

# SCIENTIFIC AMERICAN

December

1932

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a Copy

YOUR INTERNAL MENAGERIE . . . . .

By Robert Hegner, Ph. D.

Every Human Being is a Veritable Walking  
Zoo of Strange Harmful or Helpful Organisms

MORE SHIPS FOR OUR FOREIGN TRADE . . . . .

By H. Gerrish Smith

The United States Plans to Earn the Profits  
That Long Have Gone to Foreign Shipowners

SKYWAYS THAT LINK THE AMERICAS . . . . .

By V. E. Chenea

YOU CAN'T BEAT A SLOT MACHINE . . . . .

•  
AND A DIGEST OF APPLIED SCIENCE

# It's hard for a Hungry citizen



to be a Good

CITIZEN

**T**HE boy whose stomach is empty cannot be expected to do good work at school. Babies undernourished through another winter may be handicapped by frail bodies through life. The hungry father of a hungry family is hardly the man to seek employment with persistence, or to do well on the job when he gets it.

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Newton D. Baker, Chairman, National Citizens' Committee

*This winter, as never before, support your local Community Campaign*

# SCIENTIFIC AMERICAN

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EIGHTY-EIGHTH YEAR

ORSON D. MUNN, Editor

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# A light forever burning . . . A voice that is never stilled



NIGHT comes on and spreads a blanket of darkness upon sleeping cities and towns. Here and there a lone policeman. In the distance a clock tolling the hour.

In the dark silence of the night, there is one light forever burning . . . one voice that is never stilled. That light is the light in the telephone exchange. That voice is the voice of your telephone. A city without telephones would be a city afraid—a city of dread.

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**A M E R I C A N   T E L E P H O N E   A N D   T E L E G R A P H   C O M P A N Y**

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# ACROSS THE EDITOR'S DESK

WHEN an old reader takes the time and trouble to write to the editor, and tell just what he thinks of the magazine, the letter makes one of those bright spots that lighten a day of editorial routine. And when that old reader is one who has not only followed the progress of science, but has contributed materially to it, the letter takes on added brightness. Such a communication was received recently from Hiram Percy Maxim and we cannot resist the temptation to quote from it. "It seems to me," writes Mr. Maxim, "the SCIENTIFIC AMERICAN is improving faster than I remember seeing in the 50-odd years I have read the paper. . . . Your going in for atomic and cosmic science in a high-grade popular fashion will surely bring you success. . . ." This is one reader's reaction to our articles on pure science. What is yours?

"Atomic volume is mostly emptiness with much room for traveling. And all theories agree that travel the electrons do, often with a velocity approaching that of light. . . . While the electrons rush furiously about within the atom, the atoms move about within the molecule, and the molecules themselves move within the mass of matter they constitute. . . . Everything—the earth, the paper on which I write, the very air we breathe—consists of unimaginable millions of little worlds within worlds, rushing and revolving more rapidly than rifle bullets." This quotation is from the first part of an article on the wave atom, by C. J. Phillips, scheduled for publication next month. From the conclusion of the article we quote: "Wave mechanics signifies not so much a radical change as a significant evolution of the already existent atomic theory." A thoroughly readable article on atomic physics that we heartily recommend to every reader. It is one of the best that we have seen in a long time.

One of the saddest chapters of American history is the disappearance of the American Indian. So little is known of the Red Man's past that any light that can be shed on the subject is welcome. One may think that he knows something of the customs, habits, dress, industries, and so on, of the original inhabitants of the North American continent, but investigation often shows that what are supposed to be Indian characteristics have in reality been absorbed from the races which peopled the New World and mingled with the Red Men. Marius Barbeau, of the National Museum of Canada, has con-


tributed before to these pages, and his articles on the cultures of the American Indian have always been well received. Another, to be published next month, tells of the effect on the Indian of those races which usurped the rightful territory of the Red Man. You will probably be surprised at the erroneous ideas which you have about the culture of the Indian.

When something goes wrong with an automobile, disaster seldom results, but when something goes wrong with an airplane, almost anything can happen. To reduce this possibility of plane trouble, science is being applied more and more every day to the study of airplane structure. From these studies grow new methods and materials, all of which assist in "taming wild airplanes." At least, this is the phrase used by the author of a highly illustrated article on the wind tunnel and other equipment in the Guggenheim Laboratory at California Institute of Technology. The article will appear in our January issue.

We have just obtained an interesting article dealing with the present status and the future possibilities of television, and plan to publish it in our next issue. Written by D. M. Morandini, Director of Research of the California Television Society, it takes a calm and unbiased view of the entire field of television, and states facts from the standpoint of the earnest research worker.

The name of Gutzon Borglum is synonymous, in the minds of most of us, with sculpture on a gigantic scale. At the present time he is working on the massive memorial group on Mt. Rushmore in South Dakota. It is, therefore, timely that we should publish an article from the pen of Mr. Borglum telling something of his work, and especially of the way in which explosives are used to expedite the task of removing thousands of cubic yards of rock. This article, illustrated with a striking series of photographs, will lead our January issue.

Other feature articles in January will deal with various scientific subjects; and don't forget the SCIENTIFIC AMERICAN Digest, which brings to you in meaty, compact form, all the important and worthwhile news of science and industry.



Editor and Publisher

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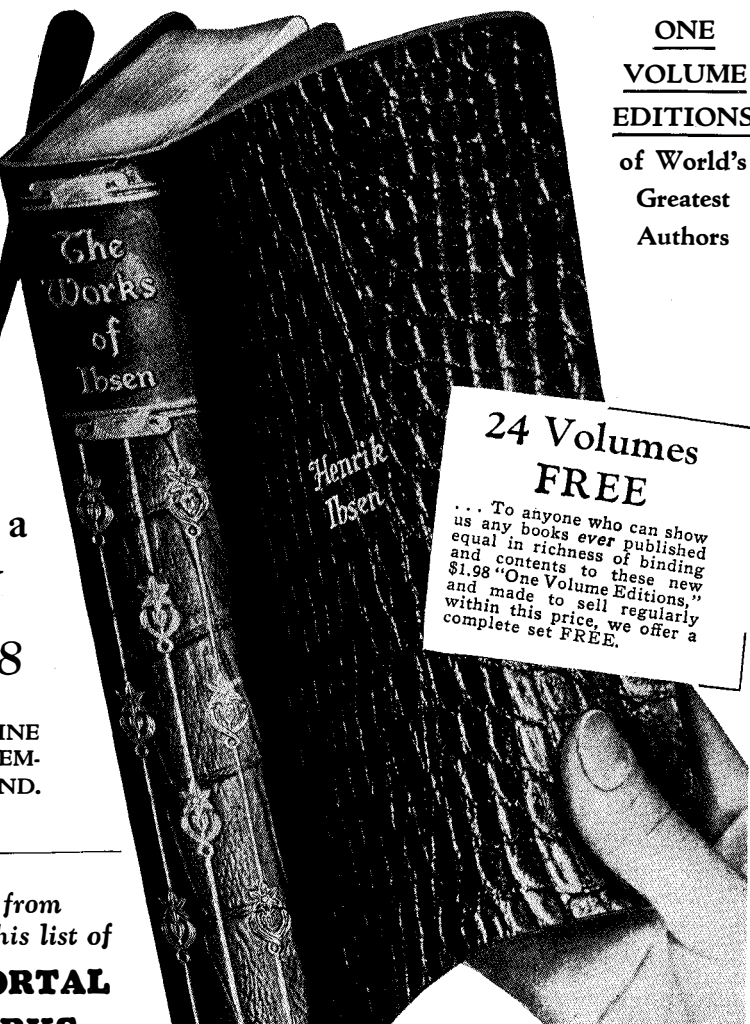
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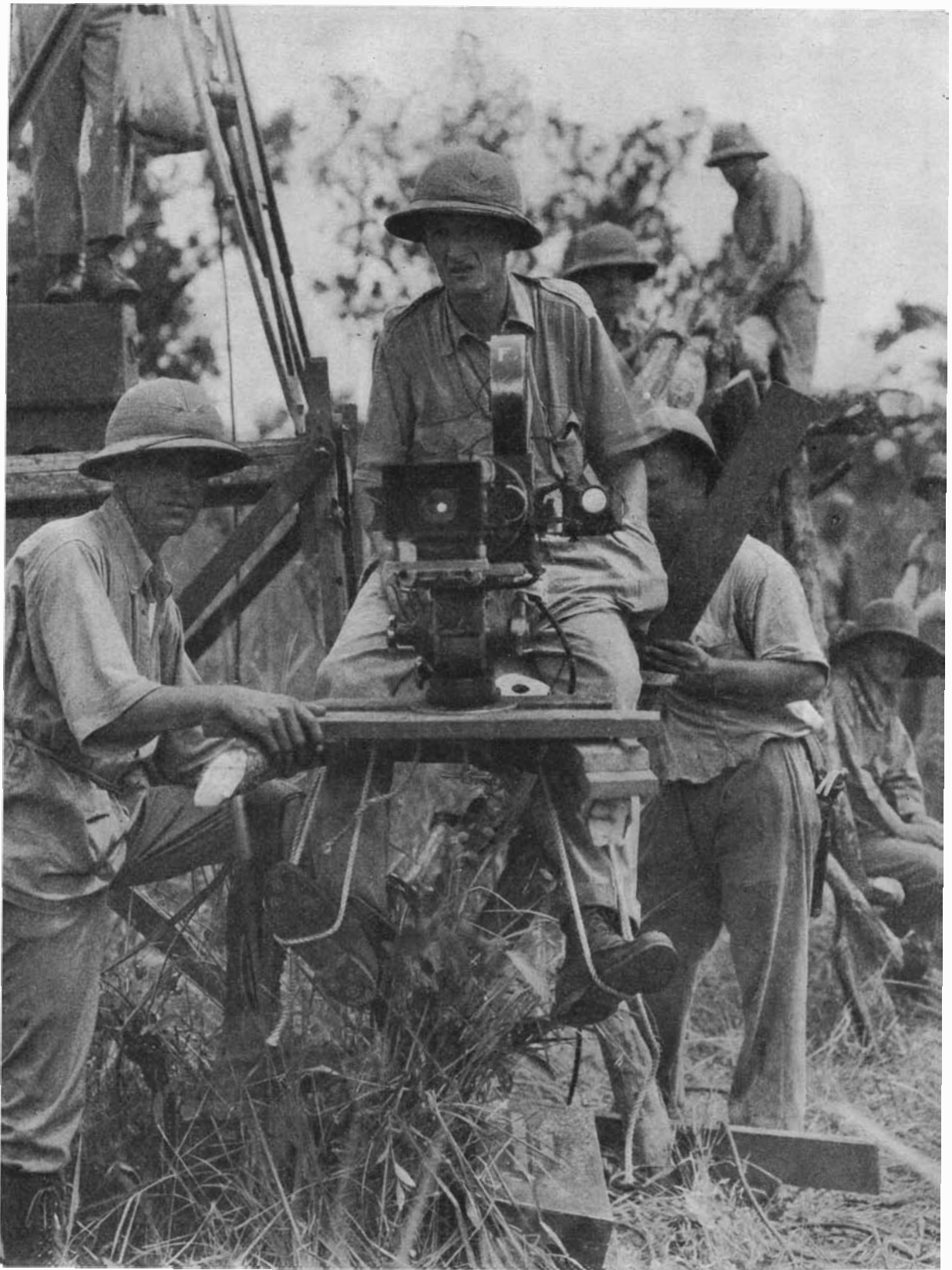
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**I**N addition to those of our astronomers whose time is spent largely in observing, there are the mathematical astronomers. They juggle mathematically, that is by pure reason or logic, with the end-products of others' observations. These are the thinkers. They make hypotheses based partly on observed fact and partly on assumption, and then wait to see whether the observers can verify these hypotheses or else what changes and modifications the new experimental evidence will force upon them. Einstein falls in the category of mathematical astronomers, and so do Edington and Jeans. They are the cosmologists—they see things "in the large." Such a scientist is Professor W. D. MacMillan, mathematician-astronomer and cos-

mologist, of the University of Chicago.

During the past decade the cosmologists have often debated the question whether the universe is eternal or is slowly running down. If the latter, its ultimate end, long deferred but inevitable, will be a cold, dark, cheerless and therefore, to us, meaningless destiny. Instinctively most persons reject this concept—though it is not good science to believe merely according to our feelings and wishes. If, on the other hand, the universe has some way of building itself up while other parts of it are running down, as Millikan believes, then it really is eternal. This concept may be traced back to Professor MacMillan, who enunciated it years before it became widely known to the general public.

---



**WAITING TO "SHOOT" ELEPHANTS  
NEAR A WATER HOLE**

**P**ATIENCE is a prime requisite when attempting to film wild animals in their native haunts. A cameraman waited for two days on this make-shift camera boom before he had an opportunity to get a few feet of film of elephants at a near-by water hole. He was normally hidden by tall grass, but when the far end of the boom was depressed, he rose in the air to a point where he could obtain good camera "shots" of the unsuspecting animals.





Courtesy RKO

Cameraman Klaffki and Director Scott on floe ice 40 miles off the Alaskan coast

## TALKIE TROUBLES

### Roaring Arctic Blizzards and Broiling Tropical Sun Put The Talkie Cameraman to Supreme Tests

By ANDREW R. BOONE

**A**CROSS Arctic wastes, possibly on floe ice a score of miles from the Alaskan mainland, the movie camera moves forward slowly, its lens poked through a narrow slit in a white screen covering the front of the sleigh; in mid-equatorial Africa, it rolls ahead boldly in a roaring American automobile, all four sides of which are covered with boards, so the animal cannot see daylight through the camouflage.

Dramas of far-away places do not come to the screen easily. Sleeping sickness and tsetse flies in Africa threaten the lives of venturesome directors and actors; snow-blindness and exposure, while living in cramped Eskimo igloos in Alaska have sent more than one property man and cameraman back to California with his health permanently impaired.

Troubles beset a director on foreign location from the time he sets foot on a chartered ship, during the time he shoots love scenes in a blizzard sweeping through a movie-built ice village with near-frozen cameras, or films a cannibal feast at Murchison Falls, far from the sea in Africa with celluloid so hot the emulsion threatens to slide

off the edges, until he returns safely with 100,000 feet of undeveloped negatives to his Hollywood laboratory.

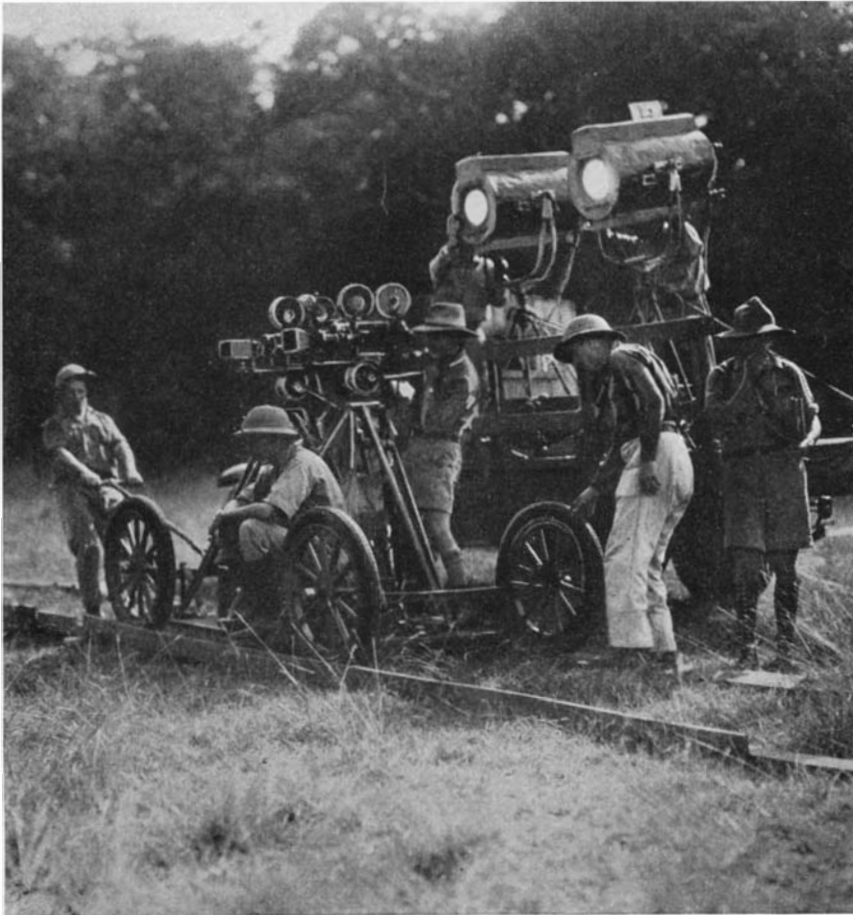
He then may or may not have a picture. Almost without exception, he must film many scenes within a great sound stage, supplementing the outdoor sequences, adding a bit of spice and humor and drama to what otherwise might be "just another animal picture." In fact, one director told me that two thirds of some "foreign" pictures are made in Hollywood, where microphones and controlled lighting are more easily available and the noises of animals can be reproduced with greater fidelity than in their natural habitat.

**I**N all this there is seldom any intent to mislead audiences, for such pictures as "Trader Horn," filmed in Africa, Mexico, and Hollywood; "Igloo," made in Alaska and Hollywood; and "Eskimo," now being filmed at Point Barrow, 250 miles north of the Arctic circle, are offered as entertainment accurately portraying native life and no

effort is made to project them as historical dramas.

The latest expedition to depart from Hollywood for one of civilization's most distant and coldest outposts saw 30 people—director, actors, cameramen, and technical people—crowded along with the crew of 12 on the little whaler *Nanook*, a 285-ton vessel packed with 785 tons of supplies. This expeditionary force cleared from Nome in late June, bound through the ice fields for Point Barrow and the islands off the north Alaskan coast where the party is now "iced in" on the lee of one of the Tapkaluk islands, there to remain through the winter until the ice breaks next spring and they can return.

Before packing his cameras, Director W. S. Van Dyke, maker of "Trader Horn" and other thrillers of distant places, subjected them to all the conditions he expects to find in the Arctic. For a week he kept the cameras in a refrigerator at a temperature of 40 degrees below zero, while he studied their action, measured the contraction and



Courtesy Metro-Goldwyn-Mayer

A "trolley shot" in Africa, with camera truck running on make-shift rails. Note the spot-lights which are often necessary, even when sun is shining brightly

expansion of metal parts. Greases froze, working parts refused to turn; and so the cameras go to Alaska without the ordinary greases, and the many wheels and gears are placed farther apart that there may be no chance of their sticking.

**A**SK any director who has plunged into the Arctic or straddled the equator with a motion picture camera what is his principal difficulty and he will tell you, not the direction or stalking of wild animals, but the killing of camera noises while filming closeups on a calm day. Mr. Van Dyke has known the clashing sound of gears in the camera to flow in a steady current down the tripod legs, through the ground and up to the microphone. Of all his troubles, no pestilence or charging wild animal has given him more concern than this. Sound-proof hoods on the cameras, blankets wrapped around the wooden tripod legs, generators hidden far away in the snow or forest are watched carefully to prevent leaks and the recording of machine sounds that may not be detected until the company returns home and sits at ease in a projection room watching the scenes unfold to the accompaniment of the camera's whir.

Ewing Scott's recent half-year on the ice off Point Hope, 125 miles south of Point Barrow, while filming "Igloo,"

brought this young independent producer more hardships than a director would find in several years of direction in a warmer climate. With Roy Klaffki, cameraman, and one actor he invaded the Arctic where for 85,000 feet of film he directed the native Eskimo in thrilling hunts for polar bear, whales, and walrus, bowing their heads in the face of terrific gales that swept at times across the ice, pointing their lenses into blizzards that only the Arctic knows, for a sound and celluloid record of the "northers" that sweep down from the North Pole and drive all human life off the roof of the world to the protection of warm igloos and houses.

Scott kept the batteries that supplied current for his equipment wrapped in deerskin bags and blankets. Often, when Klaffki set up the camera on some flat-surfaced ice promontory, he stood on these skins, which protected both his feet and the warm batteries. At frequent intervals a dog team trotted away to their camp, sometimes eight miles distant, to bring out batteries kept warm beside a fire in a native igloo. Otherwise, he said, the batteries would have frozen in the icy breeze.

During the filming of one sequence native hunters put out daily in their skin-covered boats, while Scott and Klaffki, operating two cameras from the boats and the ice, ground thousands

of feet of film as they sought bowhead whales (which never appeared) and walrus that looked disdainfully on the intruders as they reposed on ice pans. The walrus provided bait for the polar bears, whose fight and flight are sought by all Arctic picture-makers. After "shooting" a dozen walrus herds with their cameras, Scott had his native riflemen kill a few and behead them. Then they returned to their floating camp and lay in wait.

**O**N the second day they returned to the carcasses and found, as they had expected, a half-dozen weaving, cream-white bears feasting. With one camera set up on an iceberg, the other in a nearby boat for quick action, Ray Wise, the actor, darted in to harass the bears, hoping for a chase. Four hunters with cocked rifles, standing outside the camera line, were his safeguards. At last one bear did give chase for a thrilling sequence, but it is doubtful if, in his gorged condition, he could have caught any intruder. Had the bears been hungry, no trick of man could have induced them to stand idly by as strange boats crept up to their feeding place.

**L**ET'S shift the scene, now, from the world's roof to equatorial Africa, where insects, the tropical sun, wild animals, and tropical diseases threaten every visitor.

At Murchison Falls in Buganda, Van Dyke was working on a tropical picture. He had his cameras trained on a large pool containing many crocodiles. For a month, while shooting other scenes nearby, his men had been killing hippopotami and other animals, depositing their carcasses in the pool. Attracted through their noses, several hundred crocodiles had at last ambled lazily forward to the feast. From sealed airtight tin cans came negatives last seen in Hollywood, a half year before. Three hundred yards distant, hidden in heavy undergrowth and guarded by native hunters, the generator spun quietly in its steel jacket.

The "croc" became restless. They declined to snap their jaws in the face of the camera. They crashed down the barricade, tried to turn back to the river. Quickly everyone armed himself with a long pole on the business end of which was a kerosene soaked rag, plunged the rag into a nearby fire, and advanced on the threatening horde.

"Crocodiles," Van Dyke reminisced with a wry smile, "cause a larger loss of life in Africa than all other animals combined. Natives go into the water for baths, are careless, and unseen jaws reach out to drag them to a quick death. Possibly we had ventured farther than we should. The next day we mounted cameras in canoes and on a small island

in the middle of the crocodile pool. Natives jabbed down through the water in an effort to get them to rise, but without luck. At night the 'cross' would fight back, but we couldn't film them in the dark. We finally contented ourselves with several long shots, and never were able to 'work' the crocodiles."

Some African animals can be "worked," but even then the actors perform to suit the animals. Scenes of other animals must be "stolen" without any immediate attempt to tie in with the business performed by the actors. Van Dyke waited two days beside a water hole for a few film feet of elephants watering. His carpenters rigged a camera boom of native timber, placed Clyde DeVina, the cameraman, in his makeshift seat at the forward end—and waited. At last, when the herd appeared, they pulled down the rear end of the boom, the front end rose above the grass and DeVina filmed an intimate closeup.

There was no particular danger to the cameraman, for elephants do not see well. Neither does the rhinoceros have good vision. On one occasion members of the party stood within 50 yards of a "rhino" and the big fellow never saw them. Again, Van Dyke stalked a rhinoceros through field glasses, then drove down a valley to intercept him as he walked sedately down a nearby ridge. Four cameras, two rearing above the car's roof, one nailed to the floor and another hand camera ready to sweep in any direction, were in place, their operators hidden behind wooden

boards completely enclosing the auto.

"The rhino stopped, looked us over, and began to canter down the level valley," Mr. Van Dyke recounted. "We followed, caught up with the animal and soon were pacing him, on the downwind side, 30 miles an hour. Oddly, the roar of the automobile did not disconcert him at first, although the sight of a human often fills the rhinoceros with rage. After 300 yards of this he began to get mad, and without warning he stopped, wheeled and made for us broadside. I shot once. He did not hesitate. My second shot struck a vital part as he crashed against our tail board."

AS the party moved around equatorial Africa, 14 tons of equipment, including two sound trucks, followed. It manifestly was impossible to record the grunt of a charging beast with the heavy machinery then in use, so Van Dyke filmed pictures during the day and recorded animal sounds at night. He found that, to get an animal in the open charging into the camera, the scene must be staged. But at night lions roared for the mike so loudly that pans in the camp, possibly 1500 feet distant, rattled on their shelves.

The microphone brings more bewilderment to native faces, whether in dark Africa or the icy northland, than all the cameras ever assembled. They cannot understand the little black pendant. Often they think it actually "catches" their words, robs them of something—what, they can't understand.

Filming tigers involves considerable preparation. Often a director will have

built a V-shaped stockade, placing the camera at the apex, with the walls just outside the camera line. No matter where the tiger may leap, eventually he dashes, growling ferociously, toward the camera, whose operators are protected by interlaced saplings between the branches of which the lens protrudes. Occasionally a tiger can be "picked up" in the open with a long focus lens. Usually, however, the more thrilling sequences must be staged by "working" the animals.

The African sun causes more concern to directors and white actors than the wildest denizens of the forest. The equatorial sun is weird in its effect, often fatal. All members of a movie troupe wear double hats, and pads over their spines. Despite precautions, however, they sometimes succumb to the intense heat. Bob Roberts, with the "Trader Horn" expedition, fainted suddenly in the heat in mid-day, but with rare presence of mind grabbed the tripod as he fell back from a precipice over which he was shooting.

"It is no unusual thing," Van Dyke said, "to see some actor, while going well, suddenly look blank and double up. All you can do is throw a bucket of water in his face, massage his limbs, dry him off and push him back into the scene."

Whether directing action a mile above the sea in killing heat or mushing across ice in a blizzard, these vagabonding directors must provide their own outdoor sound stages, beat off wild animals, keep their troupes happy—and come home with the picture.



A crude camera boom built on location. See also illustration on page 326

# ELECTRICITY DIGS HOOVER DAM TUNNELS

**"MOVE the muck"**—that has been the keynote of work at Hoover Dam since this great project started over a year ago. With more than 10,000,000 cubic yards of muck and gravel to be handled in a congested area, Six Companies, Inc., turned to the electric power shovel to do the actual mucking and digging. Electric shovels, according to R. W. McNeill, of the Westinghouse Electric and Manufacturing Company, possessed marked advantages in that they did not impose any additional ventilation problems, they were obtain-



Far back in one of the tunnels, an electric shovel, above, removes the invert. At right: Lower portal of Number 1 tunnel on the Nevada side, as seen from across the river

able in suitable sizes, and because their operation is economical.

The driving of four great diversion tunnels through solid rock to carry the waters of the river around the dam site until the dam itself has been partially put in place, as described in our September and October issues, was the first big task confronting the contractors.

They did not wait for roads to be built but used the river instead, floating the machinery down the river on barges to a small rock talus slope on the Arizona side. Here a tunnel adit was started May 12, 1931, and this bench was enlarged to accommodate a full tunnel driving plant.

Work was soon progressing on eight faces in the main bores, from which muck was handled by Conway electrical mucking machines, Westinghouse equipped. These machines combine a conveyor with a digging dipper, and can work in close quarters. The conveyor operated continuously while mucking and discharged into a Western dump car. Power was supplied to the mucker through a three-conductor trail cable.

Ten-ton Baldwin-Westinghouse storage battery locomotives were used to haul the muck from the headings to the portals.

Considerable open cut excavation was necessary in gaining

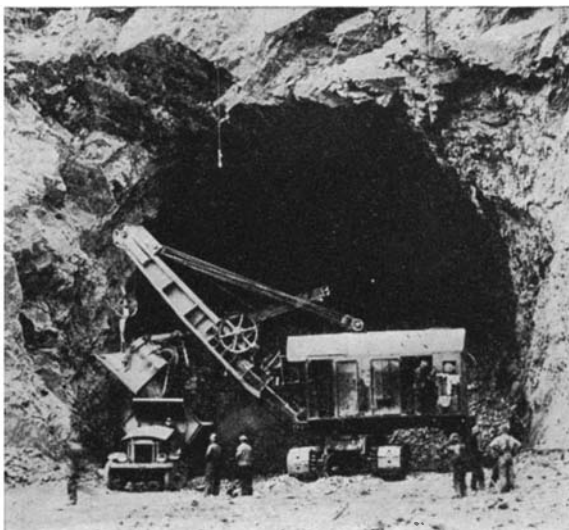


load of mucked material.

Electrical and mechanical maintenance on the shovels, including labor and supplies, was slightly less than six cents per cubic yard of material moved, and power consumption is estimated from test readings at 0.3 kilowatt-hour per cubic yard.

Excavation of the main diversion tunnels was completed in May, 1932. At this writing, three of the 100-horsepower shovels are at work on spillway excavation and on roadway work. Two more were considered for possible use in the penstock tunnels this fall. Other work before these shovels will be the excavation of the necessary material for the coffer dams which will be used to divert the river while the

Below: The beginning of work on an upper portal of an Arizona tunnel



main dam is under construction, excavation of the foundation for the gigantic dam itself, and the reclamation of a certain amount of concrete aggregate material which it will be necessary to get out before the dam is actually completed, as the present gravel pit will be flooded by that time.

In addition to the nine Marion shovels, the contractors have in operation at the Arizona gravel pit a Marion dragline with a five-cubic-yard bucket. This is electrically operated and Westinghouse equipped. Its job is to dig the aggregates for 5,000,000 cubic yards of concrete that will be used in the dam and appurtenant works.

# OUR POINT OF VIEW

## The Biggest Bridge

**J**OBBS for 12,000 men are expected to result from a loan of 62,000,000 dollars recently authorized by the Reconstruction Finance Corporation for the construction of the San Francisco-Oakland Bridge. This is the largest loan so far made by the Corporation for a self-liquidating project. The state of California is to provide the remainder of the 70,000,000 dollars necessary, and will maintain and operate the bridge.

For years, San Francisco, more than four miles distant across San Francisco Bay from her nearest important neighbors, Oakland and Berkeley, has planned this bridge to give her quick access to these neighbors and the rich hinterland beyond. Tentative plans call for a central span which will be something like a thousand feet longer than that of the George Washington Bridge over the Hudson River, which now holds the world record. The total length of the bridge will be about four and one half miles. As now planned, it will have two decks, one with six lanes for fast traffic and the other with three for slower traffic. In addition, there will be either two interurban tracks or two more truck lanes.

Since about 170,000 tons of structural steel and wire, 20,000 tons of reinforcing steel, 40,000,000 board feet of lumber, 1,000,000 barrels of cement, 1,000,000 cubic yards of rock and gravel, and 200,000 gallons of paint will be necessary for the construction work; since these materials will be drawn from many parts of the country and their purchase will therefore mean big orders, better business, and more men employed in a number of industries; and since the bridge will constitute so important a transportation link for an important city, we hope that everything may be made ready for a start on it at once!

## Patent Applications

**I**T appears that, just before signs of business recovery were about to show up everywhere, the depression finally caught up with that most optimistic of world-revolutionizers, the inventor. For the fiscal year 1932, ended June 30 last, applications for patents showed a decided slump. The total number of applications filed was 73,465, the lowest figure for the past 13 years. At the same time, however, the number of patents issued during that year broke

all records in Patent Office history.

From the decrease in patent applications, it is not to be inferred that inventive activity is on the wane. Rather should it be understood that enforced economies have caused both individuals and corporations to postpone the filing of applications. There is no doubt that once business has made permanent its recent gains and we are on the road to prosperity again, there will be a flood of applications to be handled by the Patent Office—that is, to the normal volume there will be added the thousands of applications that have been deliberately withheld. The Patent Office, now in its new quarters in the Department of Commerce Building and under the able guidance of Commissioner Robertson, will then make new high records in the number of patents granted.

## Support for Our Merchant Marine

**I**T will come as very welcome news to Americans that more than 20 of our principal exports were shipped abroad in greater bulk during the first six months of 1932 than during the same period of 1931. Exports of cotton, for example, were 66 percent higher, with total sales abroad of over two and a quarter billion pounds; wheat exports rose 77 percent; and crude petroleum exports were higher than ever before for the six-month period.

Prices being low, we did not, of course, get as much cash for these exports, as we would have in other years. Even so, we have another thing for which to be thankful: around 33 percent of shipments must have been carried in ships flying the American flag, for that is the percentage of our foreign trade H. Gerrish Smith tells us on page 334 is carried by our own ships—a larger percentage than we would have carried in other years. And that is most important to the success of our efforts to build a merchant marine that will support several millions of our people.

Thoughtful Americans have long urged the construction of ships and the rebuilding of our merchant marine. Inconceivably, many of these same people—let us be more explicit and say that even Cabinet Members, Ambassadors, Congressmen, and men and women of position who should be most interested in their own country's welfare—have seemed to prefer foreign ships to those under our flag when going abroad. Ordinary individuals may be influenced

by the liquor on foreign ships, but surely not these people. Why, then, should they permit 80 percent of their passage money to go to some other nation to support foreign workmen, ship owners, and industries? By going on American ships—which now are as fine, if not quite as large, as anything afloat—what they pay for their trip would help this country when help is sorely needed.

It follows that thoughtful, and likewise patriotic, people have cast questioning eyes toward those who patronize ships other than our own, and will continue to brand as specious their reasons for doing so.

## But—Would It Work?

**A** COLONY or kind of Utopia entirely peopled and managed by scientists, engineers, and economists has been proposed before the British Association for the Advancement of Science by Professor Miles Walker of the University of Manchester. This noble experiment would be tried with 100,000 persons who would endeavor to free themselves from the wastefulness and inefficiency now prevalent in a democracy where the level of general ability is that of the average human being; also from the selfishness, greed, and tyranny which generally result in an aristocracy when human society as a whole is dominated by those of greater than average ability.

Here we would have a different world—an opportunity, it would seem, to demonstrate what kind of world our own could be if science were put in full untrammelled control of it.

If such a demonstration is worth anything it will show the advisability of subsequently reconstituting the world so that it is all of a piece with the small sample set up in the experiment. This could be done permanently only by disposing of the remainder of the human race.

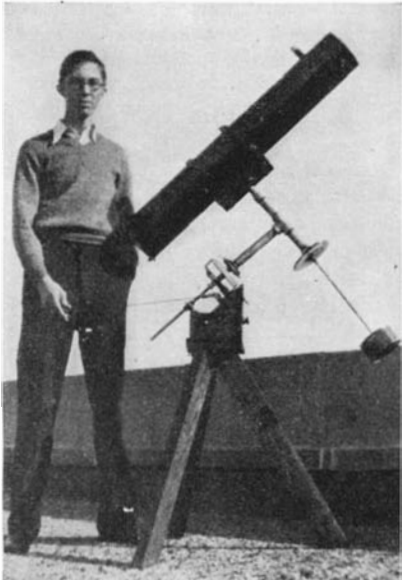
Nor could the colony even maintain its own level unmolested. As geneticists know, we are all the potential carriers of bad qualities which may be, and sooner or later are, transmitted to our progeny. Some kind of ruthless disposal of these weeds would have to be made even among the scientists but this, if it conduced to the welfare of the whole, would thereby become moral.

In our belief such a colony would become a failure. Moreover it is doubtful whether the scientists involved in it would long tolerate the economists.

# AMATEUR TELESCOPE



V. E. Maier, 1306 Parker Avenue, Indianapolis, used a camera for a counterweight. His telescope has a phonograph motor drive

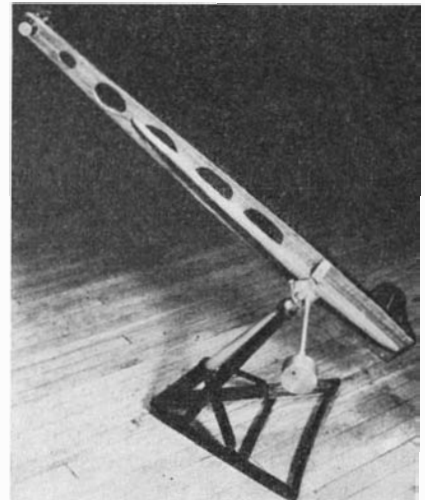


Henry C. Kawecki, Massachusetts Institute of Technology Dormitories, Cambridge, is a student of electro-chemical engineering, but in summer vacation he made a portable reflecting telescope. "Little trouble was encountered," he says. The telescope has a worm-and-gear slow motion, also setting circles



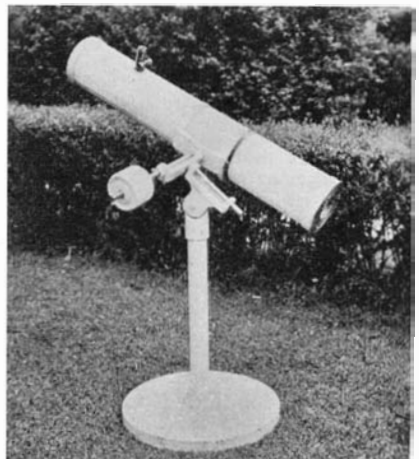
What its maker, Dr. R. A. Pittman, dentist, El Dorado, Arkansas, calls "the thing" is a six-inch reflecting telescope concocted largely from an old Chevrolet brake drum (the base), pipe fittings, and other gadgets. "This mounting has worked very satisfactorily so far," Dr. Pittman states, "and, best of all, the whole thing cost me less than six dollars. The 'observatory' consists of a step ladder and the keg on which the mirror was ground. I sat in one place all during the operation and turned the keg with my feet." Evidently the dentists in El Dorado are mechanics right down to the tips of their toes

SEVEN years ago an article was published ("The Heavens Declare the Glory of God," *Scientific American*, November, 1925) telling how a group of enthusiasts in the Vermont village of Springfield made their own telescopes and became amateur astronomers, and inviting the readers of this magazine to take up the same hobby. The response was unusual and, as a result, the instruction-book "Amateur Telescope Making" was prepared and published in the spring of 1926 by this magazine. Since that date thousands of our readers have become intrigued by this hobby and the same book has gone through two editions, the first of which contained 102 pages; the



A reflecting telescope does not necessarily require a tube. This one, made by Dominic d'Eustachio, of the Physics Department of New York University, Washington Square, New York City, employs a "spinal column" of wood cut out for lightness and braced with an edgewise strip. The five and one half inch mirror is supported on a duralumin bracket. All of the other metal parts are of duralumin. The mounting is for a city apartment dweller and is portable, weighing only 15 pounds. The total cost of materials was 35 dollars. Both axes are provided with ball bearings and clamps, and the whole is a very trim job

Left: Paul V. Roddy of North Platte, Nebraska, made this unusually neat six-inch reflecting telescope, using several aluminum castings on the mountings. Later he was accidentally killed by boys shooting a rifle. His father stands by the telescope



Right: "I had a lot of fun making my telescope and looking at the wonders of the sky through it." So says Fred J. Blum, 335 Franklin Avenue, River Forest, Illinois. "I had the advantage of access to a large, well equipped shop"

# MAKERS MAKE AMATEUR TELESCOPES

second 281 pages. A third edition of the same work, revised and greatly enlarged, has now been made necessary by the continued growth of this hobby, which still goes marching on despite recent hard times.

Ever since 1926, photographs and descriptions of telescopes made by our readers have been published monthly in a special department of this magazine but so many of these have recently been received that, in order to "catch up," a large group of them are reproduced in the accompanying pages, the descriptions sent in with them being rather reluctantly shortened owing to space demands.

—The Editor

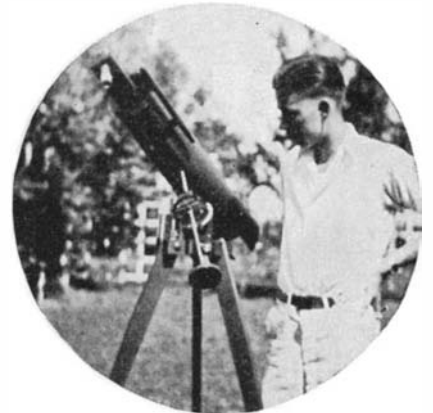


Charles Herman, 1326 Parker Avenue, Indianapolis, with a six and a half inch telescope which magnifies 390 diameters. Total cost, \$2.65



O. E. Stroehlin, Pomeroy Avenue, Meriden, Connecticut, made the concave mirror of his six-inch telescope in spare time during eight days. "This is the first time I have ever tried to make a telescope," he writes, "and it surely was an interesting experience." The post of his mounting is the housing of a Ford drive shaft, and most of the rest is of Ford parts. "The whole telescope, not counting the eyepiece, cost me 18 dollars," he states

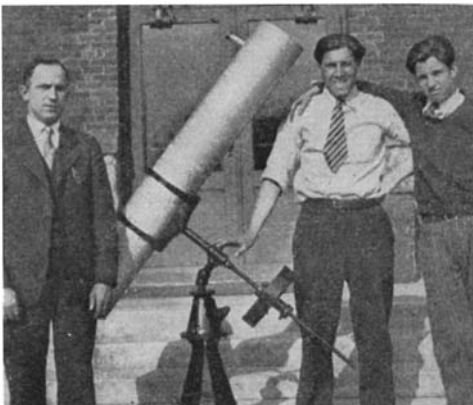
*Lower right:* Standard two-inch pipe fittings, two lengths of furnace smoke pipe and a clean-out cap, a brass tube from a bathroom fixture, and other ingenious pick-me-ups, constitute the mounting of the six-inch telescope made by L. J. Coleman, 2058 Clinton Street, Sioux City, Iowa. The total cost was 20 dollars



Don Willman, 104 Warner Avenue, Bloomington, Illinois, made a four-inch telescope from glass blanks that cost 25 cents each. It has declination and right ascension circles, and slow motion control

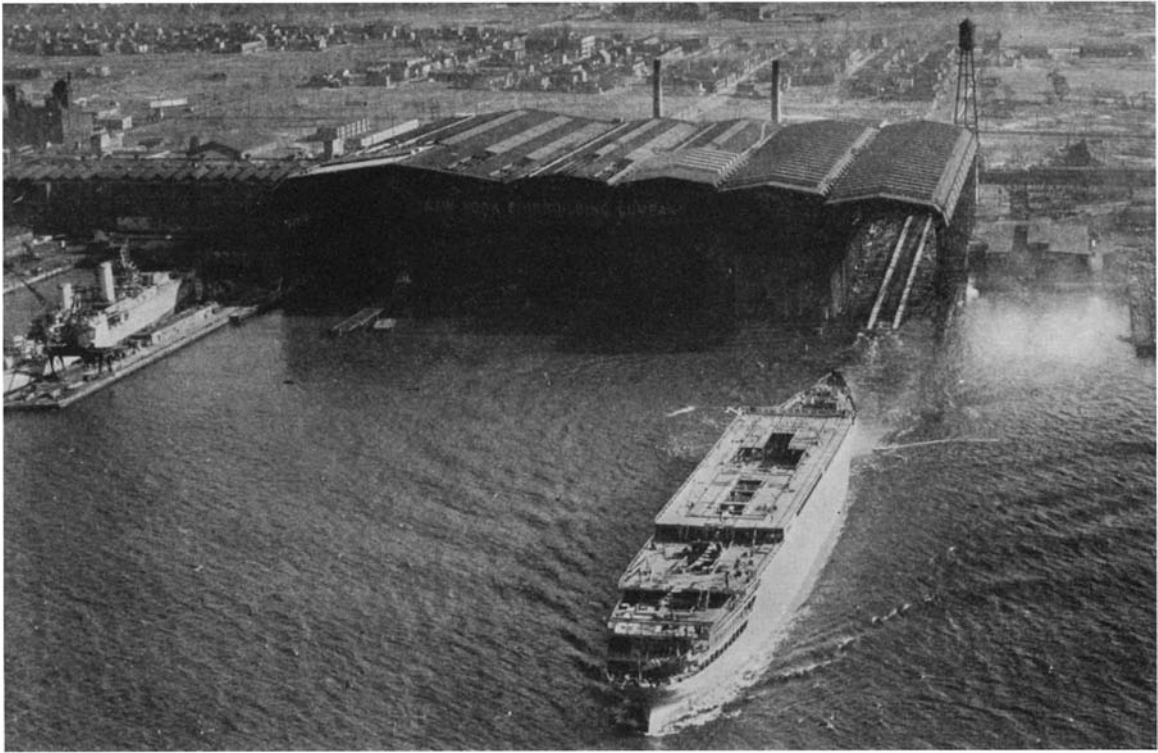


Looking down the skeleton tube of a telescope made, except the 12-inch mirror, by Samuel S. Waters of Indianapolis. The paraboloidal mirror was made by Dr. Loren S. Noblitt



*Left:* With the help of two boys, Ray McIntyre and David Pope, respectively president and secretary of the Astronomy Club of Hollidaysburg High School, Hollidaysburg, Pennsylvania, mathematics teacher Harry E. Diehl (at left) built this six-inch reflecting telescope, working in the high-school chemical laboratory. The mounting of this telescope was made of part of an old cream separator, some pipe fittings, and an old brake drum. The entire cost was just over 20 dollars





A shipyard that is typical of a number in this country where commercial ships of all kinds may be built. A view of the Camden, New Jersey, yard from which the great new liner *Manhattan* was launched

# MORE SHIPS FOR OUR FOREIGN TRADE

Having Lost Our Former Supremacy on the Seas and Suffered Losses Thereby,  
We Have Launched a Program for a Powerful Merchant Marine

By H. GERRISH SMITH

President, National Council of American Shipbuilders

IT has been long recognized by those who have made a careful study of shipping that the carriage of a substantial part of a nation's goods to foreign markets in its own vessels is an important aid in the maintenance and extension of trade with those markets. This conviction is supplemented by the fact that sea-going merchant vessels constructed and operated for commercial purposes are in a time of national emergency available and readily convertible to naval and military uses.

While it is also recognized that shipbuilding and its allied marine industries and ship operation are important businesses giving continuous employment to thousands of workmen, it is the national aspect of the importance of American shipping to the producer, affecting all industries engaged in importing and exporting, that has led to the passage of legislation for the upbuilding of an American merchant marine for foreign service.

Shipping, like other lines of business,

is suffering from the depression and many ships are now laid up. The competition for ocean transportation of passengers and merchandise as it exists today is very keen, but American ships are carrying on and a revival of world prosperity will bring with it a revival in shipping.

In 1931, 80 or more American lines of ships totaling 4,000,000 gross tons and 700 ships, were rendering regular and dependable service in established routes in the foreign and non-contiguous trades of the United States, calling at about 650 ports throughout the world.

THE demand for shipping is, of course, measured by the volume of trade. About 85 percent of our total foreign trade is water-borne. While the volume of this trade is now far below what it was in the banner year of 1929, yet it bears about the same percentage to our total business for 1932, domestic and foreign, as that prevailing in 1929, and the percentage of the total world trade now enjoyed by the United States

is not far different from what it was in 1929.

Passenger service is also very important in the sphere of shipping. The total number of passengers, arriving at and departing from American ports for the fiscal year ended June 30, 1930, exceeded 2,200,000. Those carried by the 17 lines in the North Atlantic Conference between American ports and European ports alone, totalled about 1,000,000. American citizens constitute about 60 percent of the arrivals and departures between American and foreign ports, but notwithstanding this fact, American ships carried only 27 percent of the total for the year 1930, while British vessels carried over 47 percent. Recovery of a greater percentage of this profitable American business for American ships is indeed most desirable.

American shipping in foreign trade has gone through two epochs in our national history and is now entering upon a third. The first was during the earlier years of our history when we



were largely a seaboard nation and the need of ships was paramount to develop our industries and create markets for our products. During this epoch the demands of our foreign trade caused the enactment of such legislation as was required for the protection and development of our shipping and, as a consequence, American ships carried, for many years, the greater part of our goods.

The second epoch began with our national expansion westward. With the introduction of the railroad, the opening up of our mines, the advance in our industries, and the development of our fertile farm lands, we became less ship-minded. There was work for all on the land, including the millions that immigrated to our shores, and our internal development was our first consideration. We paid less attention to shipping and entrusted to foreign ships the carriage of more and more of our goods, to and from foreign markets, with a gradual, but nevertheless sure, decadence of American shipping. We finally reached a stage at the outbreak of the World War where foreign ships were carrying over 90 percent of our goods in foreign trade.

**T**HE third epoch, in which we are now living, is one in which our internal development is largely completed. Immigration from foreign countries has been curtailed because foreign labor is less needed. Moreover, we have now reached a period when the production of our exports and the use of the imports required by our industries are necessary for the employment of our labor, a condition that has not previously existed to any such degree as obtains at present. It is estimated that 10 percent of our income is derived from our foreign trade and that it furnishes a livelihood to no less than 12 millions of our people. Foreign markets are now more than ever before vital to our national prosperity.

The World War created a demand for American ships because foreign ships which had been engaged in our trade were withdrawn from our trade for war purposes. Consequently, American producers, mostly our farmers, lost hundreds of millions of dollars through excessive ocean freight rates and inability to secure transportation for their goods to foreign markets. It was the absence of merchant vessels of suitable design and in sufficient number that necessitated the tremendous war shipbuilding program that cost the tax

payers of the United States the enormous sum of three billion dollars. Due to our lack of foresight, this large merchant fleet had to be constructed in a very short time and at fully double the cost of orderly peacetime construction.

A permanent, strong, well-balanced American merchant marine is an insurance against a recurrence of such conditions. A realization of this need led to the Shipping Act of 1916 and the

largely or wholly upon the vessels of other nations to carry them?

The answer depends entirely upon a decision as to whether the carriage of our goods in our own vessels justifies the government aid required.

The American people have answered this question in the affirmative by no haphazard decision, but as the result of the costly experience at the outbreak of and during the World War, and of the studied effect of American shipping upon our world trade and our national security. This answer is expressed by Congress in the Shipping Acts of 1916, 1920, and 1928.

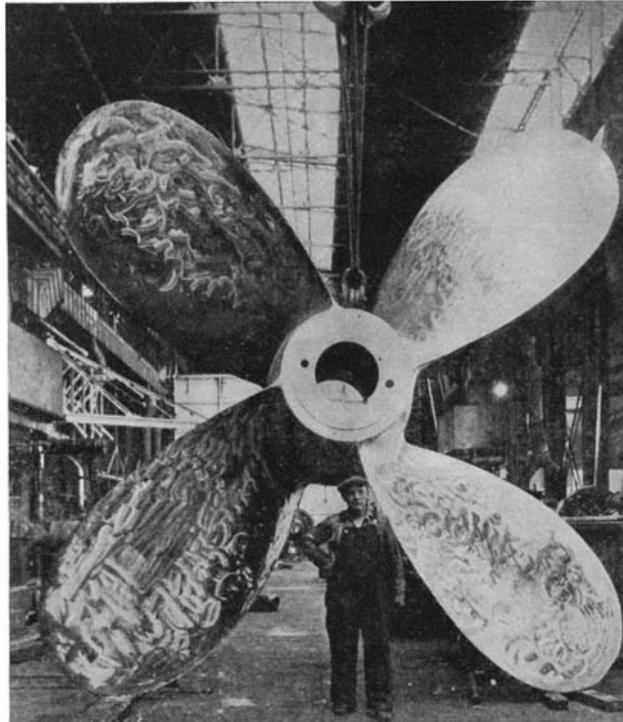
Of the things that militate against an adequate American merchant marine, a higher cost of operation of American-built than of foreign-built ships, is inherent and inescapable. Among the elements contributing to this differential in cost and constituting the larger part of the total fixed charges of operation are insurance, repairs, interest on capital investment, and allowance for depreciation, the amount of which is determined by the cost of the ship itself.

Quantity production methods are not applicable to shipbuilding, except to a very limited degree, because of its highly specialized character, changes in designs, and limited market. The cost

of building ships is controlled by the cost of labor. The shipbuilding wage rates in force in the United States are more than twice those in Great Britain, with a correspondingly higher differential between the rates in the United States and those in Holland, Germany, and Italy. It is therefore evident that our higher prevailing wage rates are responsible for our higher shipbuilding costs.

**I**N addition, the larger pay of American officers and crew and the greater cost of their subsistence, are responsible for further handicaps under which an American ship owner operates his vessel in competition with that of a foreign ship owner.

Just prior to the World War, American ships were carrying less than 10 percent of our goods to foreign markets. Because of the policy adopted by Congress in the Shipping Act of 1916 and the aids provided by the Merchant Marine Acts of 1920 and 1928, American ships now carry about 33 percent by value and 40 percent by tonnage of our goods to foreign markets. This operation of American ships to foreign ports



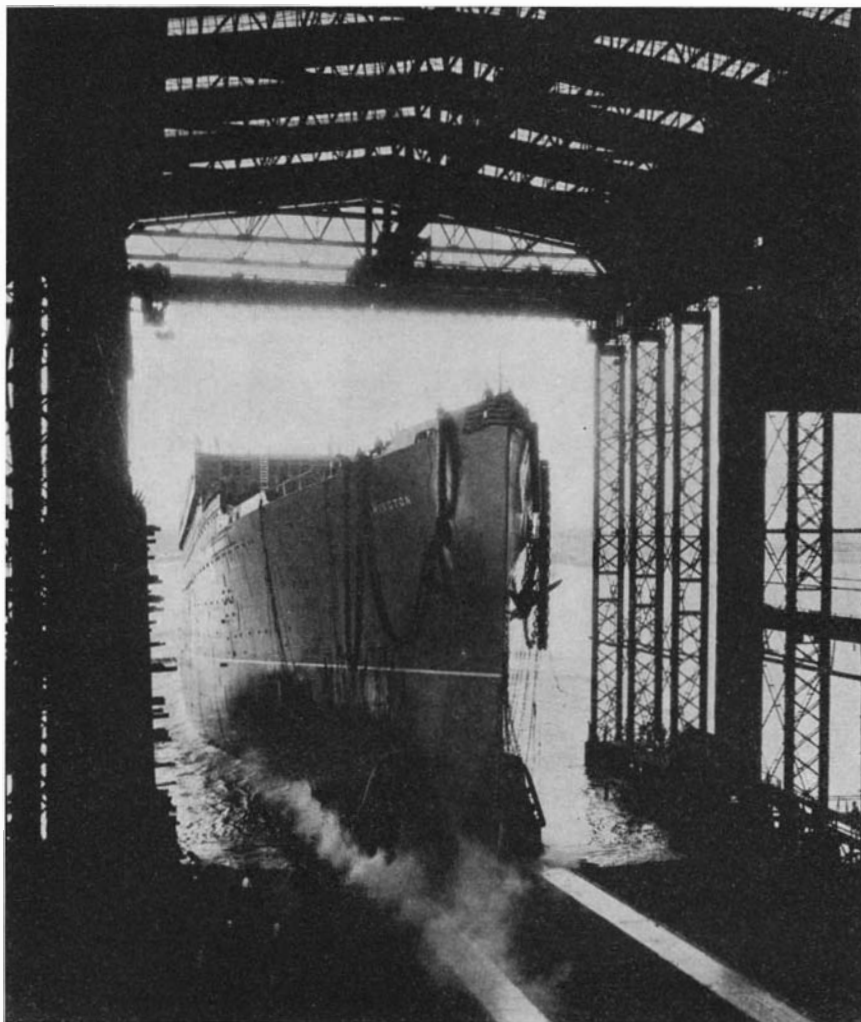
Largest bronze casting ever made in America, one of the two propellers for the recently completed *Manhattan*

establishment of a United States Shipping Board for the purpose of encouraging, developing, and creating a merchant marine to meet the requirements of the commerce of the United States.

The operation of American-built and American-owned ships in the carriage of our goods to foreign ports, however, presents problems quite different from those involved in domestic shipping between our own ports. Their operation is, in general, a private commercial venture in international trade in competition with the vessels of foreign nations that cost not only less to operate but also less to build. Therefore, there are only two possible ways by which an American merchant marine can be successfully maintained in foreign trade: 1. By direct government operation; or, 2. By government aid to private ship operators.

Of these alternatives, private operation is admitted to be the less expensive.

Faced with the handicaps under which the American ship owner operates, the problem is: (A) Shall we carry goods to foreign markets in our own vessels; or (B) Shall we rely



Launching the *Washington*, sister ship of the *Manhattan*, late last summer. These two liners are expected to recapture much of our lost transatlantic trade

senger and cargo vessels of the most improved types and of the highest efficiencies, the last of which will be completed within the next few months. These contracts require further, before their termination, the construction of from 28 to 36 additional vessels. They have also resulted in the reconditioning of 25 vessels for better service and the future reconditioning of at least 30 additional ones.

Nine oil tankers have also been constructed under the construction loan provision of the Act of 1928.

**T**HESE modern ocean-going vessels are the equal of any of similar types constructed anywhere in the world and include such magnificent vessels as the *Manhattan* and *Washington* for transatlantic service, the two largest merchant vessels ever constructed in American shipyards; the Dollar Line steamships *President Hoover* and *President Coolidge* for transpacific service; and the *Mariposa*, *Monterey*, and *Lurline* for the Oceanic Steamship Company (Mason Navigation Company) for service between the west coast of the United States and Australia.

An important effect of this construction program has been the continuous employment in the shipyards and allied marine industries of the United States of about 25,000 men during a three-year period of serious unemployment.

This splendid beginning of a permanent merchant marine in our foreign trade has been accomplished at a cost for contract mail pay far less than the cost would have been to have continued the operation of vessels by the

is being maintained notwithstanding the world economic depression.

The Merchant Marine Act of 1920 was enacted to clothe the Shipping Board with the necessary authority for the operation and sale to American citizens of the wartime built merchant fleet. The Act accomplished the purpose of establishing these ships in foreign trade routes and in selling some of them. It did not result, however, in the construction of more than a few new vessels of modern design to supplement the wartime built vessels and to replace those that become obsolescent.

The permanence of an American merchant marine in foreign trade nevertheless required such new construction, and, anticipating further legislation to bring this about, Congress called upon the Shipping Board:

“\* \* \* to prepare and submit to the Senate not later than January 1, 1927, comprehensive and concrete plans for building up and maintaining an adequate merchant marine for commerce and national security (1) through private capital and under private ownership and (2) through construction, operation, and ownership by the Government.”

After public hearings, conducted in

33 cities throughout the United States, and a study of 9000 responses to inquiries sent to representative industrial organizations and persons, the Shipping Board submitted the following conclusions:

“1. That the United States should have an adequate merchant marine for defense and for commerce.

“2. With almost equal unanimity it was held that this merchant marine should be privately owned.

“3. With equal unanimity it was held that until it was made possible for private interests to own and operate successfully the American merchant marine, the Federal Government must continue to do so.”

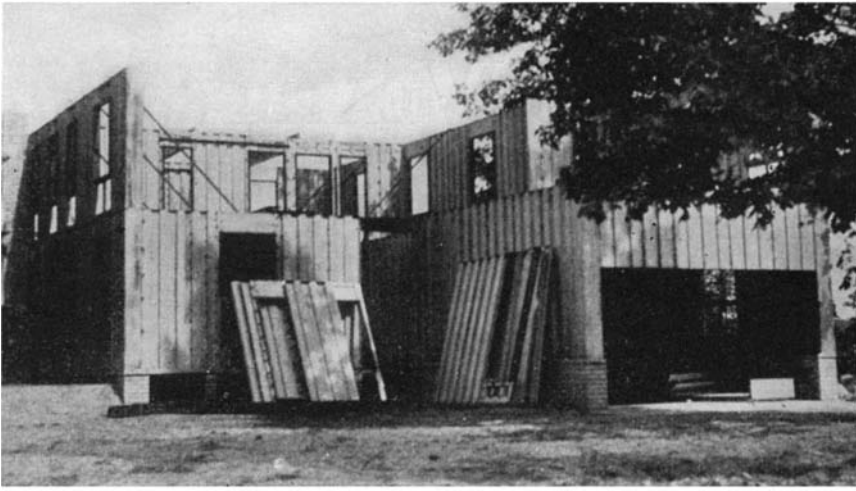
Following this report Congress enacted the Merchant Marine Act of 1928 which contains specific authorizations for the Postmaster General to enter into contracts with American citizens for the carriage of mail and for the Shipping Board to lend money at low rates of interest from a construction loan fund for the construction of new vessels.

The Act of 1928 has resulted in the award of mail contracts for the carriage of mail on 45 trade routes to foreign ports. These contracts required the construction of 32 combination pas-

1914....20 LINES....	1930....82 ".....	NUMBER OF LINES
1914....24 SERVICES..	1930....165 ".....	SERVICES AVAILABLE
1914....112 SHIPS....	1930....700 ".....	NUMBER OF SHIPS
1914....600,000 TONS..	1930....4,000,000 "...	SHIP TONNAGE IN SERVICE
1914....12 PORTS....	1930....64 ".....	DOMESTIC PORTS SERVED
1914....40 PORTS....	1930....600 ".....	FOREIGN & NONCONTIGUOUS PORTS SERVED
1914....25 COUNTRIES, etc.	1930....128 ".....	FOREIGN COUNTRIES TERRITORIES & ISLANDS
1914....9%.....	1930....34%.....	PERCENTAGE OF TRADE CARRIED

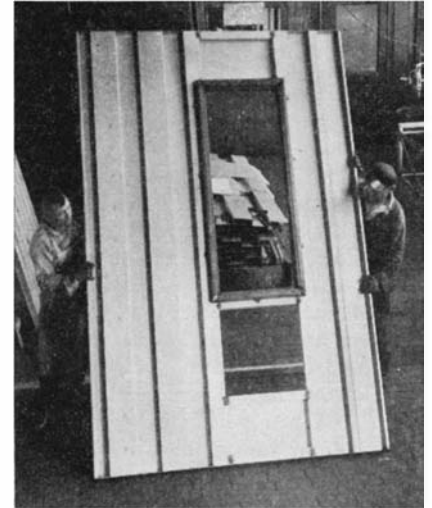
Growth of the American merchant marine, comparing 1914 with 1930

Government in these trade routes, and at a cost to the tax payers of the United States for the protection of all our industries in foreign trade of an amount extremely small as compared with the cost to the tax payers for the protection of individual industries under our tariff laws.



After 156 hours of field work, the "chassis" of the first frameless steel house nears completion. Walls will be insulated, and covered with porcelain-steel shingles

The wall sections, made in the factory, are light-weight pressed and welded metal



## FRAMELESS STEEL HOUSES

A FRAMELESS steel house which may ultimately point the way to cheaper and better homes was completed in October in Solon, Ohio, a Cleveland suburb. An artist's drawing of this house, which has been constructed by The Insulated Steel Company in co-operation with The American Rolling Mills Company, was used with our October article "Houses of the Future."

The new frameless method of construction is a marked advance toward the factory production of low-cost homes. As the weight of the structure is carried by the walls, the erection of the conventional structural frame is unnecessary.

For centuries, houses have been built largely by hand. Materials are hauled in small units; men erect the house piece by piece; there is much cutting and fitting; one contractor delays another. Waste always abounds.

A large part of the frameless steel house is factory produced. There is no waste, and no field cutting or fitting. The walls are made of 20-gage Armco steel sheets. Box-like corrugations, or channels, were pressed lengthwise in the sheets to give them strength and rigidity. These sheets were made in four different standard widths to provide flexibility in width adjustment.

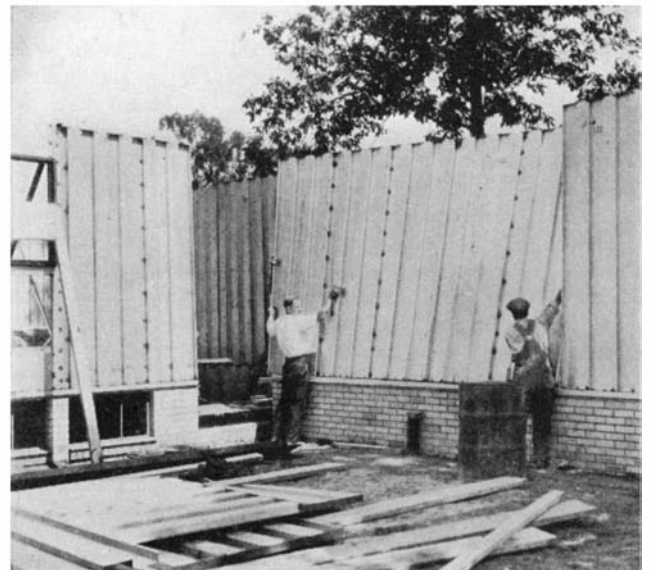
THE walls were assembled in large sections, room wide and story high, with window or door frames in place, and then welded. They were hauled to the job like stage scenery.

The floors are of 18-gage Armco steel. The individual floor sheets were formed longitudinally in the shape of a long "Z." These were lapped one over the other and welded together, forming a series of metal boxes which, though light, possess great strength.

The exterior of the house is heavily insulated against heat or cold, and is covered with porcelain-enameled shingles. It will never require painting. Other exteriors such as stucco or brick may be applied. The interior of the wall is finished with gypsum lath, on which two coats of plaster were applied. The completed wall is less than four inches in thickness.

The ceiling was finished with an acoustical tile, laminated hardwood floors were laid in the living quarters and linoleum was used in the kitchen and bath. A four-ply asphaltic roof was applied over an insulating roof slab two inches in thickness.

Assembling the floors on the foundation. When welded together, these "Z" sheets form a series of metal boxes



Photographs courtesy American Rolling Mills Company

In the field, few men are needed to install the factory-made wall sections. Two men lifted this large section

# THE ECLIPSE, BAD WEATHER, AND A NEW WAY OUT

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

AS, group by group, astronomers of some 20 nations and of all the continents gathered in the hospitable halls of Radcliffe College shortly after the recent eclipse of the sun, one oft-repeated question passed from one to another. Often it was put with caution such as it is well to use in inquiring of an under-graduate regarding the fortunes of an unsuccessful football team. "What did you get?" proved too tantalizing, and the simple directness of "Did you see it?" came to be the salutation. For seldom has the weather been more disappointing than it was on August 31.

"Partly cloudy" was the weather prediction, and partly cloudy it was from beyond the St. Lawrence to Nantucket. Nowhere was the day consistently clear, and in few places, if any, was it wholly overcast. But, by a fatality that seems to support the doctrine of the "total depravity of inanimate objects," the clouds were thickest along the central line of the eclipse zone. The astronomers who had naturally resorted to this region often drew blanks, while thousands of sightseers who took their stations near the edges of the shadow's track fared better.

THE large party of British and Americans at Magog, Quebec, just north of the border, saw nothing; nor could the Mount Wilson expedition at Lancaster, New Hampshire, make a single observation. Farther north a party from Greenwich secured a good spectrogram of the first flash spectrum, only to have the sun's emergence 100 seconds later obscured. In southern Maine the Lick Observatory expedition was the most successful of the large parties, securing perhaps two thirds of what they hoped for. A small party from Harvard had better sky, as did a few professionals and a vast throng of sightseers at Cape Cod. One party rejoiced in a sudden opening which gave them almost a clear view, though the rest of the heavens was cloudy. Another, under a nearly clear sky, saw a small but dense cloud drift over the sun just before totality and remain until all was over.

Only preliminary reports are yet

available, for by no means all of the plates have yet been developed. But it is clear that this must go down as one of the least successful of recent eclipses, from the standpoint of the professional observer.

For the amateur and the intelligent bystander who came only to see the sights, this was by no means true. The writer, for example, who saw things "with his hands in his pockets" under a largely cloudy sky, found the specta-



The solar corona during totality. A photograph made by John M. Pierce using a 6 second exposure at  $f/12$ , with a superspeed plate

cle more imposing than previous eclipses in fine weather. They impressed one as cosmic phenomena; this, with a swiftly changing shadow and light on landscape and cloud, belonged to our own earth. Even before the shadow reached our little party, as the clouds 50 miles to the northward darkened, a gap among them turned bright—clear golden yellow sky a hundred miles or more beyond where the shadow had passed and the sun shone again. The most striking of all the panoramas must have passed before the eyes of an aviator who, from a height of 28,000 feet, saw and photographed the curved outline of the shadow displayed on the clouds far below him. Some enterprising motorists had good success in a game of hide and seek with the clouds, starting a quarter of an hour or more before totality in the most promising direction and often succeeding in getting under a clear opening before the zero hour.

The eclipse was not a dark one, as usually happens in the sort of weather when the clouds outside the shadow reflect a good deal of light into it. The

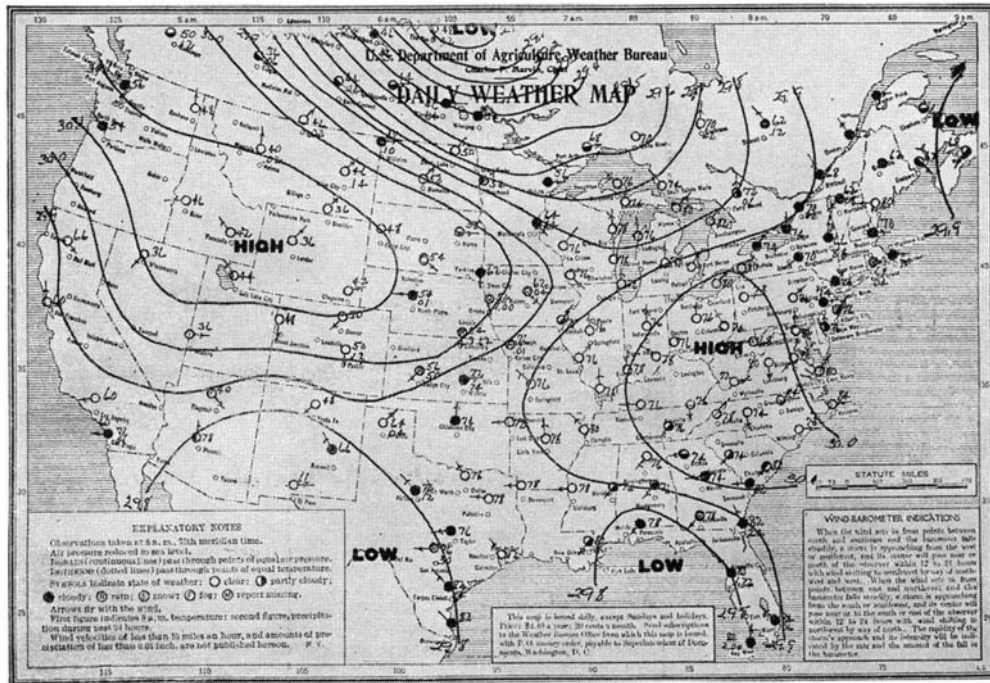
inner corona and prominences must have been unusually brilliant, to judge by the easy visibility through the clouds so dense that the disappearing crescent of the sun could be comfortably watched with the naked eye. The outer corona was of intermediate type, but nearer minimum than maximum, with long streamers, some extending to at least three solar diameters, and conspicuous polar rays.

Observers and mere watchers of the eclipse will doubtless agree with the statement which the late Professor Young, the great solar observer, used to translate literally from the French; "The earth's atmosphere is the astronomer's black beast;" or repeat with Mark Twain; "Everybody grumbles about the weather but nobody ever does anything about it."

CAN anything be "done about it"? That is, is there any way of escape from the necessity of awaiting a total eclipse in order to observe the corona, and from the resulting abject dependence upon the weather? At the very session at which the reports of the fragmentary observations of the eclipse were presented, we heard how a French astronomer, M. Lyot, has "done something," and indeed a great deal, about it.

The solar corona, of course, is always there. So are the prominences. All that prevents our seeing them is the bright foreground of sunlit air through which we look. The inner corona is only one millionth as bright as an equal area taken from the sun's disk would be, but even this is brighter than the average surface of a half moon, and about equal to that of the clear blue sky overhead at noon. We can see the half moon by daylight perfectly well. What hides the corona is the greater brightness of the sky close to the sun than elsewhere.

On an ordinary clear day, if one hides the sun with one's hand, a great whitish halo appears, extending for several solar diameters. This arises entirely from light reflected or scattered by fine particles of dust or fog. It may easily be a thousand times as bright as the sky far from the sun, and of course it utterly swamps the corona and promi-



The pure cussedness of the weather on the day of the eclipse. Clear skies (open circles with arrows) prevailed nearly everywhere except in the eclipse zone (dark circles with wind arrows: cloudy)

nences too. In really clear, dust-free air no such whitish haze is to be seen. The sky remains blue right up to the sun's edge, and brightens very little. This test of the purity of the sky, which requires no more than raising one's hand, is well known to astronomers, but probably not to the public. In thickly settled regions such really clear skies are extremely rare; but they are often to be found, even at sea level, in regions remote from artificial pollution, such as the coast of Norway, and still more often on mountains or high plateaus—best of all when the air has been cleansed by a heavy fall of snow.

Monsieur Lyot, to secure these advantages, set up his apparatus at the observatory of the Pic du Midi in the Pyrenees, at an altitude of almost 10,000 feet, carrying it up with the aid of porters through heavy snow in June.

**B**UT the best of the skies are of no avail if light from the sun's dazzling disk is scattered into the field of view by imperfections in the telescope. The tiniest speck of dust on the surface of the objective, or the minutest bubble or stria within the glass, scatters powerfully, and around the lens where it enters the metal edge of its mounting the diffraction will inevitably scatter still more light.

To escape these evils, Lyot designed a new type of telescope. The objective is but a single lens and is therefore not achromatic. But, by the choice of an exceptionally fine disk of glass and by very careful polishing, defects on the surface or in the interior were completely eliminated. The light unavoidably scattered at the edge was got rid

of very cleverly. An auxiliary lens inside the tube of the instrument formed a real image of the objective on a screen pierced with a hole slightly smaller than this image. The objectionable scattered light was thus caught, while almost the whole of the useful rays passed through. Another disk, suitably placed, cuts off the direct rays of the sun without obscuring the regions more than 30 minutes outside its edge.

The photographs of this instrument<sup>1</sup> show a thoroughly practical job. The optical parts are of the greatest perfection. The tube is a simple wooden box, light-tight and satisfactory.

With this instrument Lyot has succeeded in reducing the apparent brightness of the sky to only 1/250,000 of that of the sun's disk. Even of this minute amount, less than half comes from the sky itself. The rest is scattered in the telescope. It is amazing that he has done so well.

With this instrument the solar prominences are directly visible on any clear day—rose-colored against the blue sky—and their forms and changes may be very simply studied without the complex and expensive though effective aid of the spectroheliograph.

Besides these a faint luminous ring can be seen under the best conditions all around the sun. This is formed by a mixture of light from the inner corona, from the sky, and from scattering in the telescope. Traces of structure have been observed in it, but with difficulty. The light of the corona is polarized, while that of the sky close to the sun is not. By employing very delicate devices for the detection of polarized

<sup>1</sup>If later available, these will be shown.—Ed.

light, Lyot has detected its presence up to a distance of 6 minutes from the sun, and thus confirms the fact that part of the light comes from the corona. The faint outer streamers are, of course, inaccessible.

Perhaps the most noteworthy of all his successes is the observation of the lines of the coronal spectrum. Feeding the light from his "coronograph" (as he calls his new telescope) into an equally well-designed spectroscope, he has seen and photographed bright lines in the green at 5302.85 angstroms and in the red 6374.75, which agree excellently with the strongest of the known coronal lines.

**S**UCCESSIVE photographs with the slit placed outside different parts of the sun's limb showed marked variations in the extent and brightness of this line, so that the way is open to map out the gaseous part of the corona on any clear day without an eclipse, just as the prominences have long been studied.

This very beautiful piece of work shows how much may still be accomplished with relatively simple means and at moderate expense by an investigator equipped with enthusiasm, insight, and courage.

Eclipses will still be observed as assiduously as ever, for there are many other observations, such as those of the flash spectrum and of the heat radiated by the corona and its outer extensions, which can still be made only then. But we may hope for a very considerable and a rapid advance in our knowledge of the corona as a result of M. Lyot's insight and ingenuity.—*Radcliffe College, Cambridge, Mass., Sept. 8, 1932.*

# HOSPITAL LUXURY FOR RICH OR POOR

By A. A. HOPKINS

NEW YORK is fast becoming one of the great medical centers of the world. It already has two great aggregations of hospitals and medical schools and a third is now securing the necessary ground on which to build. The two that are already in being represent an expenditure of something over 60,000,000 dollars. The new towering edifice on the East River just north of the Rockefeller Institute occupies three entire blocks and houses the New York Hospital (a 160-year-old institution), two maternity hospitals, and the Cornell Medical College. Of the two groups already in being, we illustrated the Presbyterian Hospital in our issue for November 1928 and now record the progress which has been made since that time on the second. The third great center will be a part of New York University. Their medical school will be operated with Bellevue Hospital as a nucleus.

The gray and pink buildings rising near the East River from East 68th to East 71st Street are a most impressive group from any viewpoint. The buildings cluster around the 27-story central building which includes three separate units. The lower nine floors constitute the general hospital for medical and surgical patients; then are the floors for private patients; the upper story is devoted to the living quarters of the resident staff. Adjoining the main structure are buildings devoted to the women's clinic, the children's clinic, the psychiatric clinic, and the Cornell University Medical College. There is also a nurses' home that is a real home, and living quarters for the help.

IF you are sick and need medical and surgical attention, you can get as much luxury and attention as you want to pay for, but if you are sick and poor you can get the same scientific treatment but on a scale that is less expensive to the hospital. The private rooms have in many cases private solaria and the rooms on each floor are decorated in different color schemes; furniture has been chosen to harmonize. From the hall, the nurse can turn on a small pilot light in the floor lamp in the patient's room, giving sufficient illumination without annoying the patient. The same lamp can provide indirect lighting at will.

On some of the roofs the patients can be wheeled out on their beds to enjoy a charming river view. Usually a parapet

is in the way, but this was avoided, when the plans were made, by raising the roof a few feet so that the view is unobstructed and the patient does not feel that he is looking down. The solaria are very prominent features of the



A pneumatic tube system transports medicines as well as letters, records and so on



Photographs by Sigurd Fischer

Surgical dressings are put in sterilizers and after treatment are withdrawn at the other end

structure. Each floor taking care of private patients has a diagnostic laboratory and a diet kitchen. In these diet kitchens is a separate ice box for each room. If relatives of patients want to stay at

the hospital they may do so; a special dining room is provided for them. There is also a souvenir and gift shop where magazines and small wares can be purchased. Special entrances and elevators are provided for the private patients, who pay from eight to 25 dollars a day.

Now let us see how the ward patients fare. The old oblong ward has been done away with; the new wards are square and accommodate 16 beds. Curtains running on rods divide the ward into four quarters containing four beds each, and curtains again can separate each individual patient. This is known as the Copenhagen system. A new type of tray rest and a reading shelf are provided. Diffused artificial light comes from "egg-crate" fixtures, the lamps permitting of several intensities by a switch. In case a patient becomes dangerously ill, he or she can be removed to an adjacent room adjoining the nurses' station for constant observation. The cost of treatment in the ward ranges from nothing at all to upwards of six dollars a day.

THERE are many other interesting features in the new hospital, such as an electro-cardiograph system which can be connected at each bed so that heart beats can be registered and the results transmitted to one of the floors where they are photographed. Provision is made for various types of treatment such as the pool for physiotherapeutic work as described in our issue of September 1931. Sections are provided for eye, ear, nose, throat, and dental work. The hospital does not compete with dentists or dental clinics but there are many cases where a cure is facilitated by dental treatment.

The X-ray equipment of the hospital is most complete and includes a powerful apparatus where the ordinary limitations of roentgenography have been swept aside. In making X-ray pictures with ordinary equipment, the slightest motion of the patient, either voluntary or involuntary, greatly diminishes the diagnostic value of roentgenograms. The new machine can, however, if required in the case of a non-co-operating patient like a child, really take snapshots of the heart or other internal organs in  $\frac{1}{120}$  of a sec-

ond, or about 20 times as fast as the ordinary apparatus. The machine photographs clearly soft tissues, such as incipient ulcers and other internal conditions hitherto only imperfectly disclosed by X rays. One of the benefits derived from this machine, it is hoped, will be better diagnostic data in the case of cancerous growths. The machine was developed after two years of work by the research staff of the General Electric X-Ray Corporation in collaboration with Dr. John R. Carty, radiologist of the New York Hospital and Associate Professor of Radiology at Cornell University Medical College.

"The element of speed," said Dr. Carty, "has been the chief factor in the development of the X ray since its first practical use in 1896. At that time it took about 20 minutes to obtain an X-ray photograph of a bone. We are now able to force 90,000 watts through the X-ray tube in  $\frac{1}{120}$  of a second." In other words, 120 horsepower is used.

Much of the work of a hospital consists of surgical cases; the operating rooms are the last word in the way of design and equipment. The tiled walls are restful in tone. A limited number of students from the medical college can view operations from elevated seats reached from a special passageway in the rear. The air is all filtered, warmed or cooled, and de-humidified to give the patient, surgeons, and nurses the maximum of comfort. There are, of course, provisions against drafts.

Huge shadowless Zeiss lamps hang from the ceiling of the operating room and give an abundance of light. Brass strips in the terrazzo flooring serve to "ground" any static or stray electricity,



A 30,000,000-dollar hospital and medical college requires 1500 doctors and attendants to operate it

thus preventing a possible accident by the ignition of the volatile anesthetics. Nearby is the nurses' work room where the dressings are prepared. It is one of the busiest spots in the whole hospital. Two large sterilizers prepare the bandages and dressings; they are put into the sterilizers in one room and are taken out from the opposite end in another room.

**T**HERE are laboratories everywhere—264 in all. Some of them are for routine work and others are for research. Communication by telephone is all right for oral messages but something more is required. Records, letters, and above all medicine, must be promptly transmitted. The pneumatic tube system is a willing servant. The pharmacist compounds the prescription, the nurse puts it in one of the large

carriers, and it is sent to the central station in the basement where it is re-routed to its destination.

The resident doctors have excellent quarters, consisting of a study, bedroom, and bath. The staff dining room, the library, and the lounge would do credit to a first-class club. The nurses have a 16-story building to themselves and each one has her own room. One of the lounges for the nurses is a replica of a room in Florence Nightingale's house in England.

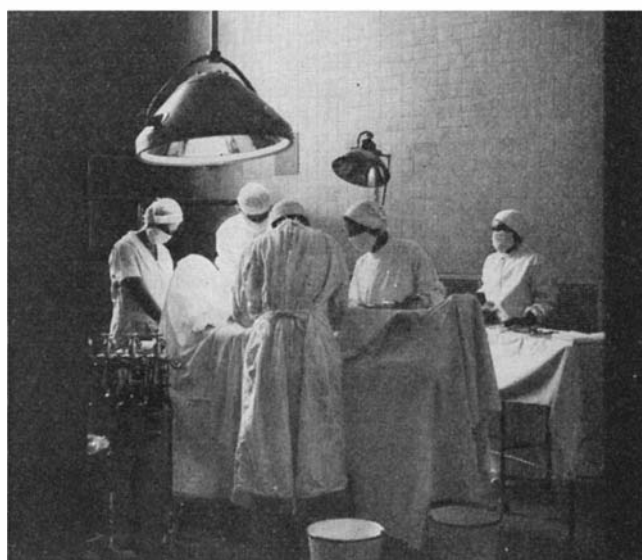
The psychiatric clinic has 114 rooms. There are nooks and reading rooms for those who are less "disturbed." There is one floor for children who need treatment for nervous and mental diseases and they have a playroom on the roof. Special attention is given to vocational work. Rooms are provided for

carpentry, metal work, modeling, painting, and even a beauty parlor. The rooms are soundproof; the latches are rollers and everything is done to rest tired nerves. There are no padded cells and no straightjackets. If a person becomes seriously disturbed, a good and patient nurse can usually calm him in a continually flowing bath with which a number of rooms are provided. There are no bars on the windows but the casements fold out in V-shape which answers the same purpose. Violent cases are sent to Bloomingdale Hospital at White Plains which is a branch of the New York Hospital.

The hospital buildings are planned to have a life of not less than 100 years. All arteries carrying water, heating, electricity, gas, and ventilating lines are easily accessible for repair or replacement at any time.



The Copenhagen system wards can be divided by curtains into groups of fours and each bed in turn can be cut off



Glareless lamps illuminate the operating room and patient on the table. Air is filtered and warmed or cooled



The monster new *American Clipper* in flight

# SKYWAYS THAT LINK THE AMERICAS\*

By V. E. CHENEA

General Traffic Manager, Pan American Airways System

GREAT pioneering flights, in the day when the commercial airplane is already a commonplace, have still the power to stir the imagination, to add a touch of romance and thrill to one of man's newer conquests, and thus carry along with them a broad general knowledge of the airplane's day-to-day accomplishments. Under such a heading must come the flights of Lindbergh, Chamberlin, Post and Gatty, Byrd, Coste, De Pinedo, Balbo, and those other great names of modern aviation which stand out so brilliantly. Close on their heels, however, have come the airlines, a new industry of transportation which perpetuates and makes of these pioneering trails, channels of travel and communication for the benefit of the world.

Just five years ago the United States witnessed completion of one of these great pioneering efforts—the good-will flight of the United States Army flyers who succeeded in the first flight around the South American continent. They had made a remarkable journey, a 20,000-mile flight to the 21 Pan American nations, and in the face of terrific obstacles accomplished it in some five

months to give a graphic demonstration of the ability of the airplane. There was then no one optimistic enough to venture the opinion that within 10 years—or even 15—those same great stretches of jungles, mountains, and open sea traversed by the Army flyers, would be flown by commercial airplanes.

YET today, big American transport planes, manned by American pilots, fly regularly over every foot of the territory covered by those good-will flyers, and, on their day-to-day schedules have penetrated hundreds of miles farther than even those pioneer pilots believed possible. Because of an enforced attitude of mind on the part of the commercial operator, who religiously seeks to remove any trace of the spectacular, the thrilling, the adventurous from his transportation project, the color and drama have been subdued, with the result that comparatively few people, who must rely upon the spectacular in aviation to keep pace with its amazing development, know the place the United States has achieved on the great international air routes of the world.

Today, through a highly co-ordinated system of 22,000 miles of airways the United States is linked directly with

32 countries and colonies—all but two—in the Western Hemisphere.

I have just returned from a trip over those airways. In just 17 days flying time I have accomplished travel that with the most perfect of schedules for surface transportation would have required more than 18 months to complete. I have had a bird's-eye view of 20 countries and visited half a hundred different cities in less time than it would have required for me to travel by boat from New York one way only to Buenos Aires. It is a bit difficult to describe in one breath, or probably even in logical sequence, an airline system which covers nearly half of an entire hemisphere, which traverses jungles, plains, deserts, crosses some of the highest peaks in the new world, spans an entire sea.

An international airway, in the first place, differs in many respects from the domestic airways with which we are all familiar. Within the borders of the United States, federal, state, and municipal governments, in some cases supplemented by local agencies, have developed for the use of domestic airline operators, model airways complete with terminal ports, intermediate landing fields, route markings, lighting, communications, and weather service. On the 28,000 miles of airmail routes

\*From an unpublished paper delivered before the summer (1932) meeting of the Society of Automotive Engineers, at White Sulphur Springs.

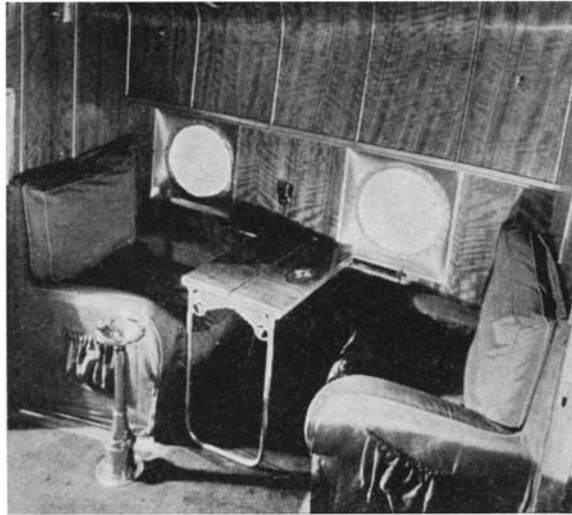


within the United States the federal government alone has invested something in the neighborhood of 48 million dollars for construction, and annually expends nearly 350 dollars per mile to maintain the routes.

Contrast this with the fact that in the international field the operator must provide his own airways without any assistance from the government; must survey, construct, or develop practically all of his own airports and intermediate fields and seaplane bases; must work out his own system of communication; and must develop for his own use a weather service—all at his own expense—and you can readily recognize the fundamental difference in background between the domestic airline project and the international routes of which I speak. Also consider this factor: that whereas federal, state, and municipal governments are in accord for the furtherance of air transport and the operators in many instances enjoy uniform regulations and policies throughout many of the states, the international operator must face divergent and often directly conflicting laws and statutes in each country, must function through different customs, clearance, immigration, and shipping regulations in 32 different countries and colonies.

**A**BOUT four years ago when the international airlines, under the airmail contracts for the United States government which made the project possible, began their first surveys in the Caribbean area, Central America, and the West Indies, much of the territory had never been flown over before. Even the best of maps were replete with uncharted areas the nature, outlines, and topography of which were not known. In the entire 7000-mile circle around the Caribbean Sea there were no more than seven fields which could boast the name of "airport," even granting the most optimistic inventory of their favorable points. Outside of a half-dozen points there was no weather service of any kind and in only three or four instances were reports complete or authoritative enough to inspire confidence. Furthermore, the airplane, known to comparatively few countries and understood by hardly more than one or two, was attempting to enter a field in which the word "transportation" was defined in terms of the ox-cart or the weekly steamer.

Today, a network of highly organized airlines borders and bisects the Caribbean Sea and encircles the entire South American continent. From Brownsville, Texas, the Western Trunk Airline stretches 6500 miles through Mexico and Central America to Pana-



The comfortable and roomy interior of one of the great Clippers which fly over Caribbean routes

ma, thence down the South American west coast to Chile and over the four-mile-high peaks of the Andes to Buenos Aires. From Miami, Florida, the Eastern Trunk Airline follows the western edge of the Atlantic for 7500 miles, spans the West Indies, and rolls on over the Spanish Main to Trinidad, the Guianas, and thence down the vast eastern coast of the southern continent to Rio de Janeiro, Montevideo, and Buenos Aires. From Miami, likewise,



At this work shop at the Miami terminal, planes and their motors are very thoroughly overhauled

the direct continent-linking route reaches straight across the Caribbean Sea, 1200 miles of its course over open sea—where the largest airliners the world has in service, the giant *American Clipper* and *Caribbean Clipper*, are operated—to Colombia where a trans-

continental shuttle line links the two trunk lines at Trinidad on the east and Panama on the west. A second shuttle connects Miami with Yucatan in Mexico, British and Spanish Honduras, and joins the Western Trunk Line at Salvador. Direct service is operated from Miami to Havana and to Nassau.

The men who pioneered these new channels of international communication have seen people in certain sections of these countries literally step from their ox-carts or crude dug-out canoes into the airplanes. Natives who have never seen an ocean liner or heard the shriek of a locomotive's whistle are laboring enthusiastically on airports or marine bases for these giant and, to them, miraculous birds of metal which have brought to them their first tangible contact with a world beyond their own horizon, a world which has always been legend.

But now the last vestiges of that pioneering era are fast disappearing. The passenger today looks upon well-designed airports and marine bases, trim passenger depots, orderly machine shops, and neatly uniformed crews that are impressive of a standardized system, immediately identified whether encountered at the home base at Miami, on the banks of the racing Suriname River at the jungle's edge in Dutch Guiana, or in the shadow of Buenos Aires skyscrapers, 7500 miles from the Florida terminal. Schedules run through like clockwork and the coming and going of the airmail planes mark the day of the week and the time of the day along the air routes.

**A**ND today, after three years of careful preliminary work, international air express has been added to the service of the airlines. Heretofore there has been no "express" service for our exporters. The 50-ton locomotive and the five-pound sample, badly needed in a competitive market, both traveled on the same steamer and took the same time in transit. "Express" applied simply to the "size" of the parcel and had lost its significance as to "time." Now, for the first time, express packages are being shipped by air to many of the countries on the airlines; service is soon to be available to every land in Latin America—an invaluable aid for our foreign commerce.

As important as rapid service for mail, passenger accommodations are relied upon by business houses to main-

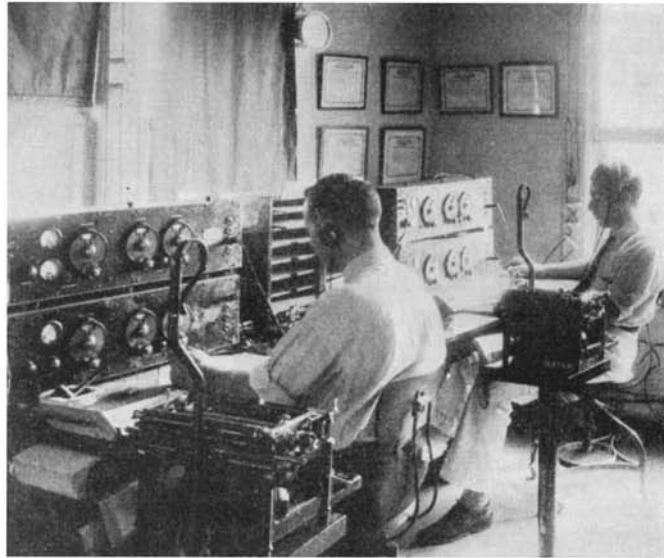
tain contact with field men and to reach markets which, before the airplane, were economically impossible of access. Faced with the alternative of a week aboard a tenth-rate coastal boat or a few hours' flight in a comfortable airliner, the traveler has been inclined to give the airplane the benefit of the doubt. And since these planes have never once failed in nearly 30,000,000 passenger-miles of scheduled flying, it is easy to understand the faith imposed in them by business men along the routes.

On my trip from Miami to Buenos Aires, I had a total of 23 different traveling companions along the line. Only three of these—a honeymoon couple air-cruising the Caribbean and a lady accompanying her brother on a business trip to Puerto Rico—could be classified as tourists. The other 20 were business men on important business missions. One export sales manager made calls and transacted business in Cuba, Haiti, Santo Domingo, and Puerto Rico on one round trip and would be back in New York City within five days. He told me he had often spent 22 days on the same itinerary before the air service was established.

**A**NOTHER phase of the international air-line operation is the perfection and use of wireless communication. A radio telegraph system, developed by the company's own communications engineers, operates through a private network of 56 ground stations, the operators of which are also trained meteorologists for reporting flying weather. Two short waves are regularly employed—one, a "heavy-duty" frequency of 32 meters, serviceable up to 600 miles, and the other a "reserve" frequency of 54 meters on which consistent plane-to-ground communication has been maintained up to 3700 miles. A third frequency, a long wave of 600 meters, is used for the radio-compasses, or direction finders, employed in checking positions or for the transmission of corrected bearings. The change from long to short wave can be made in less than half a minute.

Differing from most airlines, and considered as a matter of policy, both in order to maintain fixed responsibility and to insure the highest degree of safety, a licensed radio operator is a member of each flight crew. The telegraph system provides a written record between the pilot and his control station, or operating base, and the operator aboard insures maintenance of com-

munication between the airliner and the ground at all times. Positions are regularly reported every 15 minutes while three ground stations are constantly "guarding" each plane on their section of the route. Weather reports, assembled for the complete flight before the morning take-off, are kept up to the minute by periodic 30-minute reports except in case of sudden changes when



One of the line radio stations on the Pan American system which keep in constant touch with all airplanes in flight

specific data is sent the pilot so that he knows, at all times, the exact conditions ahead of and behind him. As an illustration of the close control of operations, our arrival at Port of Spain, Trinidad, was checked at two section points and reported to the main control center at Miami, 2000 miles distant on the airways, within one and one half minutes of the time the big flying boat touched the waters of the bay.

This radio system, which has been perfected to circumvent the powerful static disturbances encountered in the tropics, is functioning with a record for better than 97 percent consistency. It has maintained communication with as high as 27 planes in the air at one time over the company's lines. The sets installed in the planes weigh approximately 46 pounds, and fixed antennas enable the operators to communicate from the surface as well as in the air.

Largely through the perfection of its radio, Pan American Airways has solved its most difficult weather problem—the season of hurricanes common to the eastern Caribbean area. Through 24-hour watches, the stations in this territory maintain a constant series of reports to the main operating base at Miami. Here an accurate chart of the speed, course, and intensity of any disturbance is prepared and the airliners are routed through the "clear" areas. Last year, when a number of these violent tropical windstorms swept through the West Indies, one of them decimat-

ing the population of Belize and almost wiping out the city, only one scheduled trip was delayed, and that temporarily. The aircraft radio carried the first news of the disaster to the outside world when all other means of communication were paralyzed, and the first relief was directed and brought into the country by one of the Pan American planes.

For the maintenance of equipment, machine shops and supply bases are located at "section" terminals approximately every 1000 miles along the routes. Specialized studies have been made to determine exact local conditions and, from these findings, a unified system of inspection, servicing, and overhaul has been established—a system which functions with the same impressive thoroughness whether it be encountered in Miami, in San Juan, Puerto Rico, or in Natal, Brazil.

Land plane equipment, including a fleet of Wasp-powered F-10-A's and Ford tri-motors, is operated on schedules requiring an average speed of 115 miles per hour. Marine equipment, which includes 35 Wasp-powered Sikorsky S-38s and Hornet-powered Consolidated Commodore flying boats, both types bi-motored, is scheduled at 100 miles per hour. In all cases the load limit is about 1000 pounds under that authorized by the Department of Commerce.

**D**UE to its rigid operations policy, Pan American has been able to establish and maintain an unusually high record for dependability of schedule—99.81 percent—over the past year with practically every trip completed on schedule over every section of the 22,000 miles of established airways. In 1931, the system flew 14,100,000 passenger-miles without an unusual incident of any kind. To date these international airlines have carried more than 130,000 passengers, have flown 32,419,349 passenger-miles, and have transported nearly 8,000,000 pounds of mail and cargo.

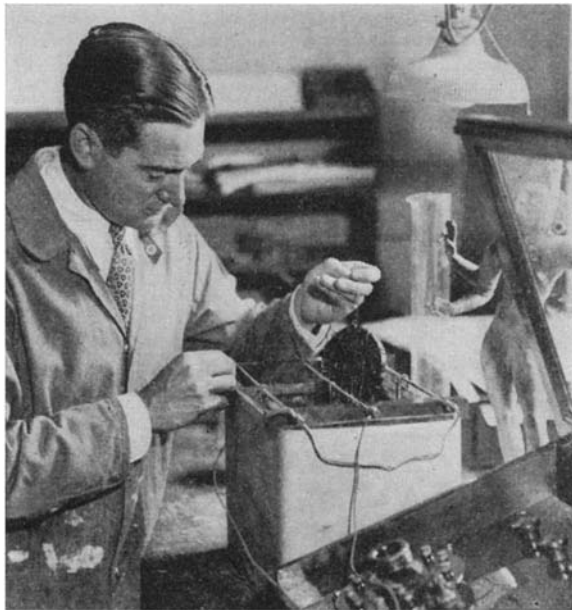
Through these airlines the United States has its first unified contact with every capital of our neighbor republics. And because that contact is the essence of our progress, new and unhampered by out-worn concepts of political diplomacy, it is receiving not only the support of American business interests it was primarily designed to assist, but it also enjoys the enthusiastic co-operation of the governments and, through them, of the people of all Latin America.

# FROM THE ARCHEOLOGIST'S NOTE BOOK

## Curing "Disease" in a Valuable Egyptian Bronze

THE Museum of Fine Arts of Boston recently purchased an Egyptian bronze aegis (symbolic breast armor) in an exceedingly poor state of preservation. It was badly ravaged by "bronze disease." After months of patient labor by the Museum's expert restorer, Mr. Young, it has been brought back to a semblance of its original state. Through the electro-reaction process, the corroding salts were reduced and much of the metal settled down into its original compact state, thereby revealing the elaborate and complete decoration of the piece. The aegis was probably used in ceremonial worship. The

(Continued at right)



head and crown were cast hollow, presumably by the "waste wax" process. There was also a cast counterpoise attached to the aegis by a hinge at the base of the wig. The castings were cut to receive the inlays which are of at least three different substances—electrum (native gold with a large percentage of silver), silver covered with gold, and an alloy of copper. The inlays as well as the main bronze body of the piece were all of light metallic tone. The object dates to the 22d dynasty, 945-745 B.C. This aegis is a type of religious object which has almost completely disappeared. Heretofore it has been largely known through little models made as funerary amulets.



Above: Mr. W. J. Young treating an antique bronze electrolytically. Left: Egyptian bronze aegis before treatment. Right: Same specimen, after this electrolytic treatment, is now beautifully restored



## Ancient Priest's Vestments

THE Metropolitan Museum of Art has recently acquired the costume of an ancient Egyptian priest, perhaps the only one at present surviving. With it came a roll of papyrus inscribed with a funerary ritual for a woman who died in 61 A.D. Being late, the vestments are only imitations of what an earlier priest would have worn. The robe is but a substitute in cloth for the leopard skin which an earlier or richer priest would have worn, and is made of linen cut in the shape of a skin. In place of the leopard's spots, formal rows of rosettes were painted on the fabric, the spots being inside as well as outside.



Costume of old Egyptian priest

## An Exquisite Lacquered Box

A JAPANESE "handy box," dating from the 14th Century, is one of the treasures of the Boston Museum of Fine Arts. It was used to hold the personal articles of a Japanese aristocrat, and is an exquisite example of workmanship. The design on the cover is of a blossoming plum and a willow tree on a hillock. The scene was drawn in gold and covered with black lacquer, which was ground down until the gold was revealed, but the rocks, the birds, and butterflies are in raised gold lacquer. The sun, half veiled by clouds, is inlaid in silver, and the background is sprinkled with gold dust.



A 14th Century "handy box"

# YOUR INTERNAL MENAGERIE\*

By **ROBERT HEGNER, Ph. D.**

Professor and Head of the Department of Protozoology in the School of Hygiene and Public Health, The Johns Hopkins University

**A** LARGE part of the animal kingdom consists of parasites. Those of us who have selected parasitology as a field of research know that every species of animal that has been studied carefully harbors within it one or more species of parasites. Man, for example, is known to be parasitized by about 25 different species of protozoa, 85 different species of worms, and several dozen different species of insects. Many of these parasites appear to exist only in man. A similar condition prevails among domesticated animals and common wild animals and probably is universal. Hence it would appear that there are at least as many species of animal parasites as there are species of animal hosts for them to live in.

The number of individuals belonging to various species of parasites is astounding. The number of ciliates in the stomach of a cow, or cecum of a horse, the number of flagellates in the cecum of a guinea-pig, the number of malaria parasites in the blood of a human being suffering from malaria, and the number of amoebae in a dysenteric patient mounts into the billions.

**I**N this paper I will limit myself to a discussion of one group of parasites in a single host, namely, the protozoa of man.

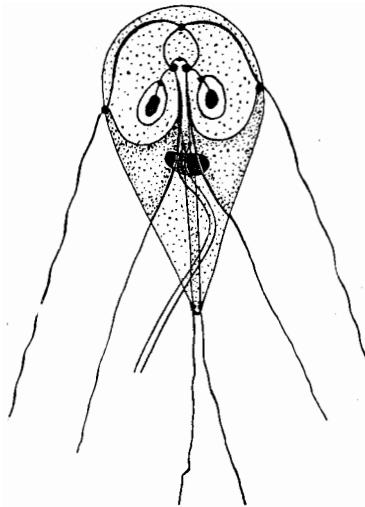
For hundreds of years investigators have been studying the structure and physiology of the human body, and no other animal has ever been subjected to such careful and exhaustive examination. However, when all this knowledge has been assembled, it represents only half of the story. What is lacking is a knowledge of the fauna that use the human body as a residence, a food supply and a common carrier.

When one observes a relative or a colleague he may think he is seeing an individual, whereas, as a matter of fact, he is really looking at a menagerie. The human body may appropriately be compared to a zoological garden closed for the winter. The animals are there but one can't see them because they

**F**ORMER students of elementary biology and others doubtless will recall examining under the microscope the antics of certain tiny one-celled organisms which are called protozoa. Generally it was an amoeba which slowly crawled along in a drop of pond water by extruding little bulges, like legs, wherever it wished from its jelly-like body and literally flowing along in that manner; or perhaps it was one of the ciliates, generally very active, which had what looked like little hairs on its body; or perhaps one of the flagellates which had tiny whips for propelling itself through the water. There are thousands of species of protozoa living in all sorts of places, and a few of these actually live inside other animals including man, some harmlessly, some harmfully. The protozoa are not bacteria, for they do not belong to the vegetable kingdom. They are animals.

Particularly because some of the protozoa in us cause a few of our diseases, there is a special and important corner of the science of biology having to do with all these organisms. In this specialized science of "protozoology" the author of the accompanying article (and of a number of standard treatises on the same subject) is a widely known leader.—*The Editor.*

are kept concealed behind closed doors. Similarly the protozoan parasites of man are concealed from view because they all live inside of the body. But a



The giardia flagellate that inhabits the small intestine of mankind

proper examination will reveal them and I propose that we take a peep through the keyhole into this marvelous assemblage of animal life.

The protozoan parasites of man may conveniently be divided into two groups on the basis of habitat. One group live in the digestive tract and are commonly

known as intestinal protozoa. The other group live in the blood stream and are known as blood-inhabiting protozoa. These protozoa do not wander all over the body at will, but each of the 25 species that occur in man is definitely localized in some particular region of the body, just as free-living animals occupy definite habitats on the surface of the earth.

It is surprising to most people to learn that about one half of the general population are infected with a mouth-inhabiting amoeba. This organism lives in the tartar around the base of the teeth. It has been accused of being the causative organism of pyorrhea but has not been definitely incriminated. Transmission from one person to another no doubt takes place by contact.

The logical conclusion is that those who are not infected have never been kissed. Human nature being what it is, there is no known method of preventing the spread of this amoeba. The other protozoon that lives in the mouth is a flagellate that is also probably non-injurious, although it occurs more frequently in diseased than in healthy mouths.

**T**HE two species of protozoa that live in the small intestine must be able to maintain themselves there against the rapid movement of food from the stomach to the large intestine. One type is a flagellate which possesses a sucking disk, by means of which it attaches itself to the intestinal wall to prevent being swept away. The other type is a coccidium which maintains itself by penetrating the cells of the intestinal wall. Coccidia are all injurious but are very rare in man.

The ten different species of protozoa that live in the large intestine are all more or less similar as regards their life histories. Most of them live in the lumen of the intestine and are harmless; but two of them, an amoeba and a ciliate, are responsible for the production of dysentery and are often lethal. Although 10 percent of the general population is infected with the dysentery amoeba, most of those in-

\*Courtesy of Science

fectured are in the carrier condition; that is, although the organism is present, the human body is able to repair the damage caused by it so rapidly that no symptoms appear. This injurious amoeba is particularly prevalent in tropical countries and is responsible for thousands of deaths every year. Fortunately, several drugs specific for this organism have been discovered, and whereas formerly patients were almost certain to die in agony, now proper treatment just as certainly restores the patient to health.

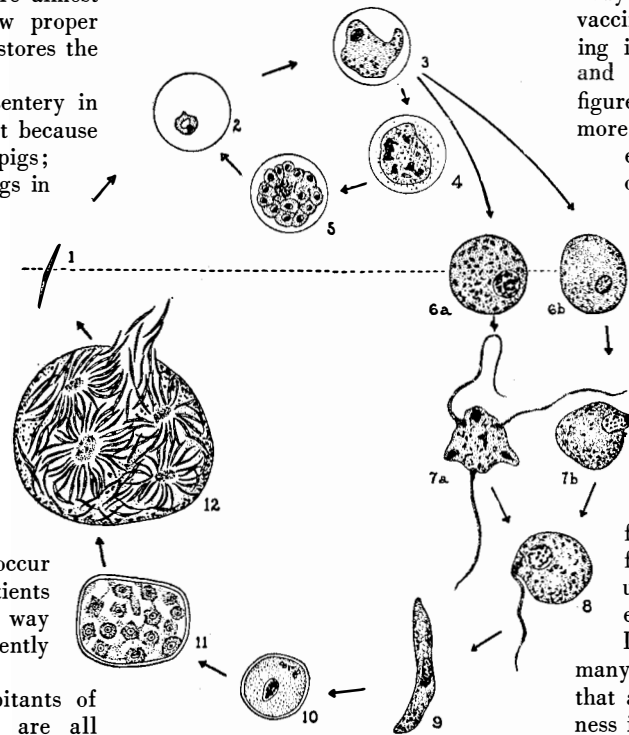
The ciliate that causes dysentery in man is of considerable interest because we share it with monkeys and pigs; probably 80 percent of the pigs in this country have intestines swarming with this ciliate. Apparently they do not injure the pigs in any way, but the cysts that they produce are sometimes swallowed by susceptible human beings in whom they bring about dysenteric conditions. Most people are evidently not susceptible to this ciliate, since our food and drink must frequently be contaminated. A study of the cases that do occur reveals the fact that the patients had been associated in some way with pigs or had eaten insufficiently cooked pork products.

The other protozoan inhabitants of the large intestine of man are all supposed to be non-injurious, although certain protozoologists claim that several species of flagellates bring about intestinal disturbances. From about 5 to 50 percent of the general population may be infected with these intestinal protozoa. Inasmuch as no antagonism exists among these organisms and one person may be infected with the entire job lot assortment, it is probable that all but a very few of us have been unconsciously furnishing a residence and a food supply for several of these parasites and were totally ignorant of it. As a matter of fact, the material used in my laboratory at the Johns Hopkins University for the study of these protozoa is almost all furnished by the laboratory staff.

**T**HERE is an interesting relation between these intestinal protozoa and the character of our diet. Meat-eating animals are not ordinarily infected with them, but vegetarians are very highly parasitized. This situation led to some experimental work which has demonstrated the effectiveness of animal proteins in preventing infection and of carbohydrates in intensifying infections. Casein seems to be the best of the proteins. A diet consisting largely of casein soon brings about a decrease in the number of certain organisms and often

leads to their total elimination. Starch, on the other hand, provides a favorite article of food and results in an enormous increase of certain of these protozoa.

The fact that rats fed on a high protein diet lost their intestinal protozoa suggested at once the treatment of human infections by modifying the diet. A series of menus was prepared in



**Life cycle of malarial parasite.**  
**1:** Infective stages inoculated into blood of man by mosquito. **2-5:** Growth and reproduction in the red corpuscles. **6a, 6b-8:** Sexual stages in the stomach of mosquito. **8:** Fertilization. **9:** Vermicle which penetrates wall of mosquito stomach. **10-12:** Oocyst on stomach wall of the mosquito, within which infective stages develop. **1-5** in blood of man; **6-12** in stomach of mosquito

which animal proteins predominated, but which included such items as pickles and strawberries to make the food more palatable. The results when applied to human patients suffering from digestive disturbances due to certain protozoa were very striking; in many cases the protozoa disappeared along with the symptoms within a week. Two objections to this treatment have been reported; one patient was unable to get strawberries and another patient just couldn't eat pickles.

The blood-inhabiting protozoa of man are local in their distribution. The leishmanias, which cause kala-azar and oriental sore in the Far and Near East, and cutaneous ulcer in South America, are flagellate protozoa, all injurious and some of them very dangerous. The organism of kala-azar destroys thousands of human lives every year in Asia.

Oriental sore is a disease that is called Delhi boil by the inhabitants of Bagdad, and Bagdad sore by the natives of Delhi. It is not a fatal disease, but leaves permanent scars in its wake. It is apt to occur on the face, being transmitted by a biting sand-fly. One attack gives immunity, hence it is the custom in certain eastern regions to inoculate children on some part of the body other than the face, much as we vaccinate against smallpox. The resulting infection is mild, gives immunity and hence insures against facial disfigurement. It is becoming increasingly more difficult, however, because of modern styles of dress, to find a part of the body for vaccination that is not exposed.

Trypanosomes that are responsible for African sleeping sickness are also flagellates. They live in the blood stream and are transmitted from one host to another by tsetse flies. They are able to live not only in human beings but also in game animals, especially antelope; hence the flies have a constant reservoir from which they may become infected. Large sections of Africa are uninhabitable because of the presence of these protozoan organisms. Drugs have been developed in Germany, France and the United States that are effective against sleeping sickness if administered in the early stages of the disease. African sleeping sickness should be distinguished from *Encephalitis lethargica*, a type of sleeping sickness that occurs in this country and is an entirely different disease, the causative organism of which is still unknown.

**P**ERHAPS the most interesting of all the protozoa that live in man is the malaria organism. Malaria is undoubtedly the most important disease in tropical and subtropical regions and in some respects is the most important of all human diseases, since it is responsible for preventing the colonization of vast areas in the most fertile regions of the earth.

As is well known, only female mosquitoes are able to transmit the disease, and even the female is quite innocent of any harmful intention, since she doesn't know the blood she sucks into her stomach is loaded. When she bites, she regurgitates juices from her salivary glands into the blood stream of her victim, and in this salivary secretion are suspended the infective stages of the malaria organism. Malaria could easily be eradicated, therefore, if we could teach mosquitoes not to spit. Malarial organisms occur in birds, monkeys and other animals as well as in man, but the bird malaria parasites are unable to set up infections in human beings.

We are not yet certain whether the parasites of man and monkeys are capable of setting up cross infections.

Much can be done to control malaria by killing mosquitoes, but there are still many problems unsolved. One of the most important of these is the problem of relapse. Quinine and the new drug plasmochin destroy most of the parasites in a patient and give relief from symptoms, but they do not ordinarily eliminate all the parasites and the host is thus in the carrier condition and liable to suffer a relapse at any time. What we need more than anything else to aid us in eradicating malaria is a drug that will destroy all the parasites in an infected person and thus prevent relapses. Many chemists and zoologists are now engaged in studies directed toward the discovery of such a drug.

Even if all the parasites are destroyed, we are in constant danger of reinfection. You probably know about the student who was once asked to name a famous parasitologist of the past. "Milton," he replied, "because Milton wrote 'Parasites Lost' and 'Parasites Regained.'" The problem of reinfection must be solved by those who are in charge of our public health activities. As every one knows, the most conspicuous successes in the field of public health have been the campaigns for the eradication of such diseases as malaria and yellow fever. In fact, the residents of the Panama Canal Zone call a policeman if they are attacked by a mosquito.

**SOMETIMES** one type of parasite preys upon another type of parasite. An interesting and important case of this so-called hyperparasitism that has attracted wide-spread attention during the past decade is that of the effects of malaria on general paralysis or paresis. Malarial organisms, when inoculated into patients suffering from general paralysis, bring about a distinct improvement in the course of the disease. Patients are allowed to go through eight or nine malarial chills and fever and are then treated with quinine to check the malaria. The results of investigations of this type carried on in various parts of the world have almost all been favorable.

One of the most interesting phases of our program is that of host-parasite specificity. In many cases a particular species of host is parasitized by species of protozoa that occur in no other species of animal. Thus the 25 species of protozoa known to live in the human body are rarely found in lower animals. The rat, for example, which is so closely associated with man and lives on a somewhat similar diet, is parasitized by at least seven species of protozoa that belong to seven genera represented among human protozoa; these seven species, however, are visibly different in

structure and may easily be distinguished from species belonging to the same genera in man.

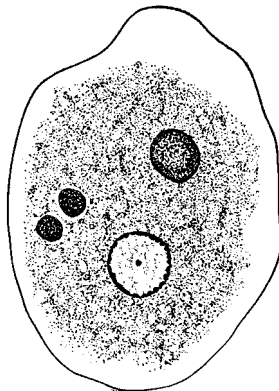
This is not true when the protozoa of man and monkeys are compared. Of the 25 species that live in man, 20 indistinguishable from them have been reported from monkeys and only three species have been recorded from



The blood-inhabiting trypanosome flagellate that causes African sleeping sickness (not the disease familiar in this country)

monkeys that are not known to live in man.

The protozoan parasites here described are considered to be normal inhabitants of the human body, and all of us probably serve as hosts for one or more species. The expression "we all" often applied by Southerners to a single person, appears therefore to be quite appropriate. In many regions, where such diseases as malaria occur, every human being is infected from soon after birth until death.



In the human large intestine this amoeba causes amoebic dysentery

Fortunately for us, most of our protozoan parasites are not destructive, and we carry them about with us unharmed. It isn't pleasant, however, to realize how many millions of creeping microbes use our bodies as a protozoan universe, and it is natural for us to want to do something about it. Much has been done and is being done.

However, protozoology needs more publicity than it has at present; probably not one person in a carload even knows that such creatures as protozoa exist. Perhaps, in the course of time, biologists may be able to defaunate the human body and thus initiate a race of supermen. Modern facilities for rapid transit are, however, making this continually more difficult. Disease-produc-

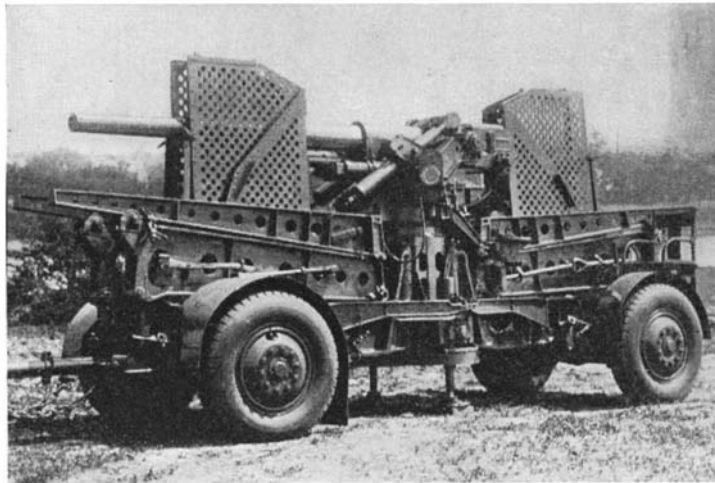
ing organisms may be transported from one locality to another and for long distances either by human carriers or by intermediate hosts.

The intermediate hosts of protozoan parasites are usually flies and blood-sucking insects; these are frequently transported from one country to another. It is usually not necessary, however, to take drastic action for the purpose of preventing the importation of animal parasites into the United States because of their complicated life-histories. For example, trypanosome diseases can not be transmitted in a locality where certain species of tsetse flies are absent, even if animals with trypanosomes in their blood are present in large numbers.

**O**NE field in which the study of the protozoa of man has taken a leading rôle is that of rendering the tropics as habitable for man and his domesticated animals as are the temperate regions of the earth. Such conquests as those of malaria and yellow fever in Havana and the Panama Canal Zone have a distinct bearing upon one of the greatest problems before mankind at the present time—the problem of population. Statistics show that the world's population has increased about two and one half times during the past century. Many methods of preventing further increases in population have been suggested, but no one can predict what the future may have in store for us in this direction. We must, however, face the problem that confronts us today. In tropical countries large areas of land exist that are now sparsely inhabited and unproductive. That these tropical regions can be made healthful to men from the colder regions of the earth has been proved again and again by various nations that have founded colonies in the torrid zone. To do this it has only been necessary to control certain diseases, and these diseases have been for the most part due to animal parasites or their transmitting agents.

My statements may lead you to believe that we think we really know something about the protozoa of man. This, however, is far from the truth. One has only to look back to the situation that existed 30 years ago to realize our own position today. Zoologists in 1900 believed that they were living in an enlightened age, but now we know that they were densely ignorant. It seems probable that in 1960, 1932 will likewise be considered among the zoological dark ages. Hence, although we have made a good beginning in the study of parasitic protozoa we must continue our efforts until we are able to escape from the humiliating condition that exists at the present time and man ceases to be held in bondage by his invisible fauna.

# NOW THE GUN CARRIAGE IS WELDED



The three-inch anti-aircraft mount, the most modern type of post-war gun carriage, which was considered best for the gun-carriage welding tests

**I**T would be difficult for anyone not familiar with ordnance practice to appreciate the dependability which must be built into a piece of ordnance, said Major G. M. Barnes, of the Watertown Arsenal, in his paper which won the second prize in the Second Lincoln Arc Welding Prize Competition. In war, ordnance must function under the most adverse conditions in the field where repairs are exceedingly difficult, if not impossible, to make. If a piece of artillery goes out of action for a few minutes due to a minor mechanical fault, its whole value may be lost; a weak or defective part may also result in the deaths of several men.

Modern welding had never been used in the construction of gun carriages by the Ordnance Department until the work described in Major Barnes' paper was undertaken at the Watertown Arsenal. In fact, there was a ruling against the use of any welding in gun and gun carriage work, for it was considered an unsatisfactory method of construction, and dangerous because practically all parts of the carriage must resist large impact forces.

The three-inch anti-aircraft mount (mobile), shown above folded on its

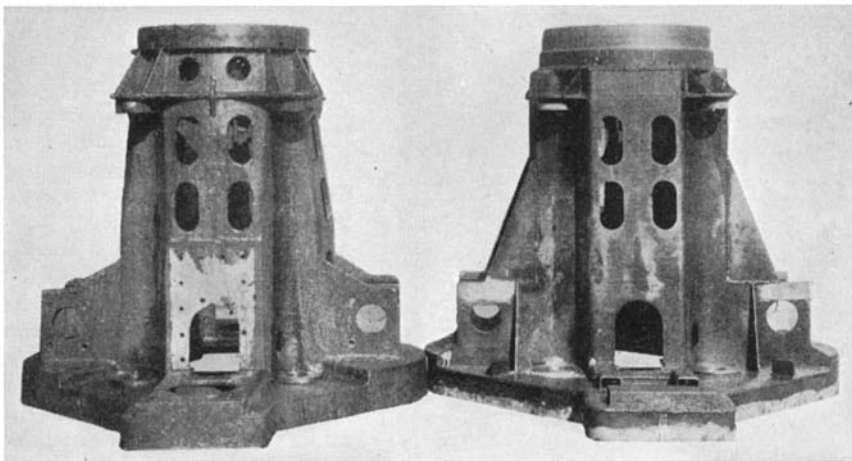
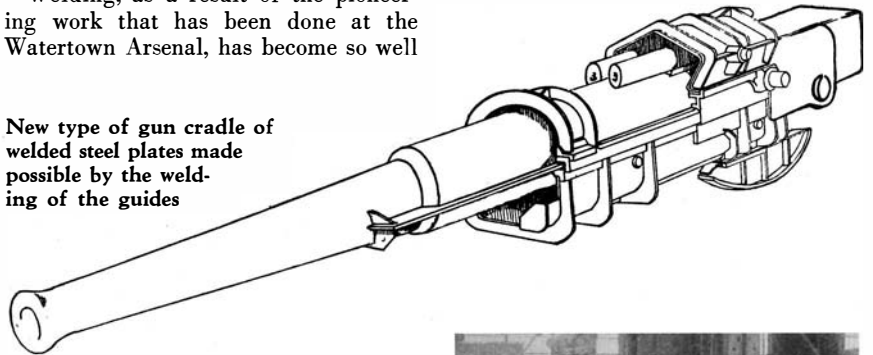
trailer, was selected as the best carriage on which to test the possibilities of welding, and it was felt that if success could be obtained in welding parts for this carriage, there would be no question concerning its successful application to other types of artillery. In all, there are 1211 parts used in the construction of this carriage, but only the principal ones are shown on this page.

Welding, as a result of the pioneering work that has been done at the Watertown Arsenal, has become so well

established as a process of manufacture, that several new types of ordnance have been built recently in which welding was adopted at the outset so that the parts were designed originally as welded members. When this has been done, the welded parts are invariably lighter, less complicated, more easily fabricated, and considerably cheaper.

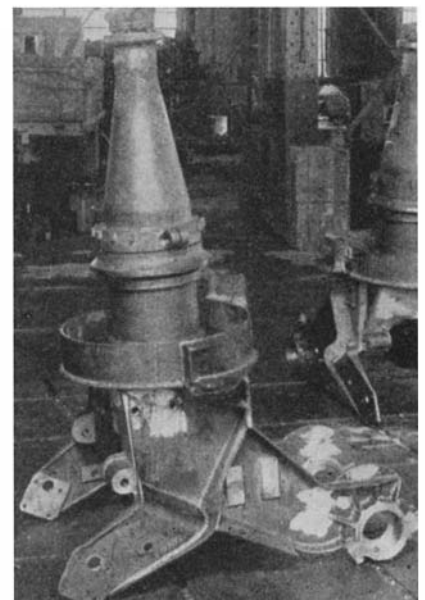
In this work, it has been found that designs can be made of welded members that would have been impossible if cast components had been employed, and production is much more rapid.

New type of gun cradle of welded steel plates made possible by the welding of the guides



Photographs courtesy Lincoln Electric Company

Above, left, is shown the old cast steel pedestal for the three-inch gun and, right, the welded design. To the right: Welded top carriage, the shaft of which fits into the pedestal. Several hundred pounds were saved by welding these

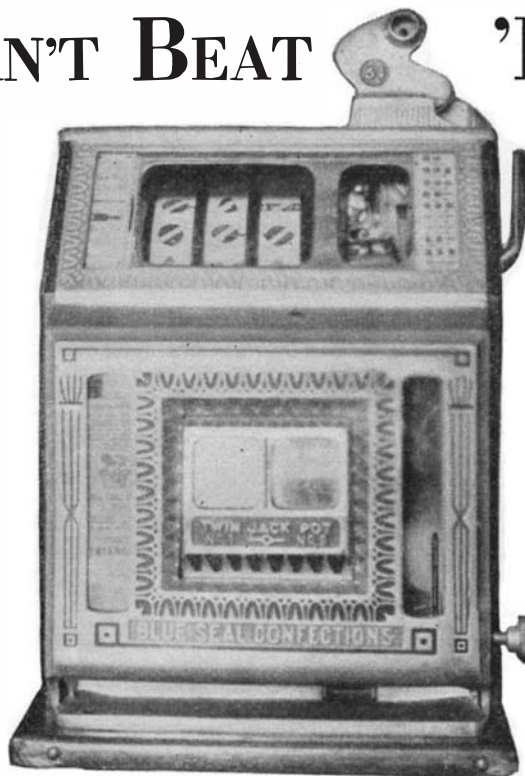


# YOU CAN'T BEAT 'EM

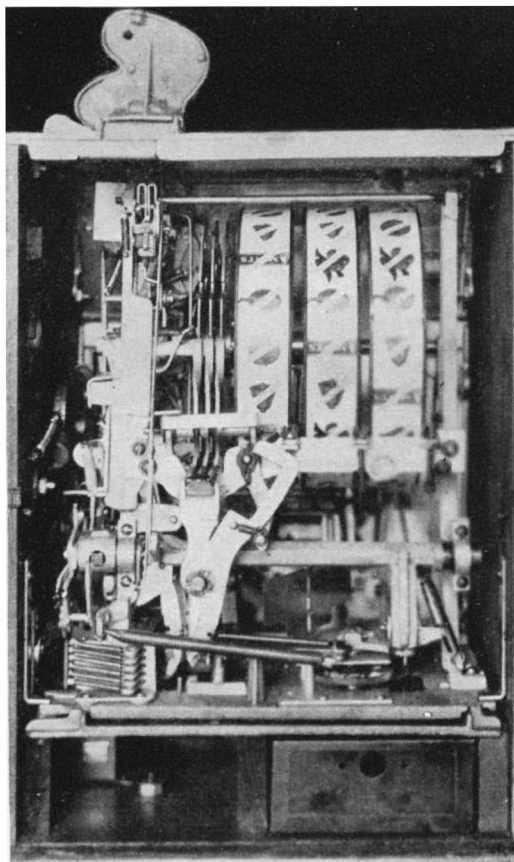
OF the many clever devices which have been created for the purpose of separating the gullible from their money, probably the most widely distributed and simplest to operate is the so-called "slot machine" of the general type illustrated here. These are to be found in more or less open operation throughout the country in small stores, barber shops, restaurants, and—*s-h-h-h-h*—speakeasies, and are variously designed to be played with nickels, dimes, quarters, and half dollars. At least one manufacturer of these devices puts out models for foreign trade, operable with foreign coins.

For those who are not familiar with the method of playing these slot machines, the following description will serve to make more lucid the description of the internal functioning of the apparatus, and of how the machine takes your money and gives you little or nothing in return. As you stand before the machine, you will find near the top a slot into which may be dropped a coin of the proper denomination. At the right-hand side is a lever. Behind a glass plate are three wheels, placed edgewise toward the player and each bearing pictorial representations of various fruits interspersed with occasional bars. One of the fruits is, very aptly, a lemon. In most of the machines is a "jack-pot" consisting of a small glass-covered receptacle in which may be found a varying number of coins or metal disks (slugs). The following description will be concerned only with one of these "jack-pot" machines.

**YOU** drop a coin in the slot, pull the lever, and the three wheels whirl around. Soon they come to a stop, one at a time, and lined up just behind the glass plate will be seen three fruits or bars, one on each wheel. If you are lucky and have "hit" the proper combination, there will be a slight pause, a click from the interior of the machine, and a number of coins or slugs will be delivered to the opening at the base of the machine. Since you played with a coin, it is now possible for you to receive a package of mints—but only if you twist the proper knob or push the



By A. P. PECK



*Upper photo: One type of slot machine, in which candy is delivered only if knob is turned. Lower: Back of same machine. Delayed-action device is in the lower right corner*

proper button. The machine does not act automatically as a vending machine, the machines, in the words of a Supreme Court Justice, "being operated under the guise of selling candies primarily for gambling purposes." And, by the way, the candies that the writer has obtained from machines of this sort were of the cheapest, most unpalatable kind.

Two methods of playing these machines are possible, and may be interchanged at will by anyone having access to the mechanism. They may be straight gambling machines, taking in coins and delivering other coins when the proper combination is obtained, or they may be operable with either coins or slugs, in which case they deliver only slugs to the lucky player.

The slugs are marked with a legend similar to "Good for Amusement Only" and a label on the machine informs the player that the slugs may be used only to operate the machine again (no candy can be obtained when this is done) and that they have no cash value. In the majority of places where these machines are placed, however, the owner or proprietor will redeem the slugs for cash or merchandise.

**BUT** we are not concerned here with either the legal aspects of gambling or non-gambling with these machines, or with the moral side of the question. The intent of the machines is self-evident, and the most interesting phases are the internal mechanism and the method by which the machine takes your money and hands you out something—or nothing.

Through the co-operation of Hon. Edward P. Mulrooney, Police Commissioner, New York City, we have been able to obtain the accompanying series of photographs which show the interior of a slot machine. This is of the jack-pot type, and it is this jack-pot that serves as the greatest drawing card or come-on for prospective players. Comfortably filled with coins or slugs, it stands as an invitation and incentive to keep on playing until you "hit" it and the contents are delivered. But how often can it be "hit"? On one machine which



the writer investigated, the mechanism was set so that it was impossible to line up three bars—the symbolic combination which is necessary to open the jack-pot. In another and fairer machine, there was one chance in 1000, mathematically calculated. In other words, on a nickel machine, you might play 50 dollars' worth of nickels before you get the jack-pot, although in the meantime you would undoubtedly obtain other combinations that would pay two, four, eight, twelve, or sixteen coins or slugs.

**T**AKEN as a whole, however, the percentage which the machine pays is on the order of 70 percent, and may range from about 65 to 75 percent. Thus, if you play consistently, the machine will retain at least 25 percent of your money. Of course, as in all gambling devices, if you are lucky enough to make a strike on the first one or two plays, and then stop, you will be ahead of the game. But to stop is not human nature, and it is the human trait of wanting something for nothing upon which these machines—and all other gambling devices—are based.

Now, let's take a look inside one of these machines. The back is securely fastened with a high-grade lock to guard against theft. When this rear panel is removed, the first thing one notices is the mechanical complexity

of the interior. However, when studied, it becomes apparent that most of the works is for the purpose of protecting the machine from being cheated. It is evident that if any cheating is to be done, it is to be one-sided—and that one side is not to be the customer's.

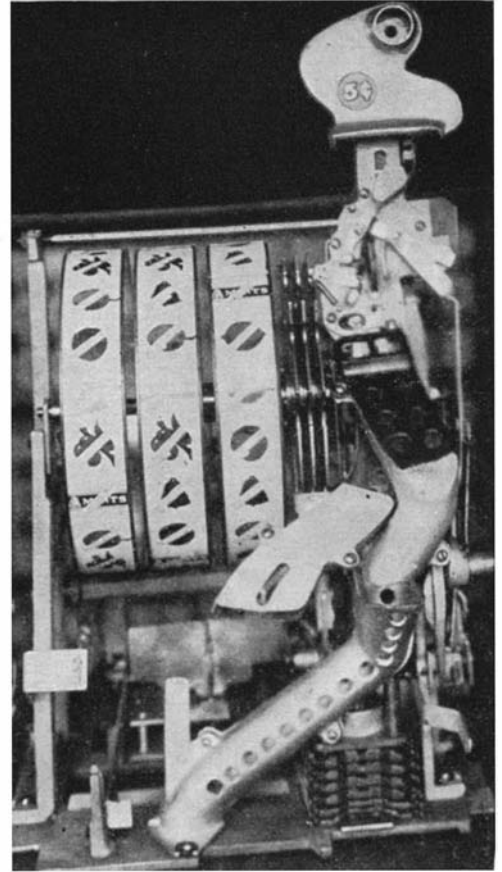
As the mechanism is traced down, it becomes relatively simple. First there is the unit that allows the lever to be pulled only after the coin or slug is inserted. Then there are the chutes through which the coin or slug is delivered to either the coin chute or "pay-out" tube (from which winnings are delivered when a lucky combination shows up), or to the jack-pot, or to the coin box. Once it gets in the latter it is gone from circulation until the owner of a key opens the back of the machine and collects.

The three wheels are prominent parts of the mechanism, and next to them and on the same shafts are three metal disks, one corresponding to each wheel. In the edges of the disks are notches by which they are held in position until the machine is operated and by which they are locked at the completion of each play. In their faces are series of

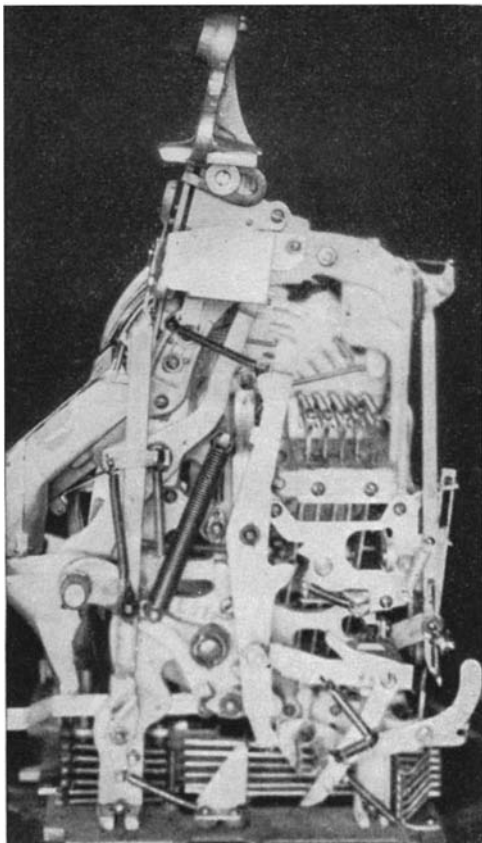
holes. Beside these disks is a group of spring-operated levers so placed that when the disks come to rest at the completion of a play they will, if the proper combination is obtained, drop into certain combinations of holes. These levers actuate another set of levers which in turn operate a metering device at the bottom of the machine, through which is delivered the number of slugs or coins called for by the combination. If the jack-pot is called for, all the levers of the first set fall into holes and the jack-pot operating mechanism is released.

**W**HEN the operating lever is pulled by the player (or should we say victim?), a spring is wound up and then released to operate a small clock-work. This timing device delays the functioning of the coin-metering mechanism until after the wheels and their corresponding disks have come to rest.

When the slot machine is delivered to the distributor or to the owner of the place in which it is to be operated, it is ostensibly a vending device and a "fortune teller." This latter phase is im-



Front of mechanism, with case removed. Long curved tube leads to money box; short one to jack-pot. Back of money-box tube is pay-out tube to metering device



Side of slot machine mechanism showing, near top, spring operated fingers that control paying mechanism when they drop into holes in disks in background

material to the present discussion, consisting merely of the appearance of allegedly humorous legends together with the symbols on the wheels. A machine in this condition may be played with either slugs or coins, but will pay out only slugs, coins going directly to the money box. However, a few moments of work will change the mechanism so that it will be a straight gambling device. (The connotation of the word "straight" is not that of honest.) In one machine, a little spring, released by the fingers, serves the purpose of conversion from a "vending" machine to one that is as surely meant for gambling purposes as are the wheels at Monte Carlo. In another type, a metal pin is removed to accomplish the same result. Most machines in this altered condition will operate with either slugs or coins, but will pay only if the proper combination shows when a coin is played.

**W**HEN a slot machine is received from the factory and is to be placed in operation, it must first be loaded. This means that the "pay-out" tube must be filled with either coins or slugs, according to whether the machine is for "vending" or gambling. This is done by pulling out a lever in the back of the mechanism and feeding

(Please turn to page 376)

# SHOTGUN SHELLS IN THE MAKING

**T**HERE are 6,000,000 hunters and trap shooters in the United States who fire between 800,000,000 and 900,000,000 shotgun shells annually. The raw materials for these shells come from the ends of the earth as well as from our own country. Even China adds its quota; antimony sulphide comes from the Changsa region where coolies mine the ore and smelt it by age-old methods. Everything needful arrives at the factory in convenient form for fabrication.

The shot is formed or "dropped" in a shot tower which is always a minaret-like structure. In Bridgeport, Connecticut, the shot tower of the Remington Arms Company, Inc., was for a long time the loftiest building in the state. It looks as though a long climb is in store for the visitor, but two elevators render the ascent easy. Everything is in duplicate, and the capacity of the tower is about 125 tons of shot a day. What is known as "soft shot" is composed of pure lead but most of the shot is made of an alloy of lead and antimony; the latter metal gives hardness.

The composition of the alloy is determined by the plant chemist and the metals are melted together on the ground floor and run into pigs or ingots. When metal is required for shot making, the pigs are raised to the top of the tower where they are remelted in ten-ton kettles. Oil fuel is used and the melting temperature is 621 degrees Fahrenheit. The molten metal is dropped from perforated iron "frying pans" or sieves into the 120 foot high shot-tower tube, which is 10 feet in diameter. The perforations in the sieves are about one half the size of the shot being made at the time.

**W**HILE the molten metal is running through the sieve, drops are formed on the under side and released by the action of a little hammer or vibrator striking on the edge of the pan. The bits of lead make a rapid descent, landing in water at the foot of the tower. In falling, the shot becomes round and hard

enough to retain its shape. The water cools the shot, which is then elevated directly from the tank to a cleaning machine that takes out all odd par-

ticles of metal. A drier removes the moisture and the shot is raised to one of the floors near the top of the tower where it is run through a polishing machine with graphite added.

The shot then goes to the inspection tables. The table contains triangular sheets of plate glass about two feet long and set at an incline. The polished shot runs from the top to the lower edge. If the pellet is round it acquires considerable speed and at the lower end jumps over a sharp partition, lands on the next glass plate below, and runs another marathon. This is repeated over four plates. If, however, the pellet is not round that is another story. The least roughness of surface or lack of roundness is a handicap to its speed; its motion is retarded and it falls short of the sharp edge of the partition and goes into a scrap conveyer to be melted over again.

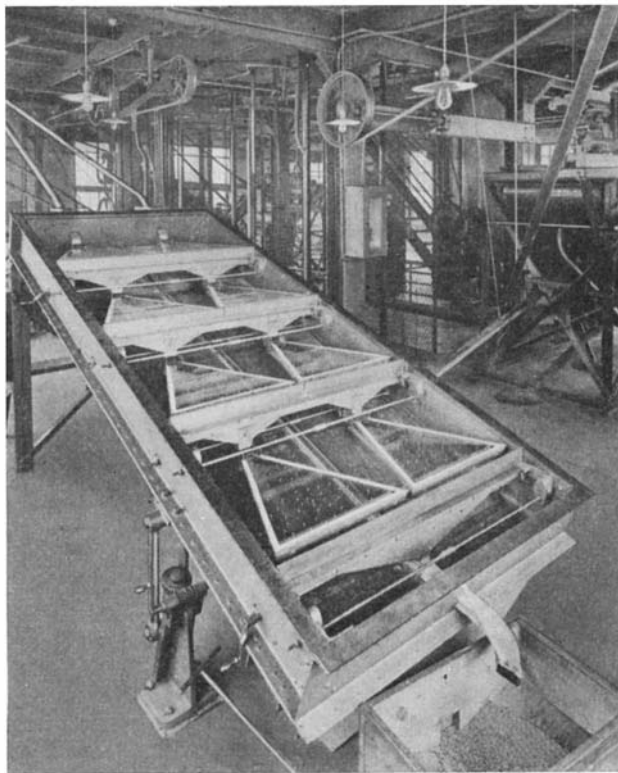


The melted lead or alloy passes through the hundreds of holes in an iron sieve, and falls in globules to the tank of water 120 feet below

**A** SERIES of steel drums with drilled and reamed holes serves to sort the sizes of shot. Then the shot is again polished and run into storage tanks waiting to be requisitioned by the loading department. This method applies to the smaller sizes of shot; large sizes are cast. Coppering of shot electrolytically is a recent development or refinement that gives the shot a hard skin so that the pellets are less likely to be deformed in shooting.

The various metal parts of the shell—heads, primer cups, and so on—are punched out of brass or copper of the proper thickness and are then "drawn" in presses to the proper shape. It is necessary to anneal and wash the pieces between each drawing operation since brass hardens when worked. Many special machines are used in fabricating these parts of the shell.

The primer of a shell has been likened to the spark-plugs of an automobile. If the primer fails, powder and shot are useless. The older primer mixtures called for potassium chlorate and fulminate, which are dangerous



All photos courtesy Remington Arms Company

All shot is passed over a series of tilted glass plates. Deformed shot either roll off the side of the plate or fail to gain enough speed to jump the gap to the next plate

substances to handle. Furthermore, as long as black powder was used there was no difficulty in keeping gun bores free from rust, but with the advent of smokeless powder it was found that guns had a tendency to rust after a day or so. It was then discovered that the primer mixture residue, with an affinity for water, was largely to blame. The next step was to develop a primer mixture which would ignite the powder satisfactorily and which would not leave a residue that would collect moisture.

**T**HE paper for the shell tubes is manufactured especially for the purpose and is cut into pieces 12 by 14 inches in size. The name of the brand is usually printed on the paper before it is fed automatically over a roller running through a trough of special paste. The paper then wraps around a mandrel of the diameter required for the gage shell being made. The tubes are then conveyed in metal baskets by trolleys to conditioning (drying) ovens and then are dipped in large tanks of melted paraffine. After draining and cooling, the tubes pass through a high-speed revolving steel die which irons or polishes them, rendering the surfaces hard and smooth and of the correct inside and outside diameter. The tubes then feed into a machine which cuts them into sections of the right length to form shells.

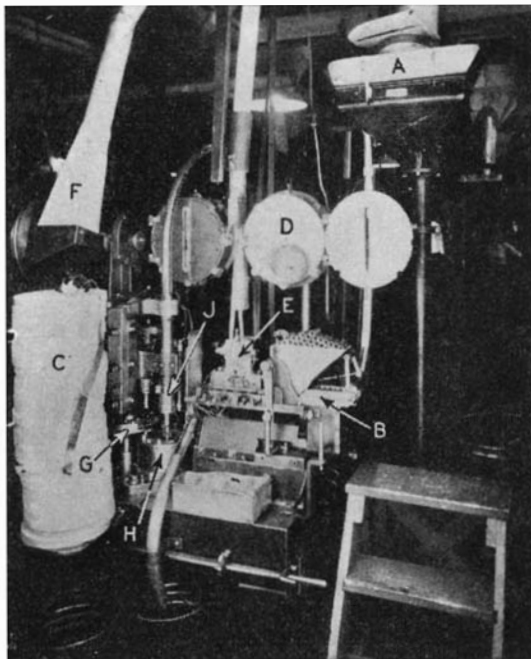
In the assembling machine the metal base is secured to the paper tube and the base wad, with a hole in the center, is wound from a roll of paper strip and forced into place. The other wads are made of cardboard or felt covered with paper. The assembled, but as yet empty

shell, and the wads are then sent to the loading machine.

While there is very little danger in loading shells, every possible precaution is taken. The explosives, or as the manufacturers call them, the "propellents," are sent by railroad to the plant in drums containing 25 to 50 pounds. The box cars are run into the large "powder park" where the shipment is broken up and stored in magazines protected and separated by earthworks. When needed, the drums are taken to isolated buildings and the powder is placed in rubber-capped brass containers holding 1½ to 2 pounds. The powder car, carrying these containers, leaves the pow-



The powder in rubber capped containers is brought by train from the "powder park" once an hour and is passed through a trap door in the wall to the individual loaders

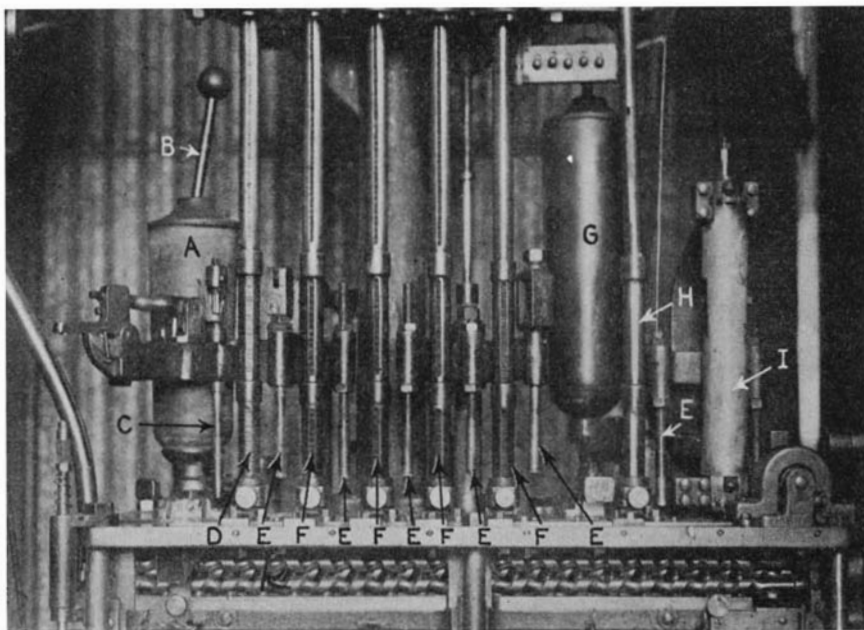


In the assembling unit the base wad is wound, forced into the paper shell, and head assembled in one operation. A; hopper for paper bodies; B; conveyor screws; C; base wad paper; D; hopper for base wad paper; E; base wad spindle; F; hopper for brass heads; G; dial for feeding heads; H; dial for seating heads; J; shell pick-up

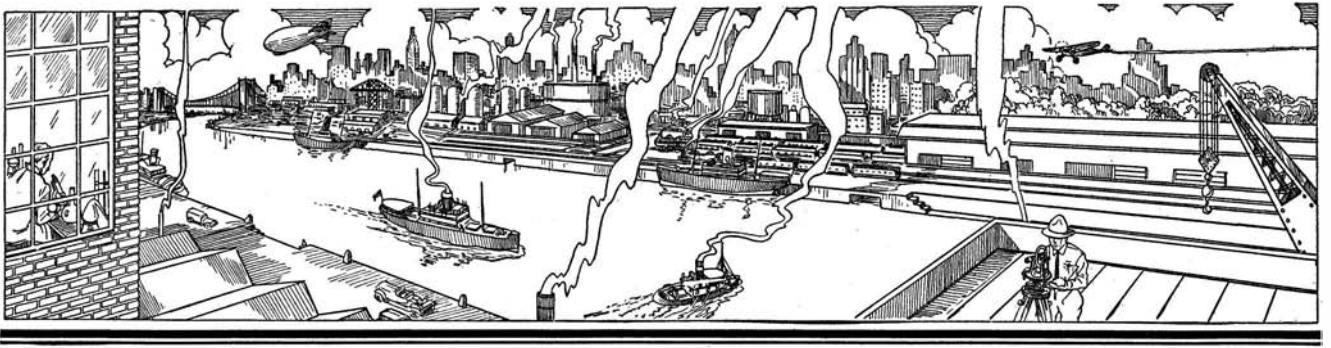
der park about every hour. On arrival at the loading building the containers are removed from the car and transferred through a trap door in the wall.

**E**ACH loading machine is automatic, but is under the constant inspection of an expert loader. The empty shells are fed from a hopper at the left and one by one they are carried to the first position where they receive the powder charge which is mechanically inspected by a plunger which gages the height of powder in the shell. If there is too much or too little powder the machine stops until adjustments can be made. The next revolution of the machine carries the shell forward to receive an over-powder wad. Felt wads are inserted and compressed to just the right height. Another revolution of the shaft brings the shell under the shot magazine and a definite amount of shot drops into the shell. One more revolution and a shot wad is forced down over the shot and at the next position a crimping device secures the wad, which also receives a small quantity of waterproofing material. The shells are then packed and are ready to be shipped.

It is truly remarkable that a shell which requires over 850 operations before it is ready for use in a gun can be sold at a price which is less than that of a package of chewing gum. The reason is, of course, mass production on a huge scale with the aid of cleverly designed machinery.



The empty primed shells are fed at left and halted for insertion of powder, wads, and shot. The parts are as follows: A; powder hopper; B; powder gage; C; powder inspection plunger; D; over-powder wads; E; wad seating punch; F; filler wads; G; shot hopper; H; over-shot wads; I; crimping device for shell end



# THE SCIENTIFIC AMERICAN DIGEST

Conducted by **F. D. Mc HUGH**

## Stainless Steel Beer Kegs

**I**F modern brewing practice in Germany, Switzerland, and England foreshadows developments likely to occur here some day, American stainless steel will find another sizeable market in yeast wagons, fermentation vessels, pipe lines, valves, buckets, and shovels. The Electro Metallurgical Company points out that even the old familiar beer keg is giving way abroad to shiny drums of "18-8" chrome nickel steel.—*A. E. B.*

## Mercury Vapor Power Plant Nears Completion

**I**N line with modernization, the General Electric Company is vigorously pushing the construction of its big new mercury vapor power plant at Schenectady, which will cost 4,000,000 dollars. The present prospect is that the plant will be ready for operation next spring. This modern, economical power station, using a mercury boiler and turbine, a development of General Electric engineers, was discussed in the November, 1931, issue of *SCIENTIFIC AMERICAN*.

From an engineering viewpoint the power plant is, in several respects, unusual. It

## Contributing Editors

**ALEXANDER KLEMIN**

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will be the first outdoor steam-electric generating plant ever built, and it also represents the first instance of co-ordinating utility and industrial power needs, building immediately into the system the use of a mercury boiler and turbine. The electrical output of the power plant will be fed into the commercial system of the New York Power and Light Corporation, while the steam output will be used in the Schenectady plant of the General Electric Company. According to the estimates of the engineers, the plant will produce steam and kilowatt hours of energy at a cost lower than has ever before been attained.

## A Ford Six?

**I**T has been rumored about that the Ford Motor Company is now working on a six-cylinder car to replace its present four and be a companion car to the present eight. That company is, as everyone knows,

so secretive about future plans that there is no way of verifying this rumor but it is repeated here on the authority of one of the most expert observers in the Detroit area. To back up his opinion, this observer states that certain orders for parts for the four have been cancelled and this, together with other significant facts, causes him to



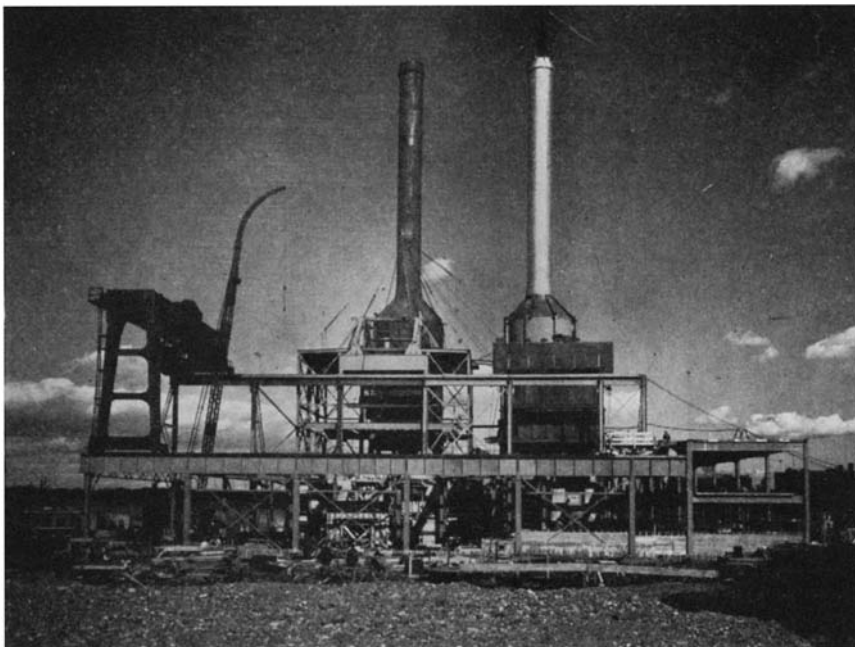
The plaque which is to honor Alfred Ely Beach, for first subway

conclude that there is more than a grain of truth to the belief that the four is to be discontinued.

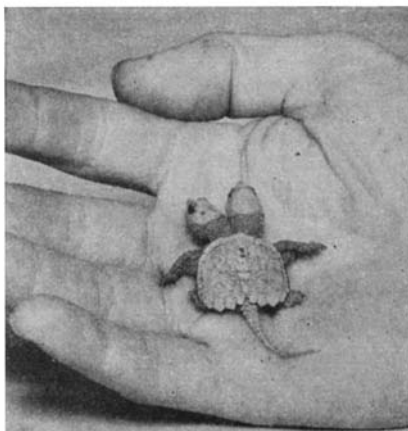
## Former Editor Built First Subway

**A** CO-FOUNDER and former editor of *SCIENTIFIC AMERICAN*, Alfred Ely Beach, is soon to be honored as the builder of the first New York subway by a plaque which is to be installed in the City Hall Station of the B.M.T. Lines, New York City.

His subway was conceived in the 60's, in the earlier years of his long editorship of this journal, as a plan for city-wide collection of the mails. After much experimentation and years of effort to obtain a charter for the work, it was finally agreed that he could build an experimental line if he did not dig up the streets. He set to work at once using the "iron mole" for the hidden tunneling work. In February, 1870, he announced completion of his short line, only a block long, ending at Warren Street on Broadway. It had cost him several hundred thousand dollars. One car in the tube was blown by a huge fan which was operated by a 100 horsepower steam engine, from one end to the other, and then was sucked



The new outdoor mercury-vapor power plant nearing completion at Schenectady



Not Siamese twin turtles, but a living two-headed mistake of nature

back to the starting point by reversing the fan. Crude as it was, it became a popular pastime to ride on this "subway" with its attendant "hurricane." In the two years it operated, the 25-cent admissions were turned over to charity.

Because of the success of this venture, a charter was granted for the Beach Pneumatic Transit Company, but nothing came of it for the panic of 1873 made raising of the necessary 10,000,000 dollars impossible. The old tube was closed up and forgotten until, years later, it was unearthed as a new subway was being built. It is now a part of the B.M.T. City Hall Station.

The plaque to honor Mr. Beach is being designed by Waldemar Rannus.

### Drinkers Susceptible to Carbon Tetrachloride

**D**ON'T use carbon tetrachloride if you have a "hang-over." This chemical, widely used for dry cleaning, for cleaning machinery, as a fire extinguisher, and in the treatment of hookworm disease, is often poisonous, and particularly so to persons who drink alcoholic beverages or who do not get enough calcium in their food.

Seven employees of a felt manufacturing plant, all wine drinkers, were poisoned by carbon tetrachloride when they used it in large quantities for cleaning the felt, Dr. L. W. McGuire of Boston has reported to the American Medical Association. When the fluid was used in small amounts to remove individual spots, the men had not been affected by it. When the felt was passed through a large, warm bath of the chemical, all the men became ill and one nearly died.

Calcium lactate or calcium chloride are successful remedies for treating carbon tetrachloride poisoning, Dr. McGuire stated.—*Science Service.*

### Moth-Proofing Soap

**A** NOVEL idea for preserving wool materials against attack by moths is covered in a recent British patent and consists of using in washing processes a soap which contains suitable moth-proofing substances. In this manner a fresh supply of moth-proofing agent is incorporated with the fabric or garment at each wash, this being in marked contrast to the practice now current of washing such that moth-proofing agents previously incorporated in the fabric are largely removed and their values consequently lost. The following is an ex-

ample of a satisfactory moth-proofing soap:  
 Soap ..... 90 parts  
 Tri-phenyldichlorobenzyl-phosphonium  
 chloride ..... 10 parts  
 —A. E. B.

### A Two-Headed Turtle

**A** TWO-HEADED turtle was recently taken to the Research Laboratory of the General Electric Company by F. B. Cliffe, chief statistician of the company, whose nine-year-old daughter found it near a small lake at Schenectady. The turtle, of the snapping variety, was born September 24, along with more than a dozen normal brothers and sisters. It was taken to the laboratory so that X-ray photographs could be obtained of the unusual reptile and because turtles are a particular hobby of Dr. W. R. Whitney, director of the laboratory. The radiographs revealed that the turtle has a division in its spinal column, so that its two heads terminate the ends of a Y-spine.

The freak's two heads, four legs and tail are normal in appearance, but its shell is wider than usual, humped in the middle, slightly pointed on the front end, and indented over the tail. The two heads behave normally, and it is apparent that they

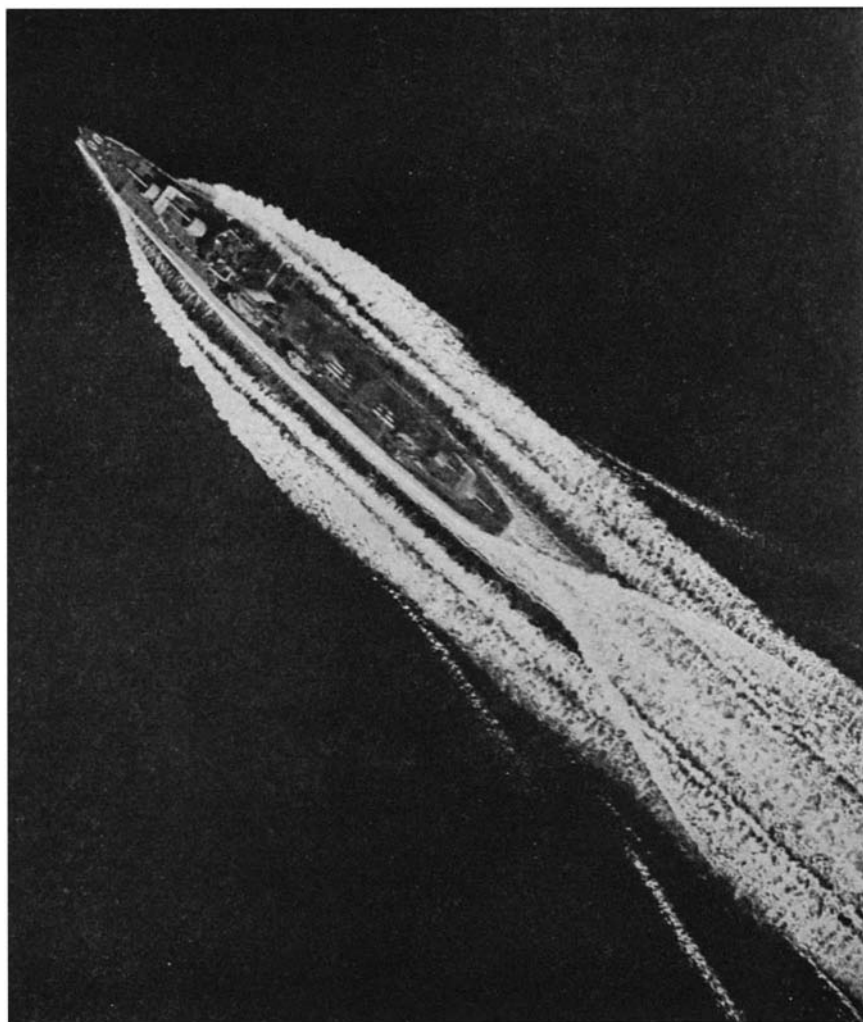
react independently. Each seems to control the two legs on its side of the body, for at times the turtle attempts to travel in different directions at the same time. At other times one head may be under water while the other is above, or the turtle may be sleeping with one head while wide awake on the other side. The right-hand head is slightly larger than the other, but it has not been noticed that either predominates in reaching decisions.

Ordinarily a turtle walks with alternate leg motions—the front right and rear left legs forward together. The two-headed turtle has been seen to walk this way some of the time, but more frequently and with more success it progresses by moving its front legs forward at the same time.

### Cold "Remedies" Sometimes Over-rated

**I**N autumn and winter, people remain indoors more, and susceptibility to colds increases. The hazard is greater also because, with the opening of school, infectious diseases are more prevalent.

These maladies, such as measles and other diseases common to children, generally appear with symptoms comparable to those of a cold, says Dr. F. J. Cullen,



An interesting study in wave pattern: the wake of the new flotilla leader, *Dubrovnik*, which was completed this year for the Royal Yugoslav Navy by Yarrow and Company of Glasgow, as seen from the air while she steamed at full speed. Her length is 371 feet, her displacement 2400 tons, and her speed 37 knots. The United States, notwithstanding her large destroyer fleet, possesses not a single destroyer flotilla leader despite our urgent need for several ships of this indispensable type for our fleet and our many years of effort to obtain them

of the Federal Food and Drug Administration. Mothers should be on their guard against such troubles and should realize that medicines ordinarily used for colds are of no value in the treatment of more serious diseases.

"For many years scientists have been working to find the causes and proper treatment of colds," Doctor Cullen states. "So far their work has been of little avail. There are medicines on the market recommended for colds but their main benefits are relief from some of the symptoms. The individual must trust to more reliable measures to remove the underlying causes.

"Some manufacturers, through their advertising, lead a purchaser to believe that their products will not only cure colds, but likewise prevent pneumonia, sinus infections, and other serious maladies. Such declarations are not based on facts. While the administration at present is not taking regulatory action against products recommended for the relief of a symptom of a cold, it is removing from the market preparations falsely and fraudulently labeled as having remedial value in the treatment of diseases such as influenza, the symptoms of which are similar to colds."

### Granular Fertilizer

A NEW kind of fertilizer, extremely concentrated in its content of plant food and produced in granular form, was recently announced by Theodore Swann, President of the Swann Corporation.

Said President Swann, "The advantages of a highly concentrated fertilizer are evident when we consider that farmers are paying 30,000,000 dollars annually for transporting and handling ordinary fertilizer,

"This problem has been solved by producing the new fertilizer in granular form. The granules are hard and firm, uniform in composition, dustless, and non-caking even in damp, humid climates.

"Their size and shape permit them to be easily and accurately applied to the soil by means of the simplest type of mechanical distributors. Recent tests show that the granular form of this new fertilizer permits uniform distribution at a rate as low as five pounds per acre, which is a degree of uniform application that has not heretofore been obtained."—A. E. B.

### Thar's Gold In Them Thar Hides!

DESPITE topsy-turvy world money standards, *Ursus horribilis*, the Alaskan grizzly bear, sticks to the gold standard, or rather, the gold standard sticks to him. When a University of Michigan forestry professor, E. C. O'Roke, went prospecting in bear hides brought from the Yukon region, looking for new types of animal parasites, he found the expected fleas and unexpected flakes of gold scattered throughout the fur.

When Professor O'Roke hunts for parasites he carefully combs out the suspected fur and then "pans" the dust in a small dish with water, much as gold is panned by prospectors. Panning his bear dust, the professor was pleased to find fleas, dead and dried up. Looking more closely he saw yellow flakes. Examined under the microscope, with the surrounding organic material stained, the yellow metal gleamed out characteristically and unmistakably.

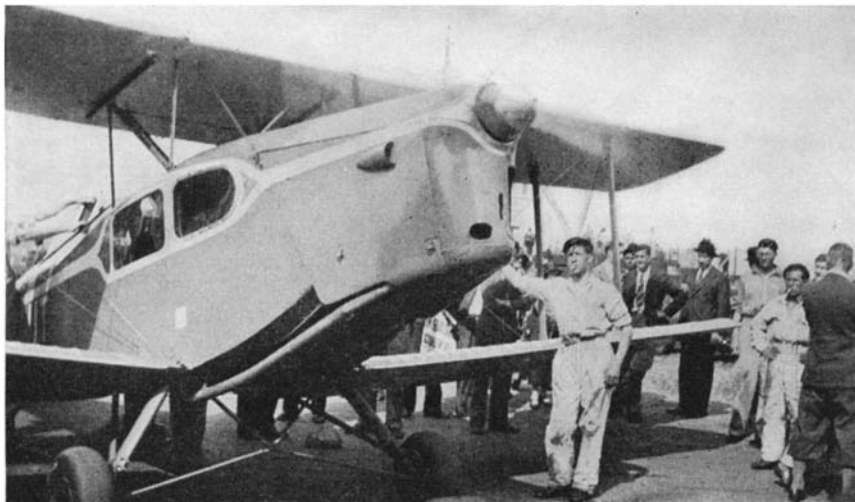
How the bears collected the gold flakes in their thick fur is a mystery. Small

amounts of gold are found in many Alaskan stream beds and the metal may have been caught under the animal's claws, later to be transferred to the fur in scratching operations, or the bears might have "rolled in wealth" on the shore of some quiet Yukon stream, picking up stray flakes of the mineral that old sourdoughs have sought ever since the great strikes of the 1890's.

### Our Aviation Editor's Impressions of an English Visit

IT was interesting to the writer to visit the Hanworth Club, located in the London Air Park, which is, with the Colonel and Master of Sempill as the directing head, the headquarters of a chain of seven flying clubs. A charming old manor, a garden known as Queen Elizabeth's walk and frequented by this queen some hundreds of years ago, trees carefully tended and centuries old, an aerodrome of really vast proportions all 'round the club house, and a perfectly level grass field make for ideal conditions.

It is rather easier to get an "A" or private flier's license in England than in the United States. Any medical student can issue a certificate of a "reasonable condition of health," and the applicant's instructor has only to testify to a minimum of three hours' solo flying. Entrance and



Seen by our aviation editor in England—Above: A canopy protects the pilot of the Fox Moth, a side view of which is shown below by courtesy of *Flight*. At the left: Winning Fox Moth being inspected by an interested group after its arrival

84 percent of which is inert matter and of no plant food value. The new fertilizer contains 64 percent or more of nitrogen, phosphoric acid, and potash, against the 16 percent found in commercial fertilizers.

"In developing this fertilizer, our chemists have solved a problem that has engaged the attention of agricultural chemists for many years," Mr. Swann continued. "When plant foods are merely mixed together in the ordinary manner, they tend to absorb moisture and to cake. They also tend to separate out of the mixture in non-uniform masses. With high concentrations, the fertilizer is therefore apt to be very difficult to apply and to distribute uniformly.



instruction fees in the club are low, and club aircraft can be hired cheaply. A large variety of sports can be engaged in by the members, ranging from lawn tennis to clay-pigeon shooting. The club shops for maintenance are very efficient and well equipped.

We mention all this in detail, because the English have apparently succeeded in making their flying clubs really suitable for flying instruction and practice, quite pleasant and agreeable, yet not too expensive for the ordinary man. The "chain" idea is eminently sound since it gives pilots "somewhere to go." One reason for the comparatively extensive private flying in England lies in the excellency of their flying clubs. All this only confirms the view that we ought to have many, well equipped, moderately expensive clubs in the United States. We cannot quote costs for



*At top of page:* The Prince of Wales' entry in the races was a Swift. *Directly above:* The Puss Moth, which finished third, is a very attractive private plane. *At right:* Our aviation editor, Professor Alexander Klemin (in center), and other American visitors examine the King's Cup, a race prize



planes, but we can concentrate on only a few representative craft out of the rather large number that were entered in this interesting race.

The winning machine in the King's Cup Race was a Fox Moth, powered with a Gipsy III A, four-cylinder, in-line, inverted, air-cooled engine, developing 133 horsepower at 2100 revolutions per minute. This machine averaged 131 miles per hour around the course. Of course, the Fox Moth used in the race had a slightly more powerful engine than the standard Fox Moth, and carried less useful load than the regulation standard load, and it had been skillfully cleaned up so that it "fooled" the handicappers. Still this average speed is very creditable.

The standard Fox Moth can, on short flights, carry a pilot in an open cockpit, and four passengers in a comfortable enclosed cabin. It has a maximum speed of 110 miles per hour and a cruising speed of 90 to 95, all with an engine of only 120 horsepower. Normally it is intended for a pilot, three passengers, and sufficient fuel for 360 miles at cruising. The Fox Moth is an excellent example of very sound, if conventional, design.

The idea of carrying the pilot in an open cockpit, with the passengers in a cabin, is, we believe, novel for a craft of as moderate dimensions as the Fox Moth, and will certainly be used again.

The weight empty is approximately 1050 pounds; the maximum permissible gross weight is 2050 pounds. With 193 pounds of fuel and 17 pounds of oil, 790 pounds are available for the pilot and other load. The wing area is 239 square feet, span is 30 feet 10 inches, and the overall length is 25 feet 9 inches. The wing loading is 8.6 pounds per square foot.

An examination of the interior of the cabin showed clever design. Two passengers can sit comfortably side by side at the rear of the cabin. In front of the rear seat there is generally placed a single comfortable chair. This chair can be rotated so that its occupant can face either towards the rear seats or forward. The rear seat is of the slung or hammock type and can be folded up, while the single chair is easily removable. Thus the whole of the cabin space can be cleared for mail or freight. The closed cabin, open pilot cockpit type is thus seen to have considerable versatility.

The constructors of the Fox Moth draw attention to two features which they con-

any particular plane, but it may be said that our American private planes are decidedly cheaper than the British craft of the same size and power.

A visit to Brooklands, where the King's Cup Race started and terminated, gave the same impression of perfect efficiency combined with every amenity; green grass, no dust, tea in the open, a quiet yet interested gathering; flying first, of course, but always comfort. Perhaps we ought to study "le confort," as the French call it, a little more closely.

It is rather interesting to study the methods of handicapping used in this English race. The minimum speed accepted as a base was 110 miles per hour around the course. The handicappers fixed, in expert fashion, the probable speed of each entry, and started it accordingly. Therefore the race becomes not so much a study in supreme speed, but a test of the pilot's ability and of the general reliability of a plane

just as it is used in everyday flying. Of course, the contestants "cleaned up" their machines a little (sometimes with rather disconcerting results from the point of view of the handicappers). Still it remained a race for the average machine, and not for a machine specially designed for a race and useless thereafter. Also, this system of handicapping does give a little more thrill to the spectators since the machine coming in first is the winning plane.

These English medium power machines do not look particularly fast, yet they made excellent and even surprising speeds. Only one failure to cross the line, out of 53 entries, is a remarkable record of reliability. Besides the good speeds and the reliability, these English planes give an impression of excellent finish and good taste both in external appearance and in interior arrangement.

We wish that space were available for a description of all these interesting air-

sider particularly important. They have found that wood and plywood, if protected by a nitro cellulose finish, are impervious to moisture, and especially so if fabric covered. Also, they have overcome all trouble due to bolts coming loose, due to shrinkage (in wood construction), by using dished spring steel washers under all nuts. Even with bolts slacked off half a turn the washers maintain the necessary friction.

The second machine to finish the race was the Comper Swift, a machine of rather recent construction, which averaged 155.74 miles per hour over the course, and was entered by the Prince of Wales. This single-seater light monoplane has a very clean appearance. Like the Fox Moth, the Swift has readily folding wings. In fact the majority of small English planes have folding wings. In the race the Comper Swift was equipped with the Gypsy III engine. Normally it is provided with the 75 to 80 horsepower Pobjoy air-cooled radial. The main interest of the standard Swift is that it provides an excellent aerostatic machine on very little power. The main characteristics of this neat craft are as follows:

Span 24 feet, width folded 8 feet 1½ inches, overall length 17 feet 8½ inches, height 5 feet 3½ inches, wing area 90 square feet, weight empty 530 pounds, weight loaded (aerobatic) 780 pounds, weight loaded (normal) 850 pounds, wing loading (normal) 9.45 pounds per square foot, wing loading (aerobatic) 8.67 pounds per square foot, maximum speed 135 miles per hour (with Pobjoy engine), initial rate of climb 1400 feet per minute, service ceiling 24,000 feet.

The Puss Moth, third to finish, and also Gypsy III-powered, averaged 130.8 miles per hour, or only a little less than the Fox Moth. While this machine has now been on the market for some time, one can never insist too much on the perfect co-ordination of the flying qualities, pilot and passenger vision and comfort, and wonderful finish which is to be found in this machine. The interior arrangement is marvelous.

In conclusion it may be said that while the British medium power planes are not superior to their American equivalents, they certainly are wonderfully finished and in every way adapted to the needs of the private owner.—A. K.

### Around the World Contest

PRINCE Bibesco, President of the International Aeronautical Federation, has donated a Challenge Cup for an all-round-the-world flight open to all aircraft, whether heavier- or lighter-than-air.

The conditions of the contest provide for the following course around the world: Paris, London, Berlin, Rome, Bucharest, Karachi, Tokyo, San Francisco, New York. The start may take place from any one of these cities, and the itinerary may be covered in either direction. At the compulsory ports of call the contestant must land his aircraft and all engines must be stopped. Any number of landings are allowed during the circuit. Refueling in the air is permitted.

The time to be reckoned when calculating the speed will be the time which has elapsed between the beginning and the end of the flight, without deducting the length of time spent on the ground. The minimum average speed is to be 100 kilometers or

62.1 miles per hour. The first to equal or exceed this speed will become the winner of the cup. Certain regulations provide that few or no changes can be made to the aircraft during the flight and the crew must always be on board.

We believe that this cup is very timely and well worth while. Our readers will perhaps remember the wonderful trip which Charles H. Day made around the world in



The new telescopic airship mooring mast in its high extended position

a comparatively small 80 or 90 horsepower machine which he and Mrs. Day navigated with so many adventures. The entire cost of this flight was only about 5000 dollars. The cup would have been a splendid reward!—A. K.

### A Telescopic Mooring Mast

A NEW self-propelling mooring mast has been constructed for the United States Naval Air Station at Sunnyvale, California, the main interest of which lies in its telescopic properties.

When the mast is lowered, the height of the apparatus is relatively small and the total height of the mast is 75 feet. When one of the new airships arrives at the station, however, electric motors raise the mast to its full height of 160 feet. The nose

of the airship is then made fast to a mooring winch, the mast is lowered, and the airship is towed into a hangar. The electrical equipment was designed by the General Electric Company. The new telescopic mast should be a valuable addition to the ground equipment of airships.—A. K.

### Refueling Planes at Sea

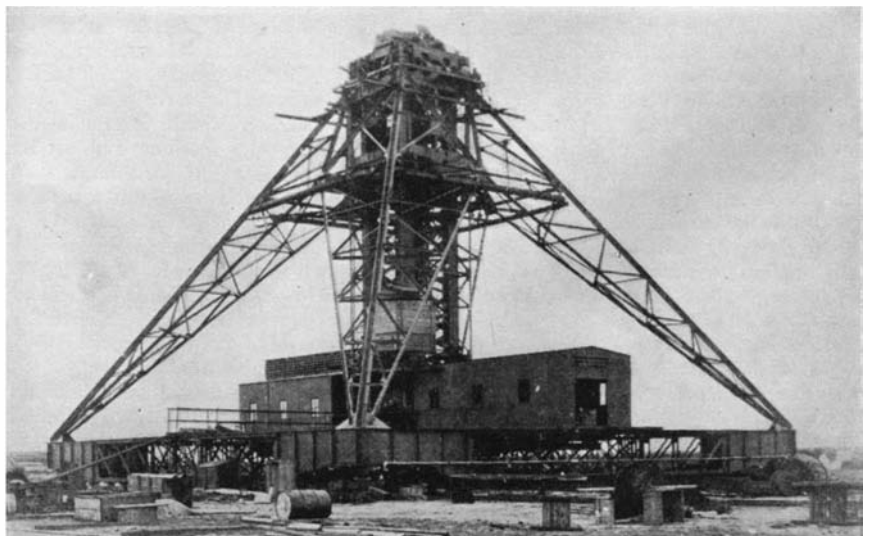
IT is an open secret that Pan American Airways and the Imperial Airways are seriously considering the operation of a transatlantic airline with a route running from the southeastern points of the United States to Bermuda, the Azores, and Lisbon, Portugal, and that a number of giant flying boats are under design or construction for this route.

The great difficulty with heavier-than-air craft for use in ocean flying is that the fuel assumes so great a proportion of the total weight, as to shorten the range or to cut down the pay load. Hence arises the idea of refueling at sea.

The Armstrong Seadrome was the most ambitious embodiment of this idea. Huge and expensive mid-ocean airports were to be constructed and anchored at various points along the route. The Armstrong Seadrome involved much skilled engineering, but so far its initial cost has prevented its utilization.

The Deutsche Lufthansa, which is experimenting with a regular air service between British Gambia in Africa, and the island of Fernando Noronha off Brazil, is giving a trial to a much less expensive but perhaps equally satisfactory floating airport. The Lufthansa has chartered the North German Lloyd liner *Westfalen* of 5000 tons, to be stationed in the South Atlantic purely as a refueling station as it is far too small to be transformed into an airplane carrier on which planes could land. The idea is that flying boats will simply alight near the steamer, pick up fuel and go on.

The objection to this plan is that it is very hard for even a large flying boat to alight safely in rough water. This difficulty is to be met by attaching a huge drag sail to the stern of the liner. When dragged through the water, this will produce a quiet area of large dimensions extending far beyond the wake of the liner. Incoming planes will alight, with running motors, in the wake of this sail while the liner is



The same mast lowered, showing some of its auxiliary equipment



# Men who “know it all” are not invited to read this page

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

### Send for this Booklet

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

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

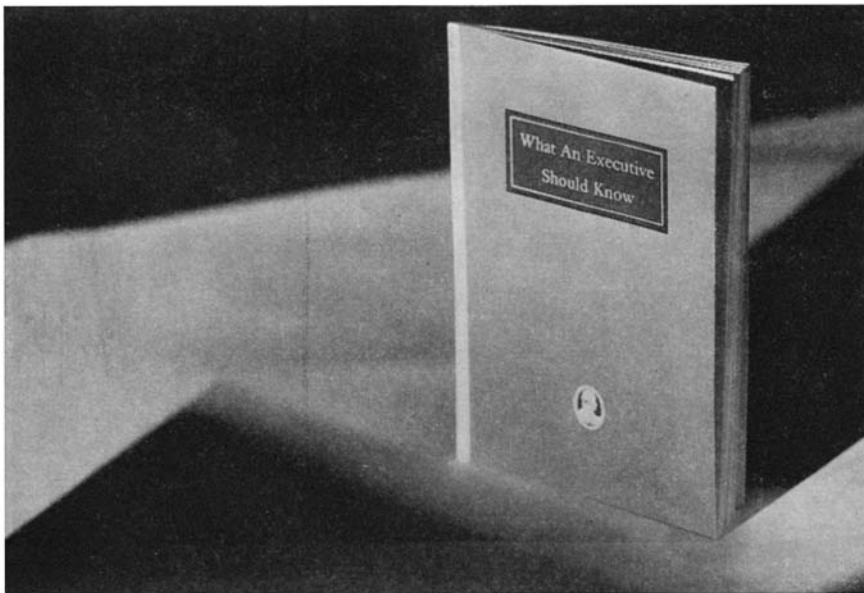
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To the Alexander Hamilton Institute, 685 Astor Place, New York City. (In Canada, address Alexander Hamilton Institute, Ltd., C. P. R. Building, Toronto.)

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

NAME.....

BUSINESS ADDRESS.....

BUSINESS POSITION.....



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

**T**HE little book pictured above should be read by every man who expects to win a secure place for himself in the next five years. It explains some of the changes which are taking place in the business world today. It tells

how you can equip yourself to take your place in the new business structure with confidence and increased earning power. It contains the condensed results of 20 years’ experience in helping men to forge ahead financially.

speeding ahead. They will then be caught up by the sail behind the stern of the liner, and hoisted aboard.

The first tests of this device off Heligoland were said to be quite successful. We see no reason why it should not come into practical service.—A. K.

### The German Super-Airliner

WHILE this country has been developing large flying boats, carrying from 30 to 40 passengers, the European countries have been developing larger and larger landplanes designed for passenger traffic. The latest addition is a Junkers four-



The seating arrangement in the center cabin of the German super-airliner described on this page, which carries a crew of seven and a total of 33 passengers

motored monoplane to be used on the Berlin-London route. It somewhat resembles the G-38, an earlier Junkers creation.

It is interesting to note the use of flaps along the trailing edge. These are clearly shown in our photograph. A slower landing speed is obtained with the aid of these.

The second photograph shows the interior arrangement of the main cabin, where 25 passengers are seated. Six additional passengers may be seated in the leading edge of the wing just adjoining the main cabin, and two more directly beyond the pilots' compartment, slightly above the main cabin. The crew consists of seven persons.

Passenger comfort is being considered more thoroughly on these large passenger air-liners than ever before. The cabins are provided with adjustable heating and ventilating equipment; they are lined with sound-proof covering to shut out as much noise as possible. What is even more interesting, the smoker has not been forgotten. The rearmost compartment in the fuselage is a smoking room.—A. K.

### Photo Cells Control Illumination of Airways

TO assure proper illumination of an airway, the beacons and airport lights must function whenever natural light is not sufficient for the safe operation of aircraft.

Beacon lights that are unattended, are operated by astronomical clocks in which switches close about 15 minutes before sunset, and open 30 minutes after sunrise. These clocks are so constructed that corrections required by the difference in time of sunrise and sunset from day to day are

automatically made. However, the misty haze of early mornings, especially in valleys, delays the penetration of sunlight so that the dawn is usually twice as long as the twilight period.

The Westinghouse Electric and Manufacturing Company has obtained the cooperation of the Department of Commerce in setting up two trial installations of light-sensitive cells, known popularly as "electric eyes."

Safe illumination has been placed at 15 foot candles; that is, every foot of ground should have as much light as 15 candles will give one foot above the ground. When the light falls below the required figure,

product, much as a dye permeates cloth, and giving wool-like properties to the cotton or artificial silk.

This product has the advantage of adding to the weight of the material, and, being cheaper than cotton, the method of applying it is not expensive. It can be used for a large range of fabrics and is applicable to linen, shoddy, and silk, and may also prove of great interest as a loader for silk. It has a special advantage when used with rayon, as it not only strengthens the material in the dry state but, more important, nearly doubles the wet strength. The process is applied after the materials are bleached, dyed, or printed.—A. E. B.

### Vitamins Reduce Lost Time In Industry

IT is estimated that the 36,000,000 wage earners in the United States are absent from their work because of illness at least 250,000,000 working days per year. The Metropolitan Life Insurance Company found that common colds are among the chief sources of lost time (6700 employees) amounting to 420.7 per 1000 employees for the year.

In view of the recognized anti-infective value of vitamin A, it seemed logical to consider the possibilities of decreasing the lost time of those dependent upon industrial employment for a livelihood by supplementing the dietary with material rich in vitamin A. Accordingly, an investigation has been conducted to determine whether using cod-liver oil as a supplement to the usual home diet would be of definite economic value for decreasing lost time caused by colds and similar infections. The results of the experiment are reported in a recent issue of *Industrial and Engineering Chemistry*.

One hundred and eighty-five persons served as subjects of the experiment (115 women and 70 men). The control group of 128 persons contained 88 women and 40 men. The members of the experimental group were given one tablespoonful of cod-liver oil daily, during the morning or afternoon rest period, as a supplement to their usual home dietary.

A daily record was made of all instances of illness or absence of subjects. From these

the "electric eye" closes the control relays of the engine-generator sets, and the artificial lights are then turned on.

In order to take care of the difference in the dawn and twilight periods, the photo cell is so adjusted and set that lights are turned on at a lower foot candle reading at night than that at which they are turned off in the morning.—A. K.

### Creaseless Textiles

AFTER 14 years research, a method has been discovered of producing creaseless cotton or rayon, by impregnation of the fibers with a synthetic condensation



The D-2500 Junkers airliner in flight. The end flaps are ailerons. Note, however, the trailing-edge flaps for slow landing; also compactness of the body

# WHAT CAN I GET *for a* CHRISTMAS GIFT?

How frequently this question comes up and how frantically we chide our minds and browse through the advertisements for that particular gift.

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data a compilation was made of the number of subjects who developed colds during the experiment. It is interesting to note that 102 members of the cod-liver oil group and 42 members of the control group did not develop colds during the experiment. For the purpose of comparison, however, these data have been reduced to a percentage basis. A consideration of the values of 55.1 percent for the cod-liver oil group and 32.8 percent for the control group reveals a decided difference in the occurrence of colds, for 67.2 percent of the controls developed colds during the

steam which develop 125,000 horsepower to drive four huge propellers, her speed is expected to reach 28 knots. This, according to the owners, will enable her to cut two days from the present southern route crossing time so that she will make Gibraltar in 4½ days and the Riviera in 6½ days out of New York.

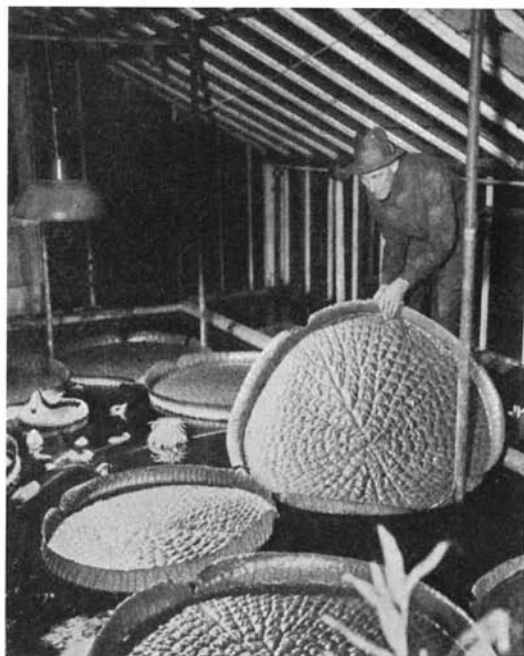
The vastness of her rooms, the luxury of her decorations and appointments, and her comfort place the *Rex* in the front line among the world's fleet of liners. On her 11 decks are some of the most charming public rooms and staterooms ever seen on

of another animal, or anything else that does not belong there, generates substances to fight against the invaders. These substances are known to scientists by the general name of "antibodies." The familiar antitoxins used against various diseases belong to the antibody classification.

Foreign corpuscles that find their way into the blood stream are attacked by two different types of antibody. One of them tends to dissolve the outsiders, and is called a "hemolysin," or simply "lysin." The other makes them stick together in clumps, and is called an "agglutinin." Both lysin and agglutinin reactions were used by the two British scientists in their researches, the former in the cattle work, the latter in the work on fowls.

Following hints contained in earlier researches, Dr. Todd and Dr. White first found that antibody reactions are not the same if corpuscles from different animals are used with the same blood sample, and that conversely blood corpuscles from the same lot will dissolve less readily in one individual's blood serum than they do in another's.

The key to their discovery came when they found it was possible to "exhaust"



Courtesy General Electric Company

Specimens of *Victoria Regia*, rare tropical lily native to Brazil, grown by A. S. Buskirk in an Ohio nursery. Light from a 300-watt bulb, used nightly, doubled the rate of growth, it is claimed. The pads often reach a diameter of six feet with rims from three to eight inches high

experiment whereas only 44.9 percent of the cod-liver oil group developed colds during the same period.

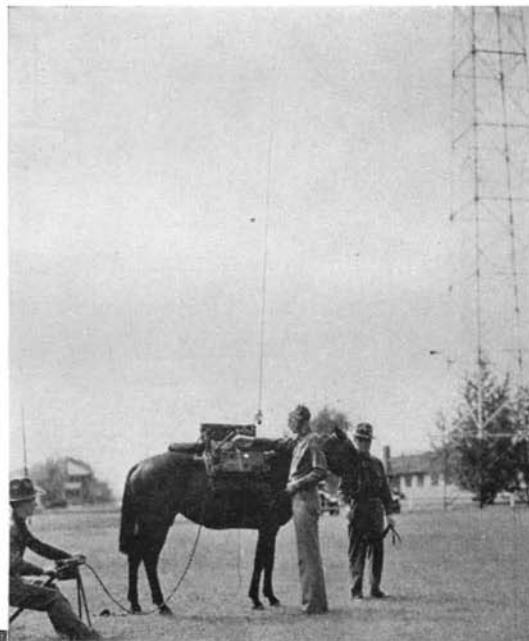
The number of hours of absence per person during the experiment was 12.8 for the cod-liver oil group and 25.1 for the control group. In other words, the subjects of the cod-liver oil group were absent during the period of experiment only half as many hours as the subjects of the control group.—A. E. B.

**"Rex"—New Monster Liner**

**T**HE newest liner to buck Atlantic waves—and she is so large that those waves will have hardly any effect upon her—steamed into New York harbor on October 7 on her maiden voyage from Genoa. The *Rex*, as she has been named by her owners, the Italian Line, is not only a marvel of workmanship from bow to stern but she is also the largest vessel built since the World War. Upon her and the *Conte di Savoia*, which will sail for New York shortly and the stabilizing system of which was discussed in our October issue, something like 40,000,000 dollars has been spent, most of it government money. Since, as *The New York Times* puts it, "In the end it is the American tourist who must pay for the *Rex* and her sister ship . . . the two are . . . flattering manifestations of Italian faith in our economic stability and ultimate financial recovery."

The *Rex's* length is 880 feet and her beam 102 feet. Her tonnage is 54,000. Powered by four turbines using superheated

For this mobile radio transmitter and receiver, developed at Fort Monmouth, the "fishing-rod" antenna serves for both functions of the set. Current is supplied by the hand generator shown in operation in the left corner. The outfit is designed to be packed on horseback



U. S. Army Signal Corps photo

any ship making New York, including a church, winter garden, children's play room, veranda social room, and staterooms with private verandas.

**New Blood Test May Decide Kinship**

**C**ASES of doubtful parentage of children, such as agitate the courts from time to time, may possibly be decided with more certainty in the future, if a new blood test originated by two British scientists is developed to a point that now appears possible. The first experiments leading to the new technique were performed on cattle in Egypt by Dr. C. Todd and Dr. R. G. White, and further researches were conducted on fowls in England, by Dr. Todd working alone.

The test depends on the reactions of blood to foreign bodies that get into it. Blood invaded by germs, blood corpuscles

the antibody in a given preparation of sensitized serum. By adding considerable quantities of corpuscles from one individual to such a serum sample, a point is finally reached where that serum will no longer have any effect on corpuscles from that particular source; though it will continue to destroy any other corpuscles that are added to it.

To do away with the large individual differences in reactions of separate lots of serum, Dr. Todd and Dr. White prepared what they called "poly-valent" sera, by mixing together sensitized sera from a large number of different animals. This ironed out the individual variations, and made the mixture about equally effective against all corpuscles of the species used in its production.

When such a poly-valent serum was "exhausted" with corpuscles from a single individual, it became highly selective, sparing those corpuscles only and destroying all

others, except that in some instances it was not so destructive to blood corpuscles from animals nearly related to the test specimen.

The possibility of testing blood relationship was thought of by Dr. Todd when he was working on his fowls in England. He bred three different families of chickens, and tested blood obtained from the chicks against the corpuscles of their parents. In all cases but one, there was a strong "family reaction," the blood corpuscles of both parent fowls combined reacting toward the chick serum as the chick's own corpuscles would. Taken separately, either paternal or maternal corpuscles might fail to react; though where one failed the other always reacted. Thus a negative test would not necessarily indicate that parenthood could be denied, but a positive test would definitely mean that the individual so reacting, and none other, could be the parent.—*Science Service.*

**Everard B. Marshall**

**I**T is with regret that we record the death on October 17 of Everard B. Marshall, a patent lawyer, who has been associated with *Scientific American* since 1884. His age was 61.

Mr. Marshall joined the firm of Munn and Company at the age of 13 and never worked elsewhere. At his death he was connected with that firm and the patent law firm of Munn, Anderson, Stanley, Foster, and Liddy. He was a graduate of the New York Law School, a member of the New York Bar, and an authority on foreign patent and trademark law. He was also an extensive reader and traveler.

**New Motorboat Speed Record—  
Packard Engines**

**S**KIMMING over the St. Clair River at the terrific speed of 124.9 miles per hour, Gar Wood, the veteran pilot and boat builder, set a new world's record for motorboat speed on September 20. This is more than five miles per hour better speed than the former record made by Kaye Don, the English racer, on Loch Lomond, Scotland, a few months previously, driving his *Miss England III*.

In Wood's *Miss America X*, there are four Packard 1600-horsepower engines, or a total of 6400 horsepower. And, according to *Nickel Steel Topics*, it isn't just temporary power planned for a single race. Wood's four Packard Twin Sixes are each four years old, and all four years of their life have been crowded with heavy service. They have three times broken world's speed records in the water. And when they haven't been racing, the various *Miss Americas* have been doing regular duty in the world's fastest 75-foot cruiser, *Gar Senior*. Two of the motors have been in wrecks, twice sent to the bottom when running at full speed. Once they were fished up from the bed of the St. Clair River. Again

**"YOU NEVER SEE HIS FACE"**



Ganymede, who was cupbearer of the Olympian gods, made quite a name for himself. But then, his was an uncommon waiter's job and he an unusual youngster, so he should have had better luck than most waiters do in the matter of achieving personal recognition. For if there is any group of men

whose identity is lost in the service they perform, it is the waiters.

The waiter has been described as "the man whose face you never see," a true and perfect description as far as most of the public are concerned. Yet the waiters do not complain; they are generally quite philosophic about it. Certainly the Statler waiters\* are.

They go on unobtrusively and deferentially serving our good Statler food to the guests who come to their tables. And the remarkable thing is that if they are largely unknown personalities to their steadiest patrons, those patrons are *not* unknown to them.

We have many, many waiters who have been with us since the houses in which they are employed were opened, and every one of them knows the intimate likes and dislikes of scores of guests. They know to whom to bring the various relishes for fish or meat, they remember that so-and-so must have his roast beef rare, that such-a-one takes cream but no sugar in his coffee and that another likes vinegar on his peas.

Waiters everywhere, of course, acquire this sort of knowledge of their guests, but we think that in our Statler hotels they do a little better job of it, evince a little more personal interest in their patrons' culinary preferences, serve a little more deftly and display a little more courtesy because of their training in the precepts of Statler Service.

*\*73% of Statler stockholders are employees.*



**HOTELS STATLER**

*where "The guest is always right"*

**B O S T O N      B U F F A L O**  
**C L E V E L A N D      D E T R O I T      S T . L O U I S**  
*in NEW YORK, Hotel Pennsylvania*

they were salvaged in the bay at the Lido in Italy. But neither time had they suffered any damage. It is noteworthy that in all this time it has not been necessary to replace any important part due to wear or failure.

The horsepower of each of Gar Wood's Twin Six units was stepped up from 770 to 1600—more than double—through supercharging and higher compression, without any important structural change in the motor being necessary to compensate for the additional stress.

### Many Worthless "Cures" for Diabetes

PERSONS who have diabetes should not rely for treatment upon almond or bran bread, suprarenal extracts, epinephrine, opium, sodium bicarbonate, or levulose, says Dr. F. J. Cullen, chief of drug control of the Federal Food and Drug Administration. There is no drug nor combination of drugs known to medical science which can cure this disease.

"Some manufacturers in this country have recommended for diabetes nostrums which could have no remedial value for the disease," Cullen states. "The only reliable method of combating diabetes is the use of insulin by hypodermic injection, together with a suitable diet—and this is not to be considered a cure."

Every country has a favorite herb which is superstitiously believed to have curative value for this serious malady. There is no record that any of these herbs can cure the disease, although many of them have diuretic action, and their use may lead the patient to think he is improving, because of an apparent lessening of sugar in the urine.

Products which are labeled with claims to cure diabetes are liable to seizure under the food and drug law.

### All-Glass Plant Produces Bromine

A UNIQUE feature of recent chemical engineering construction in the southwest described by *Chemical and Metallurgical Engineering* is a bromine (and iodine) plant built almost entirely of glass and glass-lined steel equipment. The bromine is recovered from natural brine by distillation in seven stills, all of glass-lined construction. These units, each of about 700 gallons capacity, are connected in series and placed one above another in a tower which exceeds 100 feet in height.

The stills are connected with glass tubing and glass-lined steel pipe and fittings; the vapor lines are packed with porcelain rings. An ingenious method of jointing con-

sidered for this installation employs thin strips of tantalum metal wrapped around the glass pipe and clamped above and below the joints. It was claimed that this is the only metal that would permanently resist the attack of the wet chlorine gas which is used to liberate the bromine in the brine. Operating pressure in the stills is said to be about 20 pounds per square inch, although the system has been tested for double this pressure. Stoneware pumps are used to circulate the brine.—A. E. B.

### Automatic Press Dial for Telephones

A NEW device that does away with the present lost motion, rotating dial for telephones, has been invented by Abram L. Myers, of Chicago. It is composed of some small gears, a governor, and other



Press-button phone dial

operating parts encased in a cover around which are grouped and extended 10 short keys, numbered and lettered in exactly the same manner as is the generally used and well known automatic or rotating dial telephone.

The device does not change in the slightest way the telephone system; the change is only in the operation of calling a number. Mr. Myers' device does not rotate. Consecutive numerals of a number to be called are simply pressed downward.

The press device is so made that operation of any one key immediately puts into place a lock or stop so that all other keys not in actual use can not be pressed downward until the make and break contacts in the telephone office are fully completed.

The new device is thus speedier than the rotating dial, is more accurate because of its simplicity of operation, avoids any movement or sliding of the telephone when dialing on a highly polished desk, can be operated at all times with only one finger—in fact, a touch system can be developed by switch-board operators—and costs little more to manufacture than the present rotating dial which has come into wide use.

It appears that its use should make the automatic dial much more popular because of its many advantages over the rotating system.

### Chipmunk Speed

THERE has always been much controversy as to the speed of various animals. Often it is argued that animal or bird speeds are apparent rather than real. Mr. W. J. Fraser, of Toronto, however, has the evidence of his own car's speedometer and the word of a friend who was with him at the time, to back up his statement that a chipmunk's speed is between 24 and 28 miles an hour. But let him tell it:

"My speedometer held at 24 miles an hour while Chip ran about  $\frac{1}{2}$  of a mile along the snake rail fence skirting the road. His speed, therefore, must have been about 28 miles an hour. He made no mis-step though he encountered breaks as well as bush barriers.

"Witness and I saluted this streak of skilled lightning."

### Solving Abandoned Automobile Problem

TWO very definite problems were recently solved by one enterprising community through the adoption of the oxy-acetylene cutting process, according to a recent issue of *Oxy-Acetylene Tips*. A number of the town's citizens were in urgent need of immediate employment; and at the same time the attractiveness of certain sections of the community was considerably marred by the presence of skeleton bodies of abandoned automobiles, trucks, and other types of discarded equipment. One of the town's prominent citizens who had for some time been actively interested in fostering the idea of a clean community, suggested that both of these problems be solved at one time.

A light one-ton truck which could get anywhere off the highway and a standard oxy-acetylene cutting outfit with extra long lengths of hose furnished all the equipment needed to do the double job.

A crew of men headed by an experienced oxy-acetylene cutting operator was sent out to the various locations and put to work. As the auto dumps were surrounded by refuse of all kinds, this was first fired or removed by the men while, at the same time, the operator cut up the cars into sections small enough to be carried to some point that could be reached by the village ash truck.

For three months this program was carried out intensively and a great deal of work was accomplished. It was found that an expenditure of only slightly more than



Such scenes as these can be eliminated, and unemployment decreased, by the method described above

1000 dollars both cleaned up the community and brought employment to at least 20 men a week.

The civic organization was naturally highly impressed with the ease and speed of dismantling and cutting up not only automobiles which had been abandoned but other types of metal trash such as old cement mixers and road grading equipment which had been abandoned.

**Contamination Accelerates Lead Corrosion**

**A**N unusual case of corrosion was recently reported in *Chemical and Metallurgical Engineering* wherein an unsuspected source of contamination in a sulfuric-acid-containing solution proved to be the undoing of an otherwise resistant lead-lined tank. Three lead-lined tanks of equal capacity were operating side by side in identical service. But while the two outer tanks had given an entirely satisfactory performance for a period of years, the middle tank had to be relined every few months. When the chemical engineer who was called in on the problem had examined the set-up, he discovered that the lead feed line of the middle tank contained a nickel-alloy valve, whereas the other tanks were equipped with hard-lead valves. Once he had substituted lead for the offending part, no further difficulty was experienced.

The explanation of the phenomenon lay in the electrolytic couple of lead and nickel alloy which was formed when the valve was inserted in the line. Because it is higher in the electromotive series than lead, a minute quantity of nickel went continuously into solution, and although it was insufficient to appear in the product, it was more than enough to upset the resistance of the lead to the concentration and temperature of acid used.—A. E. B.

**Slow Driving or Fast Driving?**

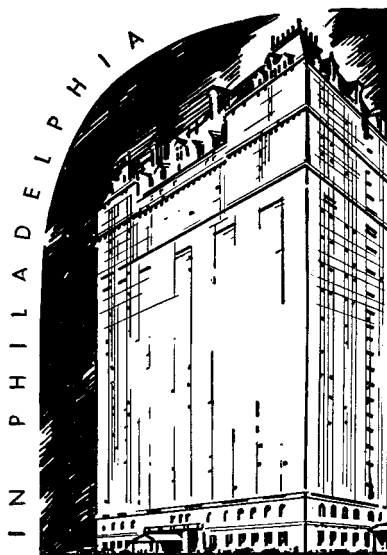
**O**NE often hears it said these days that it is more dangerous to drive slowly than to drive fast. Like most generalities, that statement has some glaring inadequacies. Certainly it is not true that a collision between two slow-moving cars is as productive of frightful tragedy as one between vehicles traveling at a high rate of speed.

The truth of the matter undoubtedly is that there is too much fast driving for conditions and quite a bit that is too slow.

"For conditions" should qualify every consideration of the subject of motor car speeds. With that qualification in mind, slow driving is receiving the close study of motor vehicle and traffic authorities in all parts of the country. Many profess to see a developing trend toward the imposition of stern penalties for the driver who proceeds at a slow pace when conditions are such as to demand a faster rate.

The significance of the situation appears to be that it forecasts the day when the road hog is going to be put out of business. It is not only his speed that makes the road hog a dangerous nuisance on the modern highway. It is a combination of speed and position. If he keeps in his proper place to the right-hand side of the highway, a driver's rate of travel does not make so much difference. Most motorists

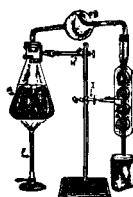
(Please turn to page 359)



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# THE AMATEUR ASTRONOMER

Conducted by ALBERT G. INGALLS

LAST month we showed photographs of a house-top observatory made by two amateur astronomers, and now we show another. This one was made by Dr. S. A. Young of 1659 Middleton Place, Los Angeles, who has installed in it a 5-inch refractor for which the objective lens was made by Bausch and Lomb. But the mounting is credited to the owner, as is the observatory. "Yes, I built the dome," Dr. Young replies, in answer to our SOS for more descriptive matter. "It is 11 feet in diameter. The shutter was built first and I mounted it on a ring plate of lumber cut to the circle. This circle runs on large rubber-tired castors mounted on the plate which supports the dome. Small rafters were placed at an equal distance on the circle, and screwed to the circle plate and to the part containing the shutter.

"The covering is of light sheet iron, each piece cut to fit from one rafter to the next. The dome has no track to run on, other than the circular plate, but is kept from running off by means of eight castings having wheels at the end. One of these can be seen in the picture.

"The clock drive, too, is home-made, being patterned after one of the many small clocks used for this kind of work.

"Scarcely anything built by the amateur can be done without using some parts of a Ford, and my equatorial mounting is made of two Ford hubs. These afford me ball bearings and work very nicely."

TO show what kind of telescopes are made by amateurs in France—though not many make them there—a picture from *L'Astronomie*, the monthly magazine of the Société Astronomique de France, amateur society of some 5000 members, is reproduced. This telescope has a 6½-inch mirror of 51 inches focal length and was made by Monsieur H. Cocquelet, artiste musicien à l'orchestre de l'Opéra Comique, 50 rue de la Justice, Paris (XX<sup>e</sup>). The diagonal is a prism. There are two finders, one of which is the half of an opera glass. The other features, except the central complex which shows poorly in the original, explain themselves.

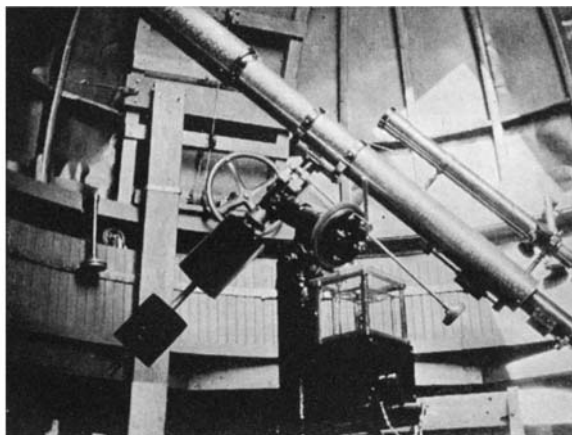
HERE is a new-old method of silvering mirrors outlined in a letter from Prof. H. L. Johnston of the Department of Physical Chemistry at the Ohio State University, Columbus, Ohio. It appears to have some points of superiority over the version of the same (Brashear) process now used by telescope makers, but doubtless will require modification, since it has apparently been used mainly for silvering the inside surfaces of thin glass flasks. Amateurs who are already familiar with silvering are invited to adapt it to telescope mirror needs and report results. Beginners are warned that it may ruin a good mirror unless used with judgment and intelligent modification based on

experience and due respect for HF and ice.

"1st. Scrupulously clean the object to be silvered. (Very important in any silvering process.) I usually do this by washing thoroughly with 50 percent nitric acid; rinsing thoroughly with distilled water; covering the object with concentrated ammonium hydroxide for a period of one to three hours; rinsing this off thoroughly;



Dr. Young's house-top observatory



Interior of the observatory dome

and then allowing the object to stand immersed in distilled water until ready to apply the silvering solution. (The surface must remain wet.) In extreme cases dilute HF may be used in place of HNO<sub>3</sub> for the initial cleaning.

"2nd. Prepare the following solutions: A. 25 grams NaOH in 350 cc. distilled water. B. 35 grams AgNO<sub>3</sub> in 350 cc. distilled water. C. 35 grams dextrose in 700 cc. distilled water.

"3rd. Mix A and B and nearly, but not quite, clear with ammonia. I usually save out a portion of B with which to 'back titrate' in case I overshoot the ammonia. The reaction is slow and, even with con-

stant shaking, one is apt to overdo the ammonia. This will ruin the job. The proportion of B is not very critical. I sometimes overdo the ammonia, in which case I simply make up some additional AgNO<sub>3</sub> solution. Even if I thus exceed the original specification by 30 or 40 percent it seems to make little difference in the results. The final solution of the ammoniacal mixture of A and B must be cloudy with a brown cloud of Ag<sub>2</sub>O. An excess of ammonia will produce a black cloudiness which will ruin the results.

"4th. Add approximately a liter of cracked ice to the ammoniacal solution of A and B and also to C. This will usually shift the equilibrium in A and B so as to clear or nearly clear that solution. This is all right and is perhaps desirable; that is, the excess of Ag<sub>2</sub>O must not be too great, but the proportions are not critical.

"5th. Mix the two ice cold solutions, and immediately pour over the object which is to be silvered (filtering out excess ice). The reaction is sufficiently slow to permit reasonable time in handling. If the object being silvered is so constructed that it can be warmed with a stream of tap water at room temperature, that is desirable as it localizes the early silvering reaction on the desired surface. If this can not be done one simply has to let the process take its course. When the silver coat is sufficiently thick everything is washed off with distilled water. If the exposed silver surface

is to be used as the mirror (as in optical instruments) it is best to cover with 95 percent alcohol in order to arrest oxidation of the moist silver surface. The alcohol can be poured off at once and the polishing process be carried out within a few minutes. This silvering formula has the disadvantage of yielding a rather heavy, flocculent precipitate during the silvering reaction. For an optical surface, it is necessary to swab the silvered surface with a soft cotton swab continuously during the silvering process, in order to prevent the attachment of this flocculent material to the newly formed silver surface.

"I have used this formula primarily for silvering Dewar flasks.

"I also used the formula for optical surfaces, in silvering some small mirrors for a reflecting telescope in use on this campus. It appeared to give satisfactory results. I told Professor Stetson of the formula and he used it in silvering their large reflector in the new telescope, at the Perkins Observatory. He tells me that he found the method superior to the standard methods in use for astronomical reflectors and with which he had had previous experience. Of course, the flocculent precipitate is a disadvantage that must be considered in carrying out the process.

"Several months ago Brickwedde (and Scott?) of the U. S. Bureau of Standards





A French amateur's telescope

published an article on silvering mirrors in which they employed substantially the same method I have here outlined to you. If you print this, I think that you should mention the fact that the formula had been used in the Chemistry Department of the University of California for a number of years (and probably somewhere else before that)."

On October 24, as proofs of this page are passed, it is doubtful whether the new edition of A. T. M. will be ready in mid-November, as announced in other pages prepared earlier. If not, the delay cannot be more than a few days or weeks.



Seventy-six years young and still at it. Dr. George F. Allen of Aurora, Illinois, grinding a mirror

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# CURRENT BULLETIN BRIEFS

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

**BELOW TEN METERS**, edited by James Milen and Robert S. Kruse, is an excellent manual of ultra-short-wave radio transmission and reception that tells "how to build" as well as the "why" and "how" of short-wave operation. There is a valuable colored supplement showing the radio, ether, photoelectric, and audible spectra. *The National Company, Malden, Massachusetts.*—50 cents postpaid.

**THE WINSLOW STRENGTH-COMPUTING SLIDE-RULE** solves any beam problem. The complicated-looking rule is "direct-reading" and its operation is extremely simple. Problems that usually require six minutes can be solved in six seconds. It solves not only problems involving calculations for transverse strength but also those relating to deflection, shear, and lateral flexure. Helpful tables, loading diagrams, and charts are given in the handbook accompanying the rule. *Henry W. Tomlinson, 611 Morris Building, Joliet, Illinois.*—\$7.50.

**REPAIRING FOR PROFIT** is a valuable pamphlet for the automotive repair shop and is accompanied by a valuable table naming automotive parts, their usual composition, and recommended methods of welding. *The Linde Air Products Company, 205 East 42nd Street, New York City.*—Gratis.

**HIGH PRESSURE HYDRAULIC PUMPS** (Bulletin 36) describes heavy duty pumps suitable for hydraulic power plants. The new hydro-gas accumulator system of hydraulic power supply is also described. *Baldwin-Southwark Corporation, Philadelphia, Pa.*—Gratis.

**THE HISTORY OF SALT** traces the development of salt from prehistoric times to the present, tells of the effect of salt on history and describes in detail the methods by which it is produced today. *Morton Salt Company, 209 West Washington Street, Chicago, Illinois.*—Gratis.

**RESEARCH INSTITUTIONS AND MUSEUMS** FOUNDED BY HENRY S. WELLCOME describes the splendid new medical and chemical research building in London which houses a number of affiliated research laboratories, museums, and so on. Some of the exhibits are priceless, such as a section of the original Lister ward in the Glasgow Infirmary. *The Wellcome Foundation, Ltd., London, England.*—Gratis.

**ACIDOSCAL PAINTS** is a manual of recommendation for paint problems and tells about rubber derivatives that minimize the corrosive action of acids and alkalis on materials. These paints have as a base a commercial form of rubber isomer which imparts valuable properties not found in ordinary paint films. *B. F. Goodrich Rubber Company, Akron, Ohio.*—Gratis.

**REVERE COPPER AND BRASS PRODUCTS**, although a trade catalogue, gives a wealth of data very difficult to obtain. There are many pages of tables. *Revere Copper and Brass, Incorporated, 230 Park Avenue, New York, N. Y.*—Gratis.

**PLASTIC PRODUCTS** describes products based on synthetic resins and other binders of various types. It is a particular field in which the property of plasticity permits manufacture by some type of molding operation. The pamphlet illustrates some of the practical applications in industry of these substances, which include even refractory insulation parts, with asbestos as a base. *General Electric Company, Schenectady, N. Y.*—Gratis.

**NATIONAL PARK PORTFOLIO**, a publication of the National Park Service of the Department of the Interior, is a beautifully printed publication of 275 pages with more than 300 illustrations. It deals with our national parks and national monuments and is bound in cloth. *Superintendent of Documents, Washington, D. C.*—\$1.00 (money order).

**THE FOUNDATION OF EFFECTIVE LUBRICATION** (Lubrication, Volume XVIII, No. 8, August, 1932) dwells upon the importance of design and installation in relation to lubrication and shows how the machinery builder and the refiner of lubricants can co-operate. *The Texas Company, 135 East 42nd Street, New York City.*—Gratis.

**MAP OF CHICAGO AND ALL SUBURBS** is one of the best maps we have ever seen of this wide-spread city. There is a brief but excellent street directory. *Hearne Brothers, 127 North Dearborn Street, Chicago, Illinois.*—25 cents.

**FIRST REPORT ON FOREIGN GEOGRAPHIC NAMES, 1932**, gives official spellings of foreign geographic names as passed on by the United States Geographic Board. *Superintendent of Documents, Washington, D. C.*—10 cents (coin).

**TECHNICAL STUDIES IN THE FIELD OF THE FINE ARTS** (Volume I, Number 1), published for the Fogg Art Museum, Harvard University, fills a niche in art literature long vacant. It deals with new methods of technical research in art work. For example the first number contains, among others, an article on "A Microsectioner for Paint Films" by which a minute boring of a picture is secured and examined microscopically. There is also an article showing how blisters in paintings can be removed by a special built-up panel. The new publication is a quarterly. *Technical Studies, 654 Madison Avenue, New York City.*—\$1.25 a copy or \$4.00 a year.

**REZYLs AND TEGLACs FOR SURFACE COATINGS AND MISCELLANEOUS APPLICATIONS** describes the newer types of raw materials for surface coatings. These are modified glycerol phthalate resins known as Rezyls and Teglacs, which range from viscous liquids to hard brittle solids and, in color, from deep amber to almost water white. They are distinctly different compounds designed for specific uses. This pamphlet goes into the subject very thoroughly. *American Cyanamid and Chemical Corporation, 535 Fifth Ave., New York City.*—Gratis.

**CENTRIFUGAL PUMPS, TYPE "S"**, describes single stage, high efficiency, double suction pumps of an approved type. Plain directions are given on how to figure pumping head. There are many hydraulic tables. *Allis-Chalmers Manufacturing Company, Milwaukee, Wis.*—Gratis.

**PROPELLER TURBINES** describes the I. P. Morris types with adjustable blades and fixed gates. They are especially adapted for small and medium size hydro-electric or power plants with operating head below 60 feet. *Baldwin-Southwark Corporation, Philadelphia, Pa.*—Gratis.

**ORNITHOLOGY OF THE ONEIDA LAKE REGION WITH REFERENCE TO THE LATE SPRING AND SUMMER SEASON** (Bulletin of the New York State College of Forestry, Roosevelt Wild Life Annals, Volume 2, Numbers 3 and 4), by Dayton Stoner, has 497 pages of text and illustration and is an interesting ornithological study. Double number. *Roosevelt Wild Life Forest Experiment Station, Syracuse, N. Y.*—\$2.50.

**STONE AND WEBSTER JOURNAL**, July 1932, is the 25th Anniversary number and is also the last issue of a very valuable journal which now ceases publication. Let us hail and farewell. *Stone and Webster Inc., 49 Federal Street, Boston, Mass.*—15 cents.

**AIR FILTERS** describes a glass-wool air filter which, while thoroughly practical, is yet so inexpensive that it can be discarded and replaced when its purpose is served. *Owens-Illinois Glass Company, Toledo, Ohio.*—Gratis.

**RESEARCH AND EDUCATION IN THE NATIONAL PARKS** (National Park Service, Department of the Interior), by Harold C. Bryant and Wallace W. Atwood, Jr., describes the opportunity to interpret and appreciate the superlative natural features in our National Parks. The average visitor needs explanations of the major features. The work of an educational nature carried on by the park authorities is most valuable and this booklet of 66 pages describes it. *National Park Service, Department of the Interior, Washington, D. C.*—Gratis.

**THE SCIENTIFIC AMERICAN  
DIGEST**

(Continued from page 365)

will admit that they have no antipathy for the slow driver provided he does not obstruct the lane in which they normally pass him.

It is this fact that may delay the wholesale enactment of minimum speed limit regulations by the various states.

In this connection it is interesting to note that the state which first considered such legislation still is without any enactment on the subject, but it is not letting the road hog continue his depredations. On the contrary, it is waging a rigorous campaign against him, one that is based upon the existing regulations providing for right-lane driving. The opinion of officials in this case is that if drivers can be taught correct position on the highway, the speed aspect of road hogging will take care of itself.

So far, this is the sentiment of the majority of motor vehicle officials on the subject.

A point that motorists should consider is that it should not be necessary either to concentrate traffic law enforcement attention upon road hogging or to pass another law designed to correct it. Primarily it should be regarded as a condition to be corrected by the individual driver.

If, however, the motorist will not reform his practices to make them conform to present laws and to the canons of safe motor vehicle operation then the corrective influence of both vigorous enforcement campaigns and new laws will be invoked. Neither is popular, either with administrative officials or with motor vehicle owners.

But the fact remains that there is a growing sentiment against road hogging as one of traffic's greatest evils. It will be ended one way or another and 1932 is destined to mark the acceleration of its demise, not only in New Jersey but in all parts of the country.—Harold G. Hoffman, *Commissioner of Motor Vehicles, State of New Jersey*, in the *United States Daily*.

**Water-Filled Fountain Pen**

WHEREVER there is water, there is a "filling station" for a new fountain pen which is rapidly becoming popular. This popularity is rightly deserved for with this new pen, called the Inkpak, one never needs a bottle of ink whether he goes to the South Seas for an extended stay and much writing, or simply loathes the messiness of ink bottles and the job of smudging the pen and filling the fingers with ink!

To outward appearance, this new pen is but little different from any ordinary fountain pen of the self-filling sort, so we'll pass that by. Inside, however, there is a sac which is to be filled—with water!—from the nearest faucet or old oaken bucket or fishing stream if you will. Flowing from this reservoir, the water passes over a perforated metallic cartridge in a slot under the nib. In that cartridge is the secret of the pen's ability to do magic: a special solid ink, something like the ordinary indelible leads of familiar pencils, dissolves slowly to furnish just enough ink for the

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instant of writing at just the place it is needed. One cartridge is said to be sufficient for two months' writing. When that is used up, a new one is withdrawn from the magazine at the top of the barrel—which holds five spares—and slipped into the slot under the nib. Water is drawn into the barrel whenever needed by means of the self-filler, and there you are.

### New Quick-Freezing Process

VARIOUS processes for the quick-freezing of foods have been developed and put into wide use during the past few years. Another, the "Z" process, which in some ways is superior to those now in common use, has been introduced to this country by the Frick Company. The "Z" process was



Fowls being placed on the conveyor in the "Z" quick-freezing system

invented by M. T. Zarotschneff, an internationally known refrigerating engineer. Tests made by the Frick Company over a period of many months have not only shown the advantages of the new process but also have given operating data.

It may be said that the new process, in order to effect rapid cooling without the necessity of maintaining extremely low temperature, employs at one and the same time all three of the known methods of heat transfer—radiation, convection, and conduction. A fine mist of brine, held a few degrees below zero, is injected into the cooling chambers through atomizers. The resulting fog, moving at high speed over the food, freezes it rapidly and thus does not rupture the cells of the product and spoil it. Since the brine mist does not exert any appreciable pressure, there is no penetration of the salt into the food as would be the case were liquid brine or a higher pressure utilized. In the case of some fruits like strawberries, the freezing action is so rapid that a glaze forms on the fruit almost immediately, and this also prevents penetration of brine. A quick rinsing in water after freezing removes this glaze and restores the beauty of coloring to the berries.

Both periodic and continuous (conveyor-type) freezers have been developed by Frick. In general, the time for freezing by the "Z" process can be assumed as 30 minutes for each inch of thickness of the product. This time is increased by 20 percent when the product is previously packed closely in containers.

### New Lacquers Resist Alcohol

WHEN guests in the future sample some "pre-war stuff," there need no longer be any fear on the part of the hosts that their tables or other pieces of furniture will be marred if some of the beverage happens to be spilled on the highly polished surface. A new alcohol-resisting linseed oil for lacquers of all kinds has been devel-

oped in the chemical research laboratory of Lehigh University (for the Archer-Daniels-Midland Co.) following several years of exhaustive research.

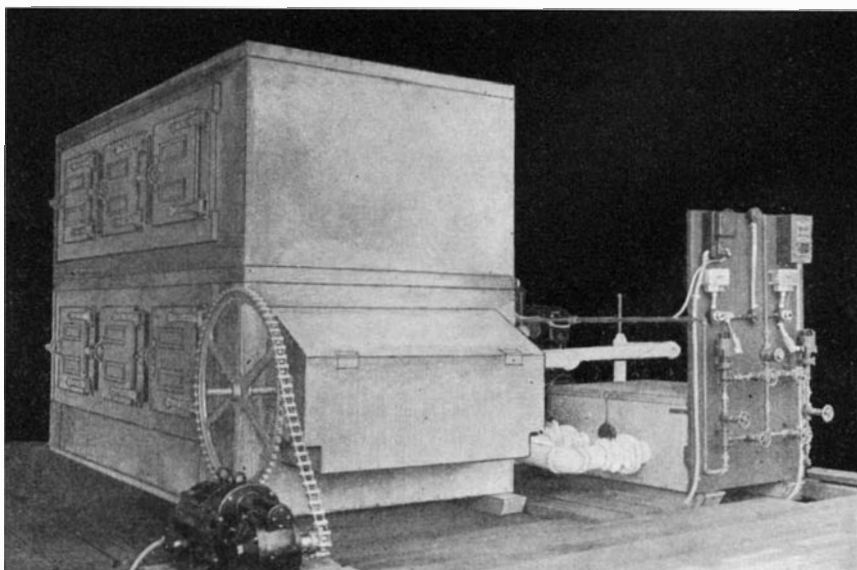
The same protection against alcoholic anti-freeze solutions in radiators will be afforded automobile owners should this new lacquer be used on the hood. Cars coated with lacquer made from this new linseed oil may be parked in the strongest sunlight indefinitely without any effect on the surface. Severe long-time tests under strong ultra-violet rays had no ill effects on test panels finished with this new protective coating.

Lacquers made with this new linseed oil require a maximum of 10 minutes to dry without the use of drying agents, which represents a marked advance in this direction. The drying is effected by evaporation of the solvents in the usual manner. The natural drying characteristic of linseed oil by oxidation and polymerization has been completely changed.

This new oil can be used on a 50-50 basis with nitro-cellulose for the most desirable results for general use. Various resin combinations are possible. An outstanding characteristic of this new material is its simplicity of formulation in that no gums or plasticizers are necessary to produce a quality film. Very light and true tints are possible with this new oil as it is particularly light in color.—A. E. B.

### Giant Hangar Has All-Welded Floors

WHEN the new airship hangar at Sunnysvale, California, is completed, more than seven miles of welded seams will have gone into its construction. The dimensions of this giant structure, which is to house the new Navy airship *Macon*, will be approximately 1200 feet in length by 308 feet in width by 225 feet in height. Not only will this hangar be one of the largest buildings in the world, but it will be the largest building in the world without pillars or posts to support it. The hangar, which will be in the shape of an enormous elongated archway, will have the world's largest single unobstructed floor area—nearly 300,000 square feet, a space large enough to house five miles of freight cars.



A complete quick-freezing unit for the "Z" process

The laying of the sheet steel battledeck mezzanine floors which run the entire length of the building, one on each side, is by far the largest job of structural welding ever performed in California. All the welds of the floor plates are continuous and the floor plate welds are ground flush with the top surface after the welds are completed.

The welding equipment being used on the job includes General Electric motor-driven and gas-engine-driven electric welding machines.

### Sound Turns Eye Into Stroboscope

ENGINEERS can see the parts of a revolving motor as though they were standing still. Singers can test the pitch of their voices by watching a revolving phonograph disk. And this without any complicated apparatus, Dr. Milton Metfessel, University of Southern California, has reported to the American Psychological Association.

Such effects are produced through the principle of stroboscopy, applications of which already make possible the photography of rapidly whirling objects. A tuning fork held against the head will vibrate the eye in synchronism with the disk, making the eye function only at the time that the disk reaches a certain position. The whirling disk then appears at a standstill.

Singers can learn to cause the eye-blinding vibration with their voices, Dr. Metfessel said. A low or middle C will make the spokes of a disk turning at 80 revolutions per minute appear motionless.—*Science Service*.

### American Tung Oil Industry Grows

THE establishment of the tung oil industry in the United States, first discussed in our pages two years ago, has been so successful that a move is now being made to expand it on such a scale that America will cease to be dependent on China for even small quantities of this commodity. Dr. H. A. Gardner has recently described the situation in a paper before the American Chemical Society.

Tung oil is essentially an oriental prod-

uct, used through the ages by the Chinese for making native lacquer and ink. Seeds were first introduced into America through the agency of the United States Department of Agriculture in 1905, and planted at the Government Experimental Station which was then at Chico, California. Extensive plantings, however, were not made until some eight years ago in the southern states. These were so successful that already 25,000 acres of land have been given over to the industry and there is a prospect of much wider cultivation soon.

The American Paint and Varnish Association is particularly concerned with this venture, as the oil is a valuable ingredient of varnishes and varnish paints. Apart from these uses, the American industries have extended considerably the application of tung oil, and it is now employed in the manufacture of insulating compounds, brake linings, linoleum, waterproofing fabrics, as a binder for wall board and plastic synthetic lumber, primers, synthetic resins, battery jars, and so on.—A. E. B.

### Fever Treatment Relieves Stubborn Asthma

**A**RTIFICIAL fever, which has been helpful in treating paresis, is now being turned to the treatment of chronic asthma. Thirty cases of the disease in which relief was obtained by this means have been reported to the American Medical Association by Drs. Samuel M. Feinberg, Strafford L. Osborne, and Meyer J. Steinberg of Northwestern University Medical School.

In 19 of these patients the relief of symptoms was complete and lasted from several days to nine and one-half months. In the other eleven cases, there was improvement without complete remission of the symptoms.

The fever was induced in these patients by high frequency electric currents, or diathermy. In all of the cases, other means of treating asthma had been tried without success. Careful examination of the patients before using this form of treatment is essential, it was emphasized, as not all patients may be able to stand it.—*Science Service.*

### Benzyl Cellulose—A New Plastic

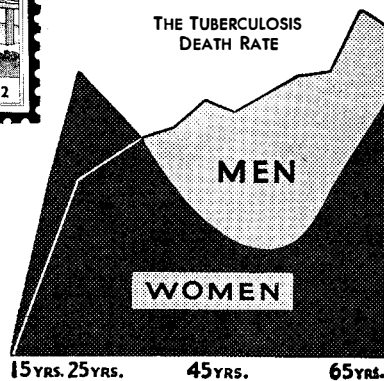
**A**NEW plastic substance, related to celluloid but with properties comparable to Bakelite was recently announced by British chemists in *Chemical Age* (London). The new material is benzyl cellulose, prepared by the action of caustic soda and benzyl chloride on cellulose. Benzyl alcohol, dibenzyl ether, and sodium chloride are the by-products formed. As benzyl cellulose is soluble in these organic by-products, the reaction mass is in a rubbery gelatinous form from which the by-products are removed during the purification. When purified and dried, benzyl cellulose is of a cream color, which becomes white when bleached. The viscosity of the product may be varied either during the process of benzylation or by subsequent treatments. In this way, a range of materials suitable for various technical applications may be prepared.

The outstanding property of benzyl cellulose is its stability. It resists the action of alkalis up to 20 percent concentration, is unattacked by sulfuric acid of accumu-



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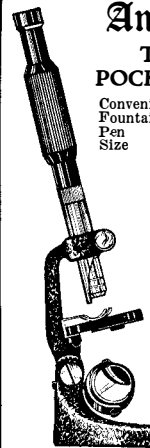
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lator strength (sp. gr. 1.4), and thus has advantages over cellulose acetate. It is thermoplastic and can be heated up to 180 degrees, centigrade, without fear of decomposition, and being relatively non-inflammable, like the acetate, can be worked at high temperatures without danger. A property which gives it advantages over other cellulose derivatives is its resistance to water. Its hygroscopicity is 0.5 to 1.0 percent, compared with 8 to 9 percent in the case of cellulose acetate. Films and articles made from benzyl cellulose are practically impermeable to water. The electrical properties of benzyl cellulose are also excellent and since it is unaffected by ozone, there is promise of a wide outlet for it in certain directions in the electrical industry where rubber rapidly perishes.

The thermoplasticity and stability of benzyl cellulose make it an ideal base from which to prepare molding powders. Such molding powders show no signs of decomposition on prolonged storage. Even the action of relatively strong acid or alkali leaves the benzyl cellulose composition unchanged. Marine weathering tests on shipboard show that moldings from these materials, after months of exposure in the heaviest of seas and extremes of climate, remain unaffected. The thermoplastic proper-

jectionable changes in flavor. The flavor of peaches, apricots, strawberries, and red raspberries has sometimes been damaged by exposure to 25 percent or more of carbon dioxide for a period of 24 hours, whereas plums, cherries, pears, apples, peas, and corn are much more resistant to carbon dioxide injury.

The carbon dioxide treatment may be given by using solid carbon dioxide along with the ice in the standard refrigerator car.

### New Type Steel Self-Supporting Roof

**WORKING** high above the ground like so many human flies, a crew of welding operators recently laid 60,000 lineal feet of welds to complete what are said to be the first self-supporting welded steel roofs in the country. This was at Albany, New York, where the roofs were erected on four huge grain elevators built by the New York Port Authorities for the Port of Albany. Welding and erection of the roofs were done by the J. K. Welding Company, New York City.

If precedents in the construction of grain elevators had been followed, the areas covered by the roofs would have been left

open—their usefulness would have been extremely limited. Instead, engineers decided to cover these areas with watertight roofs, making available additional storage space for grain or other materials. Furthermore, they planned a self-supporting roof, without columns, stanchions or purlins so that the maximum storage space would be obtained. The roofs which they designed were simple in construction and erection and represented a decided economy over the ordinary type.

The plan of the roofs is novel. Each measures 288 feet wide with a total span of 140 feet, and forms a catenary curve supported only at the top and bottom of the roof. Seventy-six sections of 12-gage mild-steel sheets, 140 feet in length and 50 inches wide, compose each roof.

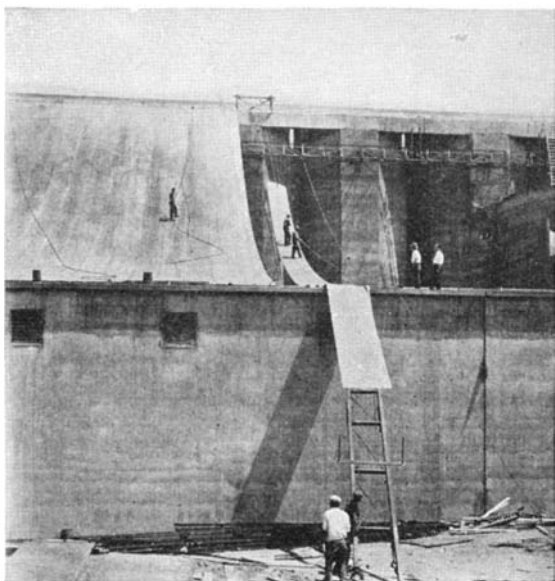
The lower part of the roof starts on a ramp, approximately 22 feet above the ground level, and extends upward at an angle between 30 and 40 degrees. Both the top and bottom ramps were constructed at an angle to conform with the slope of the roof.

Steel was ordered in lengths of 5 feet, 10 feet, and 31 feet 3 inches, and each section assembled and welded on the ground. Five sheets formed a section. These were fitted end to end in a jig and four of the seams butt welded. The last seam was lap welded.

At the ends of each section were two rows of  $\frac{7}{8}$ -inch bolt holes. The outside rows were used for erecting purposes and the inside rows for anchoring to the upper and lower supports. A yoke of  $\frac{1}{2}$ -inch steel was bolted to one end of the steel section about to be erected. To this was attached a steel cable running through a sheave at the top of the upper roof platform and thence downwards to an engine on the ground level for hoisting the section upwards.

At the edges of the ramps were anchored  $\frac{7}{8}$ -inch bolts. As the sections were hoisted into place, the inner row of holes in each section was fitted over the bolts in the concrete. In erecting, alternate sections were first anchored, leaving a gap of 46 inches. Then the intermediate sections were put in place lapping two inches on each side.

In order to hold the expansion and contraction to a minimum and to prevent un-



**Constructing the unique self-supporting roof of one of the grain elevators at Albany. At left: A strip section of steel is hoisted upward into place like a piece of ribbon, but it is strong enough to support the weight of workmen. Below: A large group of expert welders, each with his own dazzling arc, "sew up" the seams between the overlapped steel strips**

ties of benzyl cellulose, which melts at about 180 degrees, centigrade, but softens at lower temperatures, endow the molding materials with exceptional flowing properties. Molding is carried out at temperatures of 120 to 180 degrees, centigrade. For straight molding a pressure of one half ton per square inch suffices. No curing or hardening process is necessary.—A. E. B.

### Gassing Fruit Delays Spoilage

**EXPOSURE** of warm fruits and vegetables to carbon dioxide gas during the first 24 to 36 hours after loading in a refrigerator car may prove a valuable aid in preventing deterioration and spoilage.

The United States Department of Agriculture has found that carbon dioxide checks the decay and softening of fruits and helps to maintain the sweetness and freshness of such products as sweet corn and peas, but that exposure to the gas over too long a period may result in ob-



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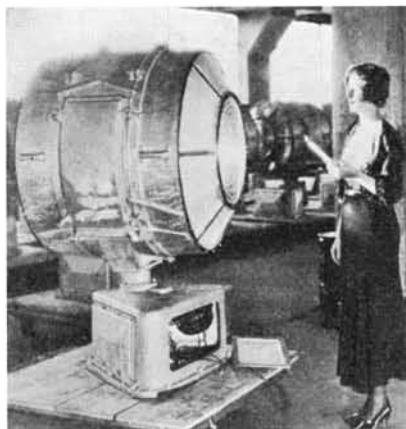
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evenness in the plates in joining them, considerable tack welding was employed. After all sections had been tack-welded in place, continuous welds were laid along each seam. The step back method was used to dissipate the heat and prevent distortion. Small expansion joints were welded in place over the longitudinal seams at every tenth seam, giving the roof free expansion and a floating characteristic. These joints were of 14-gage steel running half the length of the seam. They were staggered on the upper surface and the lower surface of the roof.

### Airway Beacons With Double Beam

**T**HE normal time lag of the optic nerve is one fourteenth of a second. Airway beacons generally rotate at six revolutions per minute, so that they swing their beam through a complete 360-degree circle once every 10 seconds. As the beam spread of such units is six degrees, the beam is



Double-beam airway beacon

visible at any one point for only 10 seconds divided by 60, or one sixth of a second. This is not quite enough time for the beam to register as effectively on the pilot's eye as the immense power of the beacon would warrant.

New beacons, made by Westinghouse for the Department of Commerce, revolve half as fast as the older type, or only three revolutions per minute. But they are "double beam" beacons with the light projected from both ends. The beacon still gives the required six flashes per minute, but the time for the beam to pass a given point is doubled and the effectiveness is increased accordingly.

Each beacon uses a special 1000-watt lamp. Two 36-inch lenses placed at each end provide the double throw. Each beam has 1,780,000 candle-power. The beacons are revolved by a one sixth horsepower electric motor.

These beacons have to meet extremely difficult conditions of operation. They may have to be hauled up almost inaccessible mountain sides. They may operate at 60 degrees below zero in Alaska, or at 120 degrees above zero in Death Valley. They may have to withstand snow, ice, and sleet in the north, or violent sand storms in the desert. They may have to operate without attention for weeks on end. Therefore their design is exceedingly complex but reliable.

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## A Test Every Man Past 40 Should Make

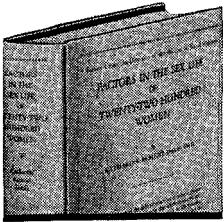
Medical authorities agree that 65 per cent of all men past middle age (many much younger) are afflicted with a disorder of the prostate gland. Aches in feet, legs and back, frequent nightly risings, sciatic pains are some of the signs—and now a well-known American scientist has written a remarkably interesting Free Book that tells of other symptoms and just what they mean. No longer should a man approaching or past the prime of life be content to regard these pains and conditions as inevitable signs of approaching age. Already more than 100,000 men have used the amazing method described in this book to restore their health and vigor—and to restore the prostate gland to its proper functioning. Send immediately for this book. If you will mail your request to W. J. Kirk, Pres., The Electro Thermal Company, 9660 Morris Ave., Steubenville, Ohio—the concern that is distributing this book for the author—it will be sent to you absolutely free, without obligation. Simply send name and address. But don't delay for the edition of this book is limited.

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The new meter, developed by Charles Englehart, Inc., of Newark, New Jersey, is operated by passing a portion of the exhaust gas through the meter after the motor has warmed up. When this exhaust gas reaches the analysis cell of the instrument, a pointer is deflected over a wide scale to indicate the exact nature of the mixture.

The meter operates on the Wheatstone bridge principle, comparing the thermal conductivity of the exhaust gas and the air-fuel ratio of the carbureter. The scale of the meter is calibrated directly in pounds of air per pound of gasoline burned.—A. E. B.

### Chemical Lumber

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farm. Cornstalks, corncobs, straw, bagasse, and spent licorice root are some of the materials that may be utilized in the manufacture of this synthetic lumber.

"Maizolith", the hardest of the list of artificial woods, has many of the properties of teak, says Prof. Sweeney's report, and closely resembles it in appearance as well as in its properties of durability, density, and strength. But its cross breaking strength coefficient ranges from 25,000 pounds to 30,000 pounds, nearly twice that of teak and almost that of ordinary steel.

"The wood can be manufactured for approximately 250 dollars a ton," Prof. Sweeney declares. "At this cost, there will undoubtedly be considerable demand for it for purposes for which it is peculiarly fitted, but if we are to help the farmer by buying his waste products, we must make the process cheaper and create a larger demand." It has been suggested for use in cog wheels, snubbers, airplane propellers, and similar articles.

"By laminating half and quarter inch boards we obtain dimensional lumber that is stronger and easier to use than natural lumber," Prof. Sweeney continues. He describes a kind of wood closely corresponding to white pine, saying:

"We are not confined to the production of boards and dimensional lumber, either. I have a window frame pressed out complete in required dimensions which was constructed at a cost of 40 cents." This is far below the cost of wooden frames.

Among the artificial woods developed recently is a substitute for cork which is cheap enough to be used for insulating houses. It is possible to replace the ordinary shiplap used in a house wall with this substance, and to sheathe the inner walls and partitions with it also, using it as a plaster base instead of lath.

"The objection has been raised," he adds, "that the raw materials for the manufacture of such wood are widely scattered and hard to obtain. However, studies have shown that a plant in the corn belt of the United States would have, within a 10-mile hauling radius, an available supply of from 327 to 586 tons of raw material a day, 300 days in a year."

Artificial lumber can be manufactured in any specified dimensions. While a board 250 feet long and four feet wide is the largest that can be sawed out of the largest tree, a board 12 feet wide and even wider, and of unlimited length could be manufactured from corn stalks.

**Field Telephones of New Type for Forest Service**

**E**FFORTS to develop better field telephone equipment in the Pacific Northwest region of the Forest Service have resulted in at least three important improvements, says W. B. Osborne, of the United States Forest Service, writing in the *United States Daily*.

A new portable telephone has been perfected which, while costing less than half as much, has about twice the talking and signaling range of the set now in use. Its aluminum shell is made up in two parts, and its mechanism is standard and easily accessible for repair and adjustment.

A new emergency wire having an insulation four times as effective as that of the old cotton-wound wire has been made up

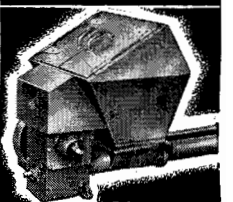


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## A New Way to Better Golf

By Alex. J. Morrison

It is one thing to know the game but it is quite another to be able to express that knowledge so that others can readily understand and, what is most important of all, be able to carry out the instruction. Such a gift has the author and there will not be a single "Mr. Over A. Hundred" who will not find it most profitable to read and reread what this "Pro." says. He has been able to prove all he contends by pupils who have vastly improved their game as a result of his instruction. In fact, this reviewer has spent much too much time on this book, with the whimsical wish that it had been available when he was a golf addict. Splendid, unique photographs and illustrations complete this best of all golf instruction books.—\$2.15 postpaid.

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By Herbert Corey

THERE seems to be a most malicious tendency to vilify Presidents, though just why the present incumbent should be the subject of such insidious attacks it is hard to understand. At any rate here are the facts as deduced from official papers and records, and from the testimony of the men themselves who had the best knowledge and were in the best position to judge. Regardless of righting an odious wrong this biography is most interesting for it gives in detail the events of a most successful career about which little has hereto been known.—\$2.65 postpaid.

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By Morris S. Viteles, Dept. of Psychology, Univ. of Penn.

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## YOU CAN'T BEAT 'EM

(Continued from page 351)

in the coins or slugs through the slot at the top. When this tube is filled, the device is ready for use. Coins or slugs now played will be distributed between the jack-pot and the money box. In a "vending" machine, all coins go into the money box and slugs into the jack-pot or pay-out tube. In gambling machines, a distribution is made. When a lucky combination is hit, the player is paid from the pay-off tube, and subsequent plays must once more fill up this tube before the jack-pot or the money box again receive their share.

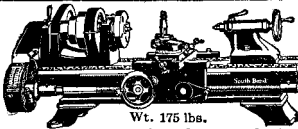
Now comes the question of whether or not these machines can be "rigged" or "fixed" so as to pay a greater percentage to the owner or lessee. It is obvious from the percentages given above that such a procedure is unnecessary, but such is the greed of some people that they cannot be satisfied even with a sure thing, and they must contrive to make it more sure. It

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is possible to manipulate the mechanism of these machines so that the three bars calling for the jack-pot can never line up. But then steady customers would become suspicious if the same well-filled jack-pot were always on display. So, it is possible to "dump" the jack-pot.

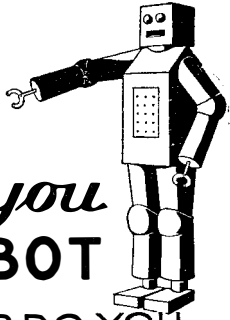
At the back of the mechanism near the bottom plate will be seen a series of levers, one above the other. If these levers are held by the finger while a coin is inserted in the regular playing slot, and the operating lever is pulled, the jack-pot and part of the contents of the pay-out tube will be delivered regardless of the combination which is shown on the wheels. This may be done at some time when no outsiders are present, by the holder of the key to the rear panel. Then the one in charge of the machine has only to spread the word carelessly that "Jack Smith hit the jack-pot just a few moments ago," and confidence in the machine returns and the coins continue to roll in. For information on the operation of the mechanism of these machines we are indebted to Sergeant William J. McMahon, of the Police Academy of New York City, and to W. H. Bush, of Brooklyn, New York, who have made an extensive study of these devices.

ANOTHER example of how the public can be misled is found in the fact that all of the symbols on the wheels are not used. On one machine with 20 characters, two on the first wheel could never line up with the window. All on the second wheel were "good," but three on the third were "dead." It is obvious that merely five "dead" characters have a tremendous adverse influence on the chances in favor of the player. On another machine, half of the characters were "dead" on each wheel.

Some idea of the large profits accruing to the ones who place these machines at the disposal of the public may be gleaned from the fact that many store-keepers are able to pay their monthly rent from the receipts of the machines. Yet they get only a "50-50" split from the distributor who services the machines and keeps them in operating condition.

Active prosecution by the police of New York City of persons having these slot machines in their possession has resulted in practically clearing the city of them. However, when the present close attention to the matter relaxes, as it must, the machines will gradually make their appearance again. In many summer resorts during the past season, these machines were to be found in great numbers, and not only near metropolitan centers, but anywhere and everywhere that enough people were to be found to make the venture profitable.

It is obvious that police suppression will not stop the slot-machine racket any more than it can stop the sale of liquor or the commission of crime. If, on the other hand, people will realize that they can not beat the machines, and will refuse to be fleeced of their money, the machines will gradually disappear as they become unprofitable. If you like to see the wheels go 'round, read silly "fortunes," and have a machine collect a toll of at least 25 percent of the money that you put into it, go on and play. But take our word for it, backed by our own studies, and those of the New York Police Department, that in the long run "You Can't Beat 'Em."



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# COMMERCIAL PROPERTY NEWS

Conducted by SYLVESTER J. LIDDY

Member of the New York Bar

## How the Courts Treat Meritorious Patents

**I**N the case of Pairpearl Products, Inc., versus Joseph H. Meyer Bros., et al., reported in 58 Fed. Rep., (2d), page 802, the United States District Court for the District of Maine sustained a patent and found infringement. This case is an interesting instance of the care with which courts seek, if possible, to uphold a patent grant and protect the patentee's right in the patented invention.

The subject matter of the patent, owned by the plaintiff, is the method of treatment of guanin, an organic substance obtained from the skin of certain fish, and when processed, used largely in the manufacture of artificial pearls. The invention of the plaintiff, as claimed, is principally in the substitution of soap or saponin for other agents previously used in separating the crystals of guanin from the material in which they are imbedded.

The defendants attacked the patent on several grounds, as follows: Lack of invention, insufficiency of disclosure, anticipation because of prior use, and non-infringement.

The form of the patent appears to have been open to criticism, for the Court points out: "It is true that the language of the patent is clumsy, somewhat ambiguous, and lends itself to a possible construction such as claimed by the defendants."

It appeared from the evidence that the defendants had at one time infringed the process by actually using soap in carrying out one of the steps of the process of the patent. The evidence showed that the defendants had apparently abandoned the use of soap and at the time of the trial were using what the defendants claimed to be a new agent, as a substitute for soap, and to which they had given the name "tec." Defendants declined to make known the constituents of "tec." Some experiments performed in the courtroom, however, satisfied the court that whatever "tec" might be, it apparently had the same properties as soap, and in carrying out the process produced the same results.

Regarding the burden of proof to establish infringement, which of course was on the plaintiff, the court had this to say:

"If the defendants had disclosed the nature of the composition of 'tec,' the plaintiff would have had the burden of showing that it was a detergent agent within the scope of the patent. By reason of such refusal to disclose there arises, at least, a strong inference, available to the plaintiff, in establishing its *prima facie* case, that 'tec' is an agent of the patent."

In attempting to prove invalidity because of prior knowledge and use, testimony was offered to show that the process, including the use of a form of soap powder known as "Gold Dust," was old long before the patent. The evidence consisted almost entirely of the testimony of certain witnesses

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

concerning the use of the process alleged to have been performed as early as 1919, but there was no corroborative documentary evidence.

While the court conceded that the witnesses had testified with the utmost sincerity and that there was no reason to doubt their credibility, it held that oral testimony alone was not sufficient, but must be fortified "by concrete, visible, contemporaneous proofs which speak for themselves." All the doubts raised by the defendants, apparently, as to lack of invention, insufficiency of disclosure in the patent, the defendants' infringement, and prior public use, were resolved in favor of the plaintiff. The patent was sustained and the defendants were found to have infringed it, with the resultant decree for an accounting and damages, and an injunction restraining the continued use of the process which the defendants were using.

## Rehearing Denied on "Dry-Ice" Decision

**T**HE Supreme Court of the United States will not review the decision determining that the term "Dry-Ice" is not subject to be registered as a technical trademark for solid carbon dioxide, Chief Justice Hughes announced recently. The court denied petitions for review sought by the Dry-Ice Corporation of America in two suits alleging infringement of the registered mark.

The Circuit Court of Appeals for the Fifth Circuit, whose decision the Supreme Court refused to consider, ruled that the term "Dry-Ice" is descriptive of the characteristics or qualities of solid carbon dioxide and that, therefore, the registration of the mark in the Patent Office is invalid. (See page 252, April 1932 SCIENTIFIC AMERICAN.)

The Dry-Ice Corporation brought the suits in question to restrain the use of the term "Dry-Ice" in the corporate titles of other companies and to restrain the use of the term in advertising and selling solid carbon dioxide manufactured by the defendants. The relief sought was denied by the Circuit Court of Appeals on the ground that the proof did not show that the defendants were guilty of any wrongful conduct having the effect of falsely representing the origin or source of their product or attempting to palm it off on the purchasing public as the product of the Dry-Ice Corporation and its licensees.

In urging consideration of the cases by

the Supreme Court, the petitioners' brief stated that they present a situation "where the lower courts have held descriptive two words in paradox which at the same time when conceived were not descriptive of the goods, consequently could not be descriptive of the characteristic of the goods and were in no sense a measure of quality." The term, it was claimed, is merely suggestive of the use to which solid carbon dioxide can be applied. "The term 'Dry-Ice' does not state or describe the fact that solid carbon dioxide is or may be used as a refrigerant. 'Dry-Ice' does, however, suggest the function of the article in question."

In opposing review, the respondents contended that the term "is not only descriptive of the characteristics of solid carbon dioxide, but is a most appropriate name for the product itself."

## Contempt Proceedings in Patent Suits

**T**HE Langsdorf patent, number 1447090 for neckties, has once more come before the courts. The case is that of Franc-Strohmer and Cowan, Inc., plaintiff, against Eugene Jacobs, Inc., defendant, in which plaintiff filed a petition to punish the defendant for violation of an injunction which had issued against him on a consent decree, the defendant having admitted the sale of neckties which in all respects were like the construction covered by the Langsdorf patent. The neckties constituting the basis for the petition in contempt were not the same as those which the defendant conceded were infringements. They were in fact of entirely different construction, but which plaintiff nevertheless contended were infringements and that the sale thereof by the defendant constituted contempt of court.

Judge Bondy has this to say:

"Proceedings to punish for the violation of an order enjoining the infringement of a patent should be resorted to only when the alleged offending device is identical with the one held to have infringed, or is merely colorably changed."

The defendants' attorneys, in opposing the petition for contempt, offered proof to show that the ties which constituted the basis of the contempt proceeding had been manufactured and sold in large quantities by the leading haberdashers throughout the United States for approximately six years, with the full knowledge of the owners of the Langsdorf patent, but that no suit had ever been instituted against either the manufacturer or a retailer, charging that such ties constituted infringements of the Langsdorf patent. Judge Bondy in his opinion, after discussing the prior litigation in connection with the Langsdorf patent, and pointing out that it had been held to be invalid by the Circuit Court of Appeals for the Sixth Circuit, and valid by the Circuit Court of Appeals for the Second Circuit, held that, properly interpreted, the

invention of the Langsdorf patent "consisted of the abandonment of the rigid or non-stretchable method of construction and the substitution of a resiliency or stretchability measurably controlled by the lining and the loose stitching. . . . It is a combination of these elements, two of which, the resilient lining and the loose stitching, are said to be wholly new that makes up the essence of Langsdorf's invention."

The defendant also contended that, because of delay in filing disclaimers restricting certain claims which had been held to be invalid, the entire patent had been invalidated and under the law no suit could be maintained thereon. The petition for contempt was dismissed.

### Hosiery Trademark Granted

**I**N a recent trademark case, Assistant Commissioner Moore held that Integrity Hosiery Company, of Philadelphia, Pennsylvania, is entitled to register the notation "Tangie" as a mark for hosiery notwithstanding the prior adoption and use by The George W. Luft Company, Inc., of Long Island City, New York, of the term "Tangee" as a mark for toilet preparations such as lip stick, rouge, complexion powders, and so on.

The ground of the decision is that the goods are not of the same descriptive properties.

With reference to the marks the Assistant Commissioner said:

"The applicant, in support of its contention that the mark 'Tangie' is not confusingly similar to the mark 'Tangee', points out that the two marks do not have the same appearance or the same meaning. I am of the opinion, however, that if the two marks were concurrently appropriated to the same goods, confusion and uncertainty would be created in the minds of purchasers as to the origin or ownership of such goods."

With reference to the goods themselves, he said:

"That toilet articles, such as those to which the opposer appropriates its mark, and hosiery, to which the applicant appropriates its mark, are not goods of the same descriptive properties has been decided by the U. S. Court of Customs and Patent Appeals in *House of Tre-Jur, Inc. versus Combine Hosiery Corporation*."

With reference to the argument of opposer that his mark was a distinctive, arbitrary, and manufactured word and nobody else should be allowed to register it, he said:

"However, the Supreme Court in *American Steel Foundries versus Robertson*, Commissioner of Patents, and *Simplex Electric Heating Company*, held that:

"The mere fact that one person has adopted and used a trademark on his goods does not prevent the adoption and use of the same trademark by others on articles of a different description. There is no property in a trademark apart from the business or trade in connection with which it is employed."

With reference to the right of opposer to be heard on the question whether applicant's mark is merely the name of the "Tangee Corporation" he said:

"I agree fully with the reasoning and conclusion of the examiner of interferences. This question not having been raised by

the opposer in its notice of opposition may not be argued by it at this time."

He then, after noting that applicant's mark is not identical with the name of the corporation and quoting from the decision of the Supreme Court in *American Steel Foundries versus Robertson*, said:

"Toilet articles and hosiery having been held by the U. S. Court of Customs and Patent Appeals in the *House of Tre-Jur, Inc.*, *supra*, not to be of the same descriptive properties, it is believed that said alleged corporate name does not form a sufficient basis on which to refuse to register the applicant's mark."

### "Sano-Bath" Mark Rejected

**I**T was recently held by First Assistant Commissioner Kinnan that Adelaide Ortegat, of Paris, France, is not entitled to register, as a trademark for perfumes, shampoos, and so forth, the term "Sano-Bath" in view of the prior adoption and use by The American Products Company, of Cincinnati, Ohio, of the marks "Zanol" and "Zano-Dent," the mark "Zanol" having been used for perfumes, shampoos, and so forth.

The ground of the decision is that the goods are the same and the marks confusingly similar.

With reference to the latter question, the First Assistant Commissioner said:

"The word 'Bath' in applicant's mark is descriptive as to some of the goods upon which her mark is used and has been in consequence disclaimed. The notation 'Sano' is deemed to be as nearly like 'Zanol' as was the notation 'Sanlo' in the case of *The American Products Company v. Herbert F. Braithwaite*, or as was the notation 'Zeno' in the case of *The American Products Company v. Leonard*. While the applicant's mark should be considered as a whole, yet the word 'Bath' being descriptive as to some of the goods would not be very distinctive, and it also appears on packages of opposer's bath salts."

### Patent Office Records Broken

**T**HE Patent Office granted more patents in the fiscal year ended June 30, 1932, than in any previous year in the history of the office, according to information made public by Commissioner Thomas E. Robertson.

### "Flit" and "Zit"

**I**T was recently held by First Assistant Commissioner Kinnan that Bonide Chemical Company, Inc., of Utica, New York, is not entitled to register, as a trademark for a stock spray, the notation "Zit" in view of the prior adoption, use, and registration by Stanco Incorporated, of New York, New York, of the term "Flit" as an insecticide.

The ground of the decision is that the goods are of the same descriptive properties and the marks applied thereto confusingly similar.

With reference to the goods the First Assistant Commissioner said:

"The applicant seeks to distinguish somewhat the character of its goods from that of the opposer and notes the latter uses its goods in the household and in smaller quantities while applicant uses its goods

upon animals and in poultry houses. It must be held however that the goods belong to the same class and possess the same descriptive properties."

With reference to the marks, he said: "They resemble each other so much in sound that mistake could readily occur where a purchaser verbally or over the telephone called for the goods of one party. Similarity in spelling and appearance exists to a considerable extent. It is believed that confusion in trade would be quite probable if the goods of both parties appear in the same market under the respective marks."

### Newspaper Title Mark

**I**N *ex parte* Pulitzer Publishing Company, Assistant Commissioner Moore held that Pulitzer Publishing Company, of St. Louis, Mo., is not entitled to register, as a trademark for a newspaper, a mark said to consist of the words *The Post-Dispatch Platform*, followed by a statement of principles and the name Joseph Pulitzer and the date April 10, 1907.

The registration was refused on the ground that the mark does not have the function of indicating origin or ownership.

In his decision, after noting that the examiner had held that the matter was adopted for the purpose of indicating the "principles" of the paper to which it was applied and that other newspapers having the same principle would have equal right to announce them and referring to decisions of the Supreme Court of the United States with reference to what is the office of a trademark, the Assistant Commissioner said:

"The applicant's alleged trademark does not meet the above requirements. Obviously it was not adopted for the purpose of identifying the origin or ownership of the article to which it is applied. . . . The declaration of principles which constitute the platform on which the *St. Louis Post-Dispatch* rests may have been entitled to protection under our copyright law as a literary production, but certainly it does not function as a trademark."

### "Hessian" Registration Refused

**I**N *ex parte* Phillips Petroleum Company, First Assistant Commissioner Kinnan held that the term "Hessian" is not registrable, under the Act of 1905, as a trademark for motor fuels and lubricating oils, since it is merely a geographical term.

In his decision, after stating that the examiner of trademarks had called attention to a publication showing that petroleum was extensively exported to Germany and noting applicant's argument that there was no evidence to show that motor fuels and lubricating oils had ever been imported into this country from Hesse and the argument that the word "Hessian" had been used in some other senses or with meanings other than merely geographical, the First Assistant Commissioner said:

"It is not thought the average purchaser of the applicant's character of goods would know whether they came from the province of Hesse or not, but seeing the notation 'Hessian' upon them would be led to think they came from there so that the notation would be either descriptive as geographical, or deceptive. . . ."

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# Books SELECTED BY THE EDITORS

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By *A. Frederick Collins*

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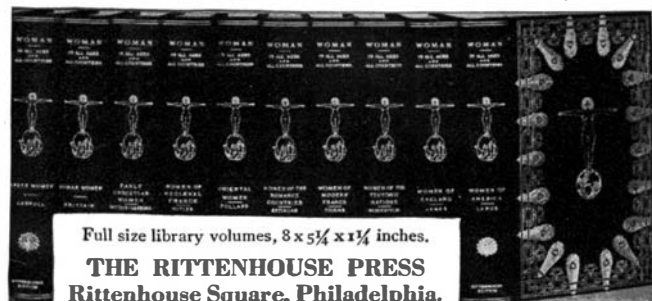
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