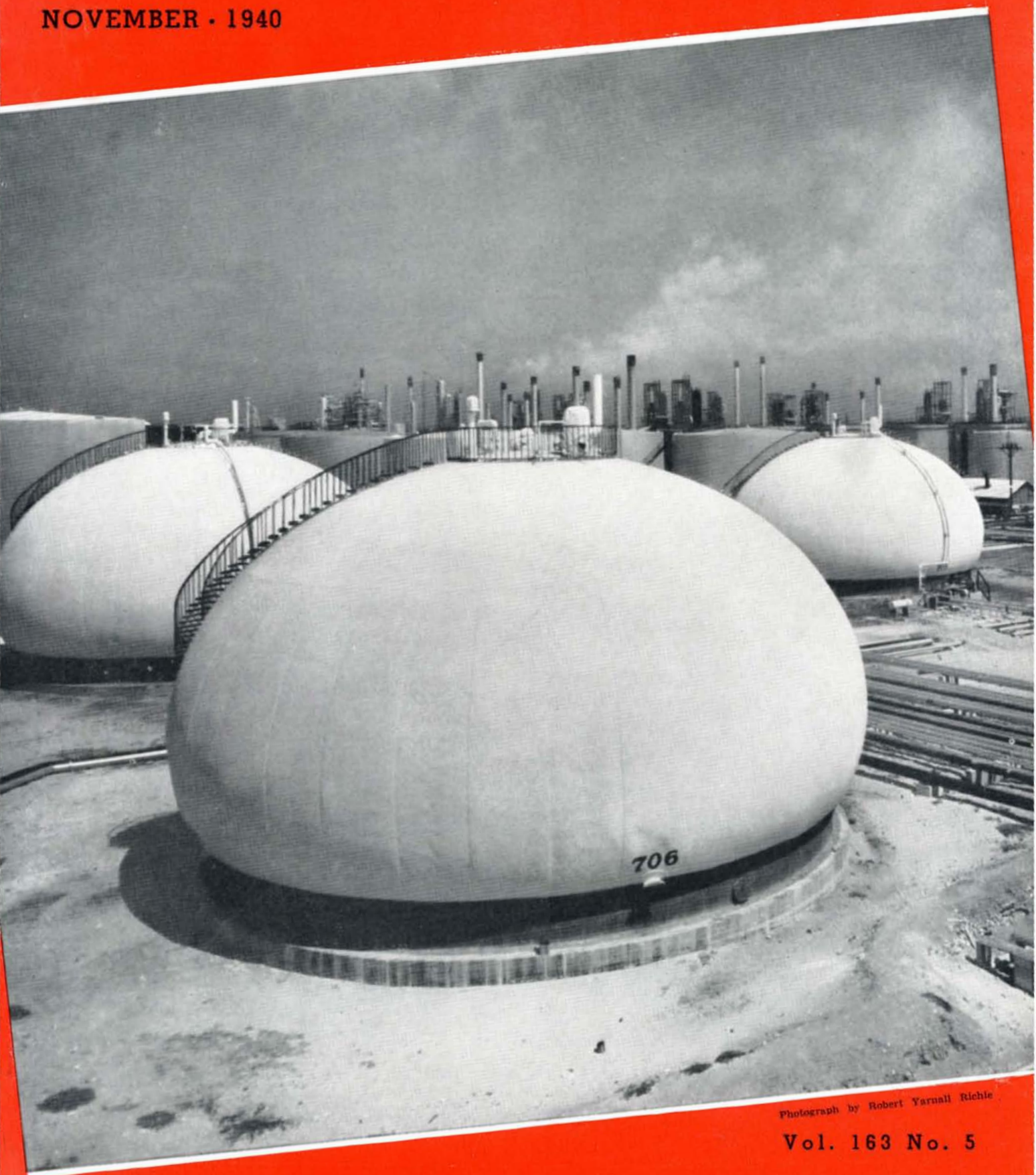
SCIENTIFIC AMERICAN

NOVEMBER · 1940



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Vol. 163 No. 5

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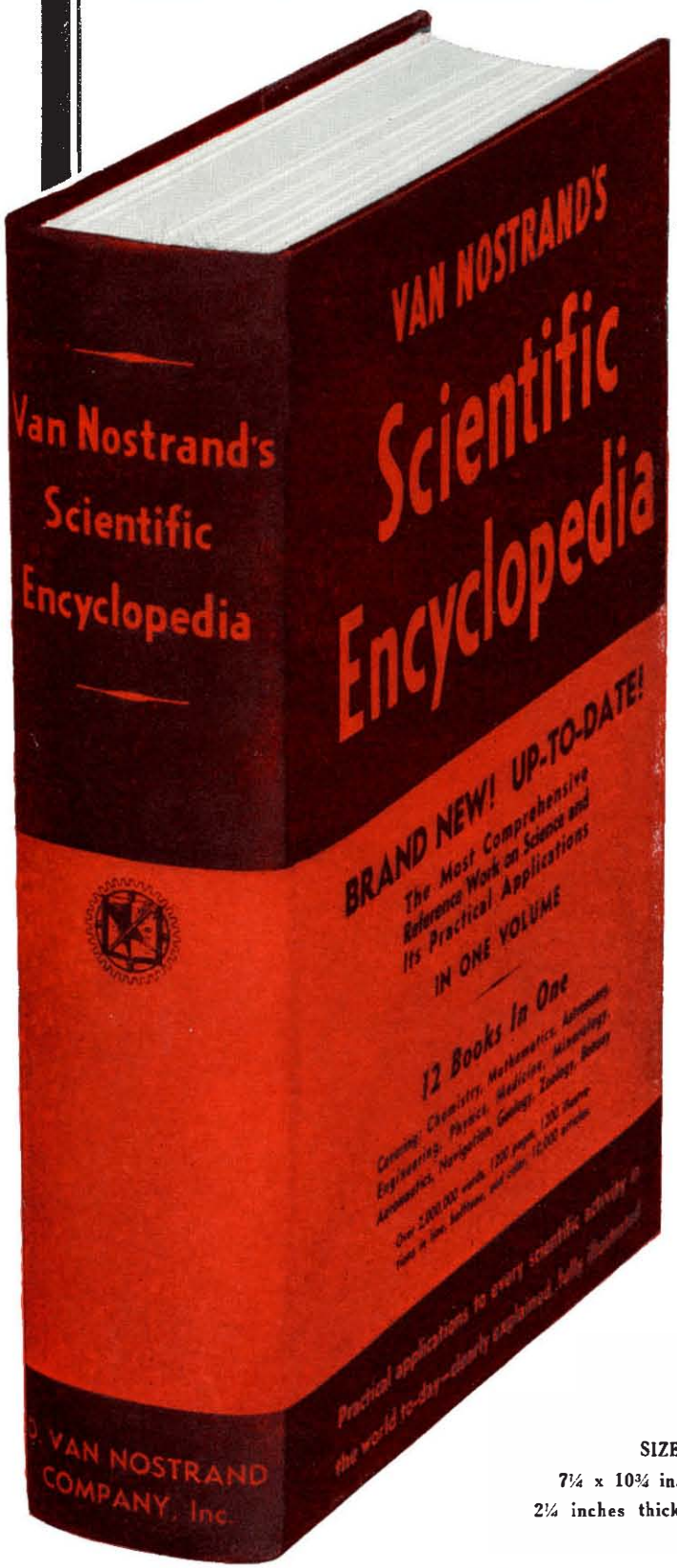

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HORTONSPHEROIDS in a modern refinery in the West Indies are the interesting objects shown on our front cover. These have a capacity of 20,000 barrels each and are used to store gasoline under two and one half pounds pressure to reduce excessive evaporation losses.

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SCIENTIFIC AMERICAN

Owned and published by Munn & Company, Inc.; Orson D. Munn, President; I. Sheldon Tilney, Vice-President; John P. Davis, Secretary-Treasurer; all at 24 West 40th Street, New York, N. Y.

NINETY-SIXTH YEAR • **ORSON D. MUNN, Editor**

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NOVEMBER • 1940

SCIENTIFIC AMERICAN, November 1940. Vol. 163, No. 5. Entered at the New York, New York, Post Office as second class matter June 28, 1879, under the act of March 3, 1879: additional entry at Orange, Connecticut. Published monthly by Munn & Co., Inc., 24 West 40th Street, New York City.

Subscription rate $4.00 per year. Canada and foreign $5.00.

SCIENTIA OMNIA VINCIT

NYLON, it was said in these pages last month, probably will not cut deeply into the Japanese silk industry for five to ten years. When and if it does, that will be the Japanese farmer's worry; what disturbs some cotton men is the expanding use of rayon. Indeed, to that fiber is attributed a sizeable part of the problem now facing American cotton farmers.

Rayon production has increased nearly a thousand percent since 1924, says the *Industrial Bulletin* of Arthur D. Little, Inc. Yet, reports that circular, it was not until 1938 that rayon consumption exceeded that of scoured wool and became a poor second to that of cotton. And if rayon consumption doubles in the next decade, it will still total a third of current cotton consumption.

Growers of the natural fiber, nevertheless, may not rest content. That one third is the equivalent of several million bales of cotton. Already an increasing production of cotton abroad is cutting into our exports, may cut far more heavily as the years pass. And with rayon taking a larger share of the home market's cash, it seems appropriate that the American cotton farmer take stock of the situation and readjust his economy in time to meet and weather the storm. Assuredly, rayon is going to be used more widely in rugs, tires, many fabrics that now commonly use cotton, and, in "staple fiber" form, as a mixer with cotton fibers in cloths traditionally made of cotton.

There is one bright light on this dark horizon. Down in North Carolina, there have been under way for years experiments in turning the whole cotton plant—stalk, leaves, boll, and fiber—into rayon. The plants are mowed down; oil is extracted from the seeds in this bunch of sticks and fiber by use of solvents; and the remaining cellulosic material is made into rayon. Years ago, this process was a laboratory success. If and when it is made commercially practicable, it will save our trees—which now go into rayon—will take up surplus cotton stocks, and will sidestep that part of cotton production which is more costly than all others combined: the picking job.

For decades, the cotton grower has been roundly scolded for concentrating stubbornly on his one crop. Still, he sticks to it. Perhaps he cannot interpret the handwriting on the wall, "Science conquers all," as saying that science replaces the old with the new. If he doesn't now make a determined effort to understand, he may soon be complaining of technological displacement.—*F. D. M.*

DEFEND YOURSELF OR DISARM

THE right of the American citizen to bear arms, secured by the Constitution of the United States, has definitely been abridged by local and state laws, but has never—*yet*—been completely rescinded. That "yet" is important. If certain fanatical anti-firearms groups were permitted to have their way, every sporting arm in this country might have to be registered and its owner duly "mugged" and fingerprinted. Or, even worse, such firearms might be subject to confiscation or to storage in some public place when not in actual use.

Every sportsman who uses firearms—whether he "plinks" with a .22, is a devotee of skeet or trap, or likes to punch holes in paper targets with rifle or pistol—should be aware of the dangers that threaten his sport. Anti-firearms fanatics formerly used the crime-prevention pretext for proposed legislation. Now they have a new one. National defense! They would keep weapons out of the hands of fifth columnists by taking them away from everyone! And just as does the thug and crook, the fifth columnist will hide his firearms where they are readily available, while the law-abiding citizen complies with the rules and leaves himself unarmed! The theory is beautiful, but it does not work out in practice.

In this same vein, Eltinge F. Warner, well-known sportsman and publisher of *Field and Stream,* holds up Switzerland as an example of a free nation where anti-firearm agitators would never be happy. "For many months," says Mr. Warner, "little Switzerland has been surrounded on all sides by warring nations, but up to today she has not felt the tramp of hostile armies. When a war plane crosses the Swiss border, the Swiss open fire. She is small, but she is mighty. Rumors have been current that armies would march across Swiss soil, yet up to date Switzerland is the only country in the theater of war that has not been ridden over roughshod.

"The citizens of that courageous republic," continues Mr. Warner, "don't keep their guns in public armories. At all times the citizen of Switzerland has a military rifle within reach, and he knows how to use it. Every young man is an army graduate. When he has completed his military training, he takes his government rifle or hand-gun home with him. And each year thereafter he is allotted a certain amount of ammunition and required to shoot this ammunition in order that he may keep familiar with firearms and know what a good rifle and a good pistol or revolver can do. Even the most rabid anti-firearm crank must admit that Switzerland would be an unhealthy place for hostile parachute troops to land."

We cannot help recalling that this vast nation of ours was virtually built by men whose very lives and livelihoods depended on their skill with firearms. True, the march of civilization has changed this picture materially, but it can never change the love that millions of American men hold for firearms and their use. It rests in the hands of these same men—you and I—to preserve for all of us the right to own and use rifles, hand guns, and shot-guns in the pursuit of sport and recreation. Make use of our democratic processes by letting your legislators know *now* that you, together with millions of others, want no interference with your rights in this matter. Write. Telegraph. Make yourself heard in the halls of Congress.

National defense by disarming the citizens! By the Red Gods, what a travesty!—*O. D. M.*

50 Years Ago in . . .

SCIENTIFIC AMERICAN

(Condensed From Issues of November, 1890)

CANAL—Recent cable advices report that work is being energetically pushed on the Nicaragua Canal. . . An aqueduct twelve miles long, to bring pure water from the mountain streams, is being laid. Offices, hospitals, and quarters for employes of the company, adequate to the present needs, have been erected. Several millions of feet of lumber have been received from Atlantic and Gulf ports, and cargoes are continually arriving.

LIGHT COST—Incandescent electric lamps are lessening in cost of manufacture while, at the same time, increasing in efficiency, that is to say in length of life. . . Now, with improvements in exhausting apparatus, it costs but a tithe of the old figure to produce a more perfect vacuum; the sealing of the platinum wires is done by machinery, and as a result a far more certain and a longer-lived lamp than that which once cost $1 may be had for considerably less than the half of it.

WAR TRENDS—The conditions under which the next armed conflict between powerful countries must take place are of an altogether different character from those known heretofore; but in such future contest, come when it may, it is safe to say that science and skill, rather than brute force, will have a determining influence to an extent never before known in the annals of war.

HORSE MEAT—Just twenty-four years ago the first horse butcher in Paris opened his shop. Since then there have been started nearly 140 horse flesh shops in the department of the Seine, and at the present time about 20,000 horses are killed every year in Paris for human food. In Paris the price of the meat is less than half that of ordinary butcher's meat. Berlin is following the example of Paris.

LUMBER—In 1880 the 25,708 saw mills then in operation converted $120,000,000 worth of raw timber stock into various kinds of lumber; at the same rate there would be no good-sized timber left in forty years.

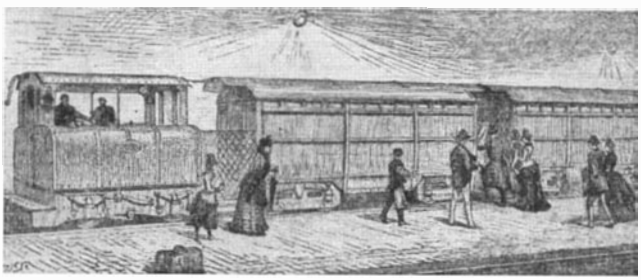
EFFICIENCY—Another path in which the American iron works can now develop is in that of reducing wastes of fuel and of material. Now that mechanical engineering has developed machinery for handling to such an extent that the smallest possible amount of manual labor is required, the engineers might be allowed to take a rest in this direction and devote themselves to perfecting the steam boilers and engines and furnaces, with a view to saving fuel.

COLUMBUS—In the confusion of new and old times, and of different years . . . it is far from easy to determine the exact anniversary of Columbus' first sight of our shores. Four hundred years ago many discrepancies existed in the times of celebration of Christmas, and there is even a possibility that the year should be 1491 or 1493.

STREET LIGHTS—One of the companies in Paris that deal in compressed air for motive power has been awarded the contract for street lighting on a novel plan. The company distributes power through its condensed air system to an immense number of small dynamos, each of which furnishes current for a small number of lamps.

TORNADOES—A special investigation of the subject of tornadoes has been carried on by Prof. H. A. Hazen, of the Government Signal Service, during the past year. . . It appears that in no State may a destructive tornado be expected oftener, on an average, than once in two years, and that the area over which the total destruction can be expected is exceedingly small.

UNDERGROUND—Among the new works lately inaugurated in London is an underground electric railway known as the City and South London Railway, 3¼ miles in length. . . The road-bed consists of two tracks 4 feet 8½ inches in width, which are laid in two underground tunnels, each 10½ feet diameter. . . There are four stations.



One of the peculiarities of the work is its great depth underground, the rails being, with few exceptions, not less than 40 feet below the streets, while in some places they are 100 feet underground. At the stations the two tunnels are brought into an enlarged chamber built underground, and from these passengers are raised by elevators to the street level. The cars are propelled by electric locomotives, of which fourteen have been supplied. . . The locomotives are able to make a speed of 25 miles an hour, but the trip of 3¼ miles, making four stops, is made at the rate of 15 miles an hour.

GROWTH—In Denmark and Sweden it has been the custom for many years to weigh and measure the school children every year. Out of 15,000 boys and 3,000 girls the results were as follows: In the seventh or eighth year of life boys grow considerably in height and in weight, after which a delay sets in which reaches its maximum in the tenth year and lasts till the fourteenth year, when a considerable acceleration of growth suddenly sets in.

INSULATION—There is great need of improvements in insulating material. An insulation for wires is needed that will be cheap, light, flexible, and durable; one that dampness will not decay, nor the heat of an electric arc dissolve or burn.

PAPER PIPES—Gas pipes from paper are made from strips of manila paper equal in width to the length of the pipe to be made, which is passed through a vessel with melted asphalt, and then wrapped firmly and uniformly around an iron core until the required thickness is attained. The pipe is then subjected to powerful pressure. . . These pipes are claimed to be perfectly gas tight . . . and very resisting to shocks and concussions.

OUR PART IN NATIONAL DEFENSE

Walter S. Gifford, President, American Telephone and Telegraph Company

THE BELL SYSTEM IS A NATION-WIDE TELEPHONE SYSTEM — READY TO SERVE THE UNITED STATES IN NORMAL TIMES OR EMERGENCY. IT HAS . .

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7. The financial strength to keep going and work ahead for the future.

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Walter S. Gifford

THE BELL SYSTEM IS READY TO DO ITS PART IN THE NATION'S PROGRAM OF NATIONAL DEFENSE

BROWSING with the Editor

THROUGH THE SCIENCE LITERATURE OF THE WORLD

TO CORRECT WIDESPREAD MISCONCEPTIONS—During a five-year test, F. H. Frankland, Chief Engineer of the American Institute of Steel Construction, observed that in a wind of 80 miles per hour the Empire State Building in the City of New York took a temporary lean of about 2¾ inches, and then swayed across that lean at the rate of 7.85 times per minute through an eight-inch arc. Thus, at one end of each sway the building reached 6¾ inches out of plumb away from the wind, and at the other end returned to 1¼ inch beyond plumb toward the wind.

REFRIGERATOR MILEAGE—The compressor motor of an electric refrigerator travels the equivalent of 250,000 miles in five years' normal operation—enough to carry it around the world 10 times if it could travel under its own power.—Notes, Westinghouse Electric & Manufacturing Company.

A TRAIN EVERY FIVE SECONDS—Approximately 18,000 passenger trains and about 15,200 freight trains operate daily over the tracks of the American railroads. On this basis, a passenger train starts on its run somewhere in the United States every 4.8 seconds, and a freight train starts on its run every 5.7 seconds, day and night, on the average.—Association of American Railroads.

MOTH LARVAE CRAWL IN—Experiments prove that a flying moth will lay her eggs in the crack of a chest or closet and the larvae when hatched will have no trouble crawling into the container if the opening is about the thickness of newsprint paper. Sealing with gummed tape is recommended.—Wallace Colman, United States Bureau of Entomology and Plant Quarantine.

CHEESE MINES—Much Roquefort type cheese, which requires to ripen an atmosphere nearly saturated with water and varying but slightly from 48 degrees, Fahrenheit, is being made in quantities in this country—in caves along the Mississippi near St. Paul; in rooms into which icy water trickles constantly, turning a fan for gentle air circulation; in abandoned coal mines; and in numerous small caves.—*The Industrial Bulletin* of Arthur D. Little, Inc.—No. 159.

MOTES—Research engineers have measured more than 100,000,000 dirt particles in a single cubic foot of air in one particularly dirty city.—Notes, Westinghouse Electric & Manufacturing Company.

WAR EXPORTS—For war supplies, Japan has depended primarily on seven countries headed by the United States. In percentages, imports of such supplies from these countries were as follows: United States, 55.7; British Malaya, 8.7; Canada, 8.5; Netherlands Indies, 8.3; Germany, 4.3; British India, 3.3; Italy, 1.3.—Dr. T. Y. Hu, Chinese Council for Economic Research.

COLONIC IRRIGATION—It is extremely difficult to determine the field of usefulness, if any, of colonic irrigation. While the role of the small cleansing enema and of the medicated retention enema seems well established, colonic lavage has been outrageously exploited in many quarters. There is little evidence to show that it may benefit diseases of the colon and there is none for the stomach. On the other hand, it may cause harm.—*The Journal of the American Medical Association,* August 3, 1940, page 404.

COLDER ICE—Ice men in Bangor, Maine, have found that their crystal-clear natural ice, frozen at —20 degrees, Fahrenheit, lasts longer than artificial ice frozen at 15 degrees. The ice is used extensively in air-conditioning Pullman cars between Bangor and Boston.—*Taylor Rochester,* Summer Edition, 1940.

YARN—Some cotton yarn is so fine that 50 miles of it are needed to make one pound. This yarn is spun on ordinary textile machinery to make typewriter ribbons, airplane fabrics, and fine dress goods.—R. J. Cheatham, U. S. Department of Agriculture.

ROSE INDUSTRY—More than one half of the world's supply of rose-bushes, or 20,000,000 per year, are now grown commercially in Texas. They are of 16,000 varieties. The industry, mainly in eastern Texas, ships rose bushes to every state and to 25 foreign countries.—Notes, American Petroleum Institute.

COMMON PIMPLES—Among Eskimos, native black Africans, Australian aborigines, and Maoris, acne vulgaris appears to be a much less common disorder than it is among civilized white people. As the Maoris adopt modern methods of living, the condition occurs more frequently.—*The Journal of the American Medical Association,* August 17, 1940, p. 555.

AIR CONDITIONING—Schools of air conditioning and refrigeration attract students with glowing promises of work in an uncrowded field, fail to give proper training, and much bitter disappointment is the result.—*Refrigerating Engineering.*

SCIENCE FRUSTRATED, PERVERTED—The function of science is to unite the whole human family, whereas the function of politics seems to be, both in the case of the human family and of each nation, to create parties and to emphasize them as much as possible.—*Nature,* August 3, 1940.

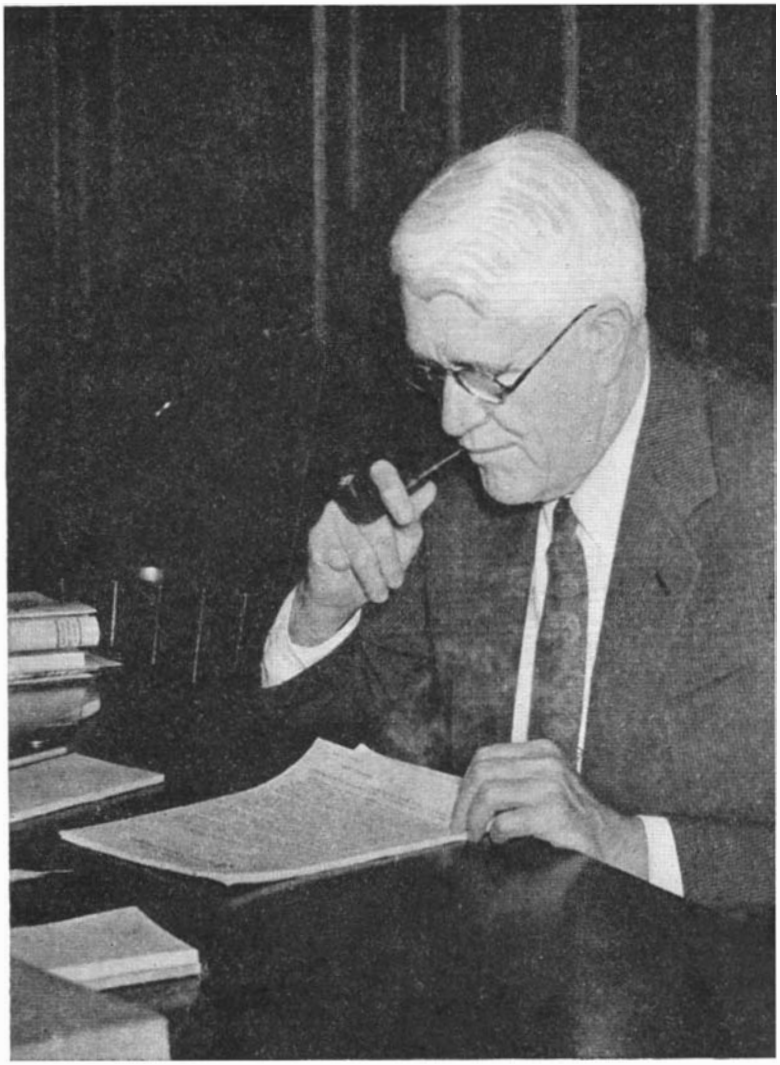
MILK WINE—Either sherry or sauterne type wine can be made from milk whey. So far, however, only seven bottles of milk wine have been made. It has an alcoholic content of 15 percent by volume.—Notes, National Dairy Products Corporation.

EFFECT OF SCIENCE—The chances of a new-born child reaching age 65 are today as great as the chances of reaching 50 were only 30 years ago.—Dr. Louis I. Dublin, Metropolitan Life Insurance Company.

TOOL ALLOY—Important to our national defense program, the steel-cutting tool material, Carboloy, was produced in July in a quantity four times that of July 1939. Also exceeded was the previous peak month of June 1940. —Notes, Carboloy Company, Inc.

WIDOWS—Every year about 400,000 wives in the United States become widows. The average age of widows at the death of their husbands is somewhat less than 55 years, and practically one quarter of them—that is, about 100,000 —are at ages under 45.—*Statistical Bulletin,* Metropolitan Life Insurance Company, August, 1940.

Personalities in Industry



WILLIAM H. MASON

WHEN William H. Mason was six years old he admired a new two-wheeled "break-cart" on his father's horse farm in West Virginia. Here, he saw, was a vehicle getting along with half as many wheels as usual. Why, this youngster thought, couldn't you go one step farther and have a one-wheeled cart? He labored and whittled and finally produced a one-wheeled cart, but it turned out to be only a wheelbarrow. He was disappointed, but he had taken his first step in a career of invention.

Mason is not the wild-eyed, long-haired type of genius. Now, as vice-president in charge of research of Masonite Corporation—a huge concern that sprang from his own research—he is intensely human and exceedingly modest. Rather than talk about himself, Mason, if you will let him, will invariably swing the conversation around to one of his pet subjects, the late Thomas Alva Edison, with whom he was associated for 17 years.

Much of Mason's youth was spent breaking and training trotting and gaited horses. After several years at Washington & Lee, he transferred to Cornell to study mechanical engineering. When the Spanish-American war broke out he left college to become a naval engineer.

After a shoe factory job, Mason went to work as a draftsman in planning Edison's new cement plant at New Village, New Jersey. Mason was retained by Edison to help supervise actual construction of the plant, and later became building superintendent of all of Edison's various enterprises.

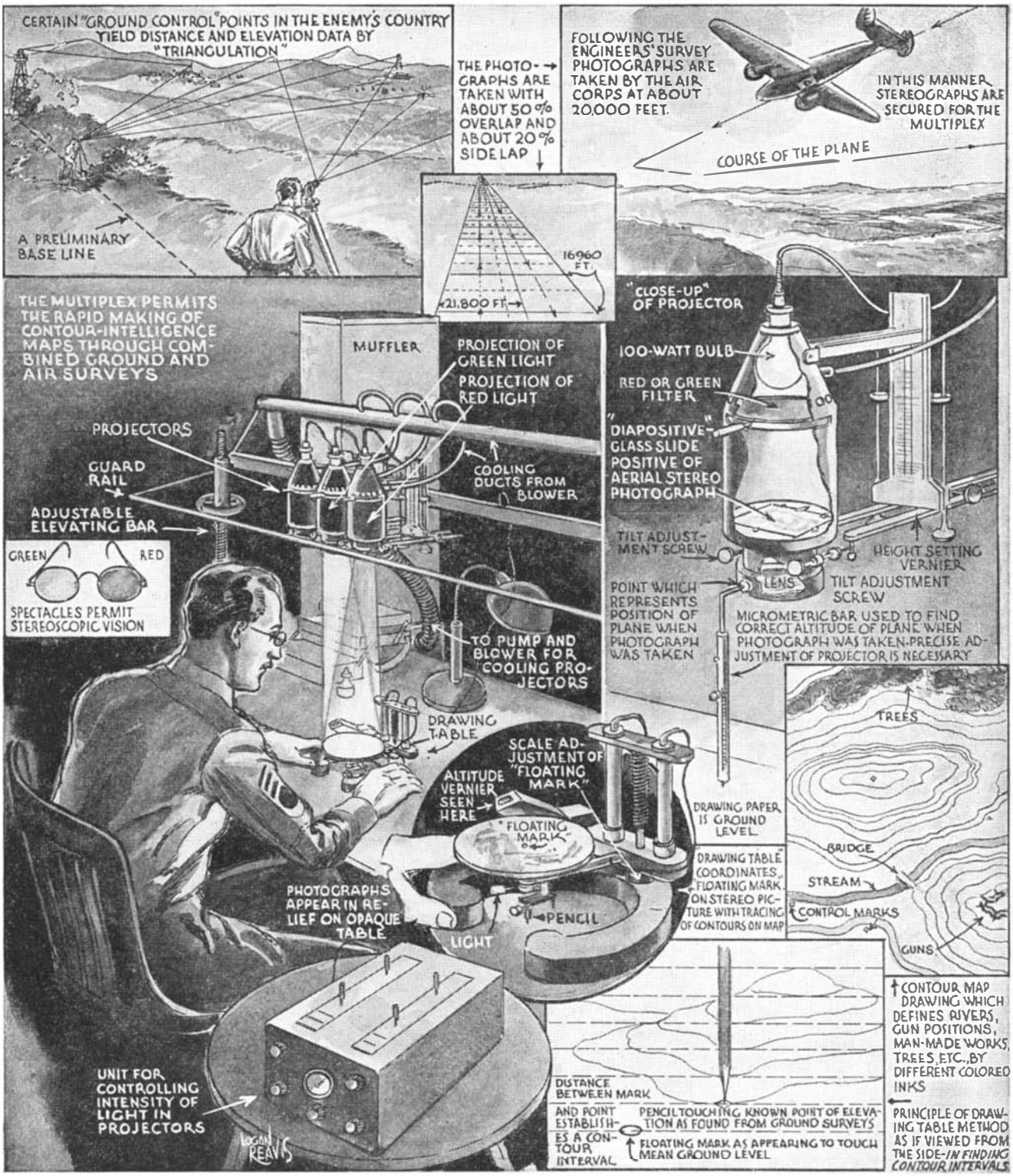
In 1916 Mr. Mason again pulled up stakes to serve his country. He was given charge of all construction for the U. S. Merchant Shipbuilding Corp., at Bristol, New Jersey. Later he went South to go into the business of extracting naval stores from sawn lumber, in which he employed a process of his own. He made his headquarters at Laurel, Mississippi.

Mr. Mason watched with interest and concern the large proportion of a tree that was utter waste in the saw mills—edgings, slabs, boards of unmarketable shape or size. Here, he thought, was a vast supply of valuable raw material going to waste. If some economical means of reducing those scraps to fiber could be found, it would be a blessing to the paper industry.

Mr. Mason found a way. He bored a deep hole in the end of a piece of steel shaft to form a cylinder. In the hole he placed clean wood chips and a little water, and then plugged up the end. He heated the cylinder with blow torches until about 600 pounds of steam pressure was generated inside. Then he suddenly released the plug. There was a roar, and the air was filled with a shower of wood fiber.

The fiber was too tough and strong to make a good grade of paper. Besides, the lignin—nature's binding cement—that coated the fiber would make the paper harsh. Instead of trying to eliminate the lignin, Mr. Mason turned it to advantage. Under heat and pressure he made the damp fiber mass into dense, smooth boards that could be used in hundreds of ways that its parent material, wood, could not, and that could withstand punishment which would destroy wood. The lignin, instead of being a drawback, served to hold the fibers together. Mason had, using nature's own materials, improved on nature. His "Presdwood" had no grain, it would not splinter, would not warp, and it had a high resistance to moisture. A new industry was born. Mississippi farmers had a new crop. Before long they were cultivating second-growth pine, heretofore of little value.

While the above article on the activities of Mr. Mason was being prepared for printing, word was received of his sudden and untimely death.—*The Editor*.



RELIEF MAPS FROM AERIAL PHOTOGRAPHS

BEFORE guns can be trained on an enemy, that enemy must be put on a spot and that spot must be on a map—a map that shows elevations as well as linear distances. Accordingly, U. S. Army engineers are employing a method of producing relief or topographic maps from stereo photographs made by the Air Corps. Essentials of the system employed are shown above. Although it is impossible to survey enemy territory from the ground, preliminary control points may be established by the usual methods. Then stereo photographs are taken from the air and, reduced to proper size, projected in the Multiplex instrument shown. Now, by means of accurate controls, the operator adjusts the floating mark so that it appears to rest on a certain level of the stereoscopic image. Then, by guiding the instrument over the drawing table so that the floating mark appears to follow points of the same altitude, the pencil attached will trace a contour line. The floating mark is then adjusted to another level, in predetermined scale, and the process repeated. The finished drawing will form a topographic map.

RUBBER FOR AMERICA

Chemical Factories at Home, Plantations in Brazil

WILLIAM B. LANDIS

As the unsettled course of world events focuses nation-wide attention on the problems of national preparedness, the question of obtaining adequate supplies of commodities and materials essential to American national defense is under frequent discussion.

One of the most important of these materials is rubber, about 90 percent of which comes from British and Dutch possessions in the East Indies. The possibility that this rubber supply will be cut off, or at least curtailed in future years, looms as a serious threat, particularly if the rubber colonies should be seized by one of the totalitarian powers. In many circles it is believed that such a situation would have serious consequences, particularly in regard to its effect upon our national defense program.

However, the picture appears less dark for the immediate future when studied in the light of other facts. Stocks of crude rubber on hand and afloat are sufficient to meet the nation's normal requirements for nearly six months, and efforts are being made to increase this supply still further. For example, crude rubber now in transit to United States ports is approximately double the amount in transit a year ago. But in spite of these accelerated shipments, it is now too late to obtain reserve supplies of crude rubber sufficient to meet our needs, if the supply from the East Indies should suddenly be cut off.

A study of the situation reveals two possible solutions to the problem. The first is rapid development of artificial or synthetic rubber. The second is to establish supply sources closer to home.

Of these two courses, mass production of "synthetic rubber" has the greatest immediate possibilities. While real tonnage production of synthetic rubber is lacking at present, and prices are consequently somewhat higher than for natural rubber, producers of the chemical product are of the opinion

SCIENCE IN INDUSTRY

that they can swing into large scale production within six to eight months, should the necessity arise.

Although no definite predictions can be made regarding price, it is thought that chemical rubber can eventually be produced at a cost that will bring it within the price range of natural rubber. This opinion is based on the low cost of raw material from which chemical rubber is made, together with the fact that mass production methods might reasonably be expected to lower the now expensive processing costs.

Already factory-made rubber is serving a variety of useful purposes, especially in the automobile and aviation industries. In many cases it is not only proving a most desirable substitute for the natural product, particularly in places where resistance to oil and heat is required, but it is also replacing leather and other materials to a large extent.

In tensile strength, vibration resistance, and other physical properties, most chemical rubbers compare favorably with the natural product. Most varieties can be worked on existing equipment in American rubber factories and can be vulcanized or processed at the same speed as natural rubber.

To conserve the nation's supply of natural rubber, consumption of that product can be reduced by approximately one half, a prominent manufacturer declared recently, if the natural rubber in tire treads and sidewalls alone is replaced with a recently developed chemical rubber. Research in that direction undoubtedly will bring out still further means of conserving the nation's natural rubber supply, either by outright substitution of factory rubber for the natural, or by combining the natural and artificial products.

Obviously, any extensive use or large scale production of chemical rubber in this country within the next few months would necessarily have to be accomplished under pressure, as an emergency measure. Many authorities agree that, from a long-range standpoint, the development of chemical rubber should go hand in hand with establishment of a source of natural rubber in the Western Hemisphere. Thus the threat that rubber shipments from the East Indies may be cut off has at least served to make America realize that something must be done quickly, if no pinch is to result from the possible curtailment of the main source of supply.

That something was already being done long before foreign events took their present disastrous course is evident from the advancements made in developing chemical rubbers.

Progress has also been made toward establishing a source of crude rubber supply in the Western Hemisphere, particularly in Brazil. The Ford Motor Company has a $20,000,000 project, consisting of two plantations, under way there on land along the Tapajoz River, a major tributary of the Amazon.

This program, launched on a

In rubber-tree bud-grafting, a bud from a "clone," or family, with desirable characteristics, is grafted near the base of a healthy seedling. The graft is wrapped with waxed tape, acres of bud-grafts presenting the sight seen directly below. At bottom of page are the healthy plants long after the seedlings were cut away. Trunks near ground show the offset or angle of the original bud-graft

more or less tentative basis in 1928, and expanded to its present proportions in 1934, is scheduled for completion in 1950. It is expected to produce an average of 1000 pounds of rubber to the acre, or 76,000,000 pounds annually. Whether or not the project can be completed by the scheduled time depends upon a number of factors, chief of which is the problem of obtaining sufficient native help. In some circles it is believed that the necessary labor might be obtained through the co-operation of the Brazilian government, particularly since a number of Brazilian leaders are urging that country to do everything possible to regain at least a measure of the supremacy it once enjoyed as a rubber producer.

In that connection, it is interesting to note that the Ford rubber estates, operated under concessions from the State of Para, are located close to the spot from which Henry Wyckham, an English adventurer, smuggled 70,000 seeds of rubber trees of all varieties, 78 years ago. Planted in the famous Kew Gardens at London, these seeds produced 19,000 healthy seedlings which were taken to the East Indies and used in founding the great rubber plantations there. For his part in this, Wyckham was knighted.

Descendants of these very trees now have been brought back to Brazil to strengthen the native stocks and develop high yielding varieties. These East Indian plantation varieties, which are expected to rehabilitate the jungle varieties and make them suitable for plantation growing, are the very finest

that have been developed in the Far East. They represent the fruits of an intensive program of propagation and cross-pollination which British and Dutch interests have carried on for years, to develop rubber trees with high yield and other desirable characteristics.

As a result of this research, rubber trees have been developed in the East Indies with yields running as high as 2400 pounds to the acre. Incidentally, in the rubber industry an "acre" means 100 trees, without regard to the area concerned.

When one compares the high yield of the East Indian trees with the 300-pounds-per-acre average yield of jungle rubber, one wonders why such a difference exists, especially when present-day East Indian varieties and native Brazilian trees are descended from the same stock. Botanists attribute this to selective propagation, a process similar to stock breeding methods by means of which thoroughbred horses and cattle are produced.

At the Brazilian rubber plantations, it is expected to increase the yield of the native jungle trees by crossing with East Indian trees and also by scientific planting and cultivation. For the present, the estimated yield is set at 1000 pounds per acre, although subsequent developments may change that figure.

Although many problems have been encountered in developing the estates, operations are well under way at Belterra and Fordlandia—the company's two plantations located 24 and 110 miles respectively up the Tapajoz from its confluence with the Amazon. Concessions upon which these plantations are located embrace a total area of more than 2,000,000 acres.

At Belterra, where it is expected that rubber will be produced commercially in rather substantial quantities by 1941 or 1942, more than 12,000 acres have been cleared and planted with approximately 2,675,000 rubber trees. These are almost entirely bud-grafted with high yielding clones from Sumatra, Java, and Ceylon. In rubber terminology, it should be explained, a "clone" is a rubber "family" of definite, known characteristics which have been propa-

gated by the process of crossing.

At the Fordlandia plantation, where 6500 acres have been cleared, activities are given almost entirely to experimental work and research. Here the Ford Motor Company has planted one million trees and is conducting all kinds of experiments to produce a high-yielding Brazilian clone that will be immune to South American leaf disease and will possess other desirable qualities.

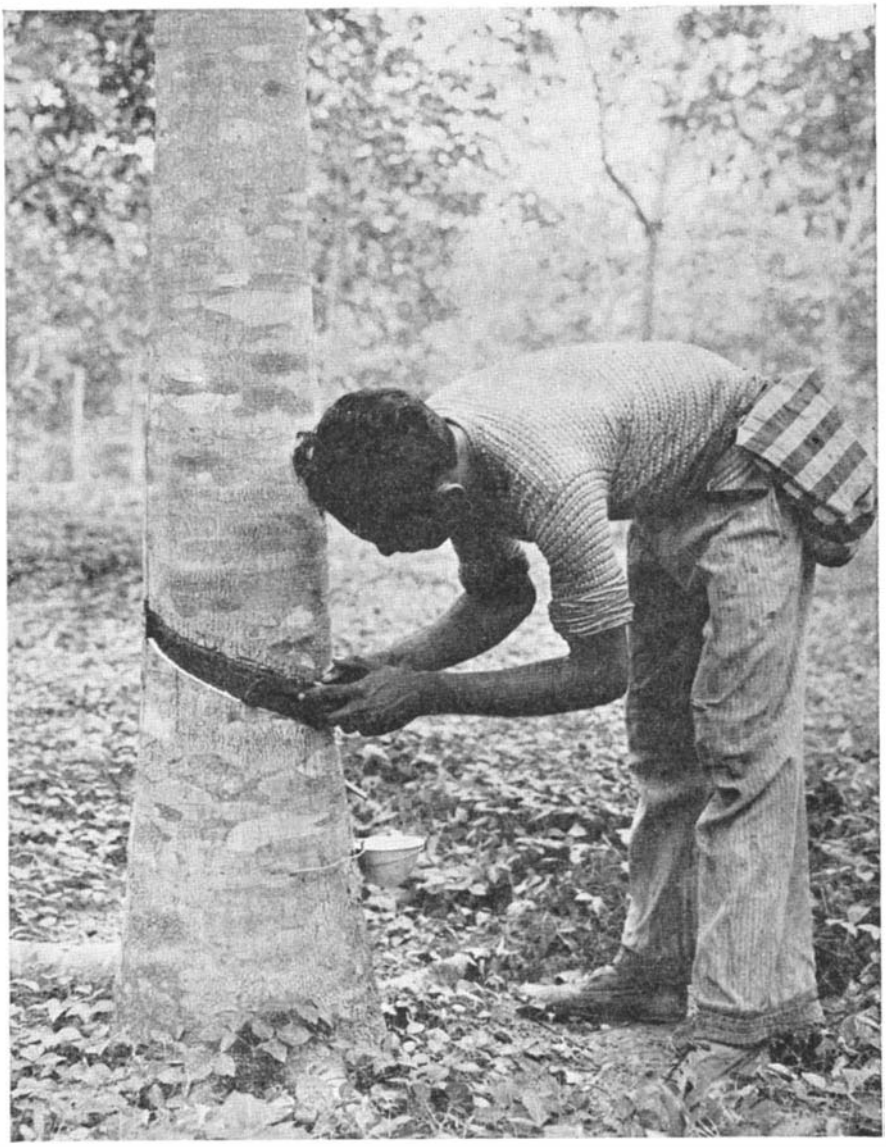
Test tappings are being taken primarily to determine what characteristics the trees are developing, but rubber thus obtained is being shipped in latex form to the Ford plant in Dearborn, where it is used in making tire fabric. In addition to developing various creaming agents to facilitate shipment of latex with a high dry rubber content, the company is also experimenting with smoked sheets, in which form a large part of the world's crude rubber is shipped.

IT might be mentioned in passing that many experts regard Brazilian rubber as the finest in the world. Although the native Brazilian trees have a lower yield than their cousins from the Far East, the rubber they produce is unsurpassed in quality and is used largely in the manufacture of surgical supplies.

To combine the high quality of the native Brazilian trees with the high yield and good health of the East Indian varieties is perhaps the main purpose of the research now being done on the Ford plantations.

Crossing these varieties is accomplished in two ways: by cross-pollination and by bud-grafting. Cross-pollination produces a seed that will reproduce the dominant characteristics of the two parent trees. Bud-grafting, on the other hand, may be used to speed the processes of multiplication and also to give one tree the desirable characteristics of several others.

Inasmuch as cross-pollination and bud-grafting play a prominent role in rubber tree propagation, a brief outline of the natural process involved might not be amiss. Before they are "crossed" by insects, two trees must be in bloom at the same time. All male blossoms are stripped from one tree, and all female blossoms from the other. Bees are then placed in a cheese cloth sack, over the male flowers (from which they gather pollen) and are later transferred to the trees from which the male flowers have been removed. Crossing by artificial means is successful approximately 7 to 9 percent of the time; while when bees are used as outlined, 20 to 25 percent successful results are obtained. After pollination, the blossoms develop into seed pods, each seed containing certain definite characteristics of the two parent trees.



In tapping a rubber tree, a special knife is used to make a cut, two feet from the ground, on a 30-degree angle along half the circumference. Care is taken not to cut into the cambium layer. A spout at the lower end of cut directs into a small cup the latex which flows from the bark

Bud-grafting is done about a year after seeds are planted. Bud-patches are cut in the seedling trees three to four inches above the ground, and a bud cut from bud-wood of high yielding clones is inserted in the bud-patch of the seedling. The patch is then turned to its original position, enclosing the bud, and taped in place with a waxed bandage.

Twenty-one days after budding, the bandage is removed in order to see whether the bud is alive. If it is, the bark that covered the bud and which still adheres to the lower part, is cut off. Seven days later the budded rubber trees are again inspected. If the buds have continued well, the rubber trees that were used as stock are cut off one and one-half inches above the bud, at an angle of 45 degrees so that rain water will not accumulate. After this, the budded rubber trees are inspected monthly. Shoots that naturally appear in the cut-back trees are pruned. Trees that die are replaced.

Each acre of land thus planted contains 220 rubber trees. When these trees reach the age of five years, a yield proof is taken. That is, they are tapped to determine the

amount of dry rubber they yield. Low yielding trees are eliminated and the number of rubber trees is reduced from 220 to 100 to 150 per acre.

Maintenance of the rubber properties is itself a major problem. After the rubber trees are developed, a leguminous plant of rapid growth and high resistance is planted, 100 holes per acre, and in a short time covers the entire planted area. This is done to check the development of weeds and also to aid in maintaining the humidity of the soil.

For the operation of its rubber plantations at Belterra and Fordlandia the Ford company is now employing about 500 men. On these plantations, the company has 917 buildings, all designed to suit the various purposes for which they are intended. Good light and water facilities are provided.

Six schools are maintained with 13 teachers giving instruction to 498 children of both sexes. Hospital services are excellent, there being two hospitals with a capacity of more than 120 beds, both with X-ray and ultra-violet ray equipment laboratories, pharmacies, excellent operating rooms, plumbing and sanitary facilities, and also completely equipped dental offices.

While Mr. Ford's primary object in setting up his Brazilian rubber plantations was to establish in the Western Hemisphere a source for a large part of the rubber consumed annually by his company, the research and experimental work that has been carried on might well prove of great value to Brazil, if rubber production on a high scientific plantation basis is to replace the more or less haphazard tappings of native jungle trees.

The Brazilian government and commercial associations are now aware that the country must have good technical men if the rubber wealth of the Amazon valley is to be developed properly. Undoubtedly, the experience which Ford has gained during the past few years will prove helpful, and cooperation between these agencies should help eventually to re-establish Brazil as an important source of the world's crude rubber supply.

Pending such developments, the United States must continue to depend chiefly on supplies of natural rubber from the Far East, at least until sufficient quantities to meet our needs can be obtained from South American tappings and our own chemical rubber production.

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Dry-Cleaning Grows Up

Chemistry Stimulates Growth of the Business Into a Great Nation-Wide Industry

COMMERCIAL dry-cleaning has, within the past two decades, entered the ranks of big business. Improved chemicals used in various dry-cleaning processes, together with lowered prices made possible by these improvements, have raised the amount of cleaning done by 40 or 50 times in the past 20 years, and the amount spent for it from $55,000,000 to more than $600,000,000 per year.

New synthetic solvents have wrought great changes in the business. Non-flammable and non-explosive, they have reduced the hazards and cut the time of cleaning from hours to minutes. Scientific cleaning with the new fluids has, indeed, brought many improvements in the quality of the service that is rendered. It is this superior quality as well as speed of service made possible by the newer chemicals that has caused the prodigious growth of the dry-cleaning industry to 12,000 plants and 200,000 retail outlets.

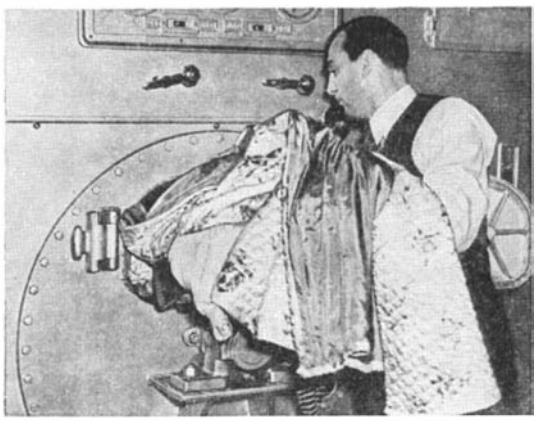
Until very recent years, a garment returned from the dry-cleaner's advertised itself by its distinctive odor. In those days, petroleum distillates such as benzene and naphtha were commonly used, replacing gasoline which was used in still earlier days. About 1929, chlorinated hydrocarbons were adopted for wide use. The use of one of these, carbon tetrachloride, required expensive equipment, however, so further research was necessary. According to M. Marean, writing in the *Du Pont Magazine*, equipment costs were reduced by a product called trichlorethylene which was first employed in 1931. Two years later the Du Pont Company made it available especially for dry-cleaning purposes. This preparation is now used by cleaners in 40 states and in the District of Columbia. Another product, perchlorethylene, was later developed to meet the specific operating needs of certain systems.

A garment is measured before the cleaning, and it must go through the process without any shrinking or stretching or alteration of original shape

Rings left by the "spotting" process are removed by spray

When you send your soiled garments to a cleaning establishment that uses these modern fluids, you can count on the sure removal of spots made by oils, fats, greases, waxes, tars, and many other substances that commonly stain fabrics. Another advantage of these solvents is that they work rapidly, requiring a minimum of mechanical action, thus saving much wear and tear on clothes. Colors become brighter, and materials regain their original feel and luster. The fluids do not cause shrinkage; silks and woolens retain their shape. As an

At the right, a quilted house-coat and several dresses are being loaded into a machine for cleaning in the modern manner with synthetic fluids. The process does an odorless job in far less time than was possible formerly. *Below:* Because hand finishing and shaping are important, an evening frock is hand-pressed after being thoroughly cleaned



extra precaution, all garments are carefully measured, before and after cleaning, to avoid any possibility of a change in shape.

After the main cleaning, up-to-date establishments carefully scrutinize all garments to see if any spots remain, for no known dry-cleaning fluid will take out all stains. Water-soluble stains, such as sugars, fruit juices, and certain pigments, usually require after-treatment, but they are easily removed by special fluids, as the general process does not set them. Then everything is thoroughly aired, and carefully pressed.

When one realizes the tremendous number of articles produced in materials that may be dry-cleaned, the benefits of quality service are more fully appreciated. According to estimates, some 550,000,000 men's suits go to the cleaners in a year, an average of a suit a month for 45,000,000 American men and boys. Women patronize the cleaner's facilities only slightly less, probably sending 400,000,000 garments a year to be dry-cleaned. Millions of window curtains, costume accessories, and upholstery covers are also included.

With the increasing adoption of modern methods and equipment, cleaning establishments are able to give all these garments thoroughly satisfactory attention, not only assuring their return in spotless, odorless condition and good shape, but preserving the strength of the materials through quick and careful handling.

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BANANA FIBER

Hemp Substitute From Skins of the Fruit

THE Formosa Development Co., a Japanese organization, reportedly has succeeded in producing a hemp substitute from banana skins. The concern plans to install 500 sets of a special fiber-extracting machine with which it hopes to produce 4,000,000 pounds of the substitute annually.

TEMPERATURE PILLS

For Production Control in Wide Heat Range

IN some metal-working industries it is next to impossible to work out a temperature control of production, especially in the black heat range. A new method, so simple that it can be entrusted to unskilled labor, has been developed by the Tempil Corporation of New York. The method involves use of small wafers somewhat like enlarged pills, different types of which melt at different temperatures. One of these, stamped plainly with its melting temperature, is placed on the surface of the metal, the temperature of which is to be controlled to an exact point. When the pellet melts, that temperature has been reached.

Tempils, as these pellets are called, are safe to use and are not corrosive to any metals. They do not pit or leave objectionable stains which cannot be easily removed. They are available in even hundred-degree ranges from 200 to 1500 degrees, Fahrenheit.

Tempils are being used to prevent cracks in metal processing; to make stronger and safer welds; to indicate the approach of safe temperature limits in the manufacture of costly castings, forgings, and machine equipment; for checking thermocouples; and for many other purposes where accurate heat control is essential.

CUTTING TOOLS

Standardized, Lowered In Price

NEWSPAPERS recently gave the impression that, because of some real or fancied hook-up with German firms, production of Carboloy in this country would be so limited as to present one of the worst bottlenecks (how that word has been worn threadbare!) in our defense program. Recent communications from Carboloy Company, Inc., indicate that Carboloy tools are not only available in numbers but have been standardized for faster production and much lower prices.

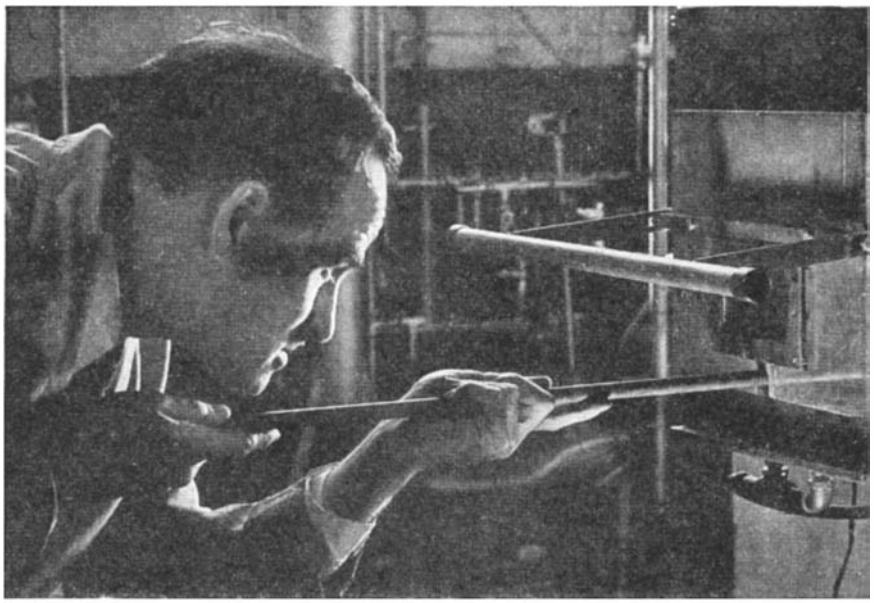
Carboloy cutting tools, as now standardized, are designed to cover 80 to 90 percent of all applications for cemented carbide tools. The simplified line comprises five styles in three different grades. They will be carried in stock ready for shipment, completely ground and ready for use—including even the grinding-in of chip breakers on tools designed for machining steel. Mass production economies will most likely decrease the amount of brazing and grinding done by organizations who at present purchase Carboloy tips to make their own tools.

A typical new standard tool costs only $1.85, as compared with a previous cost of about $5.84 in lots of one. In quantities of 50 or more, the tools now cost only 90 cents.

BACTERICIDAL

Water, Milk, Beer May Be U-V Rayed

CONSIDERABLE research has been carried on in recent years in an effort to use ultra-violet rays to kill bacteria in water, milk, fruit juices, beer, and other liquids, and there



Experimental furnace used in the development of "Endogas"

is now some promise that these efforts may be successful, according to Dr. H. C. Rentschler, Westinghouse research engineer.

Ultra-violet rays are already successfully destroying harmful bacteria and other microscopic organisms in hospitals, industrial plants, food shops, and many other places.

"Water used for pre-cooling vegetables prior to shipment," Dr. Rentschler revealed, "has been irradiated and the bacterial count reduced by 80 percent or more. Tests have shown, however, that milk and fruit juices allow only slight penetration of the radiations, hence must be treated in thin films in order to achieve material reduction in bacterial count. Beer has been found to be practically opaque to such rays.

"Seven years of intensive research involving huge expenditures, have indicated that the use of ultra-violet radiation in the field of asepsis is likely to be the nucleus of a new branch of electrical industry, open a new chapter in the field of illuminating engineering, and prove to be of inestimable value in the field of public health and industry in general."

GAS BLANKET

Prevents Burning and Carbon Loss in Steel Hardening

A NEW gas blanket protects the "skin" of high-grade steel parts against heat-burn during the hardening process, according to J. R. Gier, Westinghouse research engineer. Such fine steel products as gears, springs, bearings, and metal-cutting tools would benefit from the new gas, which has been named "Endogas."

The gas mixture answers the demand by steel manufacturers for an inexpensive atmosphere that will prevent scaling and softening of steel surfaces under heat treatment between 1500 and 2300 degrees, Fahrenheit. Loss of vital carbon from the steel can be prevented by the balancing effect of carbon in the new gas.

"Endogas" is made by mixing air with natural gas, or other inexpensive fuel gas, and heating them to 1850 degrees in an electrically heated chamber. By regulating the amount of gas and air entering the chamber, it was found, the proper amount of carbon could be sent along to the furnace to balance the amount of carbon in any grade of steel.

"OILED" SILK

Synthetic Rubber Used On Silk, Rayon

ANNOUNCEMENT of a new fabric of innumerable uses, waterproofed with a coating of a synthetic substitute for rubber which has most of the natural product's advantages without its disadvantages, has been made by the Goodyear Tire & Rubber Company. Pliosheen is the name of the new fabric.

Pliosheen fabrics, either of silk or rayon, are waterproof, odorless, tasteless, flame-resistant, contain no rubber or oil. The fabrics may be produced in the complete range of delicate pastel colors, deep tones, or clear white, all of which are sun-resistant and proof against cracking or peeling.

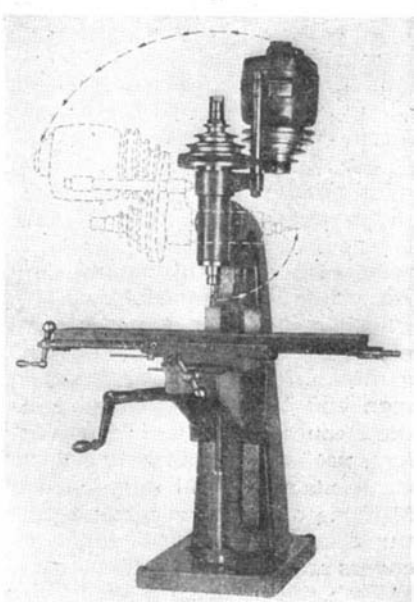
Lightweight Pliosheen fabrics are sheer and soft, but extremely strong and durable. They combine high soil-resistance with a facility for easy cleaning—a damp cloth being adequate for removal of most common stains. Pliosheen fabrics may be printed without technical difficulties, making possible an unlimited array of patterns designed to harmonize or contrast with surroundings of any specific application.

MILLING MACHINE

Univertical Bench Type With Swivel Head

A MILLING machine with a swivel head, graduated to a range of 90 degrees either way of the perpendicular, that can take over all the small jobs or about 90 per cent of the work that has to be normally done by machines costing five times as much, is announced by J. D. Duffy & Son. The Univertical high speed end milling machine is modern in every respect and capable of the most exacting precision work. It is rugged, compact, powerful; it mills, drills, and bores. Univertical mills an 8 by 16 die at one setting, and is designed for the use of cutting tools up to 5/8 of an inch. It can also be adapted to small grinding operations.

A bench type machine with a base eleven by seventeen inches,



Swivel-head milling machine

it is powered by a heavy duty ¼-horsepower motor, has a four-speed V-belt pulley, permitting a range of from 850 to 3400 revolutions per minute, handling a broad latitude of intricate milling. Its overall height is 37 inches. The maximum lift of the table to the end of the spindle is 10 inches with a work clearance of 6½ inches from the center of the spindle to the supporting column.

STERILIZATION

Process Sterilizes Animal Fibers Without Damage

A NEW process for sterilizing animal fibers and killing any disease organisms on them without damaging the fibers has been patented by three research workers of the United States Department of Agriculture. The new process will afford protection from such fiber-borne diseases as anthrax. It will also be of particular value in preventing the spread of contagious disease. The process can be used in hospitals, laundries, and dry-cleaning establishments for sterilizing blankets, clothing, and other articles that may come in contact with disease germs.

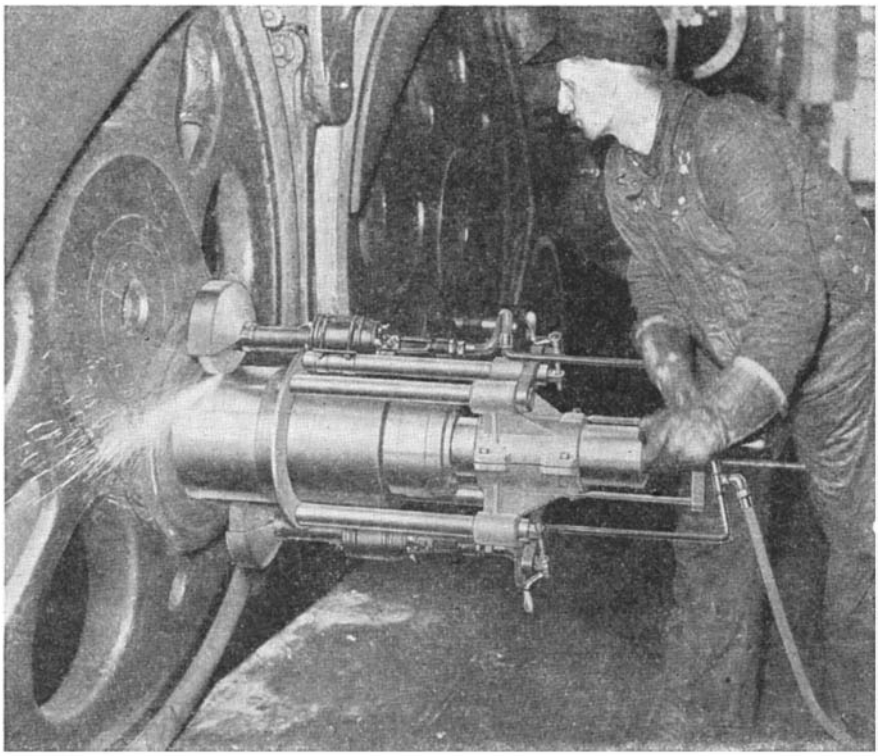
It works equally well with woven or raw fibers and with synthetic fibers made from proteins, such as the new fabric made from milk. The process cleans, disinfects, and sterilizes without injuring the keratin which is the basis of all the animal fibers. It is an improvement on current methods in the dry-cleaning industry and makes use of Stoddard solvent, a petroleum distillate of low flammability used in dry cleaning. In the new process the solvent is heated.

The newly patented process is adaptable for removing oils and fats from raw wools and permits degreasing and sterilization in one operation.

GRINDER

Grinds Locomotive Pins In Place

THE problem of refinishing locomotive crank pins has been greatly reduced in time and expense by the Milwaukee Portable Locomotive Crank Pin Grinder, a product of Goetz-Voss Corporation. The *Aluminum News-Letter* says that this grinder is mounted directly on the crank pin, and does a precision job without the delay of disassembling the drivers and putting the pin in a lathe.



Grinding a locomotive crank pin without disassembling

The grinder consists of a light-weight aluminum frame on which are mounted two grinding wheels and the necessary precision controls to resurface the pin without damage.

IODINE SHORTAGE

Germany Feels the Pinch of the Blockade

A CONSIDERABLE shortage of iodine has developed in Germany owing to curtailed imports caused by the blockade, and various measures have been adopted to restrict consumption and maintain supplies to meet indispensable requirements.

Germany is dependent upon foreign sources for all of its iodine requirements. Net imports expanded markedly in 1935, in consequence of a special trade agreement with Chile, to 228,500 kilograms from 57,600 in 1934. Subsequent to 1935, however, imports contracted steadily, falling to 126,800 kilograms in 1938, and 107,500 in the first seven months of 1939.

Residues, solutions, and other iodine-containing industrial wastes of the pharmaceutical industry plants producing inorganic or organic iodine-containing preparations, and especially the photographic chemical industry, are considered most prolific and advantageous sources for the recovery of iodine. In the case o many waste and residue materials, recovery of 98 or 99 percent is possible. Such recovery might be uneconomic in normal peace times, but costs now are subordinated to the imperative need of stretching existing supplies.

PUNCTURE-PROOF

Inner Tube for Combat Vehicle Tires

ONE thing that puzzles the layman in viewing pictures of vehicles used in warfare, is the question of why their tires are not more often punctured. The answer is that the usual type of pneumatic tire is often punctured in service by bullets. Indeed, armies of the world have endeavored to find some way of gaining the advantage of such non-solid tires and at the same time preventing their destruction by enemy fire. One of the ways of doing this is to make a sponge rubber tire. This, however, has a number of disadvantages.

A new Bullet-Seal inner tube has been developed for the tires of war vehicles by the Seiberling Rubber Company. This tube has a double thickness of small cells filled with a plastic gum and lining

the usual tube wall. The cellular structure prevents the plastic from being thrown to the outer periphery of the tire, keeps it evenly distributed throughout the inner tube. When a bullet penetrates the tire, the kneading action of the tire rolling over the ground kneads the plastic into the hole made by the bullet and effectively seals it. Tires so equipped are said to have withstood successfully a burst of shots from 30-caliber and 50-caliber machine guns.

GERMICIDAL PAINT

ANTISEPTIC and germicidal paints have long been sought by researchers. Foster D. Snell recently stated that the use of oils to which chlorine or iodine have been added produces a paint which will kill the germ of typhoid fever and some others for nine weeks after painting, and shows some but not complete killing power after six years.

FIRE WALL

Millions of "Fire-Walls" In Insulation

MILLIONS of microscopic fire-walls mixed in standard insulation constitute the newest challenge to flames which break out in one third

Testing fire-retardant insulation under blast of blow torch

of a million American homes each year. The fire walls are minute flakes of vermiculite, a non-metallic mineral which has its origin in mica. Researchers in the Fir-Tex laboratories developed a means of expanding the vermiculite flakes with heat, and then interlacing the flakes with wood fibers.

The non-metallic mineral flakes prevent the spread of flames by forming millions of fire-stops in every insulating panel. Partitions constructed with the new lath-board, covered with poultry wire and plaster, prevented the spread of fire from one room of a house to another for more than an hour. A partition of this construction also supported its normal, super-imposed weight during a fire for the same length of time.

FORGE-WELDING

Heavy Welds Made Easily as Spot-Welds

"FORGE-WELDING" is a new process of heavy-duty electric resistance welding for spot welding heavy steel and iron sections heretofore considered impossible to weld with conventional equipment.

Resistance forge-welding consists, first, in applying pressure to the work; then, interrupted current; and, finally, super-imposing a hammering action on the electrode. Under high pressure and with sufficient heat, the surfaces of work are brought into such intimate contact that when additional "impact-pressure" and intermittent heat are applied, a forged weld of superior quality is obtained.

TRANSPARENT FABRICS

British Process Increases Gloss

A NEW process has been developed by Imperial Chemical Industries (England) for making fabrics transparent and impermeable to fluids, at the same time increasing their gloss. The new process consists in impregnating the fabric with non-drying oil or semi-drying oil-modified polyhydric alcohol polybasic acid resins in conjunction with urea-formaldehyde condensation products. It is claimed that the new process eliminates discoloration and tackiness when fabrics are subjected to heat treatment for short periods of time; also that it imparts excellent flexibility, soft handle, freedom from cracking or powdering and from objectionable tendering.

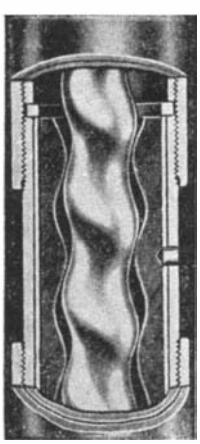
Dyed or printed fabrics may be treated as well as undyed material. The treated fabric may be subjected to a mechanical finishing treatment, and may be printed with a nitrocellulose lacquer or with a pigmented composition. The fabrics may also be finished by the methods employed in the so-called "oil-silk" trade, such as coating with shellac, and material which has been treated locally may be finished by conventional processes

PUMP

Has Low Speed, High Capacity For Water

A PUMP which embodies an entirely new principle for pumping water, operates at the comparatively slow speed of 1760 revolutions per minute, and will deliver water against a head of 200 feet or more, has been developed by the Peerless Pump Division of Food Machinery Corporation. It can be furnished in multi-stage units when service requires it. It is particularly suitable for wells at dairies, small farms, country estates, industrial establishments, and so on.

The operating motor is on the ground level. A long connecting shaft projects downward to the actual pumping unit which is at the bottom of the well. This unit is the unique feature of the pump,



Left: **Impeller unit of the high-lift pump described.** ***Right:*** **Sectional view of pump and motor**

being described as a "helically contoured rotor." The rotating part is of stainless steel, and turns in a rubber stationary part having a similar shape which is called the stator. Water is lifted in amounts ranging from 300 to 5000 gallons per hour, with lifts up to 1000 feet by what the manufacturer calls "hypocycloidal" action.

INDUSTRIAL TRENDS

CORN INTO INDUSTRY

NEWS that the Department of Agriculture will open a laboratory in Peoria, Illinois, for the study of corn as an aid to defense implies an extension of work to industrialize corn which has been carried forward by many agencies for the past several years. Corn is refined to create products that have dozens and dozens of uses aside from food, and now the possibility of using it to make synthetic rubber, plastics, fibers, and motor fuel will be explored.

Last spring, yarn, buttons, poker chips, and laminated boards, made from a corn by-product, were exhibited at the National Farm Chemurgic Conference, hence the possibilities sought by the Department are not remote.

The by-product which has already produced the above mentioned articles is a protein, zein, which constitutes about 10 percent of the whole corn. Its most practical use at the moment is for coating paper. It resists scuffing and the penetration of greases and oils. Zein films are tasteless, odorless, and non-toxic. Hence they are useful for food containers. Another use is in solid-color printing using aniline dyes. It is claimed that, using zein, fugitive dyes can be made more light resistant; that bleeding dyes can be made more resistant to water. In a clear state, zein can be formulated to carry bronze and aluminum powders.

There is such a thing as a zein plastic which can be molded and, when combined with other resins, can be used for impregnating and laminating. Still a laboratory experiment is zein fiber made by extruding the protein in gelatinous form. It is claimed that its wet strength, elastic recovery, and abrasive resistance are better than those found in cellulose fibers.

The manufacture of synthetic rubber from corn would be highly desirable. With petroleum being used as a base for synthetic rubber, and corn being pushed as a source of alcohol for fuel to offset any possible shortage in petroleum, why not short circuit this performance by making the rubber from corn and leaving petroleum to serve strictly as a fuel?

THE VERSATILE BEAN

Protein fibers are being derived also from soybeans. Two companies have produced them in the laboratory; when last heard from, one of the concerns was going ahead with a pilot plant for further experimentation. But this is not the only particular which corn and soybeans have in common. The soybean has become an industrial product with extraordinary rapidity and, if progress is maintained, it may yet nose out corn in relative importance, but this will take plenty of time and research. Oil from the beans goes into soaps, paints, and varnishes. The proteins in the meal can be made into parts for automobiles such as horn buttons, moldings, and small fittings, just like any plastic. Production of soybeans in this country has multiplied 17 times in the past six years and is still expanding. Hence, as technological competition with corn proceeds, so also does production of larger and still larger quantities of soybeans.

HIGH-SPEED CUTTING

A new alloy on the market is especially designed for fabrication into cutting tools. It is significant on two counts: It represents another link in the long chain of developments aimed at the speeding up of metal cutting operations; it calls for a smaller tungsten content in its composition than is customarily found in high-speed steels. It does not fall within the classification of the tungsten carbides or tantalum carbides in hardness or cutting capacity, but is an all-purpose tool for general machine shop use, and is competitive with existing high speed steels.

Tungsten is one of those 17 strategic materials the use of which might be curtailed in event of real emergency; thus the new alloy is a real war-time product. Its tungsten content is 5 percent as compared with 18 popularly used, and, according to claims, the reduction in tungsten does not in any way impair cutting qualities nor the ease of handling during fabrication. It can be fabricated in raw form or finished tool without special precautions. Hitherto, low-tungsten, high-speed steels have been subject to severe carburization during the hardening process; hence special care had to be taken to avoid destroying the surface of the steel during processing.

FLUORESCENT LAMPS

Credit the fluorescent with one solution to a knotty lighting problem of modernization. When additional lighting is desired and no increase in wiring is possible because conduits are imbedded in construction and cannot be replaced with larger sizes, fluorescent lamps will give more foot-candles per given amount of alternating current.

PERMANENT SUBSTITUTES

Out of effort expended to find substitutes for strategic materials may come products and processes superior in quality and lower in cost than those supplanted; hence they will outlast the emergency period and win a permanent place in industry. This explains why it is good business to keep up-to-date with all new developments—it keeps one in front of the procession.

Packaging is one of the fields likely to be permanently influenced by current developments. Now being sought are metallic substitutes for tin plating. such as aluminum, silver, and tin-zinc combinations for can coatings. There are also lacquers such as came to be used in beer cans. Besides metals for packaging. some interesting products are coming on the market which employ plastics and coated cardboards with and without re-enforcements. Some will be seen on grocers' shelves very shortly.

BERYLLIUM AGAIN

This metal likes to step into the spotlight. (See March 1940, page 142.) A bill has been introduced to make it a strategic material subject to Government control, and reports have it that the War Department has tested the metal successfully for parts in the Garand rifle. There's a lot rumbling here and facts may come to light soon.

— *Philip H. Smith*

What Are Pattee's Caves?

Are They the Remains of a Medieval Irish Monastery in New Hampshire, as is Claimed?

HUGH O'NEILL HENCKEN, M.A., Ph.D., Litt.D.
Curator of European Archeology, Peabody Museum, Harvard University

IT IS now widely realized that Columbus was by no means the first European explorer to investigate the continent across the Atlantic. The Icelandic sagas tell of Norse navigators of about 1000 A.D. who visited North America, and it is no longer seriously questioned that these stories contain a good deal of historical fact. Claims have also been put forward for early Portuguese, Welsh, and Irish explorers, but on much less secure grounds.

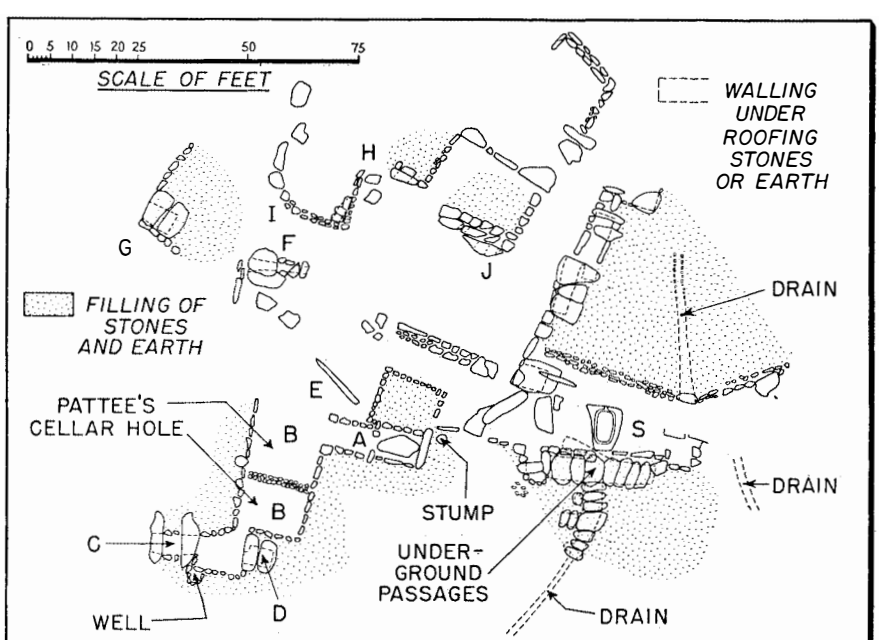
Especial interest has also attached to possible archeological traces left by these earliest transatlantic travelers. But, up to now, though numerous discoveries have been reported, those acquainted with European buildings, inscriptions, weapons, and so on, of that time have either assigned the objects to a much later date than that attributed to the early voyages or have suspected fraud. Still, one never knows at what moment the first genuine discovery may turn up.

One of the most recent claims of this kind has been put forward by the distinguished antiquary, Mr. William B. Goodwin, of Hartford, Connecticut, who has suggested that a curious group of ruins, known locally as Pattee's Caves, near North Salem in southeastern New Hampshire, is an Irish monastery. In his view this monastery would have been founded by sailor monks like those who settled in Iceland before the Norse occupation in the latter part of the 9th Century.[1]

The largest ruin, marked *B* in both plan and drawing, appears to be the cellar-hole of a New England farm house. Around it are remains of numerous rough masonry buildings with only a few patches of mortar. Some are subterranean or semi-subterranean and are roofed with huge flat stones. The walls also contain many big stone blocks.

The most remarkable structure is the so-called "Y-Cavern" (marked "Underground Passages" on the plan), a narrow, branching, subterranean passage lined with stone walls, roofed with flat slabs and provided with numerous niches and a long drain. Close to the Y-Cavern is a large flat stone marked *S* on the plan. Around its upper surface a little way from the edge there is cut a narrow channel with an outlet at one end, obviously designed to catch and drain off some liquid. It has been called the Sacrificial Stone, though, needless to say, sacrifices requiring such equipment can hardly be associated with the ritual of the Church! Comparison is suggested with the old New England lye-stones. These have such channels, though much smaller in diameter; a hogshead of ashes used to be put in the middle and water seeped through to wash out the lye. Possibly the Sacrificial Stone may be something of this sort. But to interpret Pattee's Caves as a whole is very difficult. They might conceivably have served as the out-buildings of a farm, but their size and number seem out of all proportion to the house which is known to have stood at the point *B* from 1832 to 1855, and which was not large.

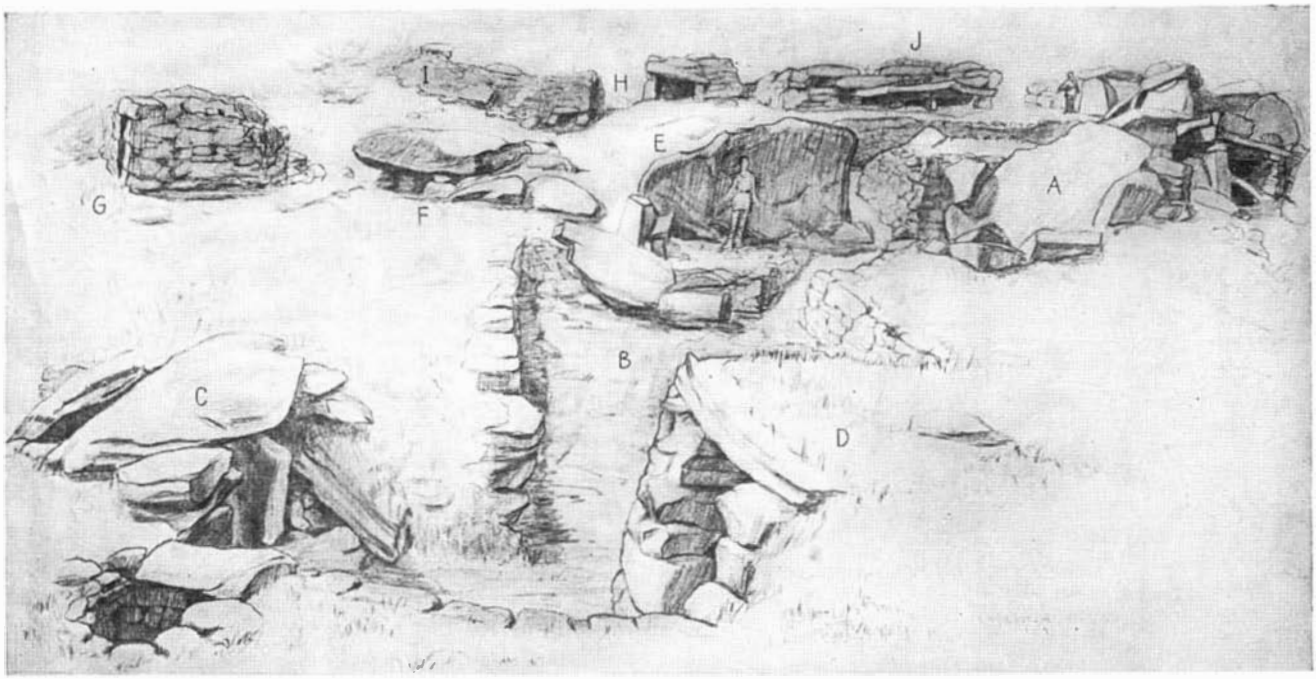
THE idea that the site was really an Irish monastery as old as the 9th or 10 Century, A.D., has been suggested by a series of references in the Icelandic sagas to a country across the ocean called White Man's Land or Ireland the Great. These sagas are long prose histories of the Norwegian families who began to settle in Iceland in the 9th Century, but they were not committed to writing before the middle of the 12th Century. Some of them describe undoubtedly historical voyages to Wineland the Good (North America) about the year 1000. In these stories also occur the references to White Man's Land or Ireland the Great. This place was said to lie west of Ireland, and there are hints that it was known to or occupied by Irishmen. On the whole, however, the accounts of White Man's Land or Ireland the Great may be considered as folk-lore rather than history.



Illustrations courtesy *The New England Quarterly*

A plan of Pattee's Caverns, near North Salem, New Hampshire, which some regard as remains of a monastery, others as an eccentric's work

[1]The writer is greatly indebted to Mr. Goodwin for every kind of assistance in examining these ruins and their history, as well as for the accompanying illustrations, and it is very much to his regret that he cannot agree that these structures represent a pre-Columbian settlement.
A fuller account will be found in *The New England Quarterly*, Vol. XII, pp. 429-442.



A panoramic drawing of the same group of structures. The letters correspond in each illustration

The view that the site was really an Irish monastery was also suggested by the presumed likeness of Pattee's Caves to certain ancient structures in Ireland. Now, in Ireland, as in many other parts of Europe, there are early stone buildings of several kinds and of several different periods. But, despite a few superficial and generalized resemblances, the caves are not closely comparable to anything in Europe. If one examines Irish monasteries of the early period, one finds that there are four features common to most of them: surrounding walls called cashels, small rectangular churches, round towers, and numerous contemporary graves often accompanied by inscribed and ornamented tombstones. Not one of these occurs at Pattee's Caves. It is also safe to say that the New Hampshire site differs equally widely from Norse sites. It may further be added that the caves bear equally little resemblance to anything ever built by Indians.

What can local history tell us of these ruins? One occupant is indeed fairly well known. He was a somewhat dubious character called Jonathan Pattee, who committed a robbery about 1826 and eluded search by fleeing to this place. About 1832 to 1835 he built the farmhouse whose cellar-hole is shown here as *B* in the drawing and plan, and here he lived with his large family until his death in 1848. In 1855 the house was burned down and shortly afterward the site was used as a stone quarry.

Tradition also can add something to historical fact, though as is often the case, it complicates rather than clarifies the issue. The people of North Salem, including some of Pattee's descendents, concur in ascribing all the buildings to Pattee himself. But one of Pattee's sons is known to have said that his father did not build the structures, but "improved" them. This expression might mean in old New England usage merely "occupied and kept up." Both of these traditions may contain a part of the truth.

MR. GOODWIN, mentioned earlier, has done much to excavate and repair the Caves and in the course of this work a quantity of broken china and other objects dating between about 1790 and 1850 has come to light. Assuming that the Pattee family probably arrived with some old or second-hand household equipment, these fragments are probably the remains of their possessions, or possibly in a few cases those of some immediate predecessor on the site. But, despite suggestions to the contrary, nothing has turned up to indicate early Europeans.

There is, nevertheless, one find that may indicate that at least a part of the Caves was built before Pattee's time. Behind structure *A* there is a white pine stump 27 inches in diameter which apparently started to grow after structure *A* was built. The stump is now so rotten that its rings cannot be counted, but a comparison with the diameter and number of rings of other newly cut pine stumps in the vicinity leads to the very generalized conclusions that probably the tree began to grow before Pattee's arrival in 1826; also that it is highly improbable that it began to grow before the *Mayflower* arrived in 1620. Hence the stump suggests that structure *A* may have been built before Pattee's time. Indeed, this might explain why Pattee went there in the first place when he was a fugitive from justice. But it certainly does not prove that Pattee's Caves were built prior to the white settlement of New England in the early 17th Century. Hence one is forced to the conclusion that they were built after the white settlement.

Who, then, could have built Pattee's Caves and why? None of the objects found by Mr. Goodwin seems to be older than 1790. The age of the white pine stump, which seems to be later than structure *A*, is not necessarily inconsistent with this, since it can be fixed only within broad limits. But it would indicate that perhaps at least structure *A* was built before—but not very long before—Pattee's appearance in 1826.

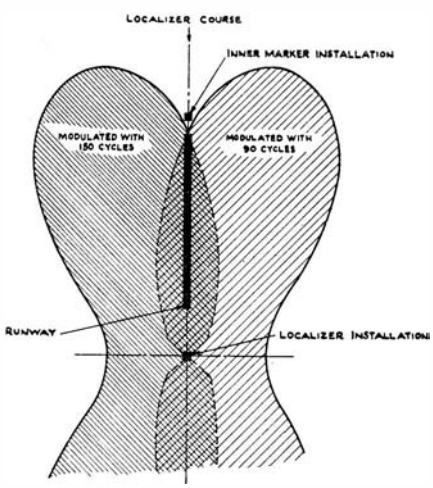
Pattee, aided by his numerous family and perhaps a team of oxen, would have had no special difficulty in building the caves. What he built them for is another matter. The people of North Salem say that he was crazy.

Blind Landing

Exhaustive Tests Show Effectiveness of System Being Installed at Six Airports

ALEXANDER KLEMIN
Aviation Editor, Scientific American. In charge, Daniel Guggenheim School of Aeronautics, New York University

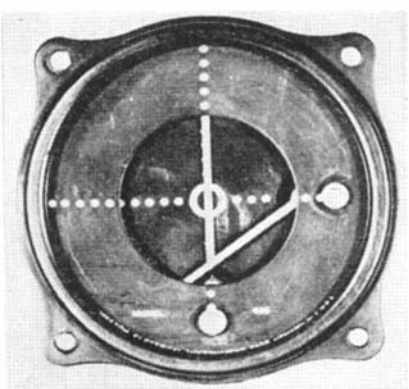
As a result of competitive bidding, and technical examination by the National Academy of Sciences, the blind landing system of the International Telephone Development Company has been accepted by the Civil Aeronautics Board, and is being installed at six of the principal airports of the United States: La Guardia, New York; Municipal Airports at Chicago, Cleveland, and Kansas City; Mines Field, Los Angeles; and Meacham Field, Fort Worth. If this blind landing system proves as effective in service as it has in exhaustive tests, our airlines will become almost "weatherproof."



How overlapping horizontal radio field patterns produce the runway localizer course

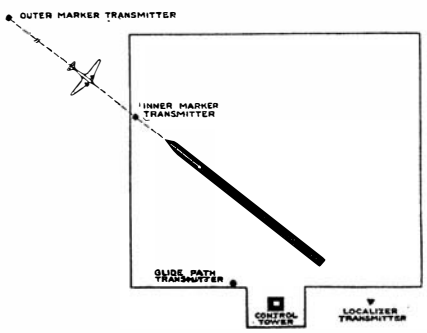
Radio navigation, with radio ranges, markers, radio compass, and so on, has been available for a number of years. It makes it possible for a transport plane to fly to the vicinity of its destination under almost any weather conditions. The more difficult problem is that of actually landing the airplane safely under conditions of low visibility. In radio navigation, low frequencies have proved fairly satisfactory. In blind-landing systems, however, high frequencies of the order of 75 megacycles are supreme and indispensable.

Why are short waves so overwhelmingly preferable to long waves? The reasons are clearly defined. With short waves, static is reduced to a minimum. High directivity is an absolute requirement, and the radio signal must not be disturbed by ground irregularities; it is only the ultra short waves that seem to be almost immune to the presence of power lines, rivers, mountains, and other irregularities on the surface of the earth. Antenna arrays are much cheaper and smaller with short than with the long radio waves.



Cross Pointer Indicator

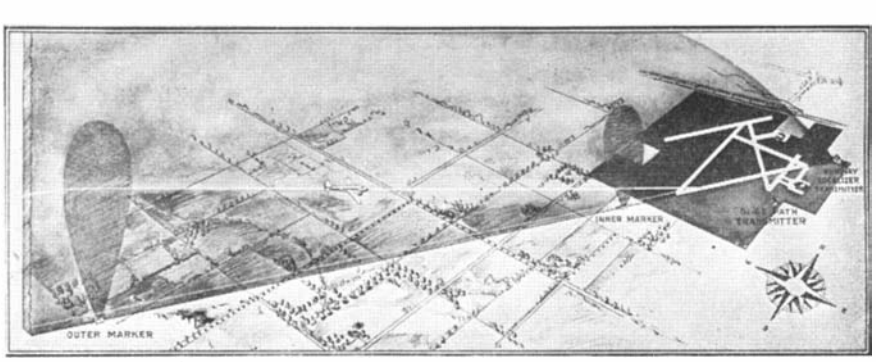
The main requirement of the blind-landing system is to provide a well-defined radio path, easy to locate, and one that will guide the aircraft in a natural glide to the approach end of the runway. To give the pilot ample time to orient the airplane in preparation for the landing, he should be able to locate the glide path some distance from the airport. The pathway meeting these requirements is analogous to a long chute sloping towards the airport. The pilot's task is to keep the landing wheels within the chute and on the floor of the chute, so to speak. Such a chute is provided by a path of constant electric field intensity beginning at a point about five miles from the airport boundary. A glide-path transmitter at the airport furnishes the ultra high frequency power for this service and a specially designed transmitting antenna establishes the constant field intensity along the path.



Layout of blind-landing equipment for use in one direction

The sides of the chute, providing lateral guidance, are given by overlapping radio fields. A runway localizer transmitter and antenna installation is located off the end of the runway at the airport. Two overlapping horizontal field patterns produce the localizer course. Each pattern is modulated with a different audio frequency and the course which the ship follows lies in the overlapped region where a signal of equal intensity is received from each pattern.

To take advantage of the path of constant field intensity and of the runway localizer, the pilot need only watch a Cross Pointer Indicator instrument in his cockpit. The



General impression of the blind landing system

vertical needle provides him with lateral guidance. The horizontal needle indicates altitude relative to the glide path. The pilot has only to control his ship so that the two needles are at right angles to one another to make a perfectly normal glide.

For further help to the pilot, two beacons are provided, located on the ground along the glide path, each projecting a narrow radio beam straight upward, to be received by the pilot as he passes by. One beacon is located two miles from the airport boundary and the other is at the airport boundary. The inner and outer marker beacons provide both audio and visual indications for the pilot. The general arrangement of the blind-landing system is shown in our illustrations. In one of them there is shown a typical layout of the four transmitters relative to the runway as installed for a single landing direction. An airport can be equipped for any number of landing directions but the maximum is ordinarily four.

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AUTOGIRO

ONE of our photographs shows the new Pitcairn direct-take-off autogiro achieving its remarkable initial "jump-off". The giro was placed about eight feet from two poles, 17 feet in height, which were interlaced with ribbons like a steeplechase hurdle. The path of the machine in space is indicated by the broken line.

The PA-36 is not only of the direct-take-off type, but also of the direct control type, in which control is achieved by tilting the rotor fore-and-aft or laterally, so that perfect control is available even when the giro has no forward speed. While direct control offers many advantages, bumps and other conditions, in earlier designs, transmitted rotor loads somewhat unpleasantly to the pilot's stick. These difficulties have now been removed by placing the axes of the flapping hinges close to the center of rotation.

The technique of the take-off is of considerable interest. Before the jump, through a hydraulic system, a single control lever locks the wheel brakes, sets the rotor blades at zero pitch, and engages the rotor clutch for power transmission to the rotor. Then the pilot advances the throttle, and since

Above: **The PA-36 autogiro, showing engine compartment with cover removed.** *Below:* **Line shows vertical take-off**

the blades are at zero pitch and in the position of minimum drag, they are over-revved to some revolutions per minute. By the use of the same hydraulic device, the rotor blades are then set at their normal pitch, the transmission clutch is disconnected from the rotor, and the forward propeller receives a greater torque. The rotor, now at lifting pitch but with a speed exceeding normal, exercises a lift greater than the weight of the aircraft. Hence the jump, which continues until the blades have lost kinetic energy and speed, with rotor turning at about 170 revolutions per minute.

An interesting feature of the new machine is a fairing of rubberized fabric which covers the hub and blades, reducing hub drag and eliminating end losses at the blade roots. The blades may be folded back over the horizontal tail surfaces of the machine on the ground, to reduce hangar space required or to permit the machine to be driven down a highway.

Our second photograph indicates the general mechanical arrangement of the machine. The 175-horsepower air-cooled Warner engine is placed behind the two occupants so as to improve vision and facilitate installation of the ground drive. A drive shaft from the engine to the propeller passes forward on the side of the cabin. There are clutches for the front propeller, for the rotor starter, and for the ground drive.—*A. K.*

SAFETY

When Taking-Off From Sand

WE have often quoted from the *Engineering News Letter* of Aero Insurance Underwriters. Jerome Lederer, Chief Engineer of this company, has now become Director of the Safety Bureau of the Civil Aeronautics Board, and we consider this a magnificent appointment. The last *News Letter* written by Mr. Lederer contains as usual at least one useful tip for flying safety. Thus, he points out that revving up the engine on beaches or gravel surfaces results in a sand blasting of the blade, as small stones, sand, and so on, are sucked up into the airscrew. Therefore, the engine should be revved up on an area free from gravel. If take-off must be made from sandy or gravel areas, the sand blasting effect can be reduced by opening the throttle slowly so that the increasing forward speed counteracts the suction from the increasing revolutions.—*A. K.*

Plastic Metals

New Knowledge Provides Science with Better Answers about Metals' Inner Nature

SIDNEY J. FRENCH
Assistant Professor of Chemistry at Colgate University.

WE LIVE in an age of modern plastics. There are plastic buttons, plastic door-knobs, plastic combs and plastic clothes; there are plastic toys and plastic dinnerware, plastic pens and plastic radios. With all these remarkable products we are likely to overlook the greatest plastic of them all—one known to man since time began—the plastic metals. Old as these plastics are, it is only in recent times that we have begun to understand the true nature of their plasticity and its control. What are some of the properties of these plastic metals?

To find this out let us enter the

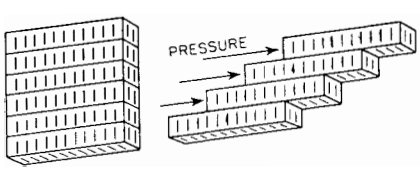

Figure 1: Left: **Diagrammatic illustration of crystal block structure of a metal crystal.** *Right:* **The crystal blocks echelonned**

G-man's world for a brief moment. A murder has been committed. Officers at the scene of the crime pick up an empty revolver. It is evidently the gun with which the crime was committed; but whose gun? The weapon is carefully examined for identification marks but the registration number has been laboriously filed out by the clever criminal.

Clever? No! The criminal has wasted both time and energy. The gun is taken to an expert metallographer who quickly swabs the filed spot with a suitable etching agent. In a moment the hidden numbers reappear once more. The magic of the etch has done its work; the numbers are read and the first step in the solution of the crime is well started.

What is the story back of this magical production of numbers where there were none before? Why does a simple acid solution produce numbers on a smooth piece of metal? It is all part of the story which the metallurgist calls the work-hardening of metals. It is a story of plasticity.

A friend of mine is an amateur silversmith, and a good one at that. He tells me that, as he hammers away at his silver, shaping his *objet d'art,* the metal gradually becomes hard and brittle. Soon he must stop and heat up the object. not to its melting point nor even till it softens, but merely to about 400 degrees, Fahrenheit, whereupon the silver becomes pliable and ductile once more. So he goes alternately hammering and heating till the object is finished. True. there seems to be little connection between silversmithing and restoring the registry numbers of a gun with an etching agent; nevertheless, both are phases of the same process, the work-hardening of metals.

The questions the scientist is seeking answers to are, first, what causes metals to harden and become brittle when they are worked or hammered in the cold, and second, why does mere moderate heating cause these same metals to regain their plasticity once more? Until recently, science has been able to offer no explanations beyond the mere statement that it is "the nature of the beast" to behave as it does. Now, however. better answers are being found as science probes into the intimate structures of metals.

IT has long been known that metals are made up of tiny crystals which can be observed under the microscope in a properly prepared specimen. Beyond and within these tiny crystals, where the microscope cannot penetrate, lie most of the answers to work-hardening. Each microscopically visible crystal is, in turn, made up of myriads of infinitely smaller "crystal blocks" or units, whose structures can be inferred by their effects upon the deeply-penetrating X-ray. Even then we have not reached the ultimate sub-division of the crystal, which is the infinitesimally tiny atom. These atoms are the single bricks, just as the crystal blocks are the stories, and the microscopic crystals are the skyscrapers of this tiny crystal world. Just as the stories of a skyscraper rest upon one another in uniform pattern, window above window, so too, these crystal blocks rest upon one another, atom above atom, in rows and columns, in regular pattern throughout the entire crystal (Figure 1, at left).

Another analogy: the atoms are the soldiers of a mighty company lined up in columns of fours. Within the company are the squads, each squad of eight representing

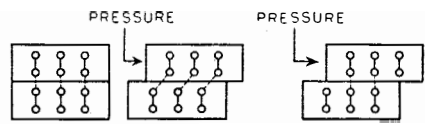

Figure 2: **Illustrating elastic deformation.** *Left:* **Moderate pressure, atoms stay within recall.** *Right:* **A permanent deformation**

a crystal block, a unit in its own right, but nonetheless an integral part of the greater unit. Each atom is alined with others of his block and each block is alined with all others of the entire crystal. This is the perfect crystal seldom found in practice.

Within the framework of the company, each squad exercises a certain degree of independence. There is an old formation in military circles called marching in echelon. At the given command each squad leader moves his squad obliquely to the right (or left) till it overlaps the squad ahead. The column is said to be echelonned in depth. This is just the sort of thing that happens when great pressure is placed on a metal crystal. Each crystal block slides past its neighbor till the whole crystal is echelonned in depth (Figure 1, right). The scientist calls it plastic deformation. If, however, the pressure is moderate, there may be no slipping beyond recall, but only a warping of atoms from their original positions. When the pressure is released, the atoms spring back into formation once more and the crystal is intact (Figure 2, left). This is called elastic deformation.

It is a well-known fact that tall buildings lean out of alinement during strong wind, yet return promptly to normal position when

the wind subsides, a good example of the elastic deformation of the metal framework. But suppose the construction were such that each story were simply set loosely upon the one below. Then it might be possible to move each story over (provided the building didn't fall down) till an upper window stood directly above a window which was formerly one space to the right. This is the sort of thing the scientist means when, in referring to metal crystals, he speaks of plastic deformation (Figure 2, right).

While all this may offer a suitable explanation of why metals may be flattened or drawn, it offers no explanation of why they harden and become brittle in the process. It is here that science steps in with its theories, none of which can yet be finally verified.

One theory of work-hardening presumes that in the slipping of crystal blocks past one another, atoms from the surfaces of each are torn loose, to be scattered indiscriminately along the slip-planes between the blocks. These mixed atoms, forming what the scientist likes to call an amorphous state, act as a sort of atomic glue causing the blocks to stick together (Figure 3, left). The farther the blocks are shoved, the greater is the accumulation of this atomic glue and the greater becomes the resistance to further slip. If the pressure is too great the crystal is ruptured between blocks, tearing the metal apart.

A second theory explains the phenomenon in a somewhat different way. As the blocks slip over one another, tiny fragments are torn loose to lodge along the slip-planes. Crystal blocks under great pressure break on the crystal fragments which have so effectively sanded their smooth gliding planes (Figure 3, center).

Still a third theory gives another answer to the problem. It assumes that, in the process of slipping, the blocks themselves become bent and corrugated (Figure 3, right). Try to slide two pieces of corrugated iron over one another in a direction at right angles to the ridges and valleys and you have the virtual answer which this theory, known as the lattice distortion theory, gives to the problem. As slipping progresses, the blocks become more distorted till further slipping is impossible. The limit of plastic deformation is reached.

THUS far, we have considered only a single microscopic crystal. In even a small piece of metal, however, there are thousands of these crystals, each, by chance, with its crystal blocks lined up in different directions, at all possible angles to abutting crystal neighbors (Figure 4, *a*). It is like a jumbled pile of glass bricks, except that there are no empty spaces. Suppose we shove the pile of glass bricks. Some are pushed forward; some push their neighbors sidewise, or even backward. So it is with a pack of metal crystals when pressure is put on the metal: some crystal blocks slide in line with the pressure, these in turn force the blocks of abutting crystals to slide sidewise, up, or down (Figure 4, *b*). The final net result of this jumble of slides is the same whether the pressure is a push, a pull or a hammer stroke; each crystal block is forced to its limit of plastic deformation. Then the metal breaks.

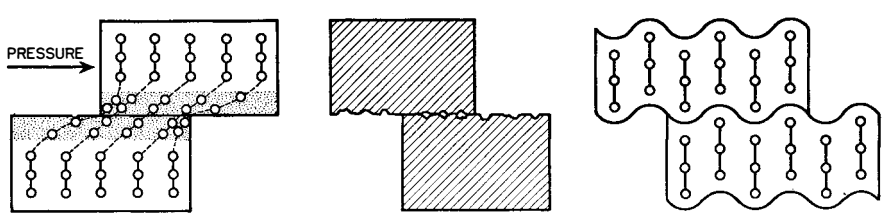

Figure 3: Left: **Illustrating, diagrammatically as before, the "atomic glue" theory.** *Center:* **The fragmentation theory.** *Right:* **The corrugation theory**

Yet, after heating, the metal is once more pliable without having lost the form into which it has been hammered. What happens to restore the pliability?

It was noted earlier that the striking tendency of the atoms is to line up in rows and columns, even when crystal blocks are shoved past one another. But this does not always happen. Often, an unhappy atom in the face of one block is forced to stop midway between two atoms of an adjacent block. Like the unfortunate neutral—between two nations at war—this atom strives to get into two positions at one time. Also, like the neutral, it is under a high state of strain. But the pressure from all sides is too great, the atom cannot move, the strain remains (Figure 5). On the surface of the metal, however, the case is different: there is no external pressure and misplaced atoms can line up in the nearest row. The surface strain is relieved.

Now we are ready to solve the apparent mystery of the gun registry numbers. These numbers are stamped into the gun under high pressure. Filing has merely removed the unstrained surface around the numbers but it has not affected the deeply strained crytals below the numbers. The etching agent removes a thin layer above the strained crystals and then attacks the crystals themselves—attacks them more vigorously than the unstrained neighboring crystals. Hence, the strained crystals underlying the numbers are most deeply etched and the numbers are reformed.

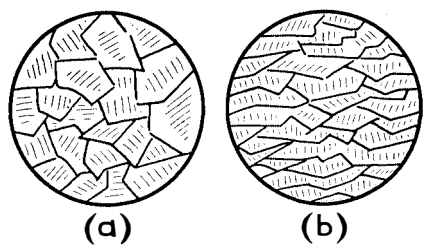

Figure 4: **Drawing (a) shows normal crystal structure, blocks lined up in different directions. (b) shows effect of cold working**

A metal under internal strain is a far from satisfactory product. The first job of heating is to relieve this strain. Atoms, even misplaced atoms in metals, are constantly in rapid vibratory motion; the higher the temperature, the greater the vibration. There comes a point in the heating of a metal when the vibration of the atoms is so great that, in spite of the internal pressure, misplaced atoms can swing themselves back into line once more. This heating, the metallurgist properly calls stress relieving or recovery. The misplaced atoms have recovered their rightful positions. The temperature required for this process is not high. Indeed, some metals "recover" at room temperature. This simply means that they do not harden or become brittle when worked, for their atoms spring back into place as soon as the working stops. Tin and lead are among such metals.

Simple recovery, however, does not restore pliability to the metal. The crystals are still elongated and distorted, as can well be observed

under the microscope. If the metal is heated somewhat hotter, a profound change, which can be followed with the microscope, begins. The distorted, elongated crystals begin to disappear, to be replaced by new, small, well-formed crystals. The amorphous atomic glue, the angular, braking fragments, the roughened corrugated crystal

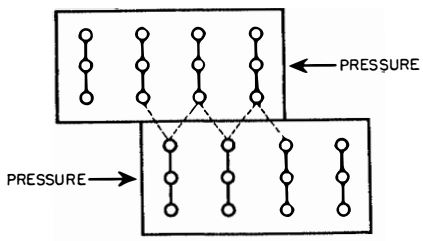

Figure 5: **Illustrating one cause of internal strain: atoms which "can't make up their minds." They do when the heat is put on**

blocks have been swallowed up in the new crystals. New glide planes have been formed. Once more the metal is willing to be flattened, drawn, or pulled to the limit of its plast-ability.

Thus does a metal pass through the phases of work-hardening and annealing. A knowledge of plastic limits, of recovery temperatures, of recrystallization temperatures, is of the utmost importance to the practical worker in metals. He knows them by instinct. But the scientist is interested in more: in the factors that motivate and promote these unique and fascinating changes in metals. He has learned much and he has much yet to learn. As he answers the whys of metal behavior, the ancient art of metal working turns into the modern science of plastic metals.

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LESS FRICTION

Barium Film Lubricates Bearing In A Vacuum

A DISCOVERY that a metal film may be used to lubricate bearings in a vacuum where ordinary lubricants are useless is reported in the September issue of the *Journal of Applied Physics* by Zed J. Atlee, Jack T. Wilson, and James C. Filmer, engineers of the General Electric X-Ray Corporation.

Vaporizing metallic barium to place a film on the steel ball bearings of a rotating anode target in an X-ray tube greatly reduced the friction, they reported. Rotating anode bearings in X-ray tubes used for high power, high speed diagnostic work have been operated hitherto without lubrication.

Use of the barium as a lubricant made possible a tube which not only operates much more quietly but also is one in which the bearing life is much longer. A number of other metallic films were found to have possibilities as lubricants but barium proved to be the most successful.

In one experiment an anode bearing was observed to have a sound level of 87 decibels, a speed of 3100 revolutions per minute, and a coasting time of 12 seconds. The barium film was then applied. In 30 seconds the sound in the same bearing was reduced to 68 decibels while the speed rose to 3560 revolutions per minute and the coasting time rose to eight minutes.

Under the normal operating temperatures of the X-ray load, the film will effectively lubricate an anode bearing for 50 to 100 hours of rotation.

"OILING" OIL

Wear-Prevention by Means of Addition Agents

THE wear-prevention qualities of lubricating oil can be multiplied as much as 17 times by the addition of two groups of chemical agents, scientists of the Emeryville, California, laboratories of the Shell Development Company recently reported to the American Chemical Society.

"There are two major groups of agents," these research workers said, "which, when added to lubricating oil, are able considerably to reduce wear. These two groups have quite different functions.

"The first group consists of organic compounds whose molecules take the form of long threads which are able to attach themselves by chemical forces, arising from the special structure of the molecules, to the surface of the metal. These compounds greatly increase the tightness with which a film of oil is held between the moving metal surfaces, even under high loads.

"However, the favorable effect of such agents is lost unless the metal surfaces themselves are highly polished and maintain their high polish in service. Even the best polish attainable by mechanical means leaves the surface covered with microscopic irregularities or roughnesses, and it is in the removal of these that the second type of addition agent finds its usefulness.

"Addition agents of the second type have the property of combining, under the influence of the heat generated by the rubbing surfaces, with the surface layer of the metal to form low melting alloys. The result is that when the tiny hills on the surfaces become engaged with each other, isolated spots of very high temperature are produced at the points of contact which cause the surface layer of low-melting alloy to melt and flow just at those points where the hills come into contact.

"These chemical polishing agents are so chosen that the whole surface of the metal does not melt, nor even grow hot, but only the minute projecting roughnesses. In this way the surface of the metal is polished to a high degree while in motion and by virtue of its motion.

"Laboratory tests using highly sensitive apparatus, capable of reproducing wear measurements within an accuracy of 1 percent, have shown that the wear properties of a highly refined white oil, for example, can be improved ten times by the addition of the chemical polishing agents alone. When both polishing and 'film holding' agents are used this factor has been increased to 17 times."

SOUND ENERGY

Noise Speeds Chemical Reaction

SOUND, without assistance from any other source of energy, can speed up the rate at which a chemical reaction takes place, Dr. Walter C. Schumb of Massachusetts Institute of Technology has reported to the American Chemical Society.

Although it has been assumed by scientists that an intense sound has an accelerative effect on certain chemical reactions, Dr. Schumb is the first to prove that this increase in activity takes place because of the noise, as such, and not because of heat energy transmitted by mechanical vibrations.

Dr. Schumb and Mr. Edmund S. Rittner showed that sound energy produced by a rapidly vibrating nickel tube partly immersed in a solution is able, of itself and apart from any thermal effect, to hasten the speed of a chemical reaction. They carefully balanced out the heat effects resulting from the me-

chanical vibration of the solution so as to be able to establish the reality of the effect of the sound *per se*.

"We were not at this time attempting to widen the scope or applicability of this form of energy or to find new uses of the vibrating unit," Dr. Schumb says. "Many such applications have been reported hitherto, such as the partial sterilization of milk, the preparation of various kinds of emulsions, including photographic emulsions, and the bringing about of certain oxidation processes. The physical erosion of metal brought about when a liquid and a metal are in relatively rapid motion with respect to one another, as in the pitting of ship propeller blades, pump impellers, and hydraulic turbines, is of practical importance and has been studied with the same type of apparatus."

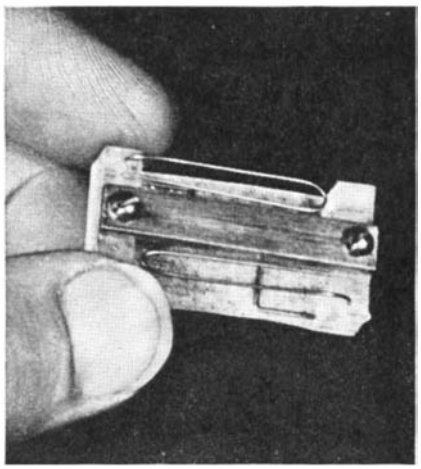
STRAIN GAGE

Small Device Permits Study of Moving Parts

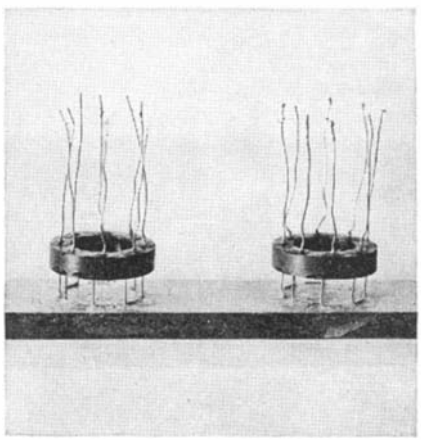
STRESS and stress distribution in such structures as the complicated members of airplanes, automobiles, railroad equipment, and bridges may now be determined and analyzed by a new strain gage. This device makes use of the fact that strain changes the electrical resistance of metallic conductors. It combines the accuracy of the testing laboratory with simplicity, convenience, and reliability. It is simply cemented to the member to be studied, has no clamps, no moving parts, no inertia distortion, and no hysteresis. Once in place, a strain gage may be left permanently installed for months during which a complete study of the part on which it is attached may be made.

The SR-4 Metalectric strain gage is simply a small grid of specially selected metallic conductors; its overall dimensions are ¾ by 1⅜ by ¼ inches. It may, therefore, be installed in places inaccessible to other forms of stress analyzers. In the accompanying photograph, the brass bar shown screwed on top is used merely for rigidity and is removed once the strain gage has been cemented into place.

This new gage is particularly suited to machinery operating at high speeds because it has no detectable inertia effects and has been tested at frequencies of over 30,000 cycles per second, with no indication as to any upper limit to the response.



An SR-4 strain gage



Strain rosettes

An indication of the wide range of application of the Bonded Metalectric method of strain measurement is in its application to the two-dimensional strain rosette problem. The strain rosette is a highly simplified instrument which is cemented as a unit to the surface under investigation. It contains four gage lines at 45-degree angles to each other, each of ¾-inch gage length. By connecting, in turn, the leads from the rosette to the control box, the amounts and directions of the principal stresses (axes of the stress elipse) of any surface can be accurately and rapidly determined.

SCAVENGERS

Gold Fish Do a Job For Research

THREE gold fish, costing 30 cents, have been put to work in General Electric's plastics research laboratory, doing the work which took seven hours' time of a chemist each week. Since the fish find food in the work they do, the upkeep or maintenance is without cost.

A large glass jar is used in the laboratory for keeping a constant temperature bath for measuring viscosity in plastic materials. The inside of this jar had a tendency to collect scum, making the glass opaque. Since it was necessary to make frequent observations of what took place in glass tubes inserted into this bath, the jar had to be emptied once or twice a week and scoured. The scum stuck, and it was a tedious job to clean it. Different acids were tried, but they didn't work. Then three gold fish were put into the jar. They took to the scum like a kitten takes to milk, and within two or three days the scum had all disappeared. That was three months ago, and since that time it has not been necessary to clean the bowl.

DISAPPOINTED

Prospector Finds Remarkably Fine Mineral; Shrugs

WHEN a Mexican prospector in the southwest stumbled on a vein of vitreous material, he leased the deposit to others, since this was not the material for which he was looking. That vein has turned out to be one of the biggest calcite deposits ever discovered. Around the borders of the schist, crystals of calcite up to 1½ feet across grew out into the clay bed.

Nothing like this had been discovered since the opening of the Iceland spar mine at Helgustadir. When the operators of the new domestic mine approached Bausch & Lomb, largest user of optical grade calcite, the company contracted to take the entire output of optically suitable crystals. The result has been spectacular. More than 500 pounds of fine spar crystals were taken out within a period of three months. Imported crystals have averaged between two and four ounces and not more than 200 or 300 pounds a year have ever entered the United States . . . none in late years. The new source, the first of any consequence found in America, adds additional protection of the optical industry.

The most important use of calcite is in the construction of Nicol prisms which are used in many scientific instruments designed both for laboratory purposes and as an aid to industry in checking the uniformity of its products.

The Origin of the Earth

Astrophysicists Still Are Unable to Solve This Near-at-Home Problem with Finality

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

It is almost two years since Bethe published his beautiful explanation why the Sun keeps on shining. Hydrogen supplied the fuel, helium formed the ashes, and carbon and nitrogen kept the process going by a chain of reactions at the end of which they were formed anew. The only doubt that could have been raised at that time was that two of the six steps in the cycle had not yet been observed in the laboratory, but had to be inferred from the theory of atomic nuclei.

Since then, both the missing links have been supplied by experiment. Ordinary nitrogen nuclei, bombarded with protons, have been observed to form a light, radioactive isotope of oxygen, according to the equation $N^{14} + H' = O^{15} + \gamma$ (where γ represents energy emitted as a gamma-ray). These oxygen nuclei emit positive electrons, and turn into heavy nitrogen, N^{15}.

This isotope forms about one part in 260 of ordinary terrestrial nitrogen. It would be hard to study were it not for the recently developed methods of concentration which produce small amounts of nitrogen compounds greatly enriched in the heavier atoms. Bombarding these with protons it has been found that the reaction predicted by Bethe

$$N^{15} + H' = C^{12} + He^{4}$$

is not only possible, but exceedingly probable. Every direct hit of a proton on a heavy nitrogen nucleus breaks it up. The alternative reaction $N^{15} + H' = O^{16} + \gamma$, in which oxygen is formed and radiation emitted, is theoretically possible, but, if at all like other radiation-producing processes, must be very much less likely to occur. Bethe estimates that it will happen in only one case in a million.

Bethe's anticipations have thus been confirmed in detail, and his theory now rests entirely on observed facts. His original predictions were, indeed, too cautious, for both of the nitrogen reactions are more probable than he originally estimated. Under the conditions which prevail at the Sun's center, the average life of an N^{14} nucleus, before a collision builds it up, is estimated by Bethe as 4,000,000 years. That of N^{15} is only 20 years. For ordinary carbon, C^{12}, it is 2,500,000 years, for C^{13}, 50,000 years. He points out that "these values may easily be wrong by a factor of about three either way" on account of the uncertainty in passing from the effects of the few, but violent, nuclear collisions which are produced in our experiments to those of the less violent, but more numerous, collisions inside the Sun.

The later results are astrophysically more satisfactory than the original estimates, according to which the life of N^{14} was 50,000,000 years. On this basis, it was necessary to assume that nearly 10 percent, by weight, of the Sun's interior consisted of nitrogen in order to account for the production of energy at the known rate, at the central temperature and density, which can be pretty well estimated. The new data reduce the calculated proportions of carbon and nitrogen each to about 0.5 percent—which accords much better with the general spectroscopic evidence. According to the new calculations, however, the abundance of N^{15} in the Sun should be only 1/200,000 that of N^{14}. The heavier isotope is about 800 times more abundant than this on the Earth.

This would raise serious difficulties, if we had strong reasons for believing that the composition of the inside of the Sun and the outside of the Earth were exactly similar. But there is no such reason, except for the assumption that the Earth was in some way formed out of matter expelled in some way from the interior of the Sun, or of some star of similar composition, and this assumption, so long accepted, is now in very serious difficulties.

The high terrestrial abundance of heavy nitrogen does not stand alone. Heavy hydrogen — deuterium—is approximately 1/5000 as abundant on Earth as the lighter isotope. But the deuterium nucleus is by far the easiest of all to disintegrate. In the Sun's interior practically no deuterons should survive. Bethe estimates their number as certainly less than 10^{-18} that of the protons—one to a billion billions. Moreover, terrestrial rocks contain small, but by no means negligible, amounts of lithium and beryllium, whose nuclei are the next easiest to break up, and would exist in only infinitesimal proportions inside the Sun.

We have here, not a difficulty with the otherwise well-established theory of the source of stellar energy, but something much more interesting and important. We are apparently led straight to the conclusion that the matter which now forms the Earth (or, at least, its accessible exterior) has never been buried deep inside the Sun, or any other star. Moreover, the same can be said about the surface layers of the Sun itself, for its spectrum shows lines of lithium and beryllium, faint but identifiable without question; showing that here, too, these fragile atoms must be vastly more abundant—perhaps it would be better to say, less rare—than in the Sun's interior.

"Never" is a very bold word to use in a scientific statement. In its stricter sense, it is clearly not permissible, for it would mean that our statement was valid throughout an infinite past—which of course goes far beyond the limits of physical reasoning. If, however, we interpret "never" to mean "not while the universe of stars has existed in its present general state," we can go far to justify its employment. Our reasoning is based on three things: First comes the undeniable fact of the existence of deuterium, lithium, beryllium, and soon, on Earth. Second, we have the easily disintegrable character of their nuclei, confirmed by numerous quan-

titative experiments. The conclusion that the mean lives of nuclei so easily disintegrated would be very short under the conditions which prevail in the Sun's interior appears to be very well founded. The third pillar of the argument is the conviction that no process exists by which these light nuclei could be built up at such a rate, inside the Sun, that they might exist there in considerable abundance, despite their rapid decay. This proposition involves the familiar difficulty of proving a negative, and is, at the moment, less conclusively based than the other two. But the number of ways in which these light nuclei could be built up out of lighter ones is strictly limited, and they have all been very carefully considered by Bethe with negative conclusions. That they could be formed by some sort of fission of heavier nuclei appears to be exceedingly improbable, for their available "packing" energy (per unit of mass) is high, while that of the heavy nuclei is low—so that such a process would have to be fed heavily with energy to keep it in operation.

We must inquire whether a mass of very hot matter inside a star, containing very little of these light nuclei, might not reconstruct them out of the hydrogen present within it, if it were removed and allowed to cool. But this would demand that, at some intermediate temperature and pressure, the atom-building processes greatly outran those of disintegration — which raises the difficulties just mentioned, in an aggravated form.

Unless—or until—some way out of this *impasse* can be found, we appear to be shut up to the conclusion that the presence of these light elements on Earth and in the Sun's atmosphere is a survival from some primitive state of the universe, perhaps antedating the existence of the stars. We must conclude, also, that there has been little or no mixing between the Sun's surface layers and its deep interior. Our present knowledge of stellar constitution does not forbid belief in this, though it by no means demands it.

Accepting this, there are various possibilities regarding the origin of the Earth (and presumably of the other planets).

1. The Earth may have been formed from the outer layers of the Sun (or of a companion star, as Lyttleton suggests), which retained, or retained in part at least, its original chemical composition.

2. The Earth may have been formed from the Sun or some other star at an early stage in the star's history, when its interior was cool and the light elements had not been broken up.

These suggestions have recently been made by Professor Bethe. We merely add:

3. The Earth, planets, and Sun may have been formed at some early epoch out of similar material, leaving the light atoms to be exhausted in the Sun's interior, but not elsewhere.

Bethe comments that, although there might be very little intermixture of the superficial and deeper material in an isolated and quiescent star, this "seems not very likely at the time of a catastrophe such as the formation of the planetary system." The question whether the brief but intense heating of the filament of matter swept off by a grazing collision of two stars would lead to the complete disintegration of light nuclei would deserve careful study, were it not that Spitzer's work has made it very doubtful whether such a filament could condense into planets.

THIS difficulty applies with equal force to the assumption of an encounter with the Sun in a primitive low-temperature state. The additional objection that the Sun probably remained in such a state for a relatively short time, and that it is correspondingly improbable that it should have met an encounter in this interval, is less disturbing — for it is well known among mathematicians and philosophers that there is great danger of fallacy in attempting to reason about the *a priori* probability of a single event. The assumption of a common and substantially simultaneous origin for the Sun and planets out of pre-existing material fits in well with the theory of the expanding universe, in Lemaître's form. If, during the initial stages of the expansion, all existing matter was crowded into a volume very, very much smaller than it occupies at present, then—as Bethe says—"such a freak event as the formation of the planetary system could have occurred more easily."

How it might have happened, no one yet dares to discuss in detail: but the immense turbulence which would attend the early stages of Lemaître's process offers possibilities which could hardly be met with elsewhere.

But how did the more fragile atoms get there, anyhow? This question, which will not down in our minds, takes us to the boundary of the speculative—but not farther than we may properly follow it for a few moments.

The theory of nuclear changes inside the stars, in its present state, accounts for the production of atoms of only one kind—the inert and uninteresting helium. Whether hydrogen is consumed, by Bethe's cyclic and catalytic process, or lithium, beryllium, and boron by what appear to be one-way, irreversible reactions, helium is the end-product. The light atoms, except helium, are consumed; and, despite a very careful search of the possibilities by Bethe, no way of building up atoms heavier than oxygen, or perhaps neon, has been found. Hence we must accept as a part of the initial data of the problem of stellar energy the presence not only of the light atoms, but of the heavy ones, which form considerably more than half of the mass of most of the stars.

Most of these, so far as we know, might have existed indefinitely in their present proportions, since, even inside the stars, their nuclei will not undergo sufficient violence to produce changes in them. But the heaviest atoms of all—thorium and the two isotopes of uranium—are radioactive, and decaying steadily. There seems to be no chance at all of building them up under the conditions which prevail inside the stars. If they ever had still heavier parent atoms, these must have had shorter lives than their own (since they do not survive). For their formation, we must look to some state much more radically removed from the present than exists anywhere inside the Sun.

It has been suggested informally by Bethe and others that these atoms might have been built up along with all the intermediate ones in an enormous mass of matter at a very high temperature (something like a billion degrees) and a fairly high density. Whether something of this sort happened at the very beginning of the expansion of the universe, we do not know; but, apparently, if we wish to make sense of what we do know, we must carry our speculations as far back as this. It would not be easy to go farther.

Dumps a Car a Minute

Engineers Construct World's Greatest Scientific and Speedy Coal Car Dumper

L. T. HENDERSON

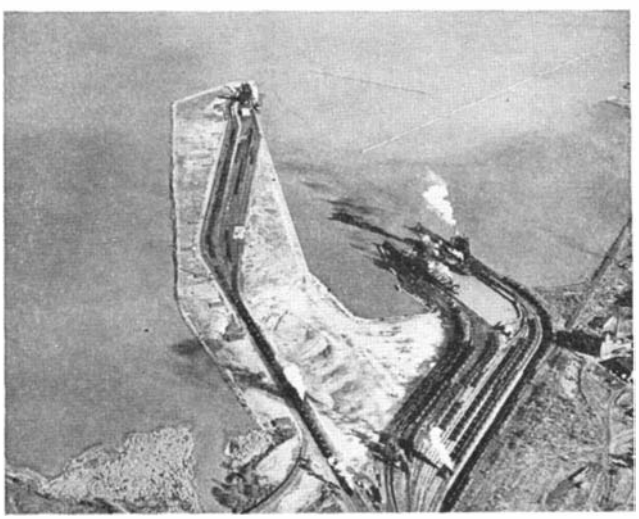
PROVIDING car-to-ship coal handling equipment unsurpassed anywhere in the world for volume and speed, and increasing its already extensive facilities on Lake Erie at Sandusky, Ohio, the Pennsylvania Railroad recently placed in operation a new machine on a mile-long dock, with yards and supporting features, costing altogether $4,250,000.

With its other two dumping machines working at near capacity season after season, the Pennsylvania Railroad decided to build a third machine, the equal of which never before had been constructed. The new dumper empties cars at the rate of 60 an hour and, together with the railroad's two older machines, makes Sandusky one of the greatest centers on the Great Lakes for the transfer of coal from railroad cars to vessels. All three machines are of the lift-and-turnover type, the new dumper being electrically operated, while the older two operate by steam.

In addition to its important new facilities on land, the railroad constructed a new channel in Sandusky Bay whereby the vessels serving this port could be handled to and from the railroad's coal-dumping equipment with a minimum amount of maneuvering. The Sandusky coal-handling docks, conveniently situated as they are, provide an outstanding outlet for coal moved by rail from the southern coal fields through the Columbus, Cincinnati, and Louisville gateways.

The docks and extensive supporting yard facilities are situated in the western part of Sandusky and the distance from the receiving yard on the south, through the classification and storage yards, to the outshore end of the newest of the three docks on Sandusky Bay is nearly five miles. The yards have a total capacity of 7800 cars.

The latest developments in car-dumper design have been incorporated in the new No. 3 machine, with numerous automatic features for controlling and correlating the various operations necessary for swift, efficient, and careful handling of coal from the yards to the ships. The powerful machine lifts with ease the largest coal car—fully loaded—dumps the contents into the ship's hold, and returns the car to its original position, all in less than a minute.

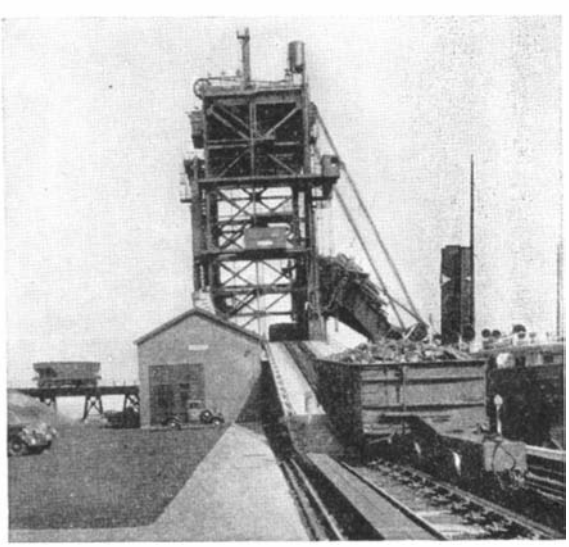


New mile-long dock and giant car-dumping machine are at left. Yards are below foreground

Loaded cars for the dumper are moved from the loaded car yard to the "ready" point at the foot of the inclined approach track of the machine by electric pusher locomotives. Four of these powerful electric pushers are in use in the dock yard, operating on narrow gage tracks alongside the yard tracks. As each loaded car is placed at the "ready" point, its wheels are engaged by a spring-type, constant pressure, car retarder which prevents it from moving until a unique conveyor, or barney (dock employes call it the "pig") contacts it from a pit beneath the loaded car and pushes it forward up the 15 percent incline and onto the elevating cradle of the dumping machine. The cradle is equipped with a pneumatic car retarder which stops the car in the desired place before it is elevated for dumping.

AS the car rises, it is automatically moved to the dumping side of the cradle on a movable platform, and heavy steel clamps press against the top of the car, holding it securely as it is tilted to dump its load of coal onto the machine's pan.

As the coal is transferred from the car onto the pan, an automatic, rubber-faced, coal flow retarder of the movable baffle type controls the flow of coal by backing gently before its load, easing the coal into a telescopic chute for placing in the boat, which is tied up beneath the chute. The combination gate and trimmer at the lower end of the telescopic chute are controlled so expertly that the coal is practically laid in the hold of the vessel. This careful handling prevents dropping or bouncing, and the coal reaches the hold in as good condition as it was in the car. The machine has a high-



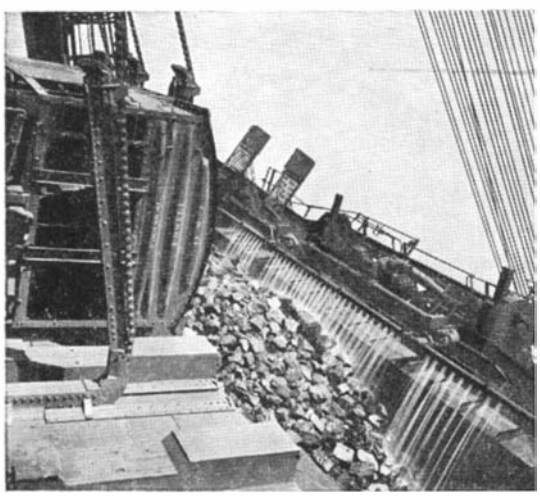
The "pig" (or barney), pulled by a cable hoist, pushing car up into No. 3 machine

pressure water line to dislodge any coal adhering to the bottom or sides of the car.

Another feature of the dumping operation is the automatically - controlled sprinkling equipment mounted on the coal flow retarder, which moistens the coal to the exact degree specified by the coal shipper or receiver.

Immediately after the car has been emptied and returned to its original position on the cradle, it is pushed off by the next loaded car and descends a 7 percent grade leading to the kick-back trestle, which reverses the movement of the car and sends it, by means of a spring switch, onto the lead to the empty car yard. However, before entering the empty yard, which is on a 0.45 percent descending grade, the car passes through a pneumatically-controlled car retarder, which regulates its speed.

The kick-back trestle of the new dumper, and, beyond, the loaded-car and empty-car yards



Moving from car, left, to pan, the coal is sprayed to regulate moisture content

Three operators control all movements of the car. One is in a cabin on the approach side of the tower of the machine at a level 12 feet above the cradle. This operator controls the barney, or "pig," and the car retarder on the cradle, and also starts the cradle in its lifting operation. Another operator, in a cabin at a point above the pan, controls the cradle hoist, the pan and the pan girder, the sprinkler system, and the flow retarder. The third operator, stationed in a cabin at the outer end of the pan, manipulates the pan, the chute, and the trimmer gates, and also the controls for raising and lowering the pan girder. The operators' cabins are connected with each other and with the dispatcher's and foreman's offices by telephone, microphone, and loudspeaker equipment.

The barney moves up the incline with a loaded car at a maximum speed of 11 miles an hour and returns to the pit at a maximum speed of 17 miles an hour, making the round trip in 55 seconds. The cradle's complete dumping cycle is 48 seconds.

Electrical power for the dumper is provided by a power company in the form of three-phase, 60-cycle current at 23,000 volts, which is reduced to 2300 volts by a substation on the premises.

The new dumping machine is situated 585 feet from the outshore end of an earth-fill dock which is 4500 feet long and 600 feet wide and represents, in itself, one of the greatest construction projects undertaken in the Middle West in recent years. Along the westerly side of the dock, the fill material is retained behind a stone revetment, while on the easterly side, which is the loading side, a steel sheet-pile bulkhead of cellular construction was built and surmounted by a reinforced concrete dock wall. A total of 9¼ million pounds of steel sheeting went into the construction of the rock-filled cells of the dock wall and more than 2¼ million pounds of steel piling support the concrete cap which tops the cells and forms the floor of the pier. The piling was driven to solid rock. The dock wall and foundation for the car dumping machine required 14,000 cubic yards of concrete.

A new ship channel was dredged, requiring the removal, by the hydraulic process, of 2½ million cubic yards of soil. Nearly two-thirds of the soil removed was used to fill in the area between the dock wall on the east and the dike, approximately 600 feet to the west; and on this made land are the new dumping machine, yards, and other supporting facilities.

The new dock yard has a capacity of 550 cars—350 in the loaded yard and 200 in the empty yard—and was planned to provide for future development, even to the installation of another car dumper, complete with supporting car yards.

The channel work included a new 400-foot dock channel, 22 feet deep, along the east side of the dock, a new approach channel 300 feet wide, 22 feet deep and 8000 feet long, parallel with the original ship channel, and 3000 feet bayward therefrom, connecting with the entrance channel to Sandusky Bay, near Cedar Point. Thus was formed a loop which permits vessels to enter the slip along the new dock via the original channel and to leave by means of the new channel. Ships loading at the No. 1 and No. 2 coal dumping machines also use the new channels, thereby expediting the maneuvering of the boats.

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NITRIDED STAINLESS

To the corrosion resistance and strength of stainless steel has now been added surface abrasion resistance by the process of nitriding. The new nitrided stainless steel is being adapted to steam valves, in textile machines, for parts in oil well pumps, and the like.

CANTONMENTS

Extensive Engineering Necessary In Building Camps

The country is launched upon one of the largest single engineering jobs it has undertaken for many a day. It will build at high speed

numerous camps for our National Guard and conscripted armies.

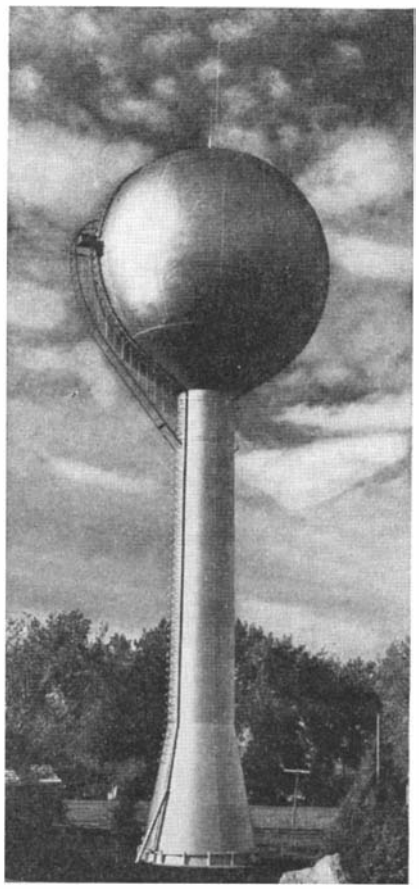
We are inclined to overlook the fact that there is more to a Conscription Law than mere passage by Congress and registration and drafting of men. World War camps and other sites will be cleared of stands of scrub timber and of the evidences of cultivation. Speedy work must then be done with excavators, tractors, and trucks, in preparing foundations, paved streets, street lighting, and all the numerous facilities required. Where semi-permanent barracks are being constructed, they will more often be two stories and (World War Veterans take note!) will be equipped with heat, shower, and toilet equipment.

Cost of temporary barracks at army posts is expected to run to more that $350,000,000. Many hundred millions of board-feet of lumber will be required as well as proportionate quantities of cement, bricks, electric wiring, and the like. It is believed that World War construction mistakes will be avoided.

BALL TANK

Sphere, For Water, Tops Enclosed Tower

THE photograph on this page does not show the beginning of construction for a World's Fair; it is one of 10 water tanks of the balanced-ball-on-pin design that have been built by Chicago Bridge & Iron Company. This particular tank was built for the town of Longmont, Colorado, and has a capacity of 100,000 gallons of water. Height is 60 feet to the bottom of the sphere. Others of the type have been built with greater water capacity and considerably higher than this one.



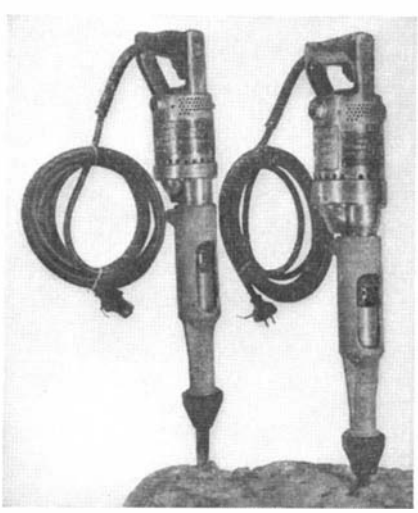
. . . 100,000 gallons of water

ELECTRIC HAMMER

Development Presented Special Problems

ONE of the things that has made American industry great is the fact that our engineers like nothing better than to tackle and lick a tough problem, whether it be in design, production methods, or materials. In the manufacture of portable tools, the electric hammer has been one of the most difficult to make.

Twenty years ago the Wodack Electric Tool Corporation set itself the task of manufacturing an electric hammer for drilling concrete, and has been at it ever since, says *Nickel Steel Topics*. A simple and practically trouble-free hammer mechanism has been evolved, but due to the terrific strain on the hammer parts in striking 2400 blows a minute, the greatest problem to solve was in finding a sufficiently strong and shock-resistant alloy steel and heat treatment that would give a reasonably long life to the working parts. A nickel alloy steel supplied the final solution of the problem.



Representative models of the electric hammer described here. The hammer-holding chuck can be seen through the case hole

The outstanding feature in the design of the Wodack "Do-All" electric hammer is that by loosening a cap screw and opening the chuck, the hammer member is removed and the power member can be used as an electric drill and grinder. The hammer drills holes in concrete and masonry as large as 1⅜ inches diameter and the drill has a rating of ⅜ of an inch in metal. The "Do-All" finds its greatest use in the building construction field but it is also extensively used as an industrial maintenance and installation tool for drilling holes for expansion bolts and screw anchors.

COUNTY MAPS

Show All Rural Structures In Most U. S. Counties

A NEW kind of county map, showing all highways and all structures in rural areas, will soon be available through state highway departments. Drafting work on sheets covering 2741 counties — or approximately 90 percent of the counties in the United States — has been completed. According to the Public Roads Administration, such maps will soon be completed for all counties in every state and many of the state highway departments already have them available for general use.

Their details range from the railroads, highways, roads, and bridges to the separate dwellings, farm units, and stores and industrial plants in the rural areas. Distinction is made between occupied and vacant structures. Streams actually navigable are shown. Also shown are such details as schools, hospitals, churches, cemeteries, camps or lodges, oil and gas wells, mines and quarries, power plants, radio stations, and air fields.

These maps are being used by business organizations and government agencies in addition to their use in highway planning. In 29 states, they were used by the Census Bureau for laying out the field work of the enumerators employed in the 1940 census and in fixing boundary limits around the settled areas of un-incorporated urban communities of 1000 or more population.

Life's Debt to Death

Nature's Attempts to Circumvent Death in Her Species May Suggest Conscious Purpose

EDWIN R. BOGUSCH

THE moment an organism begins to live it starts its relentless struggle against the forces of death. Every phase of its living existence is an expression of its effort to outwit nature, for in the plant and animal world there is no divine right to life. That belief exists only in the imagination of man.

The survival of the individual is unimportant in this battle for existence. The perpetuation of the race supersedes in importance the life of any single member of that race. Under the stimulus of approaching death living beings hasten reproduction to levels of activity abnormal to the species.

When that plant curiosity known as the agave or century plant has completed its normal span of life it produces root-sprouts at its base even before the giant flower stalk saps the last of the vital energy of the plant in its culminating triumph of reproduction. But, should something injure a normal, vigorous century plant still young and far from maturity, the plant responds with amazing concentration of energies to produce root-sprouts and provide for another generation. The activities of gnawing animals or fungi upon the roots stimulate the adjacent region to the growth of buds and new plants.

Some of our common trees, like the black locust, are so prolific in this type of response to root injury that even any interference with the normal flow of the vital water through the roots will result in root-sprouts. Just the shrinking of dry soil about the roots, that may strain and tear the tissues, stimulates this development. Botanists call this wound-stimulus. The result is an apparent effort of the plant to perpetuate the species even before the certainty of approaching death becomes established.

Similarly, when yeast plants fermenting in the bottom of a brewer's vat are subjected to higher than normal temperatures, the yeasts stop growth and undergo an entirely different physiological process. The cell contents separate into an even number of rounded bodies, each with an individual membrane. Later, when the mother cell breaks down and disintegrates, the newly formed spores are set free. Each is now a resistant individual capable of withstanding sustained high temperatures, extremes of desiccation, and even freezing; each can under optimum conditions resume life again where the parent cell was forced to stop.

AMONG the lesser forms of plant life, such as the molds and other fungi, when food becomes scarce further growth diminishes and the plant body expends its remaining energies in the production of reproductive spores. In stagnant ponds where green and blue-green algae abound, summer temperatures evaporate the water, concentrate the minerals, and stimulate rapid sporulation to guard the continuity of the species even though the parent must of necessity die.

Indeed, it is now believed that our animal and plant life has so abundantly survived because it adapted itself to seasonal conditions ahead of the time that those conditions were felt. Where the migrating bird flees southward in autumn because it must live to carry on the species to nesting time, plants developed an annual seed habit. That seed in which the tiny plant embryo nestles dormant and unaffected by winter owes its existence to the fact that the parent plant devoted all its energies to producing those seeds before frost, instead of storing an accumulation of food in its own roots for another season's growth.

Conversely, certain species commonly believed to be of tropical origin, such as the banana and the canna, have nearly or entirely lost the seed habit in the warm tropical environment, where seasons have no extremes and where the need for a dormant, resistant propagule is no longer felt.

So definite and close is the response of certain plants to factors associated with seasonal change that even the length of the day will have an immediate effect upon a particular generation. Thus the poinsettia, which normally flowers at Christmas time, may be made to produce its highly colored blossoms in mid-summer if the length of the day is artificially shortened by darkening the plant a part of each day. Likewise, in the case of the Mammoth strain of tobacco.

How the century plant doubly insures the perpetuation of its species

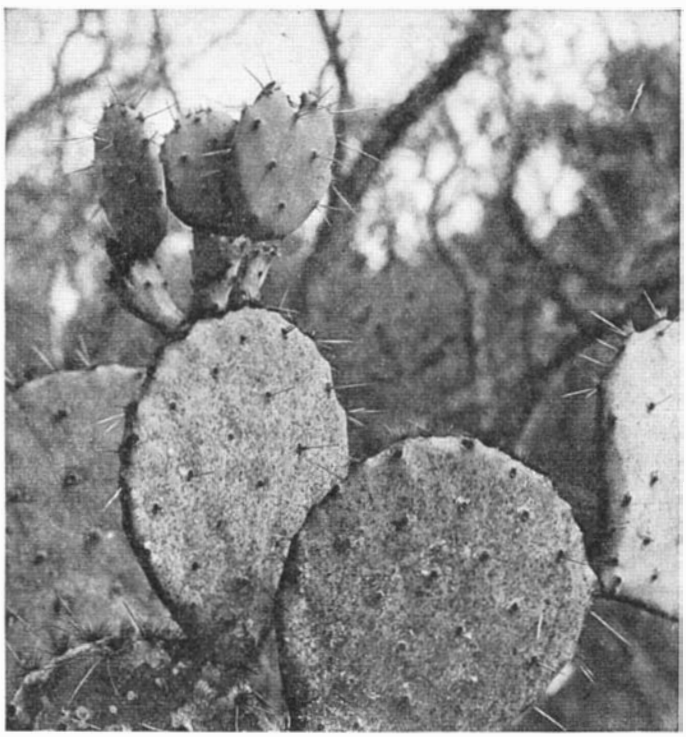
which in the latitude of Maryland devotes its entire development to leaves, the plant must be grown in greenhouses in winter during shorter days if it is to seed. Or, if it is to seed profusely, it must be planted and grown in Florida, where the summer day is shorter than that of Maryland. Shorter days herald the approach of winter, and tobacco is one of those plants which are adjusted to anticipate the change of seasons in this manner by the production of seed.

Dry, hot winds of a Central Plains summer, icy arctic blasts of a late frost, inundation from an overflow—each in its own way exacts a toll from the life it affects, each brings death to the individual. Yet, none of these forces can work the extermination of the species; for, as death stalks, new life is prepared and laid to rest in the shroud of its dead parent to await another spring. No wonder man, in his groping toward an understanding of the Universe, conceived of the immortality of the soul!

So, in this endless quest for life a feeble, bent broomweed blossoms with starry yellow flowers beside a burning hot roadside; the homely carrot of the garden rushes into bloom after a sudden late frost and dies with seed matured, instead of growing a healthy, tuberous root; a nearly drowned willow or aspen blooms once more as the slowly rising waters impounded behind a dam begin the tree's destruction.

Nor are plants the only victims of these natural tragedies; animal life responds to the extent of its ability. The caterpillar enters its pupal stage in advance of its normal time following an injury; the viviparous fly releases its maggots when trapped or hurt; the hen stops laying and starts incubating her eggs ahead of time with the arrival of hot weather. And this should not seem strange, for the human mother, without volition and through forces completely beyond her control, may enter labor and give premature birth to her child when fear, shock, or physical injury threatens her own life. It is the unconscious response to danger threatening the survival of the species. In one last valiant effort the body strains to thwart the grim reaper. Though dying, the body, whether human, animal, or plant, sets into the world a new spark of life with which the continuity of the kind may be maintained.

Then there is the example of the bee, whose communal life has become classic. Among the bees, with their perfect division of labor according to the individual's ability, the perpetuation of the kind is left entirely to the queen-mother. She weds with the drone, who, when his mission in life is done, is rewarded by death so that the food supply of the hive will not be needlessly expended. He is either cast out to die of starvation or mercifully stung to death by the workers. The queen-mother lays the eggs. The workers—all of which are sterile females and the old maids of the insect world—attend to the young, do all the necessary work, but never reproduce their kind. Indeed, reproduction on their part would be totally impossible.



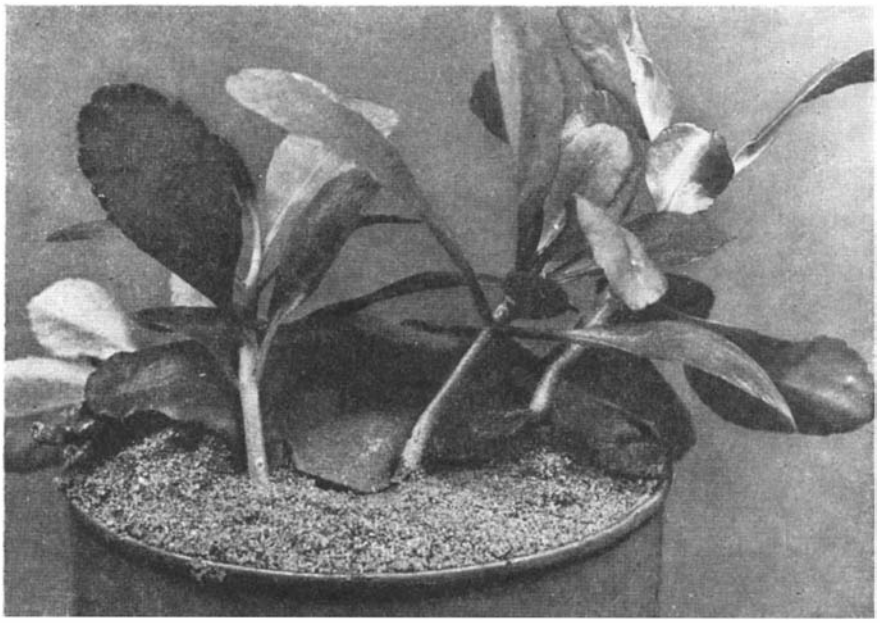
If an insect lays its eggs in a prickly pear, growth is started anew and the new pads fall off and take root

IN spite of the seeming fixedness of the potentialities of each member of the bee colony, the species still holds a trump card in its battle with death. Should death destroy the queen-mother, the species must play this card in order to survive. If no other queen is at hand, the egg destined to be a worker is placed in another cell and nourished to become a queen-mother. Should even this egg be unavailable, a sterile worker will in some mysterious manner become a fertile female, assume the role of the queen-mother, and carry on the continuity of its kind. The chain of life must remain unbroken in order to exist.

The strange and almost supernatural feature of this power to carry on reproduction is that it lies beyond the realm of voluntary control and almost beyond the powers of human comprehension. Ants, whose colonial habits rival and sometimes exceed those of the bee likewise can under conditions threatening the extermination of the species produce a queen-mother to continue the creation of progeny. Those ant-like wood-digesting insects known as termites are likewise so endowed. And the result is an enormous potentiality to live and a wonderful ability to beat death's effort to eliminate a species through the destruction of the individuals.

More commonplace are the unique relationships existing between organisms of different origin. The end-results of their mutual activities continue to stimulate the perpetuation of their own kind. Everyone has seen the warty, knot-like growths on the twigs and leaves of such trees as oak, hackberry, elm, and others. These galls are the consequence of the stimulus provided by an insect which stings the affected plant part to deposit its own eggs. The plant, to defeat self-destruction, develops corky tissues which in turn provide shelter for the larvae of the insect.

Among that large group of cacti known variously as prickly pear, nopal, or—in some of its forms—as cane cactus, the sting of an egg-depositing insect upon the seed-bearing part of the flower produces startling development. The particular insect associated with this cactus stings the ovary in which the seeds are to mature and deposits its eggs within the plant ovary. The



In bryophyllum, if the roots rot, each leaf produces new plants at the margin. These later fall off and take root. Thus the species lives on

cactus, whose own progeny are now endangered, is stimulated to renewed growth and promptly produces a new flower from the summit or the side of the old ovary. Should an insect again sting the new seed container, the cactus responds again in a similar manner.

The final result may be a chain of ovaries attached to each other, each representing the plant's involuntary effort to perpetuate its kind against the forces threatening its death. Dr. Rose, who before his death stood as the world's foremost authority on cacti, reported cactus plants in the southwestern deserts with chains of such proliferating ovaries several feet in length.

Thus each organism, in its own way, works against death and, because of that constant threat, provides in the most ingenious of ways to insure life for its children. The pathetic effort of an apricot tree whose life is doomed through frost injury to flower and fruit out of season in one valiant last effort to make seed is a drama in survival. The early maturity of the fruit of the virus-sick peach tree is a similar effort to beat death to the punch.

Likewise, the peculiar response of the so-called air-plant, *Bryophyllum*, whose leaves produce miniature plants upon its margin, is peculiarly adapted to survival. In its native tropics, when high humidity induces destructive rot to ruin the roots and stem of the plant and thus doom it to death, each leaf creates its share of small plants. These later fall to earth when soil conditions are again more favorable for growth.

Man, through his powers of reason and observation, has come to recognize how he may develop these peculiarities of plants and animals to his own ends. He has discovered that certain chemical substances known as hormones are really powerful poisons which in extreme dilutions stimulate dormant plant cells to develop roots where none would normally appear. So now he places cuttings of plants in hormone solutions and in an amazingly short time grows roots on even very obstreperous species.

Or man plays with the delicate germ plasm of certain animals and fungi under the odd and dangerous light of the X-ray and finds that evolution has been enormously hastened and even diverted into peculiar new channels. What will he get? A new species of interesting value? That depends upon the human interpretation and definition of a species. Scientific logic states that it is still the same old species, fighting a form of death by developing a mass of individuals, among which may be some more able than the rest to survive.

Thus all life owes a debt to death, for death stimulates powers within the living being to fight more effectively the forces which threaten its destruction.

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The Auto Show Moves In

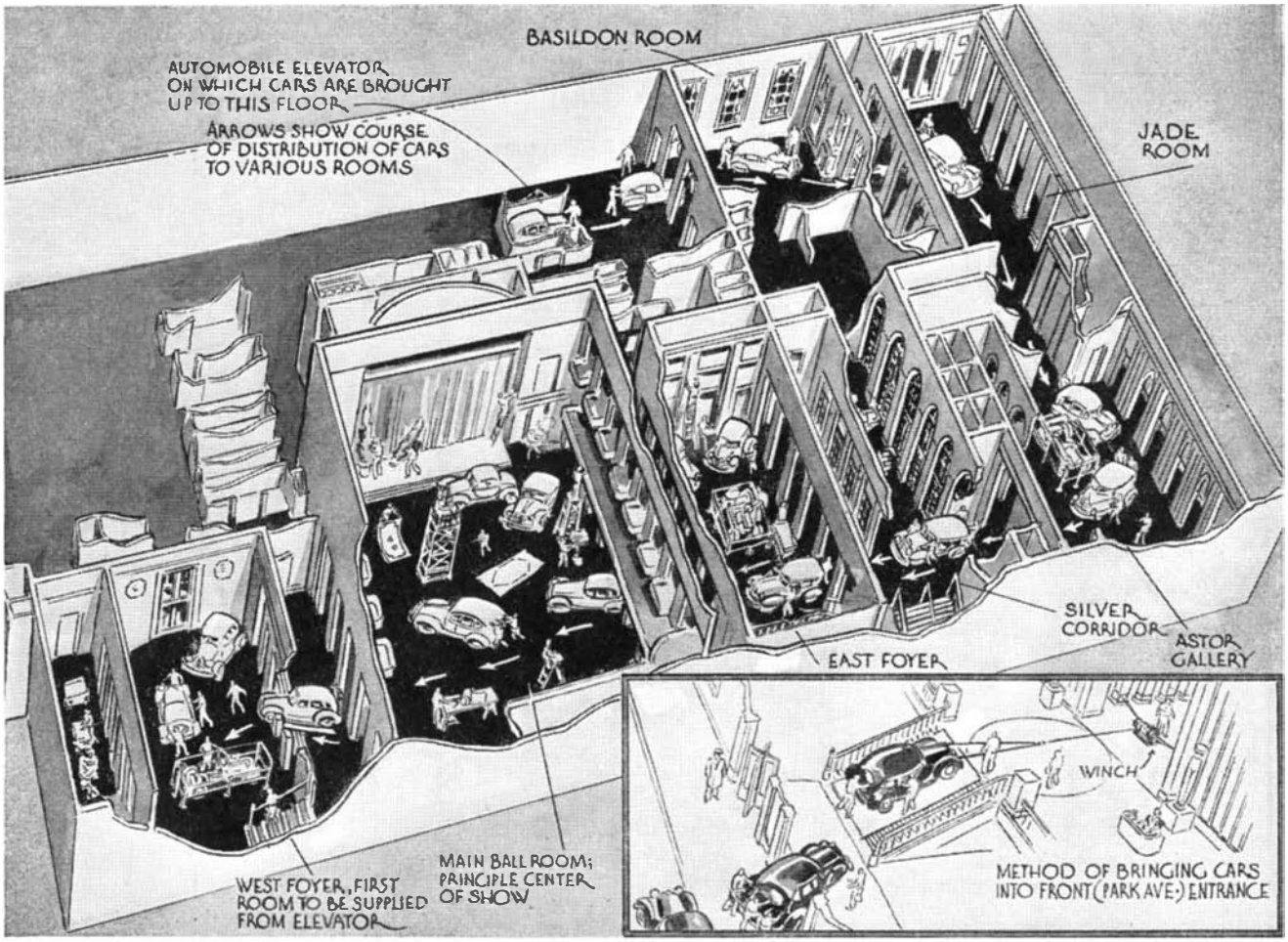
Mechanics of Handling the Cars and Other Displays in the Ballrooms of a Huge Hotel

H. T. RUTLEDGE

SURGING crowds surround the gleaming 1941 model motor cars in the main ballroom. In five adjoining salons are more cars, other mechanical displays of the automobile manufacturer's skill, more crowds. Yet only a relatively few hours before the first spectator looked upon this exhibit, these same rooms were devoted to the routine affairs of modern metropolitan hotel activity. So perfect is the setting for the motorcar show, however, that one might be almost willing to believe that the space so occupied was originally designed for just that purpose. And so it was, in the case of the Waldorf-Astoria Hotel in New York City where, a few days ago, was presented the annual General Motors display of their new models.

When the hotel was under construction, some 10 years ago, representatives of the motor-car manufacturer gave whole-hearted co-operation to the architects and builders. Even before the hotel was started, it had been decided that General Motors would hold its own annual display in the Waldorf-Astoria, in addition to participation in the Grand Central Palace Show. Knowing full well the headaches that accompany the presentation of an automobile display in buildings not designed for the purpose, officials of the manufacturing company were anxious to forestall future trouble.

As a result of this foresight, it is not only possible to make the best use of the available space for displaying cars, but also to bring in



Preparing for the auto show at the Waldorf. ***Inset:*** **How lobby display cars are brought in**

the cars and other equipment with a minimum of difficulty and a maximum of speed. Surrounding the Grand Ballroom at the Waldorf are five smaller salons—suitable for individual displays by General Motors car divisions. A template layout of the ballroom floor is made for each annual show, and the number of cars to go in each salon is decided. Of course, all of the car divisions want to have mechanized exhibits such as cutaway chassis and transmission displays in addition to the show cars, so it is necessary to subtract car space to make way for these animated attention-getters. However, the choice of display material is left, insofar as possible, to the individual car divisions.

Information on what is to be displayed must be available well in advance of show dates, because preparations must be made to provide adequate electrical connections for each exhibit. Every car on the floor has special interior lighting; some of the revolving chassis require 220 volt current; some displays use A.C.; others D.C., and so on. The practice has been established to furnish all of this essential information to the hotel engineers well in advance of the show so that when the show-date arrives the electrical connections are all in place and ready for use.

There is a very definite limit to the time alloted for the actual set-up of the show. A special invitation preview is to be held at 4 o'clock on the afternoon of the day before the Auto Show opens to the public. As a margin of safety, the deadline for having the show shipshape is set for 12 noon.

By advance arrangement, the three small ballrooms nearest the freight elevator are cleared for action 56 hours before the deadline. Dozens of crates and boxes of all shapes and sizes, packed with panels, sections of wall, canopies, decorative fabrics, and numberless articles of ornamental and utilitarian nature are hurried into these rooms and unpacked. Time and space must be found to dispose of all of the crates and boxes, to say nothing of the task of putting together the many sections which, when assembled, make up the elaborate decorations.

Swarms of workmen, most of them old hands at the game, hustle the bulky panels and decorative pieces into a semblance of order so that the moment the Grand Ballroom is declared available the pieces can be fitted into the positions for which they were built. The entire ballroom floor is available for the decorators just 32 hours before deadline. Then the transformation begins.

Special equipment to facilitate the job has been provided by the Waldorf engineers. One unique tool is a miniature derrick which is used to hoist canopies of substantial size and weight into position over main entrances. Another is a tall, scaffold-like dolly for setting up huge panels which border the main ballroom.

Each piece of decorative panelling, when designed, has to be divided into pieces small enough to meet certain physical limitations, such as the length of the freight elevator, the sharp turns in the corridors, low doorways, and so on. They must be lashed, not nailed or screwed into position. No damage must be done to the walls or pillars of the ballroom.

Twelve hours before the deadline, the first cars and displays are brought up on the huge elevator. It would seem that the job should be simple—just put the cars on the

elevator and push them into place on the ballroom floor, but it is not quite that easy. There are six different makes of General Motors cars, in addition to displays by Frigidaire, Fisher Body, Research Laboratories, Delco Appliance, GMAC, GEIC, Customer Research, Diesel Engine, and others. Some require a lot of time to set up; some are practically ready for the show the moment they are in place; some are to be centered in rooms through which other cars and exhibits must pass in order to reach their proper position. Here is a job that calls for organization.

When Auto Show cars are shipped to New York, they are directed to the storage places of the various divisions which are in somewhat scattered locations around Manhattan. Cars addressed to the big show at the Grand Central Palace must not be confused with those consigned to the Waldorf show. The Waldorf cars, by direction of a GM Central Office co-ordinator, are each assigned a number. A large tag bearing the number is placed in plain view on the radiator grille or bumper.

At the hotel, the only route from the freight elevator to the Grand Ballroom that can be maneuvered by long-wheelbase cars is a roundabout passage through four of the parlors in which cars are to be displayed, a distance of between 400 and 500 feet. This means that car #1 must be the car consigned to the farthermost point from the elevator so that it can find free passage through the rooms without interference from other cars or displays being placed in position. Each succeeding car fills in the most distant spaces from the elevator until the last unit occupies a spot just a short distance from the elevator.

None of the cars may be driven —they must be trucked to the hotel. It is obvious that the truckers must be on their toes to get the low number cars delivered first. Chevrolets, Pontiacs, Oldsmobiles, Buicks, LaSalles, Cadillacs—all must be picked up at different storerooms and brought to the Waldorf so that no time is wasted in getting them on the elevator in proper numerical order in relation to the numbered floor plan. Also, large exhibits, such as chassis and cutaway motors, must be moved in simultaneously, so that their entrance dove-tails into the car movement at just the right time.

Then, too, there is the fact that it takes longer to set up a cut-away chassis than it does to place a car in position. Squarely in the center of the Buick salon may be the spot selected for such a chassis, and a start cannot be made on putting it up until every single car which is consigned to the rooms beyond has passed through. With this problem in mind, a "time-in and set-up schedule" is prepared. If it is found that six hours will be required to get the chassis functioning, particular care is taken to be sure that all of the cars scheduled to be displayed in rooms beyond the Buick salon are in place before 6 A. M., allowing a full six hours for the Buick men to finish their task by deadline.

Even getting the cars properly located involves more than meets the eye. Ramps are laid to make it possible for the cars to climb steps. Rubber-tired jacks are used to jockey the units into exact position, with space for traffic carefully calculated. Gas tanks are drained, batteries disconnected, spring shackles are wiped free of grease, oil is drained, and interior illumination is installed. There seems to be no end to the details.

Time, time, time . . . the deadline has come and that four-hour margin of safety was a good thing. There is still some work to be done on exhibit set-up and the cleaning has necessarily lagged behind while work is still going on. Finally, with one hour to spare, the last car is polished and the show is ready. There have been times, however, when, twenty minutes before 4 o'clock, the ballroom looked hopelessly in disorder, but somehow or other the work got done, just in the nick of time.

Over and above all of the ballroom activity is still another job which must be handled in the wee hours of the morning of show day. It has been the custom to display a Cadillac car in the main lobby of the hotel, at the head of the steps near the Park Avenue entrance. There is only one way to get it in; by removing a door and frame, pushing the car over the sidewalk and through the door, and then getting it up the full flight of steps. It's a tight squeeze through the door, and another tight squeeze to get the lengthy unit around the corner so that it is headed straight up the stairway. A capstan is anchored to two huge pillars across the foyer opposite the head of the stairs, which pulls the car neatly up the steps on planks. It has even been necessary, when Cadillac planned to build a wider car than production models of previous years, to build a crate, weeks before the show, corresponding exactly with the outside dimensions of the car, and move the crate into the lobby as a sure check that the car would fit.

The Waldorf show has become a tradition in General Motors. It is the high point of announcement time, and assumes great importance as a stimulus in giving the new models a good start. During the annual motor show week, Detroit literally moves to New York and takes over the town, and as far as that goes, the entire nation. Automobiles are the topic of conversation everywhere, and the already automobile - conscious American public digests a whole new chapter of the History of Automobile Progress.

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BATTERY

Storage Type

For Flashlights

THE user of a flashlight is faced not only with the expense of frequent renewals but also with the occasional necessity for using batteries that are weak and give a poor light. The Ideal Commutator Dresser Company has wiped away both these disadvantages with one stroke in the development of a storage battery for flashlights.

This new battery takes the place of two 1½-inch, size D dry cells. Its upper section is made of DuPont's Lucite, as that material is impervious to battery acid. This transparent material enables the user to see whether distilled water may be needed at any time, this water being added by unscrewing the top cap and dropping the water in with a medicine dropper.

LONG-LIVED FUNGUS

STARVATION and other unfavorable conditions seem to make no difference in the life of at least one fungus—that which causes the stem rot of rice. The Department of Agriculture says, therefore, that it is not practicable to try to control this plant disease by rotation of crops.

A six-year test was carried out by the Department's experts by screening infested soil to prevent

Above: **The Solovox, a musical supplement to the piano, has a six-octave range and an indefinite variety of tone colors.** *Below:* **Solovox keyboard**

new infestation. After the six years elapsed, they found some of the sclerotia still in condition to renew activity and cause the disease whenever there was rice tissue on which the fungus could grow.

SOLOVOX

Fascinating Sound Effects With the Piano

A NEW electronic musical instrument—the Solovox, designed to be played with the piano—was introduced recently by Dr. Frank Black, music director of NBC on the Cities Service program. Both musicians and piano manufacturers believe that it will stimulate new interest in the tradition of music in the home and will have a stimulating effect on the piano industry.

According to Dr. Fritz Reiner, "Laurens Hammond's new instrument, the Solovox, is not only an outstanding technical contribution to the number of electrical instruments but also a musical one. Its endless possibilities for creating new and fascinating sound effects in combination with the piano, will kindle the imagination of every pianist. In fact, the Solovox may revitalize the present style of writing for the piano."

The Solovox is Mr. Hammond's third contribution to electronic music, its predecessors being the electric pipeless organ which was first introduced in 1935 and the Novachord, which made its first

appearance in 1939. Like these instruments, the Solovox is entirely electrical in operation, but unlike them it has been designed not as a complete instrument in itself but rather as an adjunct to the piano and to be played simultaneously with it. The Solovox consists of a keyboard with 36 keys, about one half the size of piano keys, which is attached by thumb-screws just below the piano keyboard, and a slim tone cabinet containing the necessary electrical equipment which is mounted underneath a grand piano or set alongside an upright piano. The Solovox keyboard is attached to the right end of the piano so that the player can span both the Solovox and piano keyboards with his right hand. Thus he can augment the brilliant percussive tones of the piano with a tremendous variety of tone colors, some of which suggest the shrill quality of the piccolo, others of which suggest the singing tones of the violin and the piercing tones of the brasses. The Solovox is easy to play and can be picked up by even the self-made pianist in a few hours. The Solovox is an instrument whose market possibilities are, numerically speaking, 1000 times greater that the organ due to its comparatively inexpensive price under $200.

MULTITUDINOUS

Bacteria In Ocean Use More Oxygen Than Fish

OXYGEN in the ocean is probably used up more rapidly by bacteria and other micro-organisms than it is by all the fish and other visible animals ranging from tiny shrimp to giant octopuses, suggests Dr. Claude E. ZoBell of the Scripps Institution of Oceanography at La-Jolla, California.

Bacteria swarm in the depths in simply incredible numbers, Dr. ZoBell states. A quart of ocean water may contain anywhere from 100,000 to 10,000,000 bacteria, consuming oxygen at the rate of .001 of a cubic centimeter to more than one cubic centimeter per quart per year. This looks rather insignificant, says *Science Service,* in reporting Dr. ZoBell's discussion, but there are quite a number of quarts of water in the ocean, and the total becomes staggering.

Oxygen consumption becomes a

particularly acute problem at great depths, for the only way this life-gas can get down there is to diffuse slowly from the surface—with bacteria and other living things snatching greedily at it all the way down. This dearth of oxygen may be an important factor in the paucity of life in the great abysses.

GLARELESS

Student's Light Makes Use of Polaroid

POLAROID is now available for the first time in a popularly priced study lamp that promises to be the modern successor to the old-fashioned "gooseneck" lamp.

Advantages of glare-free light are many. Black type may actually

disappear from a white printed page under certain glare conditions. But even under the most severe glare condition, it was determined that the proper introduction of Polaroid sheeting in the light path dissipates the undesirable glare element and restores the print-to-paper contrast that is necessary for effortless seeing.

FOREST GAME

Many Game Birds Thrive In Forests

APPROXIMATELY 66 percent of the food of all birds consists of insects. A large number of song birds are the principal consumers of insects. Many of these birds feed almost entirely upon this sort of food. Game birds also take a great many insects, the young chicks more than the older birds. This is of particular importance from the viewpoint of sportsmen.

A recent study made at Massachusetts State College shows that the alder-bottom forest floor pro-

duces the greatest number of insects and spiders which game will eat. The second most productive source of large insects, suitable for game food, is the white-pine-hardwood forest type. But the greatest total of insects, regardless of their usefulness as game food, was found on the forest floor of the hemlock-pine type.

There are many kinds of game which thrive in the forest, and the forest is always justified, from a sportsman's viewpoint, not only as cover for wild life but because of the beneficial effect it has on watersheds, and consequently the favorable influence upon fish life.

SCRATCHLESS

Synthetic Rubber Gasoline Nozzle

AUTOMOBILE owners who have had their cars scratched by the brass nozzles of filling station gasoline hoses will welcome adoption of a

Rubber protects the car finish

new nozzle made of Goodrich synthetic rubber. This nozzle, shown in the accompanying illustration, is the first such nozzle to be listed by the Underwriters' Laboratories, Inc., and is the product of several years of research.

NOT DAFFY

"Condition" Animals to Fear One-String Fences

A SINGLE string, hung between slender posts, may be enough to keep the cow of the future in her pasture if cows are psychologically conditioned. The conditioning would only mean punishing the animal with a mild electric shock

every time she went near the string. Even a cow soon learns to stay away from all strings after that.

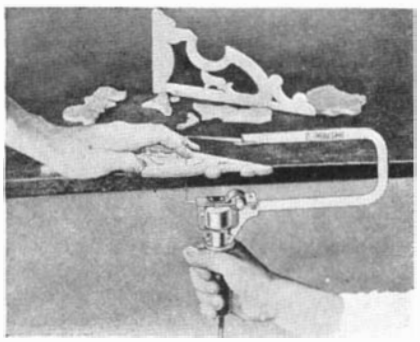
Psychology could thus save the farmer the enormous costs of iron fences and electric devices now used, Dr. A. I. Gates of Teachers College, Columbia University, recently told the Educational Section of the American Association for Applied Psychology. "Although a farmer neighbor of mine declared this was a daffy idea, it is good psychology," declared Dr. Gates.

—*Science Service.*

JIG-SAW

Hand-Operated, Inexpensive, Fast Cutting

A NEW jig-saw, put on the market by Dremel Manufacturing Company, is a hand tool which uses less electricity than a 75-watt lamp bulb, runs at a speed of 7200 strokes per minute, will cut through ordinary plywood at the rate of a foot forward per minute, and cuts so smoothly that no sanding is required. These details sum up the important features of the new Moto-Saw. The device weighs only 17 ounces, operates on 110-120 volt alternating current, and is priced at less than five dollars.



Vibrating jig-saw

The illustration shows the ease with which this machine is handled. Above the hand grip is the vibrating mechanism which holds one end of the saw blade. The upper end of the blade is gripped at the end of a spring arm, mounted on a goose-neck frame.

ALWAYS BUSY?

Bees Take Life Easy When Food is Scarce

BY an ingenious device that relieves bees of their pollen loads while permitting free passage into and out of the hive, entomologists in California have compiled records that cast doubt on the familiar idea of the inveterate industry of these insects. When a bee is "as busy as a bee" she is that way because abundant food supplies are available for harvest. But when dearth occurs, she takes life easier and does not bring home much pollen, either for immediate use or to mix with honey for storage as bee bread.

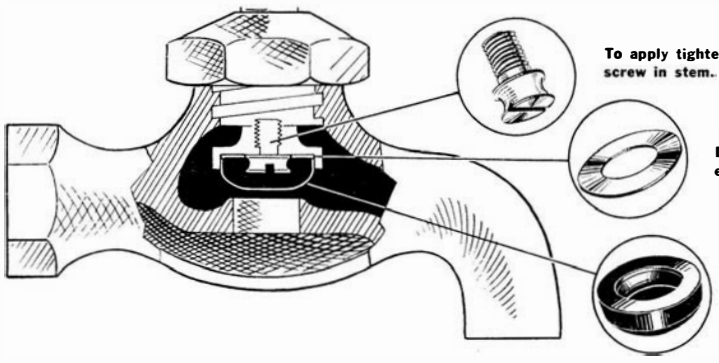
WEARLESS WASHER

A NEW snap-on washer eliminates leaky-faucet trouble. Made of rubber composition, it is so made that it does not turn and wear itself out against the seat. Furthermore, it is replaceable without a screw driver, as it simply snaps in place with the fingers.

This inexpensive new washer comes with a special screw having a grooved head, and a thin brass washer. The entire unit sells for ten cents retail, and replacement washers are but five cents.

In installing this device, the standard washer screw is removed and the grooved-headed one inserted tightly. Over this is first dropped the brass washer; then the rubber washer is snapped over the grooved head of the screw. The opening in the rubber washer is recessed so that a ridge moves freely in the groove of the screw-head.

When the faucet handle is turned, the entire unit revolves, but as soon



Wearless washer installed, and details of parts

as the rubber touches the seat it holds steady while there is slip between the thin brass washer and the rotating valve stem.

This ingenious new device is patented and is the product of No-Pans Washer Company.

WORLD CLOCK

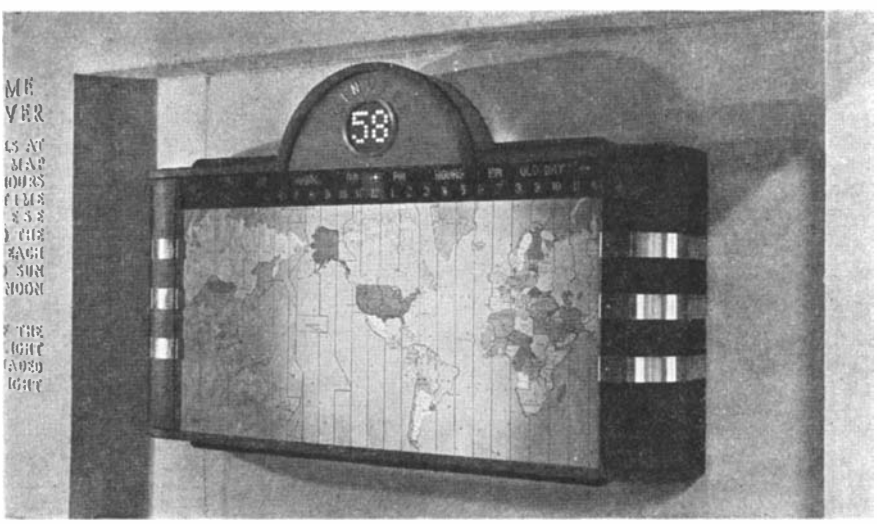
Time Throughout World At a Glance

AT both the Golden Gate International Exposition and The New York World's Fair, the International Business Machines Corporation exhibited first models of a unique clock which may find use in airline depots, in steamship offices, and in many other locations where there is need for, or curiosity about, the time in all parts of the world. This clock, of comparatively large size, is to be mounted on the wall, and consists of a projected map of the world marked off vertically in hourly time divisions.

The map itself is immovable, but a black band lettered for hourly divisions of the day moves across the top of the map. Above this moving time strip is a spot in which minutes are indicated by numerals. Reference to the accompanying illustration will best indicate the simple method of reading the time for any part of the world. It will be noted that the time band has moved to a point showing that New York, for example, is in the 2:00 P. M. range. The 58 minutes indicated above the strip give the exact time in New York as 2:58 P. M. To the right, England and a large part of Europe are in the 7:00 P. M. range; hence the time in England is 7:58 P. M.

Similarly, the time in any other range throughout the world may be instantly read by looking upward from the geographical point to the time indicated on the time band and the number of elapsed minutes shown above that. One other point to note is that lights behind the map itself follow the movement of the band at exactly 12:00, Noon, so that one gets a sense of the sun spreading over that portion of the earth at that particular time and shading into dawn at the left and twilight at the right.

This clock is a development of Miss Maud M. Clough, and will be manufactured by International Business Machines Corporation.



Time to the minute, in any part of the world

BIBLICAL SCIENCE

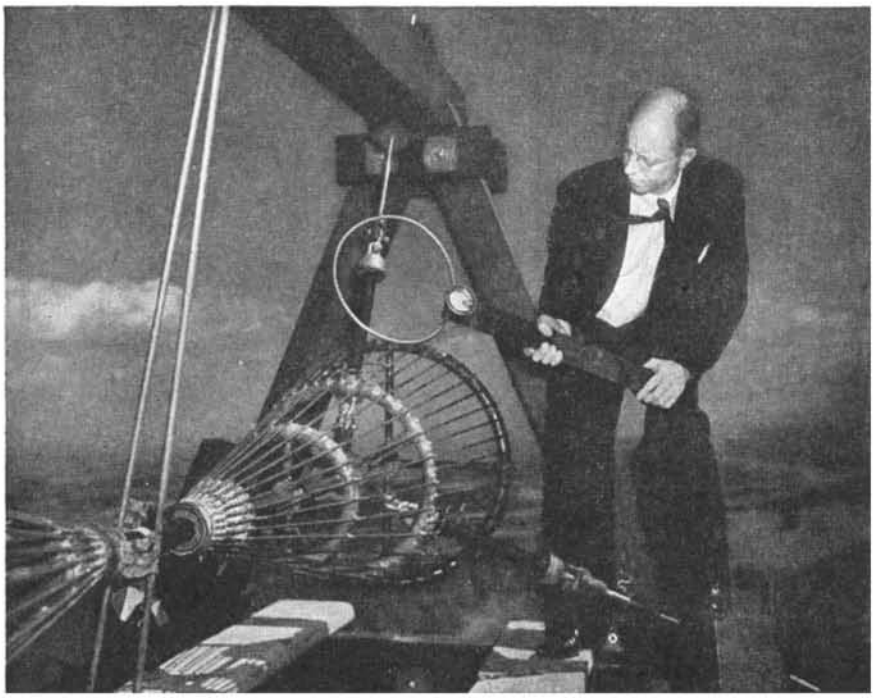
Jeremiah Made Scientific Observation

"YEA, the hind also calved in the field, and forsook it, because there was no grass.

"And the wild asses did stand in the high places, they snuffed up the wind like dragons; their eyes did fail, because there was no grass." —Jeremiah 14: 5 and 6.

Thus as long ago as biblical times the observation was made that when there is no grass on which animals may feed, one of the first and most characteristic symptoms is that of blindness. Today we know that grass and all green growing plants contain a yellow pigment, carotene, the precursor of Vitamin A, which, when absent from the ration of all animals, produces as one of its most specific symptoms, xerophthalmia, or blindness, prevalent in humans as night-blindness.

And even today, when scientists wish to determine the minimum vitamin A requirements of farm and domestic animals, no better technique is available than a deter-



Checking field distribution of new type of television antenna

mination of that minimum amount of vitamin A value which is just necessary to prevent the onset of night blindness.

Today the poultry- and cattleman can easily and quickly obtain a carotene assay of the feed he is to buy. Most feed manufacturers determine carotene as a routine practice in their laboratories and thus are able to protect themselves and their customers.

TELEVISION ANTENNA

With experimental work in television transmission progressing steadily and new methods being adopted in the endeavor to increase efficiency and service area, the accompanying illustration takes on added interest. It shows a part of the conical television antenna recently erected at the General Electric Company, Helderberg Station W2XB near Schenectady.

In the photograph, one of the engineers of this station is exploring the field distribution of the antenna, using the well-known closed loop and radio frequency meter set-up.

FOR CLOSE WORK

Lens and Lamps For Precision Work

If you have ever—and you probably have often—rigged up a strong light in connection with a large magnifying lens to do some close, fussy job, maybe you thought somebody ought to develop such a thing in finished, ideal form and manufacture it. This is what the Boyer - Campbell Company has done. It is a bracket with clamp to

Combination lens and lamp

attach to a chair or other support; case containing lens and light. The one shown is for doctors and hospitals; a similar one for shop use or precision jobs has been developed.

MECHANICAL MEMO

Keeping memo sheets on a desk so they will always be handy yet not violate the executive's demand for neatness is a problem that has now


Turning the roller on this new memo case delivers one sheet

been solved by a new device—Rolodex, a "touch control" memo sheet case. Molded of Bakelite, it completely encloses over 200 sizeable sheets.

Near the front, on the top of the case, is a plastic roller. Underneath is the pack of loose memo sheets. When one is wanted, the fingers touch the top of the roller and, as they are drawn forward, the revolving roller brings out the desired sheet, right to your fingers.

SANITARY

Woven Plastic Seats Are Attractive, Clean

MORE and more, plastics are moving in on us—replacing products which, despite certain disadvantages, have been with us for generations. The latest move of this nature is into rapid transit vehicles to replace woven seat covers.

An accompanying illustration shows the seats in a New York subway car covered with Saran, a new woven plastic "fabric." Such seats, will be more sanitary and will not split and require replacement so often as do the present woven rattan splits.

END NUISANCE

Diathermy Apparatus Need Not Bother Radio

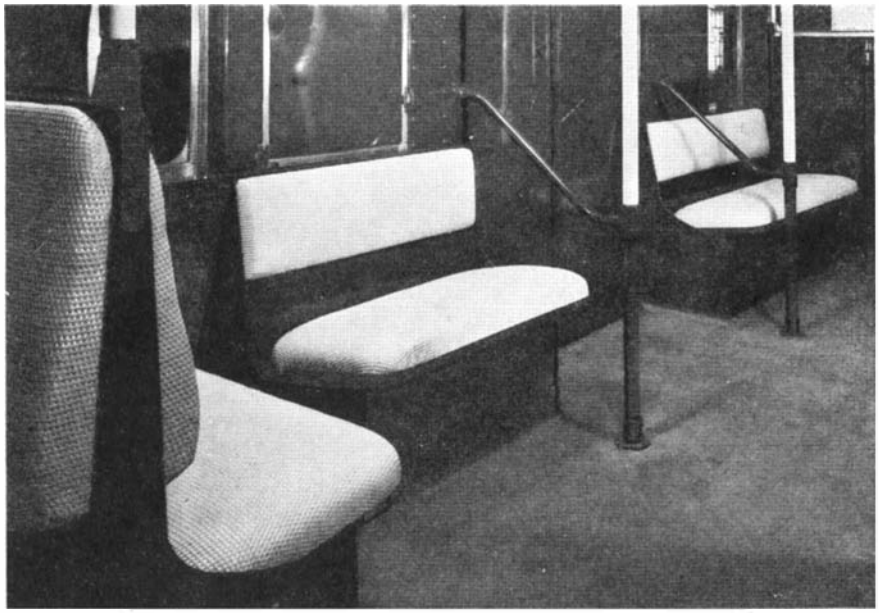
TRANSMISSIONS from electro-medical apparatus have actually been received across the continent and even across oceans. When diathermy interference first began to be serious a number of years ago, the disturbances were first attributed to stations operated by persons under the jurisdiction of foreign governments. Then the signals were traced to diathermy machines operated in medical centers and offices of private physicians.

Diathermy apparatus affects radio reception because the machines are essentially radio transmitters. The radiation that causes interference is not essential for therapeutic purposes and steps are being taken to prevent such radiation.

SYNTHETIC WOMAN?

The Chemist Can Clothe Her Cap a Pie

WE have long threatened to write someday an article on the synthetic woman—pardon us, the synthetic-clothed woman. Indeed, women are not only discovering that more and more of their garments and adornments are made of synthetics, but that these modern products of the


Woven plastic seat covers are sanitary, clean, durable

Celulose plastics add attractiveness to shoes, belt, bracelet

chemical laboratory are in some ways more attractive than would be the same articles made of natural products. We present, as an example, an accompanying photograph from Monsanto Chemical Company showing new accessories for evening wear. Attractive enough on the printed page, these articles, which are woven and crocheted in intricate designs, give the effect of simulating jewels. Furthermore, the material of which they are made is tough, strong, and resistant to water, so that only a damp cloth is needed for cleaning.

ANTI-AIRCRAFT

90-MM Gun, Now Standard, Is Effective Weapon

THE new 90-mm anti-aircraft gun is now a standard anti-aircraft weapon for the Coast Artillery. Its rôle will be essentially that of the present standard 3-inch anti-aircraft gun, M2A2, which it will replace insofar as future procurement is concerned. However, all serviceable 3-inch anti-aircraft guns, including those now under manufacture, still are classed as standard and are to be continued in service. For the present, technical details of the new weapon will remain in a restricted category.

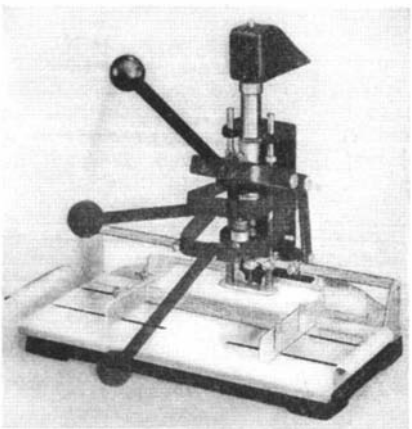
According to the *Coast Artillery Journal,* the gun will be known as the 90-mm anti-aircraft gun, M1, on 90-mm anti-aircraft mount, M1. Although its developed rate of fire probably will be slightly less than that of the 3-inch, its projectile is considerably heavier; hence in over-all effectiveness—number of effective fragments per unit of time—the 90-mm represents a considerable improvement over the standard 3-inch weapon. The projectile of the new gun also has a shorter time of flight than that of the 3-inch for corresponding ranges and consequently a greater maximum useful range. In over-all weight and in tactical mobility the two weapons are approximately equal.—*Army Ordnance.*

PAPER DRILL

Punches Many Sheets At One Stroke

IN collating all manner of office records, it is frequently necessary for an employee to use an ordinary paper punch, go through the complicated business of measuring a few sheets at a time, and then punching by hand the holes that are to fit the material into a binder. Even the larger, desk-type paper punches are often difficult to handle and do not punch accurately. Christie-Lucas, Inc., has solved all these problems, which can so often become major headaches, by developing a desk-type punch called the "Bull's Eye" paper drill.

This machine is actually a drill; it takes up to a one-inch stack of paper at one time, and will drill up to seven predetermined registered



holes without removing the paper from the tray. Despite this high efficiency, it is hand-operated and, therefore, may be moved to any location where it will find use for drilling manifests, sales bulletins, loose-leaf catalogs, and general correspondence.

Holes from ⅛-inch diameter up to and including 7/16 of an inch diameter can be drilled with this machine. Holes may be located from one-fourth of an inch to 1½ inches from the edge of a sheet. The leverage is six to one, and the manufacturer claims that any girl can operate it for hours with little fatigue.

CAMERA ANGLES

Conducted by JACOB DESCHIN, A. R. P. S.

Telling Stories With Your Movie Camera

THE motion picture camera is the story-teller par excellence in photography. The movie reel is the verbatim report of life's incidents, bringing to the screen as near an approximation of what we saw—and, in these days of amateur sound outfits, what we hear—as it is possible to achieve by means today available. The chief characteristic of the movies is motion. We take movies for that reason because it allows us to show a complete sequence of movements as when photographing a child at play or, by the stop-motion method, such subjects as flowering blossoms. But movement of itself is not sufficient. The movement must be significant, provide a living reproduction of something worth while, a subject in which movement is essential. Therefore, unless movement contributes to the objective of making the subject almost literally "come to life" on the screen, you may just as well take that particular subject with your still camera.

And that brings us to an inevitable comparison, odious though comparisons may be, between the results achieved with the still and the movie camera. Neither really competes with the other because each has its definite place. The still camera intends to and does catch but one instantaneous phase of a subject. Sometimes it makes as many as perhaps a dozen *separate* impressions of the subject and calls the group of pictures a story-telling sequence or series. Within the limits of the still camera it aims to accomplish what the movie camera does, but *without motion.* However fine the result, such a sequence or series can be nothing more than a group of individual stills or photographs of the same subject taken at intervals. The story may be complete within the limitations of the medium, but can never really be complete unless motion is introduced, to merge one still shot with another by the natural movements of the subject in changing from one position to the succeeding one.

The objective in all movie-making is the projection screen. In shooting film, particularly if economy is the watchword, as it should be, let us try

Figure 2

Figure 1

Figure 3

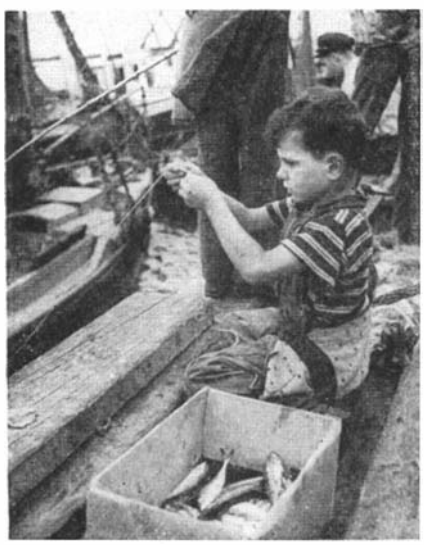


Figure 4

to visualize at the same time what the results will be when projected. Will our audience be bored because the scenes are too long or disappointed because the scenes are skimpy and therefore too brief to provide the impression or tell the story you thought you were shooting? Both faults should be avoided. In the first case, "splicing" in advance, that is, before shooting, is the best way, though some judgment and experience is admittedly required. The more splicing you do in avoiding insignificant and plus footage, the less you will have to do on the splicing block. On the other hand, if the scene is too brief it will be on and off the screen before your audience has had a chance to get any impression of it at all. Clipped scenes are probably the worst bugaboo of all for the still man who turns to movies for the first time. One of his first goals, therefore, though it is not too difficult to reach, is to battle and conquer the instinctive desire to short-change his scenes.

Concentration on significant movement is frequently accomplished by selecting an individual subject out of a group and shooting away at that until you have exhausted its possibilities. In Figure 1, we show a group of artist students painting a model on the beach at Provincetown. As a group, it was cinematically unworthy of more than brief notice—just long enough to show the group and allow the eye to get an impression of the general scene. But a look around will usually discover some one subject that holds promise of interesting movement. This we found in Figures 2 and 3. The young lady in question had grace, movement, and now and then struck attitudes somewhat flavored with humor.

The tiny fisherman made another good subject with the difficulties he was having keeping his fishing line untangled. A scene like this would make an attractive bit in a longer reel of other doings on the same wharf.

Sound Movies

DEVELOPMENTS in the sound-movie equipment first described in Scientific American for December, 1939, have brought it to a high state of perfection and flexibility. With available equipment you can make talking pictures at home, pictures as lifelike as those you see in the theater. You can photograph your family or friends, singing, dancing, performing dramatic sketches. You can take close-ups of dialogue. The voices will

Above: **Bolex camera with Synchrosound drive.** *Below:* **Turntable unit, five-minute disks**

Fifth Annual Scientific American
AMATEUR PHOTOGRAPHY CONTEST

OVER $1200 IN PRIZES

IN this year's contest, prints may be entered in any or all of the three groups listed below, in accordance with the rules. In addition to the seven major prizes and five honorable mentions, there will be three SPECIAL AWARDS that will be accorded to the three outstanding photographs among the 36 prize winners. *These special awards will be given in addition to the regular prizes that the pictures win.*

36 PRIZES *PLUS* Three Special Awards

DIVISIONS IN WHICH PRINTS MAY BE ENTERED

Division 1. Human interest, including camera studies of people, animals, and so on. Portraits will be grouped in this division.

Division 2. Landscapes, including all scenic views, seascapes, and so on.

Division 3. Action, including all types of photographs in which action is the predominating feature.

IN **EACH** OF THESE DIVISIONS THERE WILL BE AWARDED SEVEN MAJOR PRIZES AND FIVE HONORABLE MENTIONS. WINNERS OF THESE PRIZES BECOME AUTOMATICALLY ELIGIBLE FOR THE THREE SPECIAL AWARDS.

RULES of the CONTEST

1. The groups will be judged independently on the basis of pictorial appeal and technical excellence. The decision of the judges will be final. In case of a tie for any prize, duplicate prizes will be awarded to the tying contestants.
2. Prints must not be smaller than 5 by 7 or larger than 11 by 14 inches. **All prints must be mounted,** otherwise they will be returned immediately.
3. Photographs must be packed properly to protect them during transportation.
4. Non-winning entries will be returned only if sufficient postage is included when the prints are submitted.
5. Each entry **must** have the following data written on the back of the mount: Name and address of contestant, type of camera, and film, enlarger, and paper used.
6. Contestants may submit no more than two prints in each group, but may enter any or all groups. In no case, however, will more than one award be given to any individual contestant.
7. Prints must be in black and white. Color photographs are not eligible.
8. Prize-winning photographs will become the property of Scientific American, to be used in any manner at the discretion of the publisher.
9. Scientific American reserves the right to purchase, at regular rates, any non-winning entry.
10. No entries will be considered from professional photographers.
11. All entries in this contest must be in the hands of the judges by December 2, 1940. Results will be announced in our issue dated February, 1941.
12. The contest is open to all residents of the Western Hemisphere who are not in the employ of Scientific American.
13. In fairness to all contestants, failure to comply with any of the above rules will result in automatic disqualification.

THE PRIZES

1st. Three $125 LONGINES, Coronation Model, Solid Gold, Men's Wrist Watches.

2nd. Three $85 LONGINES, Presentation Model, Solid Gold, Men's Wrist Watches.

3rd. Three FEDERAL No. 246 Photo Enlargers (List Price $49.50).

4th. Three FEDERAL No. 345 Photo Enlargers (List Price $42.50).

5th. Three PIERCE CHRONOGRAPH Men's Wrist Watches (List Price $19.75).

6th. Three BERMAN-MEYERS Flash Guns complete with case (List price $15).

7th. Three FINK-ROSELIEVE Vaporators (List price $12.50)

HONORABLE MENTION

1st. Three Fink-Roselieve "Hi-Spot" Hollywood type spotlights.

2nd. Three Mimosa Perkino developing tanks.

3rd. Three Raygram Wood-Chrome Tripods.

4th. Three Fink-Roselieve Audible Timers.

5th. Three Fink-Roselieve Satin-Chrome Range Finders.

THREE SPECIAL AWARDS!

Winning pictures in the three divisions will be grouped and judged further to determine which three of them shall be considered as the best in the entire contest. To the contestants who entered these three photographs will be presented the following special awards:

1st. One No. 715 Weston Exposure Meter (List price $24.)
2nd. One No. 650 Weston Exposure Meter (List price $19.95.)
3rd. One No. 850 Weston Exposure Meter (List price $15.50.)

THE JUDGES:

McClelland Barclay, artist
Ivan Dmitri, artist and photographer
T. J. Maloney, editor of U. S. Camera
Robert Yarnall Richie, photographer

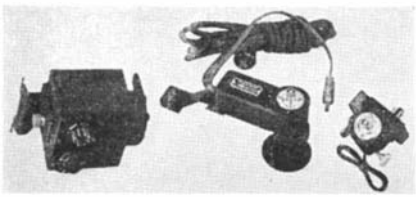
Address all Entries to

Photograph Contest Editor, Scientific American

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

be perfectly synchronized with the lip motion.

You can add narrative comment, music and sound effects to your present library of silent films. Your voice and music will match the action of each scene with split-second accuracy. Talking pictures can be made on either 8mm or 16mm film, black and white or color. The film is run at



For sound movies: Camera drive, turntable, and projector units

silent speed, 16 frames per second, saving one third of the cost of sound-film productions.

In addition to their low cost, disk recordings have several advantages over film recordings for home, educational, and experimental uses. The sound reproduction from the disk recordings is equal to the best sound-on-film. Each sound recording can be played back immediately after it is recorded for checking purposes. The records can be edited to match the final edited film. With synchronized disk recordings you can add sound to colored pictures without printing. The original reversal film may be used.

These advances in home movie making are made possible by the Syncrosound System which enables you to combine home movies with home recordings. Synchronization between the disk and film is assured by a fool-proof mechanical and electrical locking system.

To make and project talking pictures, you will need, in addition to your camera and projector, a portable sound recorder and three Syncrosound units—one for the recorder, one for the camera, and the third for the projector. The turntable unit is equipped with a bracket and mounting post so that it can be mounted on any recorder, home phonograph, or record player by means of one screw. The camera drive unit is designed so that the tripod screw and one bracket hold the camera and motor drive firmly together.

Syncrosound units are now available for Ampro projectors, Bell & Howell 8mm and 16mm cameras and projectors, Bolex cameras, Keystone 8mm camera and projector, and the Victor 16mm camera and projector. Units can be supplied for other makes on special order.

Use the Large Stops

WHEN making enlargements, it is generally preferable to use the larger stops. Some workers automatically stop all the way down as a matter of course, after having focused with the lens wide open. The only times it is really necessary to use the

smaller stops is when the film plane in a faulty enlarger is not quite parallel to that of the baseboard—in which case you should have something done about the matter anyway—and when projecting on a tilted easel as when correcting for distortion. At the very small stops, there is the danger of picking up the grain of a ground-glass diffuser, causing scattered light to cut down the contrast of the print, and unsharp pictures due to vibration during the relatively long exposures necessary at the small stops.

When is a Candid Shot?

PROBABLY you won't believe it, but this is *not* a posed picture in the usual sense of the term, although it surely does look like one. The gentleman was intently studying the picture possibilities in a group of fishing boats, when we came along and made our picture. This was a rather easy one because the subject was absorbed in thought.

"Camera Fan"

Lamp for Ultra-Speed

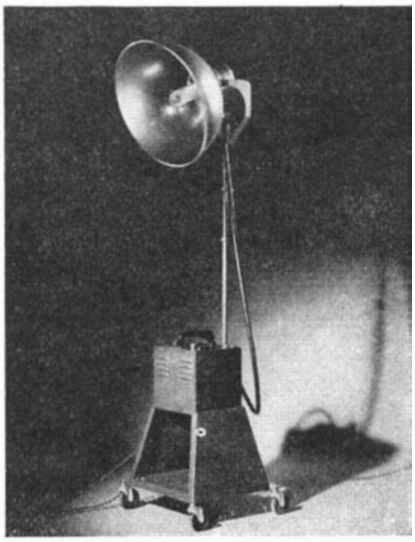
A STUNT of the laboratory has become the useful tool of the working photographer in Eastman Kodak Company's adaptation to general uses of the lamp employed for high-speed photography by Dr. Harold E. Edgerton and his associates of the Massachusetts Institute of Technology. The unit is known as the Kodatron Speedlamp and employs a gas-filled, electrically-operated flash tube, providing an effective flash speed of about 1/30,000 of a second. This speed has been found to be adequate to stop virtually any moving subject except a rifle bullet. Although the speed of the flash could be boosted to 1/1,000,000 of a second, light volume would be cut down correspondingly.

The single flash provides illumination equivalent to that of 40,000 50-watt tungsten lamps, sufficient to provide fully-timed negatives of an average subject 50 feet from the camera at a lens aperture of *f*/11. The

CAMERA ANGLES

1/30,000th second speed is, of course, many times faster than the highest setting of any camera; about 800 times as swift as the wink of an eye, and about ten times as fast as is necessary to stop an athlete in action. The tube yields more than 5000 flashes, after which it is replaced with a new tube. One flash can be made every 10 seconds, the charging time of the condenser.

"The Kodatron flash is accomplished," write the manufacturers, "by discharging a condenser through



Kodatron Speedlamp

a gas-filled tube. Ordinary 110-volt, 60-cycle current is led into the power unit of the lamp, where a specially-constructed transformer steps it up to 2000 volts. This current is then rectified and used to charge a condenser. When the trip circuit is closed (manually, by a flash synchronizer, or by the photocell unit), the energy stored in the condenser is discharged through the tube in approximately 1/30,000 of a second, producing a flash of high photographic efficiency."

The flash lamp itself has a tubular frosted glass shell, fitting over a spiral glass tube which contains a mixture of krypton and xenon gases. This is the flash element, the gas heating to incandescence when the condenser charge is released through it. Centered in the coil of the gas tube is the modeling or focusing light so that the angle of lighting is the same for both flash and modeling light. The modeling light is a V-filament projection type bulb of moderate wattage and long life.

Why Retouch?

A BRIEF for retouching as a matter of prime necessity, if successful portraiture is the goal, was recently put forth by J. Ghislain Lootens, F.R.P.S.

"If you are interested in portraiture you are going to retouch or be disliked by your friends," writes Mr. Lootens, who is a widely known teacher of photography as well as one

of our ace pictorialists. "Of course, if you're a professional you don't even expect to take portraits without some retouching—that is, if you intend to stay in business.

"Experience has taught that there is no system of lighting or type of film that will consistently give pleasing pictures of all sitters. We, therefore, don't retouch for the fun of it—it's a prime necessity.

"The average amateur buys a book or magazine illustrating the so-called secrets of lighting and faithfully measures the correct distance between his sitter and lights. He even uses the same equipment as the maestro, but his own pictures are simply terrible. Why? Unquestionably he has been trying to imitate a portrait that was beautifully retouched, but no mention was made of that fact.

"My advice would be: Study good portrait lighting, of course, but don't forget that retouching goes with it."

• • •

THE ROUND TABLE

Questions Answered for the Amateur Photographer

Q. I have heard that one can spot glossy prints by using graphite dust. How is this graphite mixed?—H. M. M.

A. The graphite is simply shaved off an ordinary lead pencil, the regular spotting brush moistened and a little of the graphite picked up on the end of the brush, which is first formed with the fingers to a point. Slightly work the graphite into the point of the brush using a piece of paper as a palette and then apply to print a little at a time. It is best to apply retouching dope to the area to be spotted. A retouching pencil or spotting color on a brush may also be used.

Q. Directors of photography for motion pictures carry the title A.S.C. Will you please tell me the meaning of the above letters?—H. H.

A. These initials stand for American Society of Cinematographers and indicate membership in that society.

Q. I have trouble with drying marks on my negatives. Can you offer a remedy?—D. G.

A. Make up a solution of

Sodium carbonate	1 ounce
Water	10 ounces

Place the negative in the solution and warm the latter to 90 degrees, Fahrenheit. Cool the solution to 60 degrees and rinse the negative in water at 60 degrees. Now place the negative in a hardening bath, wash and dry.

Q. Is there some convenient method of making enlargements without white borders?—D. L.

A. Every worker who desires borderless prints has his own way of achieving this end. One way is to cut five-ply board with dimensions about an inch larger each way than the largest picture you intend to make; for example, 9 by 11 inches for 8 by 10 prints. Center the paper on this board; at each corner drive an insulating staple, allowing it to project just far enough to permit slipping the corner of the paper in and out. For focusing the image, the 8 by 10 area may be painted white or you can use a sheet of thin cardboard or paper cut to the exact dimensions of the paper to be printed.

Q. Is there a remedy for bringing back to life negatives that have become dry and brittle?—S. C.

A. There is available a formula for conditioning negatives that has given satisfactory results in many instances. Here it is:

Camphor	1 dram
Menthol	1 dram
Oil eucalyptus	2 drams
Glycerin	4 ounces

Q. Will you please suggest a method for removing developer stain from negatives?—R. A. L.

A. The negative is first bleached in the following solution:

Potassium permanganate	50 grains
Table salt	¼ ounce
Glacial acetic acid	1 ounce
Water to make	20 ounces

After bleaching, rinse the negative in plain water; then place in

Potassium metabisulphite	1 ounce
Water to make	20 ounces

Leave it in this bath until the image turns white, then redevelop the negative in any non-staining developer.

• • •

WHAT'S NEW

In Photographic Equipment

GRAFLEX ANNIVERSARY ENLARGER ($87.50, including one negative carrier, but without lens): Condenser-type enlarger for negatives up to 2¼" by 3¼". Features "variography," altering of linear perspective by means of two-way tilt of negative, tilting lamphouse, and accessory universal-tilting easel holder. Tripod-type column furnishes two anchor points for arm carrying head. Rear leg of column serves as guide for counterweight and as conduit to keep waterproof lamp cord out of way. Baseboard 24 by 32 inches; leveling foot at right rear corner. Head supported near center of balance and counterbalanced by weight on other end of cable that runs over wheel at top of column. Negative triple-cooled by circulation of air, by radiation of heat from deep fins on lamphouse, by isolation from any direct metal path by which heat of lamp might reach it. Double condensers in basket-type carrier that bayonet-locks in position can be replaced by diffusing screen for soft light to lower contrast of print or conceal negative blemishes. Lensboard bracket accepts Miniature Speed Graphic lensboard. Negative carrier can be used with or without glass. Head comes off to mount

camera on arm for copying, macrophotography, or photomicrography; Graflex, Speed Graphic, Graflex Photorecord Microfilm Camera, or any other may be used, as well as movie cameras for tilting and other close-up work.

WATSON 5x7 PORTRAIT CAMERA ($29.50): Adjustable with reducing backs from 2¼ by 3¼ to 5 by 7. Features: Tilging, swinging lens board and front; vertical, horizontal swing back; rising front board, sliding front, all-metal slide. Reversible back. Full-length slide locks camera in normal position. Flexible 14-inch bellows.

SPEEDEX JUNIOR CAMERA ($11): Employs same design, styling and construction as original Speedex, with body shutter release; centrally-located optical eye-level finder; rapid opening, precision movement of front platform; and hinged back with safety latch. Fitted with fixed-focus, four-aperture, double lens of rectilinear correction, with shutter giving instantaneous and time exposures. Loads with B2 rollfilm, taking 12 pictures in 2¼ by 2¼-inch size.

PRINCETON MOLDED TENITE SUNSHADE AND FILTER HOLDERS ($1): Available in four sizes: Lens barrel—21-29mm, 31-39mm, 34-42mm, 37-45mm; Filter diameter—31.5mm, 39mm, 42mm. Size 34-42mm sunshade designed for Leica and Contax cameras. American made.

P. U. BROMOIL BLEACHER (25 cents): Package consists of two glass vials with Bakelite tops, holding 16 ounces of bleacher.

FOTH DERBY II ($31 with *f*/3.5 lens; $36 with *f*/2.5): Superimposed-image type, coupled range finder added to former model. Camera takes 16 pictures on standard VP roll. Shutter of focal plane type with speeds to 1/500 of a second, plus delayed action. Green and dark red windows for panchromatic and orthochromatic films.

ESSENKAY COLOR FILM ADAPTER ($4.50 to $6, depending on camera): Permits use of Bantam Kodachrome rolls in roll-film cameras taking Eastman 120 or Agfa B-2 film. Adapter installed or removed quickly. No special holes required. Made to couple with automatic film stop and film counting devices on cameras. At present available for following cameras (numerals designate number of exposures per roll of Bantam Kodachrome): Automatic Rolleiflex, 9; Super Ikonta B, 9; Rolleicord, 10; Argoflex, 8; Altiflex, 8; Wirginflex, 8; Korelle Reflex, 10; Ikoflex I, 8; Ikoflex II, 10.

MIRACLE SALON BROCHURE ($1 for 5 by 7; $1.50 for 8 by 10; $3 for 11 by 14): "Showplace" for prints. Contrasty white-enameled metal binding. Heavy celluloid cover for mounting favorite picture as cover of Brochure. Each print becomes full page of its own in book. Feature of book is method of mounting: brochure itself is series of narrow strips in binding, which operates on principle of first-aid bandage strips; you merely peel off glassine strip and expose adhesive-covered section. Then "finger-smooth" edge of print to strip. Prints may be removed at any time, without harm to print or Brochure, with provision for replacement. Suggested use: "double-mounting" prints, dry-mounting back to back to achieve effect of prints on facing pages. Complete with adhesive strips. Holds 15 regularly mounted prints, 20 to 30 back-to-back.

KODASLIDE COMPARTMENT FILE; KODAK MINIFILE BOX ($4.50 each): Kodaslide file box of black molded material, with matching hinged cover and latch. Inside are ten partitioned cells, each holding 20 Kodaslides. Minifile box, of matching design, size, and material, supplied with 25 transparent envelopes each accepting strip of four 35mm or Kodak Bantam negatives; 25 index cards, and 25 guides having visible tabs. Separator fits into notches at sides of case. Extra envelopes, 25 for 35 cents; extra index cards or guides, 25 for 25 cents.

HAMPDEN PANCHROMATIC MAKE-UP KIT ($1.50): For improving skin texture and facial modeling in photography. Kit contains five panchromatic shades of complexion foundation, varying in color from peach to chocolate, plus three shades of powder, panchromatic lip-rouge, eyebrow pencil, eyeshadow, lip brush, and powder puff. Foundation shades come in handy little wedge-shaped sticks. Illustrated booklet includes analyses of various facial types and solves individual feature problems.

WESTON MASTER CINE MODEL 720 EXPOSURE METER ($24): Styled along lines of Weston Master Universal, same size and shape, using same cell and instrument movement, but calibrated for motion picture camera use. Angle of acceptance for high scale 25 degrees. Extra scale for use in dim light. Manufacturer claims: "Model 720 will indicate a readable deflection in light levels so low that the correct exposure would be *f*/1 at 16 frames with a film having rating of 64 Weston." Top mark of 27 ample to handle brightest sand, snow and water scene.

"A TO Z" FIGURETTES ($1): For movie title backgrounds. Set includes 30 figurettes in brilliant colors. May be used over and over again; adhere instantly to wood, glass, metal or tracing paper. Applied without moistening. Photographs on black and white or color film. Cleaned with damp cloth.

AGFA TWIN-EIGHT PANCHROMATIC REVERSIBLE ($2 per 25-foot roll): For double-width 8mm motion picture cameras. Slightly slower than fast Twin-Eight Hypan Reversible, though similar in other characteristics, providing "high-quality panchromatic emulsion, brilliant gradation, fine grain, and high resolving power."

PHOTRIX UNIVERSAL PHOTOMETER MODEL B ($42.50): Equipped with instrument dial 3½ inches in width, reading 0 to 20 foot-candles in most sensitive range; intermediate range 10 to 100 fc; high range 50 to 2000 fc. Designed particularly for timing enlargements, required exposure time being determined by Photrix Enlargement Calculator, which can be inserted into lid of instrument case. Camera exposures can be timed with Photometer in conjunction with Photrix Exposure Calculator in all instances in which range or accuracy of pocket type meter is not sufficient. Other applications: densitometric measurements of negatives for timing contact prints, selecting printing papers, balancing three-color separation negatives.

YOUR FIREARMS and FISHING TACKLE

Conducted by A. D. RATHBONE, IV

INTEREST IN FIREARMS *is traditional with American men; fishing tackle is a requisite of one of the world's oldest occupations. Scientific development of guns and tackle, in the use of which millions yearly find sport and recreation, fathers this monthly department which welcomes correspondence from readers.*

Mountaineers Test Marlin

WE'VE just subjected one of Marlin Firearms Company's new, redesigned Model 39-A lever action .22-caliber repeating rifles to about the toughest test we can conceive of. The Marlin 39-A, you know, is the only lever action repeating .22 in the world, and it's endowed with the same simplicity of breech action and construction that helped make John Marlin's name famous over 49 years ago. (See May, 1940 issue.) Latest refinements on this sweet shooting little gun include redesigned receiver, shortened tangs to permit remodeling of buttstock and to allow the comb to be moved farther forward. Coil main and trigger springs have replaced the flat steel type, producing smoother and easier working action.

We took this Marlin 39-A into the mountains of West Virginia, where the present generation of gunners are direct descendants of some of the straightest shooting rifle shots this country ever knew. Many things in the Mountain State have changed since the time of the great-great-granddaddies of today's shooters, but the West Virginian's demands on a rifle, small caliber or large, are just

Marlin 39-A

as stringent now as they were when accuracy and speed of operation meant preservation of life. The gun must feel right, sight quickly and truly, shoot straight and hard, and if you think the present day mountaineer doesn't recognize "oomph" in a rifle when he sees it, you're sadly mistaken.

When the boys in the Mountain State try out a new rifle, they don't bother with such prosaic things as Army L targets or any other kind. They, like their fore-fathers, are in the habit of shooting wild turkeys in the head, and that, gentlemen, is a real mark at which to shoot. Nor do West Virginia mountaineers use a vise of any nature to hold the gun steady for a target test. If you can hold an old 9-pound muzzle loader on a wild turkey's head long enough to put a lead ball 7/16 of an inch in diameter through said head, you don't need a vise.

No, they do it this way. They cut a piece of white paper about two

Mitchell and "Ol' Yella Jacket"

inches square and peg it with four whittled pegs to a block of stove wood, which preferably has been darkened by weather. They pace off 60 yards and lay a log on the ground at right angles to the course of fire. Stretched prone behind the log, they rest the front of the gun barrel on the log, but—and this is important—they do not support the fore-end of the gun with the left hand as we "civilized" target shooters do. They bring the left hand back so it can grasp the bottom corner of the buttstock where it projects slightly below the shoulder. The right hand takes the normal trigger position, but the left steadies the gun and prevents canting to left or right.

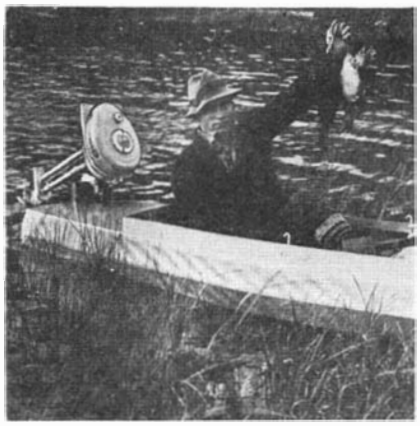
The results? Three West Virginians, none of whom had ever seen this Marlin before, each fired five shots (.22 long-rifle cartridges) at the target from the prone position. Of the total of 15 shots, 9 were well within the square of paper, two clipped the edges and the remaining four were in the wooden block, just off the paper's edge. The performance was repeated by three more shooters at the same range and this time only two shots missed the paper. The verdict? That portion of West Virginia's male population which did the shooting, as well as the onlookers, ungrudgingly and enthusiastically

voted this new Model 39-A Marlin to be one of the best shooting rifles it had ever seen.

Said Hugh Mitchell, one of the best of the marksmen, and a man to be feared in any shooting competition, "'Deed, Ah reckon this little gun is about the nicest shootin' rifle I've handled since my granddaddy gave me Ol' Yella Jacket." And by way of explanation, "Ol' Yella Jacket" is a 9½ pound muzzle loader with a 40-inch octagonal barrel 3 1/16 inches in circumference, a bore of 7/16 inches, and it still shoots a lead ball straight enough to take that wild turkey's head right off from the top of his neck. During the past three generations Mitchell's "Ol' Yella Jacket" has won more shooting matches than any other rifle, antique or modern, in that section of West Virginia's mountains, so praise from Mitchell is real praise.

Outboards for Ducks

UNDER provisions of the Federal Migratory Bird Treaty Act, ducks and other migratory game birds may not be hunted from a power boat, and a boat to which an outboard motor is attached is unequivocally within that category. However, like the lad in the picture, the hunter may use his Evinrude or Elto to propel his boat to hunting location; then he shoots from



Ducks . . . and outboards

the boat *after* the motor has been detached and placed inside the craft. Obviously, he may re-attach the motor, after hunting is over, to return home. Just to be sure on this point, we asked the Fish and Wildlife Service, Department of the Interior, and have their word that the above is the correct interpretation, but by all means take that motor off the stern before you start pulling triggers, or you'll be in trouble with Uncle Sam.

Strange Guns in Strange Places

IN 1842, Henry Deringer, Jr., manufacturer of famous pocket pistols that bore his name, received one of the contracts to furnish the United States Army with its first percussion pistols. In Brandon, Vermont, 29 years earlier, and in Hartford County, Maryland, three years earlier, were born two men, both of whom were destined to own famous Deringers and to bitterly oppose Abraham Lincoln.

The man from Vermont was Stephen Arnold Douglas, who ran against Lincoln in the Presidential election of 1860, and who later gave the martyred Chief Executive unfaltering support. The Deringer owned by Douglas had an engraved lock and hammer, with the word "Philadelphia" stamped on the former. On the German silver name plate, which also served as butt-strap, was engraved "S. A. Douglas." Before Stephen Douglas died in 1861, he presented his pistol to J. M. Tenny, then proprietor of the National Hotel, in Washington.

On the 14th of April, 1865, the man from Hartford County, Maryland, carrying a Deringer identical in every way to the one formerly owned by Douglas, save for the engraving of his name, slipped into a box in Ford's Theatre, in Washington, and shot President Abraham Lincoln. That man was John Wilkes Booth. It's a strange coincidence that Booth should use a facsimile of the pistol which belonged to Douglas, Lincoln's opponent for the Presidency. If you drop into the office of Francis Bannerman Sons, New York City, to whom we are indebted for this tale, and ask to see their extensive firearms collection, or if you'll browse through their annual "Military Goods Catalogue," you'll find many examples of "strange guns in strange places." Have you a story about "strange guns?" We'd like to hear it.

Hoffman Arms

IN tune with the growing demand from shooters for high quality, custom-built guns at moderate prices, The Hoffman Arms Company, a sterling name in the firearms world some years ago, has been fully and capably reorganized at its new plant in Amarillo, Texas, and is actively engaged in producing rifles and shotguns to

Captain Charles Askins, Jr., and his Hoffman .30-'06 sporter

the customer's measurements. After three years of careful preparation, including acquisition of a factory, selection of skilled artisans, purchase of gun-maker's steel, barrel stock, Circassian walnut, and a vast complement of tools and machinery, James A. Hedgecoke, millionaire cattleman, sportsman and sole owner, and B. R. Polley, general manager and one of the ablest of gun builders, announce they are prepared to serve America's discriminating gunners.

The Hoffman Arms Company is a complete manufacturing plant, not a mere assembly shop, and every rifle and shotgun will be entirely custom-turned from front sight to buttstock in rifle calibers from .22 to .50, and in side-by-side, double barrel, English type field scatterguns of 12 and 28 gage and .410 bore. Delivery is guaranteed in two weeks on .22 long rifle, .220 Swift, .250 Savage, 6.5 and 7 mm., .276 Dubiel, 30'06-300 Magnum, .375 and .404 Magnum, and on the above named types of shotguns. Six weeks are required for production of other calibers. In short, here is the American shooter's long-awaited chance to own that much desired custom-built gun at a moderate price, for Messrs. Hedgecoke and Polley announce their prices will be "tens of dollars beneath the usual cost of guns of this high quality." We'll be pleased to send along further details of The Hoffman Arms Company prospectus; it is mighty absorbing.

Gun Book of the Year

ALL too seldom in these days of mass publication there appears a book which causes one to gasp in amazement at the author's comprehensive treatment of the subject, to exclaim in admiration at the beauty of compilation, illustrations, and binding, and to marvel at the thoroughness and simplicity of presentation. Such a volume is "A History of the Colt Revolver," by Charles T. Haven and Frank A. Belden, who spent years in research, planning, and consultation with other eminent arms collectors and experts in preparing their work. It is a magnificent publication of over 700 pages, 8 by 11 inches, containing 500 illustrations.

In four parts, devoted respectively to history, from earliest known guns to modern Colts; an outline of the antique and obsolete models of Colt arms and their several variations; photostatic reproduction of documents contemporaneous to manufacture of Colt arms from 1832 to 1940; and facsimiles of a number of patents on the Colt revolver, the book not only is completely indexed, with a glossary, but also is arranged with Table of Contents showing chronologically the development of the revolver. "A History of the Colt Revolver" will prove to be an encyclopedia for the arms collector, an invaluable correlative volume for the historian, and a source of endless enjoyment and information for the layman.

Last month we mentioned our compilations of books reviewed during the past year. There are four of these lists, covering publications in the fields of firearms, fishing tackle, gun collecting, and natural history, and the only cost is a 3-cent stamp for return postage.

Insurance for Fishing Tackle

COMES now the time when anglers in northern zones, wistfully, with poignant memories, store away their tackle for the winter. The more care given to rods, reels, lines, lures, and boots when the frost is on the pumpkin, the better condition the gear will be in when ice goes out next spring and the first timid buds and hardy arbutus issue their annual siren call to hibernating fishermen. Hang boots heels up in a dry, cool place. Check rods carefully for loose ferrules, worn guides, cracked agates, and the protective coat of varnish. If the big-one-that-got-away left you a cracked or broken section as a souvenir, send the rod to the factory that made it.

To those who know how, removal of guides, windings, and worn varnish preparatory to application of the new coat and new wrappings is not a difficult fireside chore for winter evenings. In fact, it's fun and a good time to dream of new conquests, but if you've never done it, and if your's is a prized rod, it's best to trust the folks who made it. Too much varnish and poorly applied windings may completely alter the rod's action. Avoid excessive moisture or heat in storing rods and never leave them standing in the corner. They'll come out parabolically inclined. Store either in their aluminum cases or hung up whole or in sections perpendicularly on the wall by tip and by guide.

Reverse silk lines on the reels and thoroughly clean the reels themselves, and it's good insurance to alter the position of the click so a new point of the triangle will receive next season's wear. Enameled trout lines keep best off the reel, coiled and hung in large loops, preferably with support at many points, such as a 10-inch tube of blotting paper. Dry leaders, wash out leader boxes and moistening pads. As to trout flies, bass bugs, and other lures containing delectable tid-bits relished by moths, protect them in their cases or boxes with particles of moth balls or other repellents.

Winter is a good time to clean out the tackle box, sharpen up hooks on bass plugs, put a drop of oil on shiny spoons to keep them that way, and generally to take inventory to see what is needed. Christmas is coming, you know, and so are 1941 catalogs from Messrs. DeWitt, Heddon, Pflueger, Mills, Shakespeare, South Bend, Weber, and others. They'll be chock-full of splendid gift suggestions for the men of the house, and for milady Walton, too, especially if properly marked with a large, red pencil.

Our Book Corner

THE BOOK DEPARTMENT of Scientific American is conducted, with the co-operation of the Editors, to make available for you a comprehensive book service. Each month the Editors select and review in these columns new books in a wide range of scientific and technical fields. In addition, they are ready at all times to advise you regarding the best available books on any subject. You are invited to use this service freely. Tell our Book Department what kind of books you want and you will be furnished with a list of available titles, including prices. When inquiring about books, please be specific; remember that we can be of the greatest help only when you tell us just what you are looking for.

BRITISH WARSHIPS, THE ROYAL NAVY

By The Illustrated London News

PICTURES, text, and data concerning all the ships of the Royal Navy. Some of the illustrations, particularly of the larger ships, are full-page size; while there are also a number of cutaway drawings showing interior arrangement of ships—supply rooms, service quarters, and the like. Drawings also show armor protection of a number of the battleships. All data are extremely complete. (40 pages, 19 by 12½ inches, stiff paper binding, cover printed in gold and blue.)—$1.25 postpaid.—*F. D. M.*

LIFE ON OTHER WORLDS

By H. Spencer Jones

AT last a professional astronomer has written a whole volume on this most intriguing of all subjects connected with astronomy. And he has written neither as a radical nor as an ultra-conservative. That is, while the author's conclusions will scarcely feed the panting sensationalist with the "hop" he craves, he does not show any desire to play down the big question. What he does is to treat it just as the evidence of astronomical science appears to call for at present. The question is discussed for each planet. Readers will like the 17 illustrations—not of imaginary Martians but photographs of star clouds, nebular, lunar close-ups, spectra of planets, Mars and clouds on Mars, Saturn, Venus—all large and attractively produced. (299 pages, 5 by 8 inches, 17 plates.)—$3.10 postpaid.—*A. G. I.*

THE STEEL SQUARE

By Gilbert Townsend

HOW to use its scales, lay out braces, rafters and roof framing in general, and do other work. Written by a Montreal architect. (96 pages, 5½ by 8¼ inches, 102 illustrations.)—$1.35 postpaid.—*A. G. I.*

AIRPOWER

By Major A. L. Williams

MAJOR WILLIAMS has had a brilliant career as a naval aviator in the World War, with many flight records and other exploits to his credit. For many years he has been a close and brilliant student of military aviation and has written widely on this subject. His 1938 European tour (in his own single-seater) gave him a fine opportunity of studying at first hand the air equipment and strategy of both Germany and Italy. In "Airpower" he presents a graphic picture of such milestones in aerial warfare as the campaigns in Ethiopia, Spain, Poland, and Western Europe. His review of these campaigns and his views on the use of aircraft in modern warfare are of the greatest value and are most timely when the United States is faced with vital problems of national defense. We can almost forgive this splendid technician his hostility to England, his mistaken isolationism, because he brings us such a fine understanding of the problems of airpower and national defense.—$3.60 postpaid.—*A. K.*

GRAPHIC PRESENTATION

By Willard C. Brinton

AN excellent guide for all those interested in depicting statistics, flow of materials in production, flow of traffic along highways, progress, chronological, dot and pin maps, pictorial charts, multiple bar and contrasting bar charts, sector or "pie" charts, and numerous other modern "pictographs." A statement quoted in the book from Henry D. Hubbard of the National Bureau of Standards well describes the use of these various types of charts: "There is a magic in graphs. The profile of a curve reveals in a flash a whole situation—the life history of an epidemic, a panic, or an era of prosperity." (512 pages, 6¼ by 9¼ inches, leatherette cover, hundreds of illustrations.)—$5.10 postpaid—*F. D. M.*

A HISTORY OF THE COLT REVOLVER

By Charles T. Haven and Frank A. Belden

FOR over 100 years this nation has owed a debt of gratitude to Colonel Samuel Colt for his invention of the first practical firearms with combined automatic revolving and loading of cylinder. Without that device, settlement and control of the West, the successful termination of the Seminole Indian trouble and other episodes in later American history might not have terminated so satisfactorily. Today, that debt has expanded to include the authors of this comprehensive, factual publication and Colt's

—OUR BOOK CORNER—

Patent Fire Arms Manufacturing Company for its splendid co-operation. In writing the foreword for the book, Stephen V. Grancsay, Curator of Arms and Armor, The Metropolitan Museum of Art, said: "The authors of this volume have filled a serious gap in the literature of firearms. . . Without venturing into the field of eulogy, it may safely be said they have scored a bull's eye." The book is in four parts which respectively cover the history of Colt arms, an outline of antique models, photostatic reproduction of pertinent documents from 1832 to 1940, and facsimiles of Colt patents. Completely indexed, with glossary. (711 pages, 8 by 11 inches, 500 illustrations.)—$10.10 postpaid.—*A. D. R., IV.*

STAIR BUILDING

By Gilbert Townsend

DESIGNING and laying out stairways is not a job for a hatchet carpenter but if the style is uncommon, and is to be real architecture, it requires considerable study and labor. Many books sold to tradesmen are out-of-date and poorly produced but this one, by a Montreal architect, is modern and pleasing. It covers types of stairways, common and uncommon, their arrangement in house plans, their geometrical layout and their construction and finishing. All practical. (200 pages, 5½ by 8¼ inches, 195 illustrations.)—$2.10 postpaid.—*A. G. I.*

CHAMBERS'S TECHNICAL DICTIONARY

By thirty experts under editorship of C. F. Tweney and L. E. C. Hughes

PRACTICALLY no scientific term in common use today, whether it be Nipkow disk, endosome, motional impedence, or any other such strangely familiar but unfamiliar term, is missing from this carefully compiled volume. The best recommendation we can give is the fact that this review copy will go on our editorial shelves, pushing aside all similar preceding volumes. It is exactly the type of reference for which we have searched these many years. (957 pages, 5½ by 8¼ inches, unillustrated.)—$5.10 postpaid.—*F. D. M.*

AN INTRODUCTION TO ENTOMOLOGY

By John Henry Comstock, Late Professor of Entomology, Cornell University

THE ninth and once more revised edition of a textbook which has long been a standard. In its opening 205 pages it covers the characteristics, anatomy, and metamorphosis of insects in general—scientifically, systematically. The following 802 pages consist of a full, detailed, orderly classification of insects, giving their life histories—one or two pages of compact data on each of many specific insects, with illustrations. The re-

mainder is a detailed bibliography and index. Not written primarily to amuse the reader, this is a work for the student. It is also a reference book for all who, from time to time, wish to identify insects and look up dependable data about them from the foremost scientific source on entomology. (1064 pages, 6 by 9 inches, 1228 illustrations.)—$5.15 postpaid.—*A. G. I.*

SIMPLIFIED CARPENTRY ESTIMATING

By J. Douglas Wilson and Clell M. Rogers

IN this compact, practical little book everything concerning the taking off of a bill of materials for a house is clearly set forth, and all the rules for making an accurate cost estimate are arranged for convenient use. (204 pages, 4½ by 5¾ inches, 70 illustrations.)—$2.60 postpaid.—*A. G. I.*

WHAT MAKES THE WHEELS GO ROUND

By Edward G. Huey

PHYSICS for youngsters of age not less than 11 (unless unusually keen), remarkable as it may seem, is possible. Judging by concrete tests made on one average lad of ten, who stumbled over some of the harder words, age 11 is the minimum for this book. The subjects covered are those of regular physics—solids, liquids, gases, magnetism, evaporation, inertia, friction, sound, and so on—but they are not dealt with heavily. The style, instead, is bright and sprightly. There is also a leavening of explanations of common things such as locomotives. This book provides a good chance to test whether your young hopeful has a budding mind of the type likely to make a good scientist. (175 pages, 7½ by 9½ inches, illustrated.)—$2.60 postpaid.—*A. G. I.*

GUNS ON THE FRONTIER

By William MacLeod Raine

WHEN, in Chapter Three, the author wrote, "All frontier communities have had to discover that law is not a lot of words written in a book," he succinctly described this work. The story of the struggle for law and order in early western settlements is graphically, authentically, and most entertainingly told. All the noted "bad men" are delineated with a clarity, vividness, and understanding of their quirks of character which would almost seem to tag the author as an eye witness. It is, however, his long residence in the Southwest, coupled with intense research for his numerous other books on frontier life which have been combined to portray skilfully this new picture of the bad man who lived his short, violent day before organized law was finally achieved. (282 pages, 5½ by 8 inches, 11 illustrations, index of characters)—$3.10 postpaid.—*A. D. R., IV.*

The Editors Recommend

Best Sellers in Science

1. **GETTING MORE OUT OF LIFE**—*By Joseph Jastrow, Ph.D.* A noted psychologist's readable discussion of such things as complexes, hysteria, superstitions, memory cults, psychoanalysis, sense of humor, recruiting our reserves, etc.—all intended to increase one's scientific knowledge of common aspects of life. **$2.10**

2. **THINGS A BOY CAN DO WITH CHEMISTRY** — *By Alfred Morgan.* Simple tricks with simple chemicals: vinegar, salt, sugar, baking soda. Extracting nitrogen from air; freezing kerosine; running small steam engine with dry ice; a battery made with copper, zinc, and a lemon; etc. **$2.60**

3. **COMPLETE GUIDE FOR THE DEAFENED**—*By A. F. Niemoller.* The ear, impaired hearing and causes, diseases, drugs, ear discharges, hearing tests, everything worth knowing about the ears and hearing. **$3.10**

4. **REFINING PRECIOUS METAL WASTES**—*By C. M. Hoke.* Practical. Gold, platinum, silver, alloys, iridium, rhodium, low-grade wastes, equipment, identification, repurification, dealer list, etc. **$5.10**

5. **SCIENCE EXPERIENCES WITH HOME EQUIPMENT**—*By C. J. Lynde.* A book of 200 simple home tricks based on physical laws, each experiment being illustrated and its principle explained. **$1.45**

6. **THE ENGINEER'S SKETCH-BOOK OF MECHANICAL MOVEMENTS**—*By Thomas Walter Barber.* Working drawings of practically every conceivable movement, device, appliance, and contrivance employed in the design and construction of machinery for every purpose. Nearly 3000 illustrations. **$4.35**

7. **SUPERSONICS**—*By Prof. R. W. Wood.* A great deal of data on science of inaudible sounds, their every aspect, physical and biological, by a noted physicist-inventor. Has bibliography of articles on subject in many journals. **$2.10**

8. **OH DOCTOR! MY FEET!**—*By Dudley J. Morton, M.D.* Help for foot sufferers. Scientific treatment which makes possible discarding of arch supports and special shoes and stopping of exercises. **$1.60**

9. **HOW TO THINK STRAIGHT** — *By Robert H. Thouless.* A book that will definitely clarify your thinking and show you the argumentative tricks of others. **$2.10**

10. **THE SCIENTIFIC AMERICAN CYCLOPEDIA OF FORMULAS**—*By A. A. Hopkins.* A standard reference volume of more than 15,000 formulas. Indispensable in the laboratory, workshop, home. **$5.50 in U. S.; $6.00 elsewhere.**

11. **PERSPECTIVE MADE EASY**—*By Ernest R. Norling.* For draftsmen and artists, this volume tells the things they should know but often don't—all the details of perspective, simply explained and illustrated so that all rules may be easily grasped, progressively, from simple to complicated forms. **$1.85**

12. **MEN, MIRRORS AND STARS**—*By G. Edward Pendray.* New edition of a very popular book. Chief addition is a chapter on the 200-inch telescope. **$3.10**

13. **ATOMIC ARTILLERY**—*By John Kellock Robertson.* Electrons, protons, positrons, photons, neutrons, and cosmic rays in plain language. Also transmutation of the elements and manufacture of artificial radioactivity. **$2.35**

14. **JANE'S FIGHTING SHIPS, 1939.** Latest edition of a world-famed London authority on all world navies. Discussions, data, photographs, silhouettes, details of construction. A "must" reference for all with naval interests. **$22.50**

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TELESCOPTICS

A Monthly Department for the Amateur Telescope Maker

Conducted by ALBERT G. INGALLS

AS THE telescope making hobby continues to spread, the tendency to want permanent housings for the telescope increases; they save a lot of bother, and greatly add to comfort in cool weather. W. L. Moore, Coral Ridge, Ky., is the maker of the one shown in Figure 1. The lower structure serves as a tool house. The dome above it is itself 10′ in diameter and 8′ high. Its upper or hemispherical part is made of 28-gage sheet metal, with ribs similar to those suggested by Scanlon in "Amateur Telescope Making—Advanced." The vertical or skirt part is made of corrugated metal. Contrary to first appearances, however, the two parts are permanently attached to each other, an arrangement which affords a little more headroom at the sides. This puts the rollers, which are ball bearings from junked cars, down at the level of the observing floor. Moore says he can push the whole dome around with one hand. Inside, at present, is an 8″ reflector.

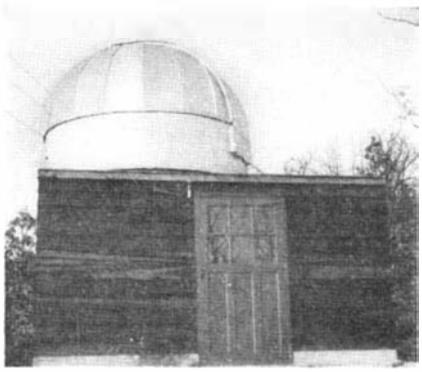

Figure 1: **Moore's observatory**

Chief value of studying others' work, before undertaking one's own, lies in finding what mistakes others made and not repeating them. Asked, therefore, what, if anything, he would not do again, Moore stated that he placed his stone pier, 30″ square, in the center of the dome, not realizing that if he ever wants to use a German or a fork mounting it will then be off-center. "If I built again," he points out, "I'd also make the seams in the dome a little higher. I turned up 1″ on one side and ½″ on the other but I should have made these 1½″ and 1″, respectively; so I had some trouble with leaks, having to use a lot of solder at the low places. I also made the frame of my shutter, which carries its two pieces of 36″ sheet metal, too light and it rubs on the dome frame, making it a bit hard to open the shutter. This wooden shutter frame rides on barn-door rollers."

A fat collection of "Things I'd Never do *That* Way Again" would be a big practical help in amateur telescope making. Who is there who couldn't contribute a few! Open invitation.

FROM Clayton F. Howe, 514 Arthur Ave., Kalamazoo, Mich., comes this note: "Here are photographs and a sketch (Figures 2, 3, and 4) of a turret eyepiece holder I have recently finished for use with my telescope. Holding a battery of three eyepieces of differing focal lengths, it is the most useful piece of equipment I have, next to my finder.

"The turret, made of aluminum, floats around on a thin film of oil and doesn't upset the aim of the telescope as changing eyepieces in the usual way often does. In freezing weather I plan to try substituting glycerine for oil.

"For convenience of representation, in the drawing, the spring-ball holder is shown opposite the large boss but, as Figure 3 shows, it actually is at one side of it. This permits the holder to be mounted nearer the main telescope tube.

"The eyepiece tubes were threaded into the turret while the whole assembly was mounted on a lathe arbor, consequently they are absolutely perpendicular.

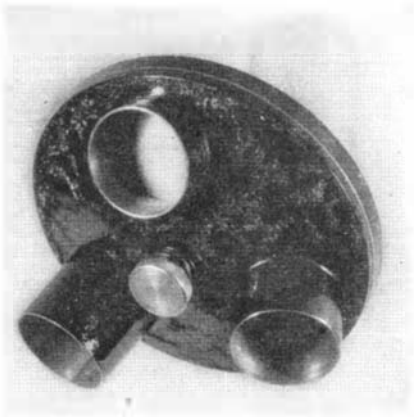

Figure 2: **Howe's turret rig**

"I am making a couple more for local TNs. I made my own patterns, and the castings from these cost me only 50 cents a set. Brass tubing was two bits and the remainder came from the scrap box."

WHILE turning over files of telescoptical items from previous years, your scribe encountered an article from *The Journal of the Royal Astronomical Society of Canada,* Sept. 1937, in which H. S. McClung, of Regina, Saskatchewan, described what he calls the "corneal reflex test." Suppose, in the regular set-up for the Foucault test, that the lamp and pinhole were removed and a small ball were substituted for it, with a strong light somewhere in front but off to the side. Then the tiny reflection of the light on the curved ball would in effect become the pinhole. This, of course, has often been done; sometimes a drop of mercury is used, or a small marble of glass, or any spherical reflecting substance.

The ball used by McClung, however, is the ball of the eye itself. This permits the effective light-source—that is, the reflection of the lamp on this ball—to lie very close to the knife-edge, thus avoiding astigmatism due to separation of pinhole and knife-edge. McClung says the light used should be strong but need not be very small in area. This light may be a disadvantage, shining, as it would, in the eye when the latter was studying the subtle shadows on the mirror. It is also hard to hold the head steady enough to conduct this test, and McClung suggests a headrest. However, some may like it. Have many been using it, since McClung published it?

Years ago in this department there was a note about using the edge of the pupil of the eye as the knife-edge and dispensing with the ordinary one. This, too, required considerable steadiness on the part of the tester. Maybe some readers will want to compound these two. We don't necessarily recommend either one for regular testing but as a variation they are interesting—like riding a bicycle while standing on your head on the seat—that is, a bit tricky.

IN THIS department, October, 1935, Joseph A. McCarroll, of Teaneck, N. J., described a penetrometer for reducing the hardness or softness characteristics of pitch to a quantita-

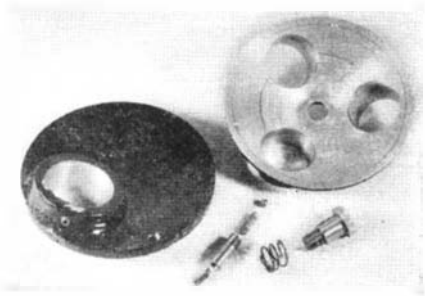

Figure 3: **Turret. Another view**

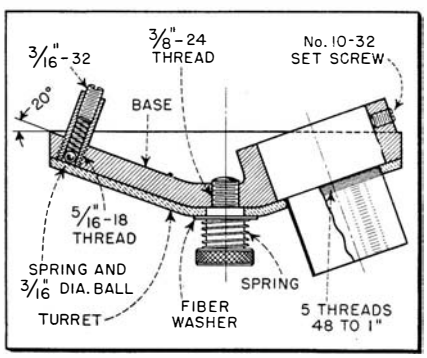

Figure 4: **Section of turret**

tive science, and, in the October, 1936, number, two more penetrometers were described. Now comes Robert E. Smith, D.D.S., Medico-Dental Bldg., Sacramento, Calif., with the one shown in Figure 5. It is made from sundry pick-me-ups, plus an optician's diopter gage to register the time-depth penetration of the point into the pitch at given temperatures. The point

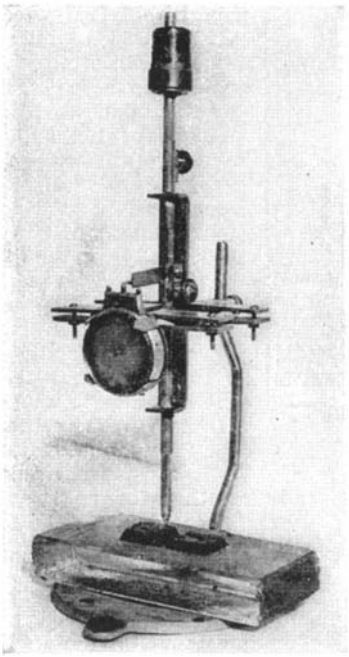

Figure 5: **Smith's penetrometer**

is shown above two pitch facets. Using this, Dr. Smith claims he knows all the time, as he works with pitch, where he is "at."

AMONG amateur glass polishers you can always get up an all-night argument about the merits and demerits of various pet fine-finishing abrasives. Here's a comment by D. Everett Taylor, 191 Prospect St., Willimantic, Conn.

"For a final step in fine grinding, before rouge, use extra fine emery in kerosene, as the grains break down easily and smoothly when so used and are much less likely to cause fine scratches."

With regard to Levigated Alumina he says, "This is a buffing flour for polishing metals and, for this purpose, it undoubtedly is tops, but when the microscope revealed that it had an extremely small grain size its use also for superfine finishing of optical surfaces was recommended. ["ATM," 4th edition, pp. 296, 493.—*Ed.*] If you are intent on using Levigated Alumina for fining glass surfaces, watch out for fine scratches."

Taylor states also that there is a glass removal of about a thousandth of an inch, between the kind of surface left by Carbo 600 and one sufficiently fined with fine flours, to be called ready for polishing. He says also that 0.0003" of glass must be removed in order to eliminate fine scratches of the kind that require magnification in

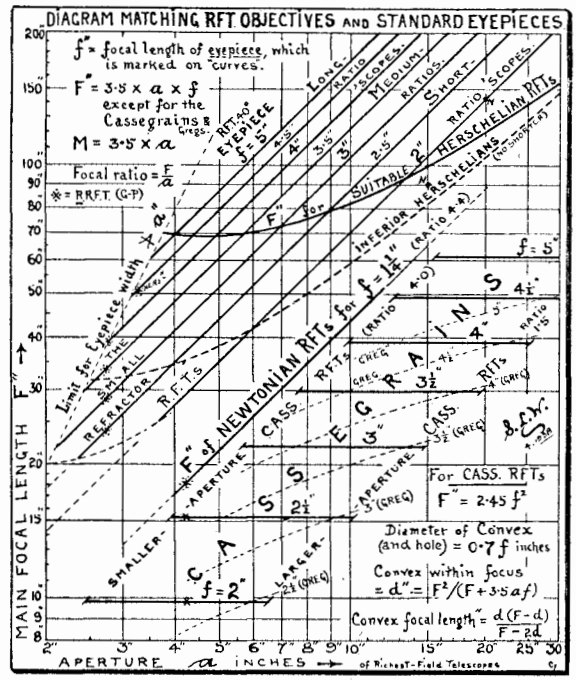

Figure 6: **Walkden's matching data**

order to be seen. Asked how he determined this, Taylor replied that the statement is based on a measurement of a lens before and afterward, using a Starrett micrometer.

INTEREST in Walkden's Richest-Field Telescope, or "RFT," continues, and many have been made. In the following contribution Walkden, whose address is 46 Cavendish Road, Harringay, London, N.4, England, discusses the matching of RFT eyepieces and objectives.

"If an amateur has an objective and wonders what eyepiece he needs to make it an RFT, he can get the answer from the accompanying diagram without even a calculation; or, if he has a few eyepieces or their lenses lying around and wonders how he could use one, if possible, for an RFT, the diagram again answers without calculation.

"A natural way of designing an RFT is to start with the aperture, *a*"; then decide on the focal ratio, *c*, then the focal length, F", and, finally, proceed to the eyepiece focal length, *f*", and the particulars of the lens. But among the eyepieces available is likely to be one not exactly but only nearly what is needed, and then, taking that nearest, we soon find ourselves working back to the main focal length and the aperture, in a matching process.

"Now the diagram of Figure 6 performs this matching process very quickly for every type of RFT—refractor, Newtonian, Herschelian, Cassegrainian and even Gregorian—and it also shows at a glance the various alternatives we might prefer to what we originally thought of constructing.

"Suppose, for example, we have in possession, or in makers' lists, a 1¼" RFT eyepiece. Looking at Figure 6, and at the sloping line for the 1¼" eyepiece, the eyepiece is seen satisfactorily to complete any Newtonian RFT of from 4" to 12" aperture, the proper focal length being read on the left-hand scale, where it is 4.4 times the aperture, agreeing with the formula near the top. The eyepiece *can* stretch over the range of 3" to 15" or even 20" aperture, but Newtonian RFTs of less than 4" aperture are not good, being too much choked by their flats; and Newtonians of 15" and 20" aperture are better with eyepieces of 1¾" and 2" focal lengths and main focal lengths of 92" and 140", and even then they hardly equal large Herschelians. While considerable margin is allowable, especially for eyes not very sensitive to the blind spot (image of the flat) in the center of the Newtonian's Ramsden circle, it is always as well to keep in mind that for an eyepiece of *f* inches focal length, the best aperture under the minimum-obstruction rule is given by $a = 4.9\ f^2$ inches. But eyepieces of less than 1" should not, and over 2½" need not, be considered candidates for Newtonian RFT construction; and the apertures of less than 3", and even 4", are really not allowable. The "best" Newtonian line, $a = 4.9\ f^2$ or $F = \sqrt{2.5\ a^3}$, may be seen to cross steeply the 1¼" eyepiece line at 7.6" aperture.

"If we have only the 1¼" eyepiece we should not think of any other RFT than a Newtonian of moderate aperture; but suppose the RFT eyepiece is of 3" focal length. This 3" eyepiece can be seen to complete any refractor RFT of over 2¼" aperture, of about the focal length to be read on the left-hand scale, 10.5 *a* inches, corresponding to the formula near the top. Or, paying regard to the thick Herschelian curve, the eyepiece will complete good Herschelian RFTs of about 5" to 10" or even greater apertures, all of the same focal lengths as refractors, or like the formula near the top.

"Should our preference be for a Cassegrainian RFT, the 3" eyepiece will complete any such RFT of 22" main focal length, ranging in aperture from about 5¾" to 14½", chosen larger according to experience and skill in figuring mirrors of small focal ratios when aided by Kirkham's scheme of using a spheroidal small convex mirror (see Scientific American, June, 1938). The formulas in the right hand lower corner may also aid the constructor; and the peculiarity of the Cass RFT may throughout be noticed, that the focal length of the eyepiece primarily determines only the *focal length* of the main mirror, leaving the aperture to be chosen from independent considerations.

TELESCOPTICS

"Should a Gregorian RFT be chosen (although it gives little reason for being liked), the 3" eyepiece will complete such an instrument, ranging from a 4¼" of 11" focal length to a 10" of 16" focal length.

"In another use often required of the diagram, suppose we have already decided on 6" aperture, and have the choice of several RFT eyepieces. Proceeding upward from the bottom of the diagram at 6" aperture, we can evidently have a 6" Cass RFT of 9.8" main focal length, employing an eyepiece of 2" focal length. And the Cass rules in the right-hand lower corner tell how the convex and the hole are both to be of 1.40" diameter; also how the convex is to be 1.85" within the main focal point, and be of 2.42" focal length. The alternative Cass RFTs of greater focal lengths, employing larger eyepieces, are easier to make, but they are less and less efficient.

"In 6" Gregorian RFTs we can have one of 10" main focal length, employing a 2½" eyepiece, but it is not a very good instrument. The alternatives of longer focal lengths, employing larger eyepieces, while easier to construct, are even less efficient.

"The 6" Newtonian RFT is one of 26" focal length, employing a 1¼" eyepiece, and is the useful handy kind of RFT which is perhaps the most liked, until the virtues of the Herschelians come to be further realized. Again, in connection with Newtonians, the 6" mirrors can be matched by others than the recommended 1¼" eyepieces. The 'best' eyepiece corresponding to minimum-obstruction design is always of focal length equalling $0.45\sqrt{a}$ inches, which is 1.10" for a 6" mirror, but the insensitiveness of some eyes to the blind spot in the Newtonian's Ramsden circle allows of considerable variation in the eyepiece focal length. When f is decided upon, the mirror must always be made of focal length $F = 3.5fa$ inches, and the flat be arranged according to the rule given in 'ATMA'. An aperture less than 3" or even 4" should not be assumed for a Newtonian RFT—and an aperture greater than 25" perhaps need not be assumed.

"The 6" Herschelian RFTs begin to be quite good at 63" focal length, employing a 3" eyepiece, but 72" focal length, using a 3½" eyepiece, proves better in definition. Only the fastidious might want still greater focal length employing a still larger eyepiece. It is curious to notice that the *larger* eyepieces go with the *smaller* Herschelian RFTs, contrary to the rule for the Cassegrainian and even the Newtonian RFTs."

As no 3" eyepiece is known to be available on the market, the amateur must make his own. For this, Walkden gives the following data on a Ramsden of the usual two plano-convex lenses. Focal length of each lens, 4". Distance of lenses apart, 2.67". Diam. of field lens, 2.31"; of eyelens, 1.3". Eye-hole distance suiting smallest need, 7/8". Eye-hole diam., ½".

LEGAL HIGH-LIGHTS

Patent, Trade Mark, and Related Legal Proceedings That May Have a Direct Effect on Your Business

By ORSON D. MUNN, Litt.B., L.L.B., Sc.D.
New York Bar
Editor, Scientific American

Reissue

THE Supreme Court has held that a charge of patent infringement cannot be maintained against a defendant who acquired and used a machine subsequent to the granting of an original patent, which did not infringe that patent but which does infringe the claims of a reissue patent applied for subsequent to the time when the machine was acquired.

In the case in question a patent was obtained on a machine for treating nuts by mixing butter therewith so as to make them more appetizing. After the patent was issued the defendant purchased and used a machine for the same purpose which did not infringe the patent. Subsequent to the time that the defendant purchased the machine the patentee applied for and obtained a reissue of the original patent. The reissue patent was of broader scope than the original patent and several of the claims were infringed by the machine acquired by the defendant.

The controversy arose over the charge of the patentee that the defendant's machine infringed the reissue patent. The Court held that by acquiring the machine which did not infringe the original patent during the period between the granting of the original patent and the filing of the application for the reissue, the defendant had obtained intervening rights which permitted him to continue using the machine even after the time that the reissue patent was obtained. The Court pointed out that when the original patent was granted it was presumed that everything not claimed therein was dedicated to the public by the patentee and that anyone had a right to rely upon this presumption. Under the circumstances the patentee was held to be estopped to enforce the reissue patent against the defendant.

Privacy

A FEDERAL Court has recently sustained the right of a periodical to publish news articles describing the intimate details of the private life of a person regarded as a public figure.

A popular magazine published an article describing the life of a man, who in his childhood and youth, was widely heralded as an infant prodigy. The article described his early brilliance and accomplishments and the widespread attention and publicity which he received. It then described his general breakdown and the revulsion which he afterward felt for his former life of fame and study. The article pointed out that he attempted to conceal his identity and to escape publicity by choosing a career as an insignificant clerk.

Suit was filed by the unwilling subject of the article, contending that it constituted an unwarranted invasion of his privacy. The Court, however, disagreed with this contention and dismissed the complaint, holding that the article was not an illegal invasion of his right of privacy. In reaching its conclusion the Court first pointed out that it was not contended that any portion of the article was untrue. The Court conceded that it was "merciless in its dissection of intimate details of its subject's personal life." On this point the Court ruled, however, that the facts with regard to even the private lives of persons regarded as public figures had legitimate news value, and as such, could be published by a periodical.

The reasoning of the Court in reaching its conclusion is set forth in the following quotation from its opinion: "Revelations may be so intimate and so unwarranted in view of the victim's position as to outrage the community's notions of decency. But when focused upon public characters, truthful comments upon dress, speech, habits and the ordinary aspects of personality will usually not transgress this line. Regrettably or not, the misfortunes and frailties of neighbors and 'public figures' are subjects of considerable interest and discussion to the rest of the population. And when such are the mores of the community, it would be unwise for a court to bar their expression in the newspapers, books, and magazines of the day."

Bad Faith

IT has recently been held by the New York Supreme Court that a manufacturer, who falsely and in bad faith notified the customers of a competitor that he was the owner of a trade mark and that it was duly registered in the United States Patent Office, was guilty of unfair competition.

In the case in question the ownership of the trade mark was in dispute between two competing manufacturers. The trade mark was not registered by either of the manufacturers in the United States Patent Office. In spite of this fact, one of the manufacturers notified the customers of

the other that he had registered the mark in the Patent Office and that it was protected by the federal trade-mark laws.

The injured manufacturer brought suit charging unfair competition and the Court sustained the suit holding that the false notices, sent in bad faith, constituted unfair competition. While the injured party sustained a moral victory, and no doubt a certain amount of consolation from the victory, he did not receive any tangible recompense for his injuries. The Court held that the damages were of too speculative a character to be definitely ascertained and awarded only nominal damages in the amount of one dollar.

Inescapable

IN a decision which is unusual only in that the conclusion reached is so obvious that a layman might wonder why it was necessary to obtain a judicial determination, it was held that a talking moving-picture is a moving picture. The owner of a copyright on a play granted the exclusive motion-picture rights in the play to a moving-picture producer who subsequently produced a talking moving-picture based on the play. It was contended by the copyright owner that the talking moving-picture infringed his copyright since he had not granted the right to use the dialogue.

The copyright owner argued that according to a custom in the industry the granting of motion-picture rights in a play did not in and of itself give the right to use the dialogue. The Court rejected this argument, however, pointing out that the copyright owner had granted the exclusive motion-picture rights to the producer and that a talking motion-picture was undoubtedly a motion picture.

In this connection the Court stated:

"The plaintiff cannot escape the obvious conclusion that a talking motion-picture is a motion picture."

Paint Remover

A PROCESS for removing paint by means of infra-red rays was held to be patentable by the Court of Customs and Patent Appeals. The process consisted of generating a beam of infra-red radiation substantially parallel to the internal line focus of an elongated reflector, and then externally focusing the rays upon a paint-covered surface. The Patent Office held that the process was not patentable in view of a prior patent which disclosed the use of infra-red rays without a reflector for the removal of paint.

The Court reversed the Patent Office and held that the process as described above was patentable because it was not only new, but also produced useful and improved results over the old method which did not employ a reflector.

CURRENT BULLETIN BRIEFS

(The Editor will appreciate it if you will mention Scientific American when writing for any of the publications listed below.)

INTRODUCTION TO POLARIZED LIGHT AND ITS APPLICATION, by Martin Grabau, is a 46-page booklet that presents in compact form a complete survey of the principles of polarized light; it continues with brief descriptions of the uses of polarized light and the advantages that can be obtained. It covers a number of industrial applications. A bibliography points the way toward more comprehensive study. *Polaroid Corporation, Cambridge, Massachusetts.—50 cents.*

RECREATIONAL RESEARCH is a 64-page booklet which presents the findings obtained as a result of observing and studying various recreational projects. It deals with both historical and recent trends as well as the general sociological effects of leisure-time occupation. It also goes into such phases as economic effects, professional aspects, and personal health as influenced by recreation. *G. M. Glass, School of Health, Physical Education and Recreation, Louisiana State University.—$1.00.*

TENITE SPECIFICATIONS is a 28-page book that presents first a classification of the various types of this plastic and then proceeds to give in tabular form specifications regarding them. *Gratis to manufacturers, molders, and designers. Tennessee Eastman Corporation, Kingsport, Tennessee.*

FOTOSHOP HANDBOOK OF COLOR is a 102-page book containing a complete description of every type and make of color camera and accessory. The book also includes thorough laboratory instructions for all the popular color-printing processes, technical data on all films and filters, light and equipment related to color photography, a course in the fundamental principles of color photography and a complete supplement devoted to comprehensive reviews of books on color photography. The book includes five pages of natural color photographs by outstanding color photographers, printed in four colors. Stainless steel wire binding, cross-indexing with manila separators, periodic supplements without extra charge, moisture proof, chemically resistant cover printed in six colors, merchandise directory, are other features. Size 5¼" by 8¼". *Fotoshop, Inc., 18 East 42nd St., New York, New York.—$1.00, refundable on cumulative purchases totaling $10 or more.*

THE NURSING CARE OF PATIENTS WITH INFANTILE PARALYSIS, by Jessie L. Stevenson, R. N., understandably deals with the practical care of patients having that disease, and is furnished by the foundation which has been linked with the President's Birthday Fund. *The National Foundation for Infantile Paralysis, Inc., 120 Broadway, New York, N. Y.—Gratis.*

DEVELOPMENT AND MANUFACTURE OF OPTICAL GLASS IN AMERICA, by M. Herbert Eisenhart (President of the Bausch and Lomb Optical Co.) and Everett W. Melson, is a reprint of a technical article. *The authors, Bausch and Lomb Optical Co., Rochester, N. Y.—Gratis.*

MU-SWITCH is a 10-page catalog giving complete information on a series of switches that have wide industrial and experimental applications. These switches are of a type in which a very short movement of the actuating mechanism—only .001 of an inch—gives positive make and break. Through a reverse-action cross-center principle, the action of the contacts is sufficiently rapid to prevent arcing. The switches are available in a number of different styles having wide variety of purposes and are designed to handle loads up to two kilowatts. *Mu-Switch Corporation, Canton, Massachusetts.—Gratis.*

SUCCESSFUL FINE-GRAIN NEGATIVE PROCESSING, third printing, is an informative little handbook presenting a complete explanation of the process of fine-grain developing, stripped of technicalities. Included are detailed instructions for the actual development of an exposed roll of film. *Service Department, Raygram Corp., 425 Fourth Avenue, New York, N. Y.—5 cents.*

TRANSPORTATION PROGRESS, by Arthur Pound, is a 52-page reprint from "The Turning Wheel." It traces the history of self-propelled vehicles from earliest times down to the modern motor car. Included are a number of interesting drawings of ancient vehicles. An appendix lists milestones in transportation. *General Motors Corporation, Detroit, Michigan.—Gratis.*

SCREW MACHINE ENGINEERING is a new monthly periodical which should be of interest to all whose work touches in any way upon machine production that involves the use of turret lathes, chucking machines, and other equipment in the screw machine field. *Screw Machine Engineering, 34 West Main Street, Rochester, New York.—Subscription rate on application.*

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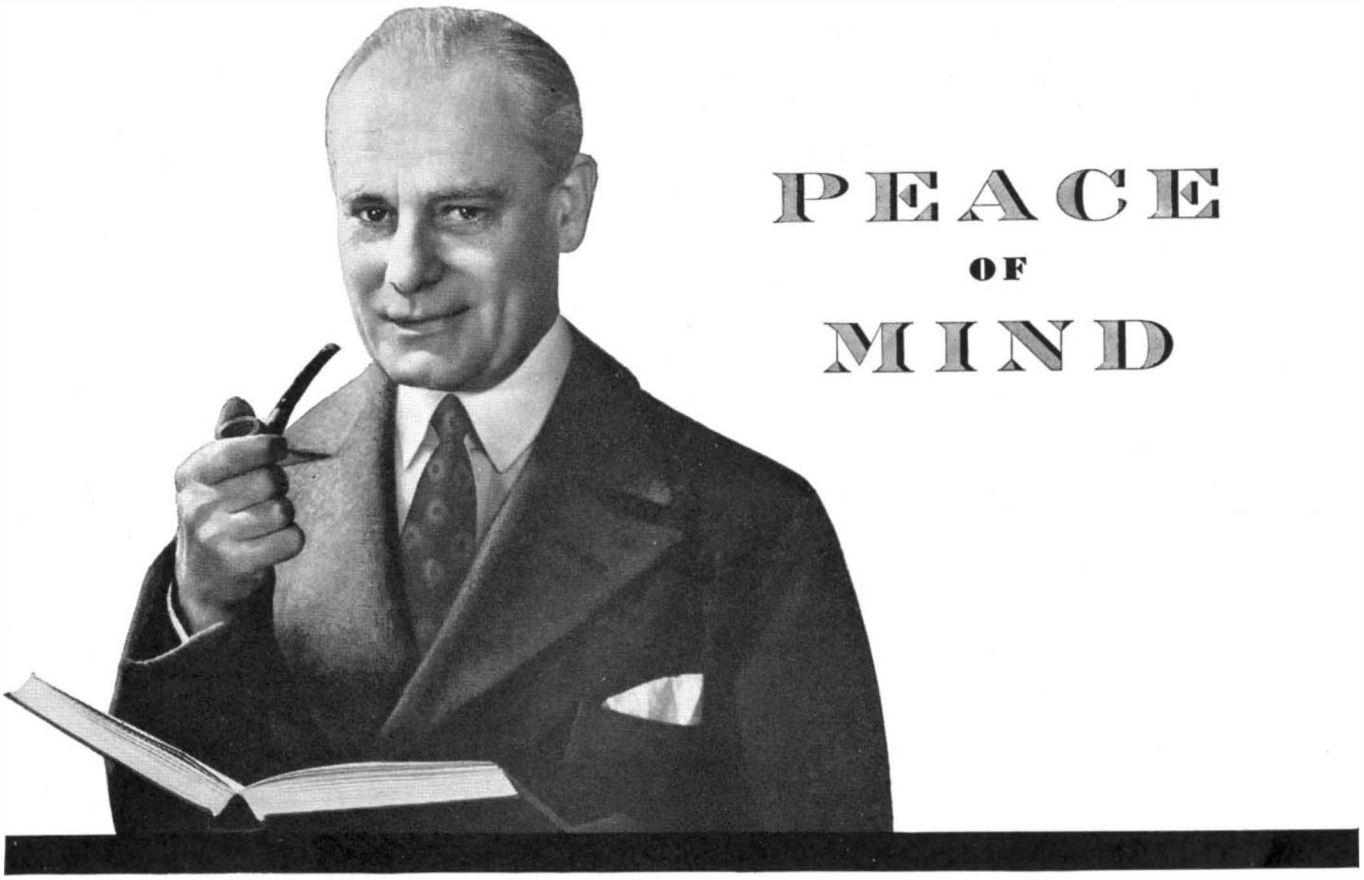

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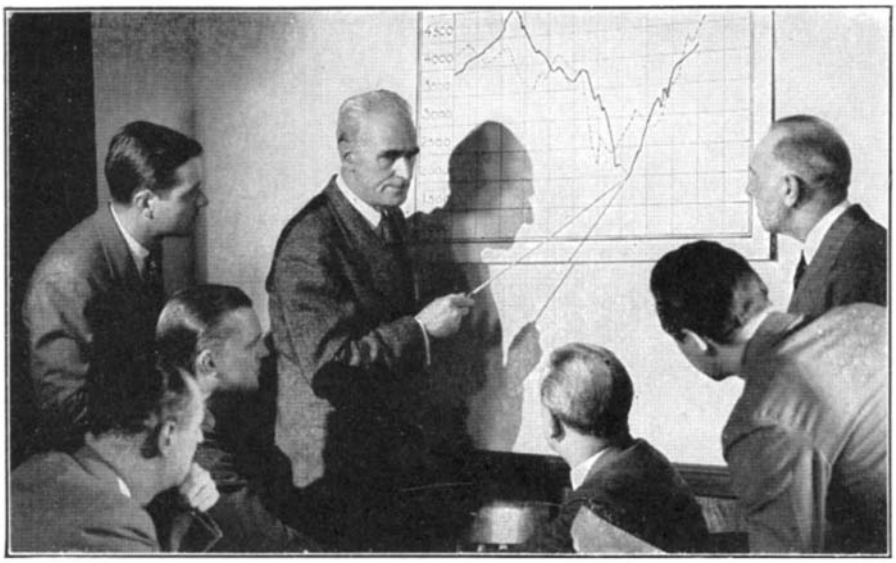

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