What It Means to be Lazy

By DONALD A. LAIRD

SCIENTIFIC AMERICAN

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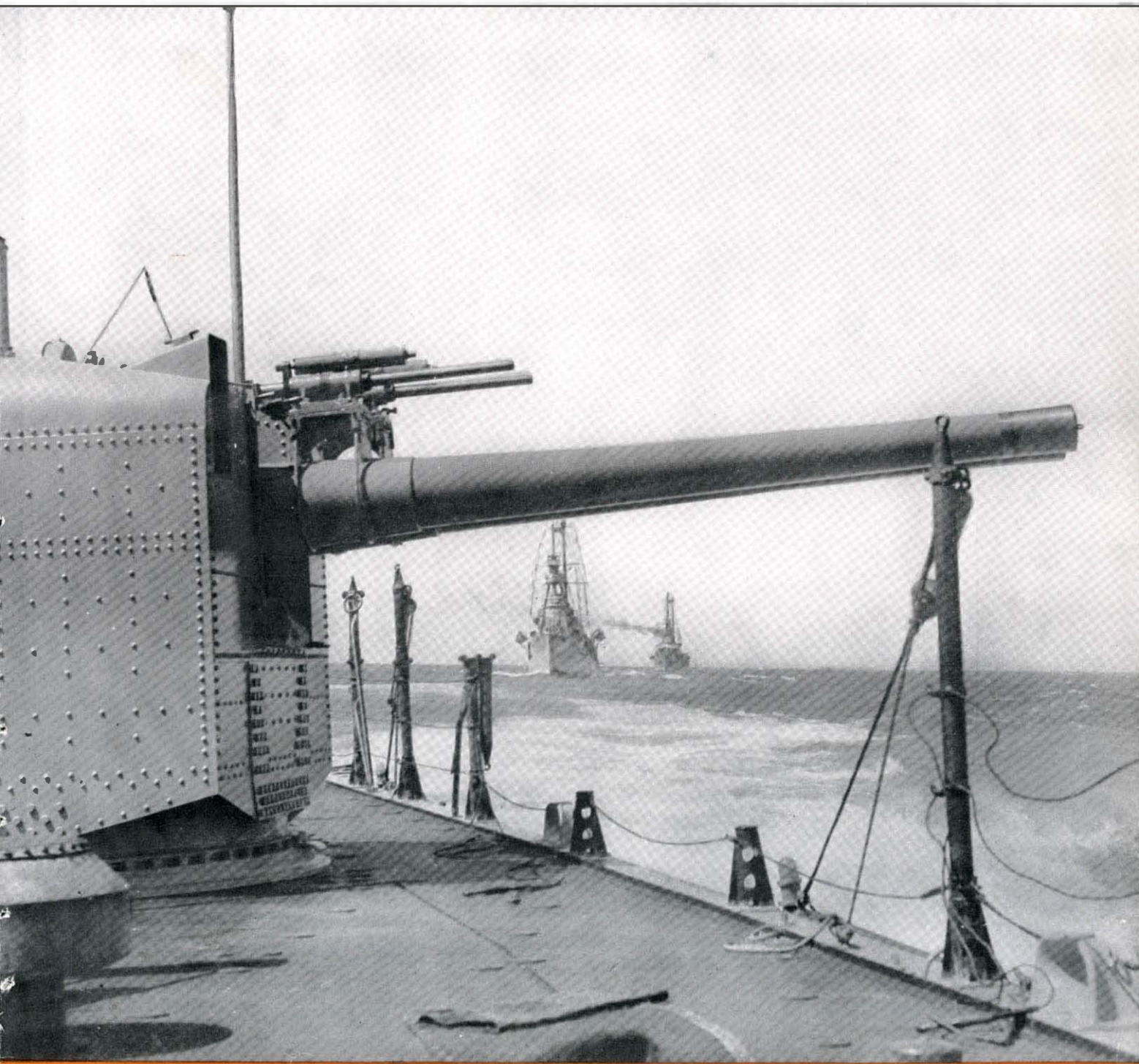

Cruisers—Our First Line of Defense (See page 18)

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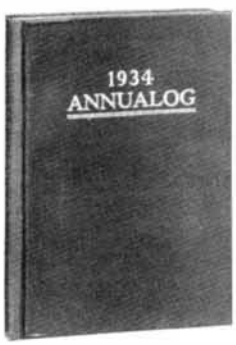

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NINETIETH YEAR • ORSON D. MUNN, Editor

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ACROSS THE EDITOR'S DESK

SO many of the motor-car models of 1933 have been streamlined to a certain extent that the trend of the industry is obvious. Cars for 1934 will undoubtedly show a continuance of this tendency toward the application of aerodynamics to the automobile. It is apparent that manufacturers are conducting an "educational campaign" for the public, and gradually making the large group of car users accustomed to the radical changes that will have to be made before the real benefits of streamlining may be reached. Just as the car of 10 years ago appears odd and clumsy in appearance beside the sleek models of today, so those of 1933 will compare, to their detriment, with the vehicles of 1943. Of course, the motor-car driver wants to know just what streamlining means to him. Will it be of large economic importance, or will it be just another selling point with little actual significance? We have in preparation one, and possibly two or more articles on this subject that will answer many of the pertinent questions which have been asked and which will surely arise in greater numbers in the near future. We expect to present the first of these articles next month.

●

"Blister Busters." This alliterated phrase is the title of an article by Charles Lathrop Pack, president of the American Tree Association, which is scheduled for early publication. The blisters are those of the blister rust that attacks white pines and renders the wood useless for commercial purposes. The "busters" are the Division of Blister Rust Control of the United States Department of Agriculture assisted by the men of the Civilian Conservation Corps. "This invader," writes Mr. Pack, referring to the blister rust, "is a modernist in methods of warfare. He employs the most vicious and subtle of the tools of death—germ warfare." How the blight of this rust spreads, what steps are being taken to control it, and how successful the campaign has been so far, make an article that is at once both interesting and informative to anyone who has ever used wood in any form—and that includes everyone.

●

". . . Campaigns against smoke and dust get satisfactory results only in cities where physicians take a leading hand. . . . Only recently have leading combustion engineers fully demonstrated their ability to fill a prescription for the smokeless and dustless operation of fuel burning plants. . . ." Thus writes Dr. W. W. McFarland, Director of Public Health, Pittsburgh, Pennsylvania, in an article entitled "The Doctor Looks at Smoke and Dust," scheduled for an early issue. Solid particles of foreign matter in the atmosphere, particularly in winter, constitute a definite health menace in many localities; therefore Dr. McFarland's impartial yet searching survey of the whole situation is of vital importance to every municipality.

●

The sundial, known to the ancients and widely used today as a garden ornament, may, when properly designed, be used as a practical and accurate timekeeper that will indicate mean solar (watch) time. Definite instructions for making various types of dials are difficult to obtain and when found are often vitiated by the inclusion of irrelevant material. We have, however, obtained a series of articles from R. Newton Mayall and Margaret Walton Mayall, which get right down to fundamentals and give concrete directions as to how to proceed. Many inquiries from readers on this subject lead us to believe that these articles, the first one of which will appear next month, will be given a warm reception.

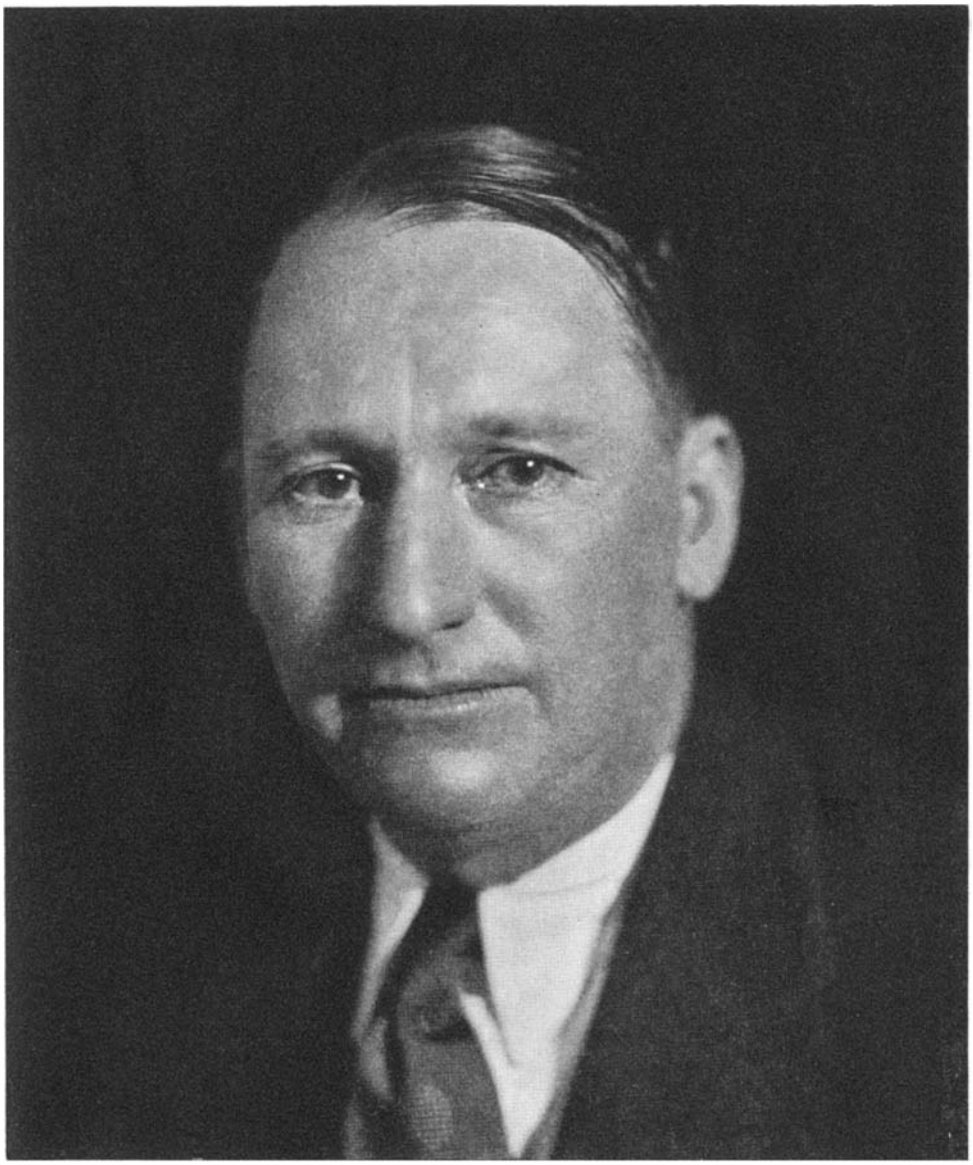
●

"Is it true that only 12 people are able to understand the Einstein theory of relativity?" This is a question that is often asked when the name of the great physicist is mentioned. According to Joseph B. Nichols, writing in next month's number, it all depends on what is meant by "understanding Einstein." Mr. Nichols' article, which was read and approved by Professor Einstein himself, carries the following title: "You Have One Chance in a Hundred to Understand Einstein." Those are not bad odds, so be sure to read the article, and find out on which side of the fence you fall.

●

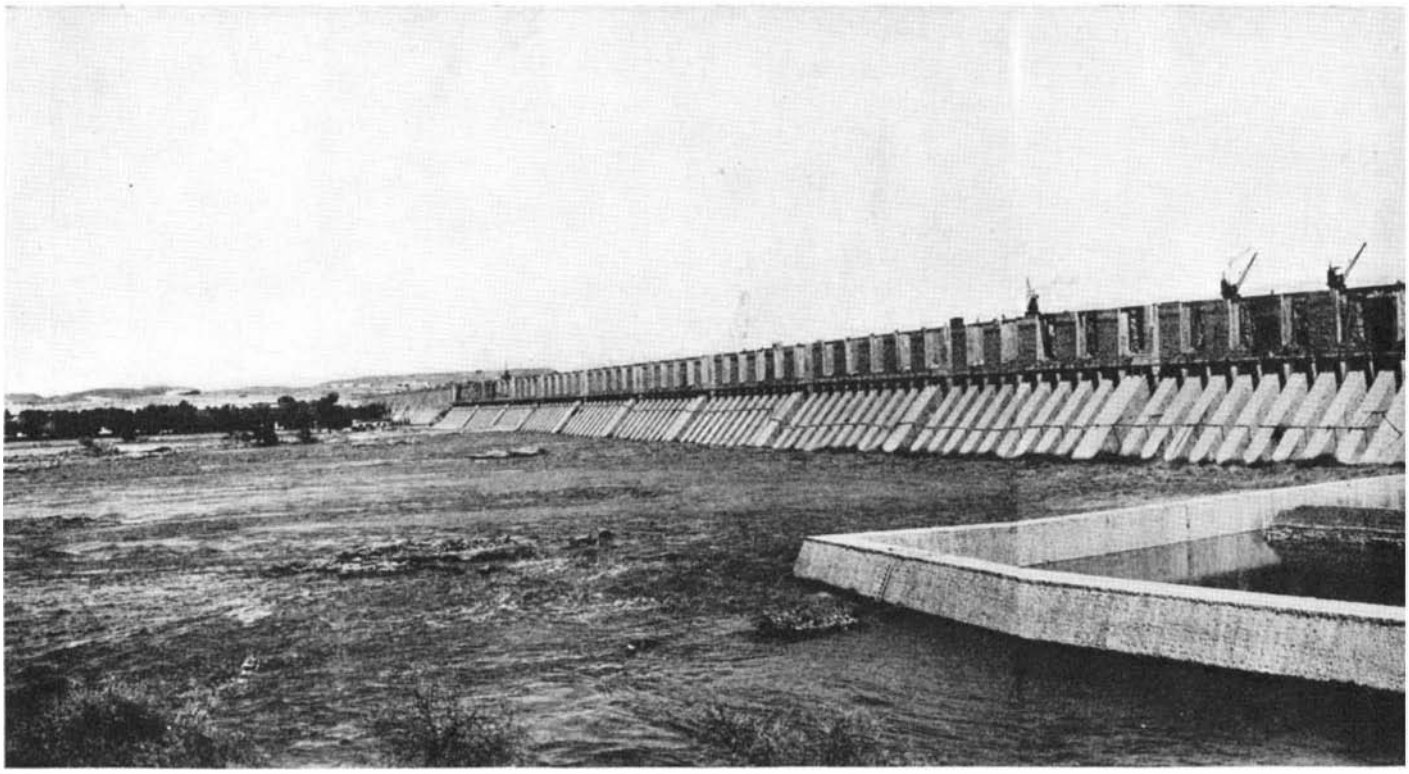
Ultra-short radio waves are coming more and more before the public, not only because of the work which Marconi is doing with them, but also because of the wide-spread applications that the waves promise in many phases of human existence. For these reasons, we have been particularly fortunate in obtaining, from Prof. F. Zwicky of the California Institute of Technology, an article on the subject of ultra-short radio waves that sketches their history, their nature, and their technical and scientific importance. This article, scheduled to be published soon, tells the story of the extreme lower end of the radio wave bands in the clearest and most concise manner that we have ever seen.

Editor and Publisher

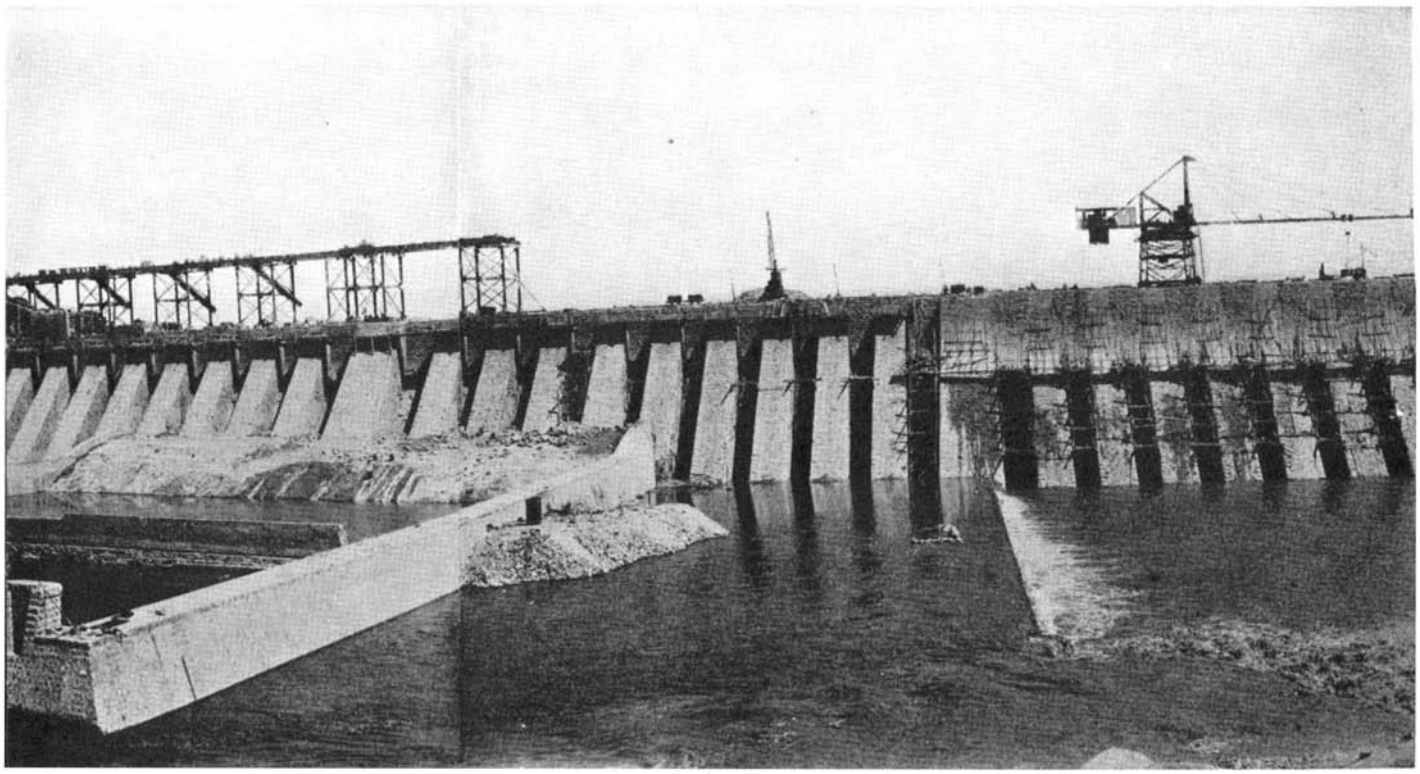


LEE A. STRONG

THAT a man who lacks a formal education and may not add a string of university degrees to his name cannot hope to gain a serious hearing in the world of science appears to be the belief of many —especially of some who complain to the editors of scientific journals that their ideas are not taken seriously for this reason. That this is not the case is proved by the attainments of several men of science whose education was not spoon fed to them. For example, the dean of one of America's best universities never went to college, yet he is a high-ranking paleontologist as well as a dean. Another man who has no college degree but educated himself, yet who "got there" in the world of science, is Lee Strong, the new Chief of the Bureau of Entomology of the United States Department of Agriculture. His life work has had to do with the prevention of the spread of plant pests and diseases—saving millions (probably billions) to farmers and the nation—sometimes by their eradication, sometimes by quarantines which prevent their introduction from other lands.



Construction work behind gate No. 2 recess locks of Assouan Dam. It will be noted that in this work, as in the original and in the first heightening, a large proportion of the structure is made up of stone rather than reinforced concrete



Panorama showing construction work in progress on the Assouan Dam in 1932

HEIGHTENING THE ASSOUAN DAM

Unusual Engineering Problems Are Involved in Egypt's Second Heightening of the Famous Assouan Dam, Greatest of Massive Monuments on the Nile

By HAMILTON M. WRIGHT

THE most marvelous of Egypt's wonders is nearly complete. In January, it is estimated, the second heightening of the Assouan Dam, which blocks the Nile River at Assouan, 551 miles south of Cairo,* will have been finished at a total cost, from commencement to final completion, of over 12,000,000 Egyptian pounds.

The capacity of the original dam, built in 1902 and once before heightened in 1912, will be approximately doubled by this huge operation, with vast benefits to the Egyptian farmer from the extra two and one half billion cubic meters of water stored. The new waters will allow the irrigation of approximately 1,000,000 acres, representing about one seventh of the Egyptian soil now under cultivation. The Egyptian Government proposes ultimately to double its present farm acreage as its comprehensive plan for the storage of Nile waters develops, until 13,000,000 acres, the estimated limit of cultivatable land in Egypt, is reached.

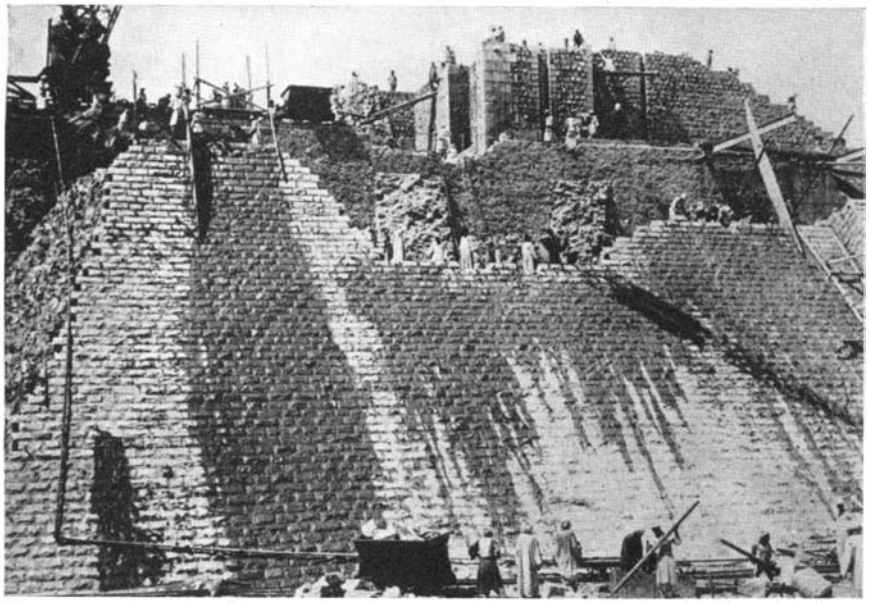
The second raising of the Assouan Dam, one and one quarter miles long, embodies many highly technical considerations. The first heightening was a relatively simple affair although it increased the capacity of the Assouan Reservoir from one billion to two and a half billion cubic meters of stored waters. The chief problem in the present heightening was in determining some different and equally effective method by which the dam could be raised, since preliminary investigation revealed that it would be unsound to use the same methods for the second elevation as were followed in the first.

IN November, 1929, the Egyptian Government appointed an international committee of engineers to discover a practical way of heightening the Assouan Dam. The committee was officially called the International Technical Commission and consisted of Colonel Hugh L. Cooper, an American engineer of note, H. E. Gruner, of Switzerland, and W. J. E. Binnie, of England. Their duties were to look over all plans submitted for the heightening and to submit any proposals of their own for the accomplishment of the gigantic task.

They submitted a program which was accepted by the Egyptian Government and work was begun early in 1929. Some idea of the huge amounts of material employed may be had from the engineers' construction plans. Totals of 176,000 cubic meters of granite rubble masonry, 168,000 cubic meters of concrete and masonry, 425,000 cubic meters of granite masonry, besides thousands of tons of concrete and iron rods, tubing, and sheathing are provided for in the plans of the technical commission.

The designs of the commission called for a unique procedure in raising the dam. The existing construction, originally a monolith, had been thickened during the first heightening from 1907 to 1912, but it was feared that a repetition of this method devised by Sir Benjamin Baker, England's engineering genius, would defeat its purpose. Accordingly, an unusual procedure for this important work was adopted. The plan, as executed, called for sliding buttresses, leaning on, but not bonded to, the downstream surface of the dam which is built of rough "rock faced"

*See map on page 259, December, 1933, *Scientific American*, with the article "Harnessing the Nile."



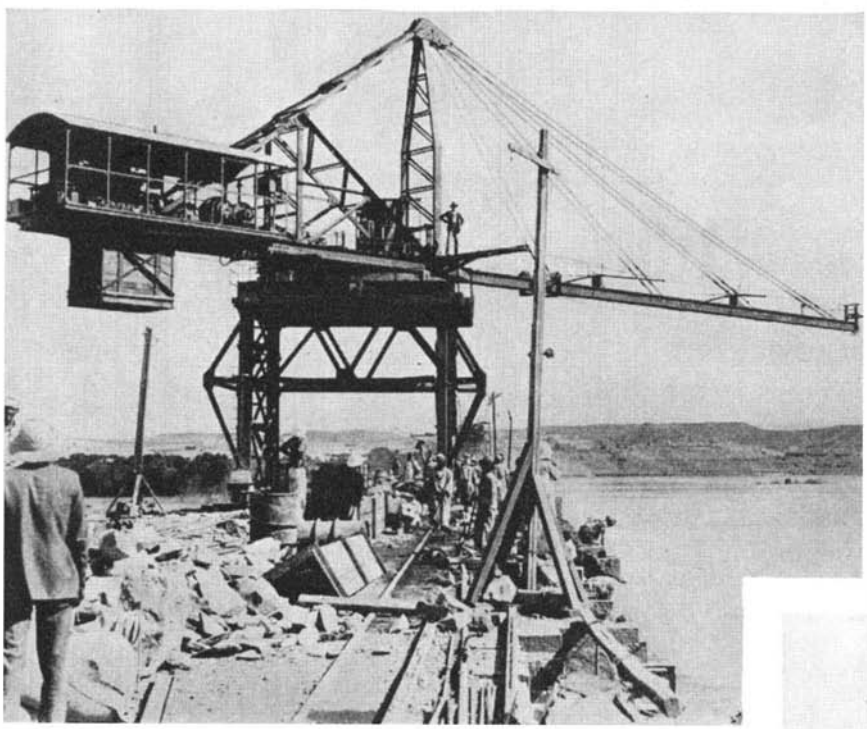
granite that was smoothed to a mathematically true plane before the new buttresses were laid against it. When this was done, sheets of stainless steel were laid on and the masonry of the new buttresses was built against them. A property of the stainless steel which insured its successful usage is that cement mortar and concrete fail to stick to it. The result of this form of construction is a series of buttresses leaning heavily against the downstream surface of the dam, assisting it to withstand the increased pressure being borne upon it by the enlarged reservoir, but entirely free to contract and expand in accordance with wide variations in daily and seasonal temperatures which in this part of the world are known to vary as much as 140 degrees, Fahrenheit.

THE buttresses are all built at this writing. The only part of the project still unfinished is an eighth of a mile along the top of the western extremity of the dam. This part of the work will be concluded in the same manner as the much greater portion already elevated. Sections seven meters (23 feet) wide by seven meters high, interspaced by seven meters of the old dam top, are first built to cover a given distance on the original crown instead of heightening a part of the dam wall as a unit. Engineering practice demands that this method be followed instead of building the heightening wall in one operation since a long masonry construction could have insufficient allowance for contraction of its materials. To heighten the Assouan Dam in a single operation with a super-structure one and one quarter miles long would thus be impossible. Four months after the sections have been built, during which time they have been allowed to set, the intermediate sections are constructed. An asphalt seal is inserted in the joints between each pair of sections, the upstream surface of the joints being caulked with lead wool. Each asphalt seal is provided with pipes so that at any future time, the seal may be tightened up with steam if necessary.

Another interesting feature of the work partially done is the reinforcement of the upstream surface of the solid dam by means of hollow stainless steel rods, to resist possible tension on the upper portion of the dam when the reservoir is full. To accomplish this, holes have been drilled from the present roadway level on its top right through the dam and two meters into its bedrock foundation which is a wide vein of red granite spanning the Nile River basin at this point. Corresponding holes are left in the heightening blocks and when the job is completed the rods are consolidated into position by liquid cement being grout-forced about them.

If all of the silt carried into the Assouan Reservoir by the Nile within the next 50 years were deposited there (and this cannot occur), 150,000,000 cubic meters of silt would be left in the reservoir basin. The reservoir has a capacity of 5,000,000,000 cubic meters, precluding any danger of an appreciable decrease in its capacity. The sluices in the dam have been constructed at low levels and during flood times are kept fully open to allow the turgid flood waters to flow out freely.

The new backwater of the Assouan Dam will extend beyond 184 miles south of the dam, its farthest point at present. As in the past, land totally submerged will be expropriated and land covered with reservoir water for a part



At top of page: **The rock for facing the dam came from the ancient quarries from which obelisks and giant sculptures once were cut**

Above: **The type of traveling crane used on top of the dam for handling the heavy stones and great quantities of other materials**

At right: **View of construction work on lock No. 1, showing progress of work in the early stages. Interesting details are visible**

of each year will be partly compensated for. Some of this area will be used to grow crops during the period of time it is exposed.

The Egyptian Government has already drawn up plans for the allotment of the two and a half billion cubic meters of water that will be available from the Assouan Dam next year. Thousands of acres of barren and inadequately irrigated land, ranging in location from the Assouan province down along the Nile River Valley to the Delta, will be rendered highly productive by this mineral bearing water.

The scheme in brief provides for the distribution of the stored waters as follows:

1. Four hundred million cubic meters will be used to complete the irrigation facilities of 400,000 feddans (1 1/10 acres = 1 feddan) of farm land now inefficiently irrigated in the Northern Delta and which lie within the drainage pump zones now under construction in this region.

2. Four hundred million cubic meters to guarantee rice cultivation in the Northern Delta within the provinces of Behara, Gharbia, Dakahlia, and Sharkia.

3. Six hundred million cubic meters for irrigation of the Sharqi lands and to improve crop rotations in Middle Egypt and the Delta.

4. Five hundred million cubic meters to convert 100,000 feddans in Upper Egypt from basin to perennial irrigation in the Assouan and Giza provinces and part of the Nile "Sahels."

5. Four hundred million cubic meters to convert 100,000 feddans of wasteland in the Northern Delta drainage pump zones to productive farmland.

6. Forty million cubic meters to convert lands in the vicinity of Kena and Luxor from basin to perennial irrigation. This step will provide cooler weather for the towns in this area.

7. One hundred and sixty million cubic meters for subsidiary objectives.

A large part of the drainage facilities of the farmlands to benefit by the new water supply has already been completed and every effort will be made to complete in entirety the drainage systems of these lands in time to receive the additional water supply that will be available from the heightened dam in the winter of 1934.

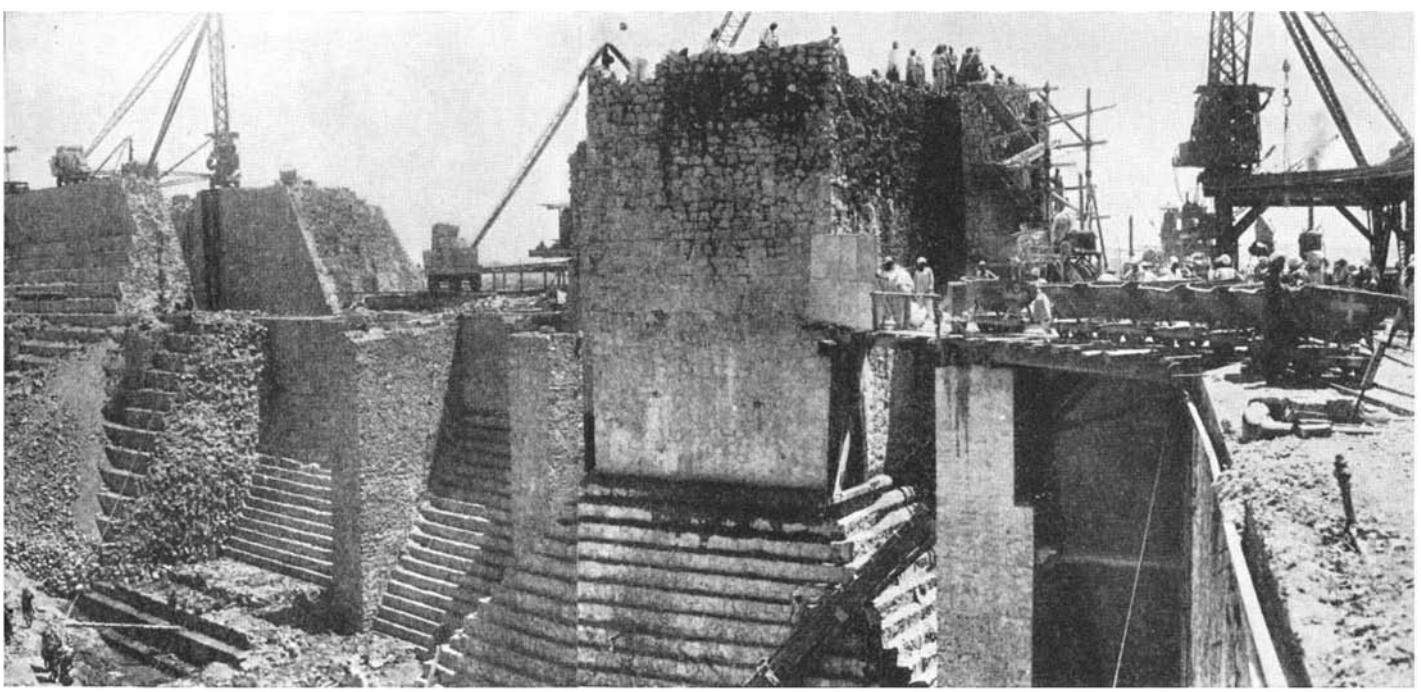
Although the original Assouan Dam was first heightened in the years from 1907 to 1912 and many other works for controlling the Nile water supply were built during the first part of the present century, this construction has been insufficient due to a steady increase in Egypt's population and a fast improving standard of living which required a more intensive realization of Egypt's agricultural resources.

The object of the Assouan Dam, which was the greatest single irrigation project in the history of Egypt, was to store one billion cubic meters of water for the summer requirements of 300,000 feddans converted in Middle Egypt from basin to perennial irrigation. The dam was then 128 feet high and one and one quarter miles long. The cost of construction was about 15,000,000 dollars. In 1904, it was found necessary to protect the rock downstream of the dam by erecting masonry aprons. This work took two years to accomplish and cost over 1,500,000 dollars.

The storage capacity of the dam was increased from one billion cubic meters to two and a half billion cubic meters, and 100,000 feddans of desert land in Middle Egypt were added to Egypt's farm area when the dam was first heightened by 16½ feet. This construction involved the thickening of the dam by the building of a five-meter wide block of stone on its downstream face, and a corresponding heightening. The money spent for this work amounted to 6,100,000 dollars. At that time, "free drainage" schemes were not in operation in the Northern Delta, beginning about 551 miles north of the dam. Strangely enough, most of the delta lands require irrigation in the summer but a difficulty arises in draining a large part of this, after it is irrigated by flooding, because of the fact that it is below the level of the Mediterranean Sea, so drainage pumps were necessary.

THE drainage system in the Northern Delta is now undergoing important modifications through government work so that the additional supply of water to be created when the present heightening of the Assouan Dam is completed can be fully utilized in summer irrigation for this region. Sixteen pump stations, located at strategic points, are now under construction throughout the Northern Delta and are to be electrically driven by power supplied from three central power stations located in the eastern, central, and western parts of the delta. A number of these stations are already completed and the remainder are in various stages of completion. The main and subsidiary pumping stations are all to be connected by a high-power transmission line totaling 184 miles in length.

Fifteen irrigation stations, being erected by the Egyptian ministry in Assouan province near the dam, will feed 52,000 feddans of high land with water from the enlarged reservoir. This project is planned for completion in the near future.



Hovering Police of the Air

A police officer in an Autogiro

AERIAL police forces are by no means new: New York City has a fleet of police planes and other cities own or occasionally use planes for law enforcement purposes. While the advantages of conventional planes are great, particularly the high speeds that may be attained, there are many disadvantages. Some of these are overcome by the use of the Autogiro. This type of ship may be made to hover almost stationary in the air and so become a mobile observation station or machine-gun nest. Thus the 'giro offers to police work the facilities of high speed when needed, together with slow flight when desired, and the ability to land and take off in restricted areas.

A recent experiment was undertaken by Police Chief Theodore Hallowell of Cheltenham Township, Pennsylvania, in co-operation with officials of the Autogiro Company, to determine whether it is practical to apprehend escaping criminals from a 'giro, when police on the ground have either lost the trail or are far away.

To demonstrate the possibilities of such work, an empty automobile with a locked steering wheel set to drive the car in wide circles was employed. The car was set in motion and, with J. Paul Lukens at the controls and Chief Hallowell in the cockpit with a submachine gun, the plane took off. Firing at the speeding automobile was done at altitudes of 300 to 500 feet, with occasional bursts at heights as low as 50 to 60 feet.

Of 77 bursts of shots, 35 found their mark. Thirteen pierced the top of the car and it was raked from rear windows to windshield in order to make sure that the imaginary occupants were put out of business. One burst tore off a front tire and another pierced the vacuum tank, after which the car burst into flames. One of the first shots passed directly through the driver's seat, which would undoubtedly have been sufficient to effect the capture of a bandit's car in actual conflict.

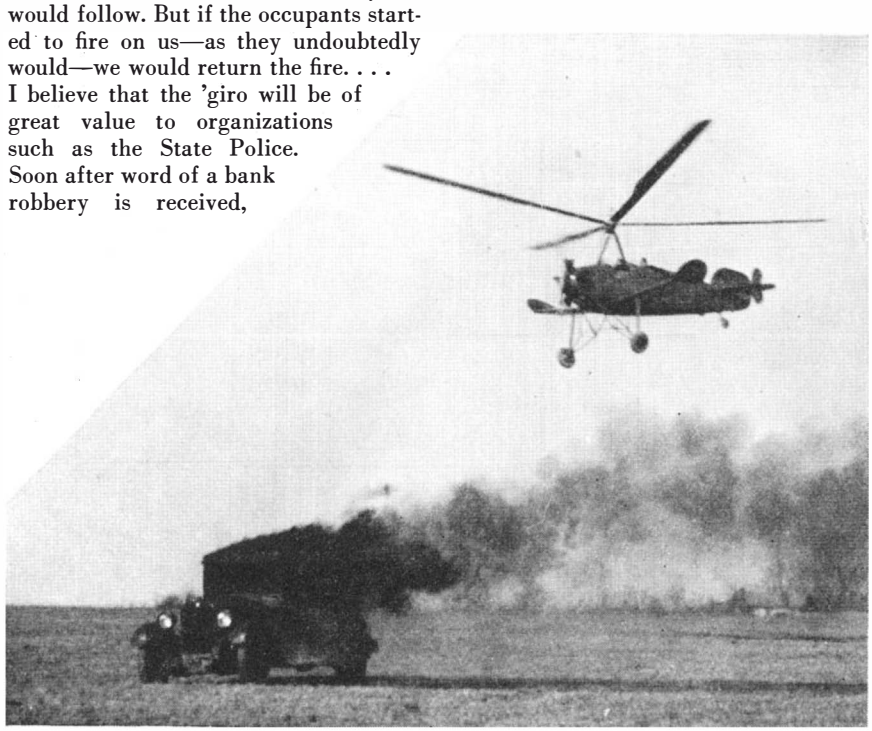
In commenting upon the demonstration, Chief Hallowell, who is rated as an expert machine gunner, was enthusiastic in his praise of the skill of the pilot. "A good pilot is more important than a good marksman," he said. "With a good pilot, an Autogiro can be brought to a full stop, or it can hover over the car it is pursuing. Then the marksman can get in his work."

THE location of the particular car sought should be a comparatively simple matter, in the opinion of Chief Hallowell. Once a description of the criminals' car has been broadcast by radio or the teletype, and the car has been sighted, it would of course be necessary to make certain that the car was the one sought before an attack could be made.

"Warning shots would be fired," said Hallowell, "and the 'giro would hover low. If the car continued on its way, we would follow. But if the occupants started to fire on us—as they undoubtedly would—we would return the fire. . . . I believe that the 'giro will be of great value to organizations such as the State Police. Soon after word of a bank robbery is received, the plane can be in pursuit, and after the fleeing car has been spotted, there can be no question of the outcome. If necessary, an Autogiro can be landed in the middle of the road."

Other lines of police work than the pursuit and capture of bandits and the like are open to the 'giro. Searching for lost hunters, campers or aviators in remote districts, directing congested traffic, patroling hunting and fishing territories on the watch for game law violators during the open season—all are possibilities. In fact, they have already been done. A plane that was forced down during bad weather in a mountainous area of western Pennsylvania was wrecked. After more than a day of fruitless search, a 'giro took off and within half an hour had located the remains of the plane. Since no sign of life could be seen, the ship was not landed, but returned to the nearest town to give directions as to the location of the wreck. Had any sign of life been apparent, the pilot stated that he could have made a landing within three quarters of a mile from the scene, in a small clearing where no ordinary plane could have been put down.

For directing traffic from the air, and in fact for many other police activities, two-way radio communication, which has been developed to a highly practical point, lends invaluable aid to the flying policeman.



An automobile crippled by machine-gun fire from the air

OUR POINT OF VIEW

Our Safe Ships

"WHAT of the safeguards and protective devices on American ships?" asked a reader. "You have often described in your pages the design and engineering features, the service and appointments of the newer ships of our merchant marine, but are they safe?"

We had our own ideas about this question but to make doubly sure we visited at her Hudson River berth the liner *Manhattan* which, as we have previously explained, will stand comparison with any liner afloat, except in size and speed. Our inspection carried us to the bridge and then throughout the ship to see what precautions had been taken to prevent or limit the loss of life in case of fire or shipwreck.

Ours was no superficial examination. On the contrary, a fire drill was arranged for our benefit; a boat drill was signaled, and all life boats on the port side lowered with ease; bulkheads throughout the ship were closed in 37 seconds; crew members at fire stations were examined as to their knowledge of their duties and found to be equal to any emergency; fire alarms and smoke indicators (locaters) were operated on the bridge; many fire doors were closed; inflammability of cabin walls was noted; and instruments for precision navigation on the bridge were called to our attention.

The *Manhattan* is equipped with 20 metal life boats and 2 wooden motor boats with a total capacity of 1724 persons. These, in launching, slide gracefully outboard down the inclined Welin-Maclachlin davits under electrical motor control. A plentiful supply of life preservers; 142 fire hydrants; over a mile and a quarter of fire hose; and fire buckets, axes, and several kinds of fire extinguishers are all ready for instant use and are inspected at regular intervals. In spite of the fact that cabin walls are of a fireproof material, ceilings everywhere are studded with fire alarm devices in which, as in sprinkler heads, a fusible link melts with heat and rings an indicating alarm on the bridge. Besides the most modern steering machines and compasses, bulkhead door control, fire location indicator, smoke indicator, Fessenden fathometer or sonic depth finder found on the bridge of the *Manhattan*, it is understood that the operators of the United States Lines are now working on a new development, explained to us in confidence, which will assure safer navigation in dense fogs than has ever before been possible.

It is to be concluded that the *Manhattan* and her sister ship *Washington* are as safe as, if not safer than, any ship on the Atlantic today.

Death Drivers

IN a community in New Jersey where approximately 5000 motor cars are registered, the opportunity was recently offered to drivers and owners to have their cars inspected for proper operation of brakes, steering gear, lights, and other important units. Despite the fact that this inspection was offered free of charge and with no strings attached, less than half of the car owners in the area availed themselves of the opportunity. Place this example of human inertia beside the frequent reports of death and injuries from motor car accidents and a striking moral will at once be seen.

Why should a man who drives a motor car with defective brakes be considered any less a criminal than he who slips a gun into his pocket and goes forth on murder bent? The automobile driver is, if anything, more to be censured because it is usually the innocent who suffer as the result of his carelessness. The driver who approaches you along a narrow road with lights that glare and blind you is surely as guilty of placing your person in danger as if he deliberately put poison in your food.

How can these death drivers who endanger the lives and limbs of the innocent, be curbed? If only the fact could be driven home that they are, beyond a shadow of a doubt, criminally responsible when an accident is caused by their lack of care for their cars or by their own lack of regard for the rules of the road, a long step would have been taken toward reducing motor vehicle accidents. Opportunities for free inspections, such as mentioned above, will help. More rigid enforcement of sane traffic laws, with severe penalties upon conviction of violators, will make our highways safer for the thinking and careful driver.

The motor car is a highly developed and efficient machine, but it lacks a brain whereby it can care for itself. It is up to the driver to supply that brain, and to keep in mind at all times when he is behind the wheel that he must have entire control of his vehicle; otherwise it becomes a potential death-dealing device which may strike at the most unexpected moment.

For Food Faddists

WE wonder what the next dietary fad will be.

A few years ago the public had become calory conscious. Knowledge of the energy content of various foods had reached the masses and some, hoping to "balance their diet," had discovered a new indoor sport—counting calories. One woman of our acquaintance weighed her growing daughter's food and allowed the child just the amounts suggested in a book. The child grew up normally but what the mother did not know about was the gross tonnage of excess calories surreptitiously consumed in the house of a neighbor who believed that Nature—one's appetite—tells us, perhaps more scientifically than anything, how many calories we need. The book was scientific but the child was hungry most of the time.

Then came the vitamins. "Ha," said the food faddists, "Here is something new and interesting—a new game to play." During the past few years we have all become vitamin conscious—we have had to. To escape vitamin-consciousness today one would be forced to escape to a desert isle. If we do not read about vitamins we hear about them from our loving friends. "Eat this because it contains vitamin A; that for vitamin B . . . ." and so on. New vitamins discovered from time to time incite faddists to write inquiries to scientific journals: "What must I eat to get the newest vitamin?" The answer is, for the average, normal, well, adult human being, eat a good all-around diet with fruit and vegetables, and forget that you have ever heard the word vitamin. Eat what and when you feel like eating—Nature will tell you both.

Is it more than a coincidence that the too diet-conscious may usually be found in the column of the sickly, and the natural eaters in the column of the hale and hearty? Man's internal organs do not need supervision; they ran for millions of years before dietetics was discovered and we seem to be here—evidence that Nature knows her stuff.

There are exceptions: See that babies and children get enough of the right vitamins, though without making a fetish of it, and if you are organically sick see a doctor.

Ice Cream by the Mile

A Successful Inventor Tells How He Commercialized His New Process For Manufacturing This Frozen Delicacy

By MILTON WRIGHT

THEY are making ice cream by the mile now instead of by the gallon. Revolutionary changes have made an exact science of the manufacture of America's favorite dessert, instead of merely an art with all the vagaries to which every art is subject.

Until this year, the up-to-the-minute freezers in the great ice cream factories of the country have consisted of cumbersome freezing cylinders with elaborate arrays of hoppers, spigots, heavy frost-coated pipes and containers to catch soupy ice cream before it spilled.

Clarence W. Vogt

But no more. A new method already has been installed in a few large cities, and so well does it operate and so popular is its product that large manufacturers in Detroit and New York have made it standard practice.

By this new process, the "mix" is pumped into one end of the machinery and from the other end are delivered cartons of paper-wrapped ice cream cylinders, each about two inches long and two inches in diameter—larger than the most generous portion of ice cream that goes with a soda. Somewhere about the middle of the machinery will be found a continuous tube of hard cream passing along an endless belt, for all the world like a never-ending stream of tooth paste being squeezed out of a giant tube.

ALL this is the invention of Clarence W. Vogt, of Louisville, Kentucky, an engineer who, it is said, will go down in the history of ice cream manufacture as the third and last of the great developers of the industry. The first of these was Jacob Fussell, Baltimore milk dealer, who became the first ice cream wholesaler when, in 1851, he froze the surplus cream from his dairy herds in York County, Pennsylvania, and then abandoned his large and profitable milk business to build up the still larger and more profitable ice cream business.

The second long step forward was taken in 1902, when Harvey Miller invented his brine freezer, and thus made possible the factory methods of ice cream manufacture which have prevailed up to now. Miller is said to have been the first to establish the value of mixing air with the freezing cream.

Now comes Clarence Vogt with his system that speeds up manufacture, makes it a continuous process, and turns out for the first time a product which is wholly uniform. Already he has approximately 60 patents and applications for patents covering about a hundred inventions on his machines and methods.

"Why didn't they make ice cream by a continuous process before?" we asked Mr. Vogt after we had looked at some of the new ice cream machinery in the plant of the Reid Ice Cream Company in Brooklyn. "Didn't anybody ever think of it?"

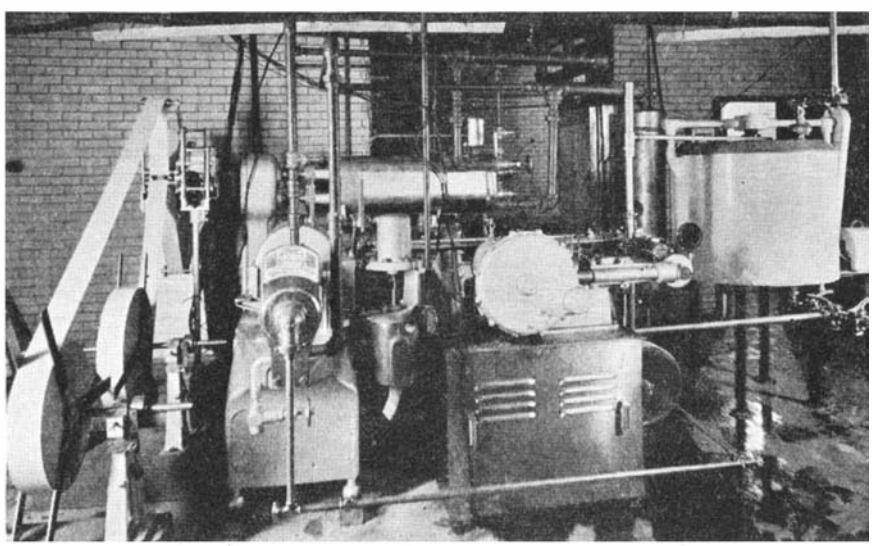
"Yes, they thought of it," he replied, "but I guess it looked too formidable. They weren't able to make the cream stiff in order to get the real benefit out of it, nor to control the 'over-run.'

"This over-run is determined by the amount of air that is put into the ice cream. It is the increase in the volume of the ice cream you take out of the freezer over the amount of the mix that you put in. In an old-type freezer the dasher mixes the air with the ice cream. Usually the ice cream in the bottom of the freezer is too heavy and that in the upper part is too light or too fluffy.

"YOU could, of course, freeze ice cream without putting any air into it, but nobody would want it. It would be bitterly cold in the mouth, heavy and soggy in body, coarse in texture and unpalatable. Too much air, on the other hand, makes it frothy and snowy.

"Injecting the proper amount of air always has been a big problem in ice cream freezing. That is why it has had to be frozen in batches—and the batches have been by no means satisfactory. With the old-type or batch freezers you get an uneven mixture, with large and weak air cells in the ice cream. That means poor body, and eventually, before the ice cream has been sold, poor texture as well.

"The new principle is simplicity itself, once you have the clue—which is merely metering the ingredients. The 'instant freezer' I have devised propels the mix and air in controlled proportions through the freezing chamber and



Freezing and forming equipment for producing ice cream by the mile. At right is mix tank, pump in center with freezer behind it, and paper feed at left

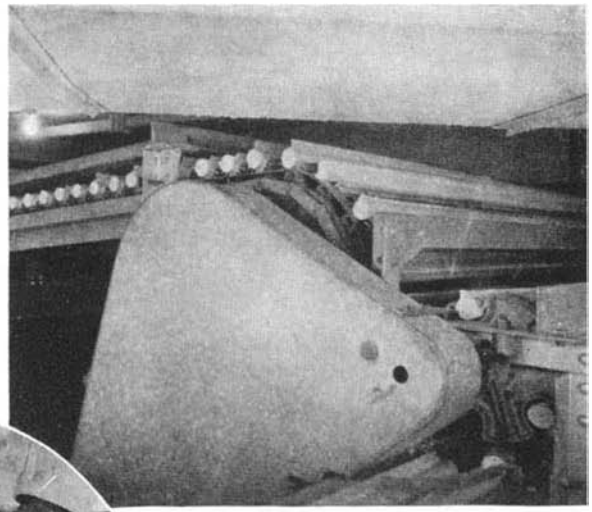
thus controls the over-run. It also produces a stiffness in the ice cream far greater than you can get with a batch freezer.

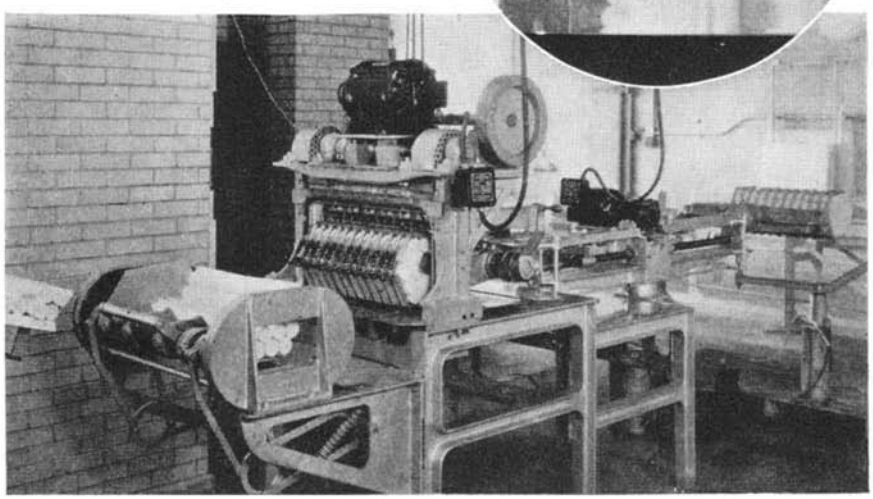
"We have a high-pressure proportioning pump of unusual accuracy. First, the air is introduced in measured amounts, then the mix enters, also in definite measured amounts. The pump is of a design which eliminates troubles from re-expansion, because the mix seals the air and there is no re-expansion."

So much for the inventor's explanation of his process which is enthusing the manufacturers. The product is what will determine the success of the ice cream made by the mile. The original ingredients are exactly the same as they were for the old method, but the finished ice cream is found to be superior. It is uniform in texture and it "stands up better." Suppose ice cream made the old way becomes a bit soft in the container behind the soda fountain; it gets flaky and icy and it loses volume. With ice cream made Vogt's way, however, it always keeps the same smoothness and the same volume. The explanation is that the air is in finer globules—really amounting to an air emulsion—and it stays that way because these fine globules are strong enough to keep the crystals apart.

Right: **The stick cutter end of the hardening conveyor. Fourteen-foot bars of ice cream in a temperature of 35 degrees below zero are cut by knives**

Circle: **The new ice cream as served.** *Below:* **Final cutting and packaging equipment with the final slicing machine in center**





Along with the new way of making ice cream goes a new way of serving it. You sit up at the soda fountain and give your order. The clerk has no scoop; he merely reaches into his large container, lifts up a cylinder of ice cream by two bits of paper rolled around it, drops it into the glass, and there you are. Quicker, easier, more sanitary.

And is the ice cream made the new way popular? Well, a large factory in Brooklyn is working 24 hours a day in a vain effort to keep up with the demand in the metropolitan district. A factory in Detroit is turning out several miles of it every day—and only one mile cut up into pieces two inches long makes a lot of servings.

That this development should be made by Clarence Vogt is only logical. He was brought up in the refrigeration business, his father and his uncle being among the pioneers. He studied refrigeration at Cornell and abroad. In the War he won a captain's commission largely as a result of his inventions, but these had to do with explosives.

For nearly a decade he has been a force to be reckoned with in the ice cream industry. Among other things, he completely mechanized the manufacture of ice cream for chocolate-coated ice cream pies. When he organized the Vogt Instant Freezer Company, the 250,000 dollars of capital stock was all subscribed within a week.

Best of all, he and his associates are receiving all the profits from his ice cream inventions to which they feel they are entitled—and they are plenty.

"How have you managed to keep your ideas from being pirated?" we asked him.

"Being careful is what did it," was his reply. "When I realized that I had discovered a way to make ice cream better than it was being made, and to make it in one fiftieth of the time it was taking by other means, I was just enough of an egotist to believe that this discovery could be exploited best by our own group. There has been a common belief, you know, that inventors are the natural prey of more clever people who rob them and then insult them. I have always had a desire to disprove that.

"AS H. G. Wells says in his 'Outline of History': 'What community of human beings has ever yet preferred creation to conspiracy? They receive new legacies like ill-bred heirs.' I was determined that if my ideas of ice cream manufacture were to be developed properly, along both scientific and commercial lines, we must see to it that the development was in our own hands.

"I am a regular 'record hound' and I don't believe in Santa Claus. Of course, I take steps to protect all my important inventions by patents, but I go further than that. Before I show a manufacturer a new process in its early stages I get him to agree that as soon as he has seen the invention he will sign a paper stating that, so far as he knows, the invention is new and original, or else stating where he has seen it before. Such a document I call an 'admission of novelty,' and it has saved me a lot of trouble. If more inventors and their backers would take precautions against what might happen, they would have less grief and more money."

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The second part of the article on food adulterations and spoilage (*see page 26 of this issue*), *will be presented in February. Here the amateur microscopist will find further information about materials that are sometimes used to adulterate the foods he eats, and how he may detect them with the aid of his microscope.*—The Editor.

SOME ASTRONOMICAL SURPRISES

The Riddle of the Coronal Lines—The Last Outstanding Puzzle in Astrophysics

By HENRY NORRIS RUSSELL, Ph. D.

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

THE unexpected still happens—in the skies as well as in human affairs. On October 9, American observatories received from the central office for astronomical telegrams at Harvard the message, "Belgium and Poland report great meteoric shower in progress." Wherever the skies were clear they were assiduously watched, but before the news had reached our side of the world the display was over. Later and fuller messages show that, on this night at least, we were living in the wrong place. All over Europe, from Russia to Spain, a magnificent shower was observed. Gerasimovic at Poulkovo reports a rate of more than a hundred per minute, Witkowski at Poznan a maximum rate of ten per second, some with brightness of the zero magnitude —equal to Vega or Arcturus.

This is the finest meteoric display since the great fall of Leonids in 1866, if not the greater shower of 1833. As in all similar cases, the meteors moved in parallel lines, and so appeared to radiate from a definite point in the heavens—this time in the head of the constellation Draco, not far from the pole of the ecliptic. The great swarm appeared therefore to be moving almost at right angles to the plane of the earth's orbit; but when allowance is made for the earth's motion it is evident that they must have been going forward around the sun, as well as downward across this plane, and so moving in a "direct" orbit with a moderate inclination.

METEOR swarms of this sort are always associated with comets, and the body responsible in this case was at once identified as the periodic comet discovered by Giacobini in 1900, and independently at a later return by Zinner. This has a period of 6.60 years, and a perihelion distance almost exactly equal to the radius of the earth's orbit. The orbit is inclined a little over 30 degrees to that of the earth, and crosses its plane in a downward direction in longitude 16°02′. At this point the comet's orbit is only 400,000 miles outside the earth's. The earth reached the place where the orbits are nearest at 8 P.M. Greenwich time on the evening of October 9, exactly the hour of the meteor shower. The computed radiant from which the meteors following the comet's path should diverge also agrees with observation, so that there can be no possible doubt of the connection.

The comet was observed this year as a very faint object, and came to perihelion on July 15, reaching the point of close approach six days later. At the time of the meteor shower it had passed far beyond, and was nearly 150 million miles away. The swarm of tiny particles which follow behind it and give rise to the shower must therefore trail a long distance. It seems probable that the recent display arose from an encounter with a denser cluster of meteoric particles in this long procession, for the main part of it lasted only about two hours, during which the motion of the meteors, relative to the earth, was only about 75,000 miles.

At the next return of the comet, early in 1940, the earth will be far away on the opposite side of its orbit, but in 1946 there should be a really close approach of the two bodies and a remarkable display may be visible—unless perturbations of the comet's orbit shift it away and spoil the show, as they did for the Leonids in 1900.

ANOTHER surprise came when Mr. Peltier, an amateur astronomer of Delphos, Ohio, found that the variable star R S Ophiuchi which he had kept under watch for years had suddenly blazed up 200 times as bright as it had been for decades. This interesting object was first detected by Mrs. Fleming at Harvard, in 1901, by its peculiar spectrum. The photographic records of the great Harvard collection show that the star had been faint (about the eleventh magnitude) from 1888 to June, 1898, when it was found to be of magnitude 7.7, about 20 times as bright as it was a month before, when the last preceding plate of the field was taken. It may have been brighter in the interim —anyway it faded rapidly and, after a smaller flare-up in 1900, returned to its original brightness, which it maintained with small and irregular fluctuations till last August, when Mr. Peltier found it of magnitude 6.5 on the 15th. An Italian observer, Signor Loreta of Bologna, observed it of the fourth magnitude on the 11th—but unfortunately his discovery was not broadcast by telegraph. Since then it has quickly faded, and it is now below the 10th magnitude.

Such a rapid outburst and steady fall suggest a nova, and the character of the star is assured by spectroscopic observations which show a bright line spectrum of the usual sort, except that the width of the bands is much smaller than for most novae—indicating that the velocity with which the gaseous shell was ejected from the star is unusually small. Plates taken at Harvard a generation ago showed a very similar spectrum during the earlier outburst, so that we have here a second example of a recurrent nova, the first being T Pyxidis which rose from the 14th magnitude above the 8th, in 1890, 1902 and 1920.

During the present outburst the evolution of the spectrum at first followed familiar lines, with bright lines of hydrogen, helium, and ionized metals, followed by the appearances of the nebular lines. But at the beginning of the present month came the real surprise. Adams and Joy, observing at Mount Wilson, found a strong, new bright line at wavelength 5303, while the red line of ionized silicon at 6371 had shifted to 6376—that is, had faded away and been replaced by another line. Now these two wavelengths are very familiar to solar observers—the lines in these positions are no other than the strongest in the spectrum of the sun's corona. They are still visible, and probably other coronal lines will be found to accompany them. The star is fading rapidly and, what is worse, getting into the evening twilight, so that within a few weeks observation will have to be suspended till February or March. It is fortunate indeed that it was not lost in the sunlight a month earlier.

HERE is something wholly without precedent. The coronal lines were previously known only in the spectrum of the sun's outer envelope. Even there they are so faint that only the brilliant experimental ingenuity of Lyot has made it possible to observe them at all except during a total eclipse. But in R S Ophiuchi they stand out strongly in the integrated spectrum of the star's light and must be many thousands of times brighter than they have ever been seen before. The last of the single instances in spectroscopy thus disappear.

There is nothing left that is confined to a single source and the conviction is reinforced that the coronal lines, whatever their origin, do not come from an unknown gas but from some known element shining under unknown conditions.

Whether the study of this nova may give further clues as to the puzzle—the last outstanding one in astrophysics—remains to be seen. Meanwhile a promising tentative interpretation of some of the coronal lines comes from the same investigators who have recently identified neon in the nebulae—Menzel and Boyce. They find that the difference in the wave numbers of the coronal lines at 6374 in the red and 3454 in the ultraviolet agrees within the error of present data with the separation of the known energy levels in the neutral oxygen atoms. That is, the two lines could be produced by transition from a previously unknown and very highly excited state of the oxygen atoms to these two known states. A third line at 3987 is in about the right place for a transition from a still higher level bearing the familiar series relation to the one first suggested. The green line 5303, though strongest of all, remains unexplained.

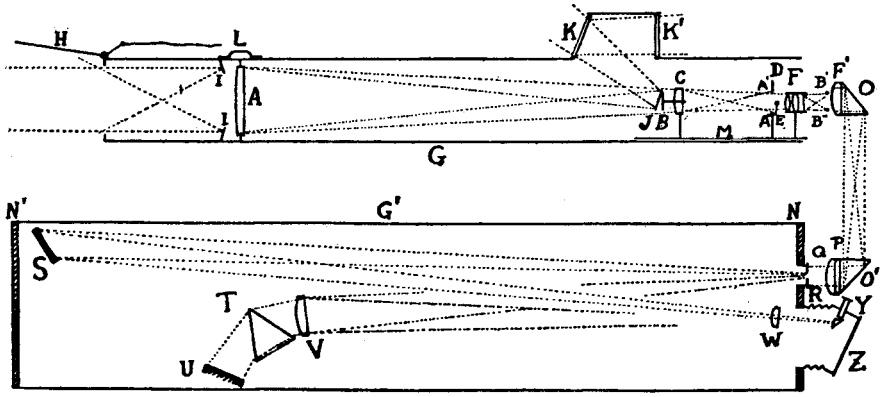
IN favor of this interpretation, first and foremost is the fact that Hopfield, some years ago, actually found the red line 6374 in the spectrum of oxygen in a vacuum tube. The agreement in wavelength of the laboratory and the coronal lines is so close as to leave little doubt that the latter is really due to oxygen. Further favorable evidence is that these three lines are strengthened in the same portion of the corona, while the green line behaves differently. On the other hand, as Menzel and Boyce point out, other oxygen lines which might be expected to appear in the corona do not. Whether this is due to peculiar conditions of excitation, time will tell.

Meanwhile, laboratory workers will doubtless grow busy with their discharge tubes, subjecting oxygen to the most varied conditions of electrical excitation that their ingenuity can devise, and photographing the spectra. Some well reasoned plan, or even some lucky fluke, may solve the problem. Professor R. W. Wood, after his notable success in producing in the laboratory about twice as many lines of the hydrogen series as had ever been secured before, said to the writer, "I supposed that everything possible had already been tried with a hydrogen Geissler tube. But apparently no one had ever thought before of making a tube 12 feet long." The long tube did it!

Whether in one way or another, there is now better hope than ever that the riddle of the coronal lines may soon be fully solved and the last important uncertainty in astrophysics be dispelled. —*Mt. Wilson Observatory*, Oct. 30, 1933.

The Lyot Coronograph

IN his article in the December, 1932 number, Professor Russell told of the discovery of a method for photographing the sun's corona without an eclipse, accomplished by the French astronomer Lyot, and in the accompanying article he refers again to the same astronomer and method. This method has now been described in detail by Monsieur Lyot, in the September, 1933 number of the *Journal of the Royal Astronomical Society of Canada* (198 College Street, Toronto) from which the accompanying illustration is reproduced and the following abstract is made:



The Lyot coronograph and attached spectograph for viewing and studying the sun

Theoretically, says M. Lyot, the corona should be observable in daylight, but the solar image produced by the objective or mirror of a telescope is surrounded by a halo of light which is a thousand times brighter than the corona. The cause of this halo is diffusion (diffraction) of the sun's light by dust and water particles in our atmosphere, also by the instrument itself —the latter due to diffraction from the edge of the aperture, from tiny flaws in the glass, air bubbles, minute scratches, and other sources of parasitic light, any one of which would hide the faint corona entirely.

The coronograph was therefore designed to eliminate these parasitic sources of light. In the sketch the upper portion is the mounting of the coronograph and the lower part is the spectograph. *A* is a plano-convex lens of 13 centimeters aperture and 3.15 meters focal length, made of finest optical glass, flawless and polished with the utmost care. This forms an image of the sun on disk *B* of blackened brass, which extends beyond the edge of the sun by 15 seconds of arc. Field lens *C* produces an image of lens *A* at *A'A"*, on diaphragm *D*, whose edge is occupied by a tiny screen *E*. "The outer portion of the diaphragm," says M. Lyot, "stops the diffracted light from the borders of the first lens. The little screen *E* stops the light of the solar image formed by reflections between the two surfaces of the lens *A*. Behind the diaphragm and the screen, sheltered from diffuse light, an objective *F*, highly corrected, forms at *B'B"* an achromatic image of the corona. These parts of the apparatus are mounted on plate *M*, which slides in grooves in order to permit the placing of any point of the solar image on the screen."

G is a wooden tube 5 meters long, the inside walls coated with heavy oil. *H* is a flap to close the tube. *I* is a concave diaphragm, and *J* is a disk which disposes of the radiation not used, in order to avoid air currents in the tube. Light from *J* emerges at windows *K* and *K'*.

Equipped with an eyepiece and red screen, this apparatus showed many solar prominences, and photographs were taken using panchromatic plates and a red filter.

The apparatus in the lower portion of the sketch is the spectrograph. The achromatic objective *F* of the upper instrument was removed and replaced by simple lens *F'*, which forms an image of the corona on slit *R*, the light first passing through two total reflection prisms *O* and *O'*, colored filter *P* which isolates the spectral region to be studied, and field lens *Q* which forms the image of the diaphragm *D* either on grating *S* or prism *T*, by orienting *Q* as desired. *W* is a converging lens, *Y* is a little microscope for observing and correcting for flexures of the tube, and *Z* is the plate. The other spectrograph has prism *T*. This is traversed twice by the light, which is reflected by flat mirror *U*. *V* is a simple lens.

Not every minor detail described by M. Lyot has been covered in the above abstract, and no constructor should attempt to build a Lyot coronograph without more precise details. The Lyot apparatus has also been used at Mount Wilson Observatory, and was briefly described in the *Publications of the Astronomical Society of the Pacific*, August, 1933, by Dr. Edison Pettit and Prof. Frederick Slocum, who have employed it.—*A. G. I.*

THERE IS RESEARCH . . . . AND RESEARCH

How Much Real Scientific Research Lies Behind Some of the Patent Medicines, Cures, and Medicaments Sold to the Less Intelligent Fraction of the Public? Who Should Conduct Such Research?

By T. SWANN HARDING

RESEARCH is a high and mighty name. There is a sort of magic and a kind of majesty about it. We conjure up thoughts of long-haired, horse-faced men sitting solemnly in impressive laboratories amid complex apparatus making Nature, like a blushing school girl, tell her secrets. We think of these men as adding to the sum total of human knowledge—as engaging in activities that are of immense social value. They are the servants of all mankind. But there is research . . . and research. There is research "The Business Builder" as well as research the servant of man.

Not long ago, a former carpenter who became an opulent cancer-cure quack was prosecuted and actually sentenced for his crimes. His cancer cure was, as a whole, commonplace. It consisted of using corrosive substances to eat away flesh, and following up with healing ointments and applications. The interesting thing is that two of his remedies consisted largely of "pyroligneous" substances distilled from peat. This distillation was performed by the use of a very intricate and impressive apparatus. This apparatus, as well as the distillate, as far as its assumed healing properties were concerned, had been patented. The whole business was not only foolishly unscientific; the very existence of the cure and its exploitation constituted a social and hygienic menace of the first order.

SUCH quacks are just as surely public enemies as gangsters and unscrupulous bankers. Yet it took some knowledge of science and it required some research to produce that elaborate apparatus and the subsequent pyroligneous remedies. That constitutes what I once called "The Degradation of Science," in the title of a book I prepared on the subject. Yet we spend many dollars today on what might be called anti-social research for every single dollar we so unwillingly expend upon fundamental research into basic problems of nature, which research is truly scientific in character.

In that period to which we referred as "prosperity," I happened to be associated with a manufacturer of pharmaceutical and similar products. The plant went in heavily for what we laughingly called "research" and "laboratory control." And this, when you truly understand it, is a very beautiful and impressive thing!

Thus, one day, the Chief Chemist suddenly and happily coined a very beautiful and musical word. It was a magical word, like Mesopotamia. He at once ran to the President, who sat in august majesty, surrounded by tens of thousands of dollars' worth of the finest period furniture. Thereupon the General Manager and the Advertising Manager were called and the four of them soon sat around a mahogany table in a room that resembled the private chapel of a mediaeval monarch (with a somewhat perverted idea of the Deity's taste in decorative art, I hope). They began repeating the magical word and it intoxicated them. An office secretary, who swore me to secrecy, declared it was very entertaining to hear them.

THEN, after they had savored this pleasure to the full extent of its very obvious limitations, they told the Chief Chemist he must find a product which would be fit to bear the name. Then he should consult with their Director of Medical Research who should find a disease for which the product with the magical name might be recommended. Then, while a few laboratory experiments were undertaken with animals, they should all again consult the Advertising Manager, who would thereupon burst into lyrical strophes; after which they could break into a Greek choral dance celebrating the curative properties of the product which had been fitted to the magical name.

Thereupon the product would go upon the market sans adequate clinical tests. Thereafter profits would roll in. Then imitators would spring into the market. The druggists and doctors would be very much puzzled by the clamant claims made by each producer for his specific remedy. Ultimately the general public would be out considerable sums of money, since everybody technically equipped to know anything about the matter would at once agree that the stuff had no real therapeutic value anyway.

All this sounds chimerical. It really is not. It is all too closely typical of the *modus operandi* of some pharmaceutical houses when putting their new orthodox remedies on the market.

You do not have to take my word for this. The physicians and pharmaceutical chemists who examine and certify "New and Nonofficial Remedies" for the American Medical Association know this is true and have said so in print. The market is full of medicaments put out by so-called reputable houses after just such inadequate travesties of "research" as this. Without moving from my desk I could show you an apparently reputable medical journal which contains advertisements of at least 20 therapeutic products that are no more useful than the one I have just described. Nor, indeed, are they of any more value than a hundred proprietary or patented remedies which our drug stores constantly sell us for our neurotic self-medication.

In times of prosperity perhaps that sort of thing is all right. But I wonder just how much of such flagrant economic waste and abuse of research we should tolerate in such periods as the present. Secondly, since this sort of exploitation has uniformly rested upon the casual, almost empirical sort of "research" carried out by private industry, or else has represented an application (or a mis-application) of fundamental scientific knowledge discovered at public expense in federal or state laboratories, just how far should we continue to permit this sort of insanity? For it is insane to abuse research, to degrade science, to make extravagant advertising claims, to compete for trade, and to undertake the expenses of production—all to perform what is economically and scientifically an anti-social act.

MY laboratory experience has been considerable. In the last depression before this I found myself in the research department of a firm that advertised its rigid laboratory control. A

certain product made by this firm suddenly and inexplicably began to have an evil odor. The research staff was at once ordered to devise some sort of spray which could be used on the product in the course of manufacture to make it smell better when finished. There was no attempt whatever to discover the real reason for the evil odor. A spray of the type desired was devised, and satisfaction reigned.

Again, certain animal glands that were used for making medicines for which were claimed almost magical curative powers—though the *Journal of the American Medical Association* constantly warns against such faith—were purchased from South America. They often spoiled en route and smelled so badly that one could not get near them when they arrived. But they were very cheap, much cheaper than domestic glands. So they were at once dumped into ice water. Then some workmen would creep up on them and rush them through grinders; finally they were dropped as quickly as possible into baths of acetone. After several subsequent acetone baths, careful drying, and some more grinding, this stuff went into capsules.

IN my naïve way I thought trouble brewed here. I said: If you send out a certain product called So-and-so, which demonstrably is not So-and-so at all; or if you send out a certain antiseptic which is not antiseptic; or a product containing silver which contains only half as much silver as it should; or perhaps twice as much alkali as it should —you will surely get into trouble. But I was told they would get into no trouble at all. Clinics, hospital laboratories, physicians, and the public rarely complained about any such things. They might go raging mad over an adverse decision by a baseball umpire but certainly not about an inferior gland remedy. If complaints were made, the company had its research department, did it not? And its control laboratory could actually be shown—in fact it always was displayed pictorially in advertising. It was just a slip. They could replace the bad lot with better products—which often came out of the same lot.

Almost the last efficient and economical service performed for a waiting public by this firm before I left it was this: At that time the field for certain liquid preparations seemed very profitable. Most of these products were very poor in quality. Indeed the majority of them were useless. My firm decided, however, that it might pay to enter this crowded, competitive field, so "research" was undertaken. A bacteriologist and a chemist went rapidly through several formula books. They finally apprehended a very common formula that looked easy to prepare. Immediately the Advertising Manager was sent for. He danced a polka, and ecstatic prophylactic lyrics gushed forth from him like radium emanations.

The Government, maintaining disinterested bureaus, is the logical source of unbiassed findings from research on products used by the people. Here are some Government scientists discussing the results of potato breeding experiment work. They are not imaginary "long-haired" scientists with whiskers, but plain men

Although it had long reposed sepulchrally in formula books, this formula now suddenly became the most matchless, the most glorious, the most powerful, and the most health-producing of all such nostrums. Bottling apparatus was purchased. Laborers were hired. Printed matter appeared in abundance. Raw materials flowed in. Production got under way. It was necessary to get the stuff on the market in almost frantic haste in order to clean up before the racket became unfashionable and was outmoded. Shipments were being sent out within a month after the initial "research" was undertaken, all guaranteed by "our watchful laboratory control."

The only trouble was that the new product proved too enthusiastic. It wanted to get at work so badly that it couldn't wait for consumers to open the bottles. It burst out of them and gushed all over the place. In more prosaic terms, a chemical reaction that might easily have been foreseen inevitably took place in such a mixture and the bottles were irrevocably blown to bits two or three weeks after shipment. Nobody stopped to think about this unavoidable chemical reaction, for the mad pursuit of profit prevented rational thinking.

There was nothing but a loss to show for all this. Even had the product "held up" in the bottles there was no social justification for its existence. As things were, the firm charged off about 100,000 dollars as loss and tried to forget it. But do not think the loss went unpaid. Ultimate consumers cheerfully paid it, as they usually do. They paid it in the price of other products they bought from that wasteful and inefficient firm.

They did not pay painfully, as in the case of an income tax with which they purchase government research that returns 5000 percent dividends to the public on the relatively small sum (20,000,000 dollars or so) annually invested therein. They paid painlessly in the form of 25 cents additional for some attractively bottled or packaged product which the firm sold for one dollar and which, container and all, it possibly cost eight cents to produce. Why did they pay the very exorbitant one dollar instead of the already exorbitant 75 cents? Because the wasteful and inefficient methods of such firms make it habitually necessary for them to charge excessively for their products, in order to cover unnecessary losses, wild extravagances, complete failures, and flagrant plant inefficiency.

IN last analysis the public pays the cost of all research. It pays the salaries of the technicians in private industry, just as it pays those of technicians employed by the Government. It pays for the plants and equipment and "research" of private firms, just as surely as it pays for that in the Government. If the public is going to buy "research," why is it not wise for it to purchase from the Government, where each dollar so expended brings 500 dollars in social profit? Why? Because such research is planned rationally. Because it concerns socially

and economically beneficial and justifiable projects and processes. Finally, because trained scientific specialists, not salesmen and business promoters, direct and control Government scientific bureaus.

IN 1843 Peter Dunn, a milkman near South Ferry, New York, bought a ship cow from the captain of an English vessel. It had contagious pleuro-pneumonia, an insidious and destructive cattle disease. It infected Dunn's herd and the infection soon spread to other nearby herds. The disease went on into New Jersey and, in 1859, broke out in Massachusetts, where it was introduced by four cows imported from Holland. The legislature of Massachusetts passed an act appointing a commission to deal with the matter. Quarantine, slaughter, and interment of diseased cattle followed, with cleansing and disinfection of premises. Nevertheless the disease soon reached five other nearby states and the District of Columbia.

National authorities and livestock men generally were indifferent to this disease until 1879. But when the British Privy Council, in an order dated February 6, 1879, decreed that all cattle imported from America must be slaughtered on the docks within a limited time, and the price of American steers dropped 10 dollars below that paid for similar Canadian animals, it was seen that this country faced an annual loss of a million dollars. Something had to be done. State action had failed to stamp out the disease; it was ineffective because close co-operation between the states could not be secured. Some states would assert they were free from the disease when they were not; one state would be blocked by the negligence of a neighboring state, and so on.

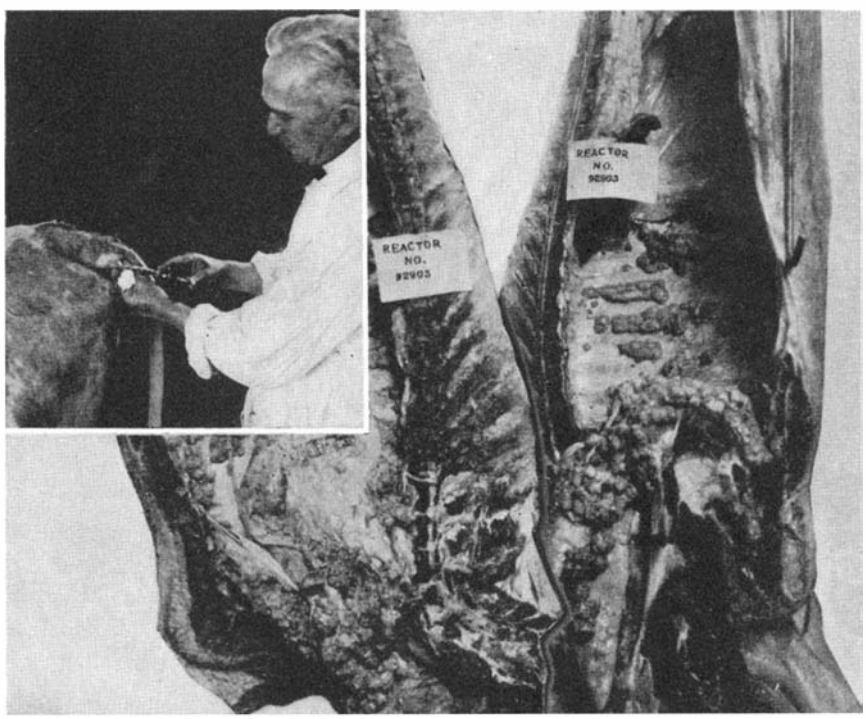
Before the National Government could act laws had to be passed, funds provided, and an organization created. In those days it was not considered a proper government function to deal federally with the production and shipment of livestock. States rights intervened. Congress was besought not to add new regiments to Federal job-holders. But fundamental research must be carried out, and its results applied on a national scale. Though the severity of the disease was questioned and the veterinarians were ridiculed, a bill establishing the United States Bureau of Animal Industry, and playfully called "The Horse Doctor Bill", was passed. That was in May, 1884. This Bureau undertook scientific research of basic biological, social, and economic significance.

Pleuro-pneumonia was stamped out in five years—a world record in the control of this disease, an immense boon to the livestock industry, and a striking demonstration of the effectiveness of Federal research in handling livestock disease problems. However, from 20,000,000 to 30,000,000 hogs died annually of hog cholera. Contagious abortion and tuberculosis afflicted cattle. There were foot-and-mouth disease, anthrax, black leg, tick fever, and other diseases. So the activities of the Bureau were extended and it became the first scientific institution in the world to demonstrate that insects could act as intermediate hosts for disease germs, work which later resulted in the eradication of yellow fever from large infested areas. No case of pleuro-pneumonia in cattle has occurred in this country since March 25, 1892. The total cost of the work of eradication was 1,509,100 dollars, or less than would have been lost in two years on cattle export to Great Britain alone.

That is typical of the research the Government undertakes. It is fundamental in character and of the greatest practical social and economic value. In January, 1933, a boisterous congressman took the scientists of the Bureau of Plant Industry to task for spending 250,000 dollars on developing one potato variety. This statement was wrong, of course, for that sum financed all the experiments carried on by the Department of Agriculture over a period of 20 years during which time it sought to develop disease-resistant varieties of potatoes. Farmers were planting many potatoes and reaping few because disease destroyed so many. That was dead loss. By long and laborious breeding and plant testing a potato called the Katahdin (after the highest and most prominent mountain in Maine) was developed.

THIS happened to be the first of many experimental varieties released for general cultivation. It was excellent in shape and appearance, smooth in skin, bright in color, with shallow eyes, high uniformity in size and shape, and had yields equal or superior to those of established varieties. Moreover, since it resisted the plant virus disease called mild mosaic, experts estimated that it alone would soon save farmers a thousand times a quarter of a million dollars by giving good yields. This would make it less expensive all along the line and Katahdin also yields more No. 1 grade potatoes than other standard varieties.

This sort of research, as can be seen for both examples, is slow and laborious. It cannot be made to yield quick profits next week or next month. It is best undertaken in an atmosphere free from the profit motive and the commercial competitive spirit. Such research is constantly being carried on by the Government. I do not mean to imply that no socially valuable research is ever carried on by private enterprise. The scientific laboratories of General Electric alone, for example, would demonstrate the falsity of such a statement. But it will be found that the companies that do undertake research of that character are usually, to all intents and purposes, large corporations quite governmental in scope and character.



A Government employee making a tuberculin test on a cow: also the interior of a tubercular cow's carcass, showing the many nodules which are an evidence of tuberculosis. Inspectors condemn such carcasses but, up to the time of her slaughter, this cow had been used as a source of milk for someone. The owner objected strenuously to the test which revealed the presence of the disease

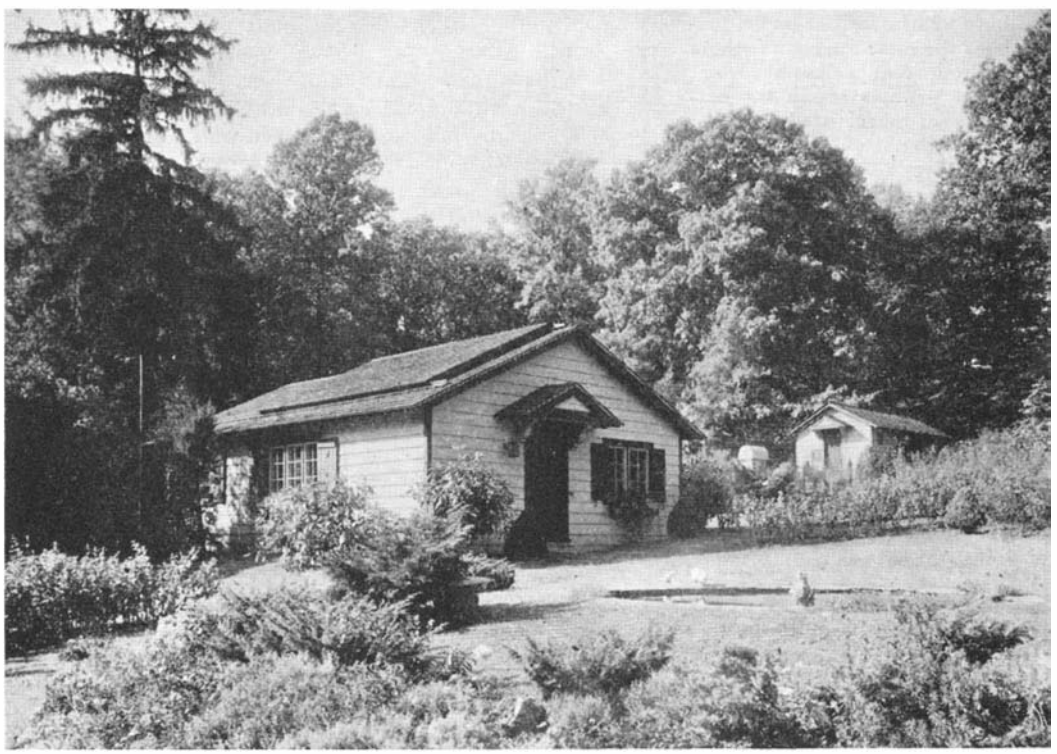
An Amateur's Dream Come True

WHAT James Stokley, Director of the Fels Planetarium in Philadelphia, writing in *The Telescope*, published at Deleware, Ohio, describes as "the most interesting astronomical institution in this region" is a private observatory which represents the hobby of an amateur. "This observatory," Mr. Stokley continues, "is the property of Mr. Gustavus Wynne Cook, manufacturer and banker, and is located on the grounds of his home, Roslyn House, at Wynnewood, Pennsylvania, one of Philadelphia's most pleasant suburbs. Because of building restrictions, intended to protect the fine residences in the vicinity, the usual observatory domes could not be built, and a type of construction was adopted that is rather unusual for so large an instrument. Walking past in the daytime, a visitor might never suspect that a building resembling a small cottage contains a large reflecting telescope. But if he were to pass in the evening, he might see the roof slide back along its peak, and the skeleton tube of the instrument emerge to sweep the heavens. Entering the building—the 'Star House,' as Mr. Cook calls it—he would find a very business-like telescope, with a mounting of the open fork type, similar to that of the 60-inch at Mt. Wilson, and a main mirror of 28.5-inch aperture. The tube is of duralumin, and the polar and declination axes are mounted on roller bearings. A choice of secondary mirrors permits the use of the telescope either as a Newtonian or Cassegrain.

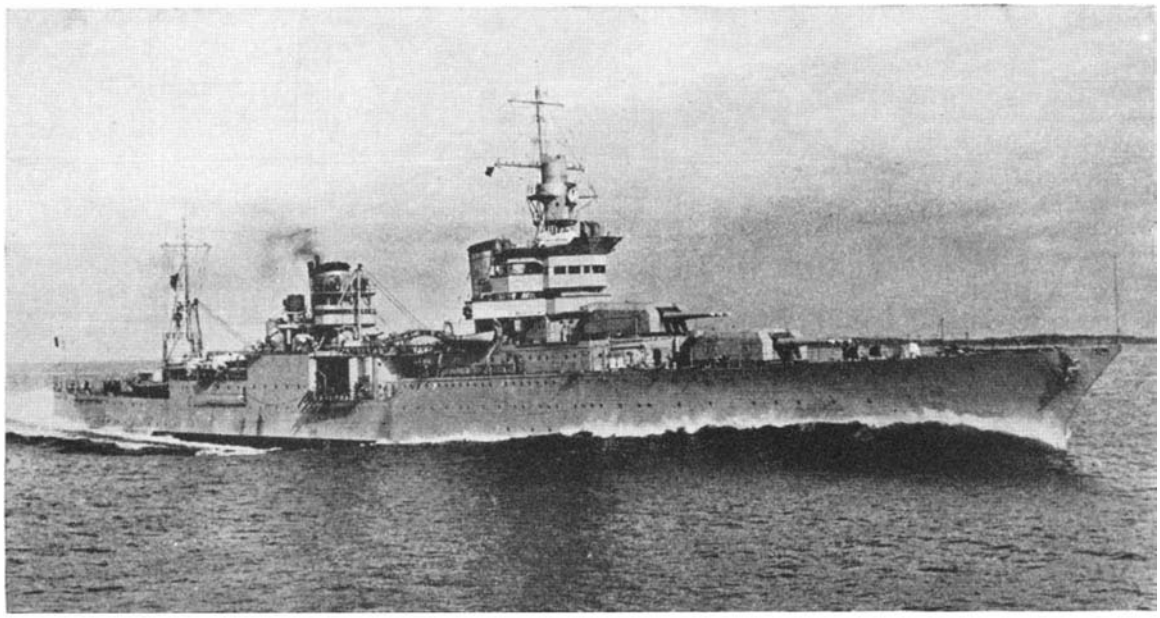
"Attached to the tube, and of the same focal length as the 28.5-inch mirror, is an 8-inch refractor, as well as a 6-inch finder, of shorter focus. The 8-inch objective is the work of Mr. C. A. R. Lundin, and it was formerly used in a Clark mounting, the predecessor of the reflector. All the other optical parts of the new telescope, as well as the mounting itself, are the work of Mr. J. W. Fecker of Pittsburgh.

"A full battery of accessories permits the efficient use of the telescope for virtually all phases of astronomical observation—visual, photographic, and spectroscopic."

Upper right: **Interior of Roslyn House Observatory, with the gantry roof rolled off, showing the 28½-inch reflecting telescope. It has an electric drive**



Right: **Exterior of the observatory. The gantry roof is closed. In the background is the building which houses a spectrohelioscope and a solar telescope**



A modern among moderns: the 10,000-ton cruiser U. S. S. *Indianapolis* at full speed

THE DEVELOPMENT OF
THE MODERN CRUISER*

SCIENTIFIC AMERICAN is frankly proud of its naval tradition; it has, through several decades, been infinitely closer to the Navy than has any other American journal for the layman. Bearing witness to this fact are the names of many famous naval authorities who have written for our pages, perhaps the most famous of whom was our own Admiral Mahan whose writings are in the curricula of naval academies the world over.

During recent years, questions of naval limitation have so occupied the press and public mind as to exclude almost completely any studies of warship design, construction, and usefulness. The moment is propitious, therefore, as the United States begins a new naval building program, to consider seriously these vital details, so that the country may the more intelligently work out its naval destiny.

During 1934, we plan to publish a number of articles by authorities who will give these naval problems their expert, analytical attention. Commander Rossell's fine article is the beginning; others will follow as speedily as they can be prepared. All will be interesting and informative.—*The Editor.*

By COMMANDER HENRY E. ROSSELL (C. C.) U. S. N.

IN recent years the design, construction, and performance of cruisers have been of great public interest, particularly in this country. The reasons for this interest may be traced back to the early days of the World War when the exploits of a few small German cruisers thrilled belligerents and neutrals alike.

Perhaps the best known of these sea raiders was the *Emden*, a vessel of only 3500 tons displacement and armed with 10 four-inch guns. For several months after the outbreak of the war this ship roamed around the Indian Ocean and nearby waters, preying on enemy shipping. All told, she sank some 70,000 tons of British merchant ships, in addition to a French destroyer and a Russian cruiser of about her own size. During her long cruise the *Emden* was able to maintain herself by replenishing her fuel and stores from captured ships. The *Emden* met her end when she was overtaken and destroyed by a larger and more powerfully armed Australian cruiser, the *Sydney*.

The depredations of German cruisers on the commerce of the allied powers, though highly spectacular, were of small military importance. In fact they had no effect whatever on the outcome of the conflict. It was in the fleet actions of the war that the more important functions of this type of ship were demonstrated. These may be explained best, perhaps, by a consideration of the history of cruiser development.

FROM about 1890 cruiser design developed along two divergent lines. The first led to a ship with a belt of comparatively heavy armor along the water line and with guns of rather large size, in some ships as large as nine or ten inch. In addition to these primary battery guns, a number of smaller guns, three to six inch, were carried for protection against torpedo vessels. The speed was about 25 percent greater than that of contemporary battleships. Ships of this type were given the name "armored cruisers." The type was inaugurated in 1890 by the French in the *Dupuy-de-Lôme*, a ship of 6500 tons displacement and 20 knots speed. At first naval powers showed but little interest in armored cruisers. In the Russo-Japanese War they gained great prestige, however, as a result of the excellent work done by Japanese armored cruisers at the battle of Tsushima. Here they were able to keep their stations in line of battle in opposition to Russian battleships.

Subsequently, armored cruisers were built in large numbers by all of the

*Courtesy *The Tech Engineering News*

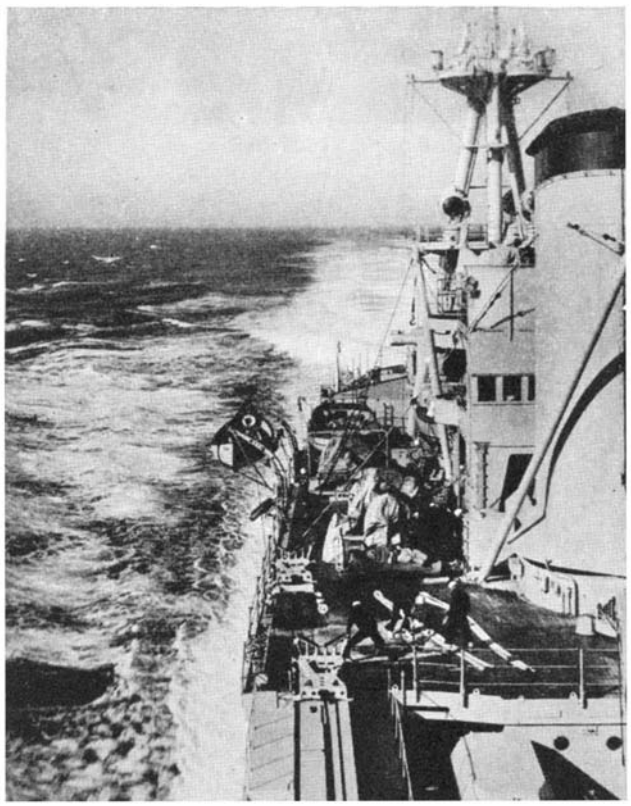
great naval powers. By 1906 such ships had reached a size of some 15,000 tons, made a speed of about 24 knots and carried guns as large as 10 inch. The armor belt was about six inches thick, and generally an armored deck was fitted to resist shell which might penetrate the belt. Armored cruisers of this period were almost as large as contemporary battleships, but they were inferior to the latter in all respects except speed.

Designers were counting, apparently, on these ships to take part in fleet actions against enemy battleships as they had done at Tsushima. Certain very important events had taken place in the meantime, however, which seem to have been overlooked by armored cruiser advocates. The penetrating power of artillery had been increased greatly without corresponding improvement in armor. Moreover, revolutionary developments were taking place in methods of control of gun fire. A third important factor was the introduction of the all-big-gun battleship, or dreadnaught, a vastly more powerful ship than its predecessors. At the same time England brought out the battle cruiser, essentially a high speed dreadnaught with slightly inferior armor protection.

The advent of the battle cruiser caused the virtual abandonment of further construction of armored cruisers after about 1908, but at the outbreak of the World War the latter type still held much of its earlier prestige. Most naval officers felt, however, that it could not be relied upon any longer for duty in the battle line at fleet actions. Its functions were to be commerce destruction and protection, scouting, patrol, and convoy duty.

THE German ship *Blücher* (1908) was among the most powerful armored cruisers ever built. She had a displacement of 15,550 tons and a speed of 25¾ knots, and carried 12 8.3-inch guns in addition to a battery of smaller guns. Her side armor had a maximum thickness of about seven inches, but her deck armor was rather light. At the battle of Dogger Bank the speed of the *Blücher* proved to be insufficient to enable her to escape the British battle cruisers. Their 13.5-inch shell penetrated her protective deck at a range of about 17,000 yards and exploded beneath it. After having been reduced to a state of helplessness by two hours of artillery bombardment, the ship was sunk by a torpedo from a British destroyer.

Other armored cruisers offered less stubborn resistance. The war was only a few weeks old when three British ships of this class, namely the *Cressy*, *Aboukir*, and *Hogue*, fell easy prey to a lone 300-ton German submarine. A few months later at the battle of Falkland Islands, the crack German cruisers *Scharnhorst* and *Gneisenau* were sunk with little difficulty by two faster and more powerful British battle cruisers. At Jutland, four of England's best armored cruisers ventured to within some 10,000 or 12,000 yards of the head of the German battle line, which consisted of battle cruisers and battleships. About two minutes of fire from the heavy German ships disposed of three of the four British cruisers. One blew up at once, another blew up during the following night, still another sank some hours later, while the fourth escaped.



The wake of another 10,000-ton cruiser, the *Pensacola*

These experiences and many similar ones led to a general lack of confidence in armored cruisers. They were too weak to fight heavy ships and too slow to avoid action against more powerful vessels. Moreover, they were not suitable for scouting duty because of their poor speed and excessive size. On patrol or convoy duty they made attractive and none too resistant targets for enemy submarines. All were agreed that armored cruisers had few merits and many shortcomings—in short, that they were obsolete. So ended one line of development which had started in 1890 with the French *Dupuy-de-Lôme*.

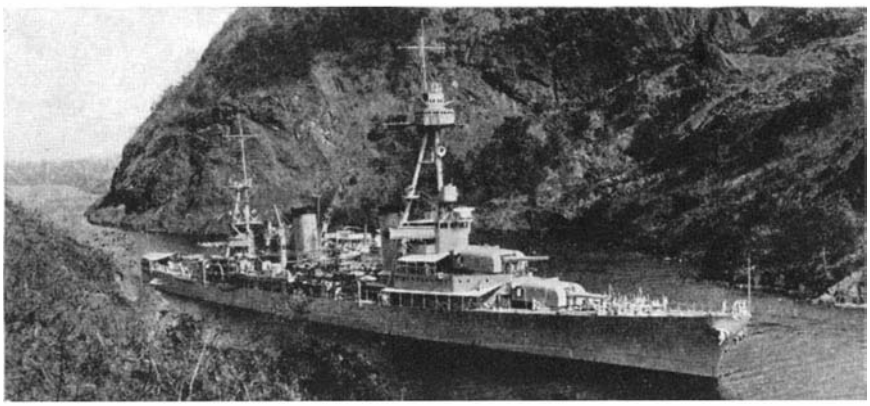
During the Nineties the British navy did not look with favor upon armored cruisers. It preferred the so-called "protected" cruisers. In these there was no side armor, in lieu of which an armored or "protective" deck was placed over the vitals or perhaps over the entire length of the ship. Ordinarily the deck was sloped down on each side so that it joined the ship's side several feet below the water line. The crown or flat portion of the deck was placed several feet above the water line so that shell holes in the side of the ship would not admit water over the entire surface of the deck. This system of protection had been introduced in 1880 in the Italian battleship *Italia*.

MANY of the British protected cruisers of the Nineties were of large size and carried relatively heavy guns. For example, the *Terrible* class (1895) was of 14,200 tons displacement and carried two 9.2-inch guns as well as a number of six-inch guns. It soon became apparent, however, that ships of such large size were not required for commerce destruction and protection. This seems to have been the primary duty for which they had been designed. Thereafter there was a gradual reduction in the size and armament of British protected cruisers.

All of the other large navies built protected cruisers during the Nineties and the early years of the present century. Most of them were of moderate size, from 2000 to 8000 tons. The ships had been designed for commerce destruction and protection, but they reflected in their widely divergent characteristics the uncertainty as to just what qualities were desirable for work of this kind. Some carried heavy guns while others were lightly armed. For example, the Japanese *Matsushima* class (4200 tons) had a single 12.6-inch gun on each ship besides smaller guns, while the Russian *Bogatyr* class (6500 tons) carried only three-inch and six-inch guns. Speeds ranged from as low as 16½ knots to 25 knots.

At the battle of Yalu in the Sino-Japanese War, ships of the *Matsushima* class were extremely inefficient. They could not make effective use of their 12.6-inch guns, for which great sacrifices in other characteristics had been made.

Among the miscellany of ships of the



The *Pensacola* in the Culebra Cut, Panama Canal

protected cruiser type, the Russian *Novik* (1900) pointed the way toward future development along rational lines. This vessel was of only 3000 tons displacement, but she made a speed of 26 knots—very high for the time. She carried six 4.7-inch guns and five above-water torpedo tubes, and had a protective deck of two-inch thickness over the vitals.

During the Russo-Japanese War protected cruisers were unable to keep position in the battle line at fleet actions, but they proved of great use in other respects. In the preliminary stages of an action they were used for scouting. During an engagement they served to give the heavy ships protection against attack by torpedo vessels. Throughout the war the cruisers were used for patrol duty and for breaking up attacks by enemy light ships. The Japanese found that cruisers were of great service in the protection of their lines of communication to Korea from the attacks of Russian cruisers. On the whole, the experiences of the war seemed to indicate that the primary functions of cruisers had to do with fleet operations and not with commerce destruction.

From 1905 to 1914, many small, fast cruisers were built, principally by the British and German navies. In these ships, speed, cruising radius, seaworthiness, and handiness were emphasized. Batteries were light, consisting of guns of from four- to six-inch caliber mounted on the deck behind light shields or entirely unprotected. In most cases side armor of two- to four-inch thickness was fitted, in addition to a light protective deck. Generally deck torpedo tubes were carried. Sizes ranged from 3000 to 6000 tons, and speeds from 23 to 29 knots. These vessels were called "light cruisers," a term which is still in use. Among the most successful of them were the ships of the British *Arethusa* class (1913). In this class, high speed—29 knots—and reasonably good offensive and defensive power were obtained on the small displacement of 3500 tons.

During the World War, the *Arethusas* did excellent work in patroling the North Sea, in scouting, and in leading destroyers in to attack. Indeed, throughout the war light cruisers of moderate size, rarely over 5500 tons, seem to have fulfilled all of their functions efficiently. In fleet actions, these vessels were of great use to both sides in ascertaining and reporting the strength and disposition of the enemy, in supporting torpedo attack, and in breaking up enemy torpedo attack. In carrying out these duties they met with surprisingly few disasters. Their protection was sufficient to enable them to engage in protracted engagements with each other. At the same time they were too small to attract the fire of enemy capital ships except on rare occasions. Even then the light cruisers were often successful in escaping by virtue of their great maneuverability, high speed, and small size.

Torpedo tubes were of little or no use to cruisers during the war. Though many torpedoes were launched, practically no hits were obtained. In fact, so far as the writer knows, the only successful torpedo attack from a cruiser during the entire war was one which sank the German cruiser *Frauenlob* during the night action after Jutland.

Normal post-war developments in cruiser design were toward greater displacements and toward slightly higher speeds. These features were incorporated in the British *Frobisher* class (9770 tons, 30 knots), British E class (7100 tons, 33 knots), and French *Daguay-Trouin* class (7880 tons, 34 knots). All except the *Daguay-Trouins* were generally similar to earlier light cruisers. The French vessels differed in that protection was very light and consisted only of a protective deck. All navies gradually adopted airplane catapults as a feature of cruiser design.

In 1922, a most disturbing factor was injected into the problem of cruiser design. This was the Washington Naval Treaty (Treaty for the Limitation of Naval Armament). The treaty set a limit of eight inches on the caliber of guns which could be carried by a ship of displacement less than 10,000 "standard" tons. Standard displacement does not include fuel oil or reserve feed water. By this measure, a 10,000-ton ship actually displaces about 11,500 tons when ready for sea.

The Treaty limitations led to the advent of an entirely new type of cruiser. Vessels of this type, which were built shortly after the signing of the Treaty, were armed with eight to ten eight-inch guns in addition to a few guns of smaller caliber. Most of them carried deck torpedo tubes and airplane catapults. Some were fitted with airplane hangars. Speeds ranged from 32½ knots on American and British vessels to 38 knots on Italian ships. All of the earlier Treaty cruisers had very light protection, in some cases insufficient to resist the attack of a destroyer's guns. In their design and construction, great effort was made to save weight in order to secure the "most ship" on the allowed weight. Costs were extremely high, because of the weight-saving policy.

WITHIN recent years there has been a strong trend in the design of Treaty cruisers toward increased protection, but even today these vessels are referred to by their critics as eggshell ships. They are styled officially as "heavy cruisers," the old name of armored cruisers being avoided.

The eggshell cruisers have met with very severe criticism abroad, especially in England. The critics claim that these ships are unnecessarily large and expensive, that they are poorly protected, and that their guns are too large. Indeed, several foreign powers have abandoned the 10,000-ton cruisers in favor of smaller vessels armed with six-inch guns.

The United States has been a staunch advocate of the 10,000-ton, eight-inch gun cruiser. It has been claimed in this country that eight-inch guns should be carried by cruisers in order that they may be able to dispose of ex-merchant vessels armed with six-inch guns. Arguments in favor of the large size of Treaty cruisers are based on the claim that this size is essential to obtain the necessary cruising radius.

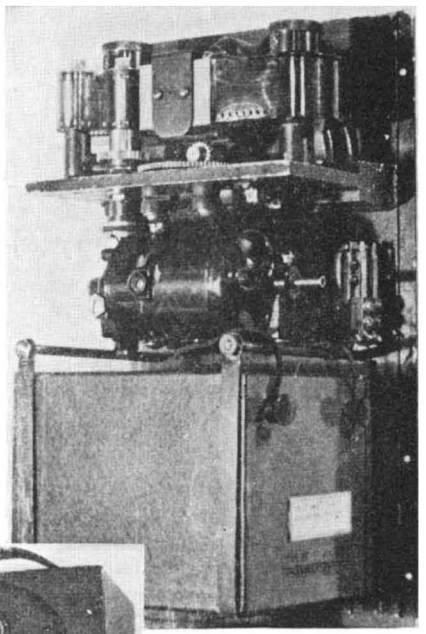
Whatever arguments may be advanced for or against the Treaty cruiser, however, we cannot escape the fact that during the late war, cruiser functions were carried out efficiently by much smaller and more lightly armed ships. Nor can we escape the fact that present 10,000-ton cruisers are so lightly protected that in all probability an engagement between two of them would be decided on the basis of luck. Moreover, to give such a ship adequate protection against eight-inch gun attack would require a sacrifice of speed. The resulting ship might be called a "pocket battleship" or more appropriately by the discredited name, "armored cruiser."

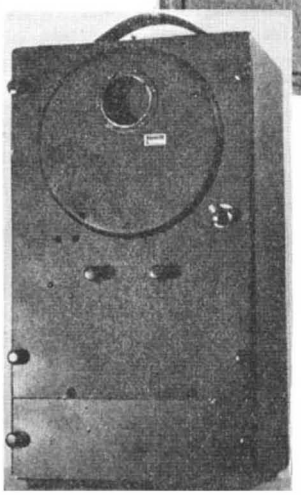
CRIMINALS PHOTOGRAPHED *IN THE ACT*

POSITIVE identification is the weapon most feared by organized crime and the ruthless criminal. Efforts have therefore been made for many years to produce a workable camera which would photograph the hold-up while the act is being committed. Now with the aid of especially fast film and very efficient lenses the problem of doing just this seems solved. Universal focus and ample field of view of the lens are of course essential to success. The problem is a hard one and considerable equipment is required; anywhere from one to five cameras are used so as to photograph the hold-up from various angles. The system is intended primarily for banks, other institutions that pay out or receive considerable sums of money, and jewelry stores.

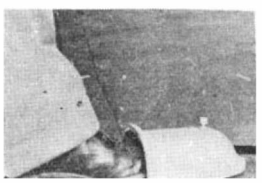
The cameras are concealed at strategic points by grillworks or other masking devices and may be started in operation in a number of ways which will not attract the attention of the bandits. Once the cameras start, a complete record of the robbery is secured. It has been determined that the average hold-up occupies only about three minutes. Each camera will make 240 exposures for each loading and it takes 12 minutes to run off the film.

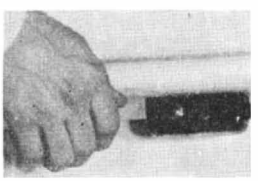
The exposures occur at regular intervals of approximately three seconds. This is sufficiently frequent to follow the acts and movements of all parties concerned. Three exposure-time values are repeated consecutively, one of which will be approximately correct for the existing illumination at the time the camera is in operation. Of course the more light the better, but there will often be cases where the light will be comparatively dim. Under normal illumination of about five foot-candles of light reflected from the object, the shortest exposure used will produce identifiable pictures. Under low illuminating values the longer exposures will produce recognizable pictures down to one foot-candle of light reflected from the object.

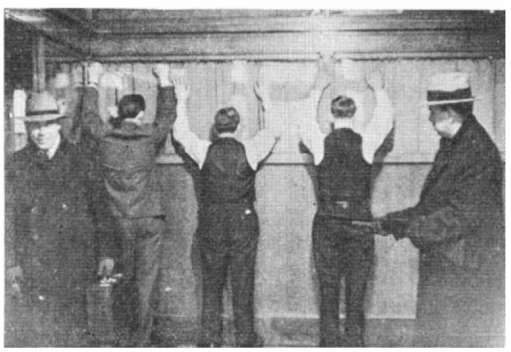




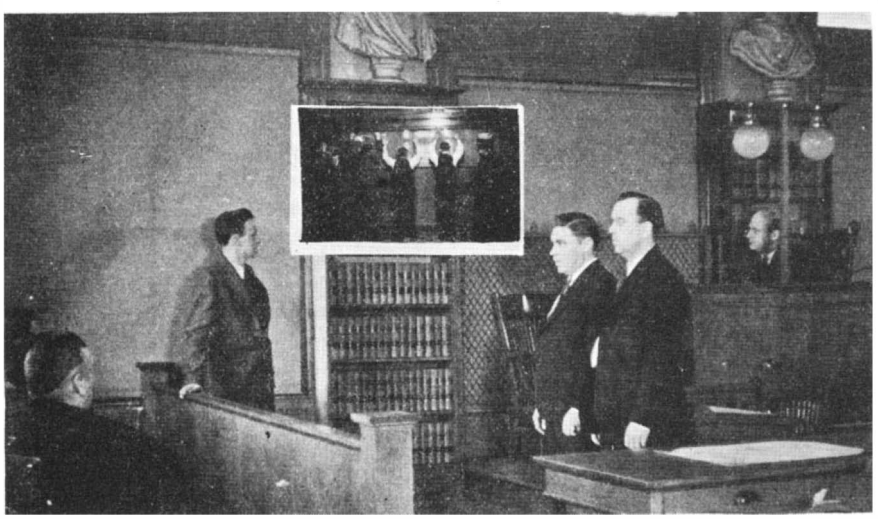
Left: **The front of the concealed camera.** *Above:* **The mechanism is operated by batteries; even if cables are cut the camera continues to work.** *Extreme left:* **Foot control.** *Below:* **Hand button**







Right: **A scene at a hold-up. "Hands up!" is a too well known slogan. The bandits are being photographed by the concealed silent camera.** *Below:* **The scene is reproduced on a screen in court**



THE system is inaudibly started electrically, and when once started there is no stopping it. If the bandits should discover one of the wires, or if they were cut in an inside job, nothing can prevent the cameras from functioning; even the lens is protected by bullet-proof glass. Naturally the cameras must have motors to drive them, but they do not depend on an outside circuit and they are all driven by dry batteries so they cannot be disabled by cutting, shorting or destroying any part of the outfit. After the exposures have been made the negatives are developed and positives are made which can be utilized by the police in comparing the pictures in the "rogues' gallery." They may also be projected in court and there is a good prospect of re-enacting the crime. Two of our illustrations show a photographed hold-up where the victims are faced to the wall, and the same scene being projected in court for the benefit of the judge and jury. The system is known as the "Oshkosh Photo-Identification System."

What it Means to be Lazy

It May Not—in Fact it Probably Does Not—Mean What Many Think it Means. And the Condition is Curable

By DONALD A. LAIRD

WERE you a lazy boy? Have you a lazy boy? Perhaps, in fact, you are a lazy boy. Well, then, here is good news: In such cases there is lots of hope. Many a lazy boy has turned out to be a genius. However, geniuses are comparatively rare, so let us omit that dream and see what the chances are of emerging from a state of laziness into no more than a plain, ambitious, ordinarily energetic average human being.

Laziness is seldom an absolute quality, like nearsightedness or flat feet or a tendency to have hangnails, but is relative to one factor—interest. If a boy is lazy he isn't hopeless; he just hasn't yet become interested in anything. If a man is lazy he has not yet found his work.

If we grant the above, ambition is not something which can be pounded into anyone, boy or man. A real interest is the prerequisite and one must be sought.—*The Editor.*

"HE is so lazy that he hates to breathe," is a phrase used by midwestern farmers to describe their lazy farm-hands, and is sometimes extended to their own sons. Indolent boys and girls are a cause of considerable worry to parents the world over, and have been for generations.

Gioachino Rossini, the celebrated Italian composer, was so lazy as a boy that his father made him work the bellows for the blacksmith and invited his playmates to jeer him. Montaigne, the French essayist, was "lazy and languorous" at seventeen. The English novelist Harriet Martineau was "indolent in body," as her discreet critics phrased it. Another English novelist, William Makepeace Thackeray, was called an "idle boy" by his teachers, and "very lazy" by his school fellows. Justus Liebig, the famous German chemist, was so lazy that he kept faithfully at the foot of his school classes, in spite of the fact that his intelligence quotient is said by Stanford University psychologists to have been as high as 165, in contrast to the average intelligence quotient of a mere hundred. But perhaps such geniuses can afford to be indolent.

Amazing are the reports of the prevalence of laziness among ordinary children of the present day. One out of every eight children in 42 classes studied in Moscow schools by P. P. Blonsky, as recently as the year 1929, was found to be lazy—more than 10 percent of school children lazy. As the reader might suspect, the vast majority of lazy children denied that they were lazy; 80 percent of the lazy ones, in fact, denied that they were indolent idlers despite overwhelming evidence to the contrary.

"The English novelist, Harriet Martineau, was 'indolent in body,' as her discreet critics phrased it," meaning lazy

It is probably another instance of "like father, like child" in this regard. The grown-up and lazy loafer is not lazy, in his opinion; he is merely "thoughtful" or "does not believe in rushing into things half-cocked." Eighty percent of undoubtedly lazy children maintain that they are misjudged, and if a house-to-house canvass were made of adult loafers we should probably find about the same percentage of denials of the charge of laziness. In other words, 80 percent of us may be genuinely lazy and not know it, just as many fellows who insist on relating allegedly humorous incidents to entertain others, are in cold fact bores rather than entertainers.

THE school children studied by Dr. Blonsky made another strange revelation—one that may cause much family discussion. Of all the girls only 4 percent were unequivocally lazy, but exactly 19.3 percent of the boys were discovered to be in this category of undeniably lazy. Think of it—more than four times as many lazy boys as girls; in fact, almost five times as many lazy boys! Can this be true?

Well, when we look into the outstanding problems of a thousand grown persons, equally divided between men and women, of the average sort, selected neither for their genius or their peculiar "dumbness," we find the confirming tendency for more men than women to have laziness their most difficult tendency to overcome. The exact figures show that 14 percent of men and nine percent of women have this human fault developed to an acute point.

So the "weaker sex" may not be as weak as men have alleged.

Plainly, women are not as lazy as men, whether the women are little girls yet in short dresses, or women in full-bloom and long skirts. This is all the more astonishing when we discover that the study of the same thousand men and women showed that, while only 11 percent of the men lacked energy to do more, 15 percent of the women showed this to be their greatest need.

When the energy of women

is measured by their metabolism it is found that they are about 15 percent below men in this measure of available energy. This fact, coupled with the observation that, periodically, women also have unusual physiological depletions of this energy, reflects but scant credit upon masculine indolence exceeding theirs. Here we find that women have more actual physiological justification for being lazy, but paradoxically it is the opposite sex that excels in laziness.

EVERYDAY observations confirm the scientific findings about which is the lazier sex. Laziness makes the automobile popular, many persons being, frankly, too lazy to walk. Every family knows who makes the most use of the automobile to avoid walking. Then, too, the husband buys a power drill for his home workshop before a family electric dish-washer is purchased. These little points are cited not to cause family arguments, but as common experiences which anyone can multiply by his own observations, in order to illustrate the point.

Being tired and being lazy are very different things, although it is easy to confuse laziness and fatigue. Women may fatigue more quickly than men, although they are less lazy. Medical examinations of the indolent children in the Moscow schools, for instance, revealed no illness or other medical reasons to account for their laziness. True laziness, such as we are discussing, is mental and not physical. It is caused by ideas and emotions, and is not caused by work or poor physical condition. The lesser laziness of women, in spite of their lesser energy available, shows it is a mental factor that underlies laziness. Tramps are not sickly weaklings; they are usually strong hulks of men with mental attitudes that make them shun exertion. Then, consider the hard application to work, against the obstacles of physical fatigue and actual illness of many outstanding personages:

As a youth, Michel le Montaigne, the great French essayist, was "lazy and languorous"

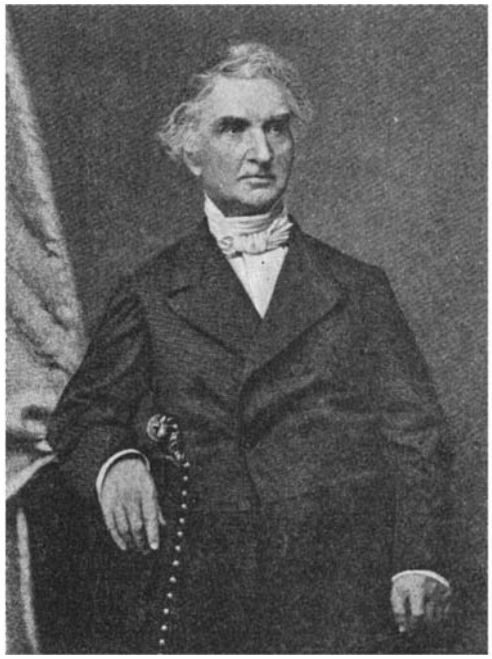
Charles Darwin's body was always racked by weakness and illness; all the vast amount of creative scientific work done by this famous English naturalist was made only at the price of great effort against his physical frailty. The great German philosopher, Immanuel Kant, labored consistently against similar genuine physical fatigue and weakness. Always frail, and with his health giving away when he was 30, Friedrich von Schiller was still an indefatigable worker, often laboring for 14 hours a day in taxing, creative work. He worked when he should have been resting in bed, and this total lack of laziness—though he had every bodily reason in the world for being lazy—is generally considered an important reason for his almost complete loss of health while still a young man. Lack of laziness finally and heroically took him out of this life in a three-thaler coffin at midnight.

Was it the efforts of Rossini's father or the natural course of events, that awoke Rossini?

An astonishing psychological experiment, which has been repeated many times, shows dramatically how potent the nervous system is in causing laziness. A person is made to lift a weight time after time with a finger, to the rhythm of a metronone, until he cannot move the finger a single time more. "My finger is tired out," the subject says, "the work has fatigued my muscles." But the weight-lifting has not fatigued the muscles of the finger, as the next phase of the demonstration experiment shows. A mild electric current is applied to the finger muscle to take the place of the nerve currents, and —lo!—the finger contracts, showing plainly that the muscle was not fatigued but that it was the "little grey engine," the mental machinery, that became tired of the exertion and gave up the job. The muscle was not tired; the mental powers and the nervous system through which these powers work simply "lazied" on the task of lifting weights, just as they lazy on many more important things. Women's muscles may tire more quickly than men's, but the findings previously discussed show that their mental machine does not give up and make them lazy.

What the mental factors are that make people lazy has been well studied in recent years by psychoanalysts in Vienna and Zurich, by industrial psychologists in England, and by vocational psychologists in America.

DAY-DREAMING is reported by the psychoanalysts to be a prominent cause of laziness. It is easier for the mental machine to take this course of idle reverie than to settle down to brass tacks and concentrate on some definite problem, although it is definitely known that we think faster when we are thinking constructively about a problem than when engaged in the pleasurable, albeit profitless, mental idling of "building castles in Spain." Practically everyone goes through a stage of intensified day-dreaming at about the twelfth to twentieth year, and some apparently never grow out of this indolent period of reveries. The tramp has been found to be especially active in day-dreaming. Reclining with his hat pushed over his eyes, he compacts the sward of the hoboes' jungle on the edge of town with his tattered clothes and dirt-encrusted body, while his mind wanders into Elysian fields. Although awake, his mind builds idle phantasies which serve no purpose other than their own fleeting generation. Like many other lazy



Thackeray was called an "idle boy" by his teachers and "very lazy" by his playmates

adults, he is lazy because he still has the uncontrolled and undirected imagination of a youth.

People day-dream because that helps them to surmount the difficulties of life through their imagination. Day-dreaming solves no problems, but it gives us the deceptive and fleeting pleasure that we can imagine they are gone. We simply try to wish them away. Hard knocks, disappointments and other similar mental experiences make day-dreamers out of many folk and, by doing that, make lazy people out of them. This should give us sympathy with lazy folks of our acquaintance, but does not explain the greater laziness of men, since theorists and practical scientists agree that womankind has more of these disappointments and frustrations than do men.

MENTAL causes for the laziness particularly of men are described by the English industrial psychologists and the American vocational psychologists. The hum-drum monotony of almost ceaseless industrial tasks is found by the industrial psychologists to cause great boredom which naturally, and almost inevitably, leads to a mental condition which readily promotes laziness. Sometimes this laziness does not become generalized, and we see the lazy, stalling worker hurrying home from the factory to work like a horse in a flower garden or building delicate and attention-straining models in a basement workshop at home. When interest in work wanes, laziness grows. So many men have to work at whatever is offered them, in order to earn bread and fuel and clothes, that this is almost a record-breaking cause of laziness. That is the reason why, when college students ask me what job they should take upon graduation, I always try to find out the job which would be likely to prove most interesting to their mental make-up; and why, in the laboratory, I am always studying the interests of the individual students, to make certain that I can get them to work on the one experiment we happen to have under way that will really fit in strongly with their basic interests.

The "dumb" man—or woman, for there are some "dumb" women, also—has been discovered by the industrial psychologists to be of a sort that seldom becomes bored with a job, no matter how monotonous it may appear. But men and women who are not "dumb" also have to work at these same jobs. Thus arises the tragic anomaly of the really intelligent people being more likely to become lazy—an important problem that the technocrats ignored and which might offset their entire theoretical system in actual practice. Because the majority of workers are intelligent, the majority of workers were therefore exposed to this pernicious and growing system which breeds laziness in strong and healthy bodies.

CLOSELY related are discoveries made by the American vocational psychologists—those of the appalling rate of change of job interests. Many, including famous persons, quickly become bankrupt of enthusiasm. Frederick Keppel found that approximately one half of men college graduates had widely changing vocational likes and dislikes, and Dr. Harry Dexter Kitson of Columbia University found that even among those in "Who's Who" a full 16 percent had changed their vocations in a major way. In rare contrast are those who know what they really want to do, and then proceed to do it successfully, in a straight-forward, and far from lazy, manner.

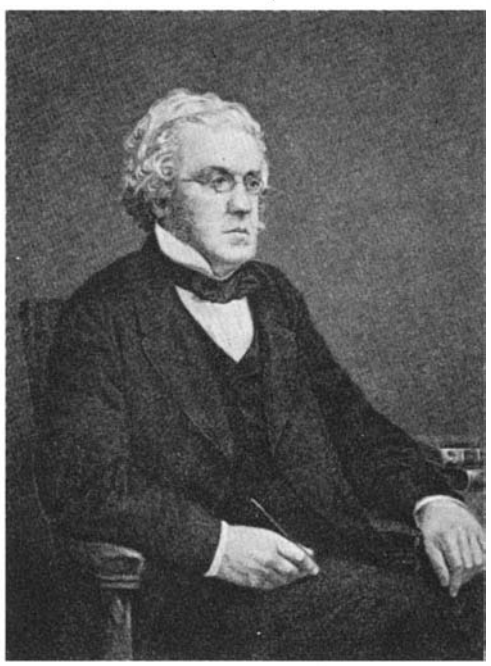
There is the rare Roy Chapman Andrews, for example, who knew full well at the age of ten that he wanted to be a naturalist and explorer, and has steadfastly and brilliantly followed through with no semblance of laziness. Or consider the brilliant young American writer, James Gould Cozzens, who knew definitely long before he entered college that he wanted to be a great writer. Without indolence he hewed to this line. We now see the reading public buying 5000 copies of one of his books in a single week, during a period when book stores have been going into bankruptcy.

We are indolent and lazy until we find our right work. Until we find this, we go through spells of laziness, with the inherent hazard that they may become fixed habits. Of course, a few favored persons may be fortunate enough to have the wide opportunity to fill many jobs at the same time. Such was the Rev. W. P. Young of Burlington, New Jersey, who, "in addition to being a minister, is a blacksmith, glass sign manufacturer, gas station owner, insurance agent, and crack harmonica player;" and who, more recently, is coroner.

THE stages that Robert Sessions Woodworth, distinguished head of the department of psychology at Columbia University, passed through are more typical of most folk. First he was going to be an astronomer, then he went back to the land and became a farmer. This was followed by his being a musician, then a minister, then a philosopher, then into the deep study of physiology, finally landing in psychology where he has been a powerful influence in guiding American psychologists from fascinating but futile fads and isms.

Thus we find that people who have not found themselves, or who are not satisfied with themselves inwardly, are the chief ones that contribute to our vast army of lazy loungers.

Some seem never able to gain such insight, however. Such was the case with the writer of a letter I recently received from Nova Scotia. He was a man just passing into middle age. He had found one of my articles interesting, but in place of writing his appreciation he wrote for me to tell him "what job he could get that required no work at all, and would make him rich."



The fact that Liebig the chemist was a lazy lad did not prejudice his future

From the Archeologist's Note Book

An Uncomfortable Royal Bed

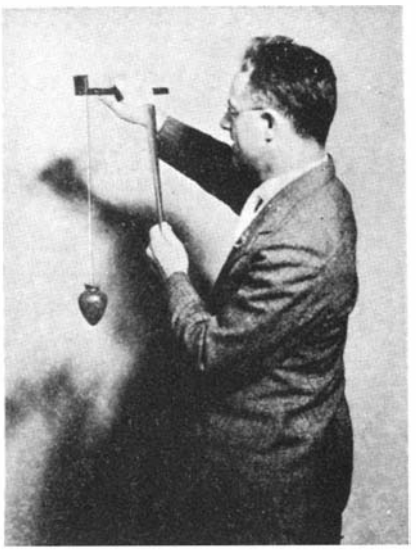
THE ancient Egyptians had good furniture, they drank wine and beer, used cosmetics, and were generally up-to-date but when it came to sleeping, a contraption that looked like an oar-lock was the torturing pillow. The bed illustrated is in the Boston Museum; it was reproduced from the original in the Cairo Museum. The bed slopes and a foot board kept the mattress from slipping off. The original, cased in gold, belonged to Queen Hetep-Heres I, mother of Cheops.

The Portland Vase's Rival

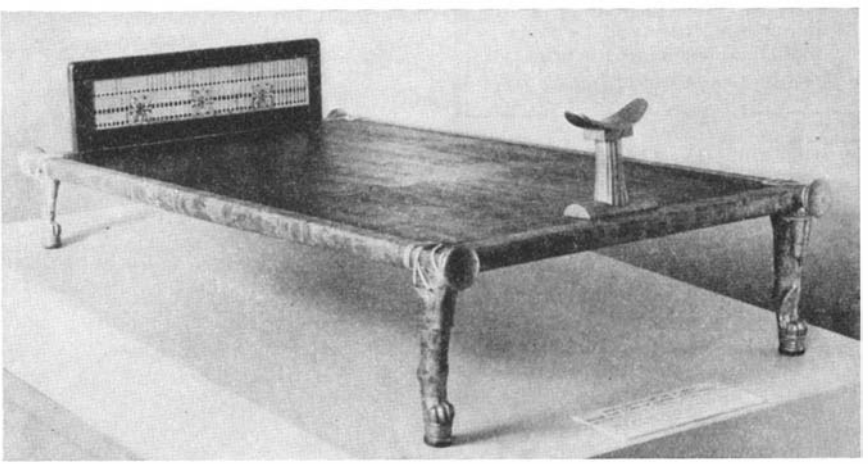
THE Portland vase, one of the world's finest art works, is a celebrated urn found in a sarcophagus near Rome. It is of dark blue transparent glass ornamented with cameos of opaque white glass, representing what are probably scenes from the legend of Peleus and Thetis. It was broken to pieces by a lunatic in 1845 and has been cleverly mended. At the Toledo Museum of Art, one of the outstanding museums of the Middle West, there is the so-called Libbey-Toledo vase of exquisite workmanship which Dr. Eisen, the great authority on ancient glass, says is superior in design and execution to the Portland vase. This author deduces from the representation of certain features on the Portland vase that the artist who executed it had a definite locality in mind, which he identifies as the promontory of La Gaiola in the bay of Naples. It is probable that the Portland vase in its original condition had a base; one of our illustrations shows how such a base would appear.

Astronomy in King Tut's Time

IN the Oriental Institute at Chicago is an astronomical instrument with which King Tutankhamen's astronomers, probably priests, took observations. The plummet, as mounted, was employed in setting the sighting instrument directly over the observer's meridian, presumably a north-south line marked on a pavement or temple roof. The observer could then determine when a star crossed his meridian, thus forming a crude stellar clock. The inscribed ebony handle and the plummet are ancient. The block and cord are restorations.



An ancient astronomical instrument



Bed of an Egyptian queen 5000 years ago. The pillow called for a heavy coiffure

Right: **The Libbey-Toledo vase in the Toledo Museum of Art rivals the great Portland vase, one of the world's masterpieces**

Center: **The Portland vase after restoration, but minus the base that it must have had when originally made**

Extreme right: **An artist has added a base to the Portland vase so that it assumes the symmetry of the Libbey-Toledo specimen**

THE DETECTION OF FOOD ADULTERATIONS

HERE is an article which leads you no farther than your kitchen to find interesting specimens and a practical application for your microscope. The branch of microscopy dealt with in it is so large that it can furnish material for a hobby in itself.

Naturally, so important a subject cannot be fully covered in an article and the microscopist will find the book, "Microscopical Examination of Foods and Drugs," by Henry G. Greenish, which can be obtained through SCIENTIFIC AMERICAN, a clear text on the subject.

The amateur is advised to follow the true scientific method from the outset of his studies and not come to too hasty conclusions regarding the purity or impurity of the food he examines. Findings should be checked and re-checked.—*The Editor*

THE complexity of our modern civilization makes it impossible for us to know what care and cleanliness has been exercised in the production and manufacture of the foods we buy. And, although the law requires that the ingredients be listed on the outside of the package along with the statement of the net weight, and that the product be made from clean unspoiled materials, not infrequently products can be found containing adulterants and impurities which can be detected readily with the microscope. However, we may be reasonably well assured that we receive wholesome, unadulterated, quality foods if they have been produced by reputable manufacturers.

For detecting some forms of adulterations, a microscopic examination is more dependable than a chemical analysis, because often the chemical composition of the adulterant is so nearly identical with the chemical composition of the pure food that a chemical analysis alone cannot be accurate. The microscope is a time saver, and aids to check the chemist's findings and to direct his searches.

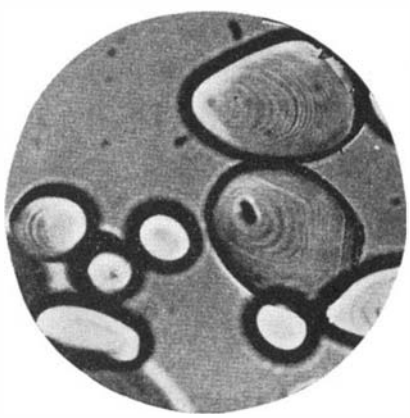
If the microscopist will make himself familiar with the physical structure of the starches and various ground substances which are used as adulterants, he can readily identify minute quantities of these materials in a mixture. A chemical analysis may show the presence of starch, but it requires a microscopic examination to determine the kind of starch present. Again, a chemical analysis may show a large quantity of crude fiber, which indicates the presence of a woody adulterant, but a microscopic examination is necessary to determine whether this woody adulterant is sawdust, chaff, hulls, powdered bark, or seeds. Accurate identification of these substances requires study and patient searching.

Some impurities in foods are not put into the product intentionally as adulterants by the manufacturer, but, through carelessness in the process of manufacturing, dust, sand, hair, insects, and waste materials find their way into the product. Adulterations of this type are relatively few, and are easily detected. The microscopist becomes well acquainted with the physical structure of the pure products he examines, and can readily detect particles which should not be present even in the most minute quantities.

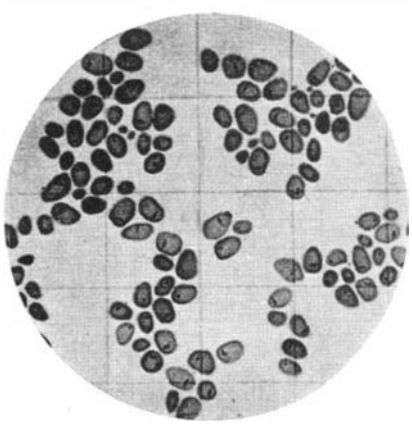
Another type of adulteration is practiced by the unscrupulous manufacturer who purposely adds some cheap, bulky, or heavy substances to his otherwise pure product in order to reduce the cost, to swell the bulk, or to increase the weight. Some jam makers have been known to use a large proportion of some cheap fruit such as gooseberries in the manufacture of "raspberry" jam, but the seeds of the two fruits are so different in structure and appearance that such an adulteration as this can be detected with no difficulty at all. However, this type of adulteration is most frequently found in foods, such as coffee, cocoa, spices, and prepared flours, where various kinds of starches are commonly used as adulterants.

Although all starches are identical chemically, the various starch granules have many individual characteristics that make their identification possible when studied under the microscope. The several varieties of starch granules differ from one another in shape, size, natural markings, and manner of grouping, thereby making it possible to classify them into three main groups:

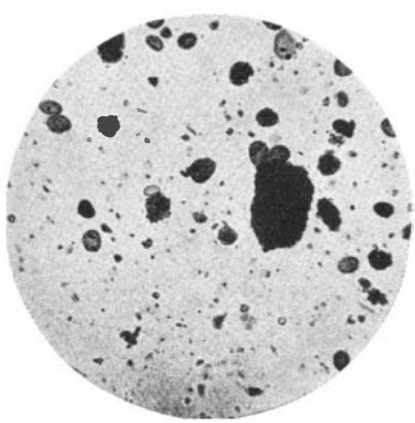
1. The circular group, including rye, wheat, barley, and tapioca.
2. The oval group, including potato, arrowroot, pea, bean, and lentil.
3. The polygonal group, including



Above: **Typical grains of potato flour, magnified 500 diameters**



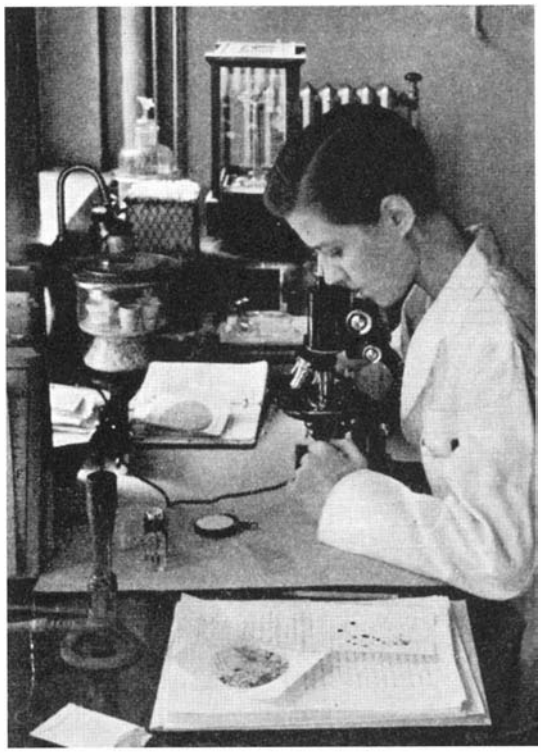
Left: **Grains of arrowroot starch. Do not confuse this with potato starch. A few examinations will make them easily distinguishable**



Right: **Breakfast cocoa adulterated with arrowroot starch. Magnified 200 diameters. The oval starch grains may easily be distinguished**

MICROSCOPE—VII
AND SPOILAGE—I

By K. BERNICE FICK, B.S.
Kroger Food Foundation, Cincinnati, Ohio



The author in her laboratory, making a microscopic examinations of adulterated foodstuffs

Indian corn, oats, buckwheat, and rice.

When starch granules are observed under the microscope dry or suspended in water, the outline is never clear or the details distinct; but, when stained with a very dilute solution of iodine and suspended either in water or glycerine, some starches become indigo, some blue, others purple and red. They stand out clearly against a white background, and certain individual markings appear very distinctly. The dark scar or marking on the starch grain is really its point of origin and is called the "hilum." This hilum varies in appearance with the type of starch as much as the shape of the granules themselves. Some appear as dots, some as circles, some as small slits, while others resemble the letter *x*. To see these markings plainly, the granules must be stained very lightly, because too much stain will make the whole mass appear as a dark colored spot. From a number of carefully prepared slides of the material suspected of adulteration with starch, when examined under the microscope, it is possible to determine whether the sample contains one kind of starch or a mixture of starches, the kind or kinds present, and to make a quite accurate estimate of the proportion of each present as an adulterant in the mixture.

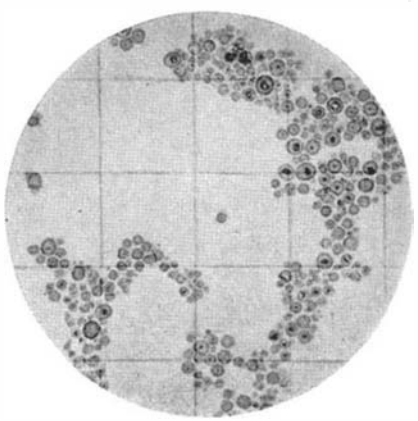
OFTEN the product contains some natural starch, and this must not be confused with the foreign starch which has been added as an adulterant. For example, cocoa contains natural starch grains which resemble rice starch, except that the grains are slightly rounded. Mustard contains small particles which resemble starch grains, but which really are small cells containing oil, and of course these cells do not stain characteristically with the iodine stain.

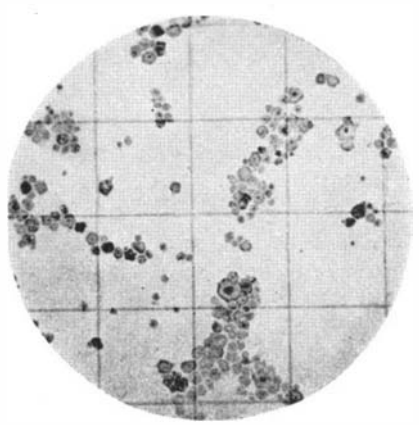
The amateur microscopist can find many food products containing starch right in his own kitchen. Some of these are pure starch, such as corn starch, arrowroot starch, and laundry starch; others contain an abundance of starch such as bread or cake flour, tapioca, Irish and sweet potatoes, and beans; and some few contain a mixture of starches such as pancake flour.

After the microscopist has collected some of these items in clean containers, his first duty is to prepare an iodine staining solution. This can be done by putting a small amount of ordinary tincture of iodine into a test tube or small bottle and diluting it with water until the solution becomes a medium amber color. Then, after he has cleaned a number of glass slides and cover glasses, he is ready to prepare his slides. This is done by dropping a drop of clean water in the middle of a slide and tapping a bit of the powdered material into it from a glass rod or pencil. Since the starch grains are comparatively small, a very small amount of the powdered material is sufficient. After the starch mixture has thoroughly dried on the slide, the slide is passed through a flame for "fixing." When cool, a drop or two of the staining solution is added and allowed to remain until the starch has turned dark blue. Then the excess stain is rinsed off with clear water, and a cover glass is carefully dropped over the darkest portion. After the bottom of the slide has been dried, the slide is ready to be examined under the microscope, which has been adjusted to give a magnification of 100x or 200x.

Since the potato is a solid material, it must be prepared for examination a little differently than a powdered substance. A fresh potato must be cut in half, and the cut surface lightly scraped with a knife to get some of the juice which contains the starch. This juice is dropped on the slide, dried, stained, and treated the same as dry materials.

(*To be continued*)





Above: **Typical woody adulterant**
Left: **Tapioca starch grains. 200x**
Right: **Corn starch grains—smaller**

Too Soon

Is as Bad as

Too Late

MAKING a scientific discovery or an invention years before the world is ready for it often turns out to be as disappointing as making it years too late. There is practical logic, it seems, in being *just* on the crest of the wave of public receptivity.

One man of science whose mind has worked about two decades ahead of the rest of us is the physicist, Professor Robert W. Wood, or simply R. W. Wood as he prefers to sign his name and as he is known to everyone in the world of science. R. W. Wood is a professor of experimental physics at the Johns Hopkins University, doing most of his research in that interesting corner of the science called physical optics. He has some kind of instinct—or call it "happenstance" if you will—for making experiments which later turn out to have widespread interest to the public.

Take, for example, infra-red photography, which he invented. Since he did this many appear to have re-invented the same thing. We see, here and there in this magazine or that, reproductions of infra-red photographs, but we see with them few mentions of Wood. In some way the captions beneath these photographs often create the impression that infra-red photography is a recent invention—perhaps of the man who took the photographs. No doubt, however, the unfamiliarity of editors with the special subject involved accounts for most of these instances.

SIMILARLY, someone—perhaps several—must have re-invented the infra-red method of making night views by daylight, widely used in motion picture photography—a method which has saved the motion picture industry millions of kilowatt hours. But it was R. W. Wood who made the original invention. The photograph reproduced below (at the right) is the first infra-red "night view" taken in full sunlight. This picture was made by R. W. Wood in the year 1909; that is, 25 years ago and long before the motion picture industry "invented" the same method.

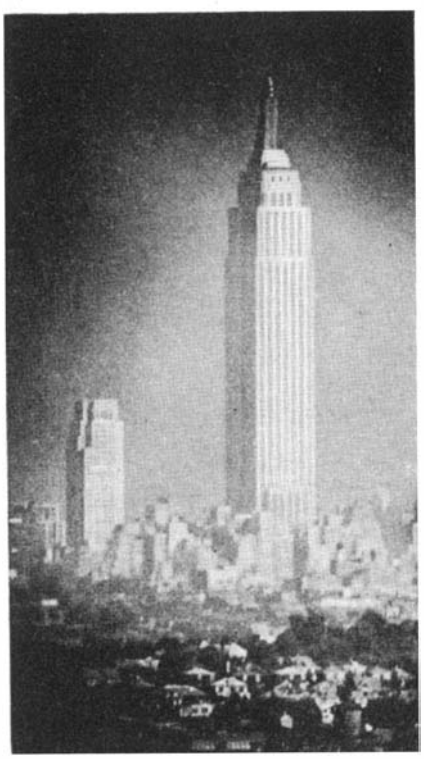
At the same period Professor Wood made the first photographs of the moon in ultra-violet light. A year or two later he lectured on the same subject at the Royal Institution of London, pointing out that an infra-red filter brings out distant landscapes by abolishing the obscuring haze. At that time the *Illustrated London News* published two pages of Wood's infra-red landscapes, but more recent publication of similar photographs gives us no clew to the original inventor. Wood's infra-red photography was also used to a great extent in the World War for photographing the earth from high altitudes.

Later, Professor Wood made ultra-violet and infra-red photographs of Jupiter and Saturn and the moon, with the 60-inch reflector at the Mount Wilson Observatory, and discovered belts on Saturn that had never been observed previously. The technique originated by him has been used to good advantage by others within recent years.

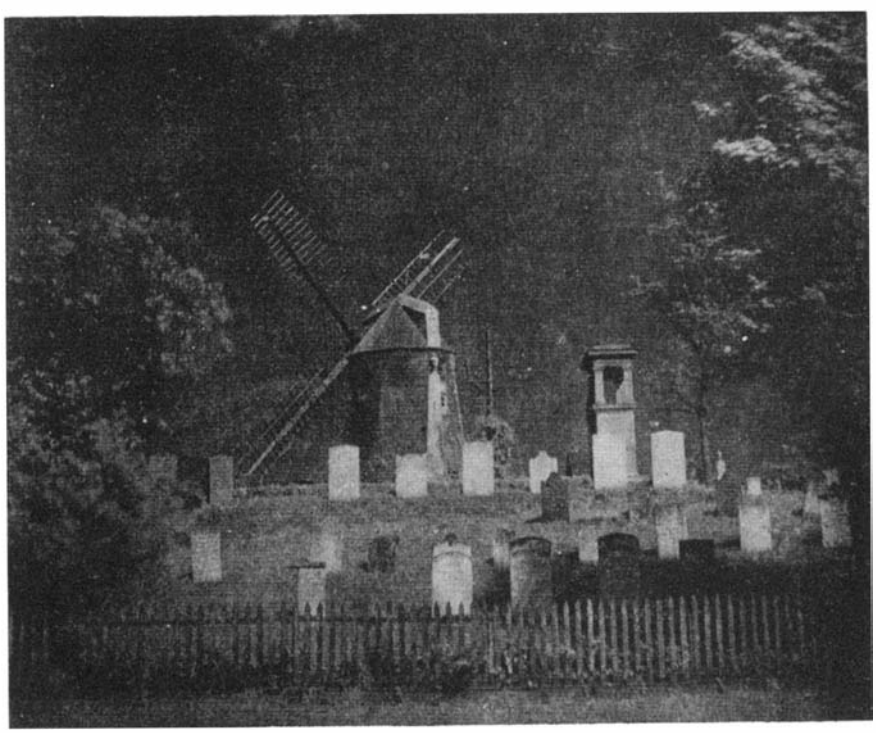
Wood showed, about 1909, that ultra-violet photographs will reveal erasures on checks and documents. A bureau of criminology in Vienna heard of this, obtained the details from him, and the method shortly afterward blossomed out as the "Vienna method."

Then it was Wood, also, who discovered the pre-fogging method of increasing the sensitivity of photographic plates. An account of this appeared in the *Astrophysical Journal* in 1903. But, according to a recent article in a photographic journal, this method was discovered in 1929 by someone else. Perhaps it was, but Wood was the first discoverer.

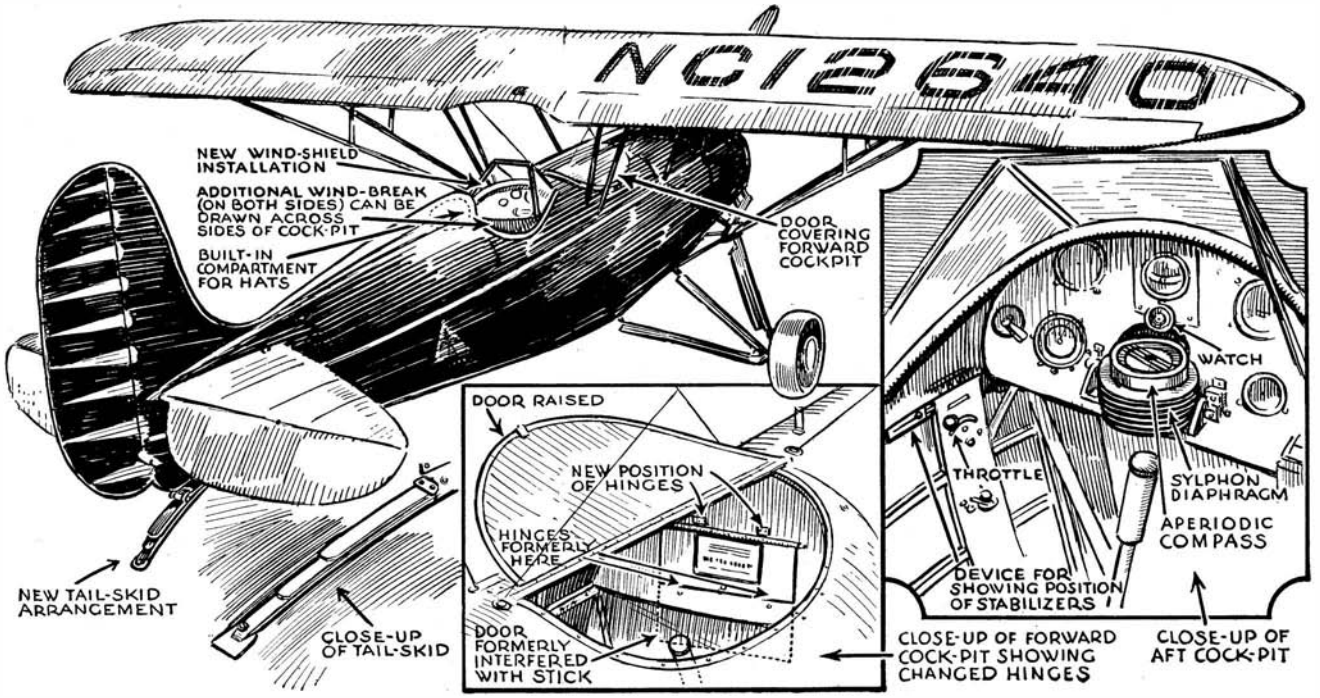
The only explanation of all these instances seems to be that Professor Wood was too many jumps ahead of the rest of us and that, when the world caught up, his work was too far back to be remembered.—*A. G. I.*



Above: **Infra-red photograph of the Empire State Building, taken from 18 miles distance, with a 6-inch telescope**



Right: **The first infra-red photograph ever taken was made by Professor Wood**



Details of improvements made to his plane by Luis De Florez, and described below

The Scientific American

Award for Plane Improvement

At the National Charity Air Pageant recently held at Roosevelt Field, New York, one of the events attracted much attention among amateur pilots and plane owners. This was the competition for the Scientific American Trophy to be awarded to the sportsman pilot, who, in the opinion of a committee of judges, had made outstanding improvements in his airplane since its purchase. The chairman of the committee was Professor Alexander Klemin, with James B. Taylor, Jr., a well-known pilot, Jerome Lederer, chief engineer of Aero Insurance Underwriters, and William K. Rose, as the judges.

A system of marking was set up which gave points for general utility of the improvements introduced for increase in safety, for improvement in aerodynamic performance, and for novel and interesting instruments or accessories.

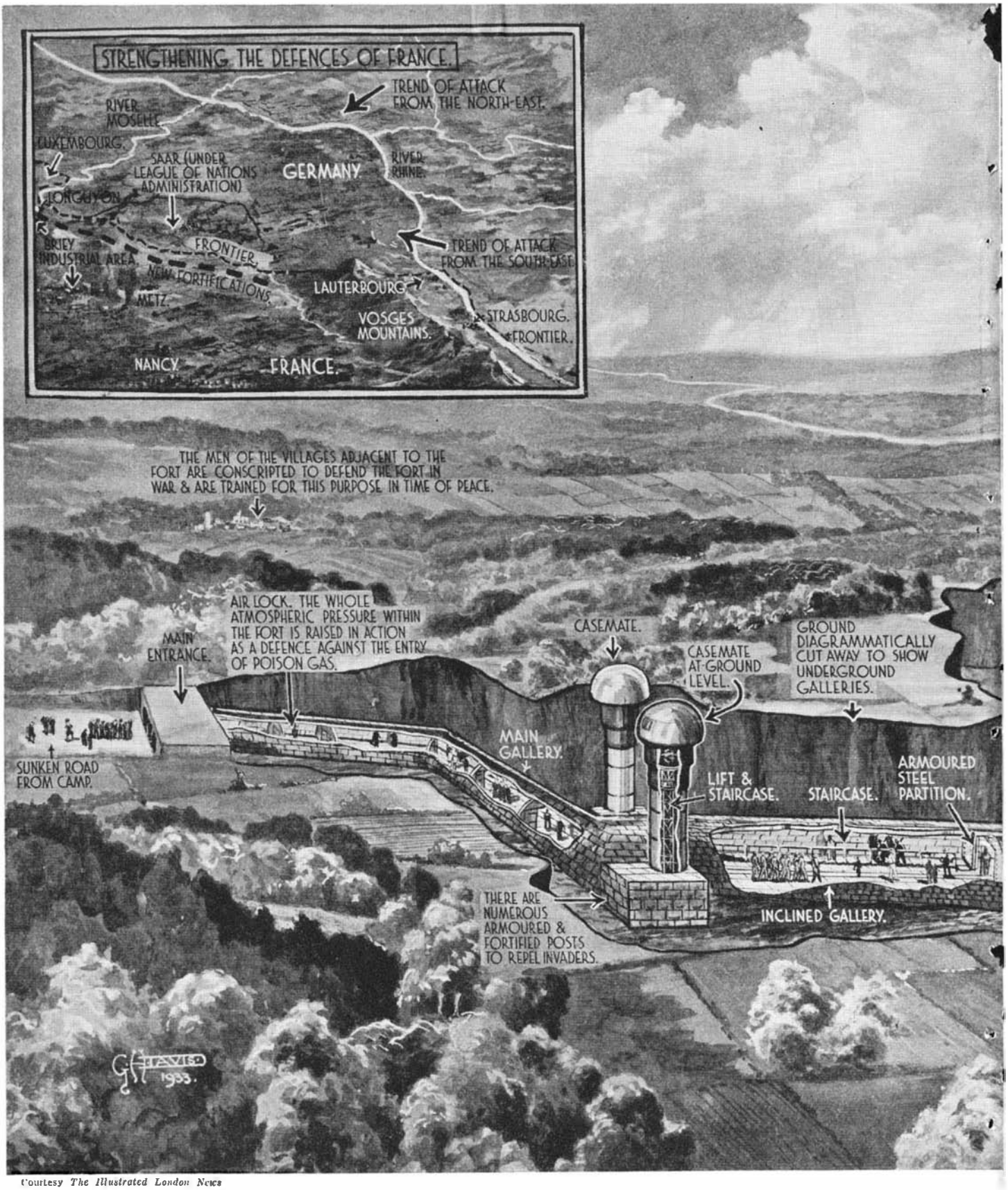
The trophy that was awarded

Careful inspection of a number of planes resulted in the award being made to Luis De Florez, consulting engineer of New York City, who introduced many ingenious and useful ideas into his Fairchild KR-22, a two-seater, open cock-pit monoplane, equipped with a Cirrus high drive or inverted engine, an excellent craft of well-tried reliability.

Mr. De Florez not only flies his own plane, but regards it as an interesting hobby and a sort of experimental station. Let us quote his personal views of what his airplane means to him:

"FROM the instant a pilot purchases a plane he becomes at once its best friend and severest critic. Flying some other person's ship does not seem to induce constructive criticism, and arguments which ensue as to relative merits only too often end in just plain disagreements. To the owner-pilot, however, who has made up his mind slowly and purchased a ship which suits him best at the time, it is a never-ending source of interest. Along with thoughts about what can be mechanically improved in the plane and how flying technique can be enhanced, it becomes only a matter of time before little by little the plane becomes filled with gadgets and those which remain are a mere fraction of those that have been tried and found useless. Along with these gadgets are innumerable other details which are usually tried, such as different kinds of waxes and polishes, lubricating oils and fuels, and so on. The plane becomes a mild form of experimental station from which some worthwhile contributions in design

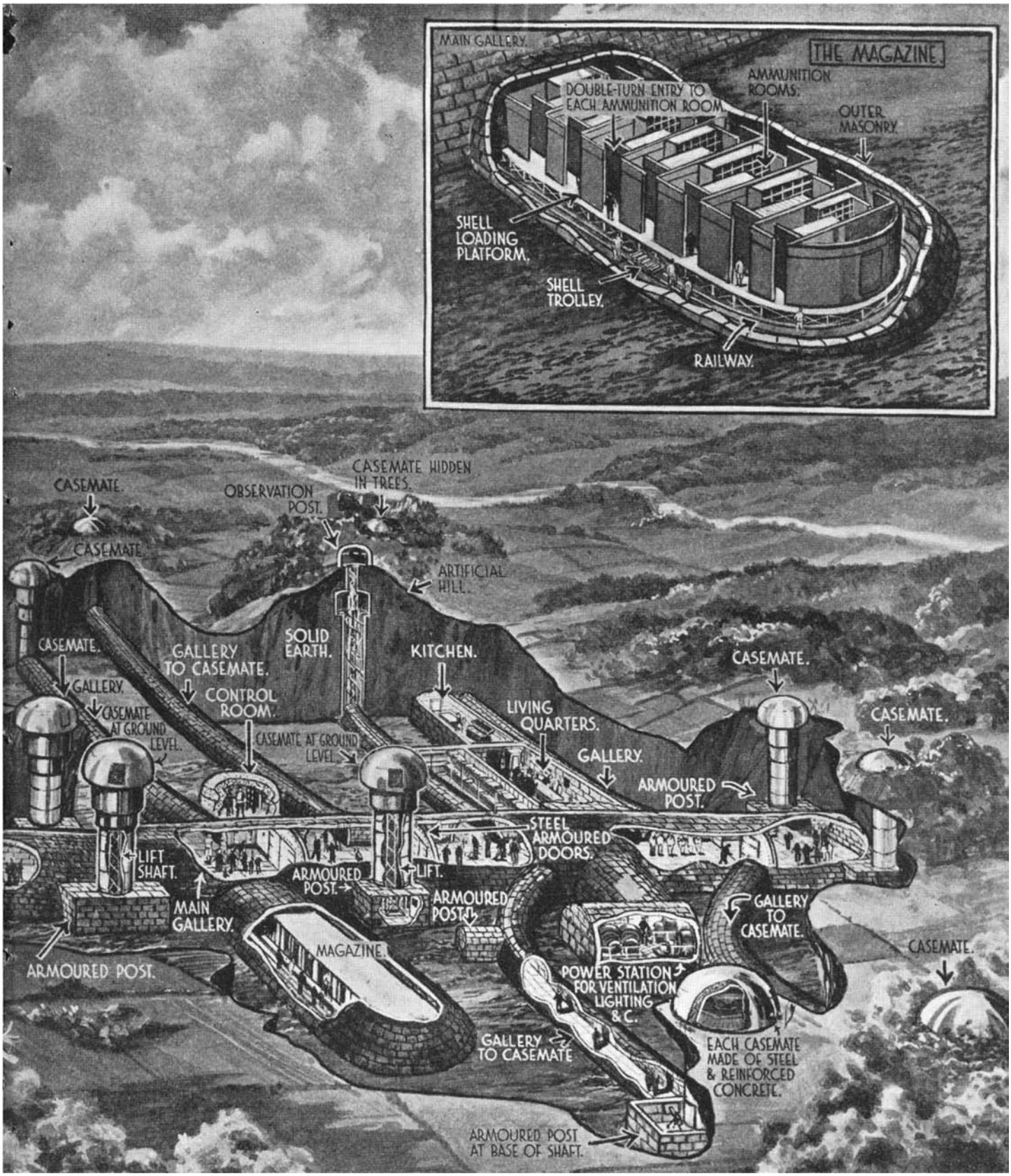
(*Please turn to page* 34)



Courtesy *The Illustrated London News*

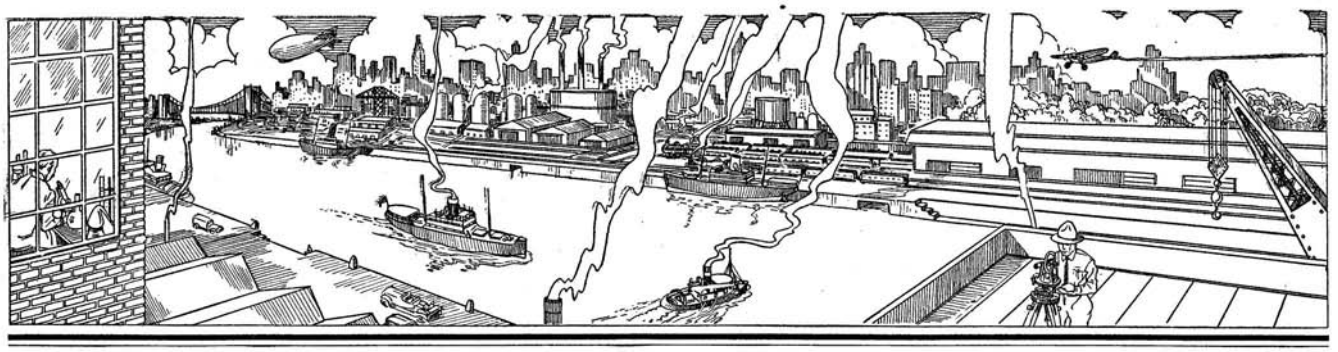
Modern Catacombs Protect the French Frontier

IN recent years, France, taking example by the lessons learned in the World War, has created an extensive system of fortifications along her frontiers. Some of the projects built for this purpose consist of strong forts while others are more spectacular in that they are composed chiefly of subterranean structures. The diagram above shows a section of the underground fortification system on the eastern frontier of France. The essential points of this system, built on a gigantic scale and believed to be the strongest ever evolved, consist of a line of fortified casemates giving each other mutual protection by cross-fire and interconnected by underground galleries safe from bombardment. As may be noted in the drawing, the above-ground portion of the casemates is concealed



by trees and other natural barriers. Below ground are galleries to contain ammunition supplies, others containing power plants, living quarters, and various appurtenances. At intervals along the communicating galleries the casemates rise to the surface on shafts in which there are electrically operated lifts, or elevators. This system will permit a sudden concentration of troops in an emergency. Means have also been provided to close the whole frontier completely within a few hours after an alarm is given.

According to *The Illustrated London News*, "Plans for the Maginot line,' so called after the late War Minister, M. André Maginot, who was in charge of the works, were first submitted in 1925 when it was decided to make a stretch of about 200 kilometers as far as possible impregnable." It is believed by those who maintain the thesis that adequate preparation for war operations is the best insurance against the outbreak of war, that this system of defense will go far toward preserving peace in Europe.



THE SCIENTIFIC AMERICAN DIGEST

Conducted by F. D. McHUGH

Contributing Editors

ALEXANDER KLEMIN

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

A. E. BUCHANAN, Jr.

Lehigh University

Newspaper Files Kept Photographically

A PROCESS by which files of newspapers may be preserved for posterity on photographic safety film was described recently by Charles Z. Case of the Eastman Kodak Company. This process is made possible by the development of a camera

Reading a newspaper file film as projected by means of a viewing device

that can photograph more than eight full-size newspaper pages on a strip of film 1⅜ inches by 12 inches and a month of 50-page papers on a single reel less than four inches in diameter.

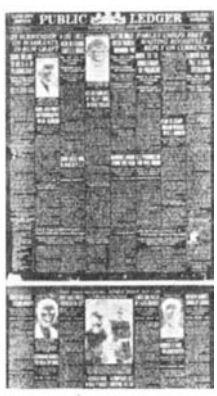
The deterioration of newsprint paper in files has presented a serious problem. By putting their back numbers on film, which is chemically much more stable than newsprint, newspapers are expected to be able to preserve their files indefinitely.

The film can be read in newspaper offices on a simple viewing device that will enlarge the tiny page images from the film up to half again the size of the original newspaper page. Articles from the files may either be read from the viewing device or may be copied full size on photographic paper.

The new miniature-image process is also useful for public libraries, which store large quantities of newspapers. Here not only permanency of newspapers but also economy of storage space is important. If files on film were installed in public libraries, a person coming in to read back files of a newspaper would be given a film to examine on the viewing device instead of a large bound volume of papers.

Linseed Oil For Dirty Hands

ORDINARY linseed oil is recommended for the removal of dyes, lacquers, lacquer paints, tar, and so on, from the hands. It is only necessary to rub about a thimbleful of ordinary linseed oil between the hands until all the materials are dissolved. Then, without wiping off the oil, the hands are washed with any soap in cold, or preferably warm, water. The soap emulsifies the linseed oil readily and yet lathers freely. With linseed oil, the oils of the skin are not removed, as in the use of benzine, gasoline, turpentine, and the like, but on the contrary, the skin is kept soft by the small



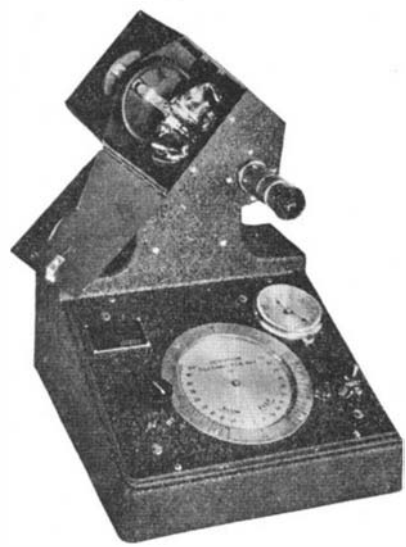
A full frame and part of another, reproduced in the exact size as used for photographing newspapers for filing

amount of residual linseed oil which remains even after washing with soap suds.

Hands which were seriously damaged by the former use of benzine, turpentine, and so on, have been healed completely within a short time by employing the linseed-oil method of cleaning. Only when the lacquer or dye residue has aged and is very dry, as happens with rapidly drying lacquer paints, is it necessary to warm the linseed oil. However, hot linseed-oil baths are an outstanding remedy for cold and chapped hands. For freeing the hands of spirit lacquer and cellulose lacquer, stearin oil (olein) may be used in place of linseed oil, which is also more effective when warm. In this case also, soap and water are used. —*A. E. B.*

New Compact Watch Timer

JEWELERS may soon be using the slogan, "Have your watch regulated while you wait," Charles H. Fetter, of Electrical Research Products, said recently when



A watch, placed in the open part of this device, is timed in ten minutes

demonstrating an electric watch timer. This compact device, developed by Bell Telephone Laboratories, permits any jeweler to regulate a watch to the maximum of its time keeping efficiency in 10 minutes, compared to about ten days now required by jewelers to adjust watches properly. The device is approximately the size of a standard typewriter.

When the watch is placed in a compartment of the timer an image of the watch fly wheel is reflected on a mirror, permitting a comparison of the watch speed with a flashing lamp. By a very simple adjustment of the timer, the actual loss or gain in seconds per day made by the watch may be read directly from a dial on the timer. With such a device in his repair depart-

ment, no jeweler need keep a customer's watch more than one day for accurate adjustment.

The motive power which drives the timer is a one hundred cycle current transmitted over wire and furnished by the telephone company from a constant frequency generator located in New York. The frequency of this current is accurate to one part in ten million.

Sulfur Dioxide as a Germicide

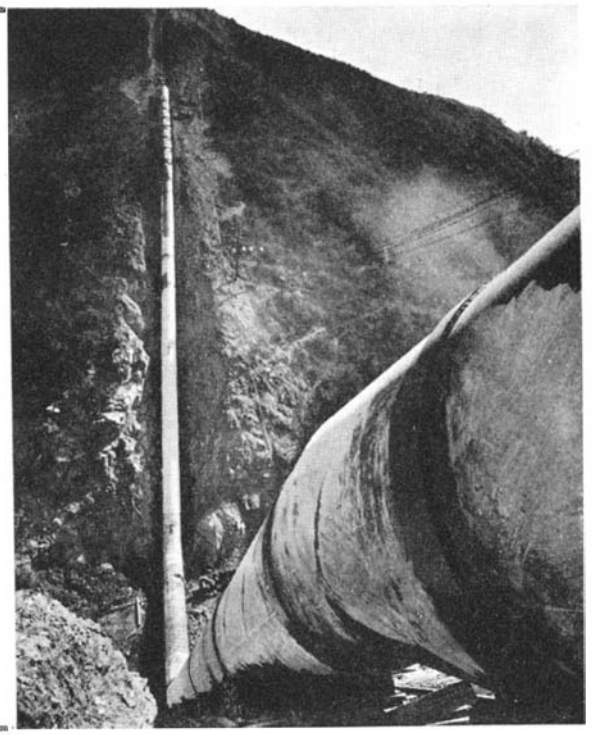
THE value of freshly made dilute solutions of sulfur dioxide as a disinfectant is reported in *Chemical Markets*. The experimenters dissolved 10 grams of sodium hyposulphite in one litre of warm water and added 1.5 cubic centimeters of concentrated sulfuric acid. The solution became turbid owing to the precipitation of sulfur. Instead of the sulfuric acid, sodium bisulfate can be used, and the disinfectant trials were carried out with the solutions made by the latter process. An improved bactericidal effect was noted, particularly on staphylococci. The solution, it is suggested, should be used as an antiseptic for wounds and in surgical operations. Doses of from 0.5 to 20 cubic centimeters of the solution have been injected subcutaneously and intravenously into dogs without any harmful effect being observed.—*A. E. B.*

Shotgun Shells Test Copper Tubing

THE strength of modern plumbing materials was dramatically demonstrated recently by two experimenters for the Chase Brass and Copper Company, who fired 12 gage shotgun shells in a cannon whose barrel is a 10-inch length of seven eighths inch copper water tubing. The breech is a regular brass pipe adaptor sweated to the copper water tube barrel and closed by a pipe plug drilled to receive a steel firing pin. The trunions of the cannon are saddle tees, sweated on and filed down to fit smoothly over the barrel. Despite the recoil shock that jolts the cannon into the air and slams it against the recoil blocks, these tees show no sign of tearing loose.

The barrel does not fit tightly around the shell (except at the extreme rear) but clears the shell all around by about one sixteenth of an inch. This gives the powder gases more room to expand than in a regulation shotgun, reducing the force to some degree. Heavy wads of damp cotton and paper are tamped down on top of the shell to insure the complete burning of the powder charge.

"This experiment should not be attempted by anyone except men skilled in the technique of handling explosives," warns the man who built the cannon. "I was surprised to find that copper water tubing could stand the shock of three drams of smokeless powder. Under some conditions this can split a steel shotgun barrel. My advice is not to play with gunpowder—there is too much danger of serious injury."



Conquering canyons and straddling mountains, a four and one half mile arc-welded pipe line will soon join the Bouquet Canyon Reservoir with the Owens Valley Aqueduct, near Saugus, California. The line will form part of the water supply system of Los Angeles. This pipe line, said to be the largest in the west, varies from seven feet ten inches to six feet eight inches in diameter, depending on pressure. It takes approximately 450 pounds of electrode to weld each joint. At the bottom of one of the canyons crossed, the pressure on the pipe is 400 pounds per square inch. The photograph at right gives a faint idea of the territory traversed by this line. (Courtesy Lincoln Electric Co.)

Carbon Dioxide Preserves Eggs

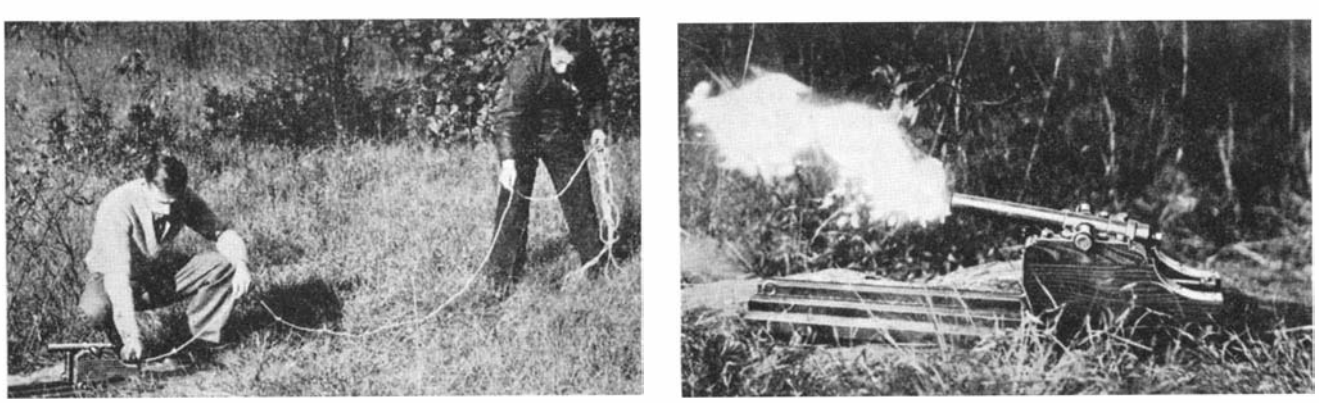
COLD storage eggs that can't be told from fresh, even when eight months old, are reported to be produced by a method utilizing carbon dioxide gas as the atmosphere in the storage chambers. According to W. M. Zarotschenzeff, who describes the process in *Food Industries*, the problem of preserving eggs in good condition is very delicate, because of the biological and physiological changes occurring in the eggs during ordinary refrigeration.

In the carbon dioxide process, carefully selected eggs are placed in sealed steel chambers, located in a room maintained at 34 degrees, Fahrenheit. The chambers are sealed with air-tight doors and the air is exhausted. A carefully regulated atmosphere of carbon dioxide gas is now introduced and is maintained at a pressure slightly higher than atmospheric to preclude the possibility of air leakage inward. A natural circulation of the gas inside the autoclave is effected by placing a cooling coil along the outside of the chamber. Condensation of moisture takes place at the coolest point on the side walls, and runs to the lowest level of the chamber without dropping on the eggs. A drop of water in the carbon dioxide atmosphere is objectionable, as it makes the egg shell coarse and covers it with a white sediment.

Although costs are slightly above those of ordinary storage, the increase in expense of the method is said to be offset by the better market price commanded by the gas-preserved eggs.—*A. E. B.*

Vitamins 'à la Carte'

WE will soon be buying our vitamins by the pound and sprinkling them on our victuals like so much salt, if Dr. George A. Curme, Jr., America's leading industrial organic chemist, envisions correctly the future development of physiological chemistry. Speaking as the recipient of the Chandler medal in New York recently, Dr. Curme pointed out the fundamental impor-



Loading and firing the copper-tube testing cannon

SCIENTIFIC AMERICAN Award for Plane Improvement

(*Continued from page* 29)

and construction often emanate."

The ship in question was purchased in the spring of 1932 and was one of the first models of the Fairchild KR-22. Improvements in structure of the ship gradually suggested themselves. For example, it was found that the tail skid fittings were inadequate and of the wrong shape, resulting in broken spring leaves. After repairing the tail skid several times, it was found that an additional flat plate corrected the difficulty. A door within the baggage compartment in the front, where a dual set of controls is installed, opened downwards and on one occasion fell open and caught the dual stick, preventing its forward travel. This was corrected by putting the hinges on top of the door.

The fittings on the base of the stabilizer struts were rigid and movements of the stabilizer tended to bend the gusset plate to which the struts were attached. These were changed to hinge joints, although no failure had occurred. Stouter drag wires were put into the wing, and investigation as to the crystallization of wire terminals led to a change in the wire fittings to the present standard which allows universal motion of the wire ends.

In the case of the engine, the Cirrus high drive, considerable difficulty was experienced with valve seats. This was eventually overcome by the use of a different type of seat metal, improvements in the air cowling, and the use of thermo-couple wires to indicate temperatures on all four cylinders. The exhaust manifold was bolted rigidly to three cylinders, although the fourth had an expansion joint; it was found that cracks developed in the manifold and two other expansion joints were added which eliminated the difficulty. All fuel and oil lines were taped, partly to damp vibration and partly to act as a possible safe-guard in the event a crack developed. A metal propeller was substituted which improved the performance of the ship materially.

The instrument equipment of the ship is perhaps of most interest. It consists of the usual line of instruments—air-speed meter, altimeter, tachometer, temperature and pressure indicators, turn and bank indicator, and compass, all mounted and connected to reduce the effect of vibration. Special mention should be made of the compass. Mr. De Florez personally became accustomed to reading a compass of the marine type through years of sailing and found that the ordinary dash compass reading on the rear of the card always required a mental effort. In addition to this, the difficulty encountered in the swinging of the card, due to friction of the pivot and

Luis De Florez, winner of the *Scientific American* Trophy, and plane

the fluid, makes it extremely difficult to use a compass when flying in bad weather.

After investigating various types of compasses, it appeared that the aperiodic type with a light needle was best suited for aircraft work. These, however, are usually mounted on the floor and used merely to set a course. Due to the facts that many ships are small and weight is of importance, and that the expense of buying two compasses, one for the dash and one for the course setting, is somewhat out of line, it seemed desirable to develop an aperiodic compass which might be placed on the dash and read directly as a steering compass, at the same time permitting accurate course setting. The difficulty in mounting such a compass in a small ship, or in fact, any ship, is that vibration blunts the pivot; unless large and relatively clumsy mounts are available, satisfactory readings cannot be obtained.

After some months of work with sponge rubber, felt, and various vibration absorbing material, it was found that the most effective means of mounting consisted of a copper bellows on which the compass bowl rested. This bellows is rigid torsionally so that the compass can be secured with a lubber line on the longitudinal axis of the ship and yet the setting will give sideways, vertically, and will even rock. In order to damp the motion of the mounting, the convolutions of the bellows were filled with felt rings and the compass bowl sealed into the bellows with the exception of a very small aperture which allowed air to flow in and out. The pumping effect of the bellows through this small aperture constituted a very effective means of damping vibration. The result has been that with this type of mount, which has recently been adopted by a compass maker, the shocks on the pivot have been prevented and vibratory effects on the needle appear to be completely eliminated. This permits a more delicate pivot with less tendency to swing.

With regard to the operation of the plane, it might be mentioned that the ship is equipped with a self-locking throttle whereby the setting stays wherever placed, preventing creep which is so undesirable and annoying on long trips. The owner has also constructed a very simple stabilizer indicator which is valuable in trimming the ship for best speed and acts as a reminder of the position of the stabilizer before take-off.

As far as the comfort of the ship is concerned, a hat compartment provides a much needed space for a straw hat in the summer time, free from grease and dirt. Perhaps the most important comfort features are the wind-shield and the side covers which virtually eliminate draft in the cock-pit and yet permit excellent visibility. The wind-shield comprises three slanting surfaces, flat in front, the two sides being at somewhat of an angle and the whole tipping rearwards. By dint of trial, the angle of the surfaces and their size and position were so arranged that the air stream could be carried well overhead and sufficiently away from the sides to permit a good view forward and downwards. Side covers extending from the base of the wind-shield to the head rest eliminate back draft. These are arranged on clips. The top edge is formed by a rubber shock cord. These can be readily fastened and unfastened, and in the event of an emergency the shock cord will give in such a manner as to allow the occupant to leave the cock-pit.

These improvements, in combination, constituted, in the opinion of the judges, a very important help to the serviceability and reliability of the ship. It is interesting to see what a private owner can do in thus furthering aviation.—*A. K.*

tance of vitamins in making bulk foods available in animal metabolism.

"As this vitally important development is still largely in the laboratory research stage," he said, "it is not yet possible to visualize the exact course which it will take. Each month brings additional information, and experimentation is being conducted at so many points by individual groups that a complete correlation of existing knowledge is not yet possible. A definite beginning of commercial operation, however, is already under way, and within the past few years at least five companies in the United States have put on the market products containing vitamin D made by the irradiation of ergosterol, using the Steenbock process. Vitamin A is known to be closely related to alpha- and beta-carotenes, vitamin B is believed to be closely related to adenine (6-aminopurine) and vitamin C is probably identical with or closely related to hexuronic acid.

"All of these substances are of such a degree of molecular complexity that synthesis from the elements or their elaboration from other naturally occurring materials seems entirely possible. In the case of the other vitamins, less is known, although it would be surprising from the information now available if they were beyond the range of synthetic chemistry. Accordingly it appears that adequate supplies of vitamins will soon be available from relatively cheap and abundant sources, and that under the guidance of physiological chemists and dietary experts synthetic chemistry will be able to add another triumph to its many past successes."—*A. E. B.*

Longer Engine Life

A 400-hour endurance test of the Wright Whirlwind 275 horsepower engine is reported rather fully in a recent issue of *Aero Digest.*

Fifteen years ago the life of an airplane engine was approximately 300 hours and overhauls every 25 to 50 hours were the rule. To-day the average life of an engine is 2500 hours and overhauls may be spaced 250 or even 300 hours apart. Although there has been no basic change in design principles in this long span of time, there has been progress in detail design, in better materials and heat treatment, and in better lubricants and oiling systems.

The 400-hour test, for the most part at full throttle, gave some remarkable results. There was no loss of power at the end of the grueling ordeal; wear was negligible; and clearances remained practically the same. The bearing surfaces remained smooth and polished. All that had to be replaced to get the engine into perfect condition was a valve guide, a crankcase bearing sleeve, two exhaust valves, a set of piston rings, gaskets, and rubber oil seals.

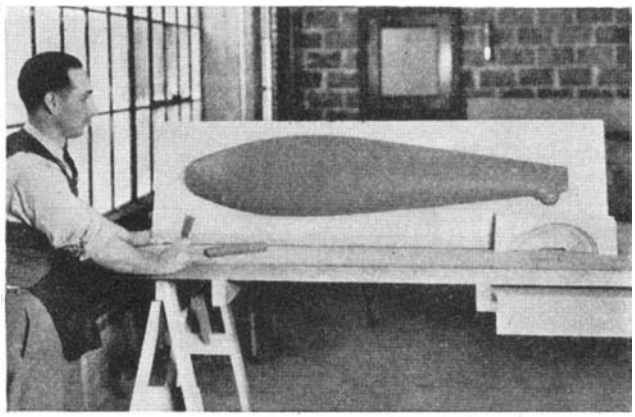
A study of these results indicated that even longer periods between overhauls could be obtained with improvements in exhaust valves, and reduction of dirt in the lubricating oil. Better valve seats, and careful filtering of air and oil to prevent entry of dirt may eventually raise the overhaul period to 800 hours. Such improvement would be of the greatest significance to operating economy, which airline operators are always pursuing.—*A. K.*

Trailing Wire vs. Antenna Mast

AIRPLANE designers try to streamline their craft to the limit, but the operators of the airlines sometimes carry the streamlining process even further. Thus, Transcontinental and Western Air found that the mast type airplane antenna reduced the cruising speed as much as four to five miles per hour. Accordingly, they reverted to the trailing wire type and found its drag to be negligible, its effect on cruising speed practically nil. Another advantage of the trailing wire antenna also lies in the solution of the problem of ice formation. The mast type presents a comparatively large surface on which ice frequently forms. The trailing wire antenna is immune to ice even under the most unfavorable weather conditions.—*A. K.*

Zap Flaps and Ailerons

ONE of our photographs shows the application of the Zap flap to a Navy XOJ-I plane built by the B/J Aircraft Corporation. The flap is placed on both the upper and lower wings, and is a simple surface of thin sheet metal with appropriate corrugations for strengthening purposes. The flap slides back and down, and thereby increases the lift and also the drag of the wing. Therefore, it is possible both to decrease the landing speed and to glide down at a steeper angle in safety. Unfortunately, when the flap extends along the entire span of the wing there is no room for the ailerons of the conventional type and a totally different aileron system has to be employed. Such ailerons are mounted several inches above the wing and are hinged at an axis approximately 25 percent of their chord from the leading edge. These so-called Zap ailerons work quite well, but their disposition has to be very carefully studied. They have to be just at the right distance above the wing and just at the right position along the chord of the wing. It is not by any means certain that this is the sole type of aileron that eventually will be used with the rear edge flap.—*A. K.*



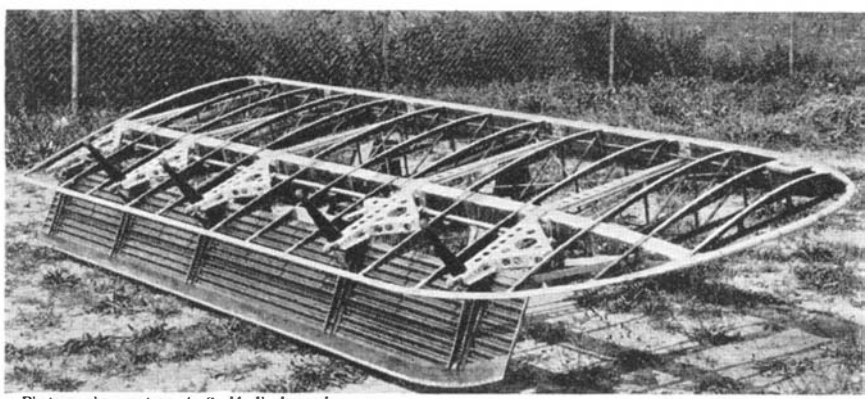
An airplane fuselage modeled in clay, as one of the preliminary steps in the design of a new plane. Airplane designers have to be sculptors as well as draftsmen

Aircraft Sculpturing

IN working out the streamlining of their modern designs, Boeing Airplane Company engineers have to be sculptors as well as draftsmen. A photograph in these columns shows one of them beside a half section model of a pursuit fuselage, done in modeling clay. By this method engineers are able to get a better conception of body lines and of fairing than from plans on paper. Wooden templates are used in making the models to exact dimensions. Similar methods are employed in the fairing of wings into fuselage, and so on, and also in wind tunnel experimentation. The man with a good "thumb" may be able to increase the speed of his ship several miles an hour. —*A. K.*

Safer Than a Motor Car

IN the first six months of 1933, according to figures of the Department of Commerce, there was one passenger fatality for each 38,231,196 passenger-miles flown by the regular air transport lines. In the same period, according to statistics obtained from the American Automobile Association, motor cars in the state of Missouri drove only 15,581,475 passenger miles for each passenger fatality.



Photographs courtesy *A. S. M. E. Journal*

A Zap flap installation before wing covering is applied. *Below:* Zap flaps on upper and lower wings of a biplane

These figures indicate that flying on the regular air lines is twice as safe as riding in a passenger car. Even if we assume Missouri to be a hazardous state for the motor car, and even if we take the recent crash of a transport plane in the west into account, the airline operators have reason to be proud of their safety record.—*A. K.*

Airplane Ambulance

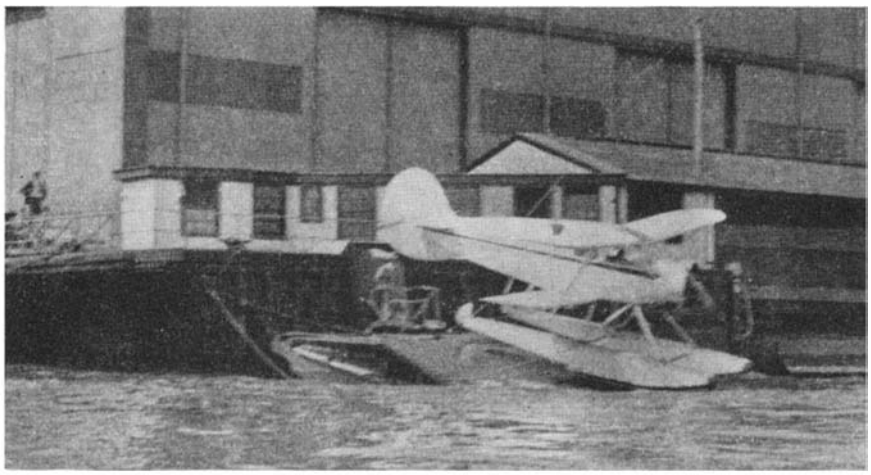
AN interesting case of the use of an airplane as an ambulance occurred recently in Pennsylvania when a man to whose spine a part of his shin bone had been grafted was flown from a hospital in Philadelphia to his home in Bloomsburg. Due to the fact that his wound would require several months to heal, a special carriage had to be constructed in the interior of the plane so that his trip might be made in a prone position.

Physicians interested in the case ex-

plained that the operation which had been performed was most unusual as it was only the fifth of its kind to be performed in this country.

A Seaplane Base for New York

NEW YORK CITY'S main airport is at Newark, New Jersey. Strange to say, its seaplane base may also be on the Jersey side of the Hudson. This is the Metropolitan Seaplane Terminal, which is built on



A seaplane on the turntable of New York's new seaplane base

a large navy barge, 164 feet in length, moored to the north side of Pier B in Jersey City. The advantages of the Jersey side for seaplane operation are that traffic is lighter than anywhere else in the Hudson or the Bay, the distance between docks is so large that aircraft operation is possible, and the current never exceeds 1.7 knots.

The forward portion of the barge is devoted to an observation deck; the rear is arranged as a modern passenger terminal. But the most interesting part of this simple yet efficient terminal is the floating ramp. This is attached to the side of the barge some distance below the deck level, and can be reached by a permanent stairway and gang-plank. The ramp is so ballasted that it is inclined at an angle of approximately 15 degrees. On the ramp is a turntable some 25 feet in diameter, planked with wood. The turntable may be rotated through 360 degrees and is manually operated by a crankhandle. The seaplane is hauled up the inclined ramp, head on, and the turntable is rotated until the passenger exit is in the right relationship to the gangway. —*A. K.*

Naval History and SCIENTIFIC AMERICAN

IN connection with our article on cruisers appearing on page 18 of this issue and particularly the boxed note in which we promise a number of authoritative naval articles during 1934, it may be of interest to our readers to note the following comment reprinted from a recent issue of the *United States Naval Institute Proceedings.* This comment is indicative of SCIENTIFIC AMERICAN'S naval traditions, containing as it does a reference to an article published by us which is considered important in naval history. The quotation follows:

Several interesting queries have been raised by Mr. William H. Morgan of the Morgan Engineering Co., Alliance, Ohio, regarding a statement in Admiral Fisher's "Memories and Records" (Vol. 1, pp. 22-23) to the effect that the concentration of the British fleet in home waters in 1908, because of the menace of Germany "was so unostentatiously carried out that it was only Admiral Mahan's article in the SCIENTIFIC AMERICAN that drew attention to the fact, when he said that 88 percent of England's guns were pointed at Germany." Mr. Morgan's first question was as to the location of the SCIENTIFIC AMERICAN article, which is not included in the bibliography in Taylor's "Life of Mahan." As a matter of fact it appeared in the SCIENTIFIC AMERICAN for December 7, 1907, and contained the following remark: "I take it from the statement (in *Brassey's Naval Annual*) that by May, 1908, 86 percent of the British battleship strength will be concentrated in or near home waters."

Mr. Morgan's second query is as to why, if the information appeared in *Brassey*, it should have required Admiral Mahan's comment to bring it to the attention of the world, and why Admiral Fisher should have given him special credit for so doing. To this the only answer seems to be that we have here simply another instance where the significance of facts is disregarded until it is pointed out by a keen, analytic mind.

Mr. Morgan closes his letter with the remark: "I am very much an admirer of Admiral Mahan, and I think it most unfortunate that he is not appreciated by the average American. Everyone knows of Paul Jones, Decatur, Hull, Perry, Farragut, and Dewey, but Mahan, who I think is head and shoulders above all of them, isn't even known outside naval circles."

"Mercury Made" Motor Oil

SOME of our friends who read the "ads" have asked: "What is this motor oil 'made by the mercury process?' Has it mercury in it?"

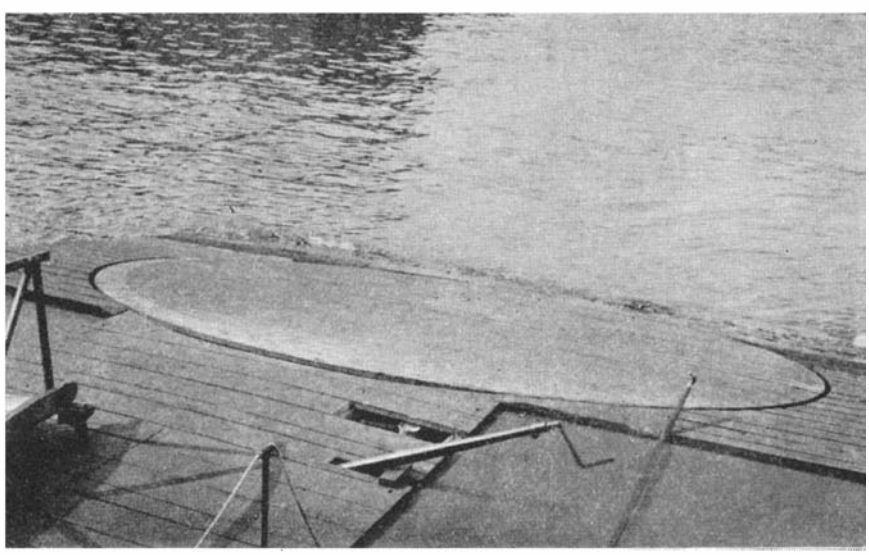
The answer is, no; there is no mercury in it. "The mercury process" refers simply to the manner in which the crude oil is heated in the stills where it is refined. Up to the present, heating in petroleum distilling units has been done more or less exclusively either by direct firing or by steam heating. Indirect heating mediums other than steam are becoming more and more popular due to the desire to use high transmission temperatures without the use of a heating medium at high pressure, and also to maintain closer control over the heat transmission process. The Sun Oil Co. uses mercury as an indirect heating medium.

Another system, based on the same principle of indirect heating, uses the organic chemical diphenyl which, like mercury, vaporizes at elevated temperatures. There is practically no decomposition of the diphenyl, but the high temperatures involved in this process, combined with the characteristics of the heating medium, necessitate the use of special high resistant pipe material. Another feature of this process is that the risk of local overheating of the oil is practically eliminated, thus permitting operation at a high mean temperature level.—*A. E. B.*

For the Amateur Optical Worker

HERETOFORE, such an important adjunct to the physics laboratory as the "optical bench" has been too costly when accurate enough for research work; or if cheap enough for individual experimentation, has been too inaccurate and limited in application to be used for research work.

There have recently appeared advance



Turntable and operating crank for handling seaplanes quickly and efficiently

notices of a new optical bench with which almost every conceivable experiment in optics can be performed, either by individuals or as a classroom demonstration. Accessories are provided for experiments in reflection, refraction, diffraction, polarization, telescopy, microscopy, photography, spectroscopy, and so on.

The usefulness of the bench can be further extended into the fields of photo-electric and thermo-dynamic phenomena by the addition of suitable equipment. Such devices are already designed and under construction and more items will be added to the already extensive list as the demand increases.

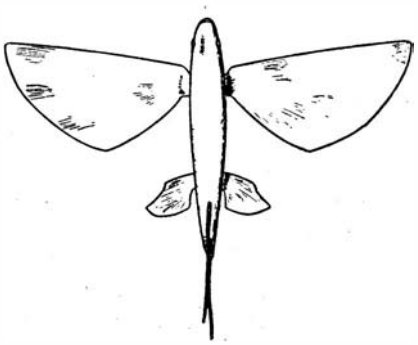
It is pointed out by the manufacturer that a laboratory or individual interested in optical research may make a modest beginning by obtaining the fundamental equipment required for elementary experiments. The more elaborate accessories may be added from time to time.

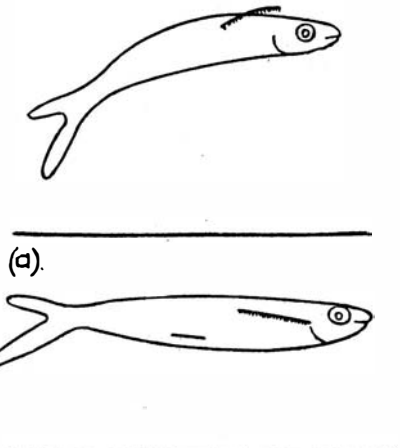
New Potash Deposits in Chile

DISCOVERY near Antofagasta, Chile, of what are claimed to be inexhaustive deposits of potassium chloride, has been reported to the Department of Commerce. The deposit is said to cover practically the entire bed of a dried-up lake. An area measuring 25 by 75 kilometers has been staked out by interested parties, which comprises less than one third of the area of the lake. The economic marketing of potash from the desert region of the new discovery, which now lacks transportation facilities, will necessitate construction of a railroad.—*A. E. B.*

The Aerodynamics of Flying Fish

THE flying fish is known to the erudite as the *Exocoetus spilopterus*. Found in tropical or sub-tropical regions, it weighs about a pound, is roughly 18 inches in length and with a span of two feet has a wing loading of about two pounds per square foot. The flying fish is far too heavy for the size of its muscles to be able to achieve the flapping flight of a bird and it is difficult to see how it can soar by making use of air currents. Yet both of these explanations of the flight of the flying fish have been advanced.

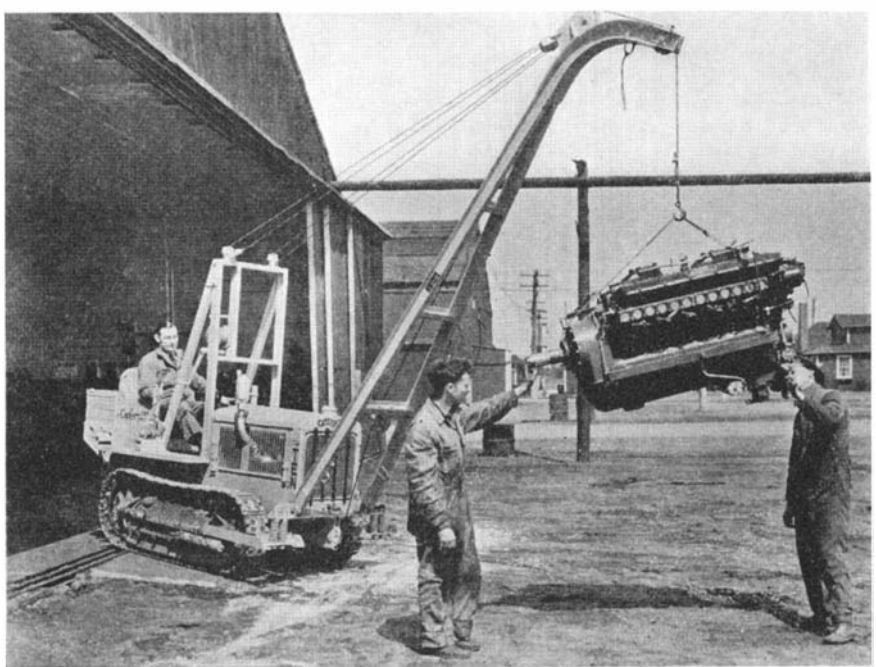




Above: **Top view of the "flight equipment" of a flying fish. *Right, a:* Flying fish, side view, in the act of taking off or ending a flight, and *b,* gliding and losing speed**

C. H. Latimer-Needham, an aeronautical engineer, who has made a hobby of bird and insect flight, advances a much more plausible explanation, writing in the *Sailplane*. The fish attains its maximum water speed in the water and then emerges into the air facing the wind. It therefore has a speed relative to the air of possibly 50 miles per hour. It then glides, just like an airplane, gradually losing speed, and simultaneously bringing down its tail, increasing the angle of incidence, and compensating for loss of speed by increasing the lift coefficient of its pectoral fins or wings. Such is the knowledge of aerodynamics that *Exocoetus spilopterus* has attained that it can cover almost half a mile in the air under favorable conditions.

Mr. Latimer-Needham philosophizes on the theory of evolution: "If we believe in evolution of life, and it is difficult to do otherwise, it is a simple matter to imagine the commencement of fish flight. For instance, if a fish were to leap out of the water, perhaps in an attempt to escape some approaching danger, and found itself facing into a fairly strong wind, then, by simply extending its fins, some measure of support would immediately be felt, due to the relative velocity of the moving air. It would not be long before the value of such a strategical move was realized by the fish and continued practice for eluding their enemies would result in improvement of the technique till the present state had been reached."—*A. K.*



Courtesy Caterpillar Tractor Co.

At airports, it is often necessary to remove engines from planes and move them to the repair or maintenance shop. These motors are often large, heavy, and unwieldy and proper handling is somewhat of a problem. One solution is shown: A 650-horsepower engine is being handled by a tractor with portable crane

More Light on Synthetic Rubber

SINCE the announcement of the perfection of a process for making synthetic rubber, chemists of the duPont Company have learned a great deal about this product which has been named DuPrene. They have found that some of its apparent differences from natural rubber are not differences at all, but are due to variations in the compounding of the finished rubber.

"Since the days of Charles Goodyear," say O. M. Hayden and E. H. Krismann, writing in *Industrial and Engineering Chemistry*, "there has been among rubber chemists a growing appreciation of the fact that almost every condition of service to which rubber may be subjected requires a different type of compound, if the best possible results are to be obtained. The most valuable lesson to be learned from the investigations reported here is that this is true of DuPrene to an even greater extent than of rubber. It would be easy for one, who had happened to immerse in sulfuric acid a DuPrene compound containing clay, to draw the conclusion that sulfuric acid causes DuPrene to swell and lose all of its strength and rubber-like characteristics; but, when we have all the facts before us, we see that it is the clay, not the DuPrene, that causes the trouble. Likewise, that very common and generally inoffensive rubber-compounding ingredient, barytes, is one of the worst materials that can be used in a DuPrene stock which is subjected in service to acetic acid, but the mere substitution of clay for the barytes produces a stock that is many times more resistant.

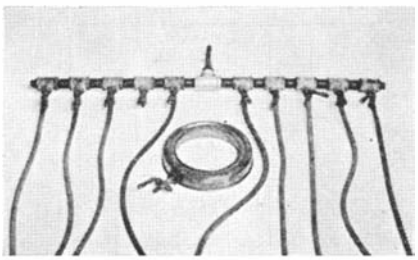
"The art of DuPrene compounding is still young. In the short time that has elapsed since the invention of DuPrene it

has been discovered that DuPrene can be compounded so as to make it more resistant than rubber to practically all chemicals. There is every reason to believe that further experience will teach how to impart even greater oil, solvent, and chemical resistance to this unique synthetic rubber."—*A. E. B.*

Floodlighted Soap Bubbles

LIGHT, which has been used in many novel ways for display purposes, continues to lend its enchantment at night for decorative adaptations. The latest innovation is the colored floodlighting of a large number of gas-formed soap bubbles as they float up and off through the air.

The arrangement consisted of ten cans about 2 feet deep by 18 inches in diameter



Part of the equipment for producing quantities of soap bubbles

placed in a group in the center of a tennis court. A solution of water, soap, and glycerine was placed in the bottom of each can to a depth of approximately 1½ inches. Experiments showed that castile soap produced the most colorful bubbles, although ordinary soap worked satisfactorily, and that the glycerine strengthened the soap film and made the bubbles last longer. It was also found that better bubbles could be blown in a shallow rather than in a deep solution.

Submerged in the water in each can was a length of half-inch rubber tubing to the end of which a weight was tied to keep the tube under water. These tubes were all connected to an iron manifold having ten outlets, the manifold, in turn, being connected by a rubber hose to the gas supply which, in this case, consisted of compressed hydrogen gas in tanks. This supply was used as a matter of convenience because of the lack of sufficient city illuminating gas where the display was held. When available, city illuminating gas is better for three reasons: First, it is less expensive than hydrogen; second, it is less explosive; and third, it has less buoyancy so that the bubbles do not rise so rapidly through the air, but rather float around in a more leisurely manner, thus making a better display.

Placed on the ground around the cans were three groups of small floodlights equipped with colored cover glasses and 100-watt lamps. These three groups of lights were pointed directly upward so that they illuminated the bubbles up to a height of 20 or 25 feet in the air at which height they were picked up by the beams of the more powerful floodlights.

The more powerful units consisted of colored floodlight projectors located at each end of the tennis court. Each projector was equipped with a cover glass and a 500-watt concentrated-filament floodlight lamp.

Glare shields made of strips of Bristol board were placed in front of the projectors to keep stray light out of the eyes of the audience. There was also a screen about 10 feet by 6 feet placed on the windward side of the cans. This allowed large masses of bubbles to form on top of the cans before the wind broke them off and took them floating away.

An interesting variation was made by connecting some of the hoses to ordinary ring-type lawn sprinklers having many small holes in them. This resulted in the forming of large masses of suds rather than the larger iridescent bubbles. As these denser masses of small bubbles floated off through the light they scintillated and sparkled like diamonds.

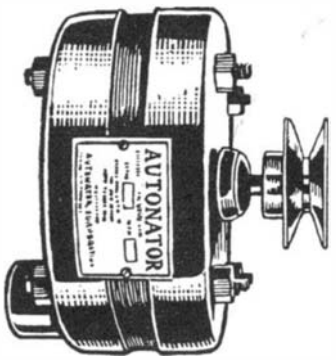
Owing to the explosive nature of the gas, displays of this sort should be handled with as much precaution as would be used with fireworks displays. In this case, as a necessary precaution against possible mishap, the entire tennis court was enclosed with wire netting.

A very good mixture for making bubbles can be obtained by using a 10 percent castile-soap solution (by volume) with about 10 percent glycerine (by volume). The 10 percent soap solution is made by boiling castile soap in water until the solution becomes completely saturated, then using one part of this solution to nine parts of clear water. It was found that 50 cubic centimeters of glycerine added to 1000 cubic centimeters of the 10 percent soap solution produced bubbles two to three inches in diameter which lasted longer than was the case when no glycerine was added. One hundred cubic centimeters of glycerine made the bubbles last from three to four minutes. Increasing the amount of glycerine to 300 cubic centimeters increased the strength of the bubbles to such an extent that groups of them could be picked up by hand without their breaking. The most satisfactory solution was found to be one part of the saturated solution of castile soap, nine parts of water, and one part of glycerine.—*General Electric Review.*

110 Volts A.C. for Automobiles

TAKING no drain from the auto battery and having no brushes, collector rings, commutator, or wire-wound armature to require service, a new device furnishes 110 volts alternating current in automobiles, trucks, buses, airplanes, motor boats, taxicabs, fire trucks, and other motor vehicles. It may also be used as an A.C. power supply for stationary installations to operate from gasoline engines and D.C. motors.

The Autonator, as the device is called, furnishes a satisfactory and economical source of portable alternating current for



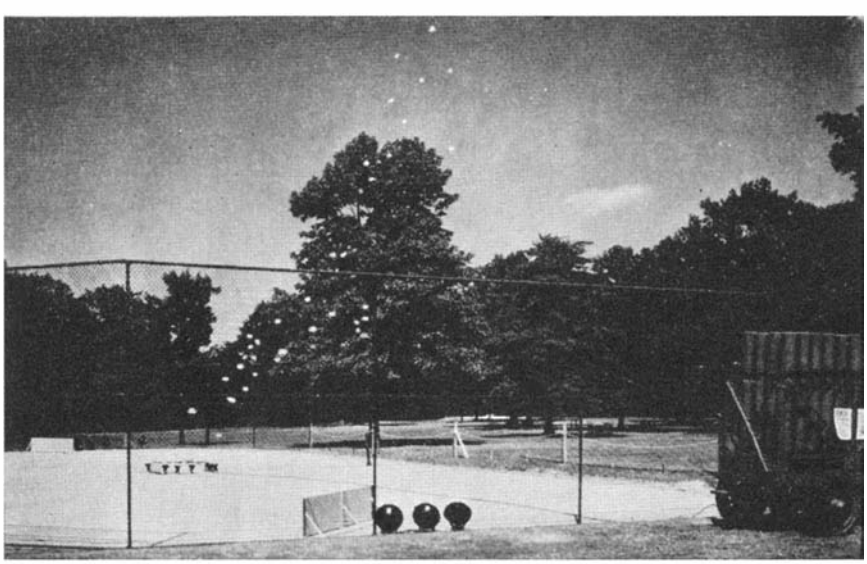
A 110 volt generator for automobiles

operating A.C. radio sets, portable sound trucks and public address systems, neon signs, searchlights, and a multitude of other electrical appliances. It is easily and quickly installed to operate from the fan belt of any motor vehicle, or by direct coupling to a stationary engine. Provision is made for regulation of voltage at all speeds. The generator is available in six sizes—50, 100, 150, 250, 350, and 450 watts.

Why Anemia?

DIFFERENT types of anemia result when the red corpuscles of the blood stop developing at any one of their seven stages of growth in the bone marrow, according to Dr. Raphael Isaacs, assistant director of the Simpson Memorial Institute for Medical Research, University of Michigan.

Using new methods worked out at the Institute for observing how the red blood corpuscles grow in the marrow of the bones of the body, Dr. Isaacs found that there are seven distinct stages before the red corpuscles are sent out fully developed to serve as carriers of oxygen from the lungs to all the tissues of the body. If development stops at any phase, the red corpuscles



The floodlighted soap bubble equipment set up, with bubbles floating away

are retained in the marrow, resulting in a shortage of oxygen carriers.

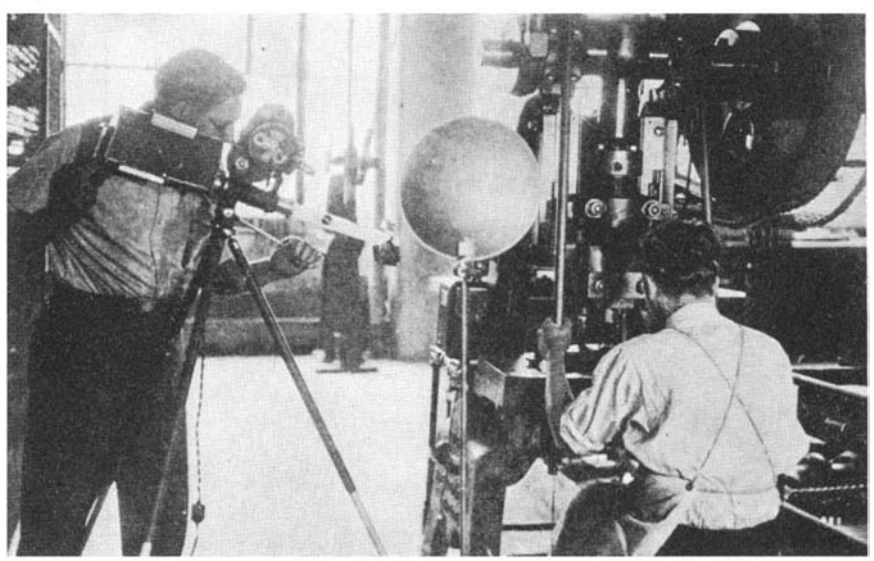
If stoppage of development occurs at the first stage, little in the way of treatment is known as yet. With too few and immature corpuscles in the blood stream, the tissues are starved for the oxygen needed for the complex chemical processes of life. Second stage growth stoppage happens in the disease called pernicious anemia, caused indirectly by the failure of the stomach to manufacture certain secretions needed to stimulate the bone marrow to doing a complete job of corpuscle making. In this case liver or hog stomach extracts will remedy the condition.

Various other less serious anemias, called "secondary," because they may follow or accompany any unhealthy condition of the body which is reflected in temporary disturbances in the functioning of the bone marrow, may occur when red corpuscle development stops at any of the seven stages. A secondary anemia may appear even with growth stoppage at an early state, if the cause of the marrow upset is due to some temporary cause, rather than the permanent secretion deficiency found in pernicious anemia. The secondary anemias of the later stages are controllable by iron preparations, Dr. Isaacs stated.

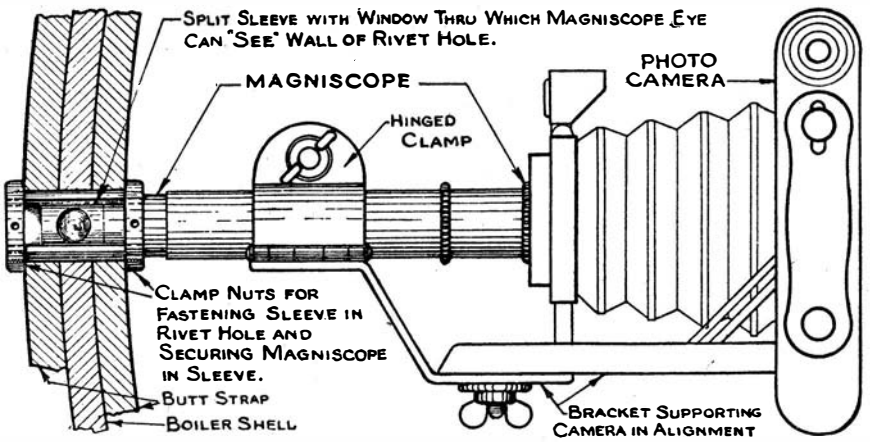
Slow-Motion Movies Reveal Machine Defects

WHEN, as often happens, a machine designed and built on apparently sound and proved principles just doesn't operate correctly, what can be done to determine the cause of failure? In such cases, design experts are now having recourse to the motion picture. They set the machine in motion and take "slow" movies of it as it operates. These movies reveal the behavior of mechanisms moving too rapidly for satisfactory observation by the human eye, and many baffling machine problems have been solved in this manner.

Says R. Fawn Mitchell, manager of the technical department of the Bell & Howell Company: "One of the first instances of securing increased efficiency in machine design by means of motion pictures had to do with a high-speed addressing machine which jammed in the envelope in-feed. A micromotion outfit was arranged to take a close-up of the feeding mechanism with the feeding pawl painted white to facilitate following its motion. Motion pictures taken at 4000 frames per minute disclosed that the feeding pawl vibrated at one time and not at another. Each time the pawl vibrated it failed to feed an envelope. Not only did the pictures show this effect, but they registered the time by means of a high-speed stop watch so that at least a reasonable approximation of the duration of the oscillation could be obtained. With this information the designers were able to effect improvements immediately."



Slow-motion movies being taken for studying defects in machines



Camera and magniscope for photographing rivet hole cracks

Photographing Rivet Hole Cracks

SEVERAL years ago the Hartford Steam Boiler Inspection and Insurance Company developed what is now known as the Hartford rivet hole magniscope, a sort of magnifying periscope which was described in our columns. This instrument has been found extremely useful in examining the walls of rivet holes for the microscopic indications of embrittlement in its early stages. However, adeptness in focusing the magniscope and in holding it steady while looking through it can be gained only through much practice. In some cases the expert inspector has had difficulty in showing to plant engineers and officials the fissures which, to his experienced eye, were clearly visible.

Recently the company's engineers carried the development of the magniscope a step further, according to *The Locomotive*, by attaching a camera to it. The combined magniscope and camera are clamped into place with the "periscope" section extending into the rivet hole, the camera is focused, and a photomicrograph made of the side wall of the hole. After as many photographs as are necessary have been made of a rivet hole, the expert may then show to plant engineers incontrovertible evidence of any faults or fissures in the steel.

Caustic distress, or fissures caused by disintegration of the binder between steel crystals, is like cancer in its insidious and dangerous growth. If detected in time, however, it may be remedied by simply reaming out the affected rivet holes and driving over-size rivets, thus preventing retirement of the boiler.

The Newer Anesthetic

ETHYLENE, which has met much opposition to its use as an anesthetic, seems now to be coming into its own. One of its discoverers, Professor Arno B. Luckhardt of the University of Chicago, speaking at the recent Congress of Anesthetists, pointed out how its value was now being recognized by both medical scientists and patients.

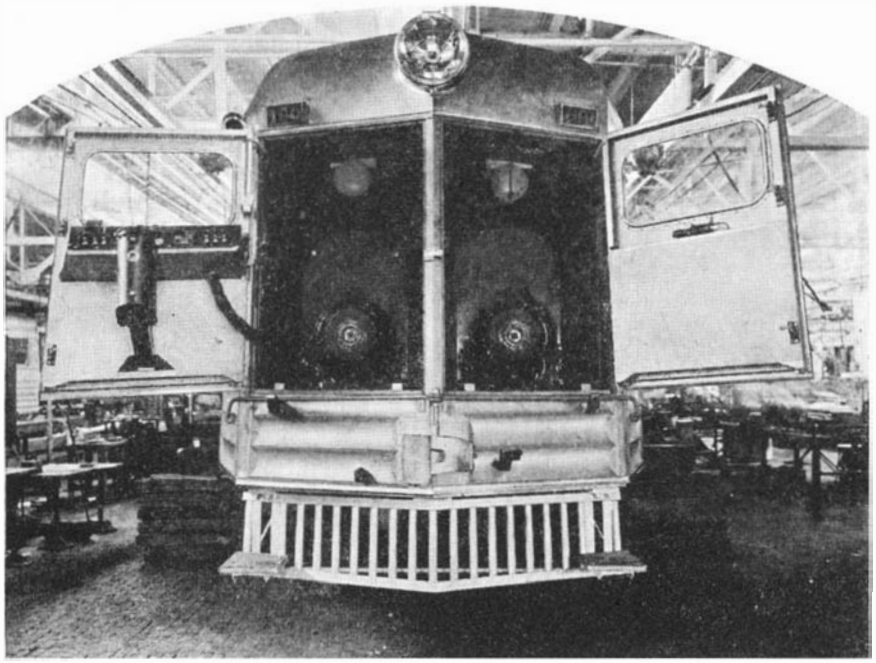
A recent survey of 534 anesthetists showed that 220 of them were using ethylene, and with no explosions recorded. The danger of this anesthetic because of liability to explosion was one of the drawbacks that made it unpopular with surgeons and anesthetists. However, Prof. Luckhardt quoted statistics showing that there was but one death from it in 332,721 cases.—*Science Service.*

Indium

INDIUM, named because of the brilliant blue lines in its spectrum, is now available to the world in commercial quantities. Until quite recently, it was a scientific curiosity in which no one was greatly interested because no one knew of any particular use for it in industry or the arts.

As W. S. Murray points out, in *Industrial and Engineering Chemistry*, element 49 was discovered in 1863 by two German chemists, Reich and Richter, and named "indium" by them. Its isolation was probably made early in its history, but the beginning of its commercial development was left until a few years ago.

Indium plate as it comes from the bath



Front view, with doors open, of new rail-car train, showing gasoline engines

is soft, uniform, and gray. It can be easily diffused into the base metal and thereby hardened. This procedure both hardens and stabilizes the surface so treated; that is, the surface becomes resistant to oxidation and tarnish.

Little has been done with indium outside the field of plating and alloying. However, with a valence of 3, the metal invites the production of many salts and compounds. Since commercial amounts are now available, this element will soon be very much better known to the commercial world.—*A. E. B.*

Another Rail-Car Train

A NEW two-car train represents the advancement made after two years of intensive development on the part of the Budd Company in the application of its "Shotweld" stainless steel construction to rail cars. For the first time it incorporates the economical advantages of light weight, high speed, safety, riding comfort and air-conditioning, even exceeding in these respects the most luxuriously appointed steam trains.

The two units constitute a train of great flexibility. The leading motor car is on two four-wheeled steel-tired power trucks, whereas the trailer, with provision for 76 passengers, is on two eight-wheeled pneumatic-tired trucks. The forward car contains the power plant, consisting of two 240 horsepower 12-cylinder gasoline engines with electric drive, 15-foot railway post-office compartment, and ample baggage space. All of the air-conditioning and refrigerating apparatus is also in this forward car, which leaves the passenger trailer free of any moving mechanism whatsoever and thus provides the utmost in easy riding and silent operation.

Both cars are constructed entirely of "Shotweld" stainless steel and make a striking appearance in their natural bright finish, which requires no painting and but little cleaning maintenance. More heat rays are reflected and those absorbed are diverted by the use of insulating material throughout the roof and sides of both cars.

The top speed is better than 75 miles per hour; acceleration approximately two and one half miles per hour per second. With this performance and 480 horsepower available the train can run some 50 percent faster, and for about half the operating cost of the steam train it will replace in 500 miles daily service on the Texas and Pacific Railway.

Preventing Infantile Paralysis

INFANTILE paralysis attacks children more often than grown-ups because, for one thing, children do not have as good "breathing hygiene" as their elders, according to Dr. W. Lloyd Aycock of Harvard Medical School.

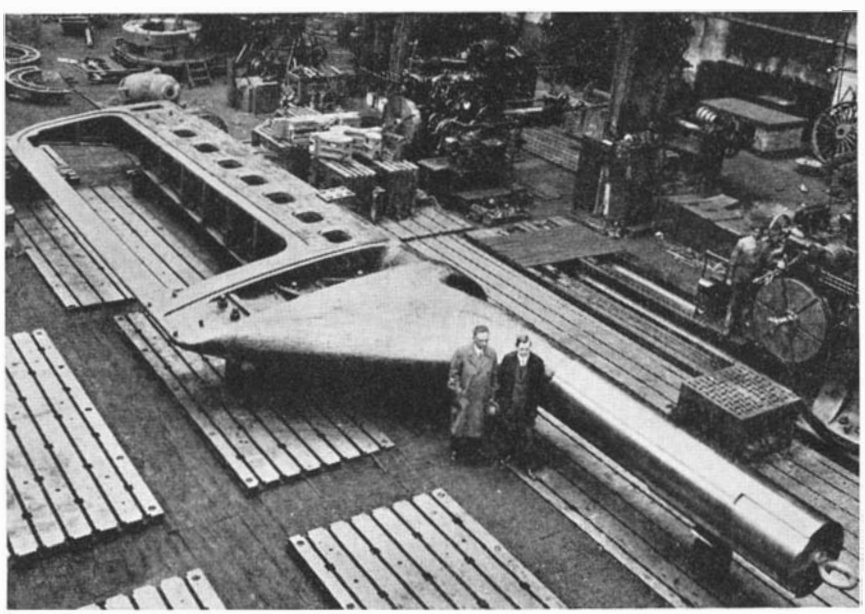
This dreaded scourge of childhood is spread by direct contact, like measles and diphtheria, in Dr. Aycock's opinion. His researches on it, which have been carried on for the past 17 years, lead him to believe that some individuals among both children and adults who are more susceptible get it and others do not. Children who lick each other's lollypops, swap whistles, and borrow handkerchiefs run a much greater risk of picking up the virus that causes the disease than grown-ups who have learned to be more fastidious about personal belongings. The same question of breathing hygiene is responsible for the greater frequency of measles and diphtheria in childhood, he said.—*Science Service.*

Rapid Aging of Liquors

SO many inventors are coming forward with processes for the rapid aging of whiskey, brandy, and rum that a large distilling company is said to have set aside an entire floor of its office building for interviewing applicants who expect the use of their methods to revolutionize the industry. The current number of a luxurious magazine pictures the apparatus with which one company proposes to make 24-hour-aged whiskey, and describes the 2,000,000 dollars "educational" campaign which is contemplated in introducing the article to the public. The idea of rapid aging is by no means new, however, for a 12-hour process for aging whiskey then in use was described in a Government report of over 40 years ago.

Apparently, two principal reactions take place in aging distilled liquors: extraction of flavor and color from oak barrels, and chemical combination of some of the alcohol with the acids extracted from the wood, to make "bouquet." There is probably no reduction of fusel oil on aging, in spite of popular impression to the contrary. In America, the barrels used are charred on the inside, whereas in Europe they are not. This charred wood gives strong color and imparts the distinctly "American" character to the flavor. The smokiness of Scotch whiskey is imparted in a different way: by drying the malt used in the smoke of fires containing smouldering peat.

Wines are aged in wood or glass, for clarification, and for improvement of the bouquet or aroma. The improvement of



Skeleton of the rudder of the *Normandie*, the "world's largest ship" of the French Line. Note how the casting compares in size with the men in the photograph

Scientific American's

AMATEUR TELESCOPE MAKING

ONCE more revised and greatly enlarged—more than 50 percent larger than the previous edition. Many new contributions, new notes, new illustrations. A mine of practical, definite, concrete, working instructions and information—a real shop book. From it thousands of SCIENTIFIC AMERICAN readers have already made their own astronomical telescopes—real instruments, not toys. By doing all of the constructional work—making the mounting, grinding and polishing the concave glass mirror disk and silvering it—the amateur may create his own telescope. A six-inch diameter (beginner's size) magnifies 50 to 200 diameters. Will read a watch at a mile and reveal many wonders of the heavens. Cost about $25; value about $250. The constructional work is real *fun*. No special tools required—just your two hands.

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TO PRESENT OWNERS OF "AMATEUR TELESCOPE MAKING":

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

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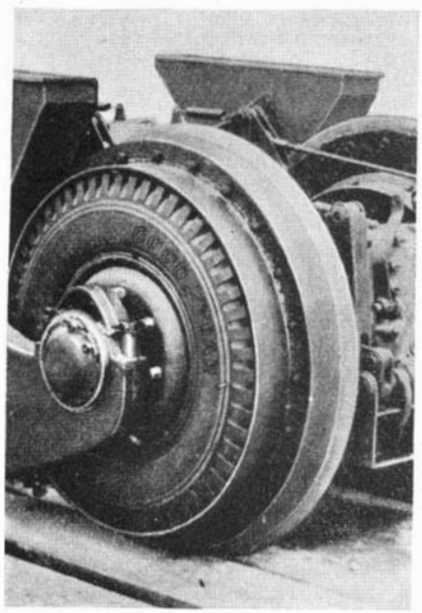
aroma is due in no small part to the combination of acids and alcohol (esterification) to make highly fragrant esters. Cider, even the so-called sweet cider, is processed over a period of time, to develop the flavor. Beer, ale, and other brewed drinks must be aged to complete the slow second part of the fermentation, as well as to smooth the flavor.

Knowledge of the changes taking place in materials with age is increasing rapidly. In particular, new reactions are available now that were unknown prior to the prohibition era. Many of these reactions are directed toward offsetting bad effects of aging, although progress in securing benefits from aging is, as these recent developments show, attaining increasing significance.—*Industrial Bulletin* of Arthur D. Little, Inc.

Wheels-On-Air Rail-Car Truck

A NEW four-wheel narrow-gage rail-car truck embodies a number of novel features. The truck frame forms a foundation for the brake rigging and gear. The weight of the car is carried on four out-



One of four wheels of a rail-car truck using large pneumatic tires

side leaf springs which, through bolsters, transmit the load to the king pin. The load is transmitted to the main frame to both equalizers through a cross-member which has a circular sliding fit in both equalizers. Both equalizers transmit the load to the center or driving axles which are supported by pneumatic tires.

In case of a deflated tire the driving or pneumatic tired axle drops five eighths to three quarters of an inch until the truck frame rests upon the guiding axle, thereby passing the load away from the pneumatic tires to the steel axles and wheels. The car therefore can continue its operation and the tire can be changed at a terminal point.

Due to the combined use of pneumatic tires and flexible running gear a marked improvement in riding qualities is assured. The shock absorbing features of the pneumatic tires make possible a lighter construction of the car as well as the truck itself. The pneumatic tires not only absorb the vertical shocks but the lateral shocks as well. This truck is intended for use on narrow gage railroads but similar trucks have been designed for use on standard gage steam railroads, rapid transit lines, and interurban railroads.

Thallium Improves Photographic Film

COMPOUNDS of thallium are likely to find some use in photography, according to *Chemical Markets*, for it has been found that thallium halide made into an emulsion with silver halide has an important effect upon the properties of the emulsion. In the case of silver iodide the presence of thallium iodide strongly increases the general sensitivity and the chromatic sensitivity.—*A. E. B.*

Monel Metal in Welding

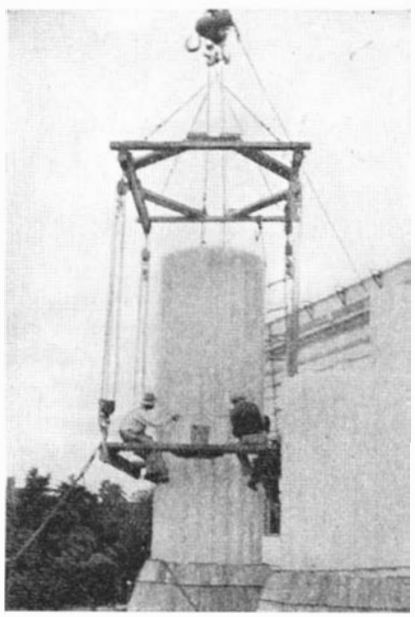
WHEN cast iron is welded with a steel or iron electrode the weld is extremely hard and non-machinable, and the surface can only be finished by grinding. For this reason Monel metal electrodes have been introduced and their use is now being extended, experience having shown that, with proper welding apparatus, they give a surface capable of being machined as readily as the parent metal. The Monel metal rods supplied for the metallic arc welding of cast iron are coated with a special flux, which protects the weld metal from oxidation and fluxes off any oxides which may be formed. Monel metal wire is supplied for oxy-acetylene welding and refined powdered borax is used as a flux. —*A. E. B.*

Pipe "Caravan"

CAMELS cross the desert in Trans-Jordan near the Mediterranean as they did 3000 years ago. Now a new form of transportation comes in competition with them—a pipe line which will transport oil hundreds of miles from the kingdom of Iraq to ports in Palestine and Syria.

This new 12-inch pipe line, 1180 miles in length, taps the rich oil fields near the Tigris and Euphrates Rivers, where petroleum was first used by man.

This pipe line is one of the world's longest and is being built at an estimated cost of 50,000,000 dollars. Many American welding operators, as well as American products, are employed on the project. Welding is being done by the shielded arc process using equipment manufactured by The Lincoln Electric Company.



For setting in place the drums of marble columns, a new combination hoist and scaffold has been developed. The scaffold is lifted with the stone when the latter is raised into place. Thus, when the marble is lowered to position, the frame on which men work is within easy reach of the joint. This saves constructing a scaffold for each column

Some Fun for the Mathematically Minded

MR. CHURCHILL EISENHART of Princeton University, contributing editor, in a recent letter mentioned the following mathematical "stunts":

During the past year many of the readers

A modern pipe line in foreground, with camel caravan on the horizon

of this magazine have, no doubt, attended the Century of Progress Exposition at Chicago. While passing the mathematical demonstrations some, perhaps, stopped to look with wonder at the method of determining π, defined as the ratio of the circumference of a circle to its diameter, by a method analogous to throwing matches of length l on a floor where the cracks between the boards represent parallel lines d units apart. In which case, if l is less than d and the experiment be repeated a great number of times (say several hundred), π may be calculated approximately from the relation

$$\pi = \frac{2l}{d} \times \frac{\text{total number of throws}}{\text{number of cases in which matches cross a crack}}$$

This result was originally stated by Buffon in 1801. Since that time many persons have performed the experiment and, in 1901, a century later, Lazzerini made 3408 trials and obtained the value 3.1415929, an error of only 0.0000003.

There is another interesting experiment that may be performed at home with two ordinary packs of cards, and it depends on a theorem given by De Montmort in the early 18th Century. As the more advanced reader knows, there is a number e which is used as the base of Napierian or Natural logarithms. (Briggs or Common logarithms use 10 as a base.) This number e ($= 2.71828$) has been chosen, since logarithms to this base can be dealt with more easily in the calculus. This e can be calculated approximately with two decks of cards as follows:

Thoroughly shuffle two decks and place them face down on a table, and about one foot apart. Take the top card from each deck and place it face up between the two decks, noting the card in each case. Continue until two *identical* cards appear at the same time. If this experiment be repeated a great number of times, and a record kept of the number of times that *no* coincidence occurred (*i.e.:* entire pack turned up without success), e may be found approximately from the following relation:

$$e = \frac{\text{total cases}}{\text{cases where } no \text{ coincidence occurred}}$$

Hence we are able to understand the traditional professor who found it easy to conceive of a race of beings whose fundamental processes of arithmetic and algebra were different from those which appear to us so evident, but utterly impossible to conceive of a universe in which e and π didn't come popping up somewhere.

The advanced reader will find the mathematical analysis of these problems in works on Probability, such as J. L. Coolidge, "An Introduction to Mathematical Probability."

Vitamins in Pasteurized Milk

OCCASIONAL statements that pasteurization of milk destroys some of the vitamins in our most nearly perfect food are erroneous, according to Dr. James A. Tobey, writing on this subject in the *Dairy World*. Milk is unique as a food, says Dr. Tobey, because it contains all six of the known vitamins and is an exceptionally good source of two of them, the growth-promoting vitamins A and G.

Of these six vitamins only one, vitamin C, is relatively unstable to heat, and even this is not destroyed by pasteurization but

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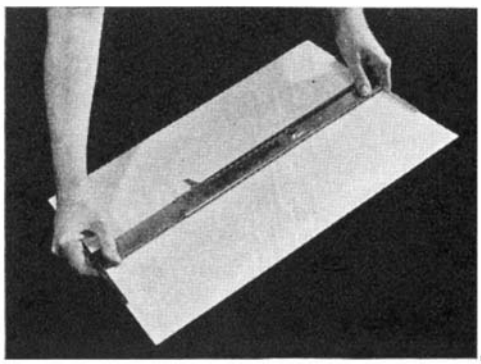
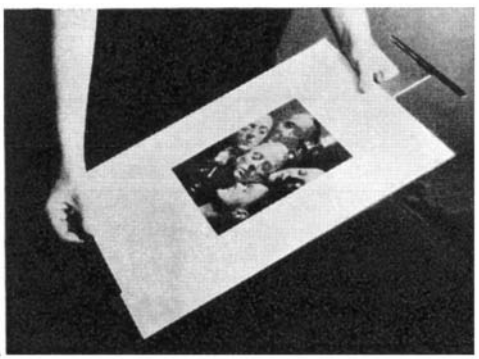


a stiff cardboard mat approximately one eighth inch thick. A piece of plate or window glass is obtained of the same size as the mat and the adjustable frame is then opened and the mat and glass inserted in the channels provided. (See below.) The frame is then closed (left) and locked in place by a simple cam in the rear channel. That is all there is to it. Picture and glass are held firmly

Adjustable picture frames that may be fitted in a few seconds to pictures within a wide range of sizes are now available. These frames may be hung on any nail, or may be provided with an easel rod. Back and front views of one of these frames being applied are shown above and at the right. The procedure is as follows: The print or photograph is mounted on
(Continued at right above)



is merely reduced in amount. The extent of its reduction depends upon such factors as oxidation and catalytic action due to poor condition of the metals used in pasteurizing machinery. Under modern conditions the diminution seldom exceeds 30 percent and may be less. A slight loss in vitamin B may also occur.

Dr. Tobey points out, however, that milk is not depended upon as the main dietary source of either of these vitamins, which are obtained chiefly from citrus fruits and certain vegetables in the case of vitamin C, and from whole grain cereals, yeast, and certain vegetables in the case of vitamin B. These slight losses are, therefore, of no practical significance from the standpoint of human nutrition.

Pasteurized milk is as valuable a food as the best grades of raw milk, according to Dr. Tobey, and has the great advantage of safety, since pasteurization destroys all dangerous bacteria which might be in milk and thus puts the final seal of safety on an already clean milk supply.

Welded Joints X Rayed

WHAT appears to be a large-sized edition of an old-fashioned talking machine is actually one of industry's most modern tools—the completely shock-proof X-ray apparatus which is being used to examine more than 75 miles of welded steel seams in the penstocks of Boulder Dam. Built by the General Electric X-Ray Corporation, the equipment is rated at 300,000 volts and will "look through" four inches of steel. The "megaphone" prevents the spread of the X rays.

Chromium Plate Given Clean Health Bill

THE gleaming chromium plate which has been coming rapidly into favor for dishes, eating utensils, and all sorts of restaurant fixtures, has been given a clean bill of health as a perfectly harmless substance to come in contact with human foods, setting at rest any rumors such as the unfounded ones which hampered the use of aluminum utensils when that metal first became popular years ago.

The very thing that makes chromium plate good-looking and easy to clean, its untarnishability, is the reason why it cannot be harmful as a food container. Tarnish means that a metal is being affected by chemicals in the air or in a liquid. To all chemicals found in foods or drinking water, chromium turns a smooth and unaffected cheek. Sulfur, in the air or in food, is the bane of some metals, but chromium resists it perfectly, report Richard Schneidewind, Research Engineer for the University of Michigan Department of Engineering Research, and Dr. Willis S. Peck, of the University Hospital.

Hydrochloric acid is the only thing which will attack chromium in any noticeable degree. Soap and washing alkalis, and natural food acids, even in the heat of cooking, produce next to no effect on it. Water in which a large chromium-plated sample had been immersed for a month was found to have dissolved only five thousandths of a part in a million parts of water. This is much less than most metals would lose, and far below any concentration which could conceivably be considered harmful, they state. To supplement their findings, the investigators polled municipal health officers in all parts of the country and found that none had ever had any reason to blame chromium for ill effects.

Heating and Cooling with Hypo

HYPO, says *Chemistry and You*, makes a good hot water bottle. A bottle filled with melted hypo is corked until you want heat. Take out the cork, rub your finger on the neck, cork again, and heat develops through crystallization. To renew the bottle, put it in hot water until the hypo is re-melted.

In reverse, this process gives a good refrigerant. Put a couple of handfuls of hypo in a bucket of water, when camping, place your ginger ale in the bucket, and it will be made nice and cold—a use discovered by Hollywood laboratory men.

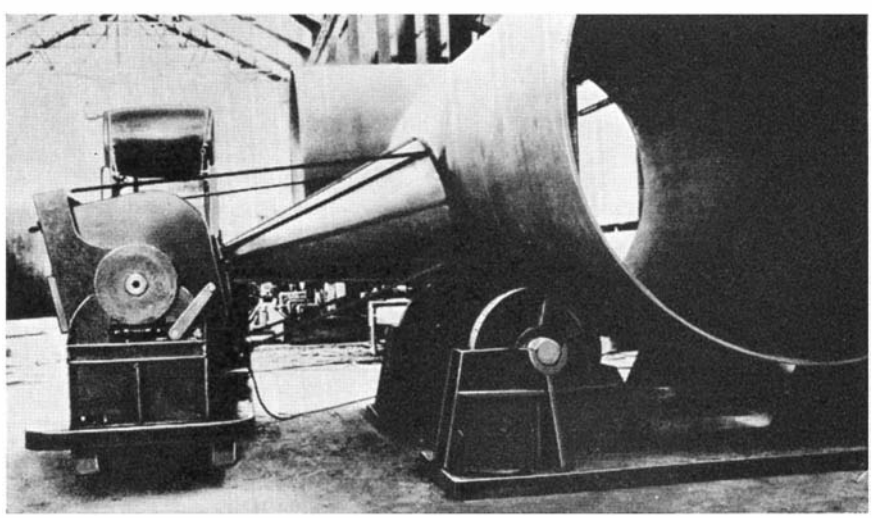
Hypo is also used in bleaching paper and cotton fabrics, to neutralize excess chlorine; in chrome leather tanning, to precipitate chromium; to preserve color and perfume in high-grade soaps; to remove iodine stains from fabrics; and for killing a common fungus that often gets between people's toes and causes itching.

Lately, physicians have found that a solution of hypo injected in the blood is an antidote against cyanide poisoning similar to the famous methylene blue. So this widely useful product may soon be found in the first-aid kit.

"Finger-Printing" New Guns

FEDERAL legislation requiring a trial firing of every gun before sale to the public so that a ballistic impression of its bullet will be on file in every city police department, is advocated by Dr. Wilbur B. Rayton of the Bausch and Lomb scientific bureau, as a method in aiding the swift tracking-down of perpetrators of major crimes in this country.

"This method as applied to tracing the gun and its ownership is similar," Dr. Rayton explained, "to the tracing of an individual through finger-print markings left at the scene of a crime. . . . Thus, by having



X raying the welded joints on a penstock section for Boulder Dam

on file ballistic impressions of the bullet of every gun before its sale to the public, identification of another bullet from the same weapon used in commission of a crime would be readily available by employing a comparison microscope test."

Selling Cars by Barter

AN Indiana automobile dealer recently accepted as part of the down payment on a new Continental Beacon a two-year-old heifer, 50 bushels of feed corn, 1 bushel of sweet potatoes, 10 geese, and 5 bushels of pop corn.

While farmer incomes in many cases have been renewed and improved so that monthly payments on the essential motor car can be made, not sufficient time has elapsed to enable the farmer to accumulate enough money to make the down payment.

In this case a canny and energetic merchant overcame this obstacle and helped to better trade conditions by accepting some of the farmer's assets in lieu of cash for the down payment.

When Southerners Go North . . .

SOUTHERNERS who migrate to the North are more susceptible than northerners to arteriosclerosis, familiarly known as hardening of the arteries, in the opinion of Dr. Clarence A. Mills of the University of Cincinnati. Calling arteriosclerosis the "greatest of our degenerative diseases," Dr. Mills said that "these southern migrants die at a much earlier age from this cause than do native northerners and also earlier than their fellowmen who remain at home in the South."

"The great influx of southerners, both white and colored, into the manufacturing cities of the North during the last 15 years has presented us some important health problems quite aside from those of sanitation and personal hygiene," he stated.

"In the free clinics of Cincinnati, where thousands of these people are seen in states of bodily and nervous exhaustion, it is evident that a major problem in public health is being presented. Not only are these migrants found more susceptible to acute respiratory diseases such as pneumonia, sinusitis and colds, but they also show frequent metabolic disturbances. Toxic goiter and diabetes seem to attack them even more than they do native northerners. Various types of asthenia [weakness] with nervous exhaustion are also particularly common among them."—*Science Service.*

. . . And Northerners Go South

PATIENTS suffering from inflammatory rheumatism and heart disease may be benefited by a tropical climate, it appears from a discussion of the advantages of cure resorts in the tropics presented by Drs. Louis Faugeres Bishop and Louis Faugeres Bishop, Jr., of New York City, at a meeting of the American Society of Tropical Medicine.

"We know that climate has a profound influence on the lives of those who enjoy its advantages, but one of the most striking facts in connection with climate is that it is not only the climate itself we look to for benefit, but equally important is change of climate at the right time," Dr. Bishop

(*Please turn to page* 49)

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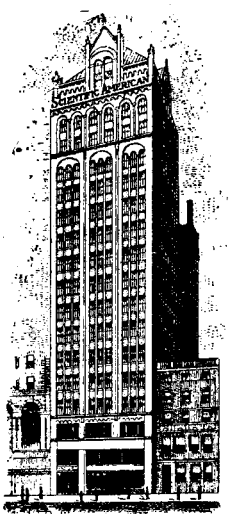

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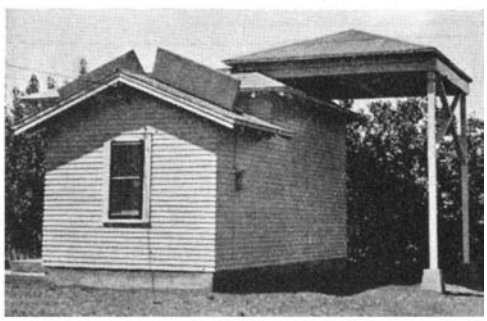
THE AMATEUR ASTRONOMER

Conducted by ALBERT G. INGALLS

AMATEUR telescope making activities continue unabated among our readers. Here, for example, is a summary of the activities of the Pittsburgh group of amateurs, sent in by Leo J. Scanlon, their local patron saint and secretary-treasurer. Six-inch reflectors: Under construction, 64; completed, 34. Eight to nine-inch reflectors: Under construction, two; completed, six. Ten-inch reflectors: Under construction, six; completed, four. Twelve-inch reflectors: Under construction, five; completed, four. Total under construction, 77; completed, 48.



A neat observatory built by John Bunyan, president of the Berthoud National Bank, Berthoud, Colorado. Main room at rear, for a ten-inch Cassegrainian—roof rolls off on track. The small room at nearer end houses a meridian telescope

We showed this summary to Wally Everest, patron saint and president of the Pittsfield, Massachusetts, group (The Berkshire Astronomical Association), who came right back at us with a tabulation showing 20 telescopes completed, also nine unmounted mirrors made, two being made and six ordered. Of these, 14 were of Pyrex and one of fused quartz. Everest goes on to demonstrate by abstruse mathematics that, since Pittsburgh's population is 600,000 and Pittsfield's is only 50,000, each Pittsburgher makes .000208 of a telescope and each Pittsfielder .000740, or 3.55 times as many. Learning of this body blow, Scanlon retaliates in red ink that his listing did *not* count mirrors merely ordered and others as yet unmounted.

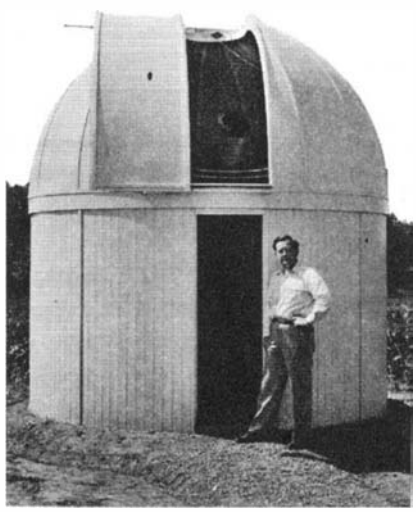
Well, anyway, there's a lot of activity in Pittsburgh and in Pittsfield too. The Pittsfield group is made up entirely of employees of the General Electric Company.

NOW comes Buffalo with a new group, the Amateur Telescope Makers of Buffalo, with 15 charter members. Thaddeus Czerniejewski, 113 Franklin Street, Lackawanna, New York, is its chairman.

Winston Juengst of Todd Union, University of Rochester, Rochester, New York, mentions the organization of an Astronomy Club in that city, which is doing meteor research and making telescopes as well.

Here is a short bit of comment which we have had in our system for a long time and wanted to get rid of: Amateur telescope makers frequently inquire regarding the relation between quality and price in telescope making supplies. It stands to reason that, on the whole, *price reflects quality*. There may be partial exceptions to this—for example, sometimes when the dealer is his own manufacturer—but there are probably few fields in which materials which look about alike, and *can be described about alike* without risk of imprisonment, may vary so widely in real quality. There may be more qualities pertaining to a prism, for example, than its dimensions. Buyers seldom get something for nothing.

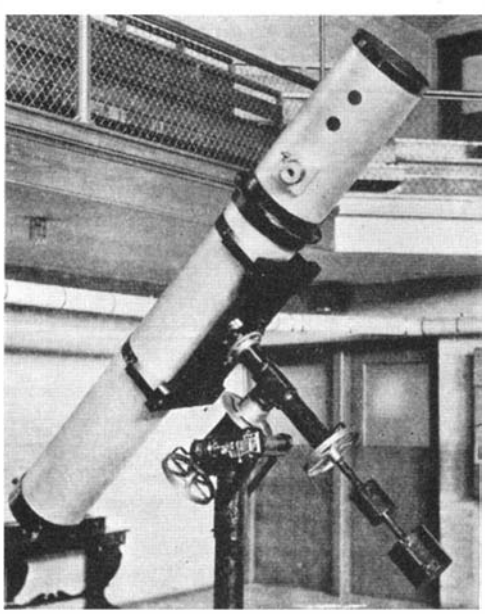
HERE is an interesting tabulation made by Professor Lundmark of Sweden, and taken from *Journal of the British Astronomical Association.* The number of permanent observatories in each country: U.S.A. 80, Germany 34, Italy 21, Great Britain and Ireland 26, France 14, Russia 14, Poland 10. The number of astronomers: U.S.A. 407, Russia 182, Germany 165, France 100, Great Britain 103, Japan 72. But Switzerland, with over 9 astronomers per million, has the greatest percentage of astronomers (we recall that the same nation has the highest percentage of inventors). Denmark has 8. New Zealand, Australia, Austria and Esthonia rank high. England and the U.S.A. have less than 4 per million. The largest astronomical society is the Société Astronomique de France (no figure given, but we think it is 5000); British Astronomical Association, 2000. The societies in Kyoto and Budapest come next. There are over 368 astronomical publications in the world. Most of these are of a very specialized nature.



***Above and at right:* Observatory and 12-inch telescope built by K. F. Davison, professional photographer, Marshfield, Wisc.**

So many have inquired about the new method of plating mirrors by evaporation in a vacuum that we have fished out the *Astrophysical Journal* for last June, which contained a five-page article on the technique, by Robley C. Williams and George E. Sabine of the Department of Physics at Cornell University (Ithaca, New York). The work requires a steel bed-plate, a glass bell-jar and a high-vacuum pumping system. The bed-plate used was 22 inches square, but this depends upon the diameter of the mirror. Glass plugs containing tungsten leads must be sealed into holes in the plate. The metal to be evaporated and deposited is heated electrically by a filament and the mirror is placed about three inches distant from it. The bell-jar placed over the whole apparatus must have a very tight joint at the bottom where it meets the bed-plate. A vacuum of one thousandth of a millimeter of mercury is required, and this demands a better vacuum pump than most amateurs have available.

Coating a 16-inch mirror requires 15 minutes. Chromium or aluminum may be applied. The latter has excellent reflectivities—90 percent in the yellow and 80 percent in the violet. Similar work has been done with magnesium, by Hiram W. Edwards of the University of California (Berkeley). Two years ago, Professor John Strong of the California Institute of Technology (Pasadena) sent us a description of his method, and tried to work up a simplification for the amateur telescope maker, but he later stated that the high vacuum would offer too great an obstacle for the amateur unless he had access to better than average laboratory equipment. It is believed that several amateurs so situated have experimented with this method, but the outline above is given mainly in order to show that it is probably out of the reach of the average worker. It is too complicated and too expensive.



A six-inch Cassegrain by Alan R. Kirkham of Tacoma, with prism

A STUNT for silvering, sent in by Lincoln K. Davis of Campello Station, Brockton, Mass., is as follows: "Get a paper pie plate, preferably the kind made of heavy, coarse pulp, with a bottom diameter about the same as that of the mirror to be silvered. Place the mirror inside, and mark around it with a sharp pencil. Then cut out the bottom on this line, or slightly inside, and the result will be a collar which can be fitted around the mirror near the top. A soaking with shellac, pitch, or paraffin makes it tight and acid-proof. A heavy rubber band immediately beneath it helps to locate it and makes the mirror easier to handle."

Frequent inquiries received indicate a desire on the part of many beginners to build up mirror disks from lamina of thin glass. There is a big gamble in this. Doliver S. White, 232 South Main Street, Mansfield, Massachusetts, with Leon G. S. Wood, made an 8-inch disk from four pieces of quarter-inch plate cemented with Rutland water glass. The mirror performed nicely but, in Mr. White's language, "after using the telescope for some days we discovered that the mirror was losing its figure. Immediately we tested it and discovered that the curve had radically changed. The curve was so distorted that we fine ground it and figured it again. Again the mirror gave what to us seemed a perfect performance, repeating its former performance. We have found, however, that the mirror cannot be depended upon to keep its figure more than a few days at the most. In consideration of our experiences we would not advise the use of this type of mirror.

"If any of the readers of the SCIENTIFIC AMERICAN would like a more detailed account of how we built a mirror that worked at no expense except for the chemicals used for the silvering process, we shall be very glad to hear from them."

Mr. White did not reveal the nature of the latter mirror in his letter.

We often hear of short cuts in polishing —mirrors polished in one or two hours, and so on. Here is what J. W. Fecker, the professional, has to say about this: "The amateurs and all the rest who have not already done so must depart from the belief that there is a quick way to obtain an optical surface. An optical surface is nothing less than a work of art and there is no short cut to results." No doubt some will regard this as a challenge, but . . .

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CURRENT BULLETIN BRIEFS

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

The Editor will appreciate it if you will mention SCIENTIFIC AMERICAN *when requesting any of these bulletins*

SUGGESTIONS FOR PHEASANT MANAGEMENT IN SOUTHERN MICHIGAN, by Howard M. Wight, gives suggestions that are intended to guide farmers and other landowners who wish to increase the supply of pheasants and incidentally of other wild life. The cost of producing pheasants by the method described is only 47 cents per bird in comparison with the usual artificial propagation cost of from two dollars to three dollars a bird. *Department of Conservation, Lansing, Michigan.—Gratis.*

ZINC describes many uses of that metal; for example, zinc die castings and rolled zinc may be used for 53 parts of an automobile. This pamphlet gives a good picture of the uses of zinc and its alloys. *New Jersey Zinc Company, 160 Front St., New York City.—Gratis.*

AIR CONDITIONING FOR HEALTH, COMFORT AND PROFIT. Hot weather may be converted into a business asset by moving picture house owners, merchants, and restaurant keepers. The uses of this comparatively new addition to our modern life are fully described in this pamphlet. *Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.—Gratis.*

AZIMUTH DETERMINATION (Engineering Experiment Station, Bulletin No. 79), by E. F. Coddington, Professor of Geodetic Engineering, Ohio State University. This booklet represents an attempt to write a manual on azimuth which will eliminate the mystery usually associated with this subject. A chapter on astronomy has been included in order that the reader may familiarize himself with the concepts involved. The sun and Polaris are the natural objects most often used in the determination of the true north. *Ohio State University, Columbus, Ohio.—50 cents.*

BAKELITE REVIEW (October, 1933, Volume V. No. 3) describes Bakelite resinoid which is a material of a thousand uses; for example, it goes into pipe stems, umbrella handles, the handle of your percolator, the casing of your refrigerator, and the cabinet of your radio. *Bakelite Corporation, 247 Park Avenue, New York City.—Gratis.*

THE CHANGE FROM MANUAL TO DIAL OPERATION IN THE TELEPHONE INDUSTRY (Bulletin of the Women's Bureau No. 110, U. S. Department of Labor) describes the effects of a mechanical device on an industry. Practically the only operators laid off at the final cut-over were temporary workers engaged only for a few months. This is a notable example of the possibilities of long-view planning in cases of technologic change. *Superintendent of Documents, Washington, D. C.—5 cents (coin).*

WATER POWER EQUIPMENT describes a new field (commencing in 1921) of a well established shipbuilding company. They have built turbines, butterfly valves, and trash-rakes for hydro-electric power plants, as well as other necessary equipment. The company maintains a well-appointed hydraulic laboratory. The pamphlet is beautifully illustrated and naturally can be sent only to interested parties. *Newport News Shipbuilding and Drydock Company, 90 Broad St., New York City.—Gratis.*

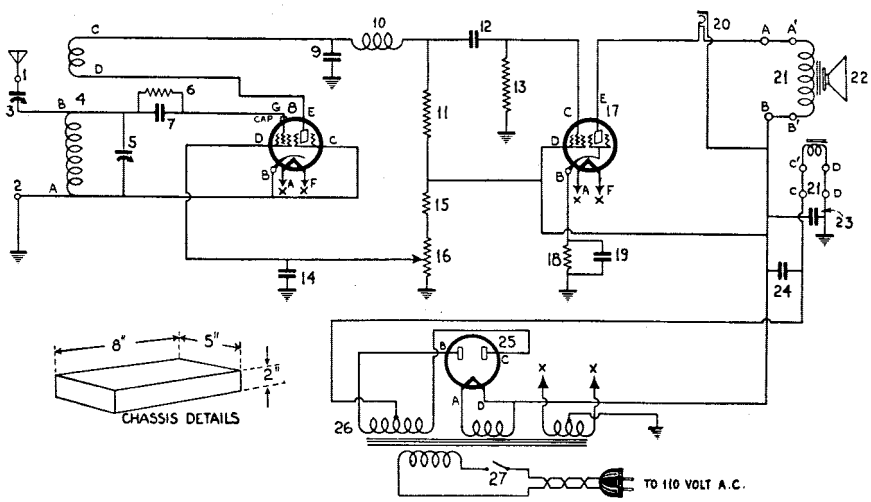
ELECTRIC MELTING WITH THE DETROIT ROCKING ELECTRIC FURNACE is a beautifully illustrated treatise on the modern trend in foundry practice. These furnaces are adapted to non-ferrous metals and alloys as well as ferrous metals and their alloys. There is a detailed analysis of costs. Many of the illustrations are fine photomicrographs. This book can only be sent to interested parties. *Detroit Electric Furnace Company, Detroit, Michigan.—Gratis.*

SERVING INDUSTRY'S NEEDS is a souvenir book for the Century of Progress and gives the multitudinous uses of the versatile link belt which Mr. William Dana Ewart conceived one Sunday morning some 60 years ago. *Link-Belt Company, 2680 Woolworth Building, New York City.—Gratis.*

A FOREST OF THE COAL AGE (Geology Leaflet 14, Field Museum), by B. E. Dahlgren, describes a most remarkable exhibit in the Museum, which has been recently opened to the public. In many cases actual surface markings were reproduced by making metal dies from which celluloid exhibition material was cut out to the extent required. *Field Museum of Natural History, Chicago, Illinois.—25 cents.*

THE SCUFFABILITY OF SHOES (October, 1933 issue of *Shoe Factory*) is a reprint of an article by Carl H. Geister, Industrial Fellow, Mellon Institute. The tests were exceptionally severe. A drum was used and the shoes are thrown almost two feet, crashing against the bottom of the drum twice every revolution. *Mellon Institute of Industrial Research, Pittsburgh, Pa.—Gratis.*

HAZARDS OF OVER-LUBRICATION (*Lubrication*, Vol. XIX, No. 10, October, 1933). This issue cites a factor in connection with industrial plant lubrication which is very often overlooked by the average operator; that is, the detrimental results of over-lubrication. The four serious consequences of over-lubrication are: waste, expense, danger to personnel, and the fire hazard. *The Texas Company, 135 East 42nd Street, New York City.—Gratis.*



The three-tube A.C. operated Find-All Globe-Trotter covers the short-wave band from 15 to 200 meters. Through the use of a special broadcast coil, this same receiver can also be used to cover the standard broadcast band from 200 to 550 meters. This set has plenty of power, giving loud speaker operation on many stations, and is sensitive and selective. Using comparatively few parts, it is easy to build and simple to operate. The circuit utilizes a 57 high gain r.f. amplifier pentode as a regenerative detector and the powerful new 2A5 pentode as the power output tube. A small Hammarlund midget condenser controls antenna capacity and makes an excellent vernier. Plug-in coils are of the Alden four-prong type. Regeneration is controlled by means of an Electrad potentiometer which varies the voltage applied to the screen grid of the 57 tube. This takes the set into and out of regeneration with extreme smoothness. Additional diagrams and views, complete list of parts, and other information regarding this receiver may be obtained from *Allied Engineering Institute, Suite 542, 98 Park Place, New York, N. Y.—10 cents.*

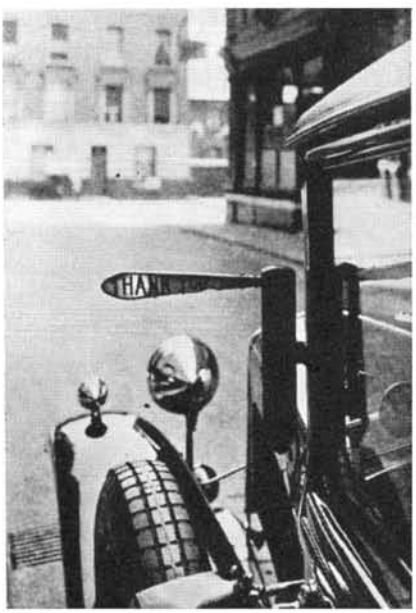
THE SCIENTIFIC AMERICAN DIGEST

(*Continued from page* 45)

pointed out. He suggested that a tropical climate should be available for physicians to order for their patients and that eventually it may be possible to determine by experiment the climate best suited to each person.

The absence of inflammatory rheumatism in the tropics, testified to by many observers, prompted Dr. Bishop's interest in the health advantages of a tropical climate. He thinks it should be tested for young people with progressive rheumatic heart disease and for elderly people with disease of the heart of the degenerative type. Many of the drawbacks of the tropics can be mitigated with modern air conditioning.

"The climate of the tropics promotes all those things which are needed in heart disease," said Dr. Bishop. "It promotes distaste for physical exercise. It is a notable fact that many heart patients who go to the tropics to pass their remaining days find those days very much longer than anybody expected."—*Science Service.*



A courtesy signal for motorists. Of English design and manufacture, this signal is used to acknowledge the courtesy of another motorist when he gives the right-of-way to a passing car. The device, electrically lighted, is shown mounted on the left because of English traffic laws

Will Civilization Starve Itself?

OUR machine age will eventually starve itself to extinction by its insatiable appetite for raw materials which will eventually be exhausted, according to an opinion of Prof. R. A. Gortner of the University of Minnesota, expressed before the American Association for the Advancement of Science. Professor Gortner points out that irreplaceable natural resources absolutely essential to modern industrial civilization are disappearing into the "maws of indus-

A New Service to INVENTORS

HOLDERS of patents who desire to place announcements of their inventions before manufacturers, business executives, and other interested parties, will find an excellent medium in a new advertising section to be published in SCIENTIFIC AMERICAN. A special department will be devoted to advertisements of the type presented below.

Patent Number 1830558. John Olson, Brooklyn, N. Y. The invention relates to clamps in general, but more particularly to a clamp of the split ring type designed for clamping a fishing reel on the reel seat of a fishing rod, to insure against the reel's accidental displacement.

The principal aim is to provide a clamp more effectual in its gripping power, yet particularly simple by virtue of means on the ears, which are of double or folded form, whereby the inner ends of the ears may be moved closer together

as the clamping means are tightened. The ears are retained in their proper shape without the use of soldering, welding or other processes of this nature; in fact, the general construction is one of simplicity, and easy to manufacture, the ears being brought firmly together by means of a screw formed with an enlarged knurled head in which there also exists a kerf to engage the blade of a screw-driver or similar tool.

This advertisement, with illustration, will be published at a cost of only 30 dollars per insertion

Patent Number 1925913. Benjamin F. Wood, New York, N. Y. The invention provides means of utilizing natural laws of surface tension whereby liquid in a container, which might otherwise drip from the spout, is drawn back into the container. The drip channel is such as to insure the requisite surface tension to restrain the liquid, even below the highest point of the spout, from gravital delivery from the spout, and further provides for drawing all the liquid in the channel back into the container.

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AT a rate of only 10 dollars per inch per insertion, which includes cost of making engravings on ads of two inches or more in length, an announcement of your patent will be prepared from your patent specification by an expert on our staff, and illustrated, if desired, in the manner shown above. Simply send a copy of your patent, together with instructions as to the length of the ad, and a check to cover the cost to:

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

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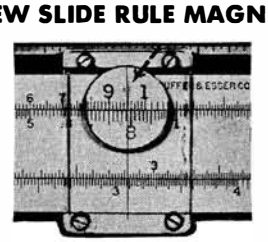

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Confidence—and Cash

"The N. I. A. training has taught me how to write a good news story, and why it should be written that way. By applying this knowledge I was enabled, before quite completing the course, to sell a feature story to *Screenland Magazine* for $50. That resulted in an immediate assignment to do another for the same magazine. I am now doing fiction and have had one short short story published. Previous to enrolling in the N. I. A. I had never written a line for publication, nor seriously expected to do so." Gene E. Levant, 2600 Wilshire Blvd., Los Angeles, Cal.

How do *you* know *you can't* WRITE?

Have you ever tried?

Have you ever attempted even the least bit of training under competent guidance?

Or have you been sitting back, as it is so easy to do, waiting for the day to come some time when you will awaken, all of a sudden, to the discovery, "I *am* a writer"?

If the latter course is the one of your choosing, you probably *never will write*. Lawyers must be law clerks. Doctors must be internes. Engineers must be draftsmen. We all know that, in our times, the egg does come before the chicken.

It is seldom that anyone becomes a writer until he (or she) has been writing for some time. That is why so many authors and writers spring up out of the newspaper business. The day-to-day necessity of writing—of gathering material about which to write—develops their talent, their insight, their background and their confidence as nothing else could.

That is why the Newspaper Institute of America bases its writing instruction on journalism—continuous writing—the training that has produced so many successful authors.

Learn to write by writing

NEWSPAPER Institute training is based on the New York Copy-Desk Method. It starts and keeps you writing in your own home, on your own time. Week by week you receive actual assignments, just as if you were right at work on a great metropolitan daily. Your writing is *individually* corrected and constructively criticized. A group of men, whose combined newspaper experience totals more than 200 years, are responsible for this instruction. Under such sympathetic guidance, you will find that (instead of vainly trying to copy someone else's writing tricks) you are rapidly developing your own distinctive, self-flavored style—undergoing an experience that has a thrill to it and which at the same time develops in you the power to make your feelings articulate.

Many people who *should* be writing become awestruck by fabulous stories about millionaire authors and therefore give little thought to the $25, $50 and $100 or more that can often be earned for material that takes little time to write—stories, articles on business, fads, travels, sports, recipes, etc.—things that can easily be turned out in leisure hours, and often on the impulse of the moment.

How you start

We have prepared a unique Writing Aptitude Test. This tells you whether you possess the fundamental qualities necessary to successful writing—acute observation, dramatic instinct, creative imagination, etc. You'll enjoy taking this test. The coupon will bring it without obligation. Newspaper Institute of America, 1776 Broadway, New York.

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Mr. }
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Why don't you write?

try" and so wastefully dissipated over the earth. The shelves in some of Nature's cupboards are showing signs of exhaustion of the materials necessary for a mechanical age.

In particular, Professor Gortner mentions the approaching exhaustion of copper, antimony, tin, lead, zinc, chromium, manganese, nickel, and iron, which are stored in parts of the earth accessible to man. The rate of use of some of these metals is doubling each decade. We still use tin-foil for wrapping up sweets and cigarettes. At the present mining rates, iron will be exhausted in Germany in about 50 years and in the United States in 100 years. The United States sulfur supply will fail in 15 years; the coal of Germany in less than 1000 years and of the United States, notwithstanding its huge lignite deposits, in less than 1500 years. Professor Gortner fears that the machine age may starve to death before long, a victim of today's profligate use of metals, coal, and oil.

No chemist will lose sleep over the dismal prospect that Professor Gortner visualizes. The chemist is sublimely confident that long before the petroleum wells are dry, he will be able to produce synthetic substitutes for all the petroleum products essential to the machine age. He can readily imagine a day when the iron that Professor Gortner is worrying about will lie undisturbed in its subterranean solitude because new and better metals will have made it worthless. It requires but little imagination for the chemist to foresee the time when unlimited power will be available from atomic energy and when sulfur or coal or tin will be made from mud or air or what-have-you by a rearrangement of the internal structure of the atom.

Wild imagination? Perhaps. But since we're speculating in the realm of the distant future, why not enjoy the chemist's optimistic outlook instead of the dreary forecast of a starved civilization? One is probably as close to the truth as the other. —*A. E. B.*

Lens for Eyes Having Cataracts

A LENS development, said to be capable in many instances of restoring to the cataract patient, following operation, near and distant visionary power equal to or better than normal vision, was made known recently by Scott Sterling, scientist of the Bausch and Lomb Optical Company, in announcing perfection of a new type of cataract lens with increased index power and having a thickness only one half that previously employed.

In appearance, Mr. Sterling reported, the new lens is hardly distinguishable from an ordinary lens of low power.

The new development is described as a combination of two lenses designed upon the principle of the bi-focal wherein a small, or seeing lens, is fused within a larger one. By use of this mechanical principle, the original power has been retained while allowing, at the same time, for reduction in over-all thickness of the combination lens to about one half the average size—in actual measurement to approximately ⅛ of an inch in thickness. In addition, the index power of the lens has been increased by use of Nokrome, an improved precision glass free from all color.

In grinding operations, the inside sur-

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The **WILLARD HOTEL**
"The Residence of Presidents"
Washington, D. C.
H. P. SOMERVILLE, *Managing Director*

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American Machine & Tool Co., Dept. S.7, 120 B'way, N. Y.

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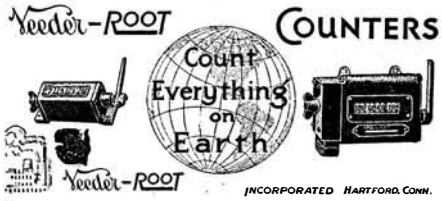

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Experience unnecessary, we tell you how. Big demand! Write for Mushroom Book free.
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EARN up to $25 A WEEK or More

BIG 3 FT. TELESCOPE Five Sections. Brass bound. Powerful 8-X Lenses. 10-Mile range. Special Eye Piece for looking at the Sun. included FREE. Can be used as a Microscope. Guaranteed big value. Postpaid $1.85. C. O. D. 15c extra. BENNER & COMPANY, T-46, TRENTON, N. J.

ELECTRIC FUN!
Make toy motors, alarms, shockers, trick lights, etc. Book telling how to do 200 stunts with 110 volts—$1 postpaid.
CUTTING & SONS
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SPRINGFIELD RIFLE, MODEL 1903

Cal. 30, 8¾ pounds, 43 inches long, 24 inch barrel, assembled and refinished, without bayonet at reduced price, $16.50. Ball cartridges $3.50 per 100. Illustrated catalog, 1933, 364 pages, Army-Navy equipment, mailed for 50 cents. NEW circular for 3c stamp. Established 1865.
FRANCIS BANNERMAN SONS, 501 B'way, N. Y. City

face of the new lens is made to the individual's prescription just as always, but the front surface consists of the inlaid or primary lens with its high index of refraction.

40,000,000,000 Germs in Pound of Earth

INSTEAD of being inert and dead, ordinary farm land is teeming with life. Cultivated soils have anywhere from a few million to five billion bacteria in a pound of top-soil; under certain favorable conditions the germ population per pound may run as high as 40,000,000,000, according to a statement of the Service Division of The American Agricultural Chemical Company. These organisms are very small, consisting of single cells only one twenty-five thousandth of an inch in diameter. They are the lowest form of plant life and contain no chlorophyll, the green coloring matter which enables ordinary plants to produce substances suitable for the support of animal and human life.

Most important of the work of bacteria is the formation of humus. The oxidation of the carbon in the organic matter provides carbon dioxide for plants. The microorganisms create many complex substances, some of which make the mineral matter in the soil more soluble, and thus more available for plant life. Some of these bacteria break down the complex protein material of dead vegetable matter and convert it into soluble nitrogenous substances which can be used by living plants. The growth of such bacteria requires oxygen, and for this reason tillage of the soil promotes their growth. There are other bacteria which change back the nitrogenous compounds suitable for plant life into unavailable substances. Such undesirable bacteria grow best in soil which lacks air and is poorly drained. Under ordinary soil conditions they have little effect on crops.

Farmers may increase the usefulness of bacteria in the soil by adopting methods of cultivation and soil treatment which favor their development. Plowing under of organic matter so that the bacteria can make humus, rotation of crops to include legumes on which nitrifying bacteria thrive, draining of wet lands, the adding of limestone to acid soils, and the use of fertilizers are recommended.

Art of Making Soap Revived

LAST year witnessed a noticeable revival of soap making on farms, reports the Extension Service of the United States Department of Agriculture.

Farm housewives in some sections of the country have made a little soap now and then as a matter of economy, but this old household art had, until recently, almost disappeared in many sections.

A report to the department from South Dakota shows what can be saved by making soap at home. In 1932 farm families in 27 counties in that state reported making soap under the guidance of extension agents. Valuing laundry soap at six cents a pound, the soap made in these counties last year was worth more than 2500 dollars.

In Oklahoma, Illinois, Iowa, Missouri, Minnesota, Colorado, Wyoming, Oregon, Washington, Wisconsin, and other states, home demonstration agents have encour-

"How I Licked Wretched Old Age at 63"

"I Quit Getting Up Nights—Banished Foot and Leg Pains . . . Got Rid of Rheumatic Pains and Constipation . . . Improved My Health Generally . . . Found Renewed Strength.

AT 61 I thought I was through. I blamed old age, but it never occurred to me to actually fight back. I was only half living, getting up nights - - constipated - - constantly tormented by aches and pains. At 62 my condition became almost intolerable. I had about given up hope when a doctor recommended your treatment. Then at 63, it seemed that I shook off 20 years almost overnight."

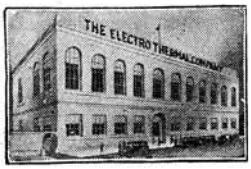
Forty—The Danger Age

Doctors now say that in millions of men the vital prostate gland often starts to show up, after the age of forty. By the age of 50, one authority says, 65% of men have acquired this weakness. No pain is experienced, but as this distressing condition continues, sciatica, backache, severe bladder weakness, constipation, etc., often develop.

Prostate Trouble

These are frequently the signs of prostate trouble. Now thousands suffer these handicaps needlessly! For a new safe way has now been discovered to stimulate the prostate gland to normal health and activity in many cases. This new hygiene is worthy to be called a notable achievement of the age.

A National Institution for Men Past 40



Its success has been startling, its growth rapid. This new hygiene is rapidly gaining in national prominence. The institution in Steubenville has now reached large proportions. Scores and even hundreds of letters pour in every day, and in many cases reported results have been little short of amazing. In case after case, men have reported that they have felt ten years younger in seven days. Now physicians in every part of the country are using and recommending this treatment.

Quick as is the response to this new hygiene, it is actually a pleasant, natural relaxation, involving no drugs, medicine, or electric rays whatever. This discovery is now fully explained in a sensational, fully illustrated new book, called "Why Many Men Are Old at Forty." Send for it. Every man past forty should know the true meaning of these frank facts. No cost or obligation is incurred. But act at once before this free edition is exhausted. Simply fill in your name below, tear off and mail.

W. J. KIRK, President
The Electro Thermal Company
9673 Morris Ave. Steubenville, Ohio

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Send for new literature and easy pay plan—only $1.00 down, then 10c a day. Also bargains in Standard Size refinished office models, sent free. Write for details and special money-making opportunities.
International Typewriter Exch., 231 W. Monroe St. Dept. 190, Chicago

aged soap making on the farm as one of the ways to avoid cash outlay and make use of a farm waste. County home demonstration agents can usually supply instructions for making soap at home.

Prevents Rancidity of Olive Oil

OLIVE oil has long been held in esteem for treating textiles, but under certain circumstances it may become rancid. This causes trouble because in that condition it becomes difficult to remove, may interfere with dyeing, and imparts a disagreeable odor to the finished goods.

Chemists of the National Oil Products Company, after a thorough study of the complex chemical reactions involved in this process and hundreds of experiments with olive oil treated in various ways, finally hit upon a method of treating the oil which eliminates rancidity as a practical consideration. Goods treated with this new material failed to develop rancid odors even after storage for a year.—*A. E. B.*

The Electric Nose

AN "electric nose" so sensitive to the "smell" of mercury that the faint whiff arising when the cork of a mercury container is held against the "nostril" will sound a gong, has been developed by the General Electric Company. The detector will act if there is only one part of mercury vapor in a hundred million parts of atmosphere. The most sensitive previous type of mercury detector would give warning of one part of mercury in thirty million parts of atmosphere, so that the new apparatus is

The electric nose "smelling" the cork from a container of mercury

three times more sensitive than the old. Also it is much faster, responding in a few seconds, whereas the previous detector operates only after some minutes have elapsed.

When in operation, the new detector "smells" through an internal "nostril" or intake duct, which draws in flue gases from the stack of a mercury boiler. The gases are given a preliminary treatment to remove stack impurities which would nullify the work of the detecting mechanism.

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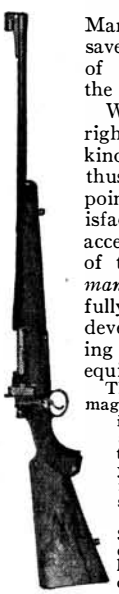

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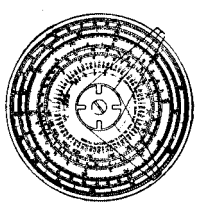

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and of a wavelength known as the resonance radiation of the mercury atom. This radiation is directed to a quartz-sodium phototube, which, unlike the usual type of "electric eye," is supersensitive to a beam of this character. Mercury vapor is opaque to this light and casts a shadow, just as smoke is opaque to ordinary light and casts a shadow when in such light.

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Perfume Research Gives Deadly Gas

BY accident, rather than by design, a research chemist of France, Professor Leonce Bert, has discovered a gas which is said to be far more deadly than any other gas used in warfare. The formula was discovered while Professor Bert was endeavoring to work out a perfume preparation.

Due to the fact that this new gas, according to reports, is irritating not only to the eyes and lungs but to all parts of the body as well, it is said that a gas mask will be of no avail against it. Tried on the skin of a dog, death of the animal resulted in a matter of a few hours.

So far no details as to its analysis are available but it is said to be comparable with true cellular poisons.

Improved Sheet Iron

AN entirely new form of an old metal—iron—is believed by its sponsors to promise a superior material for the fabrication of automobile bodies and other metal specialties. Anson H. Hayes, director of the research laboratories of the American Rolling Mill Company, reports the development of a deep-drawing sheet metal which "has physical properties new to ferrous metals and of great importance to the metal stamping world." Commercial production will soon be started.

It is claimed that the metal can be drawn and spun with facility, permitting manufacturers of pressed metal products to produce most intricate designs. The metal has great ductility and tensile strength, and tempering does not destroy its drawing qualities.—*A. E. B.*

Russet Oranges Inferior

CONTRARY to common belief, russet oranges are not sweeter than bright ones. In fact, they have a higher acid content, according to the results of analyses recently made in the United States Department of Agriculture. The analyses showed further that russet fruit loses weight more rapidly than bright fruit.

Russet oranges, Department entomologists explain, owe their color to the activity of the rust mite, a tiny creature that works on the skin of the fruit in its early stages. The mite does not penetrate into the flesh; it leaves its mark only on the rind. Apparently, however, the attack of this insect increases the rate of evaporation of fruit juice. As a result, russet oranges are usually smaller than bright oranges and their juice is more acid.

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THE DRAMA OF WEATHER

By Sir Napier Shaw

THIS book is the selection of the Scientific Book Club and will have a wide popular appeal. It is a successful attempt to dramatize the rhythm of the weather, evidently in order that readers who dislike their pills unsugarcoated may without effort pick up some weather lore as they pass. It is not a meaty book, being rather more on the superficial side of just serious enough for the scientifically inclined layman. However, the reader will gain an insight into the ways of the winds and other elements, also a glimpse of the instruments used by weather observers. This book is beautifully produced, richly illustrated, and printed on fine filled paper. It is recommended for the general reader, not the student.—$3.65 postpaid.—*A. G. I.*

THE BEAGLE DIARY

By Charles Darwin

AFTER all these years Darwin's famous "Voyage of the Beagle," in which he recorded day by day the vivid impressions of his formative years while on his famous voyage (1831-1836) around the world in quest of new data on natural history, has been re-published in expanded form. In all of the earlier editions one third of the diary was omitted. Darwin's granddaughter, Nora Barlow, has now added the omitted parts, taking them from the original manuscript notes. This is a neater edition than any previous—nice type, paper, printing, and binding. 442 pages, 6½ by 9½.—$6.70 postpaid.—*A. G. I.*

THE PRIVATE LIFE OF SHERLOCK HOLMES

By Vincent Starrett

EVERYONE who has read any or all of Doyle's stories about the famous detective of Baker Street will want to read Mr. Starrett's critical survey of the life of Holmes. In these pages both Holmes and Watson are subjected to a careful analysis and their faults and foibles are placed side by side with their admirable qualities. Poor Watson's memory is so often called to task that one wonders how he managed to function at all! If you think you know your Sherlock Holmes, consult the "Examination Papers on Sherlock Holmes" in the appendix of Mr. Starrett's book and we will wager that you will soon be refreshing your own memory in the pages of Doyle's stories. This reviewer found himself reading "The Private Life" with a complete set of the Holmes stories at his elbow for ready reference.—$2.15 postpaid. For $4.00, we can supply, postpaid, a two volume set, "The Complete Sherlock Holmes," containing all the stories of the famous detective by Doyle, nicely printed on thin paper and published as a memorial edition just after Doyle's death.—*A. P. P.*

PERSONS ONE AND THREE

By Shepard I. Franz, Prof. Psych., Univ. of Calif.

THERE is human interest as well as science in this book, which is a narrative account of the experiences of a man who forgot who he was. By digging deeply into this amnesic's subconscious, Professor Franz, the author, found that he had been one man ("Person One") until some emotional disturbance during the World War had utterly changed his personality ("Person Three"), and then had lived ten years in this country without memory of Person One. Suddenly in 1929 he slipped back into Person One, but at the same time forgot everything in his ten years as Person Three. The author was able to connect these personalities and memories, restoring the man to normal condition. The account—188 pages—makes fascinating reading.—$2.15 postpaid.—*A. G. I.*

HOUSEHOLD REFRIGERATION

By H. B. Hull, M. E.

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SCIENCE AND SANITY

By Alfred Korzybski

READERS who possess a broad and deep background in philosophy, psychology, epistemology, logic, and the other existing fundamentals of knowledge, and are prepared to put on a heavy thinking cap, will find in this book a great deal to think about. The profundity and erudition displayed in it have been widely recognized among leading men of science and others who themselves think more profoundly than the rest of us. It concerns largely the very roots of human knowledge, and shows why much of our failure to progress as fast as we might is because our thinking is itself bad. It presents a plan for radical revamping of our whole theory and practice. This work deals with the very fundamentals and is distinctly not a superficial book—quite the reverse. 781 pages.—$7.20 postpaid.—*A. G. I.*

REPTILES OF THE WORLD

By Raymond L. Ditmars, Litt. D.

THIS book has been standard for a number of years where the crocodiles, turtles, tortoises, lizards, and snakes are concerned. The illustrations, comprising 89 plates, are all at the end, thus enabling the text to be printed on matt finish paper. Reptilian nomenclature has suffered many changes in the past few years, requiring drastic revisions in this volume. The book is a very readable one from the point of view of those not familiar with natural history. The author's position as curator of mammals and reptiles at the New York Zoological Park has enabled him to study his guests with a closeness denied to others.—$5.25 postpaid.—*A. A. H.*

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New Fruits Dedicated to the Public

FRUIT specialists at the New York State Experiment Station at Geneva have never taken advantage of the extension of the federal patent law to cover new creations in the plant kingdom because they have been desirous of having their new fruit varieties propagated and distributed as widely and as rapidly as possible, say Station officials in a recent statement. A considerable number of plant patents have been issued by the government during the three years that the new provision has been in effect, including several on roses and other flowers and a dozen or more on new fruits.

The appearance of the 1934 Catalog of New Fruits, prepared by the New York State Fruit Testing Association, which cooperates with the Experiment Station in the propagation and distribution of its new varieties, called forth the statement from the Station authorities on the question of patents. "The fruits in this catalog are not patented," they say, "and members of the New York Fruit Testing Association are asked to propagate and distribute them to the uttermost."

The Fruit Testing Association is described as a non-profit-making organization open to every fruit grower, either amateur or professional, who delights in trying out new fruits. The Association has members in every state and in many foreign countries. A nominal fee is charged for membership in return for which each member receives a premium in the form of one tree of some especially promising variety or 12 berry plants selected from the list of new small fruits. Members also have first choice of all stocks listed by the Association.

The catalog of the Association contains brief descriptions of 80-odd new fruits with information on the sorts best adapted to commercial planting and those kinds deemed best for the home garden. A copy of the catalog may be obtained free of charge upon request to the Experiment Station by anyone interested in fruit growing.

"Chipso" Trademark Cancelled

IN the case of J. L. Prescott Company v. The Procter and Gamble Company, First Assistant Commissioner Kinnan held that The Procter and Gamble Company of Cincinnati, Ohio, was not entitled to register, as a trademark for soap chips or flakes, the term "Chipso" and that the registration which it had obtained should be cancelled in view of the prior adoption and use by the J. L. Prescott Company, of Passaic, New Jersey, of the term "Chase-O" upon a detergent preparation in crystal form for washing and cleansing and the harmless bleaching of clothes.

In his decision, after stating that the record showed that petitioner through its predecessors had continuously used the mark "Chase-O" upon its goods several years prior to the earliest date of adoption and use claimed by the respondent, the First Assistant Commissioner said:

"Without setting forth here in detail the various ingredients of the petitioner's compound or the subsequently made change in it by the addition of a percentage of soap, it will be sufficient to state that the goods of both parties are held to possess the same descriptive properties and to belong to the same class as these terms in the trademark statutes have been construed in a number of decisions relied upon by the examiner of trademark interferences. In fact, the decision rendered upon the case involving these same parties, The Procter and Gamble Company v. J. L. Prescott Company, 413 O.G. 1105, 18 C.C.P.A. (Patents) 1433, holding the goods there involved as possessing the same descriptive properties, is regarded as determinative of this point in the case at bar."

Argentina Copyright Law

ARGENTINA'S "intellectual property bill" has been passed by the Chamber of Deputies and is now a law. The first copyright law in Argentina, it is designed to frustrate the pirating of books, plays, and music. Under its terms, a copyright runs for 30 years after the death of the author. It protects syndicated newspaper articles, but regarding news it declares that the reporting of current events is not a matter for copyright, but if news is pirated the laws governing unfair competition will prevail.

Packaged Coal

"PACKAGED coal" has made its appearance in Canada for the first time in the history of the industry. The coal is put in 100-pound bags at the mines. The size, weight, and shipper's name are imprinted on each bag, which is sealed. In other words, this coal is sold exactly the same as any trademarked packaged commodity.

"Flex-O-Back" Trademark Registrable

IT was recently held by First Assistant Commissioner Kinnan that the term "Flex-O-Back" is not merely descriptive as used upon ladies' corsets, corselets, girdles, et cetera, and that The La Resista Corset Company, of Bridgeport, Connecticut, is entitled to registration of that mark.

In his decision he noted that the opposition of the Luxite Silk Products Company, of Milwaukee, Wisconsin, was dismissed by the examiner of interferences and no appeal was taken and that appeal was taken by the applicant from the decision of the examiner of interferences holding its mark merely descriptive. The First Assistant Commissioner then said:

"While the word 'Flex' is well known and has a recognized meaning and while the various garments are flexible in various ways and places, and possibly some are more flexible in the back than in other portions, yet the mark when viewed in its entirety is deemed suggestive rather than merely descriptive of the goods or of their character or quality. It is thought the applicant should not be denied the registration for which it has applied."

Battery Rejuvenation

THE Federal Trade Commission recently issued a formal complaint against the Lightning Company, St. Paul, Minnesota, charging that the respondent is engaged in the sale of a purported electric battery rejuvenator known as "Lightning Electrolyte" and has represented that the preparation "charges battery instantly," "makes old batteries work like new," "doubles the life of a battery," and so on. Such claims, the Commission alleges, are false, misleading, and deceptive.

The Lightning Company in an answer filled by John E. Mickman denies that its advertising statements have been false, misleading, and deceptive. It states that it does not now use newspaper or magazine advertising, alleging that the Better Business Bureau prevents it from so doing.

Copper Back Mirrors

AN order has been issued by the Federal Trade Commission to Hires Turner Glass Company, Philadelphia, to cease using certain designations in the sale of a type of mirror which has a protective coating or backing consisting of a mixture of shellac and copper dust or powdered copper, which were described and advertised as "copper back mirrors," "copper backed mirrors," and as "mirrors backed with copper."

Another type of mirror made by companies other than Hires Turner, was found to have a protective backing of a continuous sheath or film of solid copper deposited on the silver reflecting medium by the electrolytic process. This type had been known for years as "copper back" and by similar designations. Such terminology had become known among a substantial part of the trade and purchasing public as applying to such mirrors, prior to the time the Hires Turner Company began to make and advertise its type of mirror having a backing of shellac and powdered copper as described above.

The company is ordered to cease using the terms "copper back," "copper backed," "backed with copper," or similar designations to describe its mirrors having a protective coating consisting of a mixture of shellac and powdered copper.

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

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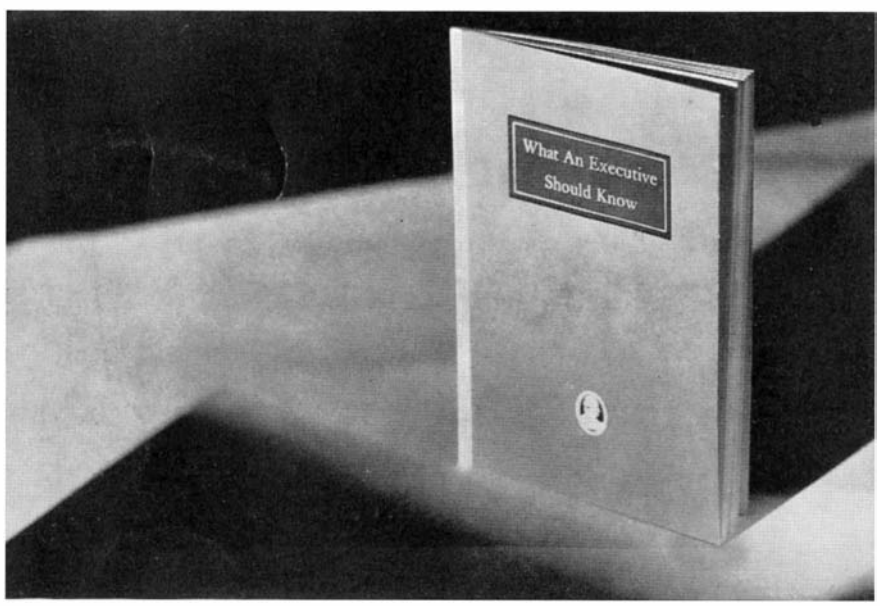
CASE 2. Local Manager at $5,200; now Regional Manager, salary $15,000.

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



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