceptance by the building trades of the sugar-sand-lime formulas which will be recommended upon the completion of the Institute's work." This reference is abstracted from an article now ready for publication, in which are described many of the industrial applications of sugar, and of the possibilities that appear in the research work which is now being conducted at Mellon Institute.

●

Rare patience combined with a thorough knowledge of motion picture technique has enabled Stacy Woodard to obtain photographic records of amazing battles between inhabitants of the insect world. Trapdoor spider *vs.* cricket; centipede *vs.* sand cricket; cricket *vs.* cricket; wasp *vs.* cricket; and scorpion *vs.* scorpion are some of the battles which Mr. Woodard has watched and photographed, and in some cases has purposely staged before the lens of his camera. We have been fortunate in obtaining from Mr. Woodard a series of unusual photographs showing some of the stages in these battles to the death. These photographs will be reproduced in our next issue, together with an article prepared by Mr. Woodard.

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For a generation one of the man-made wonders of Egypt has been the Assouan Dam, located 550 miles south of Cairo. On page 258 of this issue is an article by Hamilton M. Wright, telling of the huge water storage projects now under way in Egypt and mentioning the Assouan Dam. Mr. Wright has also prepared for us another article which deals with the dam in particular, and relates how some unusual engineering problems were recently met and solved while raising the height of the dam for the second time since it was originally completed. Mr. Wright is particularly competent to write on the subject of engineering in Egypt, as he has spent much time and study at the site of the projects. His second article will appear next month.

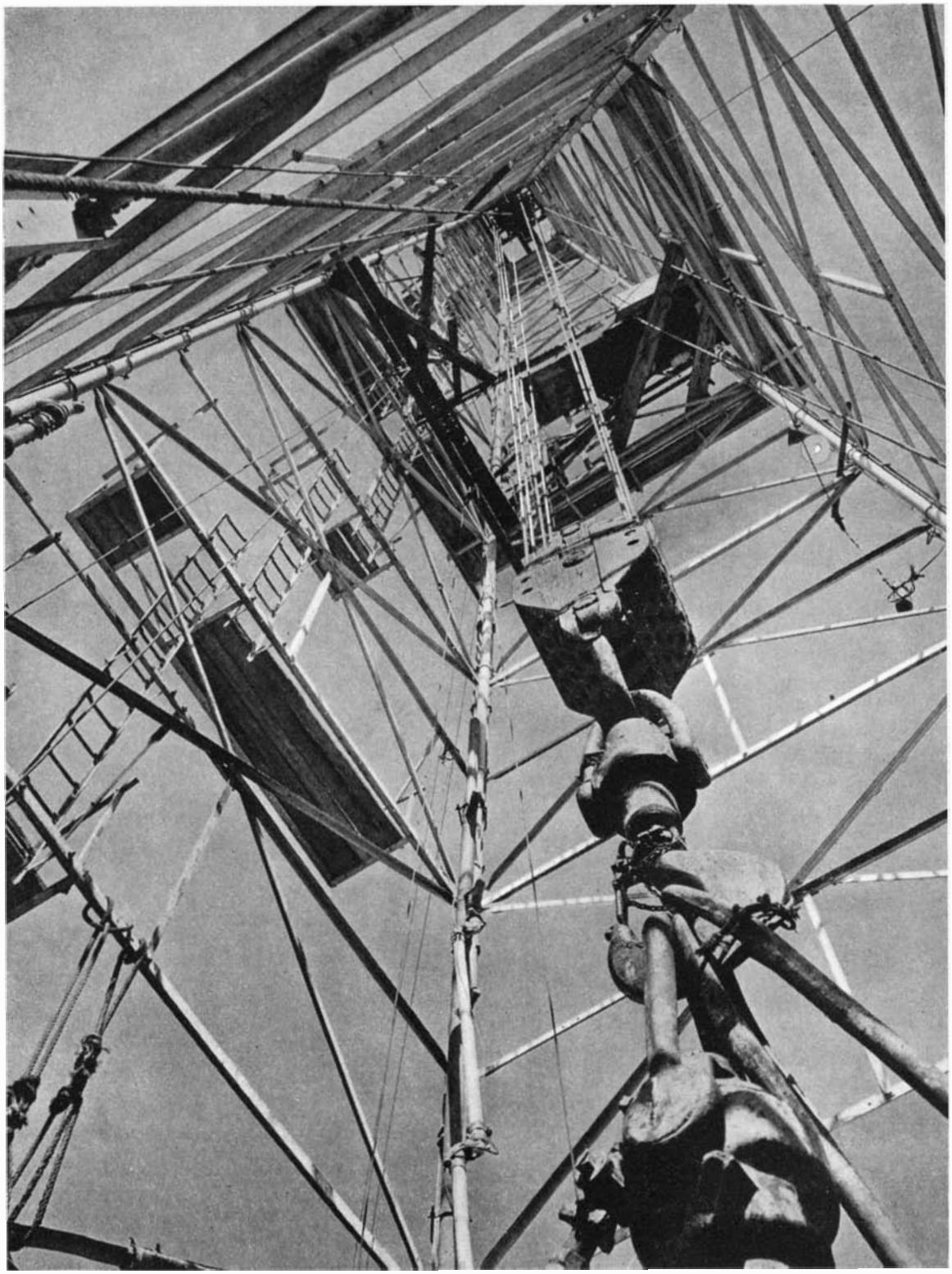
●

Hardly a day passes but that newspapers make mention, in some way or other, of battle cruisers and of the arguments pro and con regarding the building of these ships which are so vital to national defense. Just what constitutes a cruiser, and what are the various divisions into which certain types of cruisers fall? We have ready for publication an article entitled "The Development of the Modern Cruiser," by Henry E. Rossell, Commander (C.C.), U.S.N. The reader who has not had the time nor the desire to delve deeply into the subject of naval cruisers will find that this article presents the essential facts and will give him a background that will be invaluable in following the international discussions which will inevitably continue for some time to come.

●

"What It Means to Be Lazy" is the title of an intriguing article prepared for us by Dr. Donald A. Laird. In this article, to be published next month, Dr. Laird looks at the subject of human laziness from the point of view of a psychologist. William Makepeace Thackeray was called lazy by his schoolfellows. Montaigne, the French essayist, was lazy and languorous at 17. And so on, through history and modern times, it can be pointed out that certain people who have achieved prominence in their own lines of endeavor have at some time or other been characterized as lazy. Just what constitutes laziness? Is it a wholly undesirable characteristic, and can it be cured? There is one main factor that governs indolence and laziness in the average person. What this factor is will be found in Dr. Laird's article.

Editor and Publisher



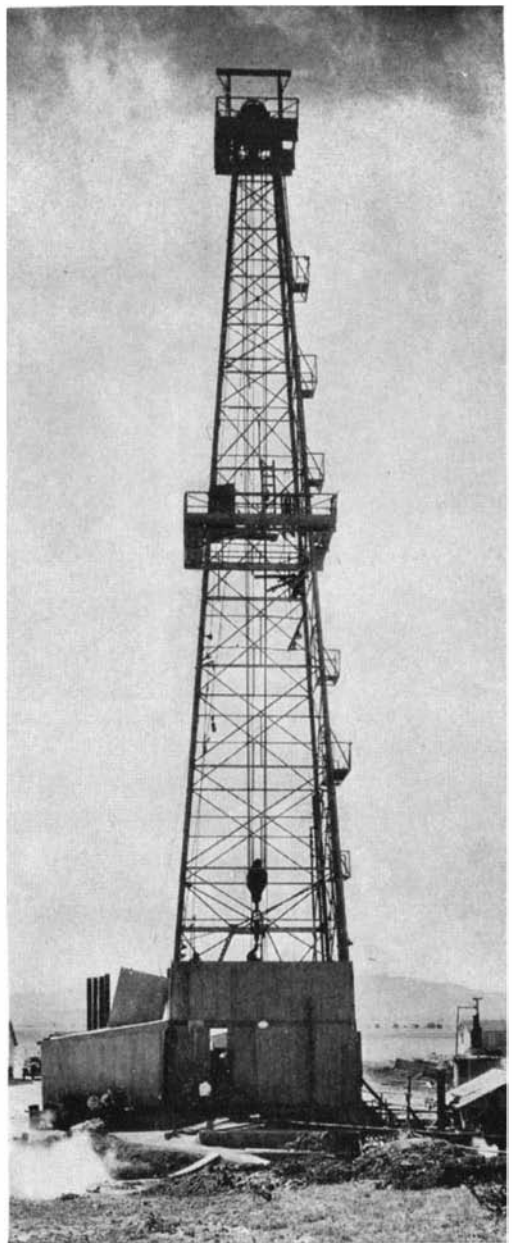
ALOFT FROM THE DEEPEST HOLE

LOOKING straight up inside the steel derrick of the world's deepest well—Lillis-Welch No. 1—in the famous Kettleman Hills district, about half way between San Francisco and Los Angeles, California. How infinitely exacting a task is that of drilling a very deep well—a task which demands the very utmost pains and care lest little slips and errors be the cause of big troubles—will be gathered from the vivid account which opens on the opposite page. Drilling to ordinary depths requires ordinary skill but, as the depth increases, the chances of failure are increased disproportionately.

Black Gold— Three Miles Down?

By ANDREW R. BOONE

THERE are two methods of drilling wells, the percussion method and the hydraulic rotary system. In the former, which is the older, a long, heavy, solid iron tool is churned up and down in the hole and its lower end, which bears a blunt chisel edge, actually fragments the rock by means of blows. In the newer system a drill bit rotates continuously on the bottom of the hole like any ordinary drill, being turned by means of a long string of pipe (which is used, incidentally, to pass liquids down and thus bring cuttings up). Power to rotate this pipe is transmitted to it through a square rod which permits vertical adjustment during work. This is shown in the photograph at the top of page 254.—*The Editor.*



All photographs by the Inman Co.

Lillis-Welch Well No. 1, at Kettleman Hills, towers like a lone sentinel above the desert

DRILLING an oil well to a depth of over 11,000 feet, as has recently been done on the edge of California's famous Kettleman Hills, whose large producing wells give promise of great fortunes to come, gives rise to three pertinent questions: Will it prove possible to go still deeper and reach a depth of three miles? What are the problems of such deep drilling? Will those who risk their fortunes find oil in those superheated subterranean rocks?

THESE are not idle questions. Already men are planning to probe deeper into the world's geological past with cutting bits and coring tools. Mr. Ed. McAdams, responsible for drilling the Lillis-Welch Well No. 1, approximately two miles from the nearest production on the north slope of Kettleman, plans to extend this well to 11,500 feet before ceasing to explore. With certain changes in equipment, Mr. McAdams believes he could go to 12,500 feet. I have heard other oil men discuss the possibilities of extending their operations down to the three-mile limit. They think they can reach this distant horizon, but that few operators will attempt to go so deep until the present visible supply of oil dwindles to the point where rising prices will justify the high cost.

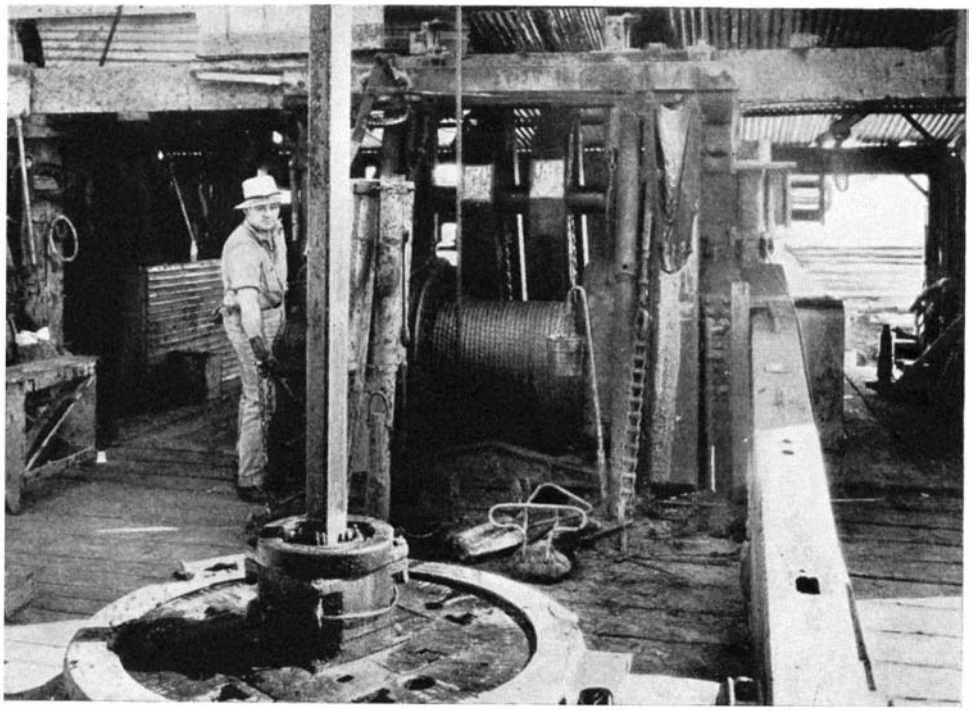
Mr. McAdams, in considering deeper drilling, looks on the subject with considerable modesty. Having achieved a record depth, he plans to pursue the present investigation to 11,500 feet. With a larger drum spool, steel cable 1¼ (instead of the present 1⅛) inches in diameter, a four-foot traveling block and a larger steam engine, he believes he can extend the operation to 12,500 feet. "Yet," he told me, "even with such equipment, mechanical failures probably would cause us to lose one hole in five." Even the fifth well should not be lost, he added, if drilling is undertaken by men of sufficient capital to drill past jammed tools or fish them out, as the case might be.

The cost? He spent 251,000 dollars to break the old record, and will sink another 100,000 dollars into the Kettleman hole before calling it a day. That sum, he believes, would represent the average cost of deep drilling, not including the lost fifth hole.

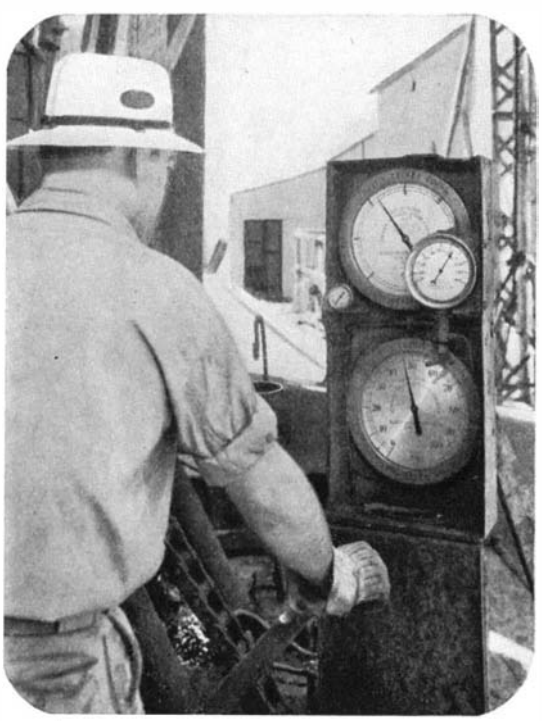
Less than a single decade ago, men declared it impossible to bore two miles down through clay, boulders, shells, shale, sand, and rock: the drill pipe would separate of its own weight or twist off. But the pipe, except in rare instances, has not pulled apart; nor does it twist off as steam turns that finger-like, writhing column that follows the turns of the hole to the bottom.

When I discussed deep drilling with Mr. McAdams I expected to be immersed in figures dwelling upon heavier and stronger materials, greater power, higher pressures. True, change in these directions necessarily follows. But the one outstanding fact which surprised me was this: Not stronger materials alone, but principally confidence among the drilling crew, makes possible boring to such depths.

The problem is, therefore, in a large measure, psychological. When the bit reached 6000 feet, Mr. McAdams called the crew together and said, "Boys, we're going very deep. From now on we will rehearse every movement before we at-



The drilling table and drill pipe attached to it rotate at 100 revolutions per minute



These dials indicate weight of suspended pipe, measure mud flow, and note the steam pressure

tack it. Before we reach 11,000 feet, we will have run the pipe out of and into the hole possibly a thousand times. We shall have difficulties; many things can happen. Take your time, work cautiously, practice every move."

Before the present depth was reached, this gang of workmen was pulling out of that hole a string of pipe weighing nearly 120 tons. A misstep or careless movement might break the line somewhere down below and bring about costly delay. Of course, troubles arose. They're expected in these deep holes. Potential troubles are, in fact, a potent reason why few men undertake what Mr. McAdams has accomplished.

Mr. McAdams said other things to his crew. He told them to think in terms of an 8000-foot hole. All of them had drilled to that depth before. When they reached 8000, they were to continue on, just as though they were performing a very commonplace task, except that they should take great care. This they did, in consequence of which Mr. McAdams reports that they found drilling no more difficult below 10,000 feet than a half-mile higher up.

During more than one third of the time the bit was on bottom and was drilling—a record in itself, especially when you consider that at 10,500 feet five hours were required to pull out the drill pipe, change the bit and run it in again. In the hard formations below 9000 feet frequent changes were necessary. Yet, by using superheated steam, soft water in the boilers, a drilling fluid (for lubrication) which was heavier than the customary mud, and by using reamers to keep the hole straight, they attacked the problem with success.

During a year of drilling 158 bits were used, starting with a great borer measuring 25 inches in diameter and finishing the task with one hardly larger than your clenched fist. Until the two-mile mark was reached ordinary mud from nearby surface clay sources was circulated down the drill pipe and up between that pipe and the outside casing, 45 gallons every minute being forced down under great pressure. Four hours later, it returned to the surface.

Then the crew discovered that cuttings of shale, two inches long and as thick as your finger, were not being brought up satisfactorily by this means. The conventional mud was then abandoned and a heavier artificial mixture containing iron oxide was poured in, which quickly solved the problem of drawing these hard chunks two miles straight up to sunlight. This change, simple as it may sound, tends to establish the limits and capacity of mud in deep drilling, and may point toward another important aid in pushing the horizon down another mile.

Rotary drilling would not be possible at these depths were there no lubricant standing in the well. Mud at once makes possible rapid drilling and, because of the very same fact, it sometimes is an innocent contributor to the drilling of a crooked hole. Crooked holes cause slow drilling, frequent "fishing" jobs, failure in correlation between walls (apparent when you consider that some deep holes wander 7500 feet off from vertical), mudding up of producers, and sometimes loss of the hole.

TO avoid these possibilities, as Mr. L. M. Spencer, Southern California Gas Company geologist, points out, operators use long heavy drill collars immediately above the bit and, by placing a reasonable amount of weight on the bit, they prevent buckling of the drill pipe. Also, he has found, by using a high rotary speed the bit will cut a clean hole instead of corkscrewing its way through a formation.

Other problems, which sound difficult, are met comparatively easily:

"Pump pressures and volume are ordinarily sufficient to wash the hole clear of cuttings," Mr. Spencer points out. "Bits are kept sharp and true to gage. When reducing the hole size or piloting ahead with small tools the new hole is centered with a diamond point or a guided pilot bit. A high degree of accuracy is maintained in measuring the weight of the bit, and crooked drill pipe is discarded.

"In addition to these precautions it is customary to check the hole at frequent intervals by means of acid bottles or special angle-indicating-and-recording instruments. If the hole is found to be crooked, caused partly by rapid drill-

ing, it is usually plugged back and redrilled; or if the angle is small the hole may be straightened by slowly redrilling from the point of deviation, with a bit and long heavy drill collar. By using a slower speed, gravity will pull the bit down to the lower side of the hole. A whipstock, or wedge-shaped device, may be employed to divert the drill into a new direction."

Mr. McAdams, after one year of drilling, had dropped his string several hundred feet deeper than any previously had gone. The earlier record was held at 10,585 feet, by Jardin Well No. 1, owned by the Penn. Mex. Fuel Company, at Tuxpan, Mexico. Before Jardin No. 1 was completed, however, drillers had stumbled on a method of holding the drill fluid in check. No doubt it accounts in large measure for their success.

WHEN a string of drill pipe has been run in to a depth of 10,000 feet it represents a weight of about 120 tons. It hangs by the slender strands of steel cables running down from the steel tower. To relieve this great weight, which in time would stretch the pipe nearly 100 feet, a float valve near the bottom of the drill pipe enables the fluid to flow down and out, but never up, inside the drill stand. A pressure of 1400 pounds to the square inch at the pumps forces the thick stuff down, there to emerge from the perforated bit under a 150-pound pressure. Thus, the pipe tends to rest on a pillar of mud at the bottom of the hole; yet this relieves the weight only about one tenth, the rest being borne by the superstructure away up above.

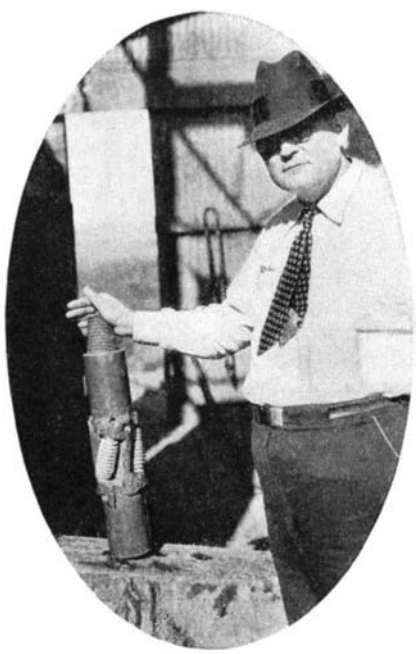
Heat often brings trouble, too. In Lillis-Welch Well No. 1, when a quart of nitroglycerine was being lowered to shoot the pipe, after circulation had been lost when the mud had cut the pipe in two, the great heat set off the explosive prematurely. Such was its force that it cut the drill pipe into three pieces. Yet it did not puncture the seven-inch casing surrounding it! Picture the difficulties of this type of work, trying to repair damage two miles distant, where the water attains a pressure of 4330 pounds to the square inch and the thermometer reaches 240 degrees Fahrenheit! Yet there are compensations: the pressure of the mud or water is sufficient to hold back the earth, and drilling continues without the necessity of lowering casing to guard the drill pipe.

But what happened when the mud cut the tool joint pin at 2500 feet, thus breaking the string of tools into two lengths, one standing on the bottom, the other suspended from the rig? Though the string was tight, since it broke while drilling, the lower segment, more than a mile and a half long, actually recoiled eight feet. When at last it was pulled from the hole, 6000 feet of pipe was found to be wavy from the recoil. This was easily straightened; in fact, bent pipe usually can be straightened unless it actually has "corkscrewed," when it is fit only for the junk man.

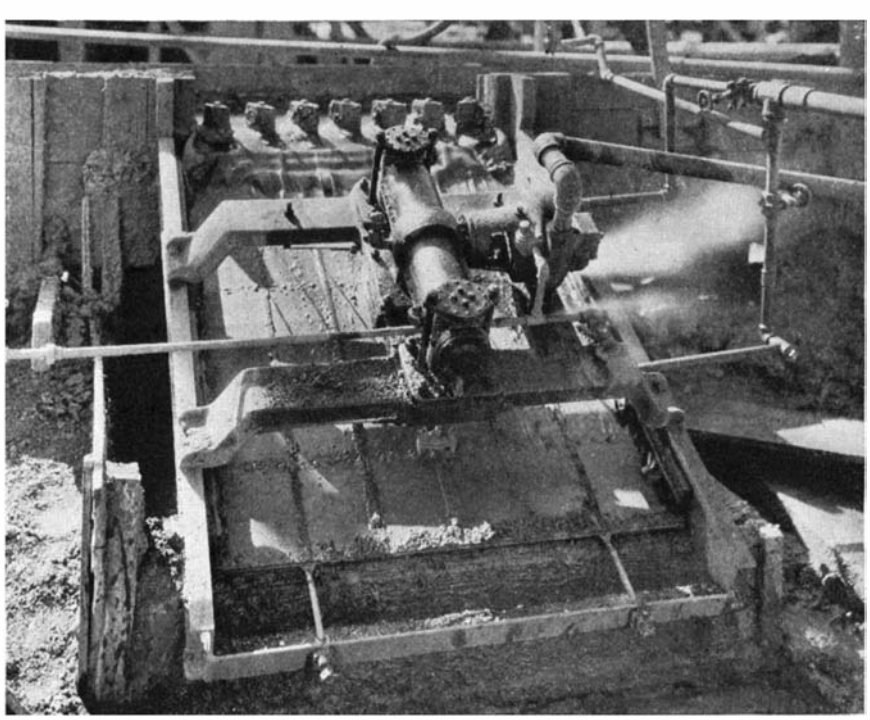
OF course, the backers of this very deep well were interested in finding oil, but they have done more. They have brought to light new information on deep beds that will be of great value to the oil industry in the future. For example, drilling commenced in the Tulare formation of the Pliocene group of strata—a yellow clay, interspersed with rocks. From this fresh water deposit, the bit pushed into marine blue shale at 680 feet, in which it continued for another 6000 feet, where it entered brown shale, of Upper Miocene age. At 8011 feet the tools struck the Temblor zone of the Miocene. This is the formation from which most of the Kettleman Hills production comes, but the bit went down to strike the tough Kreyenhagen shale, of Oligocene age, at 9570 feet, extending down to 10,825, where the bit encountered four feet of oil-bearing sand. At 10,922 the bit was boring through brown shale, and was immersed in oil sand at 10,944.

Already the tools have entered the Eocene—lower rocks of a still earlier epoch. Upper and Middle Cretaceous lie below. So little very deep drilling has been done in California, by which comparisons may be made, that the thickness of the Eocene and Cretaceous bodies cannot be estimated accurately. The important fact is this: the drill penetrated near the 11,000-foot level into oil sands in formations which produce oil elsewhere in California, but at higher levels. Possibly flush production will be encountered here in one of these, but at what depth no one can predict.

As for the future, deep drilling undoubtedly will be profitable only when each well is supported by large acreage, in order to guarantee production over a long period of time, and when a large body of oil-bearing sand is found, in order to provide a sufficient volume of the "black gold" to yield a commensurate return.



Mr. Ed. McAdams, who drilled the world's deepest hole, and reamer



As deep cuttings pour into the sluice box, after a two-mile trip from below, this mud screen casts them out and cleans the fluid for another trip down

A Raw Material of Many Uses

Whole Groups of New Products, and New Methods of Making Old Products Better, Are Being Built Around Purified Cellulose

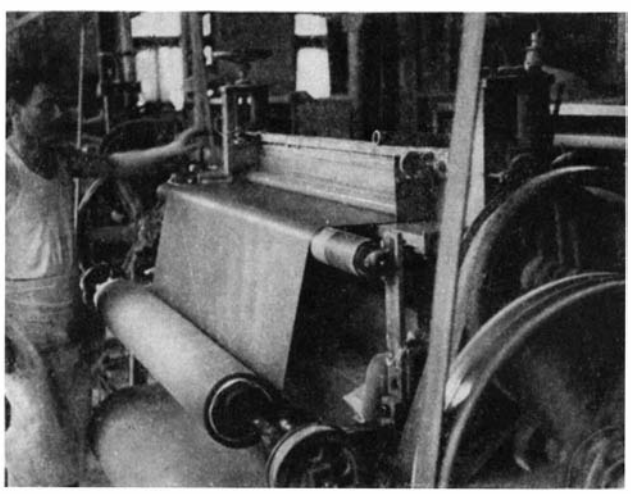
By A. P. PECK

SPRUCE forests of New England are yielding a new raw material that is going to be talked about with increasing frequency during the months to come. Research chemists have perfected a method of eliminating almost all of the organic matter which nature builds up around cellulose, and thus obtaining a basic material that can be worked into a multitude of products that are essential to the daily lives of all of us. Alpha cellulose, the technical name that has been applied to cellulose of more than 92 percent purity, is now commercially available under the generic name of solka. Already the influence of this new raw material is being felt in such widely separated fields as the shoe trade, the manufacture of roofing, paper making in all its branches, the weaving art, and the production of molded plastics.

The principal source of supply for the producer of highly purified cellulose is spruce wood although in the laboratory the same material may be obtained from any vegetable matter. In fact, cellulose is nature's own base for all vegetable matter and it is only a question of removing impurities in order to make available this highly desirable material. It is to this end that the research work of Brown Company, Portland, Maine, has been directed. By subjecting spruce wood pulp to the action of acids, washing baths, and bleaching solutions, they have found it possible to produce cellulose with a purity ranging from 92 percent upward. Held in suspension in water, for convenience in further steps, the fibers of cellulose range in size from one to one and a half millimeters.

There are two general forms in which solka is produced; namely, yarns and sheets, although in each division there are many sub-divisions determined by the physical properties of the cellulose.

In manufacturing the yarn, machinery has been designed to deal with the material which is so elusive in its physical characteristics that to produce a continuous thread from it seems almost impossible, but it is done. The cellulose fibers, after they have been suitably treated and thoroughly washed so as to remove all traces of chemicals and leave only the pure clean fibers, is formed into a continuous thread by means of a series of operations which might be likened to a cross between the spinning of cotton and the extrusion process used in the manufacture of rayon. The tiny cellulose fibers are lined up almost parallel and are formed into the yarn by taking advantage of a natural property of jelling. In this part of the process the yarn is given a slight twist which is, in a later step, carried still further according to the use for which the yarn is desired.



A roll of solka, the new purified cellulose of many uses, is fed into one end of this machine. From the other end comes a strip of tough, smooth shoe lining material

In producing solka in sheet form the water suspended fibers are felted and fed between revolving cylinders where the surplus water is removed and the material is pressed into sheet form.

Some of the characteristics that make solka such a desirable raw material to so many industries are: strength, high absorbency, low shrinkage, little stretch, smoothness in yarn, and uniformity of the final product. All of these characteristics may be readily controlled in the manufacturing process, and any one or another which may be desired can be brought out to the greatest extent. This is accomplished by regulating the purification process.

In the manufacture of shoes, alpha cellulose is finding important applications. Uppers, linings, counters, box toes, inner soles, all are being made from a solka base. A web of cellulose is impregnated with various chemical compounds, according to the use to which the final product is to be put, and the result is a uniform stock of high durability which can economically be handled in quantity production.

Roofing materials that are tough, moldable, and have highly desirable nail gripping qualities are made by felting solka fibers, thus interlocking them in a strong web. The resulting sheet is impregnated with an asphalt compound. Beautiful fabrics for clothes, upholstery, draperies, rugs, and tapestries can be woven directly from the new cellulose yarn or from mixtures of this material with wool, cotton, silk, or rayon. The high absorbency of the yarn and the fact that it is chemically inert, renders it particularly suitable for dyeing in any color. Since there can be no chemical reaction between the purified cellulose and the constituents of the dyes, it is possible to produce brilliant fast colors with a high degree of accuracy.

MANY types of artificial leathers and molded plastics are possibilities. Solka, for certain purposes produced in a powder-like form that will pass through a 200-mesh screen, makes a desirable base for such products. Here, again, the purity and inert qualities of the cellulose are a means to an end. The chemical compounds with which the cellulose is intimately mixed may be made in any desired color with the assurance that the presence of the cellulose will not in any way alter the coloration in brilliancy or strength.

The economic aspects of this cellulose appear to have many ramifications. It can hardly be considered as a substitute for anything that is now used, as it is entirely new and its possibilities are just being probed. Patient research in the chemical laboratory has made pure alpha cellulose possible; further work in both the laboratory and the field should rapidly uncover more and more practical uses for it.

OUR POINT OF VIEW

Elusive Television

"TELEVISION in the Home," "Television Now Available," "Talkies by Radio." A few years ago, newspaper and magazine articles carried titles such as these, but present-day press notices confine themselves almost entirely to brief mention of new developments in the television art, and the home entertainment side of the question seems to be conveniently forgotten. Why?

There are many phases to the answer to this simple question, involving both technical and legal aspects. True, thousands of experimental television receivers are in operation, but they are in the hands of enthusiasts who are content and in fact delighted with the merest glimmer of something that looks like a picture. The results that are obtained would not in many cases satisfy the critical observer who, not interested in the technical side but seeing television solely as a means of entertainment, has been educated by the perfection of theatrical and home movies and looks for comparable results in television.

We shall not discuss here the technical points of detail and field of view in television reception, as they have been adequately dealt with in this and other publications. Also, on page 273 of this number there is an article which goes into these phases of the subject for the reader who is sufficiently interested in television to be curious about the "why's and wherefore's."

One large corporation is stated to have ready for release a highly satisfactory television receiver for the home. It is said, however, that this same company is withholding it from the market for two main reasons. First, it will be high in price and, with the present state of business, the sale would be severely limited. Secondly, without adequate program facilities, even those of the public who would be willing and able to invest a few hundred dollars in a receiver would be loath to do so.

The blame for the dearth of satisfactory television transmitters may be laid directly at the door of the Federal Radio Commission. That body has ruled that advertising shall not be a part of any television program and that the latter shall be "for experimental purposes only." This kind of caution is commendable in that this action may prevent any repetition of the blasts of advertising that have done so much to degrade sound broadcasting. But, on the other hand, the restriction prevents the operation of self-supporting television transmitters, and without them, television receivers become only curiosities, depending for their programs on a few scattered stations operating on perfunctory schedules.

So we come to the conclusion that the television situation today is in the nature of a vicious circle. Receivers cannot be sold because there is no demand for them. The demand is limited not only because of cost but also because of the fact that there is little for the user of a receiver to see. There is little to see because television transmitters cost money to operate. Little money is forthcoming because television cannot be used for commercial purposes.

It is our opinion that if the Federal Radio Commission would loosen up the restrictions on television and make possible some form of limited commercial use, we would shortly see a rapid development and expansion of a desirable form of entertainment for the home.

Japan and Our Navy

"THE American naval program, though well within treaty limits, betrays the spirit of the London Treaty, since it encourages an armament race and renders future agreement difficult." This, from the liberal Osaka *Asahi*, is a sample, according to Hugh Byas, the keenly observant Tokyo correspondent of *The New York Times*, of the manner in which Japanese editors are interpreting a step we have recently taken in the interests of peace and unemployment relief. Other Japanese newspapers have made closely comparable statements. Why?

Again we speak for America! Japan has no cause to fear us; we seek only peace and security in the Pacific. Most of all, we emphatically do not wish to start a naval building competition, although we have the wealth to build 10 to 1 against Japan, and would if competition were our aim. We want the Japanese people to try to understand, however, that in entering into agreements for the limitation of naval armaments, we put all our cards on the table, made no mental reservations. We worked for such limitation for the sole purpose of cutting down world costs of fleets.

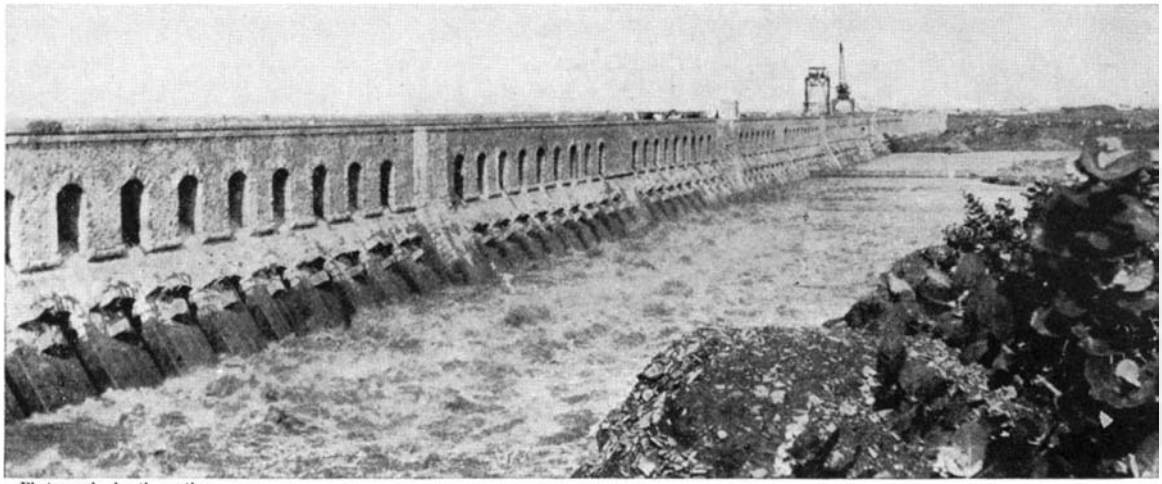
It is plainly to be seen that those Japanese newspapers which made the statements alluded to above are not to be lightly accused of Jingoism. It is something deeper, more sinister, which will, if continued, have a devastating effect on the good-will the Japanese people now have for America. Concurrent publication of the same "Hymn of Hate" by many newspapers exculpates their editors for it indicates "orders from above." The Military Party is responsible. That party, now controlling the destinies of Japan and anxious, it seems, to spill the blood of the nation futilely, having decided no longer to abide by treaties, draws a red herring across the trail leading to its own guilt by accusing others.

America counts as friends the great mass of Japanese people and it is to be hoped that they will understand America's motives and discount the suicidal Jingoism of the Military Party before irreparable harm has been done.

Duck Conservation

ONE of the outstanding examples of the effects of the encroachments of civilization on wild life is the case of the duck. Breeding grounds wiped out by the thousands of acres prevent the natural increase of the fowls in numbers sufficient to compensate for the mortality created by predators and hunters. The shooters themselves account for only a small percentage of the ducks killed, but they are the ones who are vitally interested in game conservation. They are now whole-heartedly behind the Duck Stamp Bill which is to be presented at the coming session of Congress, and which offers a means whereby the necessary funds for proper conservation measures may be raised. By taxing each duck hunter one dollar, it is estimated that a million dollars annually will be provided, three quarters of which is to be devoted to restoring breeding grounds and creating sanctuaries. The remainder of the money would be applied to administration and to research for better methods of conservation.

Thus the shooters would perpetuate their sport and would save for future generations one of our natural heritages which seems now to be headed toward extinction. Every right-thinking conservationist should stand firmly for the passage of the Duck Stamp Bill, numbers H. R. 5623 and S. 1658. Decreasing game bag limits and controlling shooting in other ways will not suffice. Natural breeding conditions that are favorable to the wild fowl must be provided, and the proposed Bill appears to be the only adequate solution to the problem.



Photographs by the author

A giant irrigation project in Anglo-Egyptian Sudan, the Sennar Dam across the Blue Nile

HARNESSING THE NILE

By HAMILTON M. WRIGHT

FROM time immemorial, Egypt has been entirely dependent for its cultivation on the Nile River, for there is in Egypt no other source of water. The valley of the Nile is bounded by an arid desert. Outside of a narrow belt near the Mediterranean there is almost no rainfall. Relying upon the periodical seasonal flood of the Nile, the ancient Egyptians, however, attained remarkably efficient results in irrigation by comparatively simple methods.

In prehistoric times, the Mediterranean shores extended as far south as Cairo, and the Mediterranean Sea occupied the area now known as the Delta of the Nile. As the Nile, in flood, brings down large quantities of silt from the Abyssinian highlands, the inundation of the Nile Valley has deposited silt to form the cultivated land of Egypt, gradually raising the valley floor and forming the delta of the Nile. This delta has existed in practically its present state since long before the earliest predynastic civilization in Egypt.

IT was the custom of the pharaohs to permit the water of the Nile to flow into large basins when the river rose in the annual flooding of the country. The basin system still prevails over about one quarter of the cultivated land of Egypt, being mainly confined to upper Egypt. In this system, the land is divided into compartments by banks, and these compartments, or basins, are filled with water by canals which supply water to the land as the river recedes.

The water remains upon the land for six or eight weeks and is then run back through escape channels to the river which, in the meantime, has fallen. The crops are then sown and receive no further water. Under the basin system in Egypt, about 1,200,000 feddans—a feddan is 1.04 acres—are cultivated.

It is only in modern times that Egypt has begun to store her surplus flood waters for use in irrigation when most needed, and so to do away with the "lean years" which are a part of Biblical traditions. In ancient times and until comparatively recent years any pronounced change in the normal supply of water, as in the case of either excessive floods or drought, was usually expressed in the ruin and misery of many. Today, the water in the Assouan Reservoir safeguards Egypt from years of even the lowest water supply.

The Egyptian Government is not only going ahead with vast engineering works to regulate the water supply scientifically but has completely envisaged a gigantic scheme for harnessing the entire Nile system. This includes the second heightening of the Assouan Dam, soon to be completed, as well as other reservoirs planned or constructed in Abyssinia, the Anglo-Egyptian Sudan, and central Africa.

At present the government of Egypt is seeking to adjust its irrigation developments to take care of the normal increase in population. The government is also seeking to stimulate industry so that the country will not be almost totally dependent upon agriculture.

Basin irrigation in Egypt has been to a large extent replaced by perennial, or year-'round, irrigation made possible by the construction of dams, barrages, and canals. The gross area under perennial irrigation in Egypt is about 4,000,000 feddans from which two, and sometimes three, crops a year are obtained. It is true that perennial irrigation existed under the pharaohs but upon a very small scale, being largely derived through the shaduf, or water wheel, propelled by oxen and also by human labor in raising the water from the river to small canals. Both these devices, familiar to every traveler, still exist and are useful in reaching isolated patches of land.

PERENNIAL irrigation was established in lower Egypt on a large scale by the great Mohammed Ali Pasha early in the 19th Century, beginning about 1820, when he dug a number of deep canals to contain water the year 'round, thus permitting the cultivation of cotton on a large scale. Then he started, in 1833, the great barrage located about 15 miles north of Cairo. This work, not completed until 1891, is really a series of four barrages, spanning the Damietta and Rosetta arms of the Nile, which raise the water level for the perennial distribution of water through the main delta canals. The other principal barrage area for perennial irrigation is located at Assiut, upstream from which is the head of the Ibrahimia Canal which feeds middle Egypt, including the Faiyum.

There is a third barrage at Esna used only for basin irrigation while a fourth at Nag Hamadi, also for basin irrigation, was completed several years ago.

The barrages, therefore, between Assouan and the sea are Esna, Nag Hamadi, Assiut, Delta Barrage (below Cairo), and Zifta on the Damietta branch of

the Nile, while projects for a barrage somewhere on the Rosetta branch of the Nile are being studied. The function of all these barrages is not to store water —although they do store some—but to raise the level of the Nile so that the water can be diverted by canals. Owing to the slight slope of the river and the large range between flood and low stage, it would be difficult without these barrages to keep the canals running at low water.

From February and March onward no water is allowed to escape to the sea. The sluices at the barrages are closed and earthen banks are built across the mouth of the Nile near the sea. These banks serve to keep salt sea water out of the river. During this low-water season, water is carefully regulated by the Assouan Dam and the Assiut, Delta, and Zifta Barrages.

WHEN the flood rises in July and August, it becomes necessary to cut down the embankments which have closed up the Nile from the ocean, since the flood supplies more water than the canals can carry and so water must escape to the sea.

The extension of perennial, or year-'round, irrigation to middle Egypt was rendered possible by the construction of the Assouan Dam, the present work on which I shall describe in a subsequent article. By its original construction, the Nile Valley south of Assouan for more than 200 miles was converted into a gigantic reservoir.

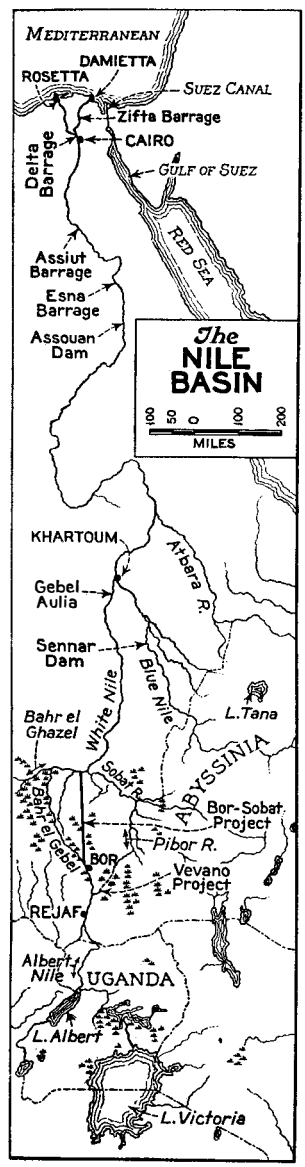
Supplementary to the Assouan Dam as sources of water supply for apportionment through Egypt, several other gigantic reservoirs are planned. One of these will be located at Lake Albert; another at Gebel Aulia, 30 miles south of Khartoum; while the great Sennar Dam constructed in the Blue Nile in 1926 and the proposed reservoir at Lake Tana, Abyssinia, will have important benefits in regulating the flow to Egypt.

The principal water supply of Egypt during the flood season—that is in August and September—comes from the Blue Nile, at Khartoum, which discharges 5700 cubic meters of water per second, or 70 percent of the total amount of water coming down to the Assouan Dam at that time. The White Nile discharges 800 cubic meters of water per second or 10 percent of the total, and the Atbara River which, like the Blue Nile, starts in Abyssinia, supplies 1700 cubic meters of water per second or 20 percent of the water going down to Assouan during the summer.

By the following April, the flow of the Blue Nile falls down to an average of 120 cubic meters per second, at Khartoum, while no flow at all is recorded for the Atbara during the months of January, February, March, April, and May. The White Nile at Khartoum has its maximum discharge in October, the average being 1400 cubic meters per second, falling to 540 cubic meters per second in April, at which time the White Nile contributes an average of 82 percent of the water supply going to Egypt.

The discharge of the White Nile is derived from two sources: the Sobat, rising in Abyssinia and flowing into the Nile almost 500 miles south of Khartoum, and the Bahr el Zeraf and Bahr el Gebel.

THE Sobat is the main tributary of the White Nile and supplies about one half of the total annual discharge of that river. It is at its maximum during the flood, or untimely season, hence to use the water to the best advantage it must be stored in a reservoir till the timely season. This is to be accomplished in the White Nile Valley by constructing a dam at Gebel Aulia. The White Nile Valley in this reach is pan-shaped and the longitudinal slope is small, hence the reservoir will be wide, long, and shallow. The White Nile water is free from silt and must be caught before it reaches the Blue Nile and gets mixed with the silty water of that river, as no reservoir on the Blue or main Nile can be safely operated till the flood is falling and the silt content is reduced to a point where there is no danger of the silt deposit choking the reservoir.



The Gebel Aulia Reservoir will be filled during July, August, and September, by water that would otherwise flow to the sea. It will stand full until early in January, the beginning of the timely season, and would then be emptied for irrigation in Egypt.

The dam will be about five kilometers long, of which about two kilometers will be of granite masonry and three kilometers a heavily protected earth bank with concrete core wall. The head on the dam will be small, not exceeding about seven meters, but the volume stored will be about 2500 million cubic meters of water, while the reservoir will be a lake about 300 kilometers long by an average of nearly five kilometers wide. It is hoped that the work will be finished by July, 1938, and Egypt receive the first benefits in the summer of 1939. The reservoir will drown a large part of the White Nile province. In preparation of this article, the writer visited the Gebel Aulia site in March of this year and found a large and substantial colony with hundreds of well built houses established for the forces to carry on the work.

Preliminary surveys for a reservoir have been made at Lake Albert which may be regarded as the effective source of the Nile for present irrigation purposes. Lake Albert has an area of 5300 square kilometers and lies partly in Uganda and partly in the Belgian Congo. The function of the reservoir to be created by the Lake Albert dam will be to store the rainfall of wet years for use in dry years, equalizing as far as possible the flow from Lake Albert. As the maximum range of levels that would have to be controlled by the Lake Albert Dam is 10 meters, the amount of controllable stored water in the reservoir would be over 50,000 million cubic meters, more than 10 times that behind the twice heightened Assouan Dam.

THE average outflow of Lake Albert along the Albert Nile is reckoned on a conservative estimate to be about 19,000 million cubic meters a year, and this is the amount that will in the future be discharged year by year, but not evenly throughout the year. As much water as possible will be allowed to flow out during the "timely" period, that period of the year when Egypt is short of water. The reservoir will be so controlled that in any year, the total flow will be equal to the mean annual flow.

The outstanding engineering problem of the whole Lake Albert project is the determination of the canal and river improvement work necessary to conduct the surplus rainfall to be stored in Lake Albert either through or around the obstructing masses of vegetation that fill the 400 miles of tropical swamps through which the Upper Nile flows after entering the plains of the Sudan and while on its way north to Egypt. The amount of water lost in these

swamps by evaporation, and by transpiration from the vegetation, has been computed as approximately twice that which would be evaporated from the surface of a clear lake of equal area, or about 13,000 million cubic meters. But not all of this water comes from Lake Albert. Much of it, in fact, enters the Albert Nile after it leaves the lake. But the rivers supplying it are torrential in character and do not constitute so dependable a source as the water to be stored in the lake which can be used when it is needed for irrigation in Egypt.

As all water beyond a certain fixed limit, coming down the White Nile from the watershed in central Africa, is lost in the swamps, the White Nile must be dredged to a deeper channel for delivering more water, and new artificial banks must be created so that the surplus will not escape, or there will be the alternative gigantic problems of digging canals and improving existing river beds that run parallel to the Nile and combining them in a new channel to conduct the flow around the swamps.

Which of the various alternatives will be most practicable and least expensive can only be determined by further research. The actual building of the dam at Lake Albert will not be tremendously expensive and is not likely to cost more than 8,000,000 to 10,000,000 dollars.

But to solve the problem caused by the escape of the Nile flow into the morasses may require the excavation of 100,000,000 to 300,000,000 cubic meters of earth. It may bring the total cost of the Lake Albert project up to from 120,000,000 to 150,000,000 dollars. In fact, estimates of the cost at this time are largely conjectural. It may take from 25 to 50 years to complete. The cost must be borne jointly by the landowners and the government, and distributed over a long period of time. The result of this and the other projects undertaken by the government is expected to more than double the amount of land under perennial cultivation in Egypt. In so arid a country, dependent to such a large extent on agriculture, this increase of tillable land represents a very important item.

THE problem of the Upper Nile is a dual one; it must either be canalized through or trained around the swamps which it encounters about 120 miles north of Rejaf and which continue for almost 400 miles to its junction with the Bahr el Ghazel. The river is, in fact, a deep channel cut through a very shallow lake which is entirely covered by dense vegetation consisting of papyrus, elephant grass, ambatch, and other growths. Generally speaking, of the water that enters this lake, only about one half leaves it. The rest is lost, as already explained, by evaporation from the water surface and transpiration from the vegetation. At some seasons when the flow of the Nile is small, naturally a higher proportion of water passes through the sudd and may be used for irrigation, but as the levels rise an increasingly high proportion is lost, and above a certain limit practically all of the flood water is lost.

The problem of remodeling the main Nile River by dredging and embanking through several hundred miles of sudd-filled swamps presents tremendous difficulties to the engineers.

Depth of alluvial deposits along the Nile, south of Luxor, as the river flood receded in March, 1933

One of the Sudd Projects under study is to divert a part of the flow of the Bahr el Gebel around the sudd by a new cut to the Pibor River, and let the diverted water flow in spring and early summer along the nearly empty channels of the Pibor and Sobat Rivers to the White Nile. This is known as the Vevano Project.

Another Sudd Project proposes to make a straight-cut new canal from the neighbourhood of Bor to the White Nile near the Sobat mouth. Variations of this scheme propose the partial remodeling of the Bahr el Zeraf; deviations to the west from the straight Bor-Sobat line to facilitate communication during construction; and placing the head works at sites more suitable than Bor. The studies for this scheme are not so far advanced as those for the Vevano Project. Both the Vevano and Bor-Sobat Projects will in all probability necessitate, at any rate in the later stages, the construction of a barrage on the Bahr el Gebel in the neighborhood of Bor, a work that would cost from 9,000,000 to 12,500,000 dollars.

The third group of Sudd Projects would probably not need such a barrage, as it proposes simply to remodel the Bahr el Gebel and the Bahr el Zeraf by dredging and embanking.

Each group of projects has certain advantages and the choice between them will eventually be a most difficult problem. Whichever is adopted, the first step is hardly likely to involve less excavation than about 100,000,000 cubic meters and should add about 2000 million cubic meters of water per annum to the White Nile, near the mouth of the Sobat, in the timely period. The final stage is not likely to be able to increase this to more than about 4000 to 5000 million cubic meters of water.

The advantage of the Albert Reservoir is that the discharge of the Bahr el Gebel will be steady and the same every year during the timely period, except perhaps after a long series of low years when it may have to be reduced by a known amount for a year or two. The advantage of knowing what water there is going to be is great from the point of view of the cultivator and this advantage will be well worth the eventual cost.

When the works hitherto described have been completed, the conditions of flow pertaining in the Nile below Khartoum will be very nearly ideal from the point of view of the irrigation engineer. The irrigation year in Egypt may be considered as beginning in February, after the annual closure of canals in January for clearance purposes. Water takes about 20 days (in winter) to flow from Khartoum to Assouan, so that in January the Irrigation Service has to decide what water to release for agriculture. The position will be that the flow of the Blue Nile and Bahr el Gebel is determined by the Lake Tana and Lake Albert Reservoirs, which are full, and the natural flow which the engineer can estimate with fair exactitude at that season.

THE first symptoms of the next flood are usually visible some time in April, but its exact arrival is unpredictable in incidence and magnitude. A safe assumption must, therefore, be made, so that if it is low and late, the reservoirs will not have been exhausted, and if it is early and large, there will not be great excesses of expensive but unwanted stored waters. This forecasting of water supply is the most difficult and responsible of the engineer's functions and mistakes may cause heavy loss of crops. To facilitate his duties there is the large reservoir at Assouan, the beginning of Egypt proper, about 550 miles south of Cairo. This reservoir will do its share in storing water during flood for use in the following spring, but as soon as it empties, a large part of the water from the southern reservoirs will be passed on to it so that if there are early signs of a good flood, it can be released for agriculture, with the prospect that before it is exhausted the river will have begun to rise.

How an Archeologist Works

By T. LESLIE SHEAR
Professor of Classical Archeology and Art, Princeton University

THE excavation of the Agora in Athens, which is being conducted by the American School of Classical Studies at Athens, presents many problems because of the extent of the area and because of its location in the heart of a great modern city. The American concession covers 16 acres of ground on which 367 houses are located. Although the general boundaries of the ancient Agora are approximately known from references in classical literature, no landmark existed in the area as a clue to the spot where the new excavations might be most advantageously begun, and no trials could be made without the prior purchase of property. Fortunately the excavation of the first block furnished the topographical clues which were sought.

The first step in an urban excavation of this kind is the purchase of private houses, which is possible on a large scale only through governmental expropriation. A special law was passed by the Greek Parliament defining minutely the procedure to be followed in the acquisition of the property in the Agora of Athens.

The first step is the serving of notice of evacuation on the tenants, who are allowed three months to vacate the premises. The buildings are then demolished under supervision of the scientific staff. When the terrain is cleared to the modern street level it is ready for archeological excavation. The staff archeologist, who has supervision of an area of excavation, keeps a field note book in which all details of the progress of excavation are recorded. When an object is found, it receives a serial number prefixed by the letter of the area. It is then minutely recorded, washed, tagged and catalogued, and finally placed with other finds. All the discoveries are housed in a building in a corner of the expropriated block. The ground floor has been transformed into a provisional museum, while the remainder of the building is used for headquarters of the staff. Here, too, technical experts are piecing together broken marble or are cleaning, sorting and mending the innumerable vases. Preliminary results are published at once, but definitive monographs must wait until the finish of excavation.

Photos courtesy American School of Classical Studies

The Agora of any Greek city was the great place of assembly, surrounded by markets and public buildings. The Agora of Athens, in the heart of the modern city, is now being explored, inch by inch, by the archeologists of the American School of Classical Studies

Left: **Head of repair department performing a delicate operation—mending a much broken vase in the workshop**

A marble statue of a faun put together from 73 scattered fragments found in a well. Restorations of this kind require expert service, patience, and much time

Above: **A bronze head of the 5th Century B.C. in the corroded state in which it was found. *Left:* The head restored and cleaned. This illustration was drawn by an artist who restored the style of the hair to its undoubted original form**

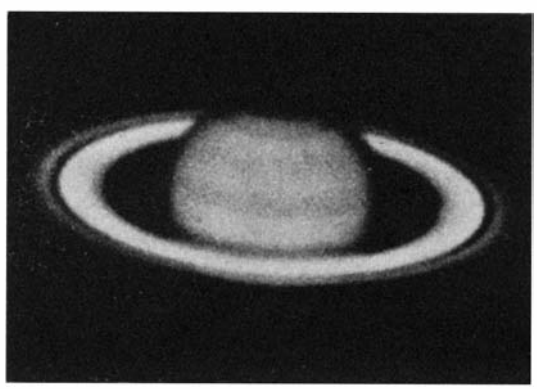
THE NEW SPOT ON SATURN

By HENRY NORRIS RUSSELL, Ph. D.

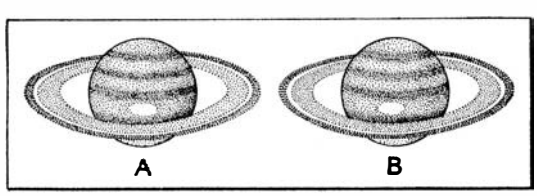
Chairman of the Department of Astronomy and Director of the Observatory at Princeton University
Research Associate of the Mount Wilson Observatory of the Carnegie Institution of Washington
President of the American Association for the Advancement of Science

WIDESPREAD interest among astronomers was aroused early last August by the announcement that a large white spot had been observed on Saturn. This was first seen on the night of August 3rd by an English amateur observer, Mr. Hay, and also at the Berlin Observatory, and found independently at the Naval Observatory, Washington, on the 5th. Ten days earlier nothing notable was visible on the same portion of the planet's surface.

The spot was first described as about one fourth of Saturn's diameter long, and one eighth of the diameter wide—that is, about 9000 by 4500 miles. Later observations with the Yerkes telescope showed it to be the brightest of a row of spots strung over some 40 degrees in longitude—50,000 miles. Its period of rotation is 10 hours 15 minutes, so that it remains in sight for only a little more than five hours at a time—practically, indeed, far less, since its visibility decreases rapidly as it approaches the limb. Were Saturn high in the northern sky, instead of low in the south, the spot might have sometimes been seen twice on the same night, after a complete rotation of the planet; but in its present position this would be possible only for southern observers, from whom no reports have yet come in.



Ordinary photograph of Saturn, made in 1911 with the 60-inch reflector at Mount Wilson



A sketch redrawn from the author's original rough sketch, and referred to in the article

THE appearance of a spot on Jupiter—even as big as this one—would be no news at all, for its surface is crowded with details, changing from year to year and even from month to month. But Saturn habitually presents an almost featureless surface. There is a bright belt along the equator, to be sure, and darker regions around the poles, but the boundaries between one zone and another are ill-defined, and there are no definite and specific details by which the rotation of the planet can be followed.

Only twice before the present year have such markings been seen—both of them white spots of considerable size. The first, discovered by Hall in 1876, appeared suddenly in the equatorial region, like the latest, and showed a rotation period of 10h 14m 24s—very nearly the same. The other spot, first seen by Barnard in 1903, lay outside the equatorial belt in latitude 36 degrees north, and had the much longer rotation period of 10h 38m. Both of these earlier spots faded out after a few months, and it is probable that this one will do the same.

Before any spots had been seen on Saturn there was no doubt that its rotation was rapid, since the flattening at the poles is greater than for any other planet. But the great difference between the rotation periods exhibited by her first two spots was surprising. There can be no doubt at all of its reality. The sketch shows how the spot would appear: (A) at the moment it covered the central meridian of the apparent disk, and (B) ten minutes later. Any reasonably careful observer, though his telescope was small and he had to rely on eye estimates of the spot's position, could certainly determine the time when it passed the central meridian within five or six minutes. The difference between the longer and shorter period would be conspicuous after a single rotation of the planet, and the weeks of observation which were possible for later spots would determine it within a small fraction of one percent.

Since the new equatorial spot shows very nearly the same period as the old one, it is evident that the equatorial regions rotate permanently at this rate, and the temperate zones more slowly. The same thing appears on Jupiter, where the abundant spots make it easy to determine the time of rotation, which is 9h 50m for the equatorial belt and about 9h 55m for the other parts of the planet—varying a little from zone to zone.

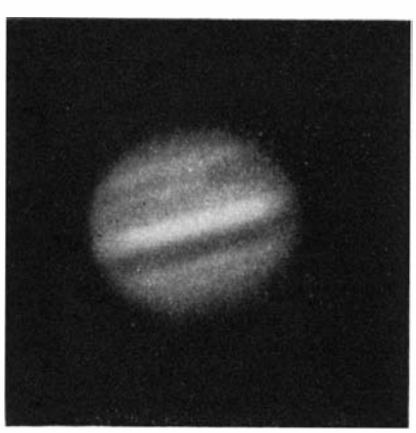
IT is obvious that the visible surface of both planets must be formed of clouds driven by powerful and persistent winds. Before we exclaim at the strangeness of such an idea let us think for a moment what our own earth would look like with moderate telescopic power to an imaginary observer on Venus. It would be thickly sprinkled with brilliant white spots, cloudy regions forming a belt near the equator, with clearer zones on each side, and irregular masses nearer the pole, corresponding to the storm areas of temperate regions. These usually move eastward by some hundreds of miles a day, so that an observer would deduce from them a rotation period shorter than 24 hours—often by 20 minutes or more. In the trade wind zones within the tropics the winds are prevailingly from the east, and the clouds would give a period longer than 24 hours. The differences in rotation period of these terrestrial spots would range over nearly an hour, or even more if the observer happened to catch cirrus clouds driven by the rapid westerly winds at high altitudes. But, though these differences are less for the great planets, the winds in their stratospheres must blow at speeds far exceeding our worst hurricanes.

If spots like the last two which have been seen on Saturn should appear simultaneously, the difference in their rotations would cause the equatorial spot to gain a whole revolution on the other, and overtake it, every 12 days. It is 232,000 miles around Saturn's equator, hence if the northern spot were fixed to the body of the planet there would be a west wind on the equator blowing 800 miles per hour. It is not so far around the planet in a higher

latitude and we could explain things by a 650-mile east wind in the temperate zone, or by a 400-mile west wind at the equator and a 300-mile east wind in the north. On Jupiter the wind velocity is smaller, but is still 240 miles per hour for an equatorial current.

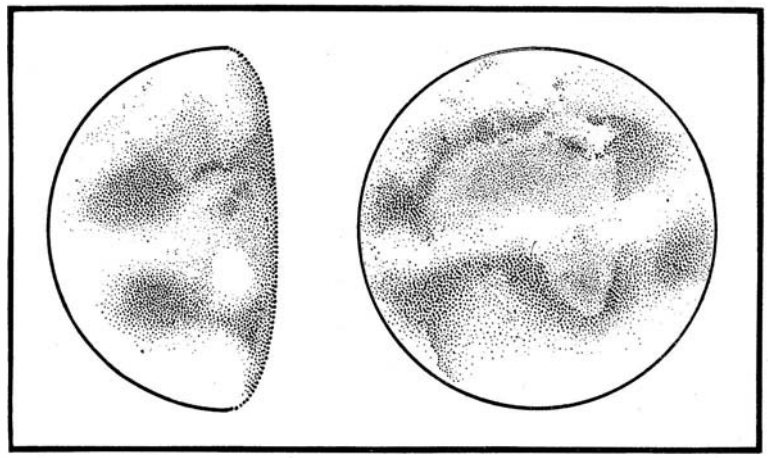
Why these tremendous gales should blow upon the great planets we do not yet understand. On earth the power behind the wind comes from the sun's heat, but on the remoter planets this is so small that it seems more probable that the driving power comes from the remains of the internal heat. It is well known that the outsides of the outer planets are very cold. Most of the heat which they send us is carried by the reflected sunlight. The small amount which their own surfaces give, in long waves, is heavily absorbed in our atmosphere. What gets through shows that the surface temperature of Jupiter is about 150 degrees above the absolute zero, or roughly −120 degrees Centigrade, but no very accurate determination is possible.

A QUITE new way of getting at this has recently been suggested by Dunham of Mount Wilson. High-dispersion spectrograms of Jupiter show the familiar bands in the red and infrared resolved into numerous lines which, by comparison with terrestrial spectra, confirm conclusively the presence of methane and ammonia in the atmosphere. Comparison of the Jovian and terrestrial absorption shows that the amount of ammonia above the visible



Jupiter, showing his famous spot. Photographed by the amateur astronomer Gustavus Wynne Cook, with his 28½-inch reflecting telescope. The planet's atmosphere is the cause of the indefinite edge

surface of the planet corresponds to a layer of the gas at atmospheric pressure and room temperature about five to ten meters thick. Gravity on Jupiter is 2.6 times as great as on earth, so that the atmospheric pressures due to the ammonia above would be about 1/500th of that at the earth's surface. This, then, must be the vapor pressure of the ammonia at the cloud level. The presence even of large quantities of other gases in the atmosphere would not alter this conclusion, provided that the ammonia was well mixed with them. The total pressure would be greater, but allowance for the fraction of this due to the ammonia would lead to the same ratio for its vapor pressure as before.



How the earth would look from space: not like the clear, sharp maps in the atlases, as is sometimes imagined by artists, but largely clouded. From a drawing by Lucien Rudaux, from *L'Illustration*

Now, at temperatures below about 170 degrees absolute, or −100 degrees Centigrade, the vapor pressure of ammonia is less than this, and there could not be as much present in the atmosphere in gaseous form as is observed to be there. This agrees well enough with the temperature found from the measures of planetary radiation, in view of the uncertainties of both.

Now a simple calculation shows that if Jupiter's surface was heated only by the sun, its temperature would be about −150 degrees Centigrade—a value quite inconsistent with the existence of any perceptible amount of gaseous ammonia in the atmosphere. It seems, therefore, that there must still be enough internal heat in Jupiter to warm its surface a little—as has long been suspected on account of the extensive and rapid changes of its surface markings.

In Saturn's spectrum the ammonia bands are very feeble—which need not mean that there is no ammonia on the planet, but rather that it is frozen out of the atmosphere by low temperature. The uniform character of its surface, and the rarity of spots, indicate that it is not "boiling" nearly as hard as Jupiter.

Dr. Dunham's argument leads to another important conclusion. It is probable that the condensable ammonia forms only a small proportion of the whole atmosphere—just as in the case of water vapor above the clouds on earth. The total pressure at the cloud level may well be hundreds of times that of the ammonia, and comparable with that of our own atmosphere at the cloud level, or even at sea level. The planet's disk appears much fainter near the limb than at the center, and this has long been recognized as evidence for a dense atmosphere—applying to Saturn also.

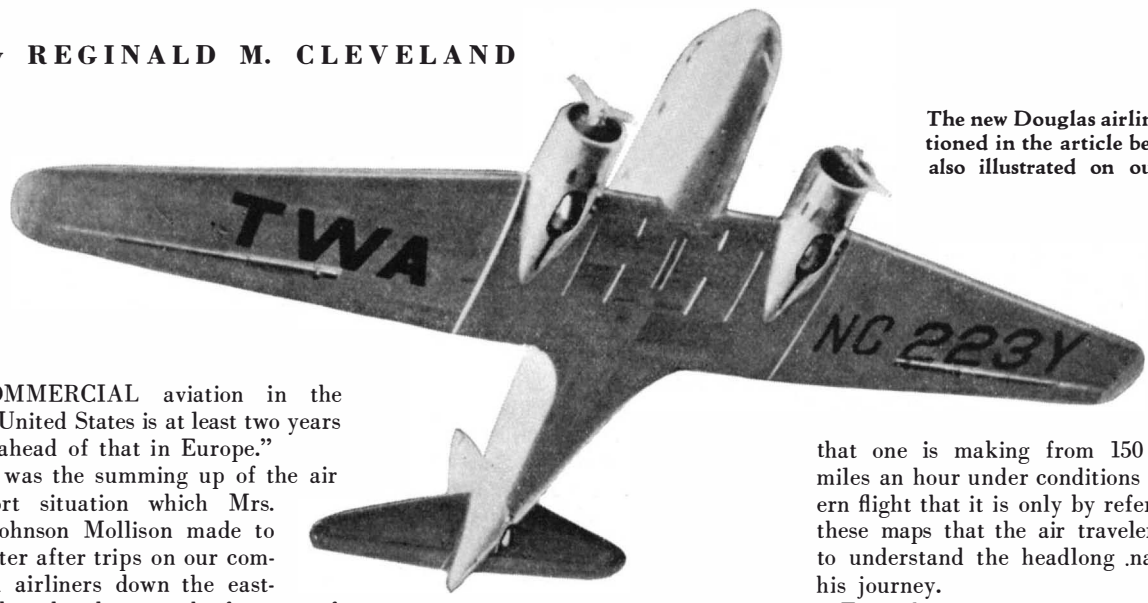
What permanent gases compose the atmosphere we can partly guess. There cannot be any great amount of carbon dioxide, for the bands which appear in Venus have not been reported in the major planets. Oxygen, too, does not appear—at least in quantities great enough to produce any notable strengthening of the bands produced in our own atmosphere. This is not surprising, for free oxygen could hardly co-exist with a combustible gas such as methane. Argon, nitrogen, neon, helium, and hydrogen may be present in abundance without detection, for none of them exerts any absorption in the accessible regions of the spectrum.

IT is very probable—as Moulton suggested years ago—that there is a great deal of free hydrogen in these planets. Hydrogen is enormously abundant in the sun, and Jupiter and Saturn have sufficient gravitative power to prevent even so light a gas from diffusing away from their surfaces into space. The clouds which form the visible surface must arise from the condensation of some substance which comes down at about 100 degrees below zero, Centigrade. Ammonia may be an important constituent on Jupiter; carbon dioxide, which condenses at a lower temperature, may be present on Saturn; or perhaps two hydrocarbon gases—propane (boiling at −45 degrees) and ethane (−90 degrees), which are found here in natural gas. Methane, which boils at −165 degrees under atmospheric pressure, could form clouds only on Neptune, or perhaps on Uranus.

Why these clouds, especially on Jupiter, show such conspicuous and various colors—white, brown and red—is a problem for the future.—*Princeton University Observatory*, October 3, 1933.

Air Transport Becomes Luxurious

By REGINALD M. CLEVELAND



The new Douglas airliner mentioned in the article below and also illustrated on our cover

"COMMERCIAL aviation in the United States is at least two years ahead of that in Europe."

This was the summing up of the air transport situation which Mrs. Amy Johnson Mollison made to the writer after trips on our commercial airliners down the eastern seaboard and across the far span of the continent. Coming from a pilot of such wide experience and one who is also intensely patriotic, it was a statement of real significance. Amy Johnson has flown in Africa and Australia, in many parts of Europe, and across the Russian wastes, and has been in a position to observe air transportation in nearly every part of the globe where it has been developed, with the exception of South America.

By her statement she did not mean solely the greater rapidity of flight, the wide use of night flying, and the much greater frequency of schedule which differentiates American air transport from that of the rest of the world. She was impressed, as every traveler by wing must be, with the growing ease and comfort which surrounds this mode of travel here and by the tremendous improvement that has marked the last summer in those features of airplane construction and those details of airline management which are aimed primarily at the creature comfort of the passenger.

THE airlines of the United States, faced with a decreasing revenue from the carriage of the mails and with the competition of a railroad structure aroused to the potentialities of its newest rival, have shown real wisdom in not merely stepping up the speed of their service by from 30 to 60 percent, but also by making intelligent efforts to make every air trip an experience of memorable comfort for the passengers.

This problem has been attacked from two angles. First, the flying qualities of the air transports of today are vastly improved, so that they combine with their greatly increased speed, great stability, comparative lack of vibration, very marked reduction in noise, and the ability to make slow and gentle landings. Secondly, real attention has been given to the problem of anticipating the wants of the air traveling public, and of creating an atmosphere of courteous and deft service.

Except for certain stretches of unusual scenic grandeur, air travel is monotonous. The earth, to the wing-borne voyager at an altitude of from 3000 to 15,000 feet, becomes a great map. At first, or over unfamiliar terrain, it is interesting, of course, to watch the checkerboard of field and woodland, the strange toy house pattern of the roofs of cities, and the courses of great river systems. But it is so new that it is difficult to orientate oneself and to take bearings from an unfamiliar dimension.

THE airlines have met this problem by distributing to their passengers comprehensive, simple, and excellently executed strip maps of the course. Usually there is, at one side of the map, a running legend which tells the traveler just where he may expect to be a certain number of minutes after the take-off, and gives him an easy method of identifying his position with relation to the map by a glance at some landmark far below the wing. Coupled with this there is often a sentence or two of interesting geographical, historical, or commercial information anent the particular bit of terrain.

So stable are many of the modern transports and so difficult is it to realize that one is making from 150 to 190 miles an hour under conditions of modern flight that it is only by reference to these maps that the air traveler comes to understand the headlong nature of his journey.

From the moment one enters the passenger terminal of a major airline, he has the sense of efficient, courteous, and disinterested service. Personal baggage is checked and removed with extraordinary dispatch. Before one knows it, it has disappeared, and been stowed aboard the plane, not to constitute a problem until it is again claimed at the end of the journey.

WHEN the traveler takes his allotted seat in the plane, he is pleased to find that his overcoat and minor belongings have been neatly stowed on the rack above his head. Before the take-off, a friendly stewardess or co-pilot hands him a little package containing chewing gum and cotton for his ears should he wish it. With the growing improvement in noise elimination, however, the cotton may soon be a thing of the past.

One does not smoke in an airplane during takeoffs and landings, but once in the air, cigarettes are offered, and the attendant solicitously points out ash tray, individual ventilating system, and produces a varied assortment of reading matter which differs from that of the familiar dental office in that it is current. It usually includes the latest editions of newspapers of the city one happens to be leaving. Refreshments, from a cup of coffee to a substantial meal, appear at appropriate intervals.

In some of the newer planes, it is proposed to install radio loudspeakers or individual head sets. Their comfortable use would seem to be possible with the constant dropping of the noise level. Motion pictures have been shown in transport planes, and it is now proposed

even to produce talkies for the entertainment of passengers by use of a new method of synchronization of sound track and image.

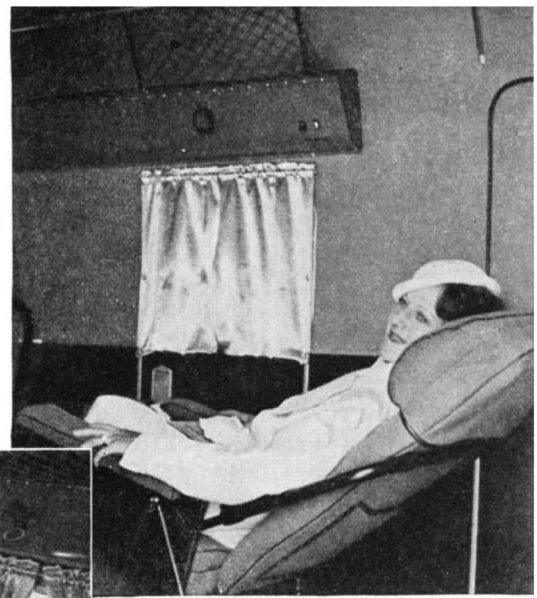
The matter of temperature and ventilation has not been overlooked by the astute airplane designers and airline operators. It is of course relatively easy to escape great heat if one travels by air, because it is only necessary for a pilot to gain a few thousand feet of altitude to defy the most torrid of hot spells. On the ground, however, it is quite another matter, and United Airlines has solved the problem of hot cabins before the takeoff, which can rapidly be brought to a sizzling degree by the power of the sun on metal structure, by introducing dry ice in the wing and blowing air over it.

IT has been found that more ventilation, that is to say, a larger volume of fresh air per minute, seems to be required for comfort in flight than in ground conditions. Thus the normal ventilating standard in public school buildings runs from 35 to 50 cubic feet of fresh air per person per minute. Some of the modern transport airplanes provide 70 cubic feet. The newest, the Douglas DC-1, provides 90 cubic feet, which passes through the cabin at a speed never greater than seven miles per hour, so that it is draftless.

Heating a plane in winter, or at high altitudes, calls for an efficient system. Exhaust heat is used in a number of different ways, the most interesting, perhaps, being also in the new Douglas transport; namely, steam heat thermostatically controlled. It is very simple. At each seat is a little grilled foot rest from which fresh air, either cold or hot, as the circumstances demand, enters the cabin. The air is drawn in at the nose of the ship, and a little flash boiler of corrugated steel in contact with the exhaust, furnishes steam. It is of half-gallon capacity, and a gallon tank of water gives a sufficient supply for the cruising range of the ship, which is 1000 miles with full load. When the plane comes down to refuel, the water tank is also refilled. The whole heating apparatus weighs but 24 pounds.

This transport plane represents what is perhaps the acme of modern design, both in relation to aerodynamic efficiency and in relation to what might be termed the comfort features for the passengers. Twenty-two of these great low-wing monoplanes have been ordered by Transcontinental and Western Air after a rigid series of tests. Under the contract specifications, the planes were required to show a top speed of 183 miles an hour; a cruising speed of 154 miles an hour; a landing speed of 64 miles an hour; a maximum ceiling of 24,000 feet; a ceiling on one engine of 8000 feet, and a maximum noise level of 76 decibels at 60 percent engine power.

Performance tests, however, with two Wright Cyclone F engines, have shown a remarkable excess over these requirements in each particular. The top speed with full load was 215 miles an hour; the cruising speed, at 75 percent engine power, 192.8 miles per hour; the cruising speed, at 66 percent engine power, 187 miles per hour; the landing speed, 59 miles per hour; the maximum ceiling 30,000 feet, the ceiling on one engine 11,200 feet, and the noise level only 70 decibels at 75 percent engine power.



Above: **Preparing for a nap in a reclining chair on an air transport ship.** *Left:* **There is plenty of leg room between the comfortable seats**

This plane has well demonstrated the immense advantages of design and construction with the constant guidance and check of wind-tunnel testing. The basic design incorporates, one might say, all the most important findings of the laboratory of the National Advisory Committee for Aeronautics, and each modification in detail was subjected to wind tunnel tests at the California Institute of Technology. It was found, for example, that the difference in top speed with a fillet between wing and fuselage of poor design, and one of good design, was 17 miles an hour. By the elimination of a radio mast and the use of a trailing antenna, three miles were gained. By a streamlined cowling over the tail wheel, two miles were gained; by the use of trap doors to close the slots of the retractable landing gear, another three miles were gained; and by the use of the Hamilton controllable pitch propeller, five more miles were added; a total of 13 miles gained by these four comparatively minor modifications.

The soundproofing of the plane, carried out under the direction of Stephen J. Zand of the Sperry Gyroscope Company, brought into play an entirely new principle. It was found that by the use of airplane fabric—doped with fireproof material and washable—for an inner skin, the pitch of resonance within the cabin could be altered, so that the low-frequency noises arising from propeller beat and engine explosion, which are the most trying among the sounds of flight, could be greatly reduced.

BY the use of thin layers of flexible kapok next to the duralumin shell, an air space, a layer of felted material, and then the stretched fabric, and by the use also of "icebox" doors, flexible non-shatterable glass of a new type, and paneling and floors made up of a combination of balsa wood, metal, and rubber, Mr. Zand was able to bring the decibel count down to 70, which is five below that of the Pullman car, and at the same time distribute and muffle the low-frequency noises to such an extent that one may talk in conversational tones from end to end of the cabin while flying at 200 miles an hour.

The two photographs on this page show the adjustable reclining chairs that are used on the new Douglas planes. For night flying, these chairs are satisfactory substitutes for berths; they permit maximum passenger comfort at all times. They are spaced sufficiently far apart to provide ample room for the longest legs.

RACE OR PLACE?

THE DOCTRINE OF NORDIC SUPERIORITY CHALLENGED

By MALCOLM H. BISSELL
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University of Southern California

"THE Nordics have truly been a great race." With this statement few will disagree. When, however, it is claimed that the Nordics have been the greatest race of all time, and that all the most advanced civilizations have been due solely to this super-race of blond giants, it is time to restrain our imaginations.

Such extravagant statements, especially when made in the name of science, stand as an ever-needed warning of the tendency of human emotions to run away with reason and common-sense. We believe them, not because of any convincing array of scientific evidence, but because we want to believe them—that is, if we fancy we are Nordics ourselves. Having once convinced ourselves of the innate superiority of our own race (or religion, or country, or party), we can easily find "evidence" to support our conviction. The process is known as "rationalizing", and is one of the most universal of all human traits; even scientists are prone to fall victims to it unless they are constantly on guard against it. It is all the more insidious and dangerous because it is largely unconscious.

THERE is nothing new in the gospel of Nordic superiority. It is, in fact, only a 19th Century phase of the age-old doctrine of the divine right of certain groups or classes of men to be masters and exploiters of others. Daniel Defoe, the author of "Robinson Crusoe", felt called upon to ridicule the racial arrogance of his own people in 1701, and many of the greatest scholars of all nations have repeatedly exposed the flimsiness of the claims of the ultra-dogmatic race exalters. Yet so powerful is the force of human emotions and passions, and so frail the voice of calm reason, that the doctrine of racial divine right constantly reasserts itself, and ever and again becomes an incentive and a justification for intolerance, hatred, and oppression. Today we are once more witnessing the demonstration of this fact.

The Nordic doctrine is an offshoot of Aryanism (indeed the terms "Nordic" and "Aryan" are often used interchangeably by the popular expounders of race supremacy), the chief exponent of which was Count Joseph Arthur de Gobineau, a French aristocrat who died in 1882. Gobineau claimed that one race alone, the Aryans, has been the creator and sustainer of all that is good and great in civilization. The idea of an Aryan race was based on the discoveries of similarities in the languages of the Indo-European group, which led to the theory that all these languages were derived from a common stem, the Aryan language. This, it should be emphasized, is a thoroughly scientific theory, based on indisputable evidence. But Gobineau and his disciples assumed that the existence of an Aryan language implies also the existence of an Aryan race.

HAVING created this mythical race, they attributed to it all virtue and excellence, and saw in it the source of every great civilization of antiquity and of modern times. The Nordics were represented as descendants of the original Aryans who settled in northern Europe, and from whom in turn came the Teutonic and Anglo-Saxon peoples. But, in spite of all efforts, no one has ever been able to produce the slightest bit of real evidence that any such race as the Aryans ever existed. There is no necessary relation between language and race, and the very use of the term "Aryan" in a racial sense—as the Germans are using it today—has no justification whatever.

As to the Nordics, their origin is not only unknown, but—though this is a point discreetly avoided by the glorifiers of the "yellow haired giants"—it is by no means certain that they represent a pure racial strain.

Whatever their origin, the Nordics have certainly been a vigorous people, and infusions of their blood have undoubtedly contributed much to the progress of central and southern Europe. The same, however, can be said of various other races. The fusion of two or more different stocks, provided they are vigorous and of good quality, usually produces offspring of marked ability and vitality, which very often is superior to any of its progenitors. The Nordic need therefore make no apologies even if he is the descendant of Asiatic, negroid and Mediterranean peoples. He in turn has contributed many elements of strength to other peoples, and there is no ground whatever for the assertion that the mixture has always been a eugenic catastrophe. The contrary is far more likely to be true, and we are quite justified in saying that the fusion, rather than the Nordic, has been the important factor.

In the present state of our knowledge it is impossible to make a valid claim of inherent superiority for any racial group whatever. We do not know whether such inherent differences exist between races, because we have not yet been able to devise any way of measuring them. Much has been made of certain so-called "intelligence tests", but it has been repeatedly shown that these do not measure intelligence apart from cultural and environmental factors.

Nevertheless, the legend of Nordic superiority persists. We are told that the glory of Greece was due solely to the invasion of Nordic tribes, that Rome was great and powerful so long—and only so long—as she kept her Nordic blood pure, that the rise of Spain is to be attributed to the blood of Nordic Visigoths and her decline to its dilution, that the Renaissance was a purely Nordic phenomenon, and so on.

LEAVING aside for the moment other considerations, let us examine the fundamental element in all these claims. To what extent is the statement justified that "the Greeks, Romans, and a few others were at the time of their greatness true Nordics"? It is obviously not an easy matter to determine the racial composition of peoples who lived in long past centuries. Of one thing alone we may be fairly certain—that with the countless wars, migrations and invasions of prehistoric and early historic times, it is very unlikely that many peoples of unmixed blood existed in Europe during the Greek and Roman era. Statements regarding the pure Nordic composition of such peoples as the Sabines, the Etruscans, and even the Greeks and Romans themselves rest mostly on the "will to believe" of the race dogmatists and are certainly not supported by such anthropological evidence as is available. The Spartans, for example, who have been hailed as typical Nordics, are classed as Alpines by Dixon. The Etruscans, again, are blithely asserted to have been pure Nordics; but of these very

people Hertz, the author of "Race and Civilization", says: "Only one fact seems established beyond all doubt, namely, that they were *not* Indo-Germans nor Nordics."

There is little or no real evidence that either the Greeks or the Romans were pure Nordics, or even dominantly Nordic, at any time. If some Greek gods are represented as blond, this is not true of the majority, and certainly not of the major deities. Zeus and Hera, the greatest of all, are referred to as dark-haired in the Iliad, and Poseidon is called "black-curled" in both the Iliad and the Odyssey. The fact that the Greeks found something strange in the blondness of the Scythians, Gauls, and Teutons indicates that Nordic features were not common among them.

But it is not necessary to resort to elaborate researches to show the absurdity of most of the claims of the Nordic enthusiasts. They damn themselves by their own contradictions. The Renaissance, for example, which is hailed by German race dogmatists as the result of a Teutonic (Nordic) invigoration of decadent Italy, is denounced by Gobineau, the high priest of Teutonism, as the triumph of anti-Teutonic forces. Scores of similar contradictions from the writing of the Nordic glorifiers might be quoted.

WHILE it would be foolish to deny the significance of race in the evolution of nations and civilizations, it is extremely difficult to separate the racial factor from others that are equally or more important. But it is characteristic of the race dogmatists to ignore completely all these other factors. To attribute the greatness of Spain solely to an infusion of Nordic blood, and her decline to the submergence of the Nordic element by other races, without considering the enormously significant historical and geographic factors involved, is, to say the least, highly unscientific. And, if the Nordics are the exclusive bringers of civilization and progress, how can we account for the fact that for centuries during the Middle Ages the Moorish civilization in Spain—which can hardly be attributed to Nordic influences—was by far the most advanced and enlightened in all Europe?

It is comparatively easy to reduce the extravagant claims of the Nordic fanatics to absurdity, but it is far less easy to find a definite and satisfactory explanation for the rise and decline of civilizations and nations. The problem is highly complex and perhaps will always defy solution. One fact in particular, which seems to have been strangely overlooked by the Nordic boosters, should serve to make us cautious in accepting fantastic claims as to the all-powerful effect of race. For many centuries northern Europe has been inhabited by a population overwhelmingly Nordic. Yet until the last few hundred years it has been the most backward part of the continent. No civilization ever originated there; nor have the Nordics ever developed any civilization of their own. Were these blond giants incapable of creating one?

At any rate, civilization began in more southerly climes inhabited by other races. India, Mesopotamia, Egypt, Crete, the eastern Mediterranean—these were the earliest centers. As history progressed, the focus of power and culture shifted from the eastern Mediterranean or Aegean region to the central and western Mediterranean, and then to the countries bordering the North Sea and the Atlantic. Not until this stage was reached did the Nordic peoples of northern Europe come to play a conspicuous part in world history. If race is the one and all-powerful factor in civilization, why did these superior Nordics remain untutored barbarians while less gifted races were inventing the alphabet, building empires, and carrying on far-flung trade? Or, if it was merely the timid stay-at-homes who remained in the northern homeland, why did these same dregs of the "Great Race" suddenly rise to world power and leadership? Our Nordic boosters cannot have their cake and eat it too. The racial composition of the British Isles has changed very little since the 12th Century. At the beginning of the 16th Century Britain was a small and relatively insignificant island kingdom; 200 years later she was a great world power. How can we possibly explain this change in terms of race?

These examples show clearly how important geographic and historical factors may be in determining the destiny of nations. The mere fact that the British Isles were on the outer edge of the world, remote from the main currents of trade and culture, prevented them from attaining major importance in world affairs, *so long as western civilization focused on the Mediterranean Sea.* But, with the discovery of America and the beginning of the Atlantic era, these islands were suddenly thrust to the center of the stage, as it were; their location on the eastern edge of the ocean, facing the New World, gave them advantages they had not previously possessed, and the rise of Britain to leadership followed speedily. Italy, which had previously held the strategic position in Europe by reason of her location in the center of the Mediterranean and her control of the overland trade with the East, now found herself shoved off to one side. The discovery of the sea route to India, which took place at about the same time, still further decreased the significance of the Mediterranean. The commercial importance of the Italian cities, and consequently their wealth and power and prestige, rapidly declined. Clearly we cannot attribute this decline solely to racial factors!

THE accompanying article was inspired by the publication of an article by W. P. Hartman, entitled "The Nordic—Superior or Inferior?", in the August number, and was written by, and from the point of view of, a geographer, whose business it is to study the relations between men and their environment. In general, the Hartman article supported the broad, sweeping claims for Nordic superiority advanced a few years ago by the Madison Grant-Lothrop Stoddard school of thought (Madison Grant, "The Passing of the Great Race;" Lothrop Stoddard, "The Rising Tide of Color"). These writers and some of their adherents are regarded by many as extremists. As was hinted by the editor in a box which accompanied the Hartman article, their claims, particularly the positive manner of their presentation, may have prejudiced many into taking the anti-Nordic side of the question, much against their original convictions.

It is unlikely that science ever will or ever can reach a definite answer to the Nordic question, since the evidence is so elusive, so shifty, so inexact—much of it forever lost. If this be the case, then all comment on that question must be in the nature of opinion.—*The Editor.*

NEW discoveries and inventions brought still other geographic elements into play. The steam engine and the industrial era which it inaugurated caused profound political as well as social and economic changes. During the last 200 years world dominance has been written more and more in terms of horsepower. And horsepower means primarily coal and iron. To ignore these two foundation stones of industrial supremacy and speak only of Nordic blood is to take leave of common sense. To what extent the British Empire and the position of the United States in world affairs have been built on coal resources is perhaps not possible to state, but we may be certain that had there been no vast stores of underground fuel buried in the rocks of Britain and America, the history of the last two centuries must have been very different.

The life story of civilization, like that of the individual, is made up of the in-

(*Please turn to page* 299)

THE AMATEUR AND HIS MICROSCOPE—VI

EXPLORING UNKNOWN WATERS—II

By JULIAN D. CORRINGTON, Ph.D.
Ward's Natural Science Establishment, Rochester, N. Y.

(*Continued from November*)

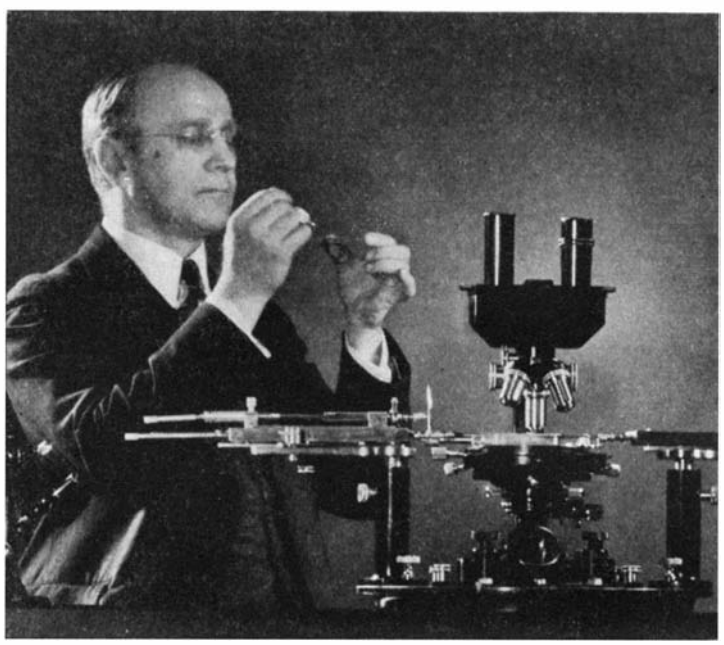
A NUMBER of devices which are of interest in studying temporary mounts from your cultures may now be mentioned. To slow down such active swimmers as Paramecium, so that one may focus on them under high power in order to watch such detailed procedures as the working of the contractile vacuoles or the feeding movements of the gullet, add a drop of dissolved gelatin to one drop of culture in making up a slide mount. Quinceseed jelly, glycerine, or a small mesh of cotton fibers may also be used for this purpose.

It will be found that the water under the cover glass gradually evaporates, drawing the cover down more and more tightly, until finally all of the inhabitants of the slide mount are crushed and destroyed. For a short while before this catastrophe occurs there is a period when pressure from the cover will confine the activities of the more dashing protozoa, permitting easy study with high power. Merely allowing the slide to dry up may serve then for detailed work, though such treatment always distorts the shapes of the compressed animals.

TO prevent evaporation will usually be more desirable than to permit it. At ten- to fifteen-minute intervals add a small drop of water from the same culture. Do this by placing the drop from the pipette just at the edge of the cover, avoiding wetting the top of the cover. The new water makes contact with the old and is drawn under by capillarity. Rather violent currents are thereby set up, and will often sweep away some particular organism which you may have been observing. Anticipating this, you may be able to keep track of the object under low power until the currents cease.

A ring of vaseline around the edge of the cover prevents rapid evaporation and converts a temporary wet mount into a regular tiny aquarium. Pack a dropper full of vaseline (much as an automobile grease gun is filled) and use the bulb for pressure, or use a ramrod whittled from wood.

Observations of feeding are especially interesting in the case of Paramecium,



A new micro-manipulator. It enables the experimenter to pick up, turn over, dissect, and otherwise manipulate minute organisms

and are facilitated by adding to the culture on the slide a small drop of water in which a bit of finely powdered carmine or rouge has been placed. Add this drop at one side of the cover, drawing off a bit of the water already present by applying a small bit of filter paper or blotter to the opposite edge. This provides readily visible particles which may be watched as the animal takes them in, along with bacteria and other minute objects upon which it feeds.

Rendering the nucleus of unicellular organisms distinct involves killing them. Any of a number of dyes may be used, though iodine serves equally well and is usually more available than the others. Dilute one drop of tincture of iodine with ten drops of water and apply one drop of this mixture to the edge of the cover of a mount. It will diffuse slowly through, bringing death to all it touches and staining the nuclei.

BY chance the reader is a portly banker or dignified statesman, with neither time nor inclination to indulge in the bog-trotting field trip. For such cases the automatic, self-regulating microcosm is just the ticket. Have at hand as many jars—the one-gallon battery jar preferred—as you wish to make up into cultures, and fill them nearly full from the tap, allowing them to stand uncovered for two days. Secure odd pieces of plain sheet glass, such as parts of broken window panes, or purchase small squares or circles of such glass from a dealer, so as to provide a cover for each jar thereafter.

THE various cultures which may be made up are nearly endless. Perhaps the best known and most widely used is the hay infusion microcosm. Merely gather a handful of dried hay from the most convenient source, such as the nearest vacant lot which supports wild grasses, and place it in one of the jars. An energy cycle is thus initiated which will run for many months without further attention, save that of renewing any water lost by evaporation. Cover the jar and put it in a light place, possibly near a window, but not in direct sunlight.

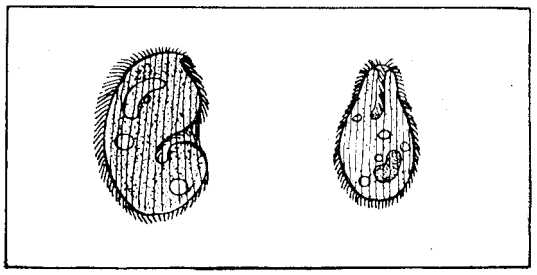
We say the hay "rots" in the water, but what we really mean by such an expression is that bacteria appear and attack the stored energy in the hay. They come from the air and from the water in the jar, but principally from the hay itself, where they have been encysted in a state of suspended animation, as it were, awaiting the return of more favorable (moist) conditions. Protozoa next come out of their cysts and feed, either on the products of decomposition of hay set free by the bacteria or upon the bacteria themselves. Larger species eat the smaller ones, and eventually worms and rotifers —multicellular organisms—will domi-

nate the scene. All is destruction. The energy of bottled sunlight present in the hay is being rapidly dissipated. Within a few months the microcosm will run down, unless the operator introduces some of the smaller species of algae and thus adds some energy-makers and produces a balanced aquarium.

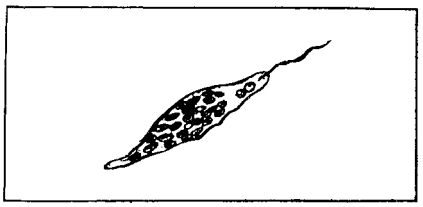
MAKE slides from this microcosm every day and note the changes in population, both as to species and number of individuals. Take cultures from bottom, middle, and top zones and see whether these show parallel fluctuations. When the microcosm is freshly made up you may be unable to find any life at all in a drop or so, when mounted for microscopic examination. But after two days bacteria will be abundant, and soon the monads—extremely minute flagellate protozoans—will be present in untold millions. Colpidium and Colpoda are related ciliate protozoans of a much larger size, which will shortly rule the scene, and Paramecium usually occurs plentifully. A daily inspection and recording of the fate of this microscopic, dog-eat-dog universe will provide a practical experiment in microbiology of much interest and value.

Next try a similar infusion made with lettuce leaves—unwashed ones from the garden. Beet and carrot tops, celery and, in fact, nearly any form of leafy vegetable, may be similarly employed and a parallel microcosm encountered.

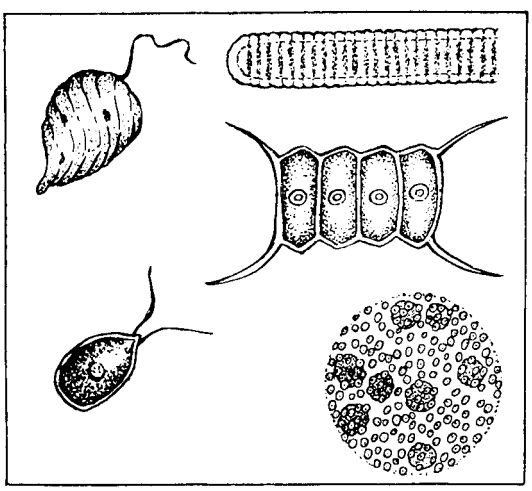
The Amoeba has been so widely studied and publicized that it is becoming quite well known by name, and all amateur students of microscopic life will be desirous of studying a specimen at first hand—rightly so, too, since no creature is more interesting. A large Amoeba is barely visible to the naked eye as the smallest of specks—a giant of the microcosmic world. He appears under low-power magnification as a large drop or mass of colorless jelly, almost completely transparent and of constantly changing shape. The protoplasm flows smoothly into a varying number of finger-like projections—the pseudopodia; the animal progresses by putting forth pseudopodia in front and withdrawing those in rear. Any one pseudopodium thus has no real identity—it is merely a portion of the cell which is temporarily projected as a lobe.



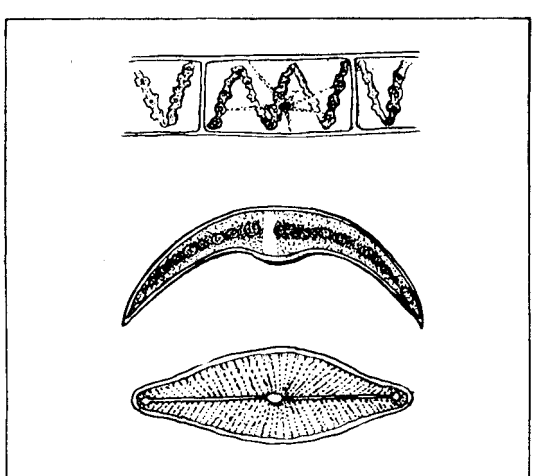
Left: Nyctotherus. *Right:* Balantidium. These microscopic protozoa are parasitic on frogs



Some organisms have attributes of both animals and plants, and one of these is Euglena. While it swims freely, by means of its tiny whip or flagellum, it also manufactures its food by means of light and has chlorophyll, as plants do. Zoologists call it an animal, botanists a plant. Nature, however, recognizes few such arbitrary boundaries



Sketches of several of the algae—forms commonly found in stagnant water. How miserably any mere drawing or, equally, the finest of photographs, fails to convey to the reader their beauty of color and hues of blue and green, as well as their living qualities, will be realized only when they are beheld in actual movement under the microscope eyepiece



Drawings from Bausch and Lomb book "Microscope Experiments"

At the top is Spyrogyra, one of the common green algae. The half-moon alga in the center is a typical desmid, Closterium. Desmids occur in wide variety but all are beautiful. At bottom is Navicula, one of the numerous forms called diatoms. Of these there are so many that diatomology is a special science

Amoeba has a nucleus and one contractile vacuole—a spherical area in the cell protoplasm which slowly fills up with water and excretions, moves to the surface and then bursts like a pricked bubble, thus ridding the animal of excess water and wastes. A new vacuole then later appears, grows, and bursts. The outer layer of protoplasm (ectoplasm) is clear, whereas the inner (entoplasm) is granular; otherwise there is no apparent structural differentiation—no organs, no systems. Yet Amoeba can do all of the things in life that are essential to even man himself! He breathes, absorbing oxygen from the surrounding water, combines this oxygen with his living protoplasm so that energy to do work is released, and voids the resulting excretions. He moves from place to place and takes in small forms of life of many kinds for his food, performs digestion and assimilation, and voids the indigestible residue. He is sensitive to stimuli and aware, at least in a general way, of the nature of his surroundings.

BUT, however desirable a subject for our studies, Amoeba is not as accommodating as many another protozoan. Finding them may prove difficult in the first place, and culturing them still more so. We may have a splendid pure culture of large and active Amoebas one day, and none at all the next, the creatures disappear overnight as if by magic. Search for them in the mud on the bottoms of ponds in which there is a good growth of green stuff, and in scrapings from the underside of lily pads, but do not be disappointed if unsuccessful. Cultures may also be purchased from supply houses.

To identify the many organisms encountered in such studies as those briefly outlined in this article, consult one or more of the following: Kudo, R. R., "Handbook of Protozoology;" Morgan, A. H., "Field Book of Ponds and Streams;" Needham, J. G. and J. T. Lloyd, "The Life of Inland Waters;" Needham, J. G. and P. R. Needham, "A Guide to the Study of Fresh-water Biology."

THE STORY OF THE SOYA

By HELEN R. CRANE

All illustrations courtesy U. S. Department of Agriculture

A field of Oo-too-ton soybeans in Orangeburg County, South Carolina

DURING the Civil War the Union soldiers were fed a coffee which they did not like very well. It tasted "so-so", but it failed to whip them on and keep them awake as did the coffee they had back home. No one bothered to tell them it was soybean coffee, and if they had been told what it was, the news probably would have meant nothing to them, for few people in this part of the world had ever heard of the soybean at that time.

The history of the soybean, or soya, in China reads like an Oriental fable. Nowhere is there anything to be found that will compare with it—a "little honorable plant" so rich in food-elements that it affords a perfect diet in itself, and so heavy in oils that it pleases the hearts of manufacturers of commercial products.

Someone had brought samples of the beans to this country about 1804, it is true, though only as botanical curiosities, and they were planted and grown in fashionable houses. But, aside from the Civil War coffee brought back by some of our traders to the East and these few hothouse specimens, no more was heard of the *soja max* in this country until along about 1890, when one of the Government's experts began to see what he could do with it. He found it to be a good silage and soil-improver, and it was introduced to some of the farmers as a crop possibility.

Time went on and then, in 1915, a shortage of cottonseed in the south coincided with a surplus of North Carolina's soybeans that were being cultivated for live-stock. The Department of Agriculture began to dream dreams of an American soy-oil. Had not the Orient been using this oil for thousands of years in making lacquers, varnishes, paints, soaps, printing-inks, candles, waterproofing, and all such?

THE Oriental method of extraction was a primitive one—with a stone hydraulic press. But the Americans did not copy that method. They used, instead, the method followed in the south for processing cottonseed. Also, they discovered that the oil could be extracted by grinding the beans and then placing them in some chemical solvent such as benzol, naphtha, or ether. The solvent was later evaporated, distilled, and used over again, while the residue, the meal and now extracted oil, was said to contain no detectable trace of the solvent. This chemical process is thought to extract more of the oil than the other method, only 0.5 to 1.5 percent remaining in the meal. One ton of beans (33⅓ bushels of 60 pounds each) yields by the expression method about 250 pounds of oil and about 1600 pounds of meal. The remainder is lost.

This oil belongs to the "drying group" and stands midway in properties between linseed and the semi-drying cottonseed. Manufacturers seized upon it when they learned that by proper refining it lost its beany flavor and could be used in the manufacture of lard substitutes, margarine, salad oil. In fact, it could be put to any use to which oils are needed in making foodstuffs. The trades accepted it to use in the manufacture of linoleum, paints, soaps, core-binder, rubber-substitute, glycerin, explosives, inks, celluloid, water-proofing, and any number of other things. The different grades of oils obtained from different varieties of beans made some of them more valuable in one place than in another.

After the extraction of the oil, the meal that was left behind was used primarily as feed for animals, and there have never been any indications of other than good results—provided the farmer remembers he is handling a highly concentrated protein. Its digestibility, also, compares very favorably with that of other oil-meals.

Scarcity of land in the Orient prohibits setting aside appreciable areas for pasturage and this, combined with certain religious prejudices of the people against meat-eating, means that very little live-stock is raised there. The Orientals, therefore, have comparatively little use for soy meal for animal feed. Millions of tons, though, are used annually in Java, Manchuria, China, and Japan for fertilizing mulberry trees and rice fields.

Americans have been slow to recognize the fertilizing value of this meal, despite Government bulletins recommending it, but for the plant itself, both green and dried, they have found a use. We have mentioned before that it makes an excellent hay and straw. It equals red clover or alfalfa for milk and but-

ter production, and is also popular as a winter ration for horses and hogs. This latter use accounted for our farmers' sole interest in the bean prior to the 1915 experiments for oil.

It was not until as recently as 1917, when conditions brought on by the World War forced the Department of Agriculture to search for a cheap source of proteins for human consumption, that the soybean was "discovered" as a real food. More than 400 different recipes exist in the Chinese cook-books, some of them dating back to about 3000 B.C., but we Americans did not find them. Our scientists went to work directly on the bean itself—although they may have accepted ideas from the Orient of using it as a flour, a curd, milk, oil, and meal. Possibly, too, they may have been influenced by the fact that the soybean is the principle article of diet of a people who evidently have a remarkably well-balanced ration, even though they make no extensive use of dairy products and consume almost no meat.

HOWEVER that may be, the Department worked over the beans until they found the general protein yield to be 40 percent, the fat 18 percent, carbohydrates 26 percent and ash 4.55 percent; the protein being equal in value to that of meat or milk, the ash alkaline in reaction, and very little of the carbohydrates existing in the form of free starch. Further experiments since then have shown a richness in lecithin, an excellent nerve tissue builder. They have also shown that the oil contains fat-soluble vitamins A, D, and E. There is a high percentage of water-soluble vitamins, and as for the mineral content—the list reads like a text-book! The oil, by the way, is digested by man to the extent of 95 to 100 percent, and the presence of fatty acids, such as linolenic, makes it valuable as a builder of fats in the cells of the body.

Chinese farmers say that there are a thousand different kinds of soybeans, and that some one variety of them is adaptable to almost every climatic vagary. One branch of the family likes dry, desert-like soil, another prefers it moist; some revel in cold weather, while their cousins pine for sub-tropical heat. More than 800 varieties have been imported into the United States by the Department of Agriculture, but only about 40 of these are being grown to any extent. These are mostly the ones adapted to the "corn belt" and the south.

The differences in the appearance of both the plant and the seed are legion. The seed may be green, yellow, red, speckled, straw-colored, black, tan, or brown; some are round, others elliptical. The plants are all hairy (there is said to be a smooth variety in Japan but it has not been introduced here). Some of the plants have strong, self-reliant stalks that grow as tall as a man, while others have a clinging disposition that keeps them close to the ground. One variety's leaf is dark, another's pale. The flowers may be white or purple, and may be odorless or they may have a delightful lilac-like perfume. And, of course, the different varieties vary in their chemical analysis and their palatability, though not to any extent.

THE soya, in China, is a plebeian food. It is eaten by the nobility, to be sure, but on the whole it is looked upon as the food of the people. The Imperial gardeners never thought of improving its strains, while the farmers, naturally enough, had no idea that controlled propagation was possible. So, through all the centuries, the god of the soya has had to look out for himself. That god seems to have fared very well under the circumstances. Nevertheless our Department of Agriculture already has made much progress in fortifying the plant against diseases and in increasing its output of seeds. Dr. W. J. Morse of the Department has interested himself particularly in it and is a leading figure in encouraging its use in the American dietary.

An Oriental soybean cake made by pressing the oil from the beans. Such cakes are fed to livestock

So it has come to pass that the United States is now following the example of the Orient and making milk, curds (not unlike cottage cheese), flour, macaroni, cakes, pies, candy, salad-oil, cooking-oil, and coffee from the soybean. Still the soya, generally considered, is looked upon as a meat-substitute rather than a cereal-substitute, and this is because of its high protein and low starch content.

Our food experts, too, have taken with enthusiasm to this new "almost perfect food . . . it fills a crying need in our dietary," they say, and they add that, ". . . for some strange reason, our knowledge of foods has lagged far behind our other technical accomplishments and we have only just begun to realize the deficiencies in our present foods . . . the soya will become a very important accessory." Chief among its proteins is glycinin, a globulin, and it is similar in

Laredo soybeans cocked up in the field for curing. Grown in White County, Arkansas

its amino acids to beef, according to Prof. Stanley Osborn of the State Department of Health at Hartford, Connecticut. The protein yield is nearly twice that of the average meat; four times that of eggs, of wheat and other cereals; five times that of most breads; twice that of lima or navy beans, and twice that of walnuts, filberts, and the majority of other nuts.

Soy-milk, which is prepared in a similar manner to almond-milk, is reported by several of our universities to be suitable for use as the only source of proteins in the diet of babies, as well as being adequate for promoting normal growth in children. It is further stated in these reports that invariably better results are obtained from its use in such cases than from cow's milk. Professor Stanley Fisher states that it makes a much finer, more flocculent mass in the stomach than cow's milk, and that its period of stay in the stomach is shorter. Chinese babies, we are told, are always brought up on this milk.

As for the cheese, or curds, they do not appeal greatly to Occidental taste at first. They seem a trifle strong in flavor and are sponge-like in consistency, but it is prophesized that they will undoubtedly come to be looked upon as the delicacy they are considered to be in the Orient. These curds, prepared in an infinite number of ways, may appear in one form as the "meat" course, in another as the salad, and in still another as the dessert. The human organism is said to be able to store 3.3 percent of the nitrogen of soybean curd but only 1 percent of that of meat.

FLOUR is now an important product from the soy, and is being manufactured in various parts of the country by the ton. It is used for making breads, cakes, and pastries. To diabetic patients and to others in need of a starch-free diet it comes as a blessing, as well as adding a very palatable and nutritious item to the pantry list of any housewife.

Europe has also been adopting this legume. It was first introduced into England in 1880, when a traveler returned home and proudly displayed some samples of a "wonderful bean" that furnished nine tenths of the food of the Near East. His surprising tales created an interest among botanists, but that was about all. Few others became "excited" about the bean, or the possibilities which might lie in cultivating them.

Then, in 1905, a Japanese trader put into the harbor of Hull with a shipload of soybeans, which he managed to sell after difficult bargaining. England found the beans good feed for cattle and sold some abroad. Gradually orders increased through the years to several thousand tons annually, but it was not until the various countries were pressed by the exigencies of the World War that interest began to grow over there, too, with regard to the possibilities of the beans as a food for humans. Today their popularity is being furthered in Europe in the same manner as in the United States; namely, through the different governmental offices and the universities. Italy, France, and England have made elaborate experiments; gossips have it that a Soy Institute has been founded in Moscow and that it houses an exhibition of more than 150 different soy dishes, including "cutlets," "meat-loaves," pastries, salads, and candies. Prizes are offered for other recipes, and expert aid is furnished peasants who are willing to plant the beans.

Soybeans grown with corn, South Carolina, for soil building and "hogging down"

A few hundred thousand acres of soybeans are being grown in Europe, but the bulk of the world's supply still comes from China, Japan, Korea, Indo-China, and Manchuria, especially the latter, where the claim is made that more is raised than in all other countries together. Locally the beans are used mostly for oil and meal and are the principal product of the country. Their export supports the harbors, railroads, and boats. In each of the countries named, as well as in Siam, the Philippine Islands, Dutch Indies, and India, they and rice form the most important articles of diet of the large populations.

The United States still imports thousands of tons of the beans, even though we have a few million acres planted to them. This acreage is steadily increasing; previous to 1917 there were less than 500,000 acres, in 1924 more than 2,500,000 acres (one million for hay, 932,000 for pasturage and 613,000 for seed). Latest figures show a continued increase, and this increase is likely to be maintained.

IT appears that some variety of soybean will grow almost anywhere in this country but, with the Manchurian imports commanding such absurdly low prices, it is not profitable to grow them in states which have a water shortage —where water must be measured and paid for. In the "corn belt" and in the south, where there is plenty of water and labor is relatively cheap, these beans are being grown with profit, and every year sees their popularity increasing.

●

¶ *"Ice Cream by the Mile" is the title of an article, to be published soon, which tells the story of the development of a new and better process for making that frozen delicacy.*

A luxuriant growth of Oo-too-ton soybeans in a field in Richmond County, S. C.

WHAT CONSTITUTES
PERFECT DETAIL IN TELEVISION?

By WILLIAM HOYT PECK

EVEN the most pessimistic admit that television will be entirely satisfactory when the reproduction can be compared to motion pictures in brilliance and clarity. The skeptics also concede that brilliance in a mechanical scanning system can be obtained through the use of such sources as arc lights or suitable incandescent lamps, modulated by a separate element, such as a Kerr cell. But they maintain that the fine detail of a motion-picture film cannot be obtained through mechanical scanning methods.

It is with this last statement that I would take issue. Motion picture film is covered with a layer of tiny silver grains which form clusters approximately .02 mm. (eight ten-thousandths of an inch) in diameter.* A close inspection of a picture projected on a smooth screen will reveal the grouped silver grains, each cluster increased to a diameter of about ¼ inch, if the complete picture is 20 feet wide.

But one does not normally view a motion picture closely. One sits far enough away so that the clusters are not seen separately, but are resolved into a perfect picture. In a similar way, one observes a television picture from a distance when it is considered as entertainment rather than as a novelty or an experiment. Witnessing television for the first time, as a critic rather than as a member of an audience, the tendency is to peer closely at the screen. Accepting it as amusement, one would view a picture two feet wide (the average size of a home movie) at somewhat less than the length of a room—say about ten feet.

NOW, what size dot or "picture element" in a television reproduction is completely resolved at ten feet? Before answering this question, let us explain the term "resolve" as applied to optics.

If you will hold any photograph reproduced in this magazine close to your eye, you will see that it is made up of a large number of tiny dots. If you hold it quite close and look at it steadily, the dots will appear separately and distinctly—more distinctly, in fact, than the picture they form.

Now slowly move the page away from your eye. You will find a rather definite point at which the individual dots can no longer be distinguished, and the picture they make is distinct and clear. The point at which the dots form a complete picture is the resolution point, and may be calculated very readily.

To understand the means of calculation, call to mind a pair of railroad tracks, extending straight ahead until they apparently meet in the distance. The point at which the eye can no longer distinguish two separate tracks is again the resolution point, though this time it is very much farther away than was the magazine page when the dots in the picture resolved. There is, however, a definite relation between these two points of resolution.

THE human eye sees in angles, and if straight lines were drawn from within the eye to two adjacent dots at a point where they just resolved, the angle formed by the two lines at the eye would measure approximately 3 minutes—1/20 of 1 degree.

Similarly, if lines were drawn from your eye to the two railroad tracks where they appear to meet, the angle formed at your eye by the two lines would again be 3 minutes.

So, in order to determine what detail is necessary to afford perfect definition in television projection, it is necessary to know only the average distance at which a picture of given size will be viewed. By calculating how far two lines which diverge at an angle of 3 minutes will spread at the distance from the eye to the screen, we find the size of a dot—or the width of a scanning line—which affords perfect definition at that distance.

Here is an example: If two lines which diverge at an angle of 3 minutes are produced for 110 inches, their ends will be 1/10 of an inch apart. Therefore, scanning lines up to 1/10 of an inch wide may be used with a viewing distance of 110 inches, and simple division shows that an image 18 inches high will require 180 lines for perfect definition.

Lights and shadows will be produced in this image by controlling the amount of light in each line or dot, an infinite number of variations between full illumination and total darkness being possible. Because of perfect resolution, the dots will all blend together, and the effect will be that of a completed wash drawing.

In other words, a 180-line picture 18 inches deep will contain all the detail the human eye can see when viewed from a distance of 110 inches, or 9 feet 2 inches.

Motion picture engineers have maintained that 1250 lines are necessary in a television picture of home movie size (about 18 by 24 inches) in order to get detail comparable with that of the home movie. The fallacy of this is readily seen when one divides 18 inches into tenths of an inch. 180 lines resolve perfectly for the average eye.

Similarly, if a screen 13⅜ by 19 inches is mounted in a television console cabinet, it will show a picture perfect in detail when a 180-line image is viewed at a distance of 6 feet 6 inches. The 180-line picture will be completely resolved when made 20 by 28 inches if viewed from a distance of 9 feet 9 inches.

THEN, too, the motion picture makes use of an illusion of detail which television may well copy. One learns a character's lineaments only in close-ups on the movie screen. When the character is seen in a group or a long shot, the features are more or less formless lights and shadows, detail being supplied principally from memory and from very general impressions. Look for this effect the next time you go to the movies.

Television, however, is new. One inspects the image, be it close-up or group, quite critically, and is disappointed if every feature of every person in a group is not sharply defined. Before making criticisms, one should inspect a motion picture as closely and harshly as a television image—or should take television as matter-of-factly as the movies, looking merely for entertainment, rather than for unnecessary engineering achievements.

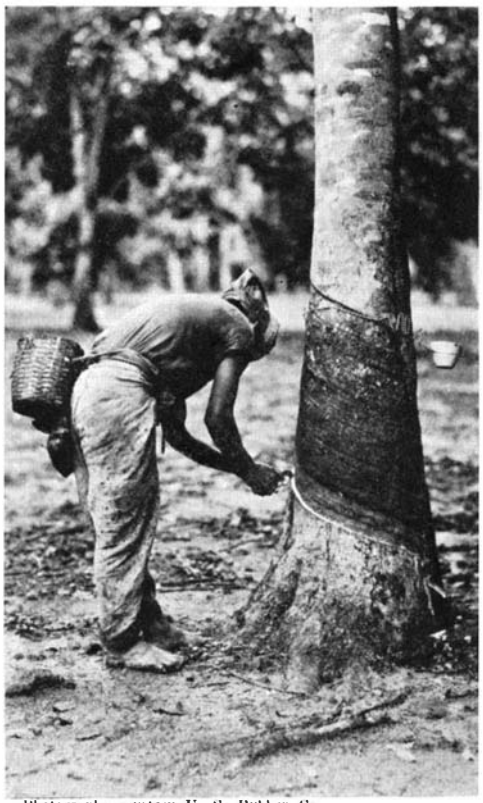
Given the same conditions as obtain in a home movie showing—that is, size of screen, amount of room illumination, average viewing distance, and audience's frame of mind—180-line television not only welcomes comparison with home movies; it seeks it!

*Note that this figure pertains to *clusters* of grains and not to *single* grains. The size of clusters varies widely under differing conditions, but for the present purpose, the figure given may be accepted as a satisfactory approximation.—*The Editor.*

Milk of the Rubber Tree

Latex—as it Comes from the Tree—Has Enjoyed a Huge Increase in Use Despite the Downward Trend of Other Businesses

By PHILIP H. SMITH



Photographs courtesy U. S. Rubber Co.

Native grooving the bark of a Hevea tree to allow the latex to drain into the spout

THE chemist and the business man alert to utilize the very latest in the development of new products are taking keen interest in liquid latex—the natural serum of the rubber plant. As a result, latex is being used in place of crude rubber for certain purposes, and in addition, it is being adopted by industries which never before employed rubber.

Latex, as it comes from the plantations, is 36 percent rubber by weight and 64 percent water. It is an aqueous solution of rubber. When this serum is clotted and dried and smoked or rolled into crêpe sheets, it forms the crude rubber of commerce. Early experiments were directed toward using latex as a substitute for this crude rubber. Then the chemist came to realize that latex had physical properties which made it valuable in its own right and so a new field of development was opened.

When concerns adopt latex for the manufacture of products formerly made of crude rubber, they make no specific mention of it. And when new uses and new products are developed, methods are very promptly patented. All this tends to keep latex from the spotlight and makes impossible a complete statement as to where and how latex is being used commercially. That its use is steadily on the increase is not to be refuted. Import data show shipments mounting year after year. All through the depression when crude rubber imports were declining, those of latex increased, and in the first four months of this year, compared with a like period of 1932, there was a 48 percent increase.

Of all latex products, perhaps elastic thread is best known to the consumer. This thread is made by extruding thin filaments of latex and covering with a winding of cotton or rayon thread. Its particular use is for weaving into garments where elasticity is desired. The textile industry has also made use of latex for impregnation of cloth to make it waterproof and for treating the cord used in the manufacture of tire fabric. Tire cord consumes the greatest amount of latex.

Carpet and rug manufacturers have also made use of latex. One scheme is to make a solution which will remain tacky but not sticky and apply it to the backs of carpets to prevent them from slipping. Another idea just put into effect applies to the joining of strips of carpet to make a broadloom effect. A very close joint can be made which will not show a ridge.

PAPER producers were among the first to adopt latex. It lent itself quickly to existing practice because solutions could be applied with regular machinery and satisfactory results obtained without additional outlay. Waterproof paper is now being made by coating one or both sides in a latex bath or by mixing the latex with the pulp in the beaters. Waterproof bags have been placed on the market for shipment of materials which would be injured by the penetration of moisture. Paper makers have recently added to their latex-treated products, and now coated printing paper, baggage tags, writing paper, inexpensive raincoats, and umbrellas are coming from their plants.

The marketing of rubber non-skid chains for automobiles last spring revealed rope makers as joining the users of latex. No metal is used in this "chain." The cross links are solid blocks of rubber bonded with latex-impregnated rope to make an inseparable unit. Latex is being used also to waterproof rope to make it resist the action of sea water and chemicals. It is applied as well to hawsers, fish nets, fishing lines, and laundry bags. Not far behind the rope maker is the manufacturer of insulated wires who for years has been using rubber but more recently has discovered great possibilities in latex and today offers a variety of wire products in which latex plays an important part.

EXCELLENT artificial leathers are now being made by impregnating special paper stock with liquid latex and embossing the surface to give a leather effect. Such materials are now being used for women's shoes and as insoles for all types of shoes, also for covering furniture and for book covers. Boot and shoe people are using latex to stick leather to leather, and to vulcanized rubber, canvas, and felt.

In manufacturing from latex there are two principal methods employed—dipping and electro-deposition. The first method is used for the production of seamless goods such as toy balloons, surgical gloves, and the like, and is extremely simple. A latex solution is prepared with the desired chemical substances added. The molds are dipped in this solution and then hung up to dry. Repeated dippings build up the required thickness of rubber. Vulcanizing takes place when the coated mold is dipped in warm water or placed in a heated room.

Latex has marked advantages in the production of dipped goods. Being an aqueous solution at the outset, no volatile solvents are needed. This reduces costs, eliminates fire hazard, and removes the difficulty of recovering the solvents. Then, too, latex has superior strength and aging properties because there is no milling or masticating and therefore no weakening of the physical

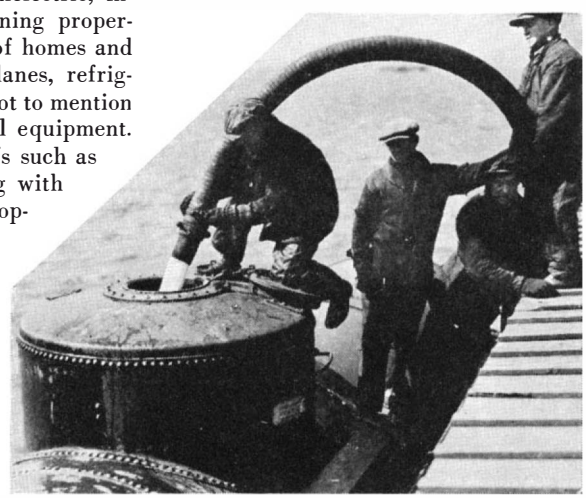
structure of the rubber. And, since vulcanization takes place at low temperatures with ultra-accelerators, a better product can be made. These advantages warrant the use of latex rather than crude rubber even though it means importation of a large volume of useless water. Rubber is a substance which cannot be returned to an aqueous solution once the original water has been driven off, without altering its physical characteristics.

THE electro-deposition or "anode" process utilizes the fact that rubber particles are electrically charged. It is really a plating process and is performed by making the article to be coated the anode of an electrolytic cell. Metal sheets and frames, and screens can be coated to advantage with this process. Corsets where ventilating holes are desired are latex-coated in this manner. Non-conducting plugs leave open spaces wherever wanted, hence it appears that the process has special merit where forms are complex and might be imperfectly coated by the more simple dipping process.

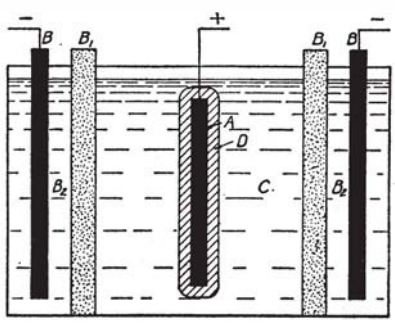
The basic problems in the use of latex which confront the chemist and which must be solved for each individual project are three in number. First, latex viscosity must be kept constant; in other words, premature coagulation must be avoided. Second, the pigments and chemicals used in conjunction with latex must be had in sufficiently fine state of division to prevent settling out when standing. The last problem relates to devising machinery for application. In most commercial work, water must be driven off from the solution and that requires special machinery, built of special metals. Copper and brass cannot be used because they are affected by latex. So far stainless steel appears to offer the greatest possibilities for use in the machinery.

In fields where latex has made the greatest strides there is still room for development. Paper and allied industries have further to go. Insulating board utilizing latex is in its first stages. Various waste products such as sawdust, shavings, and the like are being treated with latex to make a waterproof composition. This type of condensation product which has high dielectric, insulating, and sound-deadening properties, interests the builder of homes and the manufacturer of airplanes, refrigerators, and automobiles, not to mention the producers of electrical equipment.

Preservation of foodstuffs such as eggs and fruit, by coating with latex, is a possible development. Latex would make these articles impervious to air as well as moisture. Preservation of building stone, cement, plaster, and concrete, can be accomplished by painting with latex of suitable concentration or with latex combined with colloidal dispersions of resins. Waterproof paint, in which latex is the basic ingredient, has long intrigued paint manufacturers and rather promising results have been obtained. Inertness toward alkalis, boiling water, and the like, is one of the advantages of latex paints.



Latex is brought to this country in special tank ships and then transshipped by pumping into railroad tank cars



A—Anode with deposit of latex rubber
B—Cathodes
B1—Cathode diaphragm
B2—Cathode compartment
C—Latex mix
D—Deposited rubber

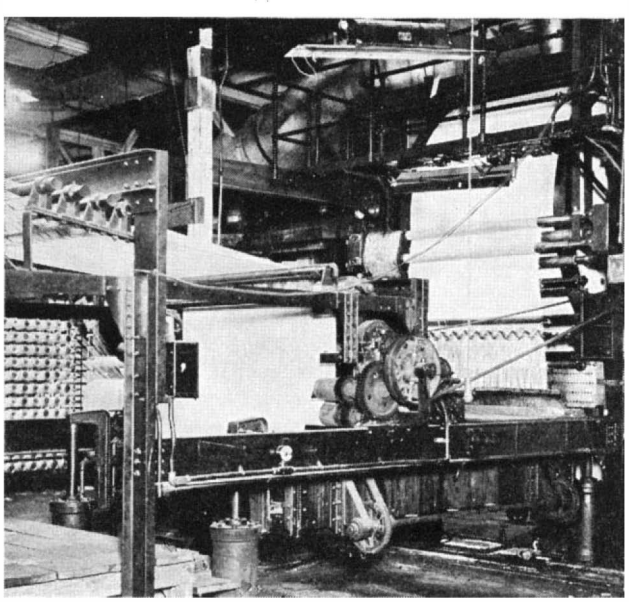
Courtesy *Industrial and Engineering Chemistry*

A schematic drawing of a cell for anode electro-deposition of latex on metal. The deposit is 40 percent water and therefore a conductor

GEORGE D. KRATZ, who has been responsible for the development of many latex products, claims that the time is not far distant when tires will be made without the use of heavy machinery or large capital investment. All that will be needed will be cotton fabric, wire, suitable molds, and a latex solution. Milling and masticating processes will go by the board.

Latex is known to make a superb lubricant for machinery, since it reduces losses from friction to a minimum. Unfortunately, it cannot be used long without sudden coagulation. It is up to the chemist, therefore, to find some stabilizing agent. The mixing of cheap hydrocarbon oils with latex has been tried, and while it is satisfactory for light machinery, the experiments have not yet reached a practical stage.

To make a rubber road which will be silent, resilient, and long-wearing, is one of the dreams of the latex chemist. Untreated latex has failed as a road surface, hence the addition of some other material to the latex will be necessary. The problem involves the use of a vulcanizing and reinforcing ingredient and the prevention of clotting while laying. An admix of latex to bitumen has been tried with a measure of success and chemists are convinced that it will be a matter of only a few more years before latex-insulated automobiles, lubricated with latex and equipped with latex tires, will traverse noiseless, latexed highways.



Making flat layers of cords for automobile tires. The cotton threads are drawn from the spools at the left, laid side by side, and then passed through a tank of latex. The impregnated "web," held together by the latex, is then used in tires without any weaving

'Cruiser Number 1. Report'

Newly Developed Short Wave Radio Equipment Enables Officers in Cruising Police Cars to Carry on Two-Way Communication with Headquarters

By J. HENSHAW CRIDER

A POLICE radio cruiser idles along the highway when suddenly a heavy sedan roars past, swaying dizzily from side to side.

"Step on it, Mike!" shouts Officer Number 1. Their radio, a few minutes before, had reported a bank robbery in the village four miles eastward.

The light police car spurts forward, closing up the gap until the fugitives are but a few hundred feet ahead. As Officer Number 1 leans out of the window to take aim, the rat-a-tat-tat of machine-gun fire bursts from the rear of the big sedan. Bullets spatter the front of the cruiser, blow out the tires and the car hurtles from the highway. With a mighty crash it strikes a tree, a pile of splintered wreckage.

One member of the police crew, barely able to extricate himself, hobbles into the middle of the road, looking into the distance which swallowed up the gunmen. No houses in sight. No handy telephone. No way to send word ahead to stop the criminals. No way to get help for his groaning buddy and himself.

If this police cruiser had been equipped with a two-way radio installation such as that which was placed in service during the past summer at Eastchester, New York, and Bayonne, New Jersey, help would have been on the way, and the police in the next town would have been waiting for the fleeing gunmen. It would have enabled them to talk to their headquarters the moment they first saw the fugitives.

Such installations have other uses than curbing crime. Recently, a lone Bayonne patrolman pulled a drowning man from the water in an isolated spot. He tried artificial respiration in vain. In the absence of telephones, he could never have obtained the inhalator which saved the man's life if it had not been for the handy radio transmitter in his patrol car.

Interior of two-way radio police cruiser, with equipment built into the instrument panel of the car

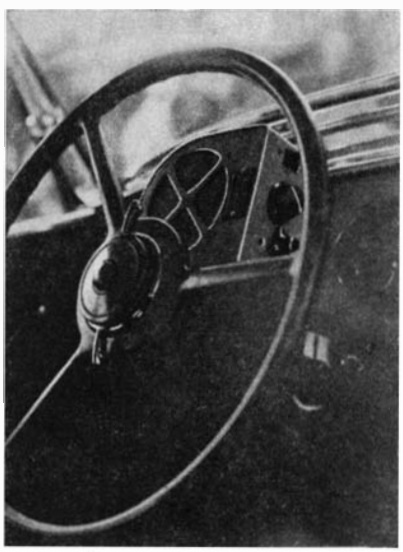
The practical demonstrations of two-way, ultra-high frequency (ultra-short wave) radio equipment, placed into regular police use for the first time in the New York and New Jersey communities, suggests a new era of radio communication in which police departments cover large areas with talking patrol cars, and high speed, transport airplanes zoom through space at four or five miles a minute, constantly in touch with a series of land stations by means of the practically static-less ultra-high frequency equipment.

Already the New York State Conservation Department uses equipment identical to that employed at Eastchester and Bayonne to maintain communication with its forest-fire patrol planes. On September 13, the Navy Department announced the successful use of ultra-high frequency apparatus built for the *Macon*, calling special attention to the static-less characteristics of the reception.

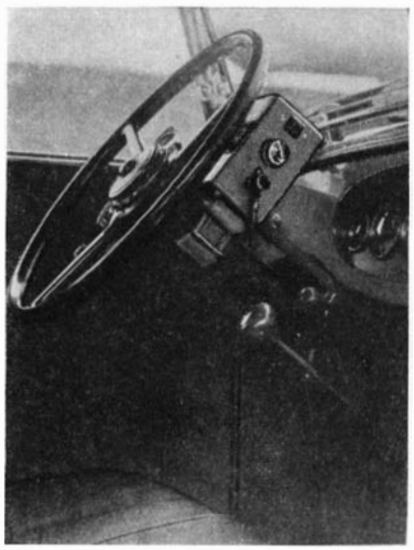
Besides giving more efficient police service, saving lives, and demonstrating new radio possibilities, the ultra-high frequency equipment offers a solution to the problem of congestion in the 1500 to 3000 kilocycle band which the Federal Radio Commission has allocated to police departments using the conventional type of one-way radio. More than 70 departments throughout the country are now operating on the eight available wavelengths.

The problem is a serious one, threatening to prevent further use of conventional short waves in the police field. The Federal Radio Commission pointed this out in a bulletin last February, urging that departments in the same areas use the same wavelengths on a mutual basis wherever possible.

There are 26 times as many

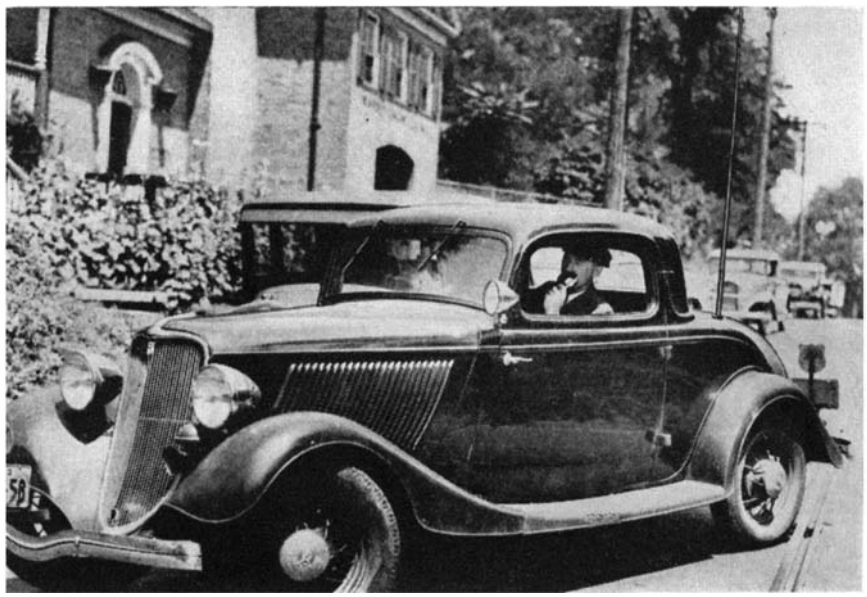


Steering-column type equipment, showing the small dynamic speaker

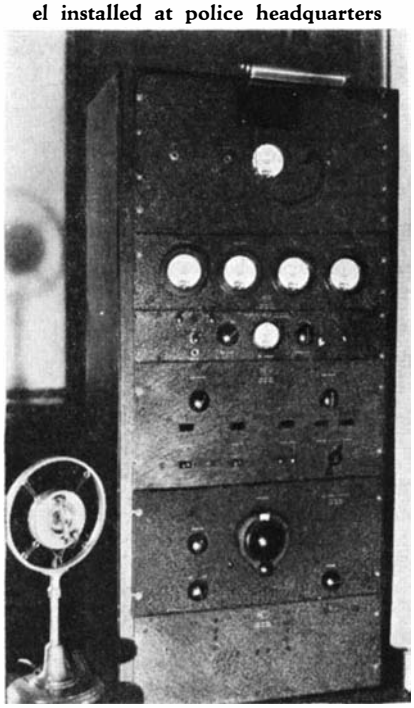


Side view of radio installation. Volume control knob in the center

Right: **Radio equipped police cruiser with telescoping aerial fully extended**



Below: **The transmitter control panel installed at police headquarters**



usable wavelengths in the ultra-high frequency bands employed by the Radio Engineering Laboratories, manufacturers of the Bayonne and Eastchester equipment. While there are only 1500 kilocycles between the limits of the present short-wave band, Radio Engineering Laboratories is manufacturing ultra-high frequency equipment suitable for operation between 30,000 and 68,000 kilocycles—a band 38,000 kilocycles wide. And these are virgin fields as far as commercial radio is concerned.

DON'T imagine that the police officers ride along in their patrol cars operating a tuning knob to tune-in on headquarters. They don't have to. The frequency is set and locked upon installation of the equipment. Once installed, the apparatus is always ready for use.

The writer, in making extensive observations at Eastchester, noted particularly the fact that the ultra-high frequency apparatus was not affected by the ordinary interferences which regularly interrupt conventional short-wave reception. In the first place, there is a power station within a city block of Eastchester police headquarters. Perfect reception was obtained in the patrol car while speeding at 60 miles an hour. During a slow ride over a steel railroad bridge, the high-tension power lines on each side did not mar reception. Police officers have reported perfect communication throughout severe electrical storms.

No special training is required to operate this new two-way radio equipment in the cars. Any police officer can do it by following a few simple rules.

The control panels in Bayonne and Eastchester headquarters, imposing as they may appear with their rows of dials and gadgets, have only five controls which concern the operator, and three of these are used only in turning the power "on" and "off." A fourth switch changes the apparatus from "transmitting" to "receiving." The radio units, both at headquarters and in the cruisers, may operate in only one capacity at a time—either as sending or receiving stations. The cardinal rule is to keep the status-control switch in "receiving" position at all times except when actually transmitting. The fifth control on the headquarters operating panels is for volume. This operates like any home radio set's volume control knob.

SO well suited to its purpose is the cruiser unit that an officer may at the same time drive the car and operate the radio. There are only three controls. At the top of the panel is the "on-off" switch; in the center is the volume control; and at the bottom is the status-control switch. The small loudspeaker is of the dynamic type.

Features which mark the cruisers as unusual are their aerials and microphones. The aerial is attached to the highest rear surface of the cruiser, and consists of a permanent tubular portion, fixed to the car, in which there is a solid metal rod which slides out to a maximum height of nine feet above the ground. Two wing bolts hold it in place.

Four and one-half watts of power are required to operate the cruiser sets —less than is used by the two headlights of the car. Power is supplied by the car's regular generating system. The transmitters at headquarters operate on 25 watts, supplied by a motor-generator operating on 110 volts.

The new equipment also enables patrol cars to talk to each other as well as to headquarters. If, for lack of power or some other cause, the headquarters apparatus should be temporarily out of order, a cruiser can be brought to headquarters and its radio substituted for the regular headquarters apparatus.

LET us ride for a moment with the patrolman in Cruiser Number 1. He drives about two blocks from headquarters before switching on his radio. Immediately, a sound as of rushing air comes from the loudspeaker.

"That's the 'rush,'" he explains. "It always lets us know that everything's working all right."

Suddenly the "rush" stops.

"What does that mean?" you ask.

"Sh-h-h!" the officer cautions, his finger to his lips, "a message is coming through."

Sure enough, a second after the "rush" fades out a voice is heard.

"Hello Cruiser Number 1. Eastchester headquarters calling Cruiser Number 1. Report your position. Kay."

The patrolman throws his status-control switch to "transmitting" and speaks into the "mike."

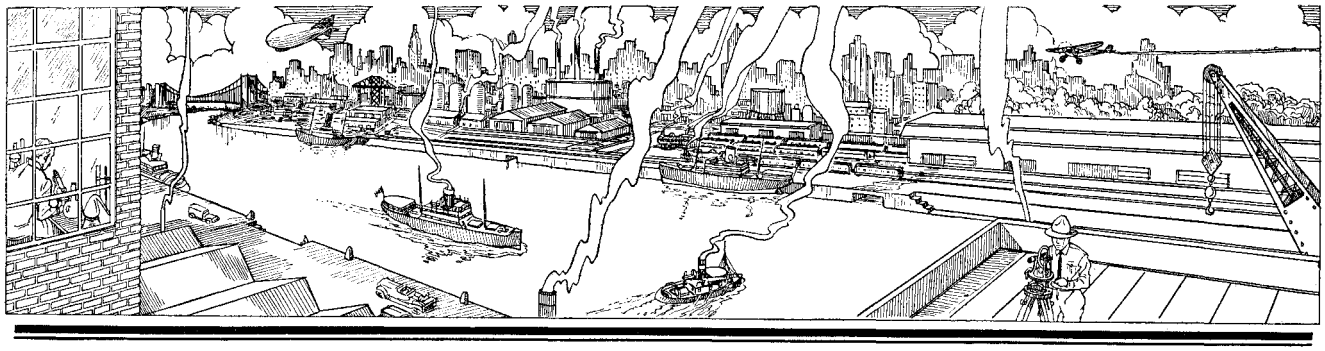
"Hello headquarters. Cruiser Number 1 calling Eastchester headquarters. I am now cruising north on Post Road at Locust Avenue. Kay."

You ask the officer if the "rush" always cuts out when a message is coming through.

"Yes," he answers, "that is what gives us a warning."

"And that 'kay' business—why did both you and headquarters sign-off with 'kay'?"

"Why, that's our signature," he says. "It means goodbye and O.K. all in the same breath."



THE SCIENTIFIC AMERICAN DIGEST

Conducted by F. D. McHUGH

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When Do You Have Colds?

IF you are one of those unfortunate persons who seem unusually susceptible to colds you may be cheered by the knowledge that such susceptibility does not persist year after year for an indefinite period. On the other hand, neither does resistance to colds persist indefinitely.

These seem to be among the findings of the studies on the common cold that Dr. William M. Gafafer and Dr. James A. Doull, now of Western Reserve University, have been conducting at the Johns Hopkins University under the John J. Abel Fund for Research on the Common Cold.

The frequency of attacks of colds in the same person for two successive years was studied both in medical school students and in members of a group of 100 Baltimore families. In the medical group the frequency of attacks in the same student for two years, with intervals of one year and two years in between, was also studied.

A tendency for persons to remain cold-resistant or cold-susceptible at least for successive years was noted; but when the years observed are separated by one year the results are doubtful, and when the interval is two years there is no indication of a definite tendency for persons to remain in the same class as regards susceptibility or resistance to colds.—*Science Service.*

More Vehicular Tunnels for New York

CONTRACT with the public works administration for 37,500,000 dollars credit for the construction of the mid-town Hudson Tunnels—across the Hudson River, at 38th Street, New York—was approved recently at a special meeting of the Commissioners of the Port of New York Authority. This project will consist of two vehicular tunnels to supplement the present Holland Tunnels, giving additional traffic facilities between New York City and New Jersey.

The main tunnel, which is the portion of the project from tunnel portal in New York to tunnel portal in New Jersey, will consist of a single tube about 8000 feet in length, providing for one lane of vehicular traffic moving in each direction. This tube is the southerly one of the two tubes of the completed project.

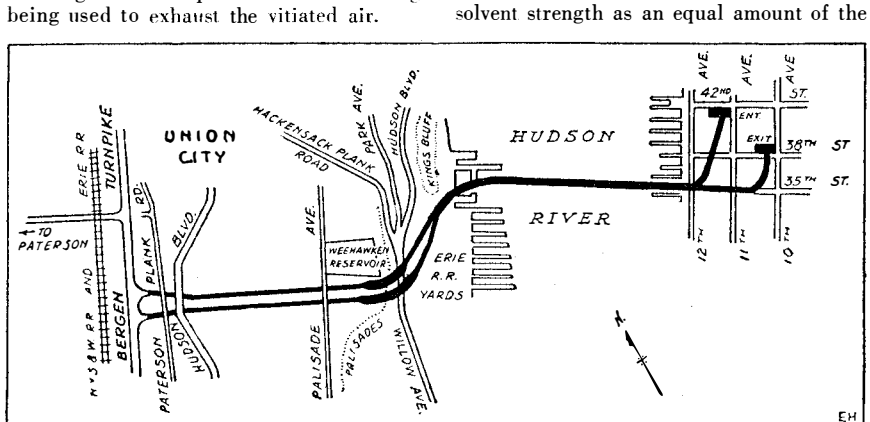
The greater part of the tube will be built in silt by the shield driven method and will consist of cast iron rings built up by bolting together segmental castings. The tube will have an outside diameter of 31 feet. Sections near the portals at each end will be in rock and will be built by the usual rock-tunneling methods. The entire tube will be lined with concrete.

The top of the tunnel will be 62 feet below mean low water at the pierhead lines and 70 feet below mean low water at the lowest point of the tunnel. It will thus conform to the requirements of the War Department as established in the case of the Holland Tunnel. There will be no obstruction to navigation during construction.

The interior arrangement of the tunnel will be similar to that of the Holland Tunnel. The roadway, however, will be 21 feet 6 inches between curbs, or 1 foot 6 inches wider than the Holland Tunnel roadway. A vertical clearance of 13 feet 9 inches above the roadway will be provided. In the main tunnel, the maximum grade will be 3.5 percent except for a short distance at the extreme easterly end of the tube where the grade will be 4 percent.

Ventilation will be accomplished by the transverse distribution method so successfully used in the Holland Tunnel, the space below the roadway being used for a duct conducting fresh air from the ventilation building and the space above the ceiling being used to exhaust the vitiated air.

The plan has been worked out so that the single tube with its plazas and connections will be a complete operating unit in itself and will permit the construction of additional facilities at any time without interference with, or damage to, either the structure involved in the first operating unit or the traffic using it. All of the work performed for the first operating unit is useful in and planned as a part of the entire two-tube project.



Courtesy *The New York Times*

Tentative plan of the new vehicular tunnel for New York

Alcohol Industry Expanded During Prohibition

FOR the past 15 years, writes John McE. Sanderson in *Paint, Oil and Chemical Review*, there has been so much discussion regarding the use of alcohols for beverage purposes that the pertinent fact that they constitute one of the most important group of solvents has been quite thrust aside. Yet during the same period the paint industry has increased its use of alcohol tremendously, not only in volume but also in variety. We have available and in regular use improved grades of denatured ethyl alcohol, which leads in volume consumed in varnishes and lacquers, with butyl alcohol, a chemical curiosity 20 years ago, second place in this field. Methyl and amyl alcohols continue next in importance, with a score of others used in smaller volume.

The growth in the use of lacquers has been accompanied by a corresponding development in the use of alcohols. As a group they are classed as latent rather than active solvents for nitrocellulose, but become activated by the true solvents so that such mixtures have substantially the same solvent strength as an equal amount of the

true solvent alone. A point of particular interest in lacquer formation is that the alcohols, in general, evaporate at a very much slower rate than the corresponding acetates, although the opposite might sometimes be expected from their boiling points.—*A. E. B.*

Safety Matches Strike On Glass

IT has often been noticed that so-called safety matches will ignite when "scratched" briskly across a sheet of glass. To find the reason for this, we consulted the Mellon Institute of Industrial Research. Their reply follows:

"The tip, head, or ignition portion of the ordinary safety match contains potassium chlorate, sulfur, and a binder, such as glue. The striking surface on a safety match box consists of amorphous phosphorus, antimony sulfide, and an adhesive.

"It is well known that an explosion results when potassium chlorate is ground with sulfur or other combustible material. When, therefore, a safety match head is 'struck' or rubbed hard on a glass surface, the friction is of the character and sufficiency to produce a reaction between the potassium chlorate and sulfur, causing ignition."

The Newest Rail Car

A "RAILPLANE," the latest example of railroad passenger equipment, combining the best points of aircraft architecture with railroad necessities, is announced by the Pullman Car and Manufacturing Corporation, the manufacturing subsidiary of Pullman Inc. This is the "mystery car" about which car manufacturers have been whispering and speculating for some months. It came into the open recently when it emerged from the Stout Engineering Laboratories Inc., of Detroit, where pre-experimental work and construction was done.

Sixty feet in length with a seating capacity for 50 persons, the "Railplane" weighs about 25,000 pounds. It is streamlined, lack of air resistance being more marked than in anything yet built for railway purposes. It has an indicated speed capacity of 90 miles an hour.

In appearance it resembles, largely, a bullet with both ends rounded. Aerodynamic experience and wind tunnel tests determined the shape, and an added feature of avoidance of air resistance is found in the location of the pair of engines. Two in number, these are mounted on the forward truck, in the space between the outside of the wheels and the outside of the car proper. Here they offer no impediment to the wind, and can be easily reached for repairs. One engine drives the front axle and the other drives that in the rear. All mechanism is controlled by one operator in the car's nose.

While conventional automotive-type engines are used for propulsion in this experimental car, the design is so arranged that Diesel engines may be substituted to meet the preference of individual railroad mechanical departments. The aim was to produce a vehicle for rail service which would have the lowest operating cost per passenger mile of any known form of transportation.

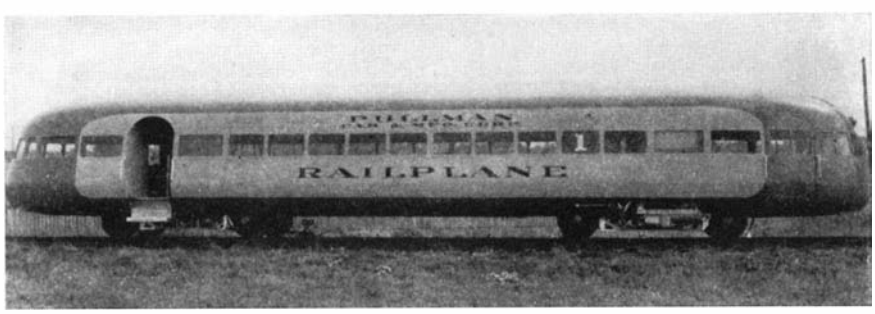
The construction of the car body is both novel and of great strength. The framework is of welded high tensile strength steel tubing. There is not a bolt or a rivet in the entire body frame. The shell, or outside of the car, is of duralumin, a heat-treated aluminum alloy having the strength of ordinary structural steel but weighing one third as much.

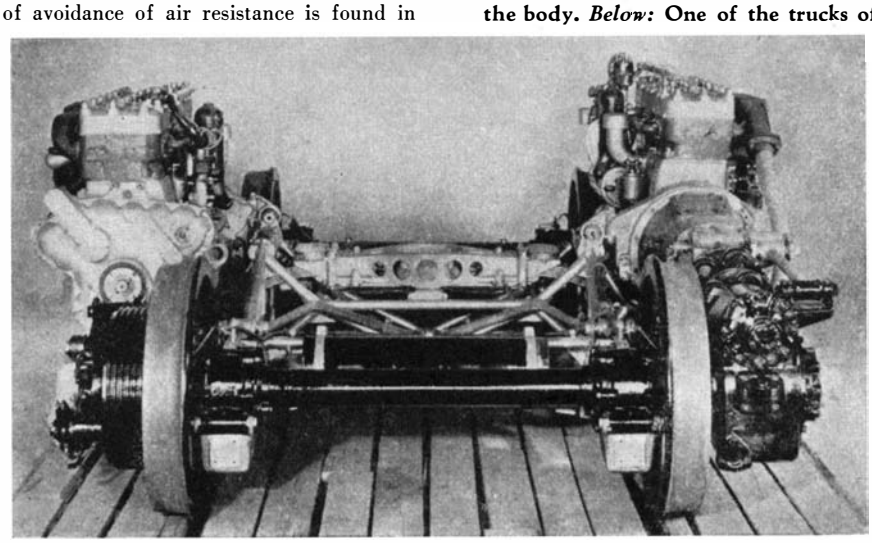
The car is heated with air passing through the radiators and is artificially cooled for summer use, the windows being sealed, using safety plate glass, set flush with the body surface. Rubberized hair is used for sound-proofing and heat and cold insulation between the outer and inner skins which together with the rubber used in the trucks and engine mounting and the air conditioning will eliminate noise, dirt, and vibration. Resilient wheels are used with rubber acting in shear, and the brakes are of the automotive drum type.

The control of the car is very simple as the gear shifting is automatic and the two engines are controlled by one throttle.

While the car constructed is a single unit, the same principles of design are adaptable for a multi-car train with units using common intermediate trucks.

Front view of the "Railplane"





Above: **Side view of the "Railplane," showing the stream-lining of all parts of the body.** ***Below:*** **One of the trucks of the "Railplane," with motors mounted**

Something New to Fear

AN ailment called broncho-sinusitis is more to be feared at present than tuberculosis, according to Dr. W. Walter Wasson of Denver, vice president of the American College of Radiology.

"Broncho-sinusitis, a respiratory disease of the 'sinus trouble' and bronchitis type, while it does not produce the same mortality that tuberculosis does, is often very crippling to the child and adult alike," said Dr. Wasson. "This ailment begins very early in life, is insidious in its progress, and lays the foundation for a variety of symptoms which may become asthma, bronchitis, and sinus infection.

"Studies conducted by myself and associates in our Denver clinic have followed the child from birth to ten years of age, so that we have quite complete X-ray films of the sinuses and chest every three months from birth to ten years. This is a group of about 100 children, and is large enough to give us much information, as it reveals the life cycle of disease of an average group of American youngsters."

Dr. Wasson emphasized the need for periodic examinations to watch for incipient broncho-sinusitis.—*Science Service.*

Selenium Softens Hard Steel

SELENIUM, first cousin of sulfur, has found a new and important field of usefulness by its ability to ease the difficult working qualities of chrome-nickel steels. In the form of ferro-selenium it is added to the molten steel just before pouring. It

compounds rapidly with the steel and so modifies the finished, hard steel that it can be drilled, tapped, threaded, and otherwise machined with ordinary shop tools.

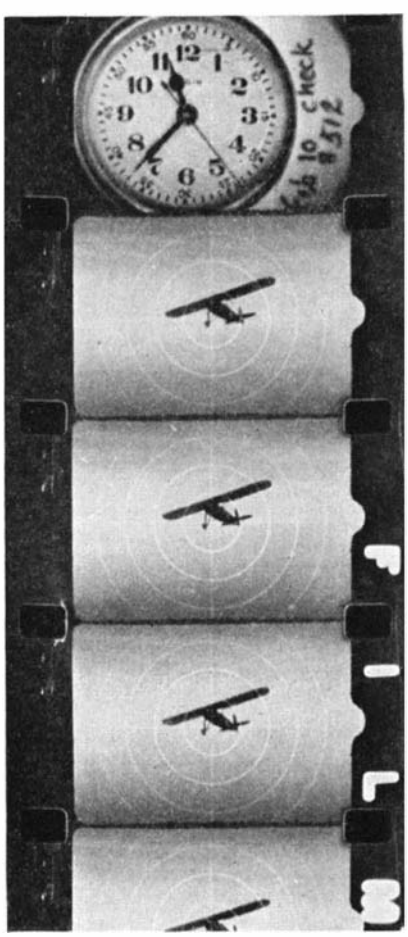
Sulfur has previously been used for this purpose, but selenium has proved superior because it gives a much tougher steel and one less subject to transverse fracture. The finished steel contains 18 percent chromium, 9 percent nickel, and 0.25 percent selenium. Far from impairing the corrosion resistance of this alloy, the small quantity of selenium is said to improve the resistance of the steel to hot acetic acid, aluminum sulfate, and other corrosives.

A process has been developed for the production of a thin film of selenium on several light magnesium alloys. This film imparts considerable resistance to the corrosive action of sea water.—*A. E. B.*

Camera Training for Aerial Gunnery

TRAINING in aerial gunnery has been given to both Army and Navy pilots by towing a glider target behind an airplane. This method is judged unsatisfactory because the target is too easy to hit, because actual conditions of combat are not duplicated, and because no very definite record of achievement is possible.

The more modern method is to use a "camera gun" in which the "enemy" plane is photographed by the pilot. Such a gun has been developed by the Fairchild Aerial Camera Corporation.



Above: **The pictorial record of gunnery practice with the new "camera gun" described above and illustrated at the right. The top frame records time and other data**

The shape, size, and weight of the camera gun are exactly the same as those of the machine guns usually carried by military aircraft. The only difference lies in the fact that the camera gun experiences no recoil. It is only by such similarity between camera gun and machine gun that full training value is attainable. The camera gun is provided with a time registering device, and takes photographs at the rate of 16 per second as long as the trigger is depressed. A total of 1000 photographs can be made with a single winding.

Each photograph has registered on it a system of concentric circles and cross hairs, so that it is possible to record the aim of the gun definitely. A study of the exposed film will also show whether the airplane is too far away or too close, too high or too low.

It is interesting to examine the accompanying strip of photographs secured by enlarging a section of the film obtained in actual practice. It shows a typical series of photographs or "burst of fire" with the image of a watch and the data card at the end. The point of intersection of the cross hairs is the exact point through which the bullet would have gone if bullets had been used instead of photography. The concentric circles and cross hairs show up clearly against both sky and aircraft.—*A. K.*

Around the World (?) in 12 Hours

TWICE around the world every 24 hours is the daily program followed by United Air Lines, whose fleet of three-mile-a-minute passenger-cargo transports is now scheduled to fly approximately 51,000 miles daily, or the equivalent of 18,432,500 miles annually. Planes of this company serve 45 cities in 20 states, including several daily Coast-to-Coast schedules.

This rapid increase in mileage is due primarily to extension of passenger carrying activities, as 31 percent of the total mileage is being flown without mail revenue, in contrast to a few years ago, when all schedules were flown with mail.

Signal Lights for the Flyer

A PORTABLE signal light has been developed by the Westinghouse Electric and Manufacturing Company which is certain to be of service to seaplane pilots. Although quite powerful (150,000 candlepower is the figure given) these lights, complete with cable and shutter, weigh less than twelve pounds. Mounted in the seaplane on each side of the cockpit, the lights will be used for signaling purposes with the ground at distances ranging up to

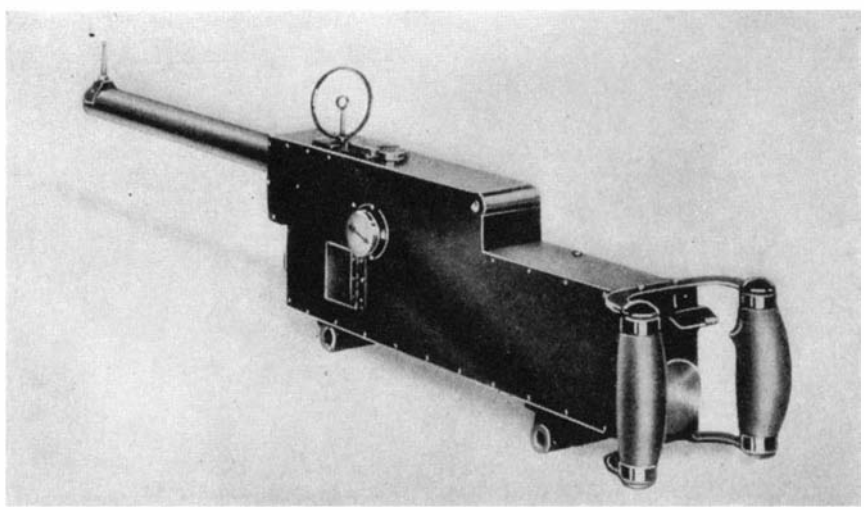
New portable signal for flyers

five miles, or as searchlights to pick out buoys and shore lines at distances of two or three hundred yards. A signaling shutter is mounted directly on the front of the unit and is operated by a small hand trigger capable of blinking the light at very high speed. Thus code signaling will be possible where no radio communication is available. —*A. K.*

Autogiro Ambulances

IN war-time, to get all the wounded back from a brigade to a collecting station which is only a mile from the front takes an average of 35.8 hours. And this is only the beginning of the process. To a wounded man the extra time required for handling and transit through the collecting station, for the ambulance trip to the hospital station, and thence to the evacuation hospital must seem interminable. Nor can a hospital truck on rough territory be a comfortable vehicle.

Colonel G. P. Lawrence of the Medical Reserve is the authority for the above figure. He advocates aerial ambulances as both infinitely faster and more comfortable than anything else available. Unfortunately no front line trench is provided with a first-class airdrome. Hence a plea for the



autogiro, capable of operation in restricted territory, as an ambulance machine.

We are indebted to *U. S. Air Services* for the suggested design of an autogiro ambulance aircraft. The ambulance would carry a pilot and three patients, two recumbent in the navy type wire basket "Stokes" litters, and one sitting. The litters would have special supports and the doors would be moved back and widened as compared with the ordinary autogiro. The door opening is so placed that the lower sill is just below the hip height of a man standing on the ground, which provides convenient conditions for rapid loading of the litters into the mountings provided in the cabin. With a cruising speed of 100 miles per hour, it would be possible to evacuate three patients to a hospital some fifty miles behind the front lines and return to the battalion aid station in little more than an hour.—*A. K.*

Airplanes Aid Farmers

AIR express aids not only industry and commerce but the farmer as well. The Railway Express Agency reports this incident. Spraying machinery at Burley, Idaho, broke down and 700 tons of sugar beets were jeopardized. Repair parts were rushed by United Air Lines and the shipment arrived on the farm 2400 miles from New York in 24 hours. The crop was saved.

The Navy Flight to the Canal

THE flight of a Navy Squadron of six twin-engined flying boats from Norfolk, Virginia to the Fleet Air Base at Coco Solo, Canal Zone, in a formation non-stop flight of 2059 miles, is the longest such flight on record. It exceeds by some six or seven hundred miles the longest non-stop hop of General Balbo's armada. The flight is far more than a record or stunt. It has decided technical and naval significance. The airplanes were Navy patrol flying boats, fully equipped but not specially built or prepared for this flight. Therefore we can conclude that the aerial forces of the Navy have complete mobility and independence of action, particularly valuable from the point of view of defense of our Canal Zone.

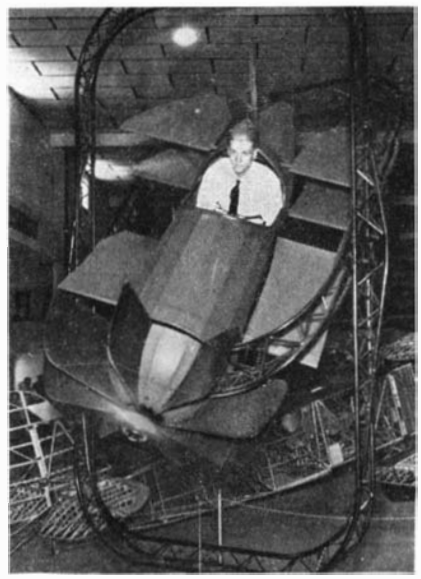
Lieutenant-Commander D. M. Carpenter and his officers and men took the flight absolutely in their stride. There was not the slightest mishap or delay. The P2Y-I airplanes have the following specifications: Gross weight, 19,850 pounds normal load; two Wright Cyclone engines, of 1250 horsepower total; fuel capacity, 1200 gallons normal; wing span, 100 feet; crew, five.

One of our photographs shows a front view of a P2Y-I, which is a biplane with the lower wing of lesser span than the upper. The logical and clean trussing, with not a wire to adjust, is a triumph of structural engineering. The splendid vision from the pilot's cockpit, the clean lines, the carefully faired lines of the hull, are the culmination of much development work by the Navy and the Consolidated Aircraft Corporation, responsible for the construction of these boats.

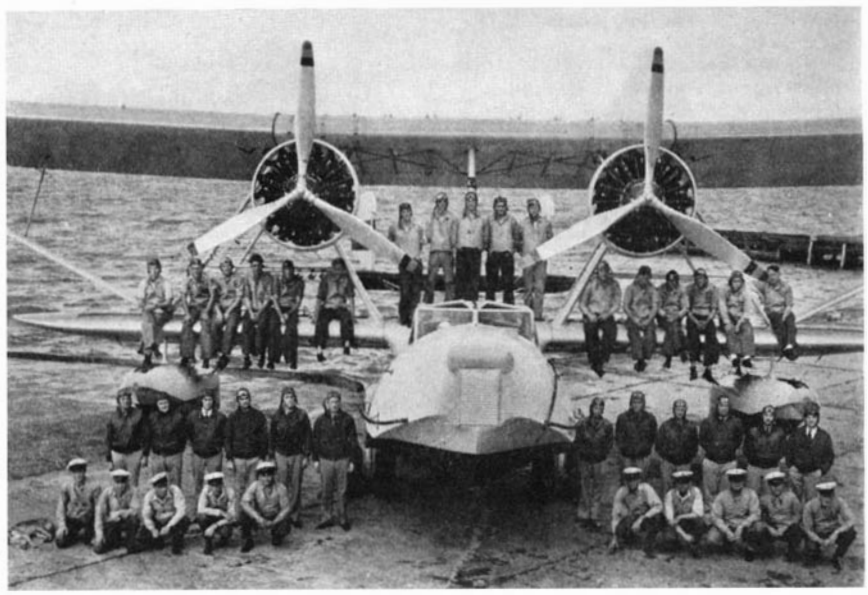
Another photograph shows one of the boats taking off for the Coco Solo flight. The water is white and eddying over a wide and long area, but there is not a sign of spray to bother the propellers and the tail surfaces are many feet above the water line and absolutely untouched. It is only particular attention to the water lines of the hull and to design of tail surfaces that makes such take-off possible with a heavily loaded plane.—*A. K.*

The Flight Tutor

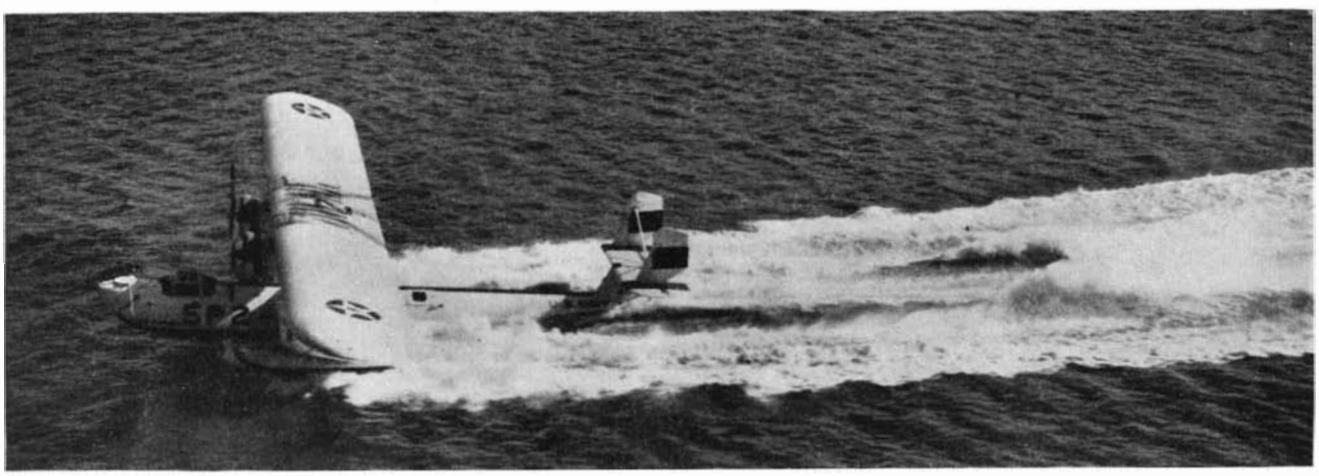
THE Flight Tutor attracted much attention at the Century of Progress. It consists of a miniature plane mounted in a main frame which can turn about a vertical axis. The main frame has bearings for another frame which can pitch up or down, and the plane itself can roll from side to side inside the second frame. In other words, the small plane has three degrees of freedom in its gymbal mounting, and can loop, roll, nose-dive, spin, bank, or do anything that a free airplane will do except move ahead. Driven by an electric motor, the propeller provides a powerful blast of air so that all the useful controls—ailerons, elevators, and rudder—are fully operative.



The "pilot" of the flight tutor can do everything except actually fly



Above: **The naval crew of the squadron which recently flew to the Canal Zone, grouped about a P2Y-I.** ***Below:*** **One of these well-designed flying boats taking off**



The pilot can do anything he likes; a novice probably finds it hard enough just to keep his fettered craft on an even keel. The expression of the "pilot" in our photograph is not entirely happy.—*A. K.*

An Aircraft Switchboard

THE United Airlines have earned for themselves a great reputation for devising improvements in their transport operations.

One of the latest wrinkles of this transport company is an aircraft radio-phone

Operator at land radio station dialing a call to an airplane in flight

switchboard. The operator in the photograph can communicate with a plane in flight by dialing the proper number. When the radio despatcher has been talking with the pilot of a plane in flight, and desires to communicate with another pilot using a different wavelength, he merely turns to the proper number, which automatically gives him the proper frequency and the desired volume.—*A. K.*

Diabetes Death Rate

THE increased diabetes death rate is not due to an increased per capita consumption of sugar, nor to changes in the national diet or living habits, in the opinion of Dr. Charles Bolduan, Director of Health Education of the New York City Department of Health. In fact, the increase in the diabetes death rate is more apparent than real, Dr. Bolduan believes. He explained his views at a recent meeting of the American Public Health Association.

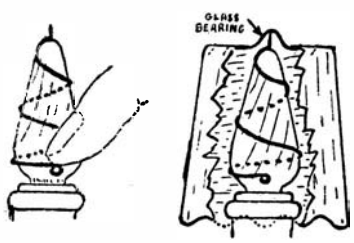
Fifty or sixty years ago diabetes was considered a rare disease. Dr. Bolduan has concluded that it was no more rare 50 years ago than it is today, but that fewer cases were detected, chiefly because simple tests for the disease were not available, and no routine examinations for diabetes were made in patients.

The disease was once considered more prevalent among men, but Dr. Bolduan believes that this was because routine tests in the course of examination for insurance and for industrial employment were made much more frequently among men than women until recent years. With the increased number of women in industry and also an increased number of women carrying life insurance policies, tests for diabetes are made among many more women now and consequently more cases are being discovered. The result is an apparent increase in number of cases among women, Dr. Bolduan explained.

Much of the increase in deaths recorded from diabetes is fictitious, Dr. Bolduan said, for many of the deaths represent the death of a diabetic individual from some other cause. It seems that when a person who has had diabetes dies, the death is officially registered under diabetes. If there were other causes, they were mentioned secondarily, but the result is a swelling of the diabetes death lists.—*Science Service.*

A Twinkle for Christmas Tree Lights

CHRISTMAS trees, so some antiquarians say, are older than Christmas. For century after century, their tinsel and trappings, their gaudy and quaint ornaments bending down their green arms, have gladdened the hearts of children the world over. And giving life and sparkle and color to it



The wire clip of the Merry-Go-Lite, and rotating shade in place

all are the Christmas tree candles—real wax candles in the old days, but for many years past little electric lights.

Now comes an improvement—the Merry-Go-Lites. A Merry-Go-Lite is simply a tiny, translucent, vari-colored shade that fits over the ordinary Christmas tree electric light bulb and keeps rotating 'round and 'round, the heat of the bulb keeping the shade moving. Instead of the lights on your tree being steady, they twinkle.

When Curtis J. McCoy, of Indianapolis, invented the Merry-Go-Lite, he took it to William H. Deubener, who is president of the company that makes two million paper shopping bags every year, which chain stores sell you so that you can carry home more things than you intended to buy when you walked into the store. Mr. Deubener undertook to manufacture the Merry-Go-Lite.

"The authorities tell me," said Mr. Deubener, "that they are the biggest advance in Christmas tree decoration since the electric light. A Merry-Go-Lited tree is said to differ from the Christmas tree of yesteryear as moving pictures differ from the old lantern slides."

Saving Silver

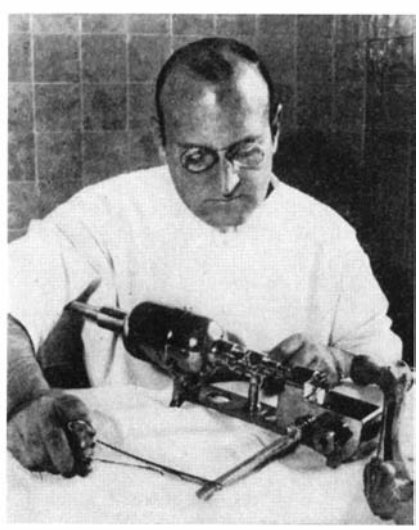
WHILE President Roosevelt is going after the hoarders of gold, chemists of the Eastman Kodak Company have been putting back into circulation large quantities of silver that would otherwise flow down the sewers of Hollywood. Tons of silver are dissolved annually in the photographic baths of the motion picture laboratories. K. Hickman, W. Weyerts, and O. Gochler describe, in a recent issue of *Industrial and Engineering Chemistry*, the process they have developed to recover this rich prize. They use an electrolytic process, depositing the silver on a large silver slab.

Plating cells with paddles to agitate the liquid have been installed in a motion-picture plant in Hollywood, with remarkable results. The cells hold 10,000 gallons of fixing bath—enough to treat 350,000 feet of mixed positive and negative film in a day. The waste silver is deposited as a mirrorlike sheet. In the first six months, 60,000 troy ounces (about two tons) of silver valued at 17,000 dollars were recovered. The yield for a million feet of film is about 1200 ounces.—*A. E. B.*

Surgical Use of Machine Tools

REPRESENTING the introduction into surgery for the first time of electrically driven automatic machine tools, as shown in the accompanying illustration, is the Albee Bone Mill, devised by Dr. Fred H. Albee. The operator is shown making a bone graft screw from a piece of the patient's shin bone which he has obtained with a motor gang saw.

The surgeon has just withdrawn the bone from the dowel cutter at the right, which has shaped it into a perfect dowel or



A surgeon making use of machine tools for shaping a piece of bone

peg. He is now pushing it into the rotating die or threader for the purpose of putting threads upon it.

The living bone graft screw can be made of any size or length desirable in accordance with the cutters selected. This apparatus represents only a part of the Surgical Mill which allows the surgeon at the operating-table to shape bone in a few minutes with as much facility as the mechanic shapes metal in a machine shop, or wood in a carpentry-mill.

New Bleaching Process Keeps Wool White

A NEW bleaching process for woolen cloth is said to produce a white color that will not turn yellow from laundering or dry cleaning. According to *Chemical Age*, investigations that led to the discovery were due to a retailer who drew attention to a woman's woolen jumper, badly faded in parts, the color of which

had deteriorated rapidly while the wearer was carrying out household duties. Strong sunlight or other atmospheric influences were ruled out as possible causes of the fading and, since the dyestuff used was scheduled as fast to ordinary conditions of wear, the case presented an interesting problem for research. Investigation disclosed that the fading was due to the amount of sulfur dioxide present in relation to the amount of alkali left in the fabric. The discovery explained not only the fading of the jumper, but the cause of many off-shade effects on dyed fabrics worn in town atmospheres where sulfur dioxide fumes are found as a result of smoke.

The new bleaching process, it is stated, is now established commercially under mill conditions, and its success has been confirmed by practical tests. Many important firms have adopted it and are marketing in increasing quantities flannels, blankets, woolen underwear, tennis-ball cloth, and all forms of white goods made from wool to which it has been applied.—*A. E. B.*

An Aid to Peace Officers

WHEN an officer of the law needs his revolver, he usually needs it badly and often the six shots that it will deliver without reloading are not sufficient for the purpose. Reloading a revolver in the ordinary manner when under the stress of an emergency is a difficult and time-consuming procedure, and the delay may have fatal results to the officer.

To overcome these drawbacks of the revolver, and to give it machine-gun speed regardless of excitement, cold or wet fingers, or low visibility, the Revolver Cartridge Clip Corporation has developed a small clip which holds six cartridges spaced exactly as they would be in the cylinder of a revolver. The clip is hinged in the center so that the two halves may be folded outwardly and placed in a convenient flat case covered with a flap. When a revolver is to be loaded, the procedure, illustrated here, is as follows: The loaded clip is jerked from its case with one finger of the left hand. With the thumb of the right hand, the cylinder of the revolver is swung outwardly. The left hand, holding the clip, is used to eject the empty shells from the chamber. Then the cartridges in the clip are "spotted" over the holes in the chamber —a simple matter—the cartridges are pushed home and the clip is jerked away.

The new revolver cartridge clip. Read left column down, then right

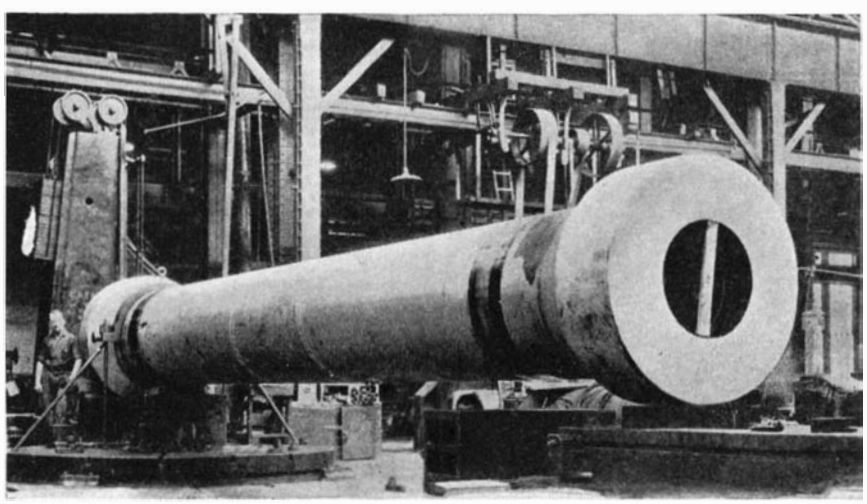
The reaction of the jerk swings the cylinder closed and the weapon is ready for use.

The new clip takes up little room in its flat case on the belt and takes the place of the individual cartridge loops which are now commonly used.

New Light on Anemia

A SERIES of experiments which throw further light on the cause and cure of pernicious anemia, and confirm some of the latest results of American research workers, has been made by Drs. John F. Wilkinson and Louis Klein, of the Department of Clinical Investigations and Research of the Royal Infirmary, Manchester, England. They have found that the blood-producing factor in hog's stomach, which is now used as an alternative for liver in checking the disease, will yield a substance resembling the blood-producing factor in liver, if it is incubated with beef muscle in the laboratory. Because of the chemical differences between the blood-producing substances in liver and in stomach, their similar curative actions in anemia have previously puzzled scientists.

Drs. Wilkinson and Klein conclude that the blood-producing principle in hog's stomach is of the nature of an enzyme, which reacts with the food—for instance, beef—taken by the patient. This enzyme, which they term "haemopoietin," appears to be identical with the "intrinsic factor" defined by the American worker, Dr. W. B. Castle. They suggest that in the living body haemopoietin produces the same actively blood-producing material as is found complete in liver, and that this material is then stored until it is needed for the formation of red corpuscles.—*Science Service.*



The production of ammonia by synthesis from its constituent gases, nitrogen and hydrogen, requires conditions of extreme temperature and pressure. Until recently, such synthesis was possible only in the laboratory, but today, thanks to the development of special steels and skilful technique, great cylinders of chrome-vanadium steel, like the one shown, successfully take the place of the chemist's laboratory tubes and make possible commercial synthesis of ammonia

Odor Remover

COMPLETE removal from air of a wide variety of odors, including amyl acetate and other acetates, mercaptans, hydrogen sulfide, and other gases and vapors is said to be effected by a new odor filter recently developed by the Consolidated Air Conditioning Company, of New York City. This equipment is available both for air-conditioning systems and for industrial systems, the latter employed for the production of pure air for processing and for the elimination of plant nuisances. The filter employs a bed of granular, activated, coconut-shell carbon as the absorbing agent. It is stated that in most installations, filters will operate about one year without reactivation. Filters are built up of steel units in which the carbon is retained by 22-mesh wire cloth.—*A. E. B.*

Armor Pierced by New Shell

REPORTS from England indicate that 16-inch naval armor on the larger battleships is no protection against a new shell for the 16-inch guns on the battleships *Nelson* and *Rodney* and for the 15-inch shells of other capital ships. No details of the shells themselves or of the explosive charge to propel them have been given out, but it is said that in actual test both sizes of the new shells passed cleanly through hard faced armor up to 16 inches thick. Further, the remarkable assertion is made that penetration is possible when the shell strikes the armor plate at angles of 15 to 30 degrees.

The new shell passes through the plate unbroken, with the fuse and bursting charge intact, so that the attacked ship is badly damaged internally by the shell's explosion.

Better Cotton

MARKED improvement in the staple quality of American cotton in the last four years is reported by the United States Department of Agriculture on the basis of grade and staple analyses made in co-operation with state experiment stations. The improvement has been most marked in that part of the crop which had been most criticized as having deteriorated in quality, says the department. For example, 20 percent of the 1929 crop was shorter than ⅞

of an inch in length of staple, but only 6 percent of the 1932 crop was shorter than ⅞ of an inch.

The improvement in the shorter cottons has been so great that the crop as a whole has gained almost 1/32 of an inch, attaining last year an average of 15/16 of an inch, according to the official standards of the United States. This length is equivalent to 1 1/16-inch staple according to old concepts still used by some reporters in other countries where, also, cotton which was 1 inch in staple according to United States standards has been described as commercial 1⅛ inch.

Chemical Rock Foundations

THE man who built his house upon the sand with such disastrous results was merely unfortunate in that he lived before chemists had developed a technique to make sand a perfectly satisfactory foundation for building. In this interesting achievement, the chemist merely adapts Nature's own method of converting sand to sandstone. He pumps a solution of sodium silicate

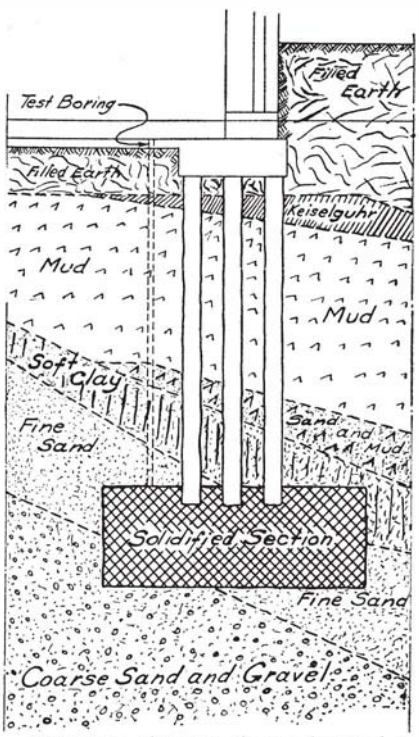


Diagram showing how chemical foundations may be laid in sand

down into the sand he wants to solidify. When the sand is soaked with sodium silicate, a strong solution of calcium chloride is pumped in to react and form a "rock" which, even under the microscope, closely resembles natural sandstone.

Our illustration shows the procedure used to provide a solid rock foundation for a building in a place where natural rock is too deep to reach economically. The method is to drive perforated pipes, suitably spaced, into the area to be solidified and to pump down the silicate under pressure until thorough impregnation has been obtained. Then, either through the same tubes in sequence or in adjacent tubes properly spaced, the reacting liquid is pumped down sufficiently rapidly to secure penetration to the calculated depth. The formation of a large block of solid material in a sand layer as a base for piling has made it possible to use piles of moderate length in cases where there seemed to be practically no bottom on which it was safe to rest a heavy structure.—*A. E. B.*

Communication for Freight Trains

A COMMUNICATION system for use between the head and rear end of long freight trains, or which may also be used between nearby trains, or between trains and wayside points, has been developed by the General Electric Company. The telephone message is delivered to the running rails by induction coils placed near the rails, is carried along the right-of-way on any convenient wire, and is returned again to the rails where it is picked up as delivered, inductively, by the receiving circuit. The system does not interfere with signal operations and no changes are required in existing signal or train control systems. It does not cause interference with nearby radio receivers and cannot be used to receive radio broadcasts.

Similar receiving and transmitting sets are mounted on the locomotive and caboose of the train. These are connected in each case to inductor coils which are mounted immediately above the running rails at the minimum allowable clearance. The coils are so connected that oscillations will be induced instantaneously in both rails in the same direction. The oscillations will not travel far in the rails unless the amount of power input is large, but efficient transmission over relatively long distances is insured by connecting the rail at intervals of about 1000 feet through static condensers to a wayside wire.

Oscillations set up in the inductor coils by a transmitter will cause corresponding oscillations in the rails and thus in the system comprising the rails, the condenser couplings and the paralleling conductor. These oscillations are propagated over a pre-determined distance and can be picked up from the rails at any point within that distance by any other set of inductor coils. Telephone, telegraph, signal or power transmission wires may be used as the wayside wire if desired and without interference with their normal function.

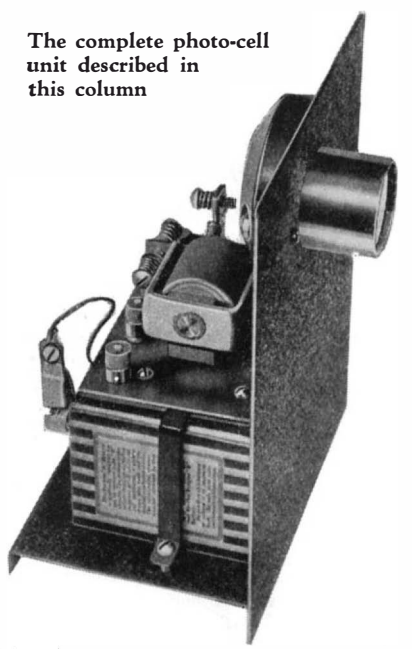
The sending and receiving sets consist of a three-tube transmitter and a five-tube receiver, the latter being designed to provide loud-speaker reception sufficient to be audible throughout the cab or caboose. The frequency used is of the order of 65 kilocycles. The receiver is equipped with automatic volume control to compensate for variations in the distance between the coil and the rail.

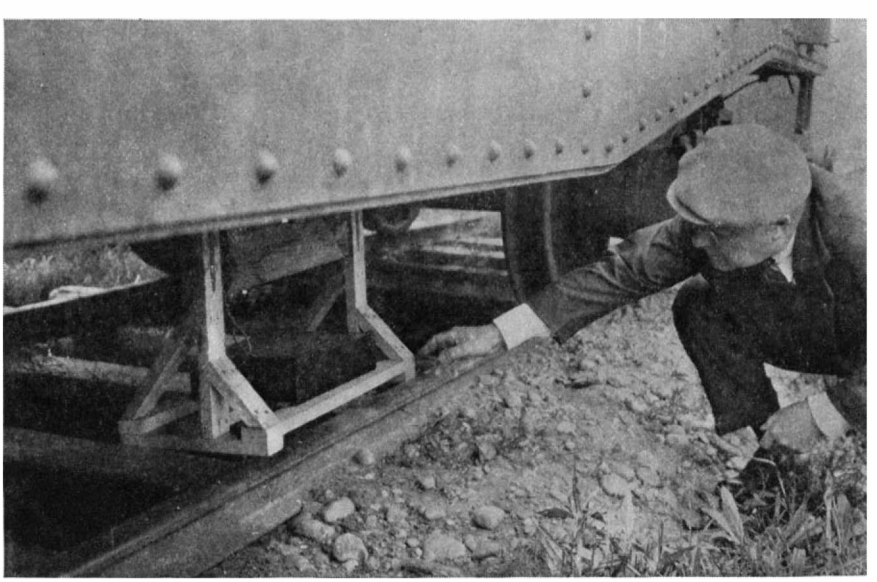
Tests indicate a receiving range of five miles or more over well-bonded tracks. The power requirements at each end of the train are 160 watts, with an output of five watts to the induction coils.

An Inexpensive Photo-Cell

OUTSTANDING features of a new photo-cell are low cost and simplicity. While present devices, used in a limited way in factories and homes, are elaborate and expensive, the Rhamstine "Electric Eye" can be purchased complete and ready for installation at less than 10 dollars. It employs a dry-disc type Rhamstine photo-cell, a small, inexpensive battery, and a sensitive relay with an accessible adjust-

The complete photo-cell unit described in this column





The inductor coils, used in connection with the freight train communication system described above, are hung on special brackets just above the rails

ment. The unit provides the basis for simple set-ups to control lights, bells, doors, fire, smoke and burglar alarms, advertising and window display signs, and traffic signals; to count articles, as on assembly lines; to provide remote recording of measurements of liquids in a gage; and to test the density of liquids, such as lubricating oils.

Typical applications which are easily and quickly made include a garage light control which is operated by a car spotlight. An application already in use is a Rhamstine relay unit installed in gas stations so that a light beam is focused from between pumps to the "eye" mounted on or in the station. When a car pulls into the driveway at the pumps, it interrupts the light beam, causing a bell to ring or light to flash, notifying the attendant.

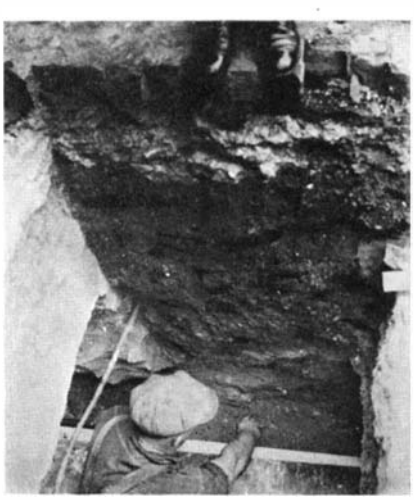
With the use of an auxiliary relay this unit can be adapted to the operation of bigger jobs, such as automatically opening doors when someone approaches, or flood-lighting whole stores from the outside. It will operate on infra-red or invisible light beams which makes possible quite elaborate burglar alarm systems for home and store use. Invisible light beams can be produced from ordinary light bulbs with a special filter.

Students, engineers, inventors and experimenters know that there is a tremendous field opening up in the applications of photo-cells in the home, shop, office, factory, and institutions—a new field of opportunity in the adaptation of the "mechanical brain" to many tasks.

It is to this type of user that the Rhamstine "Electric Eye" will be particularly valuable as a test and experiment unit, because of low initial cost and economy of operation.

Rip Van Winkle of the Frog World

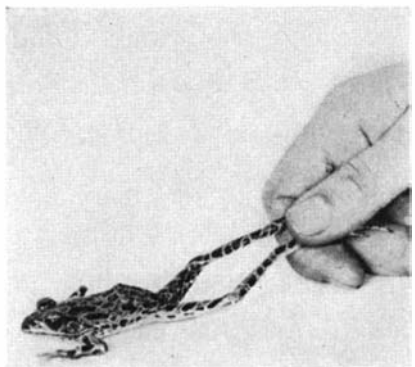
WHAT is believed to be the record breaker among Rip Van Winkles—a fully developed but greatly emaciated leopard frog—is shown in an accompanying illustration. He is one of five dug out of a bed of clay 10 feet below the surface of a



Where Rip was found

concrete roadway at the Schenectady works of the General Electric Company. The spot is within a few feet of a shop building which has been standing since 1899, and the clay was covered over by sand and earth as a filled-in foundation before the building was erected, so that Rip and his friends were securely locked in for a matter of 34 years.

Steam fitters laying a pipe line saw the frogs embedded in the clay in the face of the excavation and one of them dug out the animals with his fingers. Apparently they were dead and were tossed to one side. About two hours later the steam fitters noticed, to their amazement, that the frogs were sitting up, looking around, and even leaping up the sides of the trench. Biologists are looking into the case and, while they never heard of such a long frog sleep before, they say it is not entirely impossible. Another photograph shows the workman pointing to the spot where he dug Rip out of his clay bed.



Rip, himself

Boulder Dam Generators—World's Largest

BOULDER DAM'S electric generators will be the world's largest hydro generators, both electrically and physically, it has been announced by the General Electric Company, to whom the contract for the first two units, to be leased to and operated by the city of Los Angeles, has been awarded by the United States Bureau of Reclamation. The first unit is scheduled for completed installation early in 1935 and the other later that year.

The generators are rated 82,500 kilovolt-amperes, unity power factor, three-phase, and are designed for 50-cycle generation at 150 revolutions per minute and 13,800 volts, or 60-cycle generation at 180 revolutions per minute and 16,500 volts.

The 82,500-kva Boulder Dam unit exceeds in capacity any other generator now in operation. Other large hydro-electric generators include the U.S.S.R. 77,500-kva, Niagara Falls 65,000-kva, Ariel 56,250-kva, Spier Falls 47,000-kva, and Conowingo 40,000-kva units.

Four 82,500-kva generators will be installed for the opening of the station, and ultimate plans call for a total of 15 such units. In addition, one 40,000-kva generator will be installed now, and another one later.

The Boulder Dam generators will be smaller in diameter but both higher and heavier than the U.S.S.R. generators. The two to be constructed now by the General Electric Company will have an overall diameter of 40 feet and height of 32 feet above floor level. Each will weigh more than 2,000,000 pounds; the U.S.S.R. units, the previous heaviest ones, weigh approximately 1,800,000 pounds.

At least 40 freight cars will be required for the transportation of each unit, including generator, regulator, surface air coolers, and exciters, from Schenectady to Boulder Dam. The frame will be shipped in four sections.

The waterwheels driving the generators will operate 90 percent of the time with a head of from 450 to 560 feet, with minimum and maximum limits of 420 and 590 feet.

Once Popular Medicine now Banned as Nuisance

VALERIAN, once a popular medicine that won the public confidence chiefly because of its bad taste and strong odor, now may be sold in New York only under restrictions as rigid and strict as those applying to the narcotic drugs.

This is not because valerian is a dangerous medicine but because the offensive odor of the drug has made it a public nuisance. Valerian, once the chief constituent of "female tonics" and remedies for nervous and hysterical disorders, has come to be the chief constituent of "stink bombs" which racketeers use to drive customers out of stores in attempts to levy tribute or to coerce the store proprietors.—*Science Service.*

Singing Through Cellophane

CELLOPHANE has now come to the aid of broadcasters; the illustration shows how it is done. It has always been difficult to get a really good reproduction of a coloratura soprano voice on the radio. Strange things happened to such voices on the air. Then the idea of muting the voice came to Phil Boutelje, chief music adviser of the Paramount theaters. From the transparent material was made a hood in which a singer can stand and sing her highest notes without fear of microphone vibrations. The hood does for the human voice what the mute does for a cornet or violin.

Cellophane surrounding a radio soprano serves to "mute" high notes

Soldering Aluminum

ALUMINUM can be soldered with ordinary solder if the work is properly prepared. The reason tin solder will not ordinarily adhere to aluminum is because the surface of the metal is invariably coated with an oxide. Since commercial aluminum

and most of the aluminum alloys contain more or less silicon, the surfaces to be soldered are purified with hydrofluoric acid or with solutions developing that acid. The acid must be carefully removed by washing with water, and finally the water must be eliminated, which can be accomplished by dipping the objects into an alcohol, preferably methanol, immediately before soldering. Any solder desired may be used. If the corrosion resistance of the connection is not very important an alloy of 85 percent tin and 15 percent aluminum can be used. However, if the connection will be subjected to corrosion it will be necessary to use an alloy having a higher melting point—for instance, 90 percent of aluminum, nine percent of copper, and one percent of silver.—*A. E. B.*

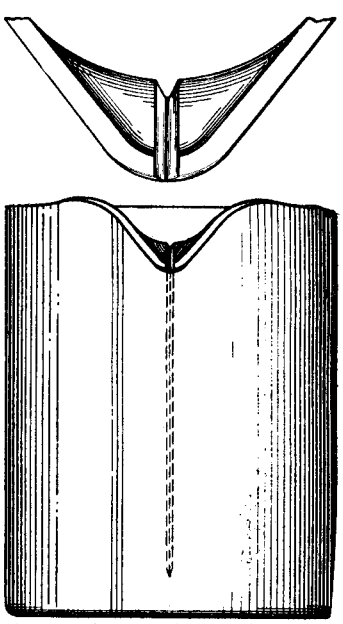
Safe Explosive Transport

DURING the last six years more than two billion pounds of commercial explosives have been transported over the railroads of the United States and Canada without the loss of a life and with a total damage of only 213 dollars in value.

Dripless Pouring

DID you ever pour cream from a pitcher? And after pouring, did a drop of cream hang from the pouring lip and eventually fall off onto the clean table cloth? What did the lady of the house say to that?

Such minor catastrophes, not only with cream pitchers but with any other vessel



The dripless pitcher with groove, and, top, close-up of pouring lip

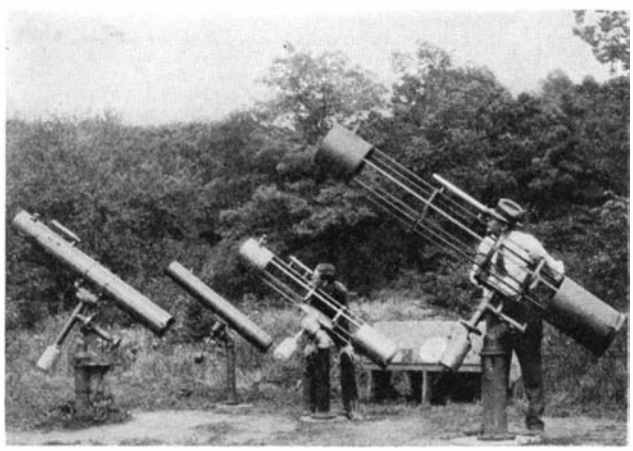
from which liquids are poured, may be averted with the newly designed and patented "drip preventing means" illustrated in these columns. Mr. Benjamin F. Wood, to whom patent number 1925913 recently issued, conceived the idea of putting a groove in the pouring lip of a vessel, the groove extending from the extreme point of the lip, lengthwise of the spout and down the inner wall of the container. Any liquid that is left in the pouring lip after the vessel is returned to normal position will be drawn up the groove by surface tension and no dripping can ensue.

(*Please turn to page* 291)

THE AMATEUR ASTRONOMER

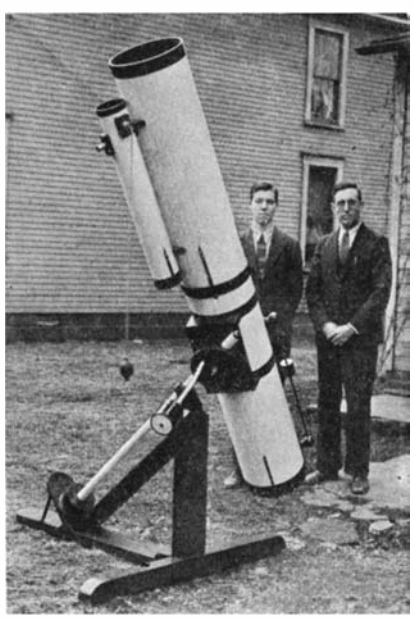
Conducted by ALBERT G. INGALLS

THAT imposing battery of telescopes—four of them—which you see pointed skyward in the nearest illustration, is the work of Clarence T. Jones, architect, of Chattanooga, Tennessee, and Bruce Jones, his son. There are two six-inch instruments, one eight-inch and one twelve-inch. We learn that the Jones combination is also making a fifth telescope. In Chattanooga amateur astronomical circles—that is, the Barnard Astronomical Society—keeping up with the Joneses must put a lot of people in a tough predicament.



Jones and Jones, with their offspring

A TELESCOPE "made in Germany" by Arno Penkühn, a mechanical engineer, Geisenheimerstrasse 41, Berlin-Wilmersdorf, Germany, is shown in a photograph taken indoors, which also shows one of those ornate, elaborate German stoves so characteristic of that land. The telescope was built from the instructions in von Krudy's "Das Spiegelteleskop" and is shown here in order to give an idea what



McGuire and McGuire

sort of job a German amateur does—not very dissimilar from a good neat job here. It has an eight-inch mirror of 73½-inch focal length and will stand a five-millimeter eyepiece in good weather, according to its owner. There is a society of several thousand amateur astronomers (note, not telescope makers) in Germany, though we have no record of its name. Herr Penkühn writes that he is also a member of the Berlin Amateur Astronomer's Association.

AS the above photograph shows, an ingenious solution of the finder problem was worked out by Walter E. McGuire and his son Daniel McGuire, of Shadyside, Ohio. The finder is a 4¼-inch reflector and the same eyepiece serves for it and the main telescope. To use the finder the rubber bulb shown is squeezed. This actuates a piston and pushes a prism out of a recess and into the axis of the finder mirror, at the same time occluding the rays from the main mirror. The latter is a 10-inch Pyrex of 80 inches f.l. The younger McGuire relates an experience with thin glass, which throws light on the 8-to-1 precept; he previously made two mirrors of 10-inch x ¾-inch glass. One held its figure while the other required a 9-point support. One sometimes *can* beat the 8-to-1 rule, but why flirt with disappointment?

"The finder," McGuire junior writes, "works fine. There are also some objects, such as the Pleiades, on which the finder with low magnification is better than the large telescope."

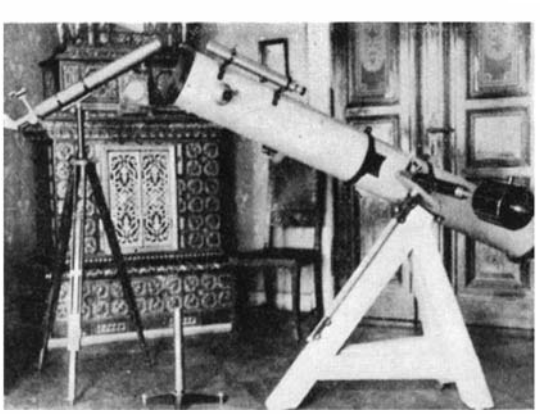
The younger McGuire is one of three who independently discovered the slit test ("A.T.M.", p. 380). Russell W. Porter's discovery of the same test dates from 1916, as recently found records show.

EVIDENTLY not many workers can be led to make wooden tubes, despite the superior seeing qualities they make possible. One made by Dr. Alvin G. Percival, optometrist, 628 Auditorium Bldg., Los Angeles, California, is described by him as follows: "The telescope is five feet, six inches in length, made of ¾-inch straight-grained redwood, finished in natural color, with about six coats of varnish rubbed down with pumice and oil. Its hexagonal shape makes a strong, light, neat looking tube. One-inch brass bands and glue securely bind the parts together." Let's have some more wooden tubes.

ANOTHER wooden tube is that of W. F. Decker, a retired mechanical engineer, aged 76, Route 2, Excelsior, Minnesota, who writes: "My tube is made of mahogany strips ¾ inch x 1⅛ inches, four and a half feet long. These are spaced on circles at each end and are re-enforced by filling pieces in the middle section. The general form is a dodecahedron. The eyepiece is fitted to an adjustable block between two strips.

"I have used standard three-inch pipe fittings for the mount," he continues. "Inasmuch as I am

Percival's wooden-tubed altazimuth

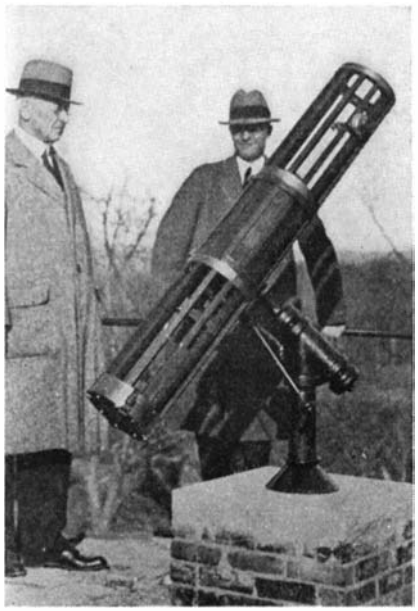


Made in Deutschland

within about seven miles of the 45th parallel, a standard 45-degree 'Y' answers well for a support of the polar axis. This is fitted with a 1-to-80 worm gear, for slow motion. The declination axis is merely a close nipple between the 'T' and saddle. It works smoothly and without backlash when screwed up to just the right point.

"I support the tube in the saddle by means of two leather straps, and can set it in any one of 12 different ways, so as to have the eyepiece always handy.

"Though I did not attempt to parabolize my mirror, I managed to se-



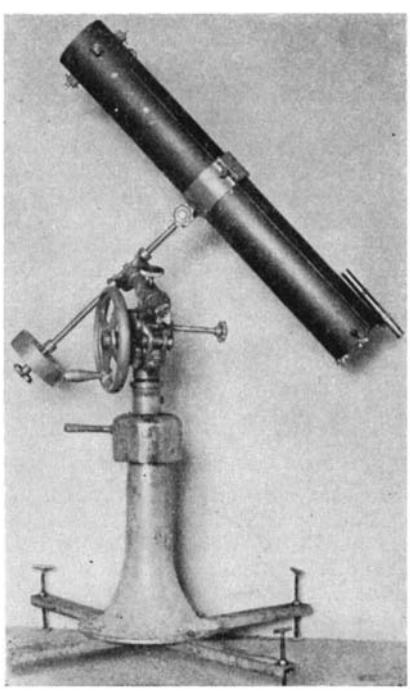
W. F. Decker, M. E. (left)

cure a good spherical surface. I saw the rings of Saturn the other morning, faintly because of the present great distance, and am having a lot of fun seeing the mountains of the moon, Mars, the double star Mizar, and in observing the rapid shiftings of the moons of Jupiter."

HERE is a letter from Wilbur J. MacNeil of the Science Dept., Punahou Academy, Honolulu:

"A five-inch telescope, constructed as a physics class project at Punahou Academy, Honolulu, Hawaii, is perhaps unique in one respect; its mounting is an anti-aircraft machine-gun mount modified to suit its new purpose.

"Frederick Reppun, now a freshman at Harvard, ground the mirror last year while he was a student at Punahou. This year William Hole, a junior, reconstructed a condemned machine-gun mount, putting on a polar axis to adapt it to this latitude, a counterpoise for the telescope, and a worm and gear to give slow motion."



MacNeil's Honolulu job

CURRENT BULLETIN BRIEFS

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

THE "WHITE FIREMAN" IN THE HOME. From this little pamphlet we find that anyone who practices fire prevention is really a "white fireman" although the name was first applied to fire prevention engineers employed by the insurance companies to reduce fire hazards and conserve life and property. Rules for reducing fire risks in the household are given. *Insurance Company of North America, Philadelphia, Pa.—Gratis.*

L. L. BEANS' CATALOG is a welcome annual publication. If you go hunting, camping, or fishing you will profit by perusing this catalog which lists foot gear of all kinds, snow-shoes, blankets, tents, kit bags, shooting and driving caps, and other articles too numerous to mention here. *L. L. Bean, Freeport, Maine—Gratis.*

THE WELDING OF ALUMINUM AND ITS ALLOYS. The rapid growth in the use of aluminum and its alloys has created a demand for making permanent joints and repairs on such material. The needs of the practical welder have been kept in mind throughout this booklet. It describes pressure welding, in the form of spot, butt, and seam welding and fusion welding in the form of torch and arc welding. *Aluminum Company of America, Pittsburgh, Pennsylvania.—Gratis.*

BURNER SPECIFICATIONS, INSTALLATION AND COMBUSTION ENGINEERING DATA is full of information regarding the installation of heating devices such as boilers, kilns, and so on. There are many illustrations and tables of great value. *Lee B. Mettler Company, 406 South Main Street, Los Angeles, California.—Gratis.*

THE EDUCATIONAL IDEALS OF JANE LELAND STANFORD, CO-FOUNDER OF THE LELAND STANFORD JUNIOR UNIVERSITY is the title of an address given before the 1933 California State Conference of the Daughters of the American Revolution by Judge Geo. E. Crothers, a member of the pioneer class who was brought into early association with Mrs. Stanford. Judge Crothers brings out in clear perspective some of her thoughtful and devoted services to the University. *Leland Stanford Junior University, Palo Alto, California.—Gratis.*

LOCOMOTIVES: PAST AND PRESENT is the title of an address delivered by Leonor F. Loree before the Newcomen Society of England at the New York branch. Those who heard Mr. Loree in person were delighted with his description of the enormously developed locomotive named after him. Sent only to interested parties by *Wm. C. Dickerman, President, American Locomotive Company, 30 Church Street, New York City.—Gratis.*

PREHISTORIC MAN—HALL OF THE STONE AGE OF THE OLD WORLD (Anthropology Leaflet 31), by Henry Field, Assistant Curator of Physical Anthropology, describes the eight dramatic groups which reconstruct man's past extending over 250,000 years. *Field Museum of Natural History, Chicago, Illinois.—25 cents.*

THREE KEYS TO WILD FLOWERING PLANTS OF CONNECTICUT, SOUTHEASTERN NEW YORK, NEW JERSEY, AND EASTERN PENNSYLVANIA, by Mary Franklin Barrett, is a clever guide to plant analysis. *Mary Franklin Barrett, 64 Park Avenue, Bloomfield, New Jersey—50 cents.*

BEER—PAST, PRESENT AND FUTURE (*Oil Power*, Vol VIII, No. 5, June, 1933) is a good general article accompanied by flow sheets, sections of breweries, and interesting features. *Standard Oil Company of New York Inc., 26 Broadway, New York City.—Gratis.*

THE SECONDARY SCHOOL LIBRARY: INSTRUCTION IN MUSIC AND ART, INSTRUCTION IN MATHEMATICS (Bulletin No. 17, published separately as monographs 17, 25, and 23). *Superintendent of Documents, Washington, D. C.—10 cents each (coin).*

THE CHEMICAL RESISTANCE OF RUBBER AS AN ENGINEERING MATERIAL (From "Symposium on Rubber"), by H. E. Fritz and J. R. Hoover, gives a summary of data pertinent to the industrial applications of rubber. *American Society for Testing Materials, 1315 Spruce Street, Philadelphia, Pa.—15 cents.*

SHALL OUR TARIFF AND COLONIAL POLICY PERMIT THE DUPLICATION ON THE ISLANDS OF SUGAR REFINERIES ALREADY BUILT ON THE MAINLAND? This is a statement by Earl D. Babst, Chairman of the Board of Directors of the American Sugar Refining Company. The sugar refineries of the United States are really far too overbuilt and need as large melts as possible without competition from Cuba and our insular possessions. *The American Sugar Refining Company, New York City.—Gratis.*

THE "SIROCCO" CONDITIONER FOR RESIDENCE AIR CONDITIONING (Bulletin No. 3227) provides summer and winter comfort in the home. During the winter perfect heating and proper humidification, automatically controlled, are provided. During the summer months adequate cooling on the hottest of days, and circulation of conditioned air sufficient to insure comfort are available. Thus the plant is useful at all times of the year. This pamphlet gives the whole story. *American Blower Corporation, Detroit, Michigan.—Gratis.*

MAP OF NORTHERN CALIFORNIA SHOWING PLACER MINING AREAS will prove an aid to the small-scale placer miner and others who may be interested in the placer gold resources of the streams of northern California. The map is on a scale of 18 miles to the inch. *Division of Mines, State Department of Natural Resources, Ferry Bldg., San Francisco, California.—25 cents.*

MODERN TRENDS IN RAILWAY MOTIVE POWER, by William C. Dickerman, is a valuable résumé of the whole subject by the President of the American Locomotive Company. It deals with streamlining, high pressure locomotives, et cetera. We must not forget that the shops of the locomotive builder are really a great laboratory. The pamphlet can be sent only to interested parties. *American Locomotive Company, 30 Church Street, New York City.*

DIESEL ENGINE LUBRICATION ECONOMY (*Lubrication*, Vol. XIX, No. 1). Paramount among the factors which bear a direct relation to the life of Diesel engines is lubrication. This article gives excellent advice on the subject. *The Texas Company, 135 East 42nd Street, New York City.—Gratis.*

INLAND WATERWAYS—THE ANSWER OF THE RAILROADS TO THE MISSISSIPPI VALLEY ASSOCIATION is a memorandum for Honorable John Dickinson, Assistant Secretary of Commerce, submitted by the Association of Railway Executives in which they present the railway's case, citing the expense of the New York Barge Canal costing 280,000,000 dollars, as well as lesser enterprises. Some of the figures given are of considerable interest. *Committee on Public Relation of the Eastern Railroads, 143 Liberty Street, New York City.—Gratis.*

OUTLINES OF SCIENCES AND BOOKS (Jeeco Manual No. 1). The object of the Junior Engineering Equipment Corporation is to "discover, encourage, guide, and develop natural engineering talent among American boys and amateurs." The first service manual is a carefully selected list of books (fully annoted) on physics, chemistry, biology, astronomy, geology, electricity, mechanics, and crafts and hobbies. *Junior Engineering Equipment Corporation, P. O. Box 150, Pleasant Ridge Station, Cincinnati, Ohio.—25 cents.*

STANDARDS AND SPECIFICATIONS FOR METALS AND METAL PRODUCTS, 1933, was prepared by Geo. A. Wardlow under the direction of A. S. McAllister, Chief of the Division of Specifications, U. S. Bureau of Standards. Cloth—8 by 11 inches; 1359 pages; tables, half-tones, and line drawings. *Superintendent of Documents, Washington, D. C.—$3.00 (money order).*

THE SCIENTIFIC AMERICAN DIGEST

(*Continued from page 287*)

This idea may, obviously, be applied to any type of vessel, whether made of glass, metal, molded material, or other substance. The groove may be formed when the vessel is cast, or it may be ground in by an abrasive.

New Rubber Filler

ONE of the latest wrinkles in rubber manufacture is the use of calcium carbonate as a reinforcing pigment. The calcium carbonate used is a precipitated product of extremely fine particle size, running over 98 percent under 0.4 micron. The surface of the particles is coated with approximately two percent of a rubber-soluble organic material which prevents cementation of the individual particles and gives complete dispersion of the pigment in rubber. The use of this pigment is said to give tensile, tear, and abrasion-resistance values considerably higher than other reinforcing rubber pigments, except the gas blacks. At approximate loadings, tensile and tear-resistance values, hitherto obtainable only with soft gas black, can be reached with "Calcene." Its use is indicated in rubber stocks requiring high tensile and high resistance to tear and abrasion, especially where a black stock is not desired, or where a relatively soft modulus is desired along with the high physical properties. —*A. E. B.*

Year's Supply of Coffee Destroyed

ACCORDING to the National Coffee and Sugar Exchange, the National Coffee Department of Brazil has, since July, 1931, destroyed over three billion pounds of coffee. This step was inaugurated over two years ago by the Brazilian Government to remove from the market a great surplus of coffee which had had the effect of greatly reducing the market price. It is said that the equivalent of a full year's supply of coffee for the entire world has been destroyed this year.

If Your Children Chew Paint—

CASES of lead poisoning in children have been detected by X-ray examination before they were otherwise suspected, Drs. E. C. Vogt and Charles F. McKhann of Harvard Medical School recently told members of the American Congress of Radiology.

Unfortunately, infants and children very often eat or swallow enough lead to be poisoned by it and in a large percentage of the cases they die. Ninety-five cases of lead poisoning have been observed at the Infants' and Children's Hospital, Boston, during the past nine years.

Most children suffering from lead poisoning seem to have ingested the lead by chewing the paint from woodwork, furniture or toys. Occasionally it is caused by lead in drinking water that had been conducted for some distances in lead pipes. The Boston physicians reported two cases

of lead poisoning in nursing infants whose mothers had used lead nipple shields. Epidemics of lead poisoning have recently occurred in homes where lead-impregnated storage battery casings were used for fuel, the lead being inhaled from the fumes as the casings burned. Extensive use of insect sprays and dusting powders containing lead is also considered dangerous in this connection.

Common symptoms of lead poisoning are convulsions and nausea, generally preceded by a period in which the child has been nervous, fretful, and naughty. There may have been loss of appetite and signs of disturbed digestion.

The greatest value of X-ray examination in lead poisoning is in distinguishing between this and other complaints. The symptoms of lead poisoning may so closely simulate other nervous or digestive disturbances that some check is usually necessary. In the case of convulsions of unknown cause, it is helpful to be able to rule out lead poisoning as a possible cause.

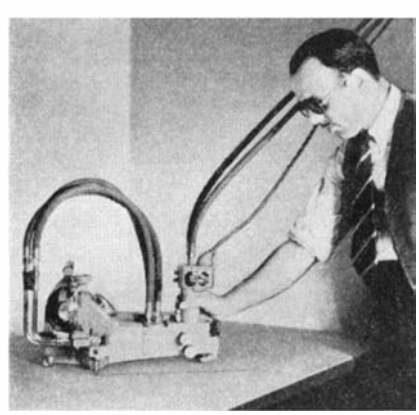
Occasionally when an X-ray picture is taken to examine a child's bones for some other cause, such as injury or fracture, signs of lead deposit are found even though there have been no other symptoms of lead poisoning. In these cases investigation usually shows that the child has been getting lead into his system from some source, and careful watching by the parents may prevent these cases of latent lead poisoning from developing into acute intoxication.

Recognition of lead poisoning from X-ray examination consists in finding heavy bands of increased density at the growing margins of bone.—*Science Service.*

Portable Cutting Machine

A PORTABLE oxy-acetylene cutting machine weighing but 43 pounds has been announced by The Linde Air Products Company as an addition to its Oxweld line of apparatus. It is known as the Secator.

Combining the portability of a blowpipe with the accuracy and finish of a cutting



The portable oxy-acetylene cutting machine in use on a flat surface

machine, the Secator makes it possible to do high-quality cutting anywhere in the shop or in the field. It finds use in plate shops, steel plants, moderate size metal working plants, or any organization that needs a cutting machine which can be brought to the work.

Essentially it consists of a specially designed blowpipe mounted on an electrically driven, air-cooled, dust-proof chassis. It is

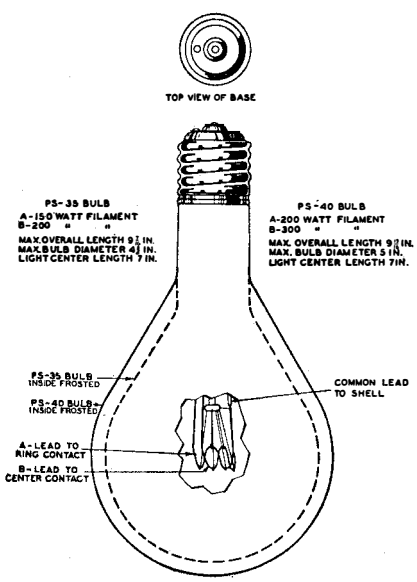
equipped with a direct drive and runs either on a 1½-inch angle-iron track, furnished with it, or on any relatively smooth plate. When operated on the track, it does straight-line cutting automatically. For cutting simple shapes it can be guided with a hand-grip. For automatic circle-cutting, a center and a radius rod are furnished. For convenience of control, the oxygen and acetylene valves are on the chassis rather than on the blowpipe. The blowpipe can be adjusted vertically and horizontally and also to cut bevels up to 45 degrees. Its cutting range is wide and the cuts are so clean and smooth that for many purposes machining is unnecessary.

A universal motor that may be used on either 110- or 220-volt circuits operates the Secator.

Three-Light Lamp Bulbs

A NEW lamp that provides three different levels of illumination from a single bulb, thereby affording flexibility in general lighting, has been announced by the Incandescent Lamp Department of General Electric Company at Nela Park, Cleveland, Ohio.

The new Mazda Three-Light lamp is inside frosted and contains two filaments,



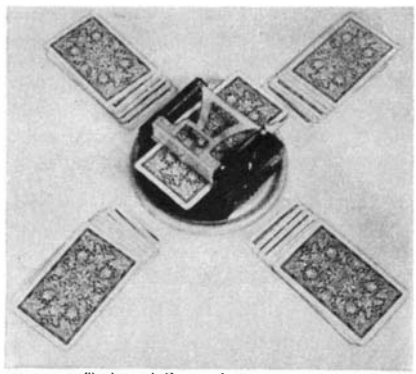
Details of the three-light lamp

each of which may be burned either singly or in combination with the other. At present it is being made in two sizes; one containing 150- and 200-watt filaments; and the other, 200- and 300-watt filaments. The smaller size combination employs the same size bulb as is used in the ordinary 300-watt lamp, and the larger size combination uses the same size bulb as does the regular 500-watt lamp.

Each of these lamps is equipped with a mogul screw base which has an additional center contact in order to permit separate control of each filament. A special socket is necessary to accommodate this new base.

It is anticipated that the new lamp will find its first application in the field of commercial lighting, particularly the small and medium-sized establishments which have definite peaks and low points in the volume of store traffic. With the new Three-Light lamps, it will be possible to use the lower wattage filament alone for minimum requirements, the higher wattage filament for

average requirements, and the two together to supply the high level illumination needed for the active shopping periods. Department stores also will welcome the flexibility feature in those departments where store traffic volume fluctuates daily or seasonally.



Courtesy Tools and Gages, Inc.

A fascinating—and efficient—little machine to speed up the bridge game. A shuffled deck of cards is slipped into place in the device as it stands in the center of the table. The vertical button is grasped and the machine is revolved rapidly on its base. Four hands are dealt, card by card, in a few seconds. The device sells for only one dollar

Dry Ice Use Gains

PRODUCTION of dry ice, or solid carbon dioxide, has shown rapid expansion during the past few years, with an estimated production of 140,000,000 pounds for 1933, according to Lewis C. Chamberlin, manager of the solid carbon dioxide division of the Michigan Alkali Company. In 1928 only 12,000,000 pounds were manufactured, and last year 122,000,000 pounds were produced in the United States.

Now used extensively in the dairy and meat packing industries, dry ice is finding new applications in many fields. Many golf ball manufacturers use solid carbon dioxide in making certain grades of balls. It is also used in low temperature testing of oils and the testing of the physical properties of steel rails.

Because of its compactness, and the fact that the carbon dioxide passes from the solid to gaseous state without becoming wet, the substance is finding increasing use as a refrigerant in the shipment of perishable foodstuffs. A barrel of 200 pounds of fresh meat can be shipped with solid carbon dioxide amounting to only one-twelfth of the weight of the meat. In refrigerating value under certain conditions, five pounds of dry ice with a temperature of 109 degrees below zero, Fahrenheit, is equivalent to 100 pounds of water ice.

Animals Recognize Own Voices on Phonograph

"HIS MASTER'S VOICE" is not just a bit of clever advertising; animals do recognize the voices of their own and other species when played on a phonograph record. So reports Prof. Bastian Schmid of Munich in the German scientific publication *Die Umschau.*

Prof. Schmid tried a phonograph record

of a mewing cat on a fox terrier that hated cats. As soon as he heard the voice of his pet antipathy he tore around the room hunting for it, and when he found the phonograph horn he tried to dive into it. The same record was then tried on a cat, which listened for a moment and then responded with the same melancholy meowing.

Another record, of a hen cackling just after she had laid an egg, was tried on a farmyard rooster. He responded immediately with the same egotistic crowing that a henyard sultan usually sets up when one of his wives has boosted her laying record by one unit.

Prof. Schmid also tried a record of a watchdog's barking on the dog himself. After a moment of astonishment the dog began to bark in reply, but in a different tone. A young ape, hearing a record of his own voice, also treated it as the voice of a stranger. Prof. Schmid is inclined to believe that animals will recognize their own voices as belonging to their own species, but not as belonging to themselves.—*Science Service.*

Aluminum base viols (see also article on aluminum violins, *Scientific American,* January 1933) are gaining in popularity because of their fine tone and imperviousness to moisture. They may be made with natural wood or metallic finishes

Eyes Warn Against Poisons

OUR eyes are the best bell wether signals that the human system provides in warning us against consumption of liquids and foods of a harmful or poisonous character, states C. A. Parenteau, Bausch and Lomb refractionist.

The rods and cones of the eyes, Mr. Parenteau explains, are by far the most sensitory nerves of the entire human system and for this reason they are the first to react to any ingredients, whether solid or liquid, of a harmful nature.

The foregoing is exemplified, he adds, by the experience of many people during the present (now almost past) prohibition era,

Photo-Electric Water Hardness Meter

A NEW device for automatically checking the hardness of water has recently been developed. Through the use of a photo-electric cell the device periodically tests the hardness of water and sounds an alarm when the hardness reaches a predetermined limit.

The method of operation is very simple. A sample of water from the soft water supply line is led into a glass cylinder at intervals and to this water a small quantity of a chemical is added. The slightest hardness causes a change of color and turbidity so that the current output of the photocell, which is illuminated by a beam of light passing through the glass cylinder, is proportional to the hardness. The hardness can thus be read on a meter scale. Furthermore, when it surpasses the limit for which the instrument is set, an alarm is caused to ring.

A second model of "Hardimeter" is built for water which varies appreciably in color or turbidity. In this instrument, two photocells and two test cylinders are used. Simultaneous samples enter the cylinders and the chemical is added to one. The electrical circuit of the cells measures the difference between the light-absorbing characteristics of the two samples and the result is thus independent of the original turbidity or color of the water.—*A. E. B.*

Fermentation of Tomato Pulp Gives Disease-Free Seed

AN accidental circumstance observed and interpreted with scientific understanding bids fair to relieve tomato growers of losses caused by the bacterial canker disease. The results, announced by H. L. Blood of the Division of Horticultural Crops and Diseases, also provide an example, say officials of the Bureau of Plant Industry, United States Department of Agriculture, of how technical progress in farming sometimes creates a new problem that requires solution.

Bacterial canker, a serious disease affecting tomatoes, has been much more common and destructive since 1927 than it had been before. Scientists of the United States Department of Agriculture and at several state experiment stations learned that the seeds carried the disease and have been experimenting with various chemicals as disinfectants.

In recent years, canneries and seedsmen have been using high-speed power machinery for extracting tomato seed from the ripe tomatoes. In general, the older and slower method of placing tomatoes in vats to ferment until the seeds loosened from the pulp had been discarded. But Mr. Blood had a lot of tomatoes which he knew were infected with the canker disease. He wanted this infected seed for tests of disinfectants. He did not have a power extractor, so he went about it in the discarded way, by fermenting the fruit pulp. From this lot he

planted untreated seed, and seed treated with various disinfectants, and to his surprise he found that the untreated seed which came from severely infected fruit was practically free from the disease—as good as or better than disinfected seed from the same lot. He repeated the experiment in Utah, where the disease has been destructive. Again the fermented seed from infected fruit proved free from the disease, and for this reason superior to mechanically extracted seed.

It seems evident from the experiments so far that seedsmen will have to abandon power extraction of tomato seed and go back to using the vats in which the tomatoes were fermented, and in which they developed a solution which seems to have disinfected the seed more reliably than any commercial substitute.

All-Rubber Lamp Cord

AN all-rubber lamp cord introduced by the General Electric Company has advantages over silk- or cotton-covered cord for table lamps, extensions, and so on, in that it will not ravel and will withstand hard usage. It maintains its appearance of newness since dust will not accumulate on the surface and since it can be cleaned readily with a damp cloth.

The cord, designated as Type SJ-PO, is extremely flexible, and therefore will not kink. Standard colors are olive green, brown, black and ivory; other colors can be supplied on special order. The cord carries the approval of the Underwriters Laboratories.

The flexible, tinned copper conductors are insulated with 30 percent rubber compound, and the outer jacket is of a compound containing a high percentage of pure rubber. The conductors are readily identified by the color of the insulation. —*A. E. B.*

Beetles Live Under Water Without Breathing

BEETLES with their anatomy organized for breathing air, yet which live under water and get air to breathe only once in their lives, have been found in the cold, swift brooklets in the Great Smoky Mountains, between Tennessee and North Carolina. They belong to a rare and very little known group of insects, of which 60 species have been discovered so far in North America, report entomologists of the Smithsonian Institution.

The beetles hatch under water and live their larval lives submerged. After they pass through the pupal stage they come out for a little flight into the upper air, which insures their distribution. Then they get under water again and never come to the surface any more.

In spite of their almost totally submerged lives, these beetles are not organized, as some insects are, for water breathing. They have no gills or similar apparatus, and although there is a small reservoir of air under their wing-cases, it appears doubtful whether this pocketful would suffice for normal breathing requirements for their months of life. The only suggestion that has been made is that they are naturally so inactive that their oxygen requirement is very low.—*Science Service.*

COMMERCIAL PROPERTY NEWS

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

Inventions Considered by Continental Motors

THE technical committee of the Continental Motors Corporation, consisting of representatives of the sales, aircraft, production, research, and engineering departments, meets weekly to consider new devices, improvements, and beneficial shop practices, according to W. W. Harris, patent counsel of the corporation.

These matters of improvement come from inside the organization as well as from outside inventors, scientists, and technical men. Every proposition that is presented is considered by the committee.

Unfortunately, many ideas and devices that are exceedingly meritorious must, in certain instances, be rejected because there is no place for them in the immediate development plans of the corporation or its subsidiaries and obviously it would be unfair thus to compel the inventor to wait indefinitely to realize the profits of his ingenuity.

Each proponent of a device or an idea is advised of the findings of the committee in writing. No form letters are employed, it is stated. A report also is sent to the management of the corporation on all important proposals submitted. As high as 100 proposals a month are received.

"RCA Licensed" Radio Sets and Tubes

ALTHOUGH previous bulletins have been issued by the National Better Business Bureau, Inc., urging advertisers to describe accurately and clearly radio products made under R.C.A. patents, a recent survey shows considerable misleading advertising still prevalent.

Radio dealers and mail order firms employ the term "RCA Licensed" in advertising radio sets and tubes of various makes. Some advertisers have shown the words "RCA" in large type and the word "licensed" in small type in a manner tending to mislead the public into believing that the product advertised is made by the Radio Corporation of America. In many cases neither the brand of the set or tube, nor the name of the manufacturer is mentioned, and this situation has given rise to confusion on the part of the public.

The description "RCA Licensed" as applied to radio products means simply that the article so advertised has been made under R.C.A. patents by a manufacturer who has obtained a license from the Radio Corporation of America. It does not mean that the product or the manufacturer is affiliated with R.C.A. or that the product is approved or endorsed by R.C.A.

In some instances advertisements of such products have used without authority the trademark monogram of the Radio Corporation of America. Such use of the RCA trademark is misleading to the public as this trademark can rightfully be applied only to products actually made by the Radio Corporation of America and its subsidiaries.

"Philadelphia" Not a Cigar Trademark

IN *ex parte* Bayuk Cigars Incorporated, First Assistant Commissioner Kinnan recently held that the company, of Philadelphia, Pennsylvania, is not entitled to register, under the Act of 1905, the word "Philadelphia" as a trademark for cigars since that term is merely geographical.

In his decision, after referring to applicant's argument that it has used the mark so long that it has acquired a secondary meaning as shown by the decision of the District Court in the case of Bayuk Cigars Incorporated versus Schwartz, he cited and quoted certain decisions of the Supreme Court of the United States and then said:

"A holding by the Supreme Court to the same effect, that while a purely geographical name cannot by reason of having acquired a secondary signification be deemed a good trademark yet the party who first used it and gave it this secondary meaning will be protected against every one not doing business within the same geographical limits and even against them if the name be used fraudulently, is also found in the case of La Republique Francaise *et al* versus Saratoga Vichy Spring Company."

He then, after quoting and citing from the Scandinavia Belting Company case, said:

"It is deemed the United States District Court of New Jersey, in the case referred to by appellant, decided nothing further than or inconsistent with what was decided in the above noted cases.

"The word 'Philadelphia' is deemed merely descriptive, and its registration as a trademark barred by the very words of the statute."

Washing Machines for Apartment Tenants

WASHING machines which operate for a set length of time for a dime or a quarter in the slot are now available to tenants in some apartment houses, says the Department of Commerce.

The washers, generally installed in basements, are reported to be owned, installed and supervised in some cases by licensees of the meter makers, in others by washing machine dealers or by independent operators who buy washers from established dealers. In each case the owner of the machines makes the collections and pays a percentage of the gross revenue to cover the cost of the current and water used.

Experience of a Milwaukee company in supplying money-in-the-slot washing machines has shown greater net returns when the charge is on a 10-cent basis than when it is 25 cents. When the machines were first installed, it is stated, a quarter was required to run the machine for 35 minutes.

Later a washer was tried out on a 10-cent basis, giving 18 minutes of service. It is reported to have been found that women will put three or four dimes in a machine whereas they would hesitate to put in a second quarter.

Renewal Applications

THE Kaisling decision, 44 F. (2d) 863, 1931 C. D. 35, departs widely from all earlier adjudications in holding a renewal applicant limited to the same subject matter that he attempted to cover in the allowed claims; Judge Garrett reviews the earlier decisions elaborately. The decision actually overrules the Prouty case, 1919 C. D. 62, although the language at F. p. 865 treats the Prouty case as being followed.

The Kaisling decision cannot be condemned as untenable. The rule which it enunciates may come to be accepted. But the question is close enough so that it will not be regarded as finally settled before it gets to the Supreme Court.—*Journal of the Patent Office Society.*

Vorticella in Patent Suit

THE case of the vorticella and the question of who is to benefit from their industry is to be reviewed by the Federal Circuit Court of Appeals of Chicago.

Vorticella are single-celled animals with large appetites. They find microbes especially toothsome, and in Milwaukee's 15,000,000 dollar sewage disposal plant, model of similar plants the nation over, uncounted billions of them are feeding on the deadly bacteria brought down by the sewers of the community.

The law suit in which they are involved is a patent action brought against the city and the Milwaukee Sewerage Commission by Activated Sludge, Inc., a company subsidiary to Activated Sludge, Ltd., a British firm. It is charged that methods of sewage disposal here are a violation of five patents held by the companies.

Activated Sludge, Inc. asked for no damages, but establishment of patent rights by the company would open the way for subsequent collections.

Meanwhile, the voracious vorticella purify 85,000,000 gallons of sewage daily at the Milwaukee plant. This process goes on in twenty-four tanks, each 236 feet long. Air is pumped up through the bottom of the tanks, and it is this process on which the patents are being contested.

The city's defense is that the appetite of vorticella was first observed in 1911 by the Massachusetts Board of Health and because the discovery was made by public workers it is public property.

RACE OR PLACE?

(*Continued from page 267*)

terplay of hereditary and environmental factors. The geographer is profoundly impressed with the importance of the environmental elements. We have mentioned only a few of these; there remain many others, the effects of which are equally striking. Whether or not these environmental factors are of greater importance than all others in determining what men do, is a moot question. But there is no doubt that they favor or handicap him to a very great degree, and to some extent at least, set limits beyond which he cannot go. Civilization is a rare product, developed only a few times and at a few places on earth. In every case it has necessarily been an adaptation to the environment that gave it birth. We cannot, therefore, fairly compare the accomplishments of different peoples or different civilizations without at the same time comparing their opportunities. Least of all can we categorically deny the *ability* of a people to achieve, because under a given set of conditions they failed to accomplish what other peoples have accomplished under different conditions. The Mayas of Central America and Yucatan built a great civilization. To class them as an inferior race, whose capacity for progress was definitely limited, because they did not equal the achievement of the Greeks, is unwarranted. The Mayas labored under two very severe handicaps; they had no beasts of burden and no iron. What would the Greeks have done without horses or cattle or iron? They inherited all these from other peoples. The environment of the Mayas provided no such advantages, and yet in some respects they surpassed the Greeks!

Such comparisons are of course of no value. They tell us nothing of relative capacities. We do not know the causes of the decline of the Maya civilization and we have no right to assign it arbitrarily to limitations of race. Competent students find many other possibilities; Huntington, for example, thinks it was largely due to climatic changes. Indeed this same author finds that climate has everywhere been a far more potent factor than race in the evolution of civilization, and it must be admitted that the evidence he adduces in support of this claim is much more convincing than that of the Nordic boosters.

Thus, perhaps, it is not race but *place* that counts most. Relief, climate, soils, plants and animals and minerals, all play their part in the working out of human history. We can hardly regard it as pure coincidence that the region bordering the North Sea and the western North Atlantic, which contains seven tenths of the world's coal and nine tenths of its iron, and includes the areas of most stimulating climate, also has dominated world history for the past 200 years. We do not doubt the importance of race; but nature has more than one way of loading the dice!

●

Are you lazy? Probably you feel that way sometimes. Psychologists believe this trait to mean simply that you have not yet found your real life work, and that it is a mental condition. Don't be lazy—read about laziness in next month's number.

Books SELECTED BY THE EDITORS

THE GREAT DOCTORS

By Henry E. Sigerist, Prof. Hist. Med., Johns Hopkins

IF you were to write the biographies of about 50 famous physicians, from ancient to modern times, you would have a framework which would constitute a sort of biographical history of medicine. This is what Dr. Sigerist has done in 400 pages. The book is a translation from the German. Through it the reader glimpses the lives of great doctors such as Pasteur, Koch, Lister, Ehrlich, Osler, and so on. However, the author devotes at least two thirds of his book to doctors previous to a century ago, hence it is more true to the ideal of writing a history of medicine than a best seller based on the romantic highlight figures of the medical profession. It has about 50 illustrations.—$4.20 postpaid.—*A. G. I.*

SEX IN THE PLANT WORLD

By W. W. Robbins, Ph.D. and H. M. Pearson, Ph.D.

THIS is almost, as its title suggests, a book on the love life of plants. It is a truly scientific, though popular, exposition of the sexual side of the vegetable world, of which there is more to be said, both in breadth and depth, than most of us probably realize. The chapter heads indicate the scope covered: Sex in Flowers; Sex in Ferns and Mosses; the Origin of Sex; Primitive Sex; Begetting Without Sex; Virgin Birth in Plants; Plant Courtships; Sex Traits; Sterility, and so on. The authors are in the departments, respectively, of botany and vitaculture at the University of California. This book has 186 pages and 66 illustrations.—$2.15 postpaid.—*A. G. I.*

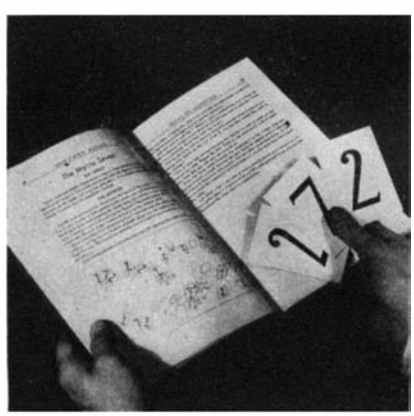
THE STORY OF AIRCRAFT

By Chelsea Fraser

IN this comprehensive and well-written popular history of man's conquest of the air, from the mythical story of Dædalus and Icarus to the present-day accomplishments of efficient airplanes and dirigibles, the author tells a running story that will interest anyone who has ever seen an aerial flight. The book is divided into two general sections—lighter-than-air and heavier-than-air—but the necessary break in sequence of events is of little moment because of the interest which has been worked into the actual telling of the whole story. It is evident that the author is thoroughly familiar with his subject, for he has written into this book a kind of enthusiasm that could come only through careful yet ardent research. The text is illustrated with many mediocre but informative drawings.—$2.65 postpaid.—*A. P. P.*

MAGICIANS' MANUAL

HERE at last we have the ideal book on magic for amateurs. This reviewer prepared a formidable work on Magic in 1896 which achieved great popularity but was by no means the equal of the present volume, when tricks that can be actually performed on the stage or in the parlor are concerned. The tricks do not require expensive outfits. In fact, all the material for the tricks is provided in envelopes or otherwise conveniently disposed in the volume, as shown by our illustration, and each diagram gives an idea of the method employed. We have little hesitation in calling this a new kind of book. It was compiled for members of the Magicians' League of America by Walter B. Gibson, Director of Service and Instruction. When you buy this book you become a member of the League.



A unique Christmas gift—the "Magicians' Manual," reviewed here

We pick the "Magicians' Manual" as one of the year's best Christmas presents. $3.25 postpaid.—*A. A. H.*

NEW FEET FOR OLD

By John Martin Hiss, B. Sc., M. D.

A PRACTICAL book for the millions who suffer from their feet, by a specialist in whose files are the carefully analyzed records of 20,000 cases embracing every conceivable type of foot trouble. Three out of five of us wince from some form of foot trouble—practically all this pain is needless. In an effort to relieve some of this unnecessary, nonsensical suffering, the author in straightforward, plain language explains the mechanics of the foot, just what causes trouble, and how it can readily be overcome. The last chapter, "Aids to Home Treatment," is alone worth the price of the book.—$2.15 postpaid.

WHAT SHALL I EAT?

By Edith M. Barber

WHIMSICAL as to eating fads and unusual diets, yet broad enough to assess with fairness the inherent good as well as the obvious chicanery which underlies some of the extreme formulas, one reads this book with the strong impression that the writer knows her hygiene thoroughly and is blessed with the saving grace of healthy discrimination. Common sense pervades the entire discussion which covers the subject thoroughly yet never touches the pedantic. There is scarcely a medical term the reader will not know at a glance. A most happy and helpful discussion.—$1.90 postpaid.

A PRACTICAL HANDBOOK ON THE DISTILLATION OF ALCOHOL FROM FARM PRODUCTS

By F. B. Wright

WORKS on distillation have become extremely rare since the Volstead Act specifically forbade the publication of such literature. The present book was revised and enlarged to meet the "Free Alcohol Act." The changes which have occurred since the re-publication of this book have not been very great. The book deals with the processes of malting, mashing and macerating, and the fermentation and distilling of alcohol from grain, beets, potatoes, and molasses. There are chapters on alcoholmetry and the de-naturing of alcohol.—$2.65 postpaid.

COMPLETE MODEL AIRCRAFT MANUAL

By Edwin T. Hamilton

HERE is the book your boy and mine have been looking for. It answers hosts of questions not to be found elsewhere, such as wing insignia, both war

and modern, dictionary of model terms, et cetera. Every tool, every step in the process of making models, such as bending woods, new methods of spraying water and applying dope, reading and using plans, bending metal fittings, kinks for cutting out, assembly, testing for balance, and on through to flying, including numerous types of planes and sailplanes, all are covered in a most thorough, lucid, and understandable way. Quite the best book of its kind that has been published. 588 pages, 253 illustrations.—$3.70 postpaid.

SMITHSONIAN PHYSICAL TABLES

Prepared by Frederick E. Fowle, Assoc. Physicist Smithsonian Astrophysical Observatory

FOR those who do any kind of research involving physics and mechanics; for inventors and makers of instruments who wish to know about the melting points, boiling points, coefficients of expansion and no end of other things concerning materials—this book should prove to be a boon. It now is in its eighth and newest edition, but is not even yet well enough known to others than physicists. Within its 660 pages and paper covers are contained an immense number of tables dealing with various units of measurement; mathematics; physical constants; mechanical properties; densities; acoustics; aerodynamics; vapor pressure; viscosity; thermal conductivities; specific heats; latent heats; heats of combustion; cooling by radiation, conduction and convection; the eye and radiation; photometric tables; photographic data; spectrum wavelengths; indices of refraction; reflecting powers; transmissive powers; electromotive forces; electrical resistence; wire tables; electrolysis; dielectric strength and constants; wireless telegraphy; magnetic properties; atomic data; atomic structure; radioactivity; X rays; electron emission; meteorology; geodesy; geophysics; terrestrial magnetism; atmospheric electricity; astronomy. This book, to repeat, is wholly a set of *tables* and is not a treatise. It is for users who are somewhat familiar with the background of physics, and is a reference book of the more advanced type. Order, not from SCIENTIFIC AMERICAN, but directly from the Smithsonian Institution, Washington, D. C. Price $3.00.

HISTORICAL GEOLOGY

By Raymond C. Moore, Ph. D., Prof. Geol., Univ. Kan.

THIS is a full-size, detailed, college textbook of historical geology—history both of the earth's strata and the fossil evidences of life contained in them, from the beginning of the earth clear through to modern times. There have been few works on this subject suitable for others than highly trained specialists. Even this book presupposes some familiarity with elementary geology. The style is sometimes good but sometimes it is labored, ponderous, and involved, and this does not make for easy reading. The book is of very uneven hardness—here assuming full previous knowledge of elementary fact and there explaining elements which any freshman student should know. As a whole, however, it is an invaluable contribution to a field in which special textbooks have been few and far between. It has 657 text pages, 6 by 9 inches in size, 413 excellent illustrations, and is printed on high grade paper.—$4.20 postpaid.—*A. G. I.*

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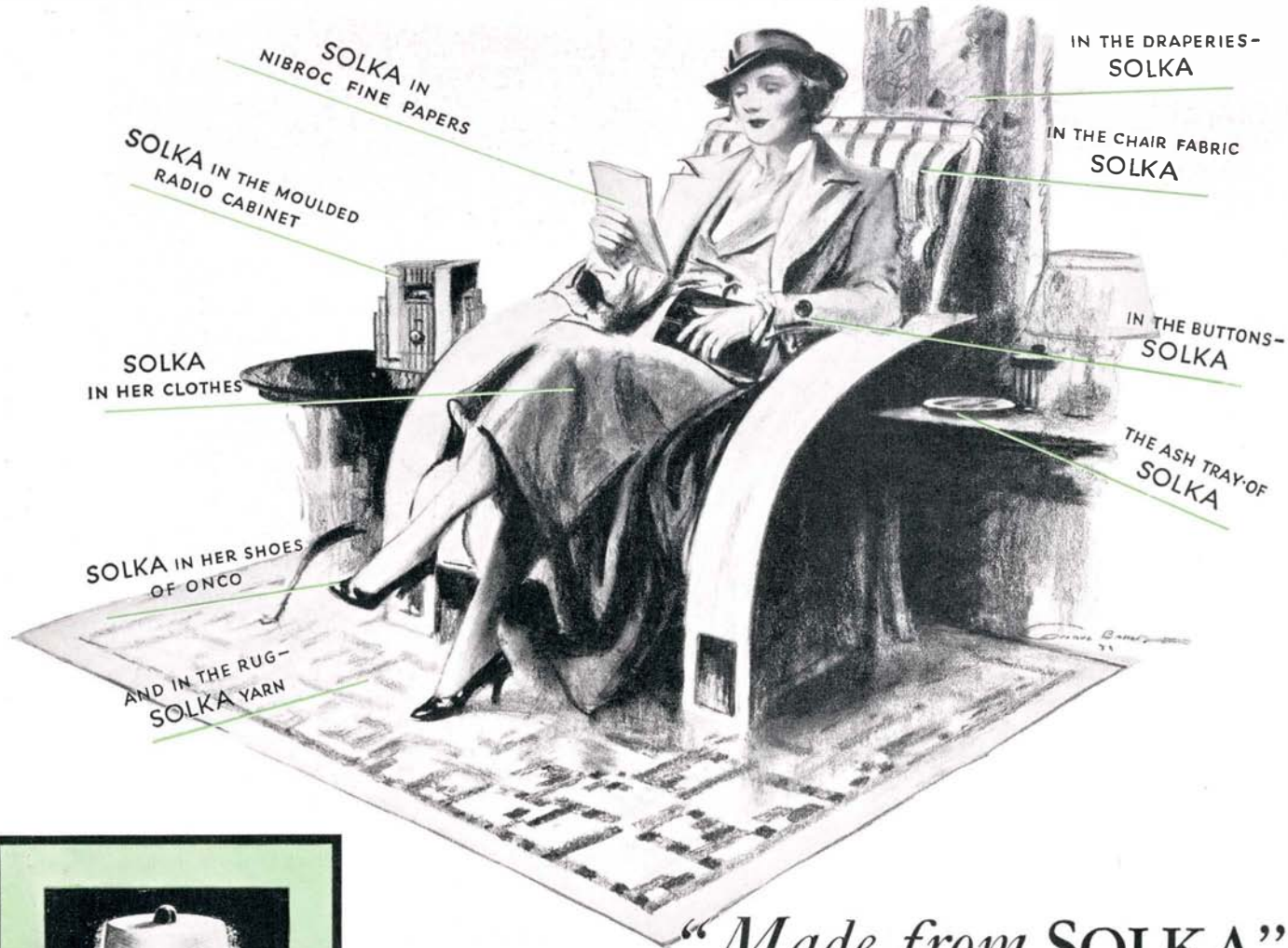

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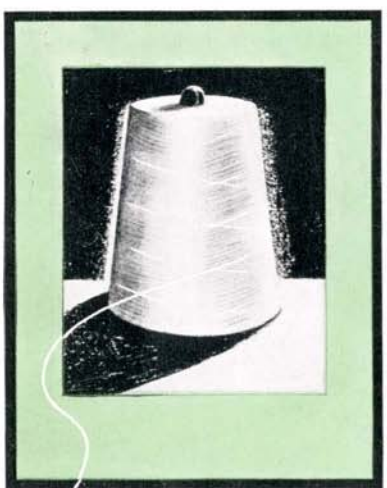

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