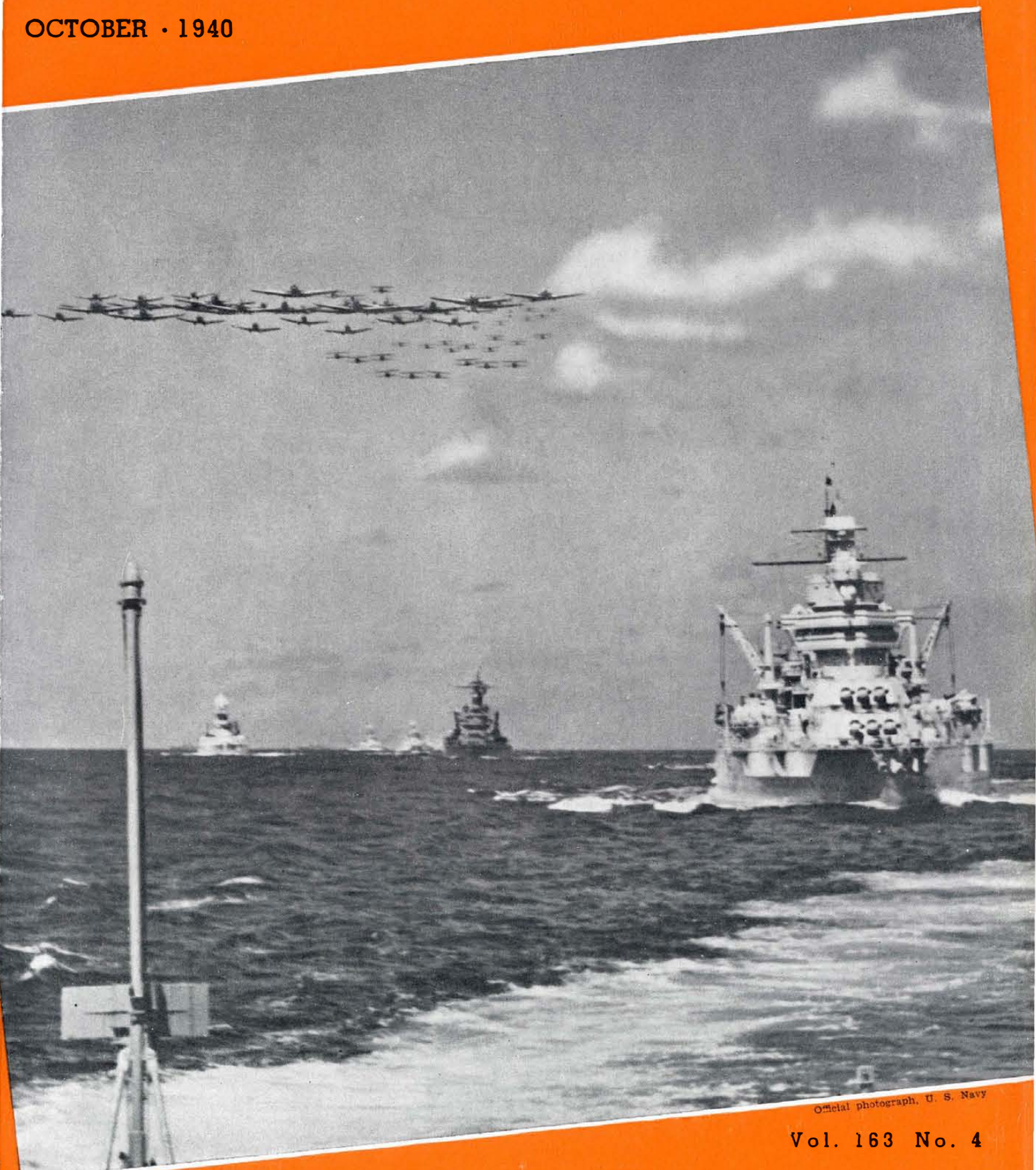
SCIENTIFIC AMERICAN

OCTOBER · 1940



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Vol. 163 No. 4

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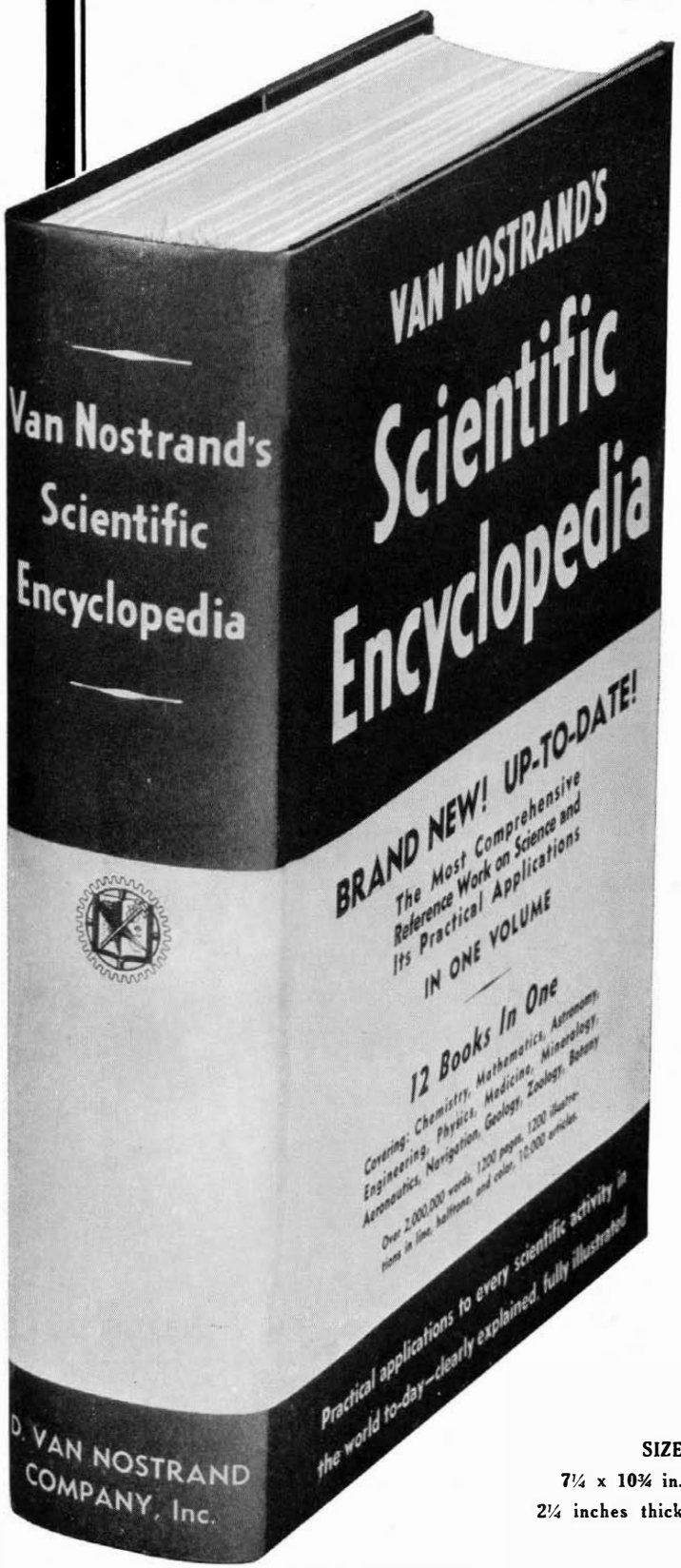

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SCIENTIFIC AMERICAN

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

OCTOBER • 1940

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MYTH? PART TRUTH?

AT LAST a way to put the Lost Atlantis tradition to a scientific test has been found. Readers will recall how Plato recorded a story, which in his time was already 8000 years old, that a vast land lying west of Gibraltar and containing a great empire, in a day and a night sank beneath the sea. The belief, therefore, that the rich cities of a civilization more advanced than our own lie today in all their arrested splendor burns bright in the souls of modern Atlantis cultists. Is that tradition entirely mythical?

Lying 12,000 feet beneath mid-Atlantic waters is the Atlantic Ridge, a vast submerged plateau which some Atlantean believers identify with the Lost Atlantis. Why couldn't this have sunk? Do not parts of the earth's crust rise and fall, as geologists commonly point out? Aside from the fact that few geologists believe large areas founder deeply, the unusual feature of the Atlantis tale is the sudden submergence it calls for. Geologists deny its possibility.

Within recent years, however, new evidence has come to light that may encourage the Atlanteans. Perhaps, instead of itself sinking, the Atlantic Ridge plateau was laid bare by a subsiding sea and later flooded again by a rising sea. The discovery of large submarine canyons far below present sea-level now leads some geologists to believe that these were excavated by rivers flowing on what then was dry land. To account for this apparent anomaly, they assume that a great deal more of the earth's water was locked up as glacial age ice than has previously been thought. One geologist, A. C. Veatch, estimates sea-level in glacial times at 12,000 feet below present sea-level. This fits in nicely with Atlantean tradition.

If the waters gradually withdrew during 50,000 years of the last glaciation, the Atlantic Ridge might for many millenia have had a population. Finally, as polar ice melted away, the seas would have risen and the area would have been submerged—not, however, overnight or even over a lifetime—something geologists refuse to accept. (Incidentally, the inhabitants could not have been able to distinguish the rising sea from a falling land.) A tradition of sinking would have started among those who departed the area, and before long the story would have picked up trimmings, most certain of which would be a submergence with dramatic suddenness, for this would be too good a supplied detail for man to forego.

Methods of surveying the sea-beds with previously unhoped-for precision, by employing the sonic depth finder in connection with remarkably exact methods of measuring horizontal distances with actual tapes (wires), have recently been developed and proved good. In many places such surveys reveal a thing that makes geologists raise their eyebrows—a complex pattern of typical land-surface, stream-erosion channels. And now Capt. Gilbert T. Rude, of the United States Coast and Geodetic Survey, in the *Proceedings of the United States Naval Institute* for August, proposes that such a survey of the Atlantic Ridge be made.

Capt. Rude does not propose this merely to test the Lost Atlantis tradition, for it would have other and greater values to science, but he does point out how it might tend to settle this old question. If a typical pattern of stream-erosion channels—in other words, valleys—were found covering the Ridge area, this would tend to favor the Atlantis hypothesis. If only typically smooth, unchanneled sea-bed topography were shown, Atlantis would look still more like pure myth than it already does to most scientists.

However, even if the eroded land-forms were found, the real essentials of the Atlantis hypothesis, as its mystical proponents prefer to have them—that is, the great "empire" and the civilization "superior" to those of our own times and all that kind of thing which mystics and occultists dearly love—would scarcely be given encouragement; unless perchance the dredges of the Survey were to haul up from over one mile beneath the surface a golden throne and some things we benighted moderns could not yet understand, perhaps an atomic energy machine.—*A. G. I.*

FEEDING FOREIGNERS

UNCLE SAM is being urged by some well-meaning but near-sighted citizens to feed and clothe the needy of European countries which are now under the domination of the German war machine. Should such a plan be put into effect, it would surely prolong the present conflict and might even be the instrumental factor in tipping the scales in favor of a Nazi victory.

At the present time, Germany is reported to be stripping the invaded countries of all available food supplies, which indicates the effectiveness of the British blockade. Regardless of any promises which might be made by Germany, food and clothing supplied to invaded countries undoubtedly would be seized by Germany as a matter of self-preservation. The fact must not be overlooked that should the present blockade continue to be effective, the obvious strain on the resources of Germany in feeding itself as well as the populace of conquered countries might bring about an early cessation of hostilities.

While we have every sympathy for the sufferings of the people of Europe, we should steel ourselves to the fact that to rob Great Britain of the effects of one of its most potent forces—the blockade—might be the means of bringing about a far greater catastrophe.

A large amount of money has been solicited from the people of the United States for the purpose of aiding the destitute of foreign countries. In fact, one organization publicizes the fact that it has available many millions of dollars. There are in the United States thousands of people who are in absolute need and worthy of every charitable consideration. Would it not be a good idea to use the funds collected for foreign assistance for the aid of our own countrymen who are unable to obtain the necessities of life from other sources?—*O. D. M.*

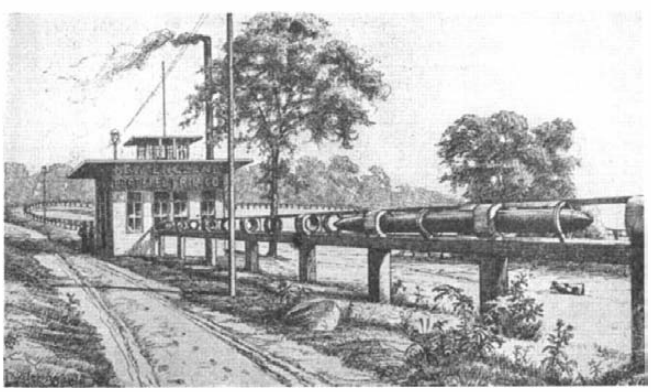
50 Years Ago in . . .

SCIENTIFIC AMERICAN

(Condensed From Issues of October, 1890)

WAR BALLOONS—During the last sixteen or seventeen years, the Dutch government has been carrying on a more or less active war with certain tribes in Acheen. a district of Sumatra, the third largest island of the world, and with this view have dispatched a military ballooning contingent, under the direction of Mr. Percival Spencer, an English aeronaut, to Kota Rajah, the fortified capital of the unconquered regions, where it is proposed to establish a permanent balloon reconnoitering corps to watch and, if possible, circumvent the strategical movements of the enemy.

PACKAGE TRANSPORT—The portelectric system . . is intended for the transportation, not of passengers, but of mail and express matter only, at rates of speed approximating two miles per minute, the steel car being drawn along its confined path at this high rate by the pull of



numerous solenoids through which the track is laid, each coil exerting its power for a short time only as the car approaches it . . . The passage of the car completes the circuit between the upper and lower rails through th solenoid in advance of the car, and the car is thus pulled into the coil until it is midway through the coil, when the current is cut out and transferred to the next coil in advance.

TELESCOPE—The glass for one part of the great forty-inch objective of the new Southern California observatory has been received by the Clark Brothers, of Cambridgeport, Mass. . . . The telescope is to be mounted in an observatory upon Wilson Peak, of the Sierra Madre Mountains, 12 or 15 miles back of Los Angeles, Cal.

GUN POWER—The range and penetrating power of modern rifles are tremendous. The six-inch rifle will hurl its projectile through ten and a half inches of wrought iron a thousand yards from the muzzle. The eight-inch rifle will pierce sixteen and three-tenths inches of iron at the same distance. The ten-inch rifle that the rejuvenated *Miantonomoh* will carry will send its missile through twenty-one inches of iron a thousand yards away. The twelve-inch rifle, of which we are to have a supply in the future, will penetrate twenty-eight inches of iron at a range of three thousand feet.

METAL VALUE—The price of platinum has recently advanced very greatly, until now it is nearly equal in value to gold. In July, 1889, the price was $8 an ounce, six months ago it was $14, and at this writing it is $20 an ounce, while gold is quoted at $20.70 (*sic*). This rapid rise in the value of the metal is due to the steadily increasing demand from the manufacturers of electrical apparatus.

CHOLERA—Advices received from Tokio, via Yokohama and British Columbia, contain intelligence of the terrible outbreak of cholera which has taken place in Japan, by the ravages of which upward of 200 deaths were occurring daily.

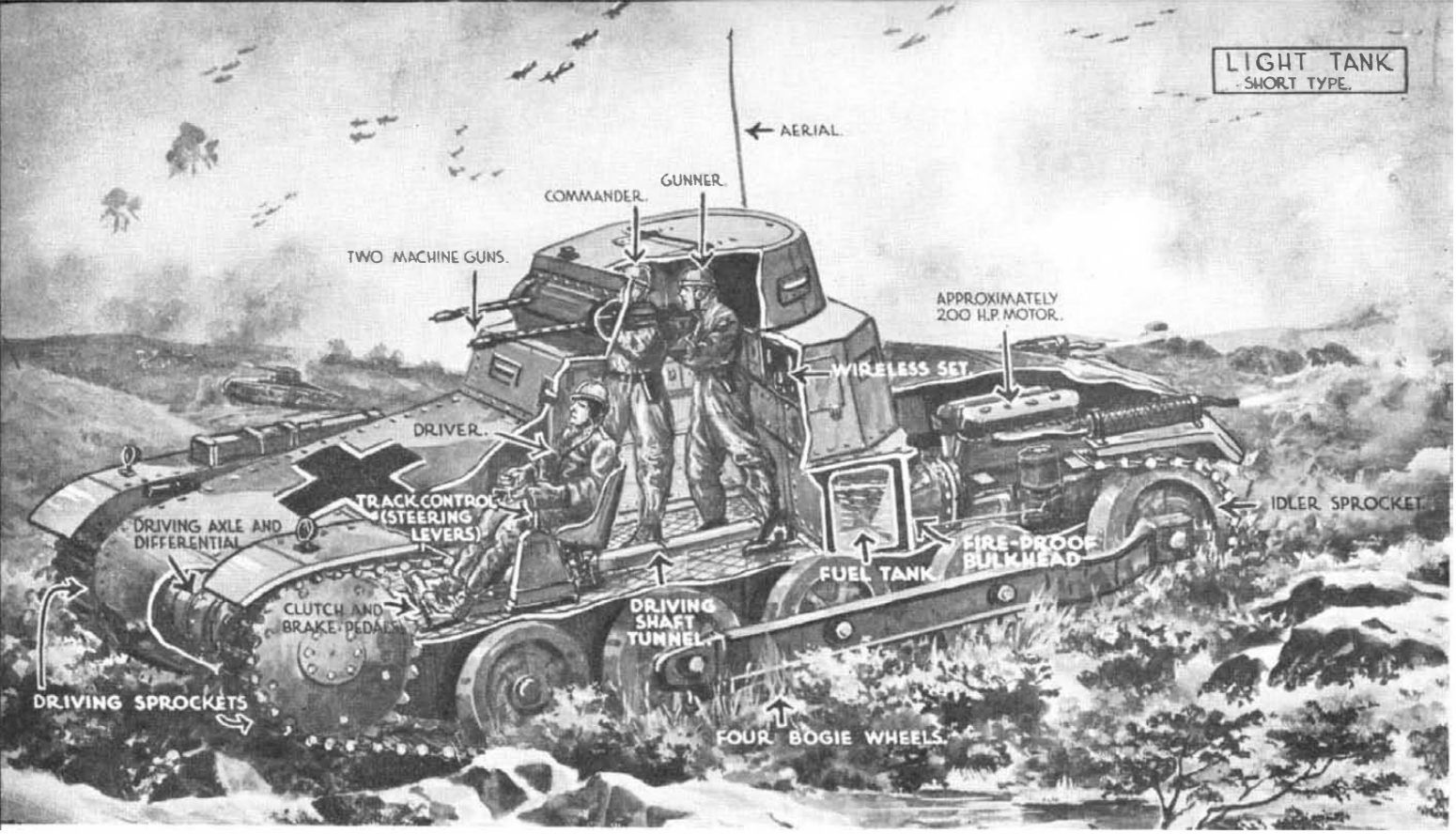
ANCIENT ROSE—At Hildesheim, in Hanover, there is a celebrated rose bush, the oldest in the world. Charlemagne himself planted it more than a thousand years ago in commemoration of the embassy received from the caliph of the Thousand and One Nights, Haroun al Raschid.

EXHIBIT—The 59th annual exhibition of the American Institute opened, in this city, on October 1, and is now in progress . . . Among the photographic novelties is the slot machine for taking photographs. On sitting in position and dropping "a nickel in the slot" and executing some manipulations, a photograph of the sitter is passed out.

PRECIOUS—Uranium was unknown a century ago, but a lode has been found in a mine in Cornwall, England. It sells for $12,000 a ton.

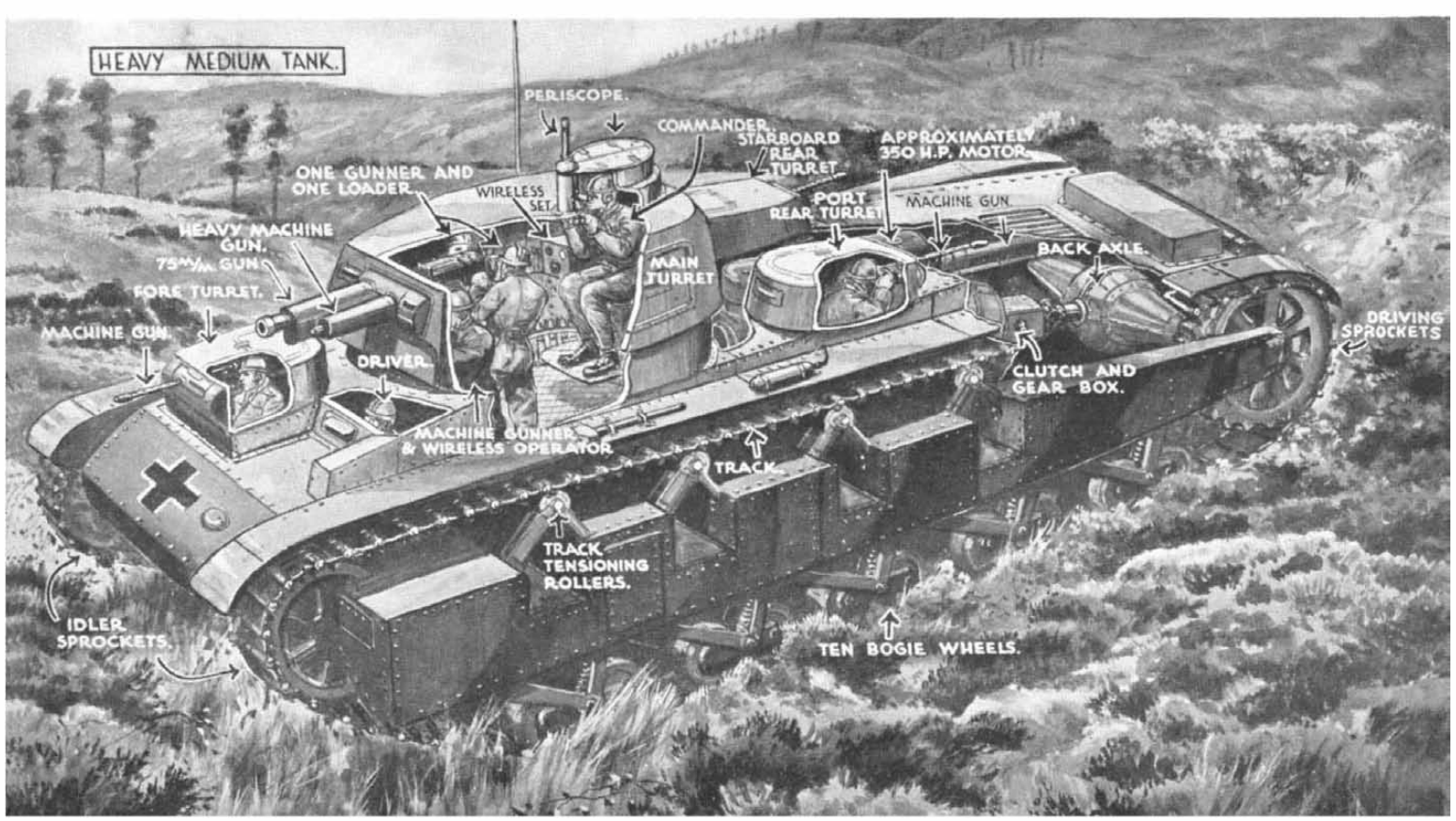
SHIPS WITHIN SHIPS—A floating island made of steel 1,000 feet long, 300 feet wide, and drawing 26 feet of water — such is the type of ship as described by Sir Nathaniel Barnaby . . . Constructor Barnaby would load and unload his ship in midstream by lighters, and, instead of breaking their bulk, would take them aboard, hull and cargo, for his plan includes a clear sheet of water for them 'tween decks, a miniature harbor into which they may be floated at one port and floated off again at another. Once the lighter fleet containing the ship's cargo is properly arranged aboard, the floating basin can be pumped dry and all comfortably stowed for the voyage — the sea being let in again after the ocean has been crossed, and the cargo thus distributed in many bottoms floated ashore.

ADVERTISERS during the Fall season of 1890 included: Keuffel & Esser Co. (surveyor's instruments); L. S. Graves and Son (elevators); Armstrong Man'f'g Co. (stocks and dies); Hartford Steam Boiler Inspection and Insurance Co.; The Eastman Company (Kodaks); G. Gennert, (Montauk cameras); Rochester Machine Tool Works (stationary engines); Felt & Tarrant Mfg. Co. (Comptometers); Babcock & Wilcox Co. (steam boilers); Overman Wheel Co. (Victor bicycles); Smith Premier Typewriter Co.; Millers Falls Co. (saws); John A. Roebling's Sons (wire rope); The Eagle Bicycle Mfg. Co.; Seneca Falls Mfg. Co. (foot power machinery); Edison Lamp Co.; L. S. Starrett (micrometers); The American Bell Telephone Co.; The Pictet Artificial Ice Company; L. Manasse (magic lanterns); Ingersoll-Sergeant Rock Drill Co.; Rand Drill Co. How many of these names are familiar today or strike responsive chords in your memory?



MECHANICAL SHOCK-TROOPS OF THE BLITZKRIEG

MODERN land warfare, as conceived by the Germans, puts the tank on the second line of offense, to follow the spearhead of the attack—the dive-bomber. Having built vast numbers of these mobile, light artillery units, the Nazis have been able to sweep irresistibly across several countries. Several types of tanks are employed, including the two shown here; a light tank, long type; a light medium type; and possibly larger types. The short, light tank, *above,* mounts machine guns, carries a crew of three, and has a road speed of perhaps 30 miles an hour. The long, light type mounts a machine gun and either 37-mm or standard anti-tank guns. The light medium tank is similar to the long, light type, but has a look-out hatch and heavier gun. The heavy medium, *below,* mounts a 75-mm gun in a turret, several machine guns, has a crew of seven. Drawings from *The Illustrated London News.*



96TH YEAR SCIENTIFIC AMERICAN OCTOBER 1940

BOMBERS PLUS BATTLESHIPS

Both Are Needed For Co-Ordinated Effort

A. B. VOSSELLER
Lieutenant Commander, U. S. Navy

WHEN the editor of Scientific American requested this article, he suggested the title "Bombers *versus* Battleships." Since the days of General William Mitchell, of the U. S. Army Air Corps, controversy has raged upon this subject and many articles purporting to analyze the problem of bombs, or bombers, *versus* battleships have appeared. Events abroad have intensified interest in this question and it is, therefore, quite understandable that the editor should think his readers would be interested in the subject.

In the writer's opinion, however, no more dangerous argument bearing on national defense problems than this very question of bombers *versus* battleships has ever occurred. In the writer's view, it would be about as easy and conclusive to present a discussion upon the subject of brothers *versus* sisters or, to select an analogy closer to the question, infantry *versus* tanks, whereas the self-evident fact is that we need both. The real question which every public-spirited officer of the Army or Navy, or for that matter, every public-spirited civilian, is interested in, is the broad question of adequate national defense rather than any narrow question of the transient superiority of some particular arm over another arm of the national defense, and that under certain given conditions. Hence the title selected and used above.

There never has been any argument, to the best of the writer's knowledge, about the fact that a bomb, if it hits, will damage a battleship—or anything else which it may strike. There has been a great deal of discussion, some of it quite acrimonious, as to whether one bomb will sink a battleship and if not one bomb, then how many. That type of argument proves nothing, beclouds the issue so far as the uninformed are concerned, and is generally destructive to the best interests of our national defense.

The opinions or assertions contained in this article are the private ones of the writer, and are not to be construed as official or reflecting the views of the Navy Department or naval service at large.

NATIONAL DEFENSE

The fact of the matter is that a battleship, or any other warship, is a very strongly constructed vessel and the damage which will be sustained by a hit from an aerial bomb will be largely determined by the location of the hit and the particular circumstances prevailing at the time.

The whole controversy of bombers *versus* battleships is strongly reminiscent of similar controversies which took place years ago concerning the relative merits of battleships and destroyers, and likewise battleships against submarines. At that time the proponents of the battleship stoutly maintained that the battleships were superior to the destroyer and the submarine, each with its torpedo; and the proponents of the destroyer and submarine were equally as insistent that their pet weapon had rendered the battleship obsolete. It should have been obvious then, as it is to all thinking people today, that neither was "superior" to the other but that, as in the controversy of the battleship and the airplane, new and highly destructive weapons for use in naval warfare had been developed.

It is submitted as highly significant that there has never been any great controversy in the Navy itself over the relative value of the bomber and the battleship and that most of this controversy has been thrust upon the Navy by others. The flyers of our Navy are not only naval aviators; they are also seagoing naval officers who understand the inter-relationship between the various parts of the Navy and therefore would no more sacrifice battleships than they would the Navy's aviation.

This is believed to account, in large measure, for the eagerness with which aviation was seized upon as a tool by officers of our Navy, once its teething days were over and the future stature of aviation became apparent to the discerning. The result was that all phases of naval aviation were strongly pushed and highly developed with the further result, today, that U. S. naval aviation is preeminent in all its phases over every other air force in the world.

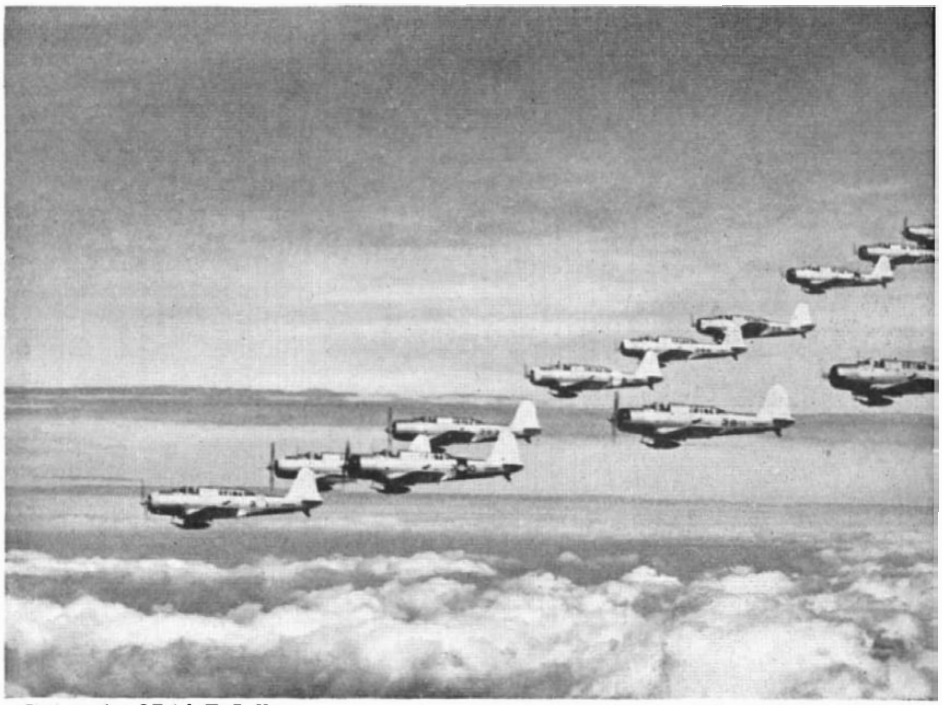
DEVELOPMENT has many times seemed maddeningly slow to the officers of naval aviation, but, as we regard the status of things at present, we find that, slow though it may perhaps have been, it has nevertheless been sure and steady and certain. The U. S. Navy today finds itself with aircraft carriers so far ahead of any others in the world in operating technique, training of pilots, suitability of aircraft carried, and, most important, training with the Fleet, that there is no comparison possible. In the same way, the long-range patrol bombers of the U. S. Navy are incomparably better in every respect than those possessed by any other air force in the world.

We have now, and have long had, more planes of this type than any other air force and newer and

finer ones, embodying all the lessons from our wealth of experience in the past, are under manufacture and soon to be delivered. The dive bomber, which has demonstrated its frightful power so overwhelmingly in the hands of the German air force, was pioneered, developed, and perfected by the U. S. Navy and today only the Germans and U. S. naval aviation have real dive bombers. All our battleships and cruisers carry aircraft to be launched by catapults from their parent vessels and these airplanes also have no peer in any air force in the world. The pilots who fly them have been especially trained and indoctrinated to work with their parent vessels and it is merely a matter of routine in the Fleet to use these aircraft for scouting, submarine searching, and spotting of gunfire.

It will be seen from the above brief summary, therefore, that technically, and in the development and adaptation to naval use of new ideas, naval aviation has led the world. Important and encouraging though this progressiveness and progress are, they are by no means the whole story, nor even the most important part.

The organization of the German air force has recently been the subject for much argument and speculation. Whether, however, Germany has in fact a separate air force, whether the air force operates under the army or vice versa, the real lesson that we should draw from the German operations in Europe is the extraordinary co-operation which has been exhibited between air and ground forces, no matter how achieved. Destruction wrought by the German air force has been terrible to contemplate. It is submitted, however, that such destruction, unco-ordinated with advance of the ground forces, would not have rearranged the map of Europe as we find it today.

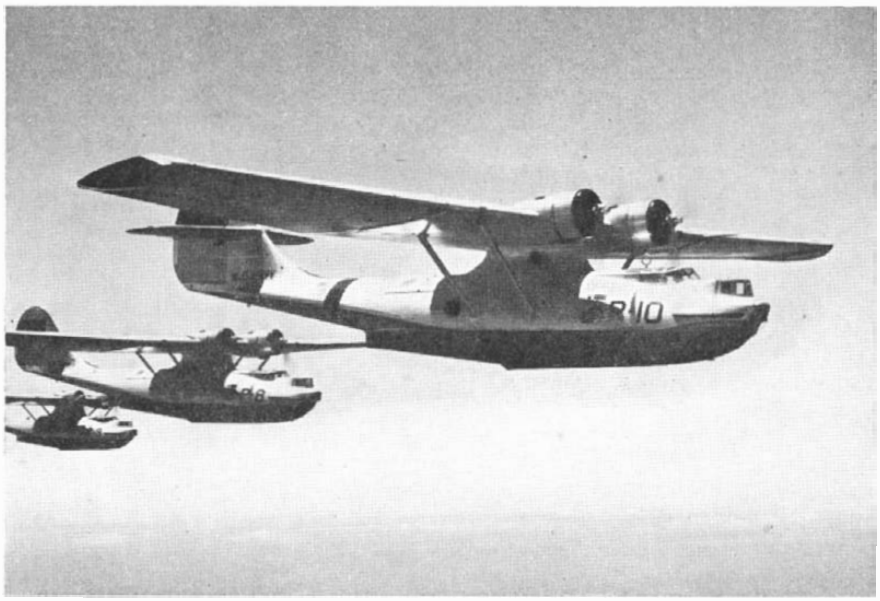


Photographs: Official, U. S. Navy

Hidden above a layer of clouds and catching only occasional glimpses

It is in this co-ordination between all arms and branches of German national defense that the *Luftwaffe* has displayed its outstanding qualities and it is in these same characteristics that the U. S. Navy, including its naval aviation arm, is likewise outstanding. For years, naval aviation has been going to sea with the Fleet, daily, monthly, year in and year out; in each year for at least the last 15, naval aviation has played a large, and many times predominant, part in the annual Fleet maneuvers.

Most of the officers and men now serving in naval aviation have served in all its branches: battleship- and cruiser-based, patrol plane and carrier squadrons. In their years aboard battleships and cruisers, they have taken their turn at watch-standing and know as well as their comrades on general service duty what the mission of the surface vessel is and how that mission should be carried out. Aboard the carriers they have become thoroughly indoctrinated in the methods of co-ordinating and delivering the group air attack on both enemy surface vessels and aircraft and they realize full well that co-ordination, timing, and teamwork are the essence of any joint effort.



Sky-going ships of our aerial Navy. These patrol bombers have wide range and carry enough bombs to start and finish a battle-line job

IN this connection it is of interest to mention that all of the non-flying line officers of the Navy are required to be familiar with the theory and practice of aviation and must periodically, before promotion, undergo examination in this as well as other professional subjects. These non-flying line officers serving in battleships, aircraft carriers, cruisers, and tenders are, of course, continually working with the aviation personnel attached to these ships and they in turn learn

of the ground, a utility squadron flies on toward its objective

in this practical way the capabilities and limitations of aviation.

Those who serve in the patrol wing understand that, although they carry heavy loads of bombs, their primary mission is to act as the Navy's long-range, high speed air cruisers until the enemy is located and his intentions diagnosed. They understand the reason, too, which is that the mission of our Navy in the next war, as it has been in the past, will be to seek out and destroy the enemy completely and finally, using all the force at our command on the surface as well as above and below it. The fact that the British were able to evacuate some 300,000 men from Dunkerque to England under the very nose of overwhelming German air power has not been lost on these men and they want no sole dependence on air power which might allow such a thing, in reverse, to happen on our shores.

It is believed to be generally recognized now that one of the greatest and most far-sighted public services which was ever rendered the United States was the determined effort and successful fight waged by the high command of the Navy in preventing the formation of a unified air service to include naval aviation. We have before us several excellent, if also tragic, examples of the difficulties which the United States might now face had our present course of action not been followed. The principal one of these is, of course, that of Britain, wherein the Royal Air Force was set up as a third arm of Britain's defense with the result that the Fleet Air Arm cannot now afford the British Navy the strong air support which that Navy so badly needs. The final history of the present war will record the tragic loss of many British lives because of the slip-ups and misunderstandings inevitable under any such system of divided control.

The above record of progress and accomplishment has been set down so that the reader may understand why we in the Navy consider the "bomber *versus* battleship" question an abstract argument. The problem facing the Navy today is to build, upon the excellent nucleus we now have, the expanded naval aviation of tomorrow, maintaining the co-ordination we now possess so that when and if our Navy goes into battle, all its components will be there in adequate number and all will be working together in the most efficient way to achieve the final result—total defeat of the enemy.

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AIRCRAFT versus WARSHIPS

ALTHOUGH Mr. Charles Edison, when Secretary of the Navy some months ago, stated that airplanes have a temporary advantage over battleships, it is apparent that protective measures for the ships were already known. An editorial in a recent issue of *The Engineer* (London) discusses this matter in detail and states the protection necessary. We quote below a pertinent part of that editorial.

"We have now had experience of many months of war, and it is not unreasonable to inquire whether this question can yet be answered. It is, of course, less a single question than a group covered by a single title, for there are ships and ships. If we consider first the vitally important question of the battleship, it may be said at once that we do know a great deal more than we did. It is true that we knew beforehand that the battleship of today

Torpedo planes, dive bombers, and cruisers—they're all part of the team. Properly co-ordinated, they make a powerful defensive arm

was strongly protected by deck armor and was difficult to hit. To penetrate armor requires high striking velocity, and this, in turn, calls for a high altitude of attack on the part of the aircraft, though the greater this height the less chance of hitting. Hence the two chief attack requisites were, and still are, mutually conflicting. Nor can modern developments materially affect this position.

"The bombs now in use are better streamlined than in the last war, and they are heavier, but even so the velocity they acquire during descent remains much where it was. Even were air resistance entirely removed, the vertical velocity attained from any height could not exceed that corresponding to a vacuum trajectory, which from 20,000 feet is but 1100 feet per second; in practice it would, of course, be materially less, and even were the height of release pushed up to 30,000 feet, or even 40,000 feet, the velocity would be but little greater since, in the neighborhood of the speed of sound, the rapid rise in air resistance cushions further increase. Nor could an attack during a dive from high altitude materially alter the situation, since an initial downward speed of even 400 feet per second would hardly affect the velocity at sea level. To fire the bomb downward fast enough to increase the ultimate speed would, for a bomb of adequate size, require an aircraft gun of such dimensions and weight as to be outside the field of possibility; whilst any form of rocket-bomb is likely to present great practical difficulties. Hence, if the armored deck can keep out a bomb which arrives with a striking velocity of 1100 feet per second, it can be said to have the latter beaten. And this, our present war experience has shown it can do.

"ONE at least of our battleships has been hit by such a bomb and the armored deck has proved to be just that protection which our naval architect said it would be. Hence the contest between the battleship and the bomb has largely ceased to be the doubtful factor that it was. It is true that this leaves out of account the 'near-miss,' the bomb which explodes under water close to the ship, but this should be regarded rather as an attack by a mine or aerial torpedo than by a bomb. The essence of a bomb is to cause such an explosion inside a ship as will damage the vital machinery below the armored deck, or even hole the ship from the inside; whereas the object of the mine is to blow in the side or bottom of the ship by means of the intense pressure wave created in the water by its detonation. Hence the 'near-miss' must be looked upon as a mining attack and any battleship adequately protected against mine and torpedo may be looked on as protected also against the 'near-miss.'"

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HELLDIVERS

Describing the Technique of Dive-Bombing, Conceived for United States Naval Use

JAMES L. H. PECK
Author of "Armies With Wings"

YOU are at the controls of a rapidly climbing dive-bomber—the most feared, most spectacular of warplanes—miles out over the sea, leading a three-plane "V" formation in search of an enemy cruiser. You level off at 8000 feet. A moment later, you spot the warship off the port wingtip; you lift the microphone and radio a terse command to your "wing men." The one who is flying behind and to your right, slides over neatly and settles into place behind the left, or Number 2 "wing man." Now the dive-bombers are in left échelon, or step formation—an excellent arrangement for the attack.

You swing in a wide curve to the left; it is early afternoon and you want to keep the formation between the sun and the enemy so that the ship's anti-aircraft gunners will find difficulty in spotting you. Peering down at the dark sea to ascertain wind direction, to check the drift of smoke from the ship's funnels, you note that the wave crests are rolling in a direction almost parallel to the cruiser's course. Good. From the angle you are contemplating attack, the wind's effect will tend to compensate for the common tendency to bomb "over," or beyond the craft. There will be just one attack; each plane is carrying an 1100-pound armored demolition bomb; each must count.

A succession of staccato explosions just reach you from below when they are duplicated a short distance above, and behind the formation. You make a sharp tack, then another in the opposite direction; then you lead the formation down about 200 feet and make another tack. Shrapnel, accompanied by blossoming, black puffs, burst where the planes were a few seconds ago. Almost over the vessel now; you slide to the left just a bit. The ship is turning, but it will be just right by the time the bombers drop down.

Another terse radio command. You roll the speedy monoplane over on its back, "peeling off" the echelon and heading down in one big hurry. You are shooting down, a bit over on your back—upside down. Now the plane is vertical; you're streaking down an invisible roller-coaster with the sun at the top. The huge engine down ahead is throttled back, but not all the way, because the carbureter would flood and the engine would cool off too quickly. Down at the bottom you're going to need all the engine you have to get up and away. You have trimmed the bomber's elevator tabs so that the ship is slightly nose-heavy; it dives better so. Your eye is glued to the telescope sight, and you watch the cruiser's gray-looking deck and superstructure rush up toward you.

THE sea grows bluer. Guns, turrets, deck gear, and the scrambling crew become larger and more distinct, more detailed. Machine guns swing in the direction of your plane, you are literally flying down the gun barrels. But the sun is with you, protecting you. Your left hand darts to the bomb release toggle. You bring the nose up a trifle, just before the toggle is pulled. If the ship were on its back or perfectly vertical at the time of release, the bomb would take a part of the propeller along as it dropped away.

Now! You can feel it as the bomber is freed from its half-ton burden. You ease back on the control stick, and ease the throttle open. Ease is definitely the word: You pull out of the streaking dive in such a manner as to make it

easy on both the plane and yourself. A weighting force crushes you down against the seat, but there is no blanking-out of vision because the pull-out was gradual. Momentum of the dive, and the power of the engine, boost the dive-bomber up the other side of the invisible roller-coaster at a terrific rate.

You look back over the tail at streaking tracers from the vessel's machine guns, but you've much too much speed. Your Number 2 man comes out of his dive just above the pall of smoke from your bomb. There's a flash and mushroom of evil smoke as his bomb hits the ship's taffrail. Then the Number 3 pilot lets go. Just aft of the stern, you see a huge billow of white foam, then a geyser and an expanding ring of churning water. Tiny splashes are everywhere, caused by the rain of debris.

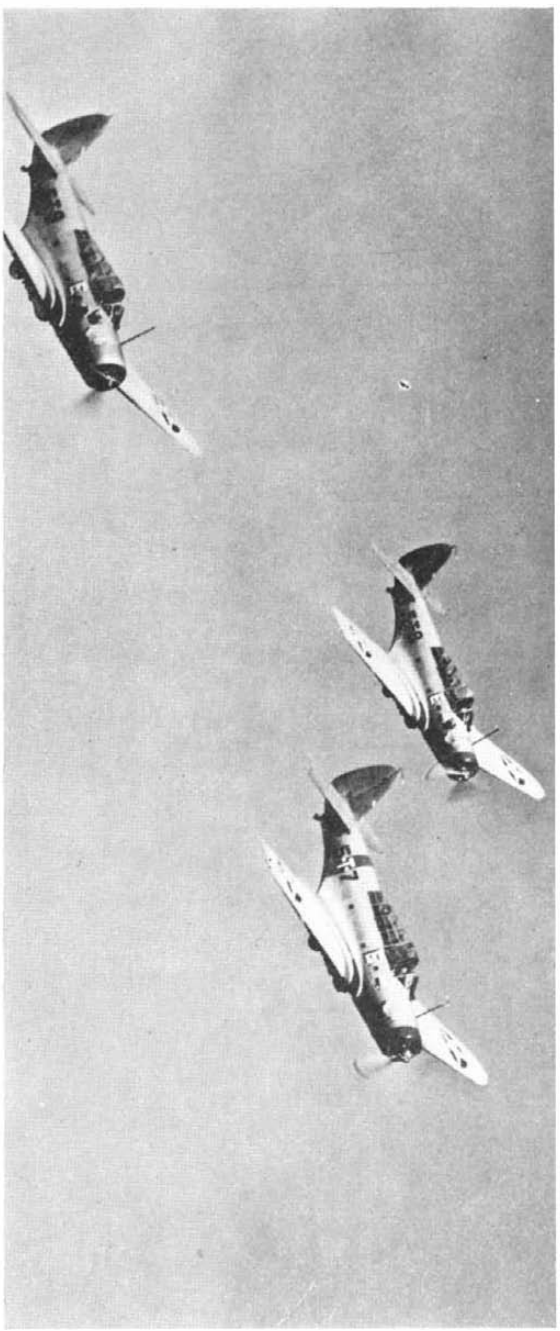
You throttle down so that the "wing men" can join up. But the formation is just a loose string, a follow-the-leader affair. The cruiser lists badly to starboard. Your gunner is watching through glasses from the enclosed rear cockpit. Men are scurrying about the deck of the cruiser, manning the boats. The ship is going down by the stern, slowly but steadily.

Again you pick up the microphone; but this time your message has to do with saving life, not the taking. You report the success and completion of your mission, and give the sinking vessel's position so that one of your destroyers can pick up the survivors.

That is dive-bombing — the method by which more than a few ships have been sent to Davy Jones' Locker during World War II; the method by which Nazi fliers soften land defenses as they form the spearhead of the swarming *blitzkrieg* assault. This new tactical employment of the dive bomber against airdromes, fortifications and gun emplacements, troop concentrations, supply depots, and other objectives in the British back areas is designed to supplement artillery fire. Hitler's *Sturzkampfflugzeug* — literally meaning dive-fighter, and popularly known and feared as "Stuka"—wreaked havoc in Spain, grounded the ill-fated Polish Air Force in just three days, helped make central Norway untenable for the Allies, was a prime factor in bringing about the capitulation of France.

Photographs: Official, U. S. Navy

Newest of our dive-bombers is this sensational Northrop XBT-1



Douglas TBD-1's, of Torpedo Squadron Five, "on the way down" in formation

MOST widely known "Stuka" is the gull-winged Junkers JU-87 monoplane which is powered by a 1000-horsepower Junkers Diesel motor, and has a top speed of 242 miles per hour. The outstanding features of this four-year-old, all-metal, dive-bomber are its wing flaps and slots and deflector fork. The flaps comprise four hinged surfaces on the wing's trailing edge which may be lowered to increase the air's drag, thereby slowing diving speed from 430 miles per hour to just a few miles per hour more than the ship's top speed in level flight. Used in combination with these "diving brakes" are two slots or foils in the leading edge of the Stuka's wing—all of which make for bombing accuracy, in that the craft can dive within a few hundred feet of the ground to release its deadly cargo. The "Stuka's" deflector fork is the bomb rack gadget which lowers the 1100- or 550-pound bomb so that it will clear the arc of the propeller blades when released. The bomb is carried snuggled up against the center section of the wing to diminish air resistance. When the pilot makes ready to dive, the rack is extended. Additional firepower consists of four 110-pound bombs carried in wing racks, and three .312 caliber Rheinmettal - Borsig machine guns; two in the wings and one

Official photograph, U. S. Navy

Grumman mid-wing fighter "peeling off" into a dive. "Peeling off" increases accuracy, as pilot can keep target in sight; when nosing over into a dive, motor and cowl hide target until ship is at a steep angle

for the rear gunner to ward off back-biters.

Closely resembling the Junkers plane is the B & V Hamburger 137—an all - metal, single - seater having the same up-swept wing and pointed nose. The Henschel 123 is a stubby biplane powered by a radial air-cooled engine; it carries the same armament and bomb load as the more widely known Junkers. All three prototypes were originally classified as attack planes or *Schlachtflugzeug,* and they engage in attack-plane tactics as well as dive bombing. The latter are employed against more or less isolated objectives whose destruction calls for extreme accuracy. When strafing enemy troops, however, the attack-plane tactics demand low-flying assaults in which the "Stukas" do not dive steeply, but maneuver on level keel.

Machine-gun fire from craft flying at tree-top altitude in horizontal attitude describes a grazing, creeping barrage, while that from planes in a steep dive is necessarily limited in its forward travel. The level assault offers more protection, in that hedge-hopping "Stukas" are within sight and range of ground machine-gunners —larger anti-aircraft guns are useless against planes flying lower than 100 feet—for the shortest possible time. When diving at a steep angle, they may be seen and fired upon as they are on the way down and, necessarily, on the way up following the pull-out. Low-flying craft are difficult to perceive from higher altitudes, and this offers some protection against enemy pursuit planes. "Stukas" operate in three-plane units in both diving and level-flying assaults.

Because of the sensational success of both dive and attack tactics in World War II, it would seem that these are new applications. But Germany developed an attack plane —the armored, all-metal Junkers-Fokker, carrying three machine guns and some 200 pounds of bombs—early in 1917; and the United States conceived the dive-bomber, primarily for naval use, just ten years later. The famous Martin dive-bombers and Curtiss "Helldivers," with their characteristic, back-swept upper wings, became the pride of the Naval Air Service, and the Curtiss 02C's did yeoman service with the Marines in Nicaragua.

TODAY, the all-metal Curtiss SBC-4 biplanes form a very important part of our Flying Fleet, together with the Douglas SB2U and Northrop XBT-1 monoplanes. The former two are known as scout-bombers; like their brothers of the Army, the reconnaissance bombers, once they spot the enemy, they stop scouting and commence bombing. The Northrop, newest of the Navy's dive craft, is a two-seater and strictly a dive-bomber. There can be little doubt that, after the most convincing demonstration abroad, Uncle Sam will provide faster and better dive-bombers aplenty for U. S. defense. The "Helldivers" have come of age.

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SMOKELESS, FLASHLESS

New U. S. Powders Don't Betray Gun Positions

A SUPERIOR quality of propellant powder will be manufactured at new powder plants which are to be built by the government near Louisville, Kentucky, and operated by the du Pont Company. When these plants are ready, the nation's present output will be tripled, these new ones making something like 200,000 pounds per day.

The new powder is not only smokeless but also flashless so that when a gun is fired at night only a dull red glow may be seen a short distance from the gun. It is said even the noise will be decreased.

Sikorsky's Helicopter

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

In our September issue we reported on Igor Sikorsky's views regarding the utility of the helicopter in military operation. With these views we agree thoroughly. But the pioneer inventor does not merely hold views; he builds aircraft to substantiate them. Witness the VS-300 helicopter, recently constructed and tested in the plant of Vought-Sikorsky Aircraft.

The new helicopter, as indicated in our photograph, is equipped with a single lifting rotor, three-bladed and 28 feet in diameter. There is considerable advantage in a single rotor, because the maximum lifting and forward flight efficiency are secured thereby, and because the overall dimensions are kept down to a minimum. Moreover, with the engine placed immediately below the rotor hub, the transmission system is reduced to its barest elements. With a single lifting airscrew, there is, however, a turning moment to take care of; the fuselage and its occupants would otherwise spin around dizzily in space. This difficulty is met by placing a small auxiliary airscrew at the very tail of the helicopter, rotating in a plane which is parallel to the plane of symmetry of the helicopter. With this plane of rotation, the auxiliary airscrew provides lateral thrust and the turning moment of this thrust counteracts the torque of the main rotor. When the pitch of this auxiliary airscrew is varied, its thrust is varied. Hence rudder action is provided.

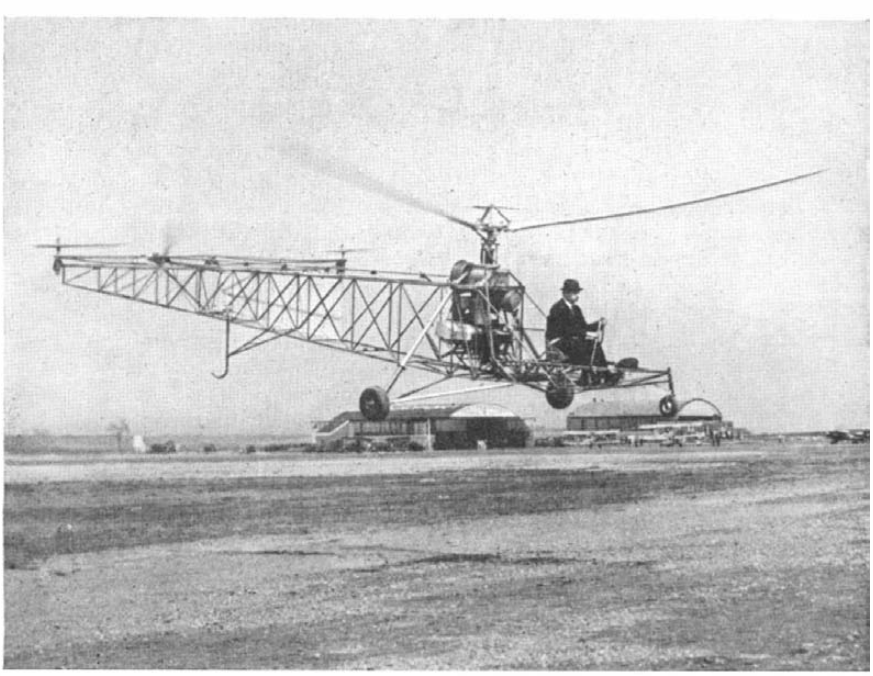
The reader will note that there are two other auxiliary airscrews, mounted on outriggers from the tail end of the main fuselage. The pitch of these screws can also be varied at the will of the pilot. If their pitch is varied simultaneously they give longitudinal control; that is, control in pitching the craft up or down. If the pitch of the two outboard screws is varied differentially, they give lateral control like the ailerons of an airplane.

Thus the Sikorsky helicopter has control about all three axes, (which is an essential of all aircraft). Since the controls are engine driven they are operable when the machine is hovering, while ordinary movable control surfaces are operative only when the aircraft has forward velocity.

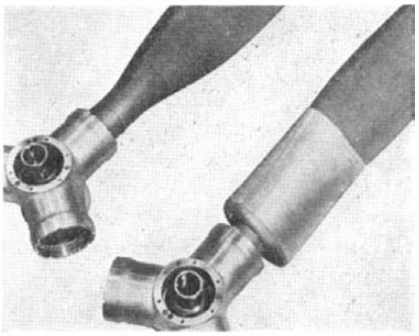
To secure vertical ascent it is only necessary to give the blades of the main rotor a fairly large positive pitch. While the machine has not yet risen to very high altitudes, the photograph indicates that ascent has been achieved. Forward flight is achieved by simply inclining the machine forward—that is, nose down—using the elevator airscrews for the purpose. Thus the thrust of the main rotor has a forward component which serves to accelerate the machine in a horizontal direction. As a matter of fact, the helicopter can go forward, backward or sidewise.

In case of engine failure, the pitch of the main rotor will automatically decrease so that vertical or gliding descent at a steep angle will become possible just as with an autogiro. The auxiliary screws remain in the same mechanical connection with the main screw whether power is off or on. Therefore the auxiliary screws remain operative as controls even when the engine is dead.

We congratulate Mr. Sikorsky on an elegant solution of the helicopter problem, and await further progress with real expectations.



Igor Sikorsky flying his helicopter



Conventional propeller shank, and shank with cuff (see below)

PROPELLER CUFFS

One of our photographs shows, in its upper left corner, a conventional type of Curtiss Electric Controllable Pitch propeller with the blade shank exposed. At the lower right the blade shank is covered by a so-called "cuff." The cuff, of sheet aluminum alloy, continues the airfoil section of the blade, improves the streamlining and hence the efficiency of the propeller. Moreover, the thrust of the propeller is now distributed more closely to its center so that air is driven backward forcibly to the inner portions of the engine. Cooling is improved thereby. The sheet aluminum cover is easily removed and serviced, and we should not be surprised to see the use of cuffs become widespread.—*A. K.*

Geriatrics

The Newest Medical Specialty Deals with the Aging, Now that the Elderly Increase

BARCLAY MOON NEWMAN

WITH surprising suddenness, a new division of medicine has appeared—geriatrics—to help oldsters grow older, toward maximum longevity. The name was coined long ago, from *ger*—indicating old age, and *iatrics* meaning therapy. But, until a year or two ago, the specialty was little more than name.

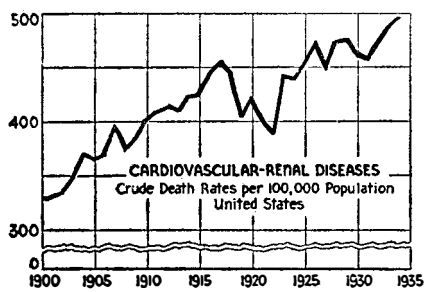
The aged we have always had with us. Why this sudden great interest? We have only to look about us—to see more individuals than ever before in the upper age brackets.

Greater than ever in world history are the odds in favor of our reaching advanced age. In Rome during the early Christian era, life expectation at birth was probably only 20 to 25 years. In certain European cities of two centuries ago, the newborn could expect to live 25 to 35 years. In the United States, just after the Revolutionary War, the expectation of life at birth was 30 to 35 years; in 1900, 50 years; today, white male babies can look forward to 60 and female to 63 years. The increase in expectation of life, at birth, since 1900, slightly surpasses the increase during the previous 100 years. By 1960, a newborn boy of this country may expect to live 75 and a girl 80 years.

There has been no observable increase, however, in the maximum length of life attainable by the most longevous man or woman. Persons surviving to advanced ages do not live longer than formerly. In fact, it is believed that those who, in 1890, reached three score and ten could expect more years than men and women who today are entering their eighth decade.

Only the average duration of life has been increased. Thus, in 1890, 72 percent of U. S. boy babies attained the age of ten; now more than 91 percent do. The early dangerous years are more often survived, and so the average age at death has gone up. Medical discoveries and their wide application, public health measures, improved nutrition, the elevated standard of living, and education, deserve the credit. The chief successes have been over microbic diseases—smallpox, bubonic plague, yellow fever, typhoid, diphtheria, tuberculosis. And newer nutritional discoveries may right now be in the midst of adding another 10 percent to the present average age at death.

In the meantime, the birth rate has been declining. By 1950, according to some calculations, our population will have become stationary, with the number of births equaling the number of deaths.



An effect largely of aging population is the upward trend of the curve: more people live long

Declining birth rate and declining mortality rates for infancy, childhood, adolescence, and early adult life co-operate to yield an aging population. A century ago, youngsters under 20 made up half our population. Today only a third of U. S. individuals are in this group. A century ago, less than three percent of the population were elderly; that is, 65 and older. This percentage has already been doubled. Within another half century, men and women past 65 will make up more than 15 percent of the total population. More striking, however, is the fact that about 27 percent of us are today already 45 and older. In 1980, more than 40 percent of U. S. persons—infants to oldsters—will be 45 at the youngest. In another ten years (1950), the elderly (those past 64) will be as numerous as children under five years of age—the percentage of each in the total population will be about eight. The geriatrician will have as many patients as the pediatrician.

Pensions, old age "economic" schemes, and old age pressure groups have come to the fore, and doctors, like the rest of us, are awakening to the results of the crowding of the higher age brackets. The social and economic results are going to be enormous. Business and its advertisers must take into account the aging of the "average" consumer, who will have different tastes, interests, attitudes, habits, pleasures — and, above all, probably, increased conservatism. The dependent oldster is replacing the dependent youngster.

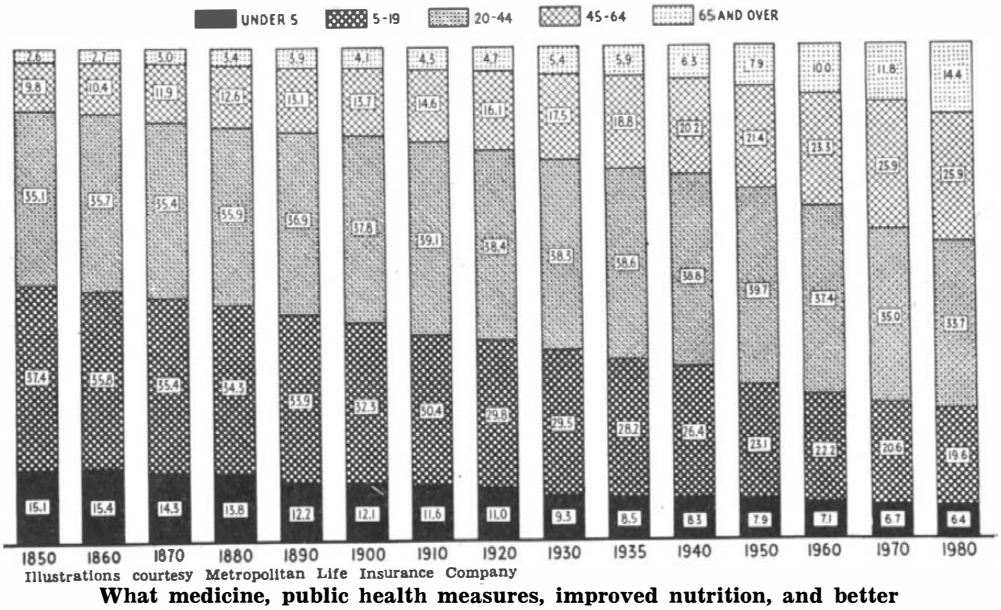
The average doctor notes not only that his average patient is older but also that the number of aged patients has increased. Old age is commonly said to begin at 65. However, many individuals are really younger at 75 than the average person is at 55 to 60. Time is a poor indicator of degree of senescence.

THE geriatrician does not find new diseases appearing after a certain age. The elderly have practically all the diseases of youth, but none additional. At certain ages, however, certain disorders are more common. The so-called degenerative disorders—especially of the circulatory system, the kidneys, and the brain—are less frequent in youth, more frequent in the upper age brackets. Sexual decline sets in usually during the middle years, if not before, so is not a problem for the geriatrician alone.

Heart disease takes its greatest toll during the fifth decade, and then declines in relative importance—though still very important—as far as geriatrics is concerned. Arteriosclerosis, found even in babies, is almost universally present in oldsters. Chronic high blood pressure becomes more and more common as years are accumulated. The kidneys increasingly are sources of ills as the decades pass. Heart, blood vessels, and kidney pathologies carry off two thirds of those dying between the ages of 80 to 89. Cancer, also found even in babies, is most common in later years. For white males, cancer reaches its mortality peak between the ages of 60 and 69, but during the next ten years is almost as im-

portant a cause of death. Among women, cancer is most prevalent from 50 to 59, but during the next 20 years the mortality remains high—second only to mortality from heart, blood vessel, kidney diseases. The mortality hazard of tuberculosis attains one peak in the middle twenties, and a second peak in old age. After 60, the tuberculosis death rate rises sharply, the aged having a lower resistance to this disease than the middle-aged.

The geriatrician, then, must be especially expert along specific lines. Furthermore, in advanced age, though there are no new disorders, the same disease usually runs a course markedly different from that followed in earlier decades. The tissues and organs have changed with time—some say because of time, but nobody can prove this speculation. The reaction of the old body is different, and so are the symptoms and the treatment. Fever typically present in the diseased person of lesser years may often be absent; in lobar pneumonia, the patient may stage a quiet, fadeout without fever. Appendicitis simulates mere intestinal obstruction.



Illustrations courtesy Metropolitan Life Insurance Company

What medicine, public health measures, improved nutrition, and better education are doing to the age composition of our population. 1850-1930 are from census data, 1940-1980, estimated by Thompson and Whelpton

Generally, in the old, there has been loss of weight and height. The fat depots beneath the skin, as of cheeks and temples, are much reduced. The skin itself is, as we all know, markedly altered: more pigmented, drier, rougher, wrinkled of course—though the degree of wrinkling is not a good indication of age. The sweat glands and oil glands are wasted. The muscles are deteriorating, perhaps undergoing fatty degeneration. The heart is enlarged, and has deposits of abnormal substances, as do the blood vessels, now much less elastic. Lung capacity is much diminished.

The bones have become somewhat porous and fragile from loss of calcium and phosphate and from gain of organic matter. There is less cartilage. The spinal curves are accentuated.

Digestive secretions are less in quantity and potency. The stomach, for example, is much less efficient, the gastric juice having a diminished content of hydrochloric acid. The alimentary tract is liable to bulging and the motility of its muscular walls seems to be weaker.

The liver, kidneys, spleen, pancreas, and brain are smaller and firmer, and their active cells have been extensively replaced with relatively inert fibrous tissue and fatty or other growths. Nerve cells of brain and spinal cord have accumulated mysterious granules, called waste materials by some investigators. Tonsils and lymph nodes are extremely shrunken, and the enigmatic thymus gland, too. The acid-alkali balance is readily upset and more slowly returns to the normal condition when disturbed, as by toxic substances. The lower extremities are less sensitive to vibrations. Sense of balance is impaired. In fact, as a general phenomenon, sensation throughout the body is impaired—"the organs suffer in silence," as one geriatrician puts it. Even traveling gallstones, excruciatingly painful in more youthful days, may in the elderly pass painlessly down the duct from the gallbladder. Youth's elasticity and resilience have sagged.

SUCH changes encountered in younger patients would be called pathological. The geriatrician, rightly or wrongly, must nowadays regard them as normal or "physiological." He must not let these common or characteristic changes obscure diagnosis of outright—more serious or more rapidly acting—disease, for the time being, at least; senescence not being called disease. To recognize disorder in the aged, the geriatrician must first be familiar with the moving picture of that which is termed "orderly progression of changes incidental to living long." It is difficult to know what is normal or orderly when most of the body is sinking into disorder; practically, the "normal" is the run-of-the-mine, or commonly observed, degeneration. The geriatrician's task is all the more confusing when he encounters the stalwarts of 80 or even 90 who are evidentally old but still hale and hearty — with good brains, hearts, livers, and stomachs. These stalwarts are either abnormal or supernormal! Their secrets the future may elucidate.

Treatment in geriatrics is as specialized and difficult as diagnosis. A severe disease frequently offers only mild symptoms until there is sudden collapse and death. Reaction to drugs is greatly altered; they are absorbed slowly, and often fail to give their familiar results. Heart stimulants may not stimulate, and sedatives may excite, usually do. And the drug's effect today may be changed tomorrow. Long stays in bed are unsafe; pneumonia or suddenly increased heart weakness makes insidious attacks.

On the other hand, the aged body has astonishing powers. Contrary to popular belief, the aged endure surgery better than many youngsters. It is often stated that the wounds of the aged heal slowly. Wounds in the adult of any age heal more slowly than wounds in the child. After the middle years, there is no perceptible retardation.

Diet is important. The vitamins of liver, especially the different vitamins B, have taken on increased importance for the geria-

trician; many of his patients are deficient in these. Out of fear of food, many old men and women indulge in harmful food fads. Still less fat should be eaten, and much fattening food avoided. The lightweight wins the battle of the century. Discoveries on the way may amazingly add to the life expectation after 65.

The geriatrician points out that the psychology of the aged is of immense importance. Indeed, physicians are more and more impressed by the theory that the lifelong outlook has major effects on the body. The chief cause of early death—before one's actually allotted span is accomplished—is surely the phrase "three score and ten." This phrase, the geriatrician knows, should be replaced by one indicating the real span of life. Man possibly is endowed with a life span of more than 100 years—how much more, even the geriatrician with his rapidly increasing wisdom does not know. But this new specialist, in an apparently discouragingly difficult field, is encouraged to find out—by keeping his patients well, if he can, well past the century mark. In the meantime, the basic bio-sciences proceed with the still unavailing search for secrets of rejuvenation. But of rejuvenation, the geriatrician can take no note; there is today no such thing for man or woman. Tomorrow?

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STEADILY BETTER

Three Decades of Science and Child Mortality

STRIKINGLY presented in the curves of the accompanying figure, from the *Statistical Bulletin* of the Metropolitan Life Insurance Company, are figures which show what three decades of scientific research has enabled medicine and public health to have done to cramp the style of a variety of prominent disease germs. Encouraging are these accomplishments, especially since intensification of the same efforts are expected to continue their improvement.

The curves are not based on the general average of the child population but on white children insured in the Metropolitan. The children insured distinctly are not those of a favored class; they are the children of an urban, wage-earning group who take out small industrial policies — say, $250 — and pay the premiums at the rate of a few cents a week. Figures for the general population would, however, not show much variation.

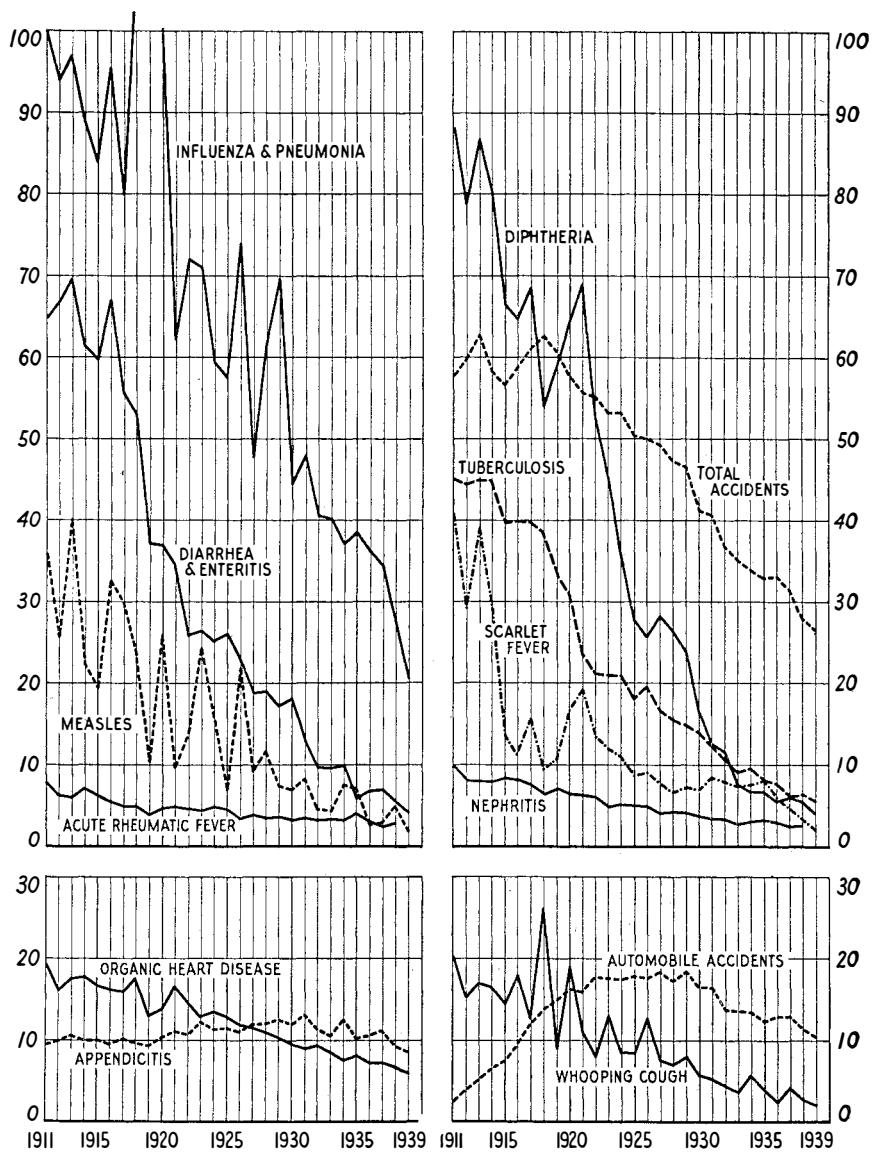
ROTO

New Cancer Treatment Method By X-Rays

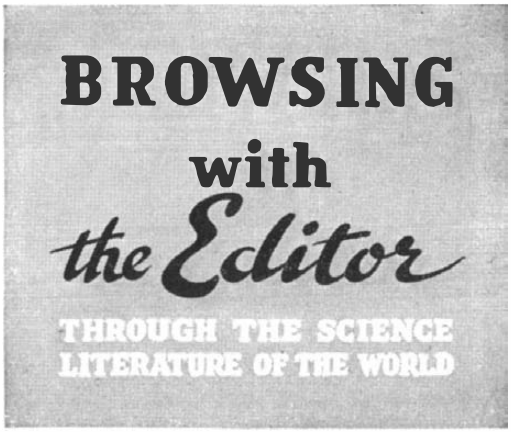
AN improved method of using X-rays in the treatment of cancer hidden inside the body has been devised by Dr. S. J. Hawley, Roentgenologist at the Geisinger Memorial Hospital, Danville, Pennsylvania, and is used with modern Westinghouse X-ray apparatus.

"In the treatment of cancer hidden deep beneath the skin one of the limitations is the amount of X-rays which the skin can tolerate during treatment," Dr. Hawley states. "The X-rays must pass through the skin before penetrating to the cancer, and, since the skin is closer to the X-ray tube, it is subjected to a larger dose than the cancer. . . To get a larger dose into the deeply situated cancer without harming the skin, it has been common practice to aim two, three, four or more beams of X-rays at the cancer through separate areas of the skin. This allows a large dose to be given to the cancer while spreading the dose over a large area of the skin."

Dr. Hawley's method is to spread the dose over the largest skin surface while always aiming the beam at the cancer; he places the patient on a turntable and rotates him during the treatment. The patient is positioned on the turntable so that the cancer is centered on the center of the turntable and the X-ray beam is aimed at the cancer.



Childhood mortality (ages 1 to 14 years) by cause, from 1911 to 1939



WE CONSUME—The average American each year requires only 30 pounds of textile fibers and a ton of food; to meet his power demands, however, he burns 10,000 pounds of coal and oil and salvages still more energy from waterfalls, wood, and wind.—*The Industrial Bulletin* of Arthur D. Little, Inc., No. 160.

OUR DAILY BREAD—Three pounds of food and four pounds of water a day will keep the body functioning, but these would be of little use without 34 pounds of air daily. —G. R. Harrison, "Atoms in Action," page 293.

MILES OF R. R. TRACKS—If all the railroad tracks in the United States were so laid out, they would form 133 parallel tracks between New York City and San Francisco.—Association of American Railroads.

LEGS GROW MAINLY NEAR KNEES—Contrary to what one might assume, the leg bones do not make their longitudinal growth at the same rate throughout their length. Most of the growth occurs in the region of the knee joint. —*The Journal of the American Medical Association,* August 10, 1940, page 479.

MAN'S BUMP DEFLATED—Recent work by Federal entomologists shows that when mosquitoes have free choice they prefer horses and cattle to human beings by about six to one. Pigs were three times as popular as humans. Dogs were lightly preferred. Man rates just ahead of chickens and cats as a preferred source of the blood meal which most of the biting mosquitoes require before they can begin depositing eggs.—Notes, *Journal of the Franklin Institute.*

SIZE OF RHODE ISLAND—Buildings cover one part in 2500 of the United States area (rough estimate). If brought together they would cover an area about 35 miles square.—*Popular Astronomy,* August 1940, page 369.

CIGARETTE SMOKE—A few lighted cigarettes can quickly fill an ordinary room with smoke, but the particles are so tiny that it takes 320 cigarettes—16 packs—to make one ounce of smoke particles.—Notes, Westinghouse Electric & Manufacturing Company.

STRAIGHT TRACK—A perfectly straight track—78.86 miles in length — on the Seaboard Railway between Wilmington and Hamlet, North Carolina, is the longest stretch of track in the United States without a curve. —Association of American Railroads.

IMPURE METAL—No metal has ever been made so pure that the spectroscope could not find impurities in it. Even the superfine, extra-pure, 1000-proof gold which is the basis of the currencies of many countries is found to contain much atomic dirt under this revealing eye which sees through atoms.—G. R. Harrison, "Atoms in Action," page 165.

UNLUCKY FRIDAY—The reluctance of seamen to sail on a Friday reached such proportions that many years ago the British government decided to take strong measures in proving the fallacy of the superstition. They laid the keel of a new vessel on Friday, launched her on a Friday, named her H. M. S. *Friday.* Then they placed her in command of a Captain Friday, and sent her to sea on Friday. The scheme worked fine, and had only one drawback—neither ship nor crew was ever heard of again.—*Our Navy,* Mid-August 1940, page 15.

POWER DIVE SPEED—A modern plane doing a power dive is moving as fast as a revolver bullet.—G. R. Harrison, "Atoms in Action," page 319.

50,000 PILOTS—The Civil Aeronautics Authority, charged with responsibility for training 50,000 civilian pilots by next June 30, already has launched more than 32,000 students in ground schools and 17,494 in flight courses in its Civilian Pilot Training Program.—Robert H. Hinckley, Assistant Secretary of Commerce.

LARGEST U. S. LINER—During her recent sea trials, the S. S. *America* exceeded both power and speed requirements, and also bettered her guaranteed fuel consumption figure. Designed to develop 34,000 shaft horsepower normally, she averaged 38,500 shaft horsepower during an overload test in the trials. Her contract speed was bettered by over two knots.—*The Log,* July 1940, page 24.

DESERT BUSINESS—Death Valley, commonly thought of as an uninhabitable desert, has its attraction for visitors. It is extimated that visitors spent more than a third of a million dollars in Death Valley during the season of October 1938 to May 1939.—*Economic Geography,* July 1940.

LANDING BY INSTRUMENT—The instrument landing system [for aircraft] at Indianapolis is the most extensive and most complete system installed anywhere in the world. It is an installation providing for instrument approaches and landings in four different directions. All of the 16 stations involved are completely controlled and monitored from the airport control tower.—*Journal of the Aeronautical Sciences,* July 1940, page 383.

ARMAMENTS COST—During the past five years, expenditures for armaments for the nations were, in American dollars: Germany, 19.0 billions; Russia, 13.5 billions; England, 6.2 billions; United States, 5.1 billions; Japan, 5.1 billions; France, 4.9 billions; and Italy 3.7 billions. In the United States and Engand, and probably in France, less was obtained per dollar than in the other, low-wage countries.—Statistics by Colonel Leonard Ayres, Cleveland Trust Company.

RUINATION THAT DID NOT MATERIALIZE—The consumption of marihuana in the United States, which had for several years increased, has recently been effectively checked.—*Science,* August 9, 1940, page 118.

PETROLEUM—Underground waste of oil virtually has been eliminated in the development of America's oil reserves. More than 99.5 percent of the recoverable oil known today in underground reservoirs ultimately will be produced by a continuance of present production methods.—Notes, American Petroleum Institute.

ICE CREAM COWS—The total production of more than 1,000,000 cows, supplemented by many tons of fruit and other ingredients, goes to supply the 1,200,000,000 quarts of ice cream which Americans consume annually.—*Telephone News Bulletin,* August 1940.

How Big Does The Moon Look?

In Which it Turns Out that Astronomy Has Something to Learn from Psychology

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

THERE are some problems, related to astronomy, and perfectly susceptible to investigation by scientific methods, in which training in astronomical observation practically disqualifies one as an investigator.

A very pretty instance of this sort was recently reported to the National Academy of Sciences by Professor Boring of the Department of Psychology at Harvard, and later discussed with great interest by a large group of astronomers, old and young, at the Harvard Observatory. It deals with the old, every-day question: Why does the Moon look larger when it is low in the sky, near the horizon, than when it is high in the heavens?

Practically everyone, educated or uneducated, agrees that it does, except a very few hardboiled astronomers; and it is practically certain that these exceptional folk, being convinced that the Moon does not really look any bigger near the horizon, have trained themselves to disregard the ordinary "evidence of their senses."

This seems a very queer phrase to use; for there is of course no doubt whatever that the true angular diameter of the Moon, when seen near the horizon, is no greater than when it appears in the zenith. This is true, no matter whether the diameter, in minutes and seconds of arc, is measured with a sextant, or whether photographs are taken with the same telescope or camera, and is certainly true also of the image of the Moon produced on the retina of the eye by its own lens apparatus.

Other things being equal, the Moon actually looks *smaller* near the horizon; for, at any given instant, it is nearly 4000 miles farther away from an observer who sees it on his horizon than at his zenith, and so appears smaller by 1/60 of its apparent diameter. This effect, though very easily measurable with instruments, is too small to be perceptible to the unaided eye.

The changes in the Moon's angular diameter with its changing distance are much greater, and extend over a range of more than 10 percent. These could easily be seen without optical aid, by comparing the Moon on different nights with an artificially illuminated disk of fixed size and distance—say three inches in diameter and 27 feet away—but are not great enough to be detected by comparing what we see one night and what we remember of another. (Should any one wish to try the experiment, the disk should be put at a considerable distance, so that the differences in focus of the eye do not disturb the observations—which, of course, must be made with one eye only.)

THE increase of the Moon's apparent size near the horizon is therefore a phenomenon of psychology, and not of physics. The *angular* diameter is sensibly the same; but the *appearance*—that is, the conscious perception which follows automatically upon the sense-impression—is very different.

Does our sense of vision then deceive us in this case? Before we answer, we must consider that what we perceive, when we look at an object, or hear a sound, is really an interpretation of our sense-impressions rather than the impressions themselves.

This process of interpretation must start very early indeed in our lives. We can none of us remember when we learned that the person who walked across the room toward us was not really growing bigger, but coming nearer. The perception of an individual of fixed size coming nearer displaced that of an enlarging retinal image, long before we had words to express either. We left the unsophisticated impressions of infancy, and learned to substitute an interpretation based upon more complex experience so thoroughly that we are quite unconscious that we are doing it.

Familiar instances of this kind exhibit the almost universal fact that what seems to us to be the immediate evidence of our senses is a complex compound of the real sense-impressions and a mass of sub-conscious interpretation, based on our whole previous lives, and depending on a multitude of "cues" not part of the immediate sense-impression, but relevant to its interpretation.

In looking at something at a moderate distance, we have the focussing of the eye on a near object, and the convergence of the two eyes, which gives the stereoscopic effect. Both involve muscular adjustments which, though made without conscious attention, powerfully influence our distance-judgments.

Professor Boring and his colleagues—trained psychologists, whose observations of their perceptions were not prejudiced, as are those of astronomers, by too much thinking about how the Moon ought to look—have found that the Moon, even high in the sky, produces the impression of looking as big as a disk 10 or 12 feet away, and of nearly four times its real angular diameter, while near the horizon it looks almost double this size. When the influence of extraneous factors is weakened, as by observing with one eye instead of two, by looking down a long dark tube, and so on, these effects diminish.

Another set of external "cues" come from the position of our head and eyes. If we look at a low Moon, our heads are normally poised, and our eyes nearly level—that is, with the eyeballs in their normal position. To see a high Moon, we must throw our heads back and turn our eyes up. That these muscular adjustments have the principal influence upon the "horizon effect" is conclusively shown by the work of the Harvard psychologists. When an observer lies flat on his back, and looks up at the sky, so that his head and eyes are in a normal position when he looks straight up, a high Moon looks big to him, and a low Moon, to see which he has to bend his head back, looks smaller. Curiously enough, the same is true of a low Moon in

the direction of his feet, for which he has to bend his head forward, and his eyes down.

Many other ingenious experiments confirm the conclusion that the position of the head and eyes is the principal factor which conditions our perception of how big the Moon looks. The fact that the Moon looks smaller if it appears to be below, as well as above, the observer's personal horizon, at right angles to his backbone, has naturally not been a matter of direct celestial observation.

In the summer of 1918, Dr. D. L. Webster—now Professor of Physics at Stanford, then a Captain in the United States Air Service—and the writer were engaged in work on airplane navigation at Langley Field, Virginia. One Sunday afternoon, when no work was being done, we were out on Hampton Roads in a sailboat—incidentally looking at the ships of the Atlantic Fleet, anchored in the Roads. Next morning we were flying over the same spot—at perhaps 4000 feet—and we noticed independently that the warships, though at the same distance, looked from the air like toys—very much smaller than when seen on the level. The impression was so striking that we commented upon it after our return. Conversation in the aircraft of that date during flight was hardly possible, so that our impressions were strictly independent. Both were experienced in physical observation and both familiar—one highly so—with things seen from the sea and from the air.

The question remains: Why should an object, of the same angular subtense, produce so definite an impression of being largest when it is on or near the horizon? In the writer's opinion, the answer is to be sought in common experiences, involving an interpretation which, though geometrical in nature, is so simple that no formal knowledge of the science is required for it. Consider first, objects below the horizon. We are all used to looking down from a height, a housetop or a tower, hill or mountain. (In these days, one might add an aircraft; but there has not been time for these actual birdseye views to become familiar enough to get into the sub-conscious level.)

In the most of such views, we are looking down from a height upon a substantially flat surface—garden, field, or plain. The most rudimentary geometrical sense indicates that an object which appears at a large angle of depression, far below the horizon, is nearer us than one for which this angle is small; and it follows immediately that, of two objects of the same apparent angular extent, the more distant one must be much the larger. We thus soon unconsciously learn to use different scales of real size for bodies of the same angular extent, but different angles of depression.

This is simple enough; but why do we do the same thing for the Moon, in the featureless vault of heaven? The answer, I think, is that the sky is not always featureless. The stainless blue of a perfect day has little about it to make the sky seem nearer in one part than another; but, even then, the paler blue near the horizon suggests haze, and we all associate haziness of appearance with greater distance.

BUT, very often indeed, the sky is clouded, wholly or in part, and more often than not, the clouds form an obviously flat ceiling at a definite (though not obviously measurable) height above the earth. Looking at such a ceiling from below we are geometrically in very closely the same situation as when we look down on a floor from a height. The part of the ceiling directly overhead is the nearest, and the distance of other parts increases steadily with diminishing angular altitude above the horizon. An isolated cloud, in a layer of broken clouds like the familiar "mackerel sky" will be smallest for the same angular extent, near the zenith, and larger and larger the nearer it is to the horizon.

In the language of the geometer, we project the observed pattern of clouds upon a plane surface at a fixed height above the earth, to get an approximate idea of the real dimensions of its components. What we do practically is far simpler than this technical statement would suggest and is "obvious to the meanest intelligence."

It is not clouds alone that call for such subconscious estimates. Birds, especially migratory birds, usually fly nearly horizontally, and everyone who knows the country at all must have seen a flock of crows change from mere specks low on the horizon to clearly-seen birds overhead, only to shrink again as they go on their way.

These are common observations, which must have been part of human experience since men began to recall and act upon their past impressions. It is no wonder that, by this time, we have sub-consciously adopted different scales of real size for bodies high above the horizon and low down. Rather may we wonder why the impression that the low Moon looks bigger amounts barely to a doubling in size instead of an increase of five or ten fold.

It may be suggested that very near the horizon flying birds are too remote to be seen, even as specks, and distant clouds are lost in haze. Moreover—as everyone recalls who has seen a sunset at sea under a layer of scattered clouds—the clouds at very low angular altitude do not flatten out into nothingness as perspective on a plane would demand, but remain of finite size right to the horizon. They are distributed on a spherical shell concentric with the earth—and the sense that clouds right on the horizon are not enormously more distant than those at an altitude of two or three degrees must have arisen long before the true geometry of the case was understood.

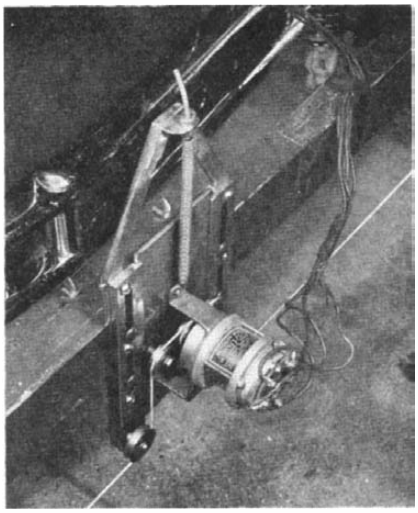
When we can see the actual horizon, our sub-conscious correction-system is automatically referred to it. When we cannot, Professor Boring's researches show that each of us has a personal horizon of his own—referred to his backbone as principal axis—with respect to which the illusion still persists—or, rather, the rational, though unconscious, attempt to make better sense of what we see than mere crude unthinking seeing would do.

Further tests of this interpretation are possible. It would be very interesting to find out whether dwellers in mountain-sides, who, from babyhood, were used to seeing objects at large angular elevations and depressions, but at about the same distance, were subject to the "illusion." Observations from aircraft might also tell something. The writer vividly recalls the Moon sweeping from his subjective horizon to the zenith and beyond to the horizon in a few seconds, while the plane in which he was looped-the-loop at night, and has no recollection that it appeared to change in size. But the time of observation was too brief and the conditions otherwise too unusual, to make this recollection of psychological value.—*Jamestown, Rhode Island. July 19, 1940.*

When You Steer a Motor-Car

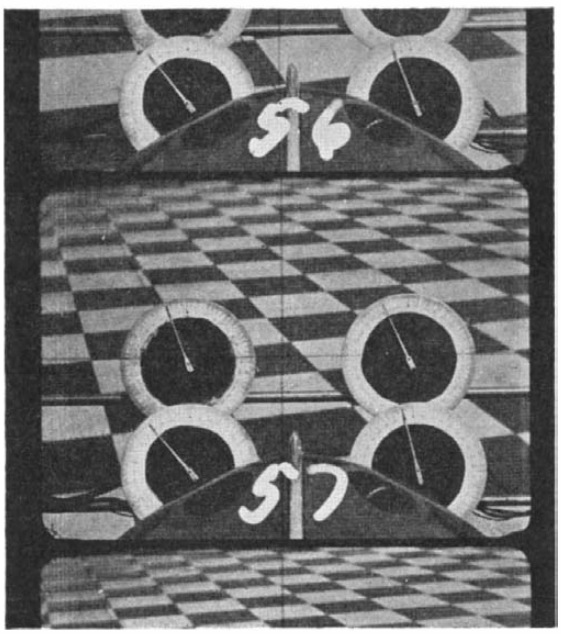
Mechanism Has been Designed to Indicate Steering Deviations When Car is Rolling

A. P. PECK

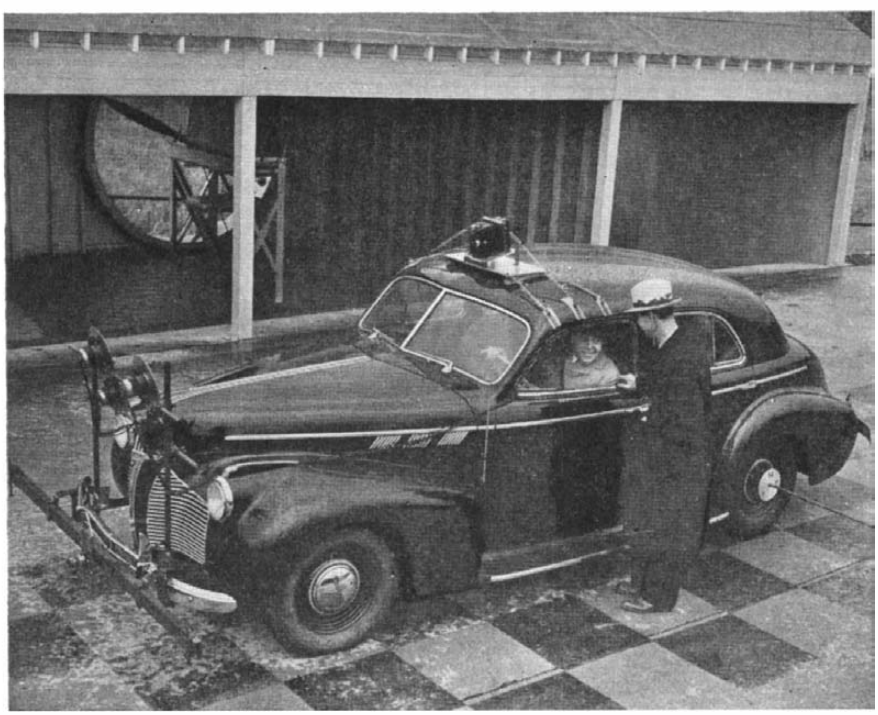


ONE of the main objectives of motor-car engineers is to design an automobile that approaches self-sufficiency, that virtually steers itself, that makes less demand on the attention of the driver as far as keeping the car on a straight path is concerned. This apparently simple problem involves many parts of the car, as well as such external influences as wind pressure on the car body. The separate actions of the steering gear, of all four wheels, of the chassis itself, contribute to the final result. Yet these actions do not take place until the car is in motion; hence they are difficult to record and study.

In order to determine the directional adjustment demanded by the modern motor-car—that is, the amount of steering which the driver must do to keep the car on a true course—and to obtain at the same time accurate data on the actions that necessitate this adjustment, engineers of Pontiac Motors have designed elaborate equipment that does what was heretofore considered impossible. It makes records—24 of them a second—of exactly what happens to vital parts of a car when it is in motion over a road. With these records available for leisurely study in the laboratories, the engineers are enabled to place their fingers on "reasons why" that might never be found otherwise.



Below: **Set-up of equipment on motor car for recording those factors which contribute to the necessity for directional adjustment.** *Right:* **An enlarged frame of movie film taken by the camera on top of the car. Here are recorded the checkerboard background and the four indicating dials.** *Upper right:* **The "autosyn" motor, mounted on the front bumper, transmits, to its dial, indications of horizontal rear axle movement**

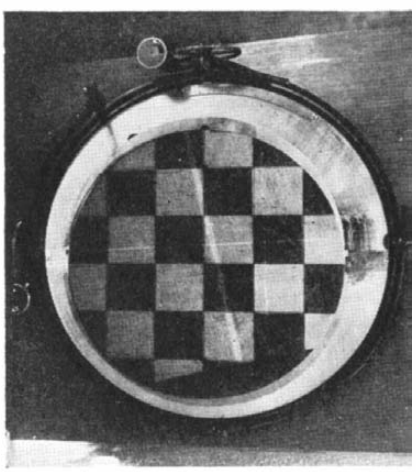


The equipment used involves a standard movie camera rigidly mounted on the roof of the car under test, a set of four dials placed on a bracket attached to the front bumper, means for actuating these dials, and a section of Proving Ground track painted in a checkerboard pattern. Available also is a huge airplane propeller with which cross winds of varying velocities can be simulated as desired. Supplementing all this is laboratory mechanism for studying and analyzing the movie film after it is processed.

Accompanying photographs show details of the equipment. Attached to the steering wheel and to each of the front wheels are small "autosyn" motors by means of which any

movement of these three units are recorded on three of the four dials. Mounted low on the front bumper is another "autosyn" motor which is coupled through piano wire to extensions of the rear axle. This arrangement is so devised as to indicate, on the fourth dial, any tendency of the rear axle to move in a fore-and-aft direction.

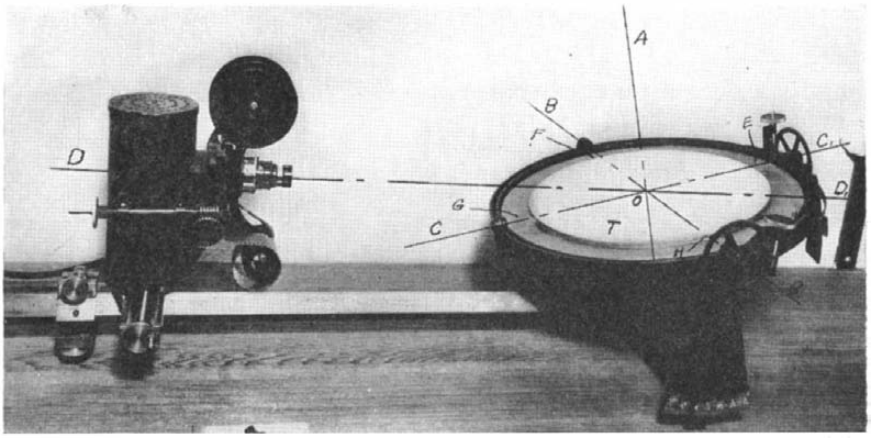
When the test car is placed in motion over the checkerboard track, the movie camera starts to click off 24 frames a second. This camera is so aimed that it photographs simultaneously the four dials as well as that part of the track directly in front of the car. Thus is obtained a continuous record of the motions of the steering gear, of the front wheels, and of the rear axle, all correlated with the precise



Turntable and checkered disk for studying the movie film records of steering deviations

direction of the car as it travels along the checkerboard.

After the movie film is developed, there comes the laborious and painstaking study of the records and what they indicate. In the laboratory is a turntable on which is mounted a disk ruled off into perfect two-inch checkerboard squares. The turntable is movable in all directions, its motion being controlled by screws. Any displacement of the turntable can be read, on calibrated scales, to degrees, minutes, and seconds. A single frame of the movie film is projected on the disk, and the checkerboard image on the film is accurately aligned with the squares on the turntable. When this registration is achieved, it is obvious that the disk bears the same relationship to the camera as the camera did to the road when the film was exposed. Thus, by comparison of successive frames of the film it is possible to



Movie projector at left throws film images on turntable at right. By means of accurate adjustments of table, valuable engineering data are obtained

calculate precisely the path of the car and the car's steering abilities. The indications on the four dials show exactly what was happening at any split-second when the car deviated from the straight path. From these data it is possible to eliminate "bugs" in design and to perfect not only steering mechanism but also other car parts that directly influence the steering of the vehicle.

The mechanism described was developed under the direction of Thomas Carmichael, physicist in charge of instrumentation at General Motors Proving Ground, and William H. Manning, assistant chief engineer of Pontiac. Says Mr. Manning: "The information we have gathered and will continue to obtain by the 'checkerboard test' makes possible the development of a car whose safety built-in characteristics must of necessity supplement the driver's inherent ability."

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Carbon Dioxide on Wheels

Industrial Plants and Military Airports Are Using Mobile Units Carrying Fire-Killing Gas

WITH incendiary bombs peppering European airfields and supply depots, military aviation experts are looking to fire-fighting methods which can cope with this growing hazard. A leading candidate for the job is the carbon dioxide fire-truck, a development that has proved highly successful in tests made by the British Air Ministry as well as our own naval air-base officials. The ability of the CO_2 to smother oil and gasoline fires quickly makes it doubly valuable at war-zone airfields where a fire serves as a beacon for succeeding waves of bombers if it is not immediately extinguished.

Carbon dioxide fire extinguishing is not a brand new development, having been used for some time by oil refineries and other industries where flammable liquids constitute a hazard. But the mounting of high-pressure cylinders, containing large quantities of the gas, on swift fire trucks which can dash around a far-flung airport and extinguish all manner of fires with clouds of the white vapor, is a recent advance. This extinguishing technique has gained support as a result of its successful use by London A.R.P. squads.

Carbon dioxide, which is also used in aviation and marine installations in the form of small built-in systems for smothering engine compartment fires, functions by diluting the oxygen content of the air around a flame to a point where fire cannot burn. This dilution is extremely rapid and the gas penetrates into crevices and past

obstructions which might hamper liquid fire-extinguishing agents. Carbon dioxide, which becomes a liquid when compressed and turns to gas and snow when released, is harmless to human skin and materials, and recharging of the cylinders is quick and relatively inexpensive. Pressure within the steel storage cylinders is approximately 850 pounds per square inch at 70 degrees, Fahrenheit.

In addition to this main extinguishing agent, most of the new airport trucks are equipped with derricks and grappling hooks which can be thrown over airplanes to pull

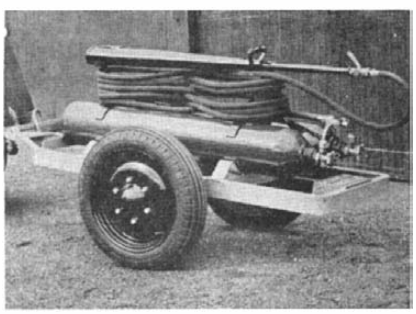
them out of range of a fire. Ladders, asbestos suits, and gas masks for rescue work are other items of equipment provided for on these trucks, which are usually built on a commercial chassis and have speeds of 50 miles an hour.

The gas cylinders are usually stored in banks at the rear of the driver's cab, and are manifolded to hose-reels which give a range of several hundred feet in all directions. A supply of charged replacement cylinders is usually kept so that the truck can be used during recharging, which takes but a few hours. Some truck models carry water-pumps, while those built for combat zones are usually made as self-sufficient as possible and carry their own supply of water in tanks —for use on hangar fires if hydrants and mains are damaged.

Of the trucks so far ordered—and hundreds have recently been put into service at British airfields and training schools—few have had gas capacities of more than 1500 pounds, although tons of gas can be carried. Engineers estimate that 1200 to 1500 pounds of gas is ample to envelop several planes and to enable rescue workers to get to the occupants.

To supplement these larger units, or for use on smaller airports or manufacturing properties, a number of trailers and motorcycle units have been developed by the New

Above: **Airport fire-fighting truck that carries 1000 pounds of compressed carbon-dioxide gas as well as grappling hooks and a derrick.** *Left:* **A motorcycle unit used by the Navy.** *Right:* **A small trailer unit carrying 150 pounds of the gas**



York engineering firm of Walter Kidde and Company, who have also designed and produced many of the larger trucks. The trailer units, which can be hooked to any handy truck or automobile, or even trundled to a fire by a couple of men, usually carry upwards of 300 pounds of the carbon-dioxide gas and are equipped with hose-reels and long nozzles to give the unit a wide effective range. The motorcycle units, several of which have been purchased by American military fields, carry large quantities of the gas and can accommodate two or three men as they dash around an air-base. They also carry portable cylinders of the highly compressed gas which can be lifted off and carried to the seat of a blaze.

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NYLON

Slow Competition with Silk

Now that the first excitement over the introduction of nylon hosiery has subsided, people are beginning to wonder how deeply nylon will cut into Japanese silk production. Ordinarily the business of producing silk supports two million Japanese farmers and another half million people who reel and handle silk.

Though American production of nylon will be rapidly increased, it is said that the full force of its competition will not be felt by the Japanese silk industry for five to ten years. By that time Japan can have readjusted her economy as she did when rayon was first introduced. At that time she turned to production of the new fiber and is now one of the world's greatest rayon producers. She may follow suit with fibers identical or comparable with nylon while silk production will be limited to supplying of a few "luxury" lines.

TURBINE SHAFTS

"Baking" Them Permanently Straight

A General Electric engineer, S. Homer Weaver, recently received a Charles A. Coffin award from his company for his method of "baking" permanent straightness into steam turbine shafts and rotors. Turbine rotors weigh up to 10 tons and must retain perfect straightness at 3600 revolutions per minute and 950 degrees, Fahrenheit, operating temperatures.

In Weaver's process, the ma-

chined-straight shaft, or rotor, is suspended in a standard lathe bed. The electric oven, sectionalized for different length requirements, is closed about it and controlled heat is applied through strip heaters. The rotor is turned at two revolutions per minute, and thermocouples riding on it give temperature readings. As the oven heat is raised, the rotor loses its straightness. Sliding rods pass through the wall and, riding against the turning rotor, indicate increasing shaft deflection as the temperature goes up. Then, at a certain critical temperature, a straightness is restored which is not affected by temperature or temperature changes. Thus the treatment is a true stabilizing cure.

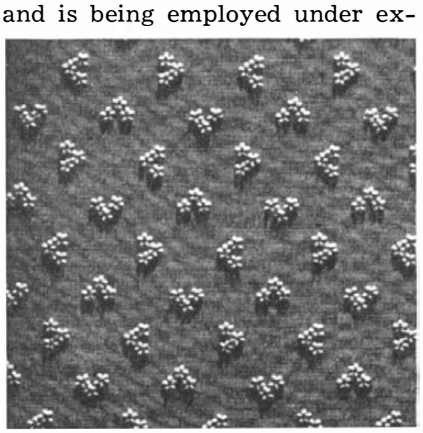
ELECTRO - COATED

High Pile Put on Textiles Electrically

"ARTIFICIAL lightning," which some years ago was converted into a useful tool for the manufacture of abrasives, is now being harnessed for an apparently unrelated purpose—the production of high-pile fabrics that resemble velvet, reports A. J. Sidford, writing in a recent issue of *The Frontier*.

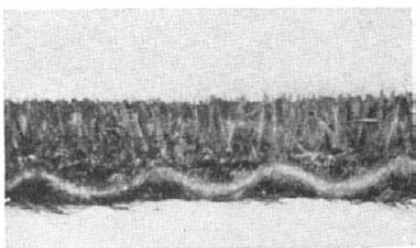
Remote as abrasives and fabrics seem from each other, the principle underlying the use of electrostatic fields is the same in both cases. As early as 1926, Elmer C. Schacht produced sandpaper "coated by artificial lightning" at the Watervliet plant of Behr-Manning Corporation. This patented process is used to do three things: propel, disperse, and orient the particles. Since 1932 it has been adopted on a large scale in the manufacture of abrasives, both in this country and abroad.

The same process was next applied to the tufting of dress fabrics, and is being employed under exclusive license by Arnold Print Works. Accurately cut particles of cotton, rayon, wool, or mixtures are deposited, under the influence of the electrostatic field, in an upright position on the patterns, which have been previously coated with an adhesive.



An "electro-coated" pattern

Then came the latest step in the development—the complete covering of a cotton-backed material with accurately cut fibers. The fibers are securely anchored in a coating of vulcanized latex, producing a high-pile type of fabric that resembles velvet. The electro-coated fabrics are distinguished by depth of pile and density of coat.



Enlarged section of Norzon fabric, showing erect fibers

Wear strain is taken on the ends of the fibers, which number as many as 300,000 per square inch, and tests indicate much higher durability than the older type. These new pile fabrics, designated as Norzon, are being tested for upholstery by two leading producers of automobile bodies.

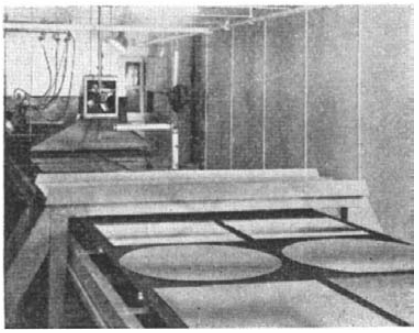
Already it is fairly well established that electro-coating can be used for carpets with a very admirable pile surface. That further research may uncover new applications seems entirely probable. A process that has already been adapted to the manufacture of abrasives and textiles undoubtedly has other uses as yet undiscovered.

MIRRORS

Made By Automatic Process

A TOUGH film of silver of unprecedented hardness is achieved in an almost wholly automatic process of mirror making developed by Logan Porter Mirror Company. The manufacturers claim that the silver solution is scientifically proportioned to every square inch of glass to be covered.

In this new process, glass plates are placed on a conveyor outside the processing rooms. Here they are flushed of all surface impurities preparatory to a gentle, thorough scrubbing with distilled water inside the machines. The sensitizing fluid flows from the laboratory above to each plate in an exactly adjusted quantity and the continuously operating conveyor carries the plate to the automatic silvering device. The mirrors meet human contact only after the processing when the conveyor carries them outside the processing room to be stacked manually.



Mirror production line

CRANBERRY CHEMICALS

CRANBERRIES, graduated from the laboratory recently, came out with a product worth $80 an ounce! Chemists call it "ursolic acid." Cranberry growers call it a lucky break. This hitherto rare, emulsifying agent which helps to make oil and water mix, is derived from the skins discarded in the manufacture of cranberry sauce. From the same "waste" product, cranberry seed oil, a rich source of vitamin A, can be obtained. Plans are afoot for a $50,000 "pilot plant" to pioneer the manufacture of the two new products.

CONTROL MECHANISM

Device Stops a Machine Error Before it Happens

A DEVICE which operates on the principle of acceleration rather than velocity and is sensitive to the rate at which a change is taking place rather than the extent to which the change has progressed has been developed in the Westinghouse Research Laboratories. It actually begins to correct something that has started to happen before it can happen. This is a new high-speed regulator which, in combination with a novel gyroscopic stability control, indicates the possibility of some promising applications for the control of mo-

tions and speeds in many mechanical operations and processes.

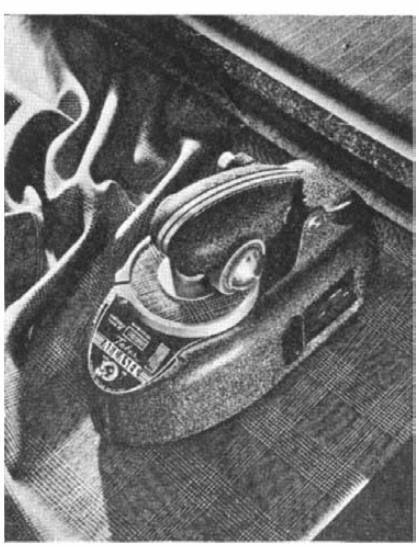
"Experiments now in progress," reports M. W. Smith, vice president of Westinghouse, "indicate the possibility of using this scheme for the control of tension and gage thickness of steel produced on high-speed strip mills. If this experiment is successful, it will materially reduce the scrap losses from off-gage material, which is one of the major problems in the steel industry today."

CLOTH TESTER

Machine Wears Surface Under Test Conditions

DEVELOPED for industrial use in determining abrasion resistance of plated metals, for example, the Taber Abraser has been adapted to testing of woven fabrics. This adaptation is based on the continuous rotary principle, though the pressures against the specimen are considerably smaller than those employed in the larger abraser for use on paint surfaces.

In the rotating head, a piece of the fabric to be tested is clamped tightly by the special ring that is employed for this purpose. The motor then rotates the head at a speed of 60 to 70 revolutions per minute and the test is continued until the two abrasive wheels have worn the fabric to an appreciable degree. Comparison between different kinds of cloth may easily be made by running each for the same period of time under the wheels of the abraser; the wearing quality of each may be determined under test with strict controls.



Above: **Compact cloth tester in use.** *Below:* **Typical cloth sections after test, showing how surface is worn by the Abraser**

TACHOMETER

Needs No Contact with Rotating Part

OFTEN it is desirable to check the speed of rotating or vibrating parts when it is impossible to get at those parts with an ordinary tachometer. Such is the case, for example, with electric refrigerators, vacuum cleaners, electric shavers, concrete vibrators, and similar equipment. James G. Biddle Company has developed an instrument which overcomes this difficulty. The new instrument, called the Frahm Hand Tachometer, is of the vibrating reed type and needs merely to be held against some part of the machine whose rotational or vibrational speed it is desired to learn. In the accompanying photograph it is shown taking the speed of a vacuum cleaner.

When determining the speed of rotating parts with a new tachometer, it is only necessary to hold the tachometer case in contact with machine housing

The principle of this device is as simple as a tuning fork. The sole mechanism is a set of very accurately tuned steel reeds. On the principle of resonance, certain of these reeds become energized by the vibration of the machine on which the instrument is held or mounted. The speed of the machine is then read on the scale of the instrument.

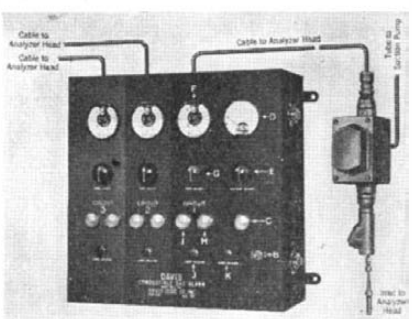
The advantages of this device are that it requires no contact with the rotating element, imposes no load on even the smallest motor, can be used in any position, does not have to be oiled, and has no wearing parts, no magnets, or electrical connections.

GAS ATMOSPHERES

Indicator Keeps Constant Watch on Explosive Mixtures

IN industries where hazardous mixtures of air and gases of any kind occur, it has been common practice to draw a sample of the mixture into a container which is then carried to a laboratory for analysis. On the results of such a test, certain manufacturing controls or changes in operation may be made. In this process there is not only a delay but also the possibility that the sample of the mixture may become contaminated.

An analyzing unit called the Davis Continuous Combustible Gas Indicator prevents all such errors because its analyzing head is installed immediately in the area to be tested. This indicator consists of one or more analyzing heads, a panel box, and a pump. The sample of gas and air mixture is drawn through only a few inches of tubing and the determination of the mixture's characteristics is instantaneous. Each analyzing cell, of which there may be a number installed at various locations, forms a part of a complete Wheatstone bridge circuit, the other half of the circuit being located in the panel box which is the indicating part of the system.



Panel box and analyzing head of new combustible gas alarm

INDUSTRIAL TRENDS

CEMENTED CARBIDES

THE first World War saw the introduction of a material in Germany which has become an indispensable aid to domestic production in the present holocaust. This material is cemented carbide. (See Scientific American, February, 1935.) Introduced to this country in the late twenties, the technique of manufacturing it to desired forms as well as the knowledge of how to use it in industry has improved by leaps and bounds. Now the pressure of war preparation has brought it into full flower.

Tools tipped with cemented carbides have permitted acceleration of metal cutting operations a hundred fold; and progressive manufacturers were fairly prompt to adopt them. Now, even the backward producer must employ cemented carbides or fall behind because defense preparation allows no lagging. Likewise, the marginal producer climbs aboard because it's necessity, not choice, which governs use.

MACHINE TOOLS

You have heard lots about the shortage of machine tools and the high rate of obsolescence, but you rarely hear of the part the cemented carbides have played in bringing about this situation. Machine tools wear out, but cemented carbides made them obsolete. Old-style machine tools would not permit maximum use of cemented carbide tools. They couldn't stand the punishment inflicted by the high operating speeds, hence much of the machine-tool replacement of recent years has been done to bring equipment into line with modern practice. Fortunately for industry, machine-tool builders re-designed their product long before the present emergency.

Incidentally, the centers of machine-tool manufacture are humming day and night. A superficial survey of plant expansion made the other day revealed that more than 300,000 square feet of new manufacturing space is about to go into use.

CIGARETTE PAPER

It seems most likely that laymen will feel the annoyance of war in small, incidental ways—at least for some time to come. Apropos of this I anticipated trouble to the cigarette manufacturers due to the shutting off of paper from French mills. But it develops that American mill capacity can be expanded to meet all needs and that there is plenty of flax grown in the United States to make all the paper we can use. We already have a small production and a new company got into operation about a year ago. Thus tragedy becomes an opportunity.

SHEET-WIRE

No industrial process is free from the possibility of revolutionary change, looking to lower costs and better quality. Among the recent upsets, for which there is promise, is a wire-producing process which ignores the customary multiple drawing operations. Here's how it works:

The first step is to butt-weld strip to permit continuous operation. The strip is then grooved longitudinally between forming rolls. Next step is to pass the grooved strip over vertically staggered slitting rolls to separate the strands. At this stage an eight-sided wire emerges. The finish operation, conducted in two stages, puts the strands through trimming dies to give the wire 16 sides (cross-section), but if wholly round wire is desired, a pass through a semi-drawing die does it.

It should be noted that annealing and pickling operations are eliminated by this process as well as the use of multiple drawing dies. Sponsors of the process are going to apply it to the manufacture of wire rod and hex bar direct from sheet bar, with the promise of cost saving.

POWDERED IRON

A plant for the production of powdered iron has been projected for the West Coast, now that imports from Sweden are no more. This news is significant for two reasons: It represents a capitalizing on world trade dislocation to the benefit of domestic industry; it is proof of growing commercial importance of metal powders.

Powder metallurgy evolved from the need to handle metals too refractory to be melted or cast conveniently. First application was in production of tungsten filament. (See February, 1939.) It also permitted the combining of components which would not alloy properly because of extreme differences in melting points or because of immiscibility. Since then a host of applications have been developed.

What will be attempted in California is the gas-reduction of iron ore—novel in itself—with the stated benefit of obtaining a high purity product and accurately controlled carbon content due to the low temperature employed, which reduces the iron without a coincidental reduction of the oxides. Also claimed by the sponsors is the opportunity to utilize large deposits of iron ore hitherto blocked by the lack of coking coal. Large-scale user of powdered iron is the automobile industry, finding that many small parts can be made cheaper and better by compressing and sintering powders to exact form.

SELF-SUFFICIENCY

Whatever our capacity to meet the exigencies of trade stoppage, whatever our ingenuity at substitution, time is the all-important factor in reaching self-sufficiency. For this reason, every move made right now may be worth a hundred frantic moves made later. Here, then, is progress to provide a cheery note:

Anaconda Copper Mining Company announces the breaking of ground for a smelter, capable of producing 100,000 tons of manganese annually, starting six to nine months from now. Manganese is an essential in steel production, which puts it at the top or near top as a strategic material. A new process for extraction from low grade ores makes this project feasible.

American Cyanamid Company, looking to the time when artificial rubber will swing into big production, is undertaking large scale manufacture of acrylic nitrile, one of the essental components of Perbunan.

Koppers Company announces building of a plant for the production of ammonium thiocyanate crystals, hitherto imported. This chemical, recovered from manufactured gas, is a base for many resins, has application in the textile, chemical, and metallurgical industries.

— *Philip H. Smith*

The Evanescent Mesotron

With Knowledge Incomplete, Science Strives to Account for some Puzzling Phenomena

C. W. SHEPPARD

ONE day in 1937 physicists studying the cosmic rays discovered another new sub-atomic particle. This new physical specimen they named the mesotron, sometimes meson. It was about 180 times as heavy as an electron and carried the same charge.

Almost at once, a few of the Olympian souls who breathe the rarefied air of theoretical physics announced that this new particle would turn out to be one of the most important discoveries of the decade. There are two reasons why they believe this to be true. Let us consider the first.

As most persons know, the atoms out of which matter is constructed are tiny "solar systems." Each has a central nucleus and a number of electrons revolving around it, like planets around the Sun. After many years of hard work, scientists have managed to push their explorations inside this outer group of electrons and actually find out what the tiny nucleus is made of. They will now tell you that it is a collection of two kinds of particles —neutrons and protons. These particles weigh almost the same— about 1800 times the mass of an electron. The proton carries a single electric charge, the neutron does not. One can picture the average nucleus as a collection of protons and a slightly larger number of neutrons. They cling together like a sort of popcorn ball, each one touching the next, and they perform an irregular spinning, vibrating, and churning motion around each other.

But all was not plain sailing. The thing which had to be explained was the nature of these sticking forces which caused the nucleus to be held together so powerfully against the natural electrical repulsion of the positively, and, therefore, like-charged, protons. This glue-like force behaves in such a strange manner that it cannot be an electrical or a gravitational attraction but must be something new. Electrical and gravitational forces act in a characteristic manner; they exert their influence over a large distance. For example, in the case of the attraction of the planets of the solar system, the gravitational force of the Sun acts with great strength over a distance of many thousands of times the size of the Sun itself. Nuclear forces, however, are entirely different. If one could get in and pry out one of the particles, he would find that this took a tremendous effort; but, once he got the particle out a little way, it would snap free and the force would drop off sharply. Furthermore, the force is such that any particle in the nucleus is acted on by only a few other particles nearby, while the rest of the nucleus has no effect. These peculiarities of nuclear forces have convinced scientists that they are here dealing with a brand new force hitherto unknown to physics.

THEORETICAL physicists sharpened their pencils and went to work on the problem of these forces. It soon became evident from theory that the force which a neutron and proton exerted on one another could be explained only if the two particles were constantly exchanging places. This may seem a strange idea, but to the physicist it was no more strange than many other recent ideas about physical forces. To explain it, consider for a moment the electrical force between two electric charges. How can one charge act on another which may be a long distance away? How can it cause that distant charge to move and how can it impart momentum and energy to it? One modern explanation says that the one charge gives out electrical disturbances, or "protons," such as constitute light and other so-called "ether vibrations," and that these electromagnetic corpuscles are absorbed by the other charge and act as energy and momentum conveyors between the charges.

In 1935, this idea suggested to the Japanese physicist, Yukawa, that nuclear forces also possessed "carriers." But, unlike electrical forces, the nuclear forces require the proton and neutron to change places, as stated before. Yukawa explained this by saying that, in this case, the carrier was a charged particle. If it were positively charged it could leave a proton, changing it to a neutron; and arriving at a neutron, it would change it to a proton (Figure 1, left). If the carrier particle were negative, it would do the opposite (Figure 1, right). This assumption of a continual stream of carriers going back and forth between protons and neutrons would account for the interchange forces. By a simple calculation, Yukawa was at once able to show that this carrier would weigh about 180 times as much as an electron.

After the discovery of the mesotron, two years later, it took theoretical physicists very little time to

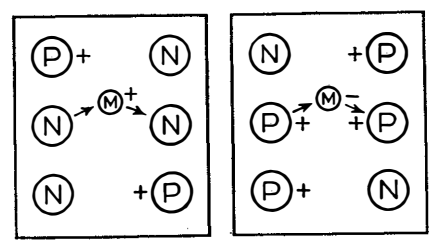


Figure 1: **Exchange of proton and neutron in atomic nucleus.** *Left:* **For a positive mesotron.** *Right:* **Same for a negative one**

agree that this was Yukawa's carrier particle. An apparently crazy theory had carried with it a prediction which came true!

The new particle soon showed itself to be important for a second reason. There are certain radio-active substances, either in nature or artificially made in the laboratory by nuclear transmutations, which eject electrons, either positive or negative. It is known that, when a nucleus shoots such a particle out, a certain definite amount of energy is let loose. Unfortunately, however, if one examines the electron after it is emitted, one finds that it usually doesn't have the correct amount of energy, but a good deal less. Scientists therefore have been forced to say that the missing part of the energy has been carried away by a phantom particle which has no charge and practically no mass—the one marked ? in Figure 2. This particle has been named the neutrino, but it has never actually been detected.

All this is bad enough, but let us consider for a moment: We have said that the nucleus consists of protons, neutrons, and carrier mesotrons alone. If this is true, where do the ejected electron and neutrino come from? The suggestion soon was made that the mesotron is not a stable particle but that it disintegrates into an electron and a neutrino. Its extra mass would then be converted into energy, in accordance with the theory of relativity, and carried away by the neutrino. Calculations showed that on this assumption the mesotron could last only a few millionths of a second before this decay process occurred.

It was at once evident that, if mesotrons decayed in this manner, it should be possible to detect the

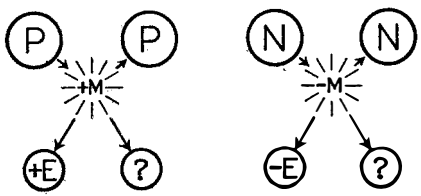


Figure 2: **New explanation of the radio-active emission of electrons from an atomic nucleus. In case I, at left, the electron emitted is positive and in Case II, at the right, it is negative**

decay in the mesotrons present in the cosmic rays. A mesotron should, in such a case, decay in its rapid course within several hundred feet of where it was produced. To test this assumption, Professor Bruno Rossi, of the University of Chicago, hauled a truckload of apparatus to the top of Mount Evans in Colorado. At an altitude of $2\frac{2}{3}$ miles, he measured the intensity of the cosmic ray mesotrons found there. He then descended to Echo Lake, about $\frac{2}{3}$ of a mile lower, and repeated the experiment. He compared the loss of mesotrons in the intervening $\frac{2}{3}$-mile air blanket with the loss in traversing a block of carbon of the same absorbing power and found that less than half as many got through the air as through the carbon. The conclusion was that, in $\frac{2}{3}$ of a mile travel, many mesotrons had had time to decay.

To settle the matter once and for all, scientists turned to the Wilson Chamber. This remarkable instrument works in the following manner: An enclosed glass chamber contains a small amount of water or alcohol. This evaporates, filling the vessel with saturated vapor. A

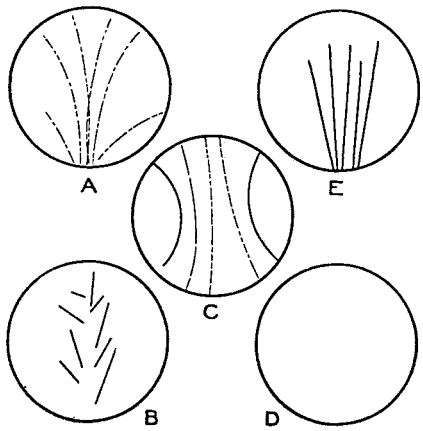


Figure 3: **How the five fundamental particles involved in modern theories of the atomic nucleus appear in the Wilson chamber.**

A: **Electrons make weak, straggling tracks which can be curved by application of a magnetic field perpendicular to the page. Positive electrons bend one way, negative the other.**

B: **Neutrons are not charged and thus cannot ionize the vapor in the chamber and leave a track. However, they are heavy enough to collide with protons, which then produce so-called recoil tracks having this characteristic appearance.**

C: **Mesotrons are hard to identify. When going fast they look like electrons; when going slow, like protons, though they curve more in a magnetic field.**

D: **The neutrino makes no track and is not heavy enough to make recoils, and thus cannot be seen.**

E: **Protons have a distinct and fairly heavy track which is practically straight except in fairly strong magnetic fields.**

piston in the bottom is suddenly drawn out. This causes expansion, thus lowering the temperature enough to make the vapor condense. The expansion is adjusted carefully until condensation just fails to occur. If now any small, charged particle, such as an electron or proton, goes through the chamber, its electrical action causes the molecules of vapor in its path to become ionized. These ions now act as centers of condensation which cause tiny droplets to form, and the result is a track which can be seen and also photographed.

Such an instrument was the ideal thing for detecting the decay of a mesotron, but it had one failing. It is only when a mesotron is going slowly near the end of its travel that its track can be distinguished from that of an electron. Thus, to the relatively rare occurrence of decay was added the further rarity of decay near the end of its course. For this reason, many pictures had to be taken to catch such a rare phenomenon in the act of taking place.

Early in 1939, the English physicist, E. J. Williams, had set out to catch a mesotron in the act of decaying. Within a few months his patience was rewarded, and he got a picture of the heavy track of a mesotron suddenly coming to an end in the chamber (Figure 3, *C*). From the end of this track came the very faint track of an electron, as called for in Figure 2. Since the neutrino, the other particle called for in Figure 2, has no charge, it produces no track and thus could not be seen.

All the foregoing work has shown that the mesotron is just about what physicists have been crying for. It casts new light on the nature of nuclear forces, explains the emission of electrons from radioactive nuclei, and strengthens one's belief in the existence of that phantom particle, the neutrino.

But there still are a few unanswered questions. It is known that forces between neutrons and neutrons, and between protons and protons, are almost as strong as those between protons and neutrons. This indicates that there must be neutral mesotrons as well as the charged ones already discovered. Certain meager evidence which has been brought forward to prove the existence of such particles has been felt to be entirely inconclusive.

Why are mesotrons not found in the laboratory? It is known that it takes about 100,000,000 volts to make a free mesotron. The only place where such energies now exist is in the cosmic rays. At present, attempts are being made at the University of California to produce such high energies with the large cyclotron.

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SPECTRO-PHOTOMETER

Analyzes Alloys By their Light In Less Than Two Minutes

AN automatic machine which rapidly and accurately analyzes various materials, an invention expected to prove of tremendous value in accelerating the inspection of metals and alloys in the na-

tion's defense program, has been developed by Prof. George R. Harrison and his associates at the Massachusetts Institute of Technology, reports *Science Service.*

The device, known as an automatic high-speed recording spectro-photometer, not only analyzes materials, as does the spectroscope, but quickly draws the graphs and curves depicting the results of its analysis. It completes the entire process for a given sample in about 100 seconds—less than two minutes.

Heretofore, scientists have used a spectrograph to analyze the material but they have then been forced to interpret this analysis on other machines, a procedure which often required half a day or more. The new device makes records and interprets 20 measurements a second, doing so with an accuracy of one part in a hundred.

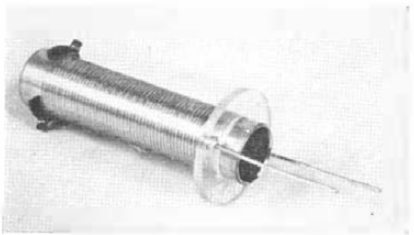
The device covers a broad spectral range, making its investigations not only in the visible range of the spectrum but also in the infra-red and ultra-violet regions. It is fairly simple in its operation and, according to Dr. Harrison, could easily be adapted to other similar problems.

HYGROMETER

Electrical Device for Measuring Humidity at High Altitudes

A NEW type of electric hygrometer has recently been developed by Francis W. Dunmore, of the Radio Section of the National Bureau of Standards. It has proved superior to other types for measuring upper-air humidities by the radio-sonde, because of its rapid response and ability to function at low temperatures. It may also be used for making and recording humidity readings when the humidity unit is remote from the point of indication. As it is comparatively small, it may be used for measuring humidities in confined spaces.

The device, which gives results accurate to within 2 or 3 percent, consists of two fine palladium wires spirally wound about 1/64 inch apart, 20 turns per inch, on a thin-walled aluminum tube which has a thin insulating coating of water-resistant polystyrene resin. The wound unit is then covered with a very thin film of partially hydrolyzed polyvinyl acetate with the addition of a small amount of lithium chloride. The latter takes up water very rapidly. With such a device the electrical resistance of the film between the two spiral coils is dependent upon the humidity of the air in contact with the film. The variations in resistance



For measuring humidity

may change the audio note which the radio-sonde transmits or may be made to operate a direct-reading ohmeter with the resistance scale marked in terms of percentage of relative humidity.

MORAL SCIENCE

Physical Science Becomes Dangerous if Dishonest

THE scientist is more honest in his work than is the politician because lack of morality in science is likely to destroy the experimenter, says Dr. Harlow Shapley, director of the Harvard College Observatory, according to *Science Service.* It is perversion of international morality, he believes, not of gadgetry, that has resulted in the decay of present-day society.

"Morality in physics and chemistry is to some extent forced," he said. "The scientist, naturally, is as human in his irrationality as others. Survival, however, requires a kind of honesty. The unmoral experimenter poisons himself or blows himself up.

"If only a false economic doctrine, while still prenatal, would also electrocute its progenitor! Or an education schism backfire during fabrication and reduce its advocate to impotent illiteracy and confusions!"

A closer communion between the physical, psychological, and social sciences was urged by Dr. Shapley as a means toward development, for the social and psychological sciences, of "a logical and rigorously experimental method similar to that which has brought such achievement in the physical sciences.

"The value of these methods," he said, "are well-publicized by the success of everyday tools. You rely on your electrical refrigerator, designed by the engineers; but you trust mighty little your politicians and diplomats. Thousands of people ride in automobiles with complete confidence in their mechanism. They worry not at all about the engine; reserving their anxiety for the unverified assertions of their Congressman, for the economic system, for the treachery of man in fields where a forced morality does not exist.

"If we are to escape descent into darkness," he declared, "the scientist must join forces with other intellectual leaders, because on the advances in the educational, social, and political fields, does the advance of our science depend."

CATTLE PATERNITY

BLOOD tests can be used to settle paternity questions among cattle, Dr. Lloyd C. Ferguson, of the University of Wisconsin, recently reported. Procedure, however, is not the same as in human cases. Human paternity is decided on the basis of blood types, such as are used in "matching" blood for transfusions. In cattle, the things used are antigens—definite chemical entities in the blood that react in the presence of one particular substance. Cattle blood has been shown to possess something over 20 such antigens, each dependent on a single hereditary character or gene.

WEATHER

Automatic Radio Weather Reporter Aids Study

AUTOMATIC weather observing stations, untouched by human hands for months at a time, may soon be scattered around on high mountain peaks or at inaccessible sea locations so that Uncle Sam's weathermen can have complete and automatic radio reports on the changing weather, necessary for predictions, says *Science Service.*

An automatic radio weather reporter, developed by two National Bureau of Standards radio engineers, Harry Diamond and Wilbur S. Hinman, Jr., with the co-operation of the Naval Bureau of Aeronautics, has undergone a successful two-months test at Naval Air Station at Anacostia.

Radio messages that it sends out at predetermined intervals tell the barometric pressure, air temperature, relative humidity, wind direction and velocity, rainfall, and other meteorological factors.

Roots are Pumps

Research Shows Capillary Attraction Has Little To Do With Sap Circulation

PHILIP H. SMITH

TOMATO roots, no bigger than a piece of store twine, have a pumping mechanism capable of developing pressures of 90 pounds per square inch.

This is one of the recent findings of science and it may help to explain the phenomenon of sap rise which has puzzled scientists for centuries.

If and when you studied botany, your professor probably gave you the "cohesion" theory to explain the movement of fluid in plants and trees. This theory recognizes the enormous pull generated by evaporation at leaf surfaces and the fact that water has great tensile strength in capillary tubes. It seemed to be the best theory available and even now it isn't voided by the revelation of root-pressure, but it falls short of explaining the sudden uprush of sap when there are no leaves to transpire, or how fluid can be lifted as high as 350 feet, as it must in the tallest trees.

The reality of root-pressure was confirmed at the Rockefeller Institute for Medical Research as a sort of scientific by-product. Dr. Philip White, of the Department of Animal and Plant Pathology, was trying to find out how viruses are carried around in a plant which has no circulatory system such as is found in man. He turned to the vitalistic root-pressure theory which had been advanced about 200 years ago by the Englishman, Stephen Hales, the extraordinary clergyman who first measured blood-pressure in animals, and invented the first gas mask and the first ventilating system for ships. Hales' theory had been abandoned in favor of more mechanistic theories. He had worked with decapitated, dying roots and the slight pressure obtained was unconvincing.

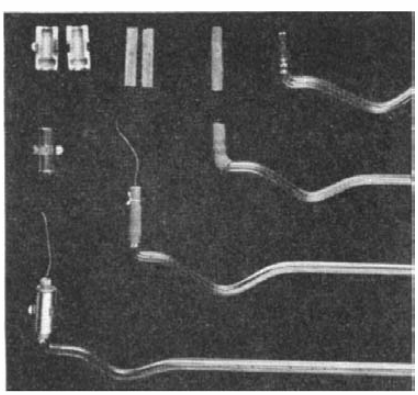
To carry out his experiments, Dr. White built upon a previous achievement—that of being able to keep excised roots alive in nutrient. Roots can be made to live indefinitely, floating in a beaker, provided they are supplied with everything they get normally from soil plus what they would get from the air if they had the benefit of leaves—a sort of super-hydroponics.

Just such a delicate root strand, kept alive for several years under artificial conditions, was selected for the experiment. Its base was inserted in a glass tube, or capillary manometer, and anchored firmly in place with a rubber collar, to give a set-up in which part of the root was in the tube and part protruding into the nutrient. The root then secreted water into the tube, building up pressure. When the pressure mounted it became necessary to add a metal clamp lest the rubber be ruptured, but at no time could the root itself be crushed.

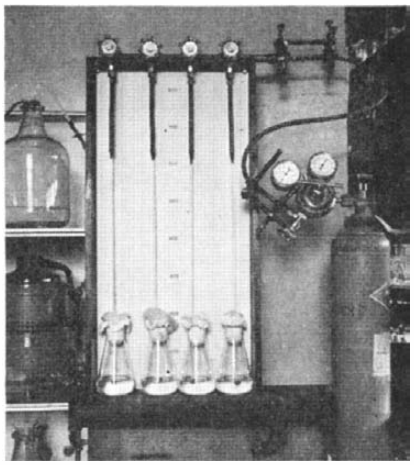
When first attempted, the surprising pressure lifted the water to a height necessitating the running of the tube up a stairway to a second floor, and even that wasn't enough. When mercury was substituted for water in the tube, the pumping was maintained with irresistible force. Finally, to keep the experiment within bounds, compressed air was applied at the opposite end of the tube and the root forced to pump against it, which it did readily.

It was observed, also, that whether pumping against pressure or not, the rate of secretion displayed a diurnal rhythm.

Ninety pounds pressure represents the limit reached by experiments rather than the limit of root capacity. When 90 pounds was attained, the root was still pumping, and Dr. White is of the opinion that pressure cannot be less than 150 pounds per square inch, and is probably more.



Manometer assembly used in the study of plant root pressures



Root pressure apparatus showing air tank for back-pressure

One now wonders what starts the rise of sap in the spring. Observing nature, one would guess temperature or light, or both acting together. However, subsequent experiments, conducted elsewhere, under controlled conditions of temperature and light, failed either to stop or start the pumping, or to alter the diurnal rhythm. Nature holds her secret close. One might wonder, too, what difference there is in the constituents of the nutrient taken in by the root and the fluid secreted by it. Are the nutritional elements removed, or are some food values passed along to nourish the rest of the plant which isn't there? The quantities available for analysis are so minute that special methods will have to be devised for such determination.

Scientists do have an interest in trying to determine whether there is a diurnal rhythm in respiration rate corresponding to the rhythm of secretion. If this could be established, it might reveal the mechanism which supplies the energy for the pumping.

The nature of this work warrants the layman's critical "So what?" Are there immediate, practical results? The reply must be "No." We are simply further along in the understanding of plant physiology. Add other facts yet unknown, to widen the horizon, and sometime the practical value may emerge in the most unforeseen manner as it has in innumerable cases.

Business and Changing Climates

Are Slow Climatic Changes the Basic, Underlying Cause of Economic Cycles?

CLARENCE A. MILLS, M.D., Ph.D.
Professor of Experimental Medicine at the University of Cincinnati

MAN is far from a uniform being of standard proportions and capacity for accomplishment—he differs widely from place to place and from time to time. Years of investigation have revealed that the primary basis of these variations is the ease or difficulty of heat loss from the body.

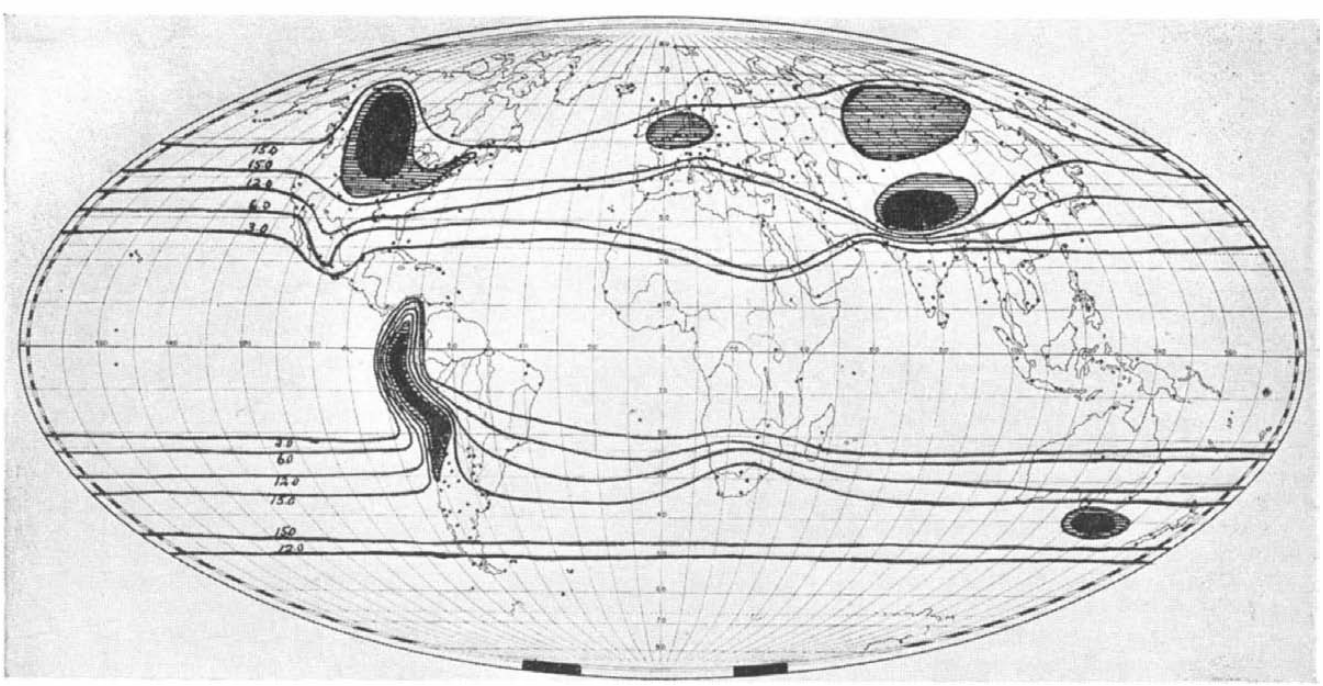
All bodily and mental activities or functions are intimately bound up with the combustion of foodstuffs in the cells and the liberation of heat and energy. Every activity in the body is accompanied by and dependent on this combustion and heat production. Growth and development, ability to resist infections, as well as muscular and mental activity, are based on this internal burning of food materials. Hence the factors that determine the combustion rate become dominant forces controlling the general activity and energy level of the individual.

With man—and other warm-blooded animals—the body temperature is maintained at a constant level, usually above that of the surrounding environment. So long as life processes go on, heat must be dissipated to the surroundings, else fever and death ensue. Higher external temperatures, making heat loss more difficult, result in a suppression of internal combustion and a lowered level of vitality and general body function. Growth and rate of development are slowed, resistance to infection falls, and energy available for action is sharply curtailed. When body heat loss is accelerated by lower outside temperatures, just the reverse occurs. It is in the temperate regions of the earth, where body heat can easily be dissipated, that children are heaviest at birth, grow most rapidly, enter puberty earliest, and reach greatest adult size. There energy available for action is highest and people are irresistibly driven into a restless activity that attacks difficult problems with a high degree of success.

In polar cold, however, body heat loss becomes too free, and, instead of human vitality and energy there rising highest, it tends to fall, as the body is faced with the necessity of using too much of its combustion activity merely for keeping warm. The exhaustion effect of prolonged cold is seen also in the temperate regions during late winter, when the death and sickness rates rise, and all other indices of general vitality fall.

Man, then, responds very definitely in a great variety of ways to the ease with which he loses his body heat. The temperate regions of the earth are in general best adapted for his maximum activity; tropical warmth subdues his functions, while polar cold exhausts and benumbs. This is a relatively new concept of the dynamics of human existence and of the part climate and rate of body heat loss play in life. Let us now see just what this concept means for mankind over the earth.

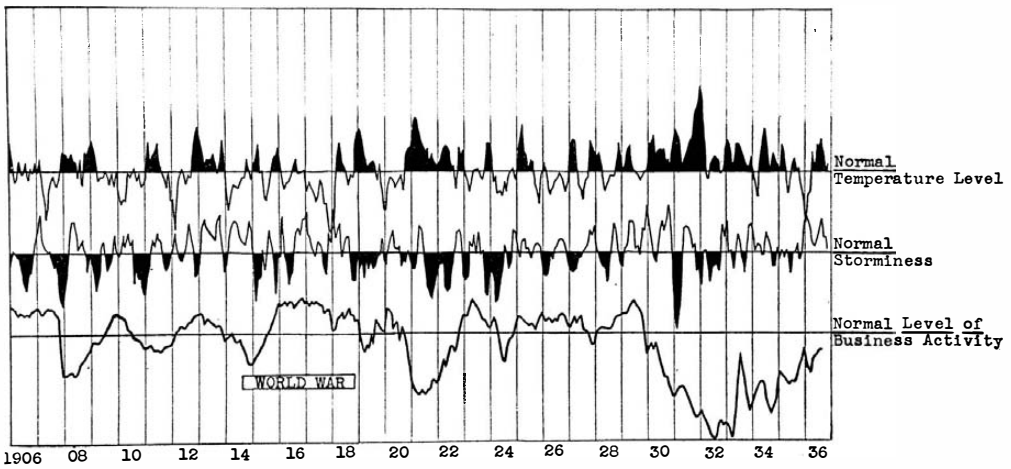
THE tropical lethargy and listlessness, carefree existence, together with retarded growth rate and body development, result directly from the difficulty people there experience in getting rid of the heat production that goes with a higher level of bodily activity. In the coolness of the temperate zone existence is on a faster, more energetic plane. While infections account for most of the deaths among



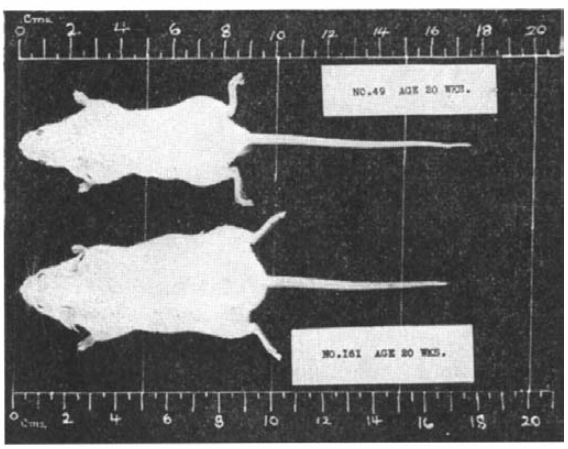
Climatic stimulation over the earth. Index numbers represent intensity of the climatic drive

tropical natives of low vitality, in the energizing temperate climates it is body breakdown from the strain of a fast pace of life that kills the greatest number. Vascular sclerosis, heart failure, diabetes, pernicious anemia, nervous and mental breakdown —these are the signs of stress that are mounting as causes of disability and death in the regions of most energizing climate.

It has ever been the people of cooler lands who have ruled over and exploited the less fortunate ones living under depressing, moist warmth. In wars between nations the same energy gradient has also been a determining factor in the final outcome, for rarely can a low-energy people withstand armed forces full of vigor and determination.



Weather stimulation and business activity (industrial area of the United States). Upper curve: Deviations from normal temperature. Middle: Deviations from normal storminess or temperature variation. Bottom: The fluctuations of business activity



Environmental temperatures and body growth. Smaller mouse represents average size of a large group raised in tropical moist heat (artificial), while those raised under identical conditions except in a cold atmosphere are represented by the lower one of large, robust form. But the ones raised in warmth live longer, though less actively

Regional differences in energy level have been of untold importance throughout the course of history, but there have also existed differences on a time base that have altered the destiny of individuals and whole population masses. The most common time change in energy level is the one that man undergoes as the seasons of each year pass. Energy in temperate regions rises highest through the fall and winter months and subsides to its lowest level in summer heat. Man actually uses less oxygen and has a lower blood pressure in summer heat than he has in winter cold.

Unexpected and unpredicted changes in this climate stimulation, however, bring disastrous upsets in human plans, and with these irregular changes in earth temperatures go changes in human energy level and desire or ability to accomplish.

Correlation of such temperature changes with business activity, back through the past 65 years of weather bureau records, shows remarkably high coincidence of business recessions with the periods of elevated temperatures, and of business booms during prolonged periods of normal or unseasonably low temperatures.

This basic dominance of all human function, and especially of economic activity, by the climatic drive, as body heat loss becomes easier or more difficult of accomplishment, deserves close attention and further study. With the rising energy tide of low temperature periods, business activity expands. At the same time the signs of bodily stress increase and death and sickness rates rise. In the periods of ebbing energy general health improves as business activity recedes to lower levels.

It has been man's failure to recognize this dominance of environmental stimulation that has made impossible a solution of the basic cause of economic cycles. Moreover, the irregularity of their timing has rendered difficult the perfection of plans for meeting the changes as they come.

Fluctuations in the climatic drive, aside from the seasonal and irregular ones of short duration, have left their imprint on the history of nations back through the centuries. The past two centuries of continuous temperature records yield an enlightening picture of the workings of this drive. Outbursts of national expansion, as well as bloody revolutions for greater freedom of individual action, have shown an uncanny tendency to come during years of subnormal mean temperatures—years of the cold, stormy weather that drives men to greater activity.

LONG undulations in earth temperatures have taken place and will undoubtedly continue in the future. Longest and greatest of these changes are represented by the glacial epochs and the intervening ages when tropical warmth spread well outward toward the poles. We are only perhaps 20,000 years away from the coldest part of the last glacial epoch, with a likelihood of generally rising temperatures for ten times that number of years to come. The rise in temperatures has not been steady, however, but has come in 2000-year waves. The most recent high point came with the warmth of the Middle Ages (800-1000 A.D.), while the subsequent low point occurred about the middle of the 19th Century. After 1850, world temperatures rose slowly and irregularly for several decades, but since 1920 this rise has become more emphatic. In 1932 the bodies of Vikings were being unearthed in

excavations in Greenland after having been solidly frozen-in for almost 1000 years. And with this recent warming-up has come a sharp turn back toward despotic forms of government all over the earth. Man has felt weaker.

With the cold of the last century came a marked increase in world population and such an abundance of energy and inventive genius as had never before been witnessed in human history. Since 1920, however, population increase in many of the most energetic countries has shown signs of tapering off, with statesmen of several countries worrying about the possibility of an actual decline in numbers.

We seem, then, recently to have passed a crest in human affairs and to be headed for a considerable period of recession. The improvement in stature and trend toward earlier maturity, that has been in evidence during the past century, will no doubt be reversed shortly, for animal studies have clearly shown that these basic characteristics are closely linked to the ease or difficulty of body heat dissipation.

What shall we do about it all?

Disastrous fluctuations in business activity might be robbed of their evils if we could predict the timing of the energy tides in man that seem responsible for the economic swings. If the irregular fluctuations in energy and trade were as predictable as are the seasonal ones, we would be much less disturbed by them and be more inclined to take them in our stride, for panic arises from fear of the unknown. In the individual phase of weather dominance, however, much can be done to relieve us from the undesirable aspects of such influence. Through newer methods of air conditioning and control of indoor environments, we can to a considerable degree alter the effects of outside weather. People in the tropics can raise their energy level and bodily vigor almost at will through indoor cooling to allow ready dissipation of body heat. So also can the physical and mental let-down of mid-summer in temperate regions be eliminated by proper cooling, although it is a question whether it is wise to forego this period of lessened effort when the body relaxes and recuperates for the strenuous winter months to come.

Much remains to be discovered in this matter of weather dominance over man. Humanity really need not stumble blindly through the centuries, engaged in stupidly fighting deep currents of change which are based on forces whose magnitude dwarfs to insignificance man's puny efforts. Is it expecting too much to hope that man will some day arrive at intelligent and understanding co-operation with these outside forces, instead of putting up a futile resistance to the changes they bring?

• • •

TURKEY STEAKS

FROM the United States Department of Agriculture comes word of popular acceptance of turkey steaks. These steaks are small pieces of turkey meat and housewives can buy them wherever turkey is sold by the piece. They are usually cut from the breast, ½ to one inch thick.

NIAGARA BRIDGE

Structure Over Gorge

Safe From Ice Jams

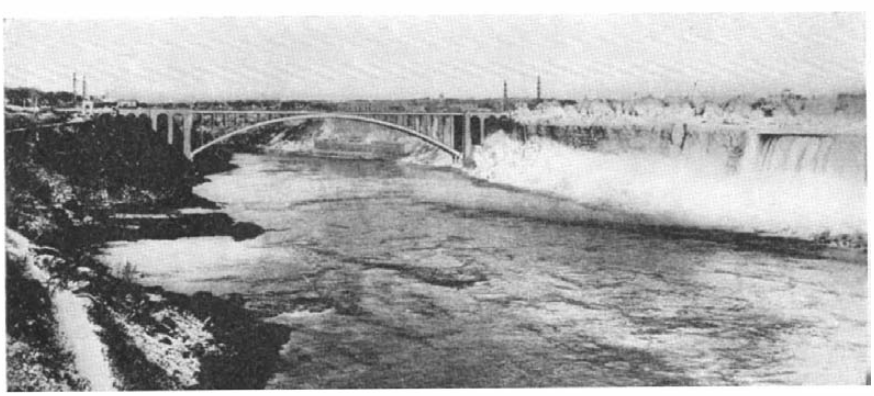
ALMOST directly on the site of the famous Falls View Bridge at Niagara Falls, which was destroyed by an ice jam in 1938, a new bridge was started in June. This new $4,000,000 project will have a main arch span of 950 feet across Niagara Gorge at a point about 2000 feet below the American Falls. It will be the longest bridge of its type in America, the next longest being the Hendrick Hudson Bridge across the Harlem River in New York City. It will have one graceful structural arc across the Gorge and will have no superstructure other than the railings. There will be a wide promenade on the southern edge of the double roadway, giving a full view of both the American and Horseshoe Falls. Traffic will be carried by two 22-foot roadways separated by a mall. Of particular importance is the fact that the foundations for the new structure, in the face of the Gorge cliffs, will be high above any possible ice-jam of the future.

CARBON IN CEMENT

Colloidal Carbon as a Grinding Aid in Portland Cement Manufacture

COLLOIDAL carbon, commonly known as carbon black, is an effective grinding aid in the manufacture of Portland cement, according to the results of research carried out by the Columbian Carbon Company's Industrial Fellowship at Mellon Institute, Pittsburgh.

The report of this investigation discloses that a carbon dosage as low as 0.32 percent on the clinker increases the fineness of the cement by 30 percent when the time of grinding is constant, and that the same carbon dosage decreases the grinding time by 28 percent when the grinding is to run constant fineness. With a 1 percent carbon dosage, these improvements become 50 percent and 34 percent, respectively. In terms of power saving and increased output these results are of practical significance. The cements prepared with carbon present as a grinding aid, compared to the controls, showed improved strength properties in tensile and compression tests on mortars. These benefits are attributed in the main to the increased fineness of the cement, although there is evidence that the carbon, per se, is contributory. The use of carbon in dosages up to 1 percent does not alter appreciably such standard properties of Portland cement as consistency, setting time, and



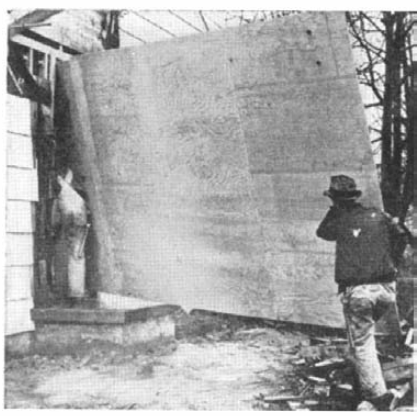
Architect's drawing on photo shows how new Niagara Bridge will appear

soundness, color excepted, and has no noticeable effect on the resistance of cement mortars to freezing and thawing treatment.

PLYWOOD PANELS

Large Size, Seamless, Easy to Erect

COMPOSITE plywood panels in room sizes up to eight feet by 20 feet and faced with fabric have been announced by the Speedwall Company. The giant size of these panels eliminates joints. Ordinarily, one board makes a room wall, while



One-piece panel

four of them make a whole room. Thus this Jumbo Speedwall, as it is called, saves erection time, and eliminates joint making on the job and the possibility of the development of cracks later on.

This Jumbo Speedwall is made up of standard grade, water-resistant, Douglas fir plywood panels, hot-press "welded" together with synthetic resin glues. Surfaces to be decorated are sealed and "dressed" with a strong woven fabric, such as is often applied by fine decorators over many different types of surfaces. The special adhesive with which this fabric is applied also provides fire resistance and a moisture barrier for the wall when it is used.

PLATINUM

Metal Leaf Used for Decorating Building Entrance

THE first application of platinum leaf for building decoration was completed recently on the outer vestibule ceiling of the 67 Wall Street Building, in New York City.

Platinum leaf—latest product of the ancient art of gold beating—is beaten down to a thickness which requires a stack of 250,000 leaves to measure an inch in height. Yet, when applied to a surface, the leaf provides a metallic effect with all the rich color and beauty of platinum. The metallic leaf was selected for the entrance because of its brightness, tarnish resistance, and freedom from discoloration by atmospheric conditions.

Platinum leaf has been available for several years for outdoor signs, interior decoration, bookbinding, and many other decorative uses.

QUICK-FREEZE

Machine For Home Freezes Foods

AMERICA'S first sub-zero locker box for the home has been named Deep-Freeze. It is being built in one-barrel and two-barrel capacities and incorporates certain innovations in refrigeration.

Conventional refrigerators pull against a vacuum but the Deep-Freeze unit actually operates on the pressure side. Tests have shown, it is claimed, that the Deep-Freeze unit requires considerably less current to produce zero cold than does conventional equipment.

The cooling element is unique. It consists of a double wall cylinder of heavy steel which serves both as the food box and as the cooling element. Freon refrigerant is circulated in the space between the cylinder walls; hence the entire usable interior space is surrounded by a refrigerant.

This new Deep-Freeze food locker was developed by W. L. Morrison. The one barrel capacity will be more generally used by urban families while the two barrel capacity might be used by farmers to provide long-term cold-storage facilities for meat and other fresh foods, including vegetables. Sportsmen might use it for quick freezing of fish and other game.

Quick-freezer for the home

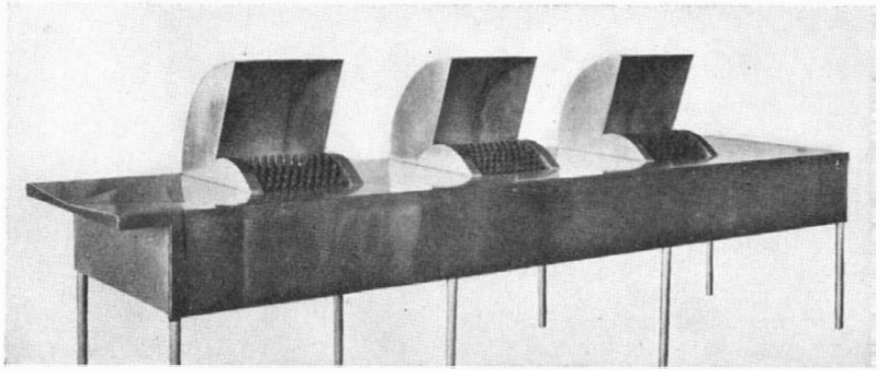
CELLOPHANE CEMENT

A NEW Cellophane cement adaptable to food packaging has been placed on the market by Carmen Products. It is described as transparent, tasteless, and odorless, moisture-proof, and resistant to acids and alkalis.

RUBBER ROAD ROLLERS

THE ponderous iron road roller with its clanking, barrel-like rollers, is being displaced in some types of service by vehicles equipped with pneumatic rubber tires. Use of the tires for road rolling has proved the best method of

Multiple pneumatic tires replace the iron barrel of the steam roller



obtaining the equivalent action of heavy traffic compaction on road mix and rock asphalt surfaces, tests have shown. Developed by The B. F. Goodrich Company, the new tires are mounted in series with as many as nine or more to a single vehicle.

TRENCH MORTARS

And Shells Made From Standard Steel Tubing

STANDARD seamless steel tubing can now be used to make trench mortars for the United States Army, according to Captain Daniel J. Martin, writing in a recent issue of *Army Ordnance.*

Trench mortars are light weapons originally intended to be used by infantry to blast the enemy's trenches. They have been so improved that they have become actually light artillery—very effective for blasting out enemy machine-gun positions. Of the two types used, the 60-mm mortar weighs but 39 pounds, while the 81-mm mortar weighs, assembled, 134 pounds. This latter mortar may be carried, disassembled, by three men.

Since trench mortars are smooth-bore weapons and the powder charge is relatively small, Captain Martin explains that both the weapon and the shells it fires may be made of standard tubing. From this it is obvious that manufacture of adequate numbers of these weapons can be attained rapidly and easily.

CHICKEN PLUCKER

Machine Does Work Ten Times Faster

PLUCKING the family chicken—or the game bird from your autumn hunt—will cease to be a burden if you have a new machine recently put on the market as a commercial

Above: **Three-unit machine for removing chicken feathers.** *Below:* **Making the feathers fly**

product. However, since it's designed for mass production, you probably still will find that the old hand method is more economical in the home.

Expert hand pickers in the poultry market can pluck about 35 or 40 birds an hour. The machine will handle about 250 or 300—with some limitations. Tail and wing feathers require manual attention. But aside from that the machine will make the feathers fly. Actual results in the Schulte Poultry Company in Cleveland largely have confirmed the predictions of the manufacturers that the equipment will revolutionize the industry.

Essentially the machine consists of one or more metal drums, each about 2½ feet in diameter. Each drum is bristled with rubber tube fingers, thus in effect becoming a cylindrical rubber brush. As this revolves rapidly it literally brushes out the feathers.

These flying wet feathers naturally are corrosive to many metals. Further, they tend to stick to the machine as they dry. Because of the ease with which it can be cleaned, as well as its resistance to corrosion, the machine is made of Monel. It is manufactured by Mueller Metal Products.—*INCO.*

NON-SKID

Abrasive is Cast Into Metal Stair Treads

SLIP-PROOF stairway treads, which incorporate an abrasive material penetrating the entire thickness of the plate, are a development of the National Bronze and Aluminum Foundry Company. This abrasive, which is called Ten-Lox, is cast in the metal in molten form to insure a perfect bond around each particle of the material. These stairway plates are cast in any size or thickness and are easily installed on existing surfaces through the use of countersunk screws, bolts, or specially prepared mastics.

Ten-Lox slip-proof stair treads and floor tile are impervious to the action of water, oil, and grease. They can be furnished as cast, sand blasted, scratch brushed, or polished, with or without nosing.

TIMBER PROTECTION

Impregnation of Timber With Arsenic Salts, New Swedish Method

MANY attempts have been made to find suitable means of protecting timber against rot and insects. Painting is, of course, the most common but, being only a surface preparation, it does not prevent the body of the timber from taking up moisture, and therefore rot gradually appears even in painted wood.

The effective components of a new Swedish impregnation method are certain arsenic compounds. The method has been developed by the Boliden Mining Company, in Stockholm, which obtains large quantities of arsenic as a by-product in the smelting of copper ore from its mines in northern Sweden.

The impregnation liquid used consists of a solution of various salts, including arsenic. After these salts have entered the timber, a chemical process takes place, with the co-operation of certain easily oxidized substances in the wood itself. The final result of this chemical process is the production of zinc arsenate and chromic arsenate, which become inseparably fixed in the wood, and constitute the effective elements against attacks of decay or insects.

Arsenic-impregnated timber is

said to retain its mechanical qualities. It takes on a soft green color with a slight shade of brown, which is sufficiently strong to render painting unnecessary if the timber is used in buildings. Another advantage is that the timber does not catch fire as easily, and burns less quickly than unimpregnated boards, thus contributing to damage reduction in case of fire.

The new method is said to compare very favorably in cost with other methods. In the Scandinavian countries, arsenic-impregnated timber at present is being used increasingly for various kinds of out-door purposes, including quay and other under-water constructions. Twelve impregnation plants in various parts of Sweden are employing the method, in addition to some in Norway and Denmark.—*Holger Lundbergh.*

PIPE PROTECTION

Oil Pipes Covered with Cellulose Sheet

EXPERIMENTS have been conducted in the Texas oil fields for more than six years by a major pipe-line company in an effort to find a protective coating material that would be physically and economically satisfactory for use on oil lines. From the many materials tested, there has emerged one shield of considerable promise: Pyralin sheeting.

In one test case, clear, transparent Pyralin .005 of an inch thick was used and in the other, black Pyralin .008 of an inch thick. A coat of hot asphalt was applied to a six-inch diameter pipe which was then wrapped with the Pyralin shield. The line was replaced in soil known to be highly corrosive and inspected intermittently over a period of three years.

Final inspection of the two sections showed that both the clear and the black Pyralin had remained free from chemical or physical change. Considering that a price differential favored the black material, it was decided to select that color for future work, and to use .01 of an inch thick material as a safeguard against breakage from clods and rocks in the trench bottom.

Pyralin is not appreciably affected when exposed to damp atmospheres or immersed in water, reports *The Du Pont Magazine.* Under normal conditions it will absorb only about 3 percent of its weight. In addition, it is only slightly affected by weak acids and weak alkalies. Experiments show that it remains smooth and hard when underground; that when earth surrounding the pipe contracts due to change in temperature, it slips away, leaving the wrapping unharmed. The material

has the required rigidity and yet is pliable enough to permit easy application.

To obtain a tight fit around obstacles such as collars and girth welds, the sheets are first softened in a liquid solution of one part ethyl acetate, three parts alcohol, and four parts water. The Pyralin expands, when softened, but upon drying shrinks a greater amount, making possible a tight form fit on sections of irregular shape.

HEREDITY RULES

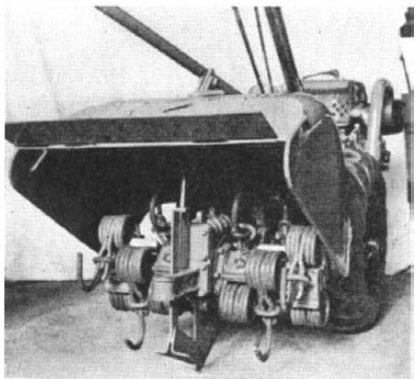
Despite Science's Attempts To Change a Fly

FIFTEEN years ago a normal fruit fly of the species Drosophila was mated to a female with degenerate wings. From their descendants a similar pair were chosen and mated, the male normal in every respect, the female with vestigial wings. This procedure has been repeated for 300 generations, the equivalent of 9000 years of human life, yet today the genes that produce normal wings in this fly are still functioning, stubbornly refusing to be bred out of existence or changed in their action.—*The Industrial Bulletin* of Arthur D. Little, Inc.

MOTORIZED TILLER

Machine Shreds Soil in Seed Bed Preparation

A NEW motorized garden tiller, which is steered by handles like an



Left: **Shredding garden soil with the motorized tiller.** ***Above:*** **Rotating tines that do the work**

ordinary plow but which is completely motorized, is the product of the Ariens Company. Ariens Tillers are used by truck gardeners, greenhouse men, city parks, nurseries, and the like, for they are ideally suited for these applications as well as for small farms.

A particular feature of this tiller is the group of rotating, sharply pointed tines under the hood at the rear of the machine. These tines literally tear the soil to shreds, thus making it unnecessary to plow and then to disk and perhaps to harrow a seed bed being prepared. The machine operates equally well in tall weeds which it rips up by the roots. It is particularly adaptable to the job of tilling soil between shrubs or in other restricted or confined spaces.

GLOWING CARPETS

Carpet Fluoresces; Lamp Activates It

COINCIDENTALLY, there comes to our desk news of two complementary developments. The first concerns a new "magic carpet" which glows in the dark under the invisible "light" from ultra-violet ray lamps. The other concerns development of a lamp for activating such carpets, making them glow, in such locations as the aisles of darkened theaters.

The new carpet was announced by H. E. Millson of the Calco Chemical Division of the American Cyanamid Company. He explains that the carpet is dyed with special dyes which appear quite ordinary in daylight but glow softly with various colors under invisible ultra-violet rays. Hence, it will be of value in providing an extra safety feature in theaters.

The Continental Lithograph Corporation announces the other

development — new Conti - Glo Black Lights which were designed specifically for this use. Formerly black light equipment gave spotty results whereas the beam pattern of the new one is very long, narrow, and exceedingly sharp in cut-off at the edges.

DRINKING WATER

Need For Better Water Pipe Inspections

RESIDENTS of Joliet, Illinois, a few months ago found their drinking water strangely flavored with beer and soda-water flavors. The reason was a cross connection between city water and a private supply in two breweries and two soft-drink bottling places which permitted backflow into the city mains.

Reporting this occurence to the trade journal, *Plumbing and Heating Business,* A. R. McGonegal, formerly plumbing inspector for the District of Columbia, points out that "poisonous solutions such as acid copper-cleaning compounds might have been drawn into the mains by a drop in pressure just as easily as beer."

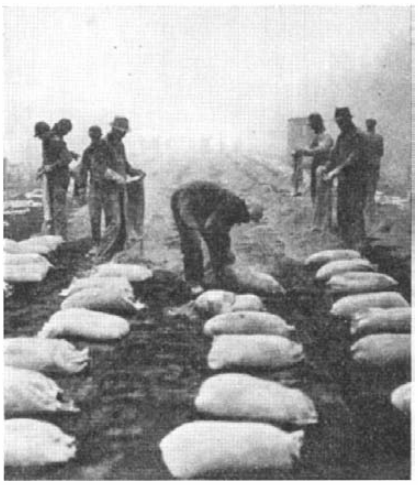
Renovation of water piping in industrial plants all over the country is a health necessity, according to recent reports from public health engineers. Their reports refer to conditions during normal times but the situation probably needs attention more urgently than ever, now that industrial production is being speeded up for national defense, with consequent extra loads on plumbing and piping.

FEEDER ROADS

Surfaced with Cement and Soil Mixture

MOTORING around the country, you soon may be riding on a "dirt" road made with cement! Already, in 29 different states, sections of this new type of road have been installed, using a method of construction which engineers thought impossible only a few years ago, according to James Stokley of *Science Service.* The new method is being used on feeder sections of roads where the $20,000 to $40,000 per mile for concrete construction is not justified.

For years, specifications for making concrete had prohibited use of material containing more than 5



Above: **Spreading cement for resurfacing a dirt road.** ***Below:*** **Cutting the cement into the dirt**

percent of dirt. However, some experiments in South Carolina in 1933 and 1934 indicated that under some conditions it might work. Under the direction of Frank T. Sheets, then director of the development department of the Portland Cement Association, and Miles D. Catton, studies were conducted and formulas and tables were developed to guide future builders.

In building a soil-cement road the first step is to take samples of the soil and test them. These tests show the proportions of cement and water to be used. Road work begins with a scarification of the old road to a depth of about six inches with rake-like devices hauled by a tractor. A disk harrow then pulverizes the surface. Portland cement in pre-determined amounts is then spread over the road and this is cut into the loose surface by disking and with gang plows drawn by tractors. Water is then added under pressure in carefully controlled amounts, and harrows, plows or cultivators again go to work. The surface is then packed down, graded, and rolled. After slow drying for about a week, the road is opened to traffic, though about a month is required for the road to "season." Sometimes a thin asphalt layer can be applied to give the proper riding surface, though this is not necessary as a protection.

FLOWER POISON

Cut Flowers Keep Best In Absence of Fruit

BY rule of thumb, florists have thought for years that cut flowers would keep better at a refrigerator temperature of 50 degrees. Actually, they keep better at a near zero temperature, though florists who stored cut flowers at that temperature usually found that the flowers would not keep. The Department of Agriculture has found the "nigger in the wood pile."

When the florists stored carnations at just above freezing, it usually happened that storage space was in a warehouse that also contained apples in storage. Ethylene gas is given off by apples in storage and ethylene gas is poisonous to flowers. That is true even when minute quantities of the gas are present as in the case where flowers are stored in a warehouse which formerly contained apples.

GIANT ARC

Quenched by Compressed Air Blast

A POWERFUL blast of air racing six times faster than a tropical hurricane recently blew out an electric arc powerful enough to light for an instant all the lamps in Chicago.

Surging with 150 pounds pressure from a container not much larger than an automobile gas tank, at a speed of 600 miles an hour, the gust of compressed air extinguished an arc of one and one half million kilovolt-amperes in approximately one one-hundred-and-twentieth of a second. Only a slight puff of smoke trailed off as a reminder of the once powerful arc.

Executives and engineers of electric power, industrial, and transportation companies from all over the country witnessed this unique demonstration of a newly developed compressed-air circuit breaker at the East Pittsburgh works of the Westinghouse Electric & Manufacturing Company. L. R. Ludwig, manager of the company's air circuit breaker engineering department, said this test

represented the greatest amount of power ever interrupted by a 15,000-volt commercial breaker operating in air.

One of the functions of a circuit breaker can be likened to a fuse on a power system to open the circuit in case of trouble on the line and prevent its reaching the power house. The other is that of a disconnect, comparable to the wall switch at home, which enables the power engineer to open and close power circuits at will.

Essential parts of the breaker include a tank of compressed air at a pressure of 150 pounds per square inch, valves and pistons to operate the air mechanisms, contacts, and arc chutes or fan-shaped interrupting chambers. All of this mechanism is interlinked mechanically and takes up no more space than a household refrigerator.

The new circuit breaker quenches in a few inches of space an arc that theoretically would have to be pulled out some 40 feet to be extinguished in ordinary air.

WATER-SOLUBLE

New Waxes are First Completely Water Soluble

Two recently-introduced products should be tempting to experimenters interested in testing each new kind of substance in the hope of finding distinctive properties to impart to existing articles. One of these substances, reports *The Industrial Bulletin* of Arthur D. Little, Inc., is physically like petrolatum and the other resembles a wax of 125 degrees melting point, but both have solubility properties that are unique. They are the first waxes completely soluble in water, forming solutions as transparent as water itself. While readily soluble in benzene and toluene, the acetates, and acetone, they are not appreciably soluble in naphtha or other petroleum products, or in turpentine, waxes, or fats. Odor and taste are slight, and preliminary tests on animals indicate that these products are harmless, at least when applied externally.

The waxy or greasy feel suggests slip or lubricating action, for uses where actual greases are not wanted. For these and other applications they can be applied as clear water solutions.

The producers, Carbide and Carbon Chemicals Corporation, suggest the soft form as a plasticizer for casein, gelatine, or glue; in

various binding and film-forming applications; as a lubricant for rubber; as a softener for belt-dressings; and as an ingredient of air-scrubbing liquid, in addition to cosmetic application in creams, lotions, and hair preparations. The hard form has binding properties applicable to films, and its surface activity favors suspension of pigments and lakes. This combination of pigment-holding and binding properties offers possibilities for water-soluble, temporary marking crayons and paints, and even for calcimines, grease-proofings, and dressings. Many other kinds of uses will undoubtedly be discovered by experimentation.

ENAMEL REMOVER

Non-Caustic, Floats off the Surface

AN opaque liquid about the color of cream, and called Metastrip, strips baked enamels, varnishes, lacquers, paints, and even the latest synthetic finishes from all kinds of metals by a simple emulsifying action. This product of Surface Finishing Products Company contains no caustics, yet it floats the finished surface away from the metal in about two minutes or less. If the surface finish remains in the solution, it breaks up into small particles and stays in suspension.

No special equipment is required for using this agent. Metastrip is maintained at a heat of about 190 degrees to 213 degrees, Fahrenheit, and the work is simply immersed in it. When removed in about two minutes, the metal has a clean, bright surface.

Metastrip is made in two strengths, single and double. For average work the single is recommended.

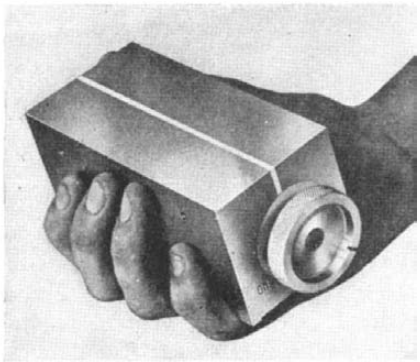
HOLDING TOOL

Magnetic Holder For Small Parts in Production

ADAPTATION of the principle of the magnetic chuck to a new magnetic tool has been made by Brown & Sharpe Manufacturing Company. This tool, which seems merely a block of metal with a knurled wheel at one end, constitutes a holder of very small magnetic parts which would be distorted or marred in some way if held by the usual vise. Iron or steel work wide enough to span the narrow insert in the top of the block can be held firmly on

it for testing, inspection, and hand operation.

The knurled wheel revolves a magnet inside the block. In one position the magnetic flux moves only within the body of the block. When the wheel is turned in the "on" position, the polarity of the



magnetic flux is so changed that one field passes up and over the insert in the top of the block, continuing its circuit through the "work." The opposite field of flux passes downward and through the conductive surface on which the block rests so that the block is held as firmly as though in a vise, and it, in turn, holds the work firmly on top.

CULT SNAKES

Why Cultists Prefer Copperheads to Rattlers

COPPERHEAD snakes are less deadly than rattlesnakes, water moccasins, and coral snakes. This may explain why followers of the Holiness religious cult in Georgia have been able to handle copperheads in their church rites with apparently few fatalities.

The bite of the coral snake is very dangerous because the venom of this reptile attacks the nerve centers. The venom of rattlesnakes, moccasins, and copperheads, on the other hand, destroys red blood cells and breaks down the walls of the blood vessels. Serious as this condition is, it takes a little longer period before it becomes fatal, giving a chance for the victim's recuperative powers and medical aid to overcome the effect of the snake venom.

Copperheads are very dangerous and there are records of deaths from the bite of this snake, but such deaths are not common. The reasons why the copperhead is less dangerous than the rattler are that the copperhead has shorter fangs, less virulent venom, and, because of its smaller size, injects a smaller amount of poison into a bite.

The habits of the copperhead may also have helped to protect those who handled it in religious rites. This snake is very quiet, seldom striking unless very definitely annoyed or attacked.—*Science Service.*

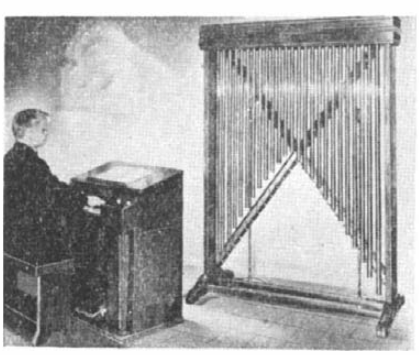
RADIO FIRE-TRUCKS

IF A fire department has no quick means of calling for additional help, or if it is unable to notify the apparatus of an error made in the location of a fire and the trucks have to make an unnecessary run before finding this out, then the department is not utilizing its apparatus with the greatest efficiency. If the department cannot send apparatus back to the station when it is found that they are not needed, or if it cannot shift equipment and men from fire to fire, the department may be said to be operating at lower than its maximum efficiency. Through the increased use of the radio, this condition is being steadily improved. Two-way radio has made possible the operation of a department as a closely co-ordinated, yet flexible, unit, free from confusion and lost motion.—*Fire Engineering.*

CHIME-CARILLON

Gives Impression of Costly Belfry Carillon

WHAT is said to be the world's most accurately tuned carillon is now being produced by the Sundt Engineering Company. This instru-



ment is an amplified, 25-chime, 37-note, keyboard-operated, tubular, chime-carillon. The keyboard is played like that of a piano. Large outdoor speakers mounted in a church belfry give the impression of a large and costly bell carillon.

The Sundt carillon is tuned to

such close accuracy that it eliminates the out-of-tune sound so frequently occurring in outdoor carillons when two or more notes are played together. Special electric pick-ups on each chime pick up the deep sub-octave bell notes which are amplified separately. In this way the range is extended a full octave. Microphones pick up the usual chime note. The two are blended by foot pedals to obtain unusual "distance" effects and variations.

Although the total weight of the Sundt carillon is only 600 pounds, the deepest note it produces equals the tone produced by a bell of 12,500 pounds.

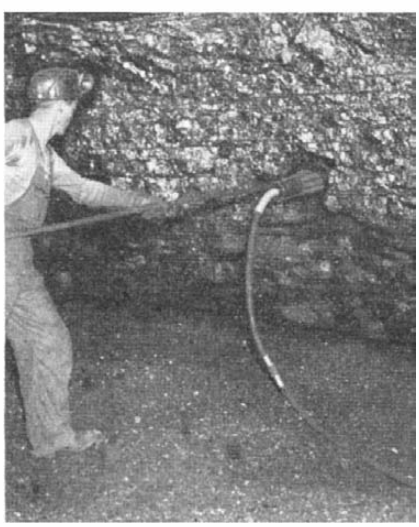
HYDRAULIC

Coal Mining With a Pressure Tube "Explosive"

HYDRAULIC pressure is now being used in coal mining to take the place of explosives usually used. Results of tests made over a period of about two years have been promising enough to warrant the du Pont Company placing this process on the market in a limited way.

The hydraulic mining process is basically simple. After the usual holes are drilled in the coal face a special tube, closed at the end, is inserted. The protruding end is connected through an electrically driven pump to a storage tank containing a special oil. The pump drives the oil under very high pressure into the tube inserted in the hole, the tube expands under the great pressure, and the coal face is broken down.

In other words, the pressure exerted causes such expansion and resultant enlargement in diameter of



Inserting a hydraulic mining tube in face of a coal vein

Close-up of the mining tube that expands under pressure

the tube that the coal is broken free along its natural parting lines, without explosion, flame, or the evolution of fumes or smoke.

The mining tube itself is of rubber with a relatively small hole and a thick wall, and is covered with a steel braid that both protects it and prevents its rupture.

Experimental work on this new method was conducted by the du Pont Company in a number of mining areas. The most extensive tests have been made at the New Monarch Mine of the Consolidated Coal Company at Herrin, Illinois.

OIL

U-V Rays Detect It In Mud From Wells

NEW aid to rotary drillers in finding oil-bearing formations is the ultra-violet ray. Inventors say it detects instantly minute quantities of oil invisible to the naked eye in drilling muds.

After mud has travelled down through the hollow drill pipe, passing out through the drill, bringing cuttings back to the surface, a beam of ultra-violet rays is focused upon it. The tiny particles of oil, if present, become fluorescent.

WARSHIP SPEED

Italians Test Unfinished Ships

MUCH has been written in recent years of the success of the Italian Navy in building enormous speed into Italian warships. Almost invariably trials of cruisers and destroyers show speeds several knots higher than those in comparable vessels of other navies. It is to be wondered if these high speeds are all to be explained as may be that of the 10,000-ton cruiser, *Zara*. We

quote the following paragraph from *Engineering* (London) regarding the trials of that ship.

"A photograph from the air of the 10,000-ton cruiser *Zara* on trials showed that she was minus the whole of her main armament, including not only the guns, but the turrets themselves. In such circumstances, it is not difficult to attain remarkable trial speeds, but the assumption is reasonable that another year, at least, would be required before the vessel could be regarded as an efficient fighting unit, fit to take part in any combined naval operations."

COPPER PLATING

Immersion Process

Is Simple, Economical

OFTEN a coating of copper is desired on metal quickly and more economically than is ordinarily obtainable by electro-plating. Use of Cuprodine solves the problem. This is a powdered chemical which is employed in much the same manner as ordinary copper salts but produces a denser, more adherent, and more lustrous coating. The process is particularly adaptable to the job of coating round wire to reduce the wear on drawing dies.

The Cuprodine process is simple. The surface to be copper coated is first pickled and then rinsed. It is then immersed in the Cuprodine solution until the coating is completed, which may require from 10 seconds to two minutes depending upon the nature of the steel or the thickness of the coating desired.

TREES

Personal Histories

Suggested

THE life history of a single tree may not seem particularly important, yet such a history, if complete in many details, would make not only an interesting record for future generations but conceivably might supply scientists of the future with facts regarding tree growth that would be valuable to them.

Professor Ralph G. Unger, of the New York State College of Forestry, at Syracuse University, recently suggested that such personal histories of trees might be made by many persons. Under his plan, the common and scientific names of a tree—perhaps one planted for

shade purposes in a yard—would be recorded: other facts would include the origin of the tree, the date and age when planted, and by whom. Thereafter, an annual record would be kept of the diameter in inches, height in feet, crown spread, disease and insect attacks, any injuries, extent of seed crop, and similar details. These records would be handed down from generation to generation in a family, or from owner to owner.

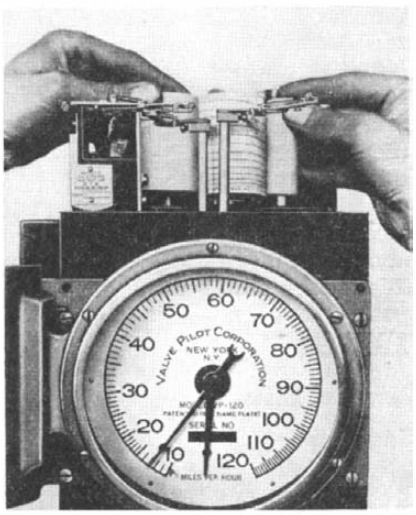
Professor Unger urges adoption of this plan because, as he says, "our historical trees are disappearing rapidly . . . and the young tree of today may become important historically in the future."

LOCOMOTIVE RECORDER

Checks Engineer's Alertness to Signals

To provide railroad officials with a graphic record of their engineers' alertness to running signals, Valve Pilot Corporation of New York City has developed an Automatic Train Signal Recorder.

Where railways are equipped with automatic block signals, a



train will stop automatically if it runs past a caution light. By moving the so-called forestalling lever, the engineer forestalls this automatic application of the brakes and then proceeds in accordance with the instructions flashed by the signal. Ordinarily his superiors have no record of this action, but if the locomotive is fitted with an Automatic Train Signal Recorder, a record is made automatically each time the engineer forestalls.

The instrument consists of a pencil attached to the armature of an electromagnet. When the engineman forestalls, a warning whistle in the cab sounds off. The rush of air to the whistle closes an electropneumatic switch which sets up an electric current in the magnet and causes a pencil on the armature to make a mark on a paper tape.

The Automatic Train Signal Recorder is housed in the Loco Valve Pilot instrument which indicates and records speed and cut-off control. From one unit, therefore, there is obtained a record of the engineer's attention to three important operating factors—efficiency, speed, and safety.

FIRE ALARM

Self-Contained Unit Rings a Loud Gong

A DEVICE no larger than the hand and employing mercury as an activating agent conceivably might save many of the 10,000 lives that are annually sacrificed through fires in American homes.

The life-saving invention is an automatic fire alarm, complete in itself, which sounds its warning almost immediately upon the outbreak of any fire in the area which it guards. The alarm functions through the thermostatic action of a tiny mercury switch. When the temperature about it reaches a degree which indicates the presence of fire, the mercury switch sets off a gong of sufficient volume to arouse the household, even from the deepest sleep.

Since the new alarm is so small in size, it can be hung inconspicuously on walls or laid upon dresser or table—and the price has been made sufficiently low that the average family can place several units in danger spots throughout the home without any strain on the budget.

LABORATORY RUBBER

Another, of Superior Quality, Added to List

THE newest of the synthetic rubbers, Chemigum, has just been announced by Goodyear as a result of several years research. A new plant having an initial capacity of 10,000 pounds per day is being installed at Akron.

Chemigum is derived from petroleum through a cracking process, and tires made of it are said to give superior performance to those made of German Buna. In

fact, the manufacturer claims that such tires are equal to those of natural rubber. Like other artificial rubber, however, Chemigum at present costs more than natural crude rubber. Nevertheless, its increased tensile strength; resistance to aging, abrasion, and oils; and the fact that it may be processed more easily than Buna, make it important industrially. It also has possibilities for blending with natural rubber, so that it might help in an emergency to eke out slender supplies of the natural product.

SAPPHIRES

War Cuts Down Supply For Industry

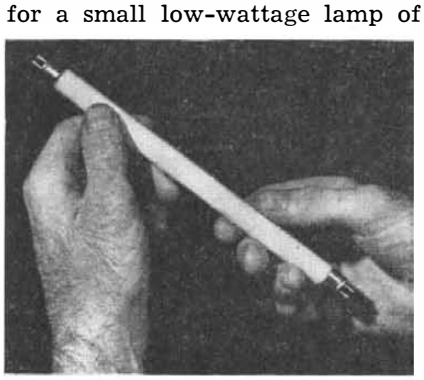
SYNTHETIC sapphires, important for use in jewelled watches and many industrial instruments, are becoming scarce, as we have had to import them from Switzerland, France, and Germany.

These gem stones have been made since 1902 by the Verneuil process which fuses alumina. The globule which is obtained is split and sliced into thousands of tiny jewels. Those used in watches are of small diameter and almost paper thin. The price of these ranges downward to about one and one-half cents each.

TUBULAR LIGHT

Smaller Fluorescent Tubes For Restricted Spaces

WITH fluorescent lamps becoming more popular every day, the need for a small low-wattage lamp of



this type for use in limited space has been filled by the production of one only nine inches long. This new lamp is of six-watt capacity, is available in two colors—daylight and white—and sells for $1.15. It is expected to find applications in illuminating business machines, curved showcases, and airplane cabins, in bed lamps and the like.

YOUR FIREARMS and FISHING TACKLE

Conducted by A. D. RATHBORNE, IV

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

Strange Guns in Strange Places

IN 1855, General William Walker, one of America's most meteoric soldiers of fortune, simultaneously reached the ripe old age of 32 and the shores of Lake Nicaragua, in the country of that name. With his "expeditionary" force of 66 men, he appropriated a boat from The Accessory Transit Company, a Cornelius Vanderbilt-controlled freight and passenger line, captured the key city of Granada, and made himself master of Nicaragua. For five years his star alternately flared and dimmed. It was completely extinguished with his execution in 1860, but the name of William Walker was forever engraved in Nicaragua's history, and elsewhere, as will be seen.

Uprisings, rebellions, punctuated by short periods of quiet, beset the little country until 1927, when President Coolidge's emissary, Colonel Henry L. Stimson, brought peace to the rival parties. Government troops and rebels were both disarmed under the treaty, which provided $10 Nicaraguan money and an honorable discharge to each officer or soldier who surrendered anything that would shoot. The U. S. Marines had charge of this collection of arms, of which there were thousands. They consisted of ancient Spanish brass cannon, modern Thompson sub-machine guns which were in the hands of Nicaraguan rebels before our Marines ever saw them, flintlocks, cap-and-ball revolvers, and modern Springfields. Where all the guns came from, no one knew, but among them were collectors' pieces by the bull-cart load. A request was made that such arms be saved, either for an American museum or for the Nicaraguan National Museum. It was denied and three box-car loads of surrendered arms were destroyed under American supervision.

A long, thin echo of the American soldier of fortune, General William Walker, bounced down the ages, trickled through the destruction of Nicaraguan arms, to reach, in 1940, the ears of Charles Edward Chapel, eminent gun collector and author, in California. Chapel visited a brother gun collector who showed him a Colt Model 1848 Pocket Revolver, sometimes called the "Baby Dragoon" Model. This was a caliber .31, 5-shot, percussion (cap-and-ball) revolver with a standard 4-inch barrel, worth about $25 in good condition, about $37 in what collectors call "fine" condition. As antiques go, it was no show piece, but what attracted Chapel's attention was that, in addition to the usual markings, the barrel was engraved with the name "William Walker."

"My grandfather," said the collector, in response to Chapel's question, "whose name was Walker, carried it in an inside pocket as a personal weapon during the Civil War."

Chapel grinned, asked his friend what he knew of Nicaraguan history.

Courtesy Colt's Patent Firearms Mfg. Co.
"Baby Dragoon"

Under cross-examination the collector broke down, admitted he had bought the gun from a dealer and that the ancestral story was pure hokum. Then Chapel told his friend a bit of the gun's history and tried to buy it, but the collector refused to sell, even though there are plenty on the market like it—like it save for the engraved name, "William Walker."

"How do you happen to know so much about this particular gun?" asked the collector.

Replied Chapel: "I was a lieutenant in the 5th Regiment of Marines, on expeditionary duty in Nicaragua. I saw that engraved Colt at that time. It was I who made the request to save the collecors' pieces, and when it was denied, I was ordered to take my guard detail and the three box-car loads of guns to Managua, where the arms were burned."

Was that 1848 Colt engraved "William Walker" as the would-be conqueror's personal gun? Where was it during the 67 years from the filibuster's death to the surrender of Nicaraguan guns in 1927? How did it escape the supposedly all-consuming fires that destroyed the other surrendered arms at Managua. How did it get into the hands of an American dealer in antique arms? These questions may never be answered, but

they show in part the color and romance of gun collecting. Has anyone else a story about "Strange Guns in Strange Places"?

[Note: Charles Edward Chapel retired from active service as 1st Lieutenant in the U. S. Marines Corps in 1937, after having served in China, Nicaragua, and other points since 1926. His book "Gun Collecting" now has a companion piece, "The Gun Collector's Handbook of Values," both of which are essential to amateur and professional collectors of antique arms. A publisher as well as an author, Chapel's latest production is a second printing, limited to 1000 copies, of Charles Winthrop Sawyer's "Firearms in American History—Vol. 2—The Revolver, 1800-1911." Sawyer, still regarded as the Dean of American arms historians, wrote and published his first edition in 1911. It sold rapidly and is extremely rare today. —*Ed.*]

Behind the Trigger Pull

IN the intricate science of firearms manufacture, it's little things that count. Take, for example, 1/600 or 1/700 of a second which elapses from the moment a shotgun hammer is released by trigger pull until the firing pin detonates the percussion cap. Doesn't sound like much, but multiply it by 800,000, the number of tests rounds recently fired by Federal Cartridge Company in a Savage shotgun and you will find that the hammer of that test shotgun was in downward motion a total of 22 minutes, 13 seconds. "So what?" you say, for no average shooter will live long enough to fire 800,000 shells. Why, that's a box of shells a day for 87 years and 245 days!

So, this. When you buy an American-made shotgun, you can be confident the gun will stand up, that it will give you a lifetime of satisfactory service. Neither Savage Arms Corporation, nor any other American arms maker expects Mr. Average Gunner to burn 800,000 shotgun shells, nor do they anticipate the hammers of their guns will be in action 22 minutes and 13 seconds, but they do expect their products to perform satisfactorily. To that end, the arms—rifles, shotguns, handguns—are tested far beyond the potential possibility of their use, and actual firing tests are by no means the only indication of solicitous care in manufacturing processes.

On a recent visit through the Savage plant we passed row after row of assembly work benches, and we noticed that every vise which was holding a gun part was carefully padded to prevent scratching or otherwise damaging the part. We saw hundreds of wheel-equipped racks, built to transport highly polished stocks, shiny gun barrels, or complete guns from one department to another, and every one of these racks was also carefully padded. Particularly fine stocks were protected from mars or dirt by soft flannel bags in which they traveled about the plant until they became a part of a beautiful new gun, and then the gun itself went into a bag for safety and protection until final wrapping and shipment. All too few gunners comprehend the meticulous care their guns receive before coming into their possession, and sad to relate, all too few owners give their arms as good care as they had in the process of manufacture.

Simplification of operating mechanism in modern arms is another of those "little things" which years of scientific study have accomplished. If John Q. Gunner had to manipulate an old flintlock, which contained 22 parts, or a muzzle-loading lock of 15 parts, he'd have something to worry about. Even the breech-loading hammer gun lock has 17 parts, and certain types of high grade hammerless guns contain from seven to 22 working items in the lock. By comparison, the Fox Lock, a Savage Arms product, with its three principal working parts, is simplicity personified. There's the coil spring, the one-piece hammer, of which the firing pin is an integral part, and the sear. That's all.

There are thousands of other examples of scientific advancement in the history of American-made firearms. It's a record to be proud of. The American lover of guns, whether for target or game shooting, is the most fortunate gunner in the world, for he has a limitless line of guns from which to choose. He has, at his command, a corps of manufacturers, research engineers, scientists, and skilled artisans who persistently endeavor to produce better firearms at moderate cost. Best of all, he has, with few minor restrictions, complete freedom of use of his rifles, shotguns, and handguns. So, Mr. John Q. Gunner, when you take your gun afield this fall, just remember that behind the simple action of pulling the trigger lie years of intensive study and research, all to the end that you may better and more thoroughly enjoy your sport.

October Bass

AS the prize short-short story, we nominate the motto, "Fish and Feel Fit," adopted by The Associated Fishing Tackle Manufacturers, used extensively by South Bend Bait Company. When you analyze that slogan, you find it tells all. At this time of year the word "fish" conjures up for salt-water anglers visions of striped bass, weakfish, channel bass, bluefish, and

many others. To the fresh water Waltonian, those four letters bring mental pictures of pike, pickerel, walleyes, black bass, and huskie muskies, all of which have been rejuvenated, imbued with new fight by Autumn's cooling waters.

The second word in the slogan isn't really necessary, but it's euphonic, and it provides the suspense angle in this short-short tale. "Fish, and . . . ." And what? Ah, those two last words, "Feel Fit." They're the ones that settle the suspense, if any, and provide the logical, truthful, satisfactory, hammer-home-the-point climax.

It's difficult for us to imagine how any two-fisted chap could fish and not feel fit, but we claim those two words form a "logical" climax, because any

OCTOBER BASS
Rod by Heddon
Reel and line by South Bend
Plug by Shakespeare
Bass by Ye Editor!

angler knows that one reason he goes fishing is to feel fit. When he accomplishes his purpose, he's proved his point. It's a Q. E. D. The same words comprise a "truthful" climax. When you toss that plug into the muskie's lair, tinged with reflected colors of the Autumn forest, or when the salt spray crisps your face as that striped bass tries to take your tackle from October into November, you forget every worry you ever knew. You *have* to feel fit.

Those two words make a "satisfactory" conclusion to the short-short tale. Most of us like happy endings, and what could be more satisfying than to "Feel Fit"? And if it isn't a "hammer-home-the-point" climax, we never saw one! When you think of the phrase, "Feel Fit," don't you vision a Dempsey in his prime; a 4-times champ, Bobby Jones; a Tilden, aceing through the field; an unstoppable Ty Cobb? And aren't they all sort of rolled into one and a part of you,— when you "Feel Fit"? All this is just another way of saying there are still several good weeks of fishing before we pack away the tackle. If you'd like proof, take another look at that October bass. The picture vividly brings to mind the cool of a fall evening, the graceful flight of the plug, the smashing strike . . . and then, did I Feel Fit!

Butts

ONE of the surest ways to start an argument among a group of surf fishermen is to ask an apparently innocent question regarding the relative merits of spring butts and club or extension butts for surf rods.

Confirmed spring-butt addicts will rise to the bait, claiming that this type, by far the older form in the comparatively young art of surf casting, permits the surfman to gain greater distance. This, they will insist, is due to the spring action which brings out more of the rod power, and hence throws lead farther.

Club-butt adherents will scoff at this theory, holding that this so-called spring action does just the opposite; that it introduces a vibration in the rod which robs the stick of some of its power. Further, they will say that rod power is delivered largely by no more than the top two-thirds of the rod; that if a rod is so constructed that the action extends even as far as the ferrule it will not have the casting qualities of one that is properly proportioned.

One of this country's leading craftsmen in the field of hand-made surf rods, Charlie Maltby, has held forth on this subject for long hours with the writer. When a cast is made with a spring-butt rod, says Charlie, the entire rod, from tip to butt, approaches the form of a slim letter "S" as casting power is applied. Then, as the lead sails seaward, the bend of the butt part of the "S" reacts and causes the tip to vibrate.

Here is a field that offers opportunity for study by some scientifically inclined surfman. Perhaps one angle of approach would be to take slow-motion pictures of a good surf caster using first a spring-butt rod and then a club-butt stick. Analysis of such pictures might reveal facts that would substantiate or disprove theories.— *A.P.P. casting for A.D.R.IV.*

POT-SHOTS
At Things New

STOEGER ARMS CORPORATION's advance information on their 1941 Catalog-Handbook indicates the publication will be most ambitious in Stoeger's long history and will more than ever merit its designation as "The Shooter's Bible." New volume will show 4700 revisions from 1940 edition, as well as replacements for many items made unavailable by changing world conditions. Gun tools and gunsmithing section will be one of most comprehensive ever published; hunting clothes, accessories and book section will be larger; over 100 pages will be devoted to gun parts for American guns; ballistics tables have been thoroughly revised. As virtually all

prices have changed due to rising costs and governmental taxation for national defense, new figures will be shown here for first time. In all, more than 16,000 items, accompanied by 6000 pictures, many in color, are described and priced in the 1941 Stoeger Catalog-Handbook. Frankly, we couldn't get along without our annual copy of "The Shooter's Bible," especially when it's only a dollar, and we're sending in our reservation for a copy right now.

GRIFFIN & HOWE, INC., announce their new "Zero-Rig Telescope Mount," which is a new and radically simple fixed mount for all standard 'scope sights. Once 'scope is set at zero with Griffin & Howe rig, it remains at zero, regardless of how often sight is dismounted. "Zero-Rig" embodies a firmly fitted, square shoulder joint with large, flat-headed screws to hold each bracket arm and 'scope ring in secure contact. By removing these two flush-set screws, 'scope and clamps can be lifted from the fixed base to leave top of the rifle clear for aiming with other sights. We have descriptive folders.

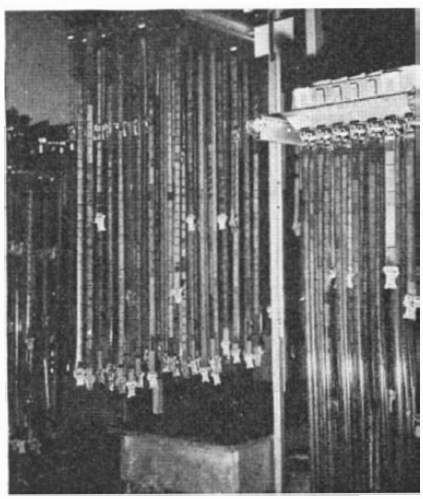
FREE BOOK LISTS. We have read and reviewed many interesting and informative books and other publications in the fields of firearms, fishing tackle, natural history. Reviews have appeared in Scientific American's "Our Book Corner" and publications have been mentioned in this department under "Books of the Moment." For your convenience, we have prepared lists of the books thus covered, showing titles, authors, prices, and a line or two of explanation. If you'd like one or more of these compilations, drop us a line and specify your desires. Only cost is a 3-cent stamp for return postage. (Note: Gun book list includes "History of Colt Revolvers," by Haven and Belden, sponsored by Colt's Patent Firearms Manufacturing Company, and hot off the press September first.)

CAMERA ANGLES

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

Letting George Do It

"POP" goes another myth—the degeneracy of the photo-finishing plants. There is widely current the time-worn notion, frequently based on fact, that he who seeks the "drug store" finisher deserves what he gets: sluggish work for sluggard workers. But the truth is that there are good photo-finishers and there are bad ones, just as there are good and bad photographers and good and bad anything else.



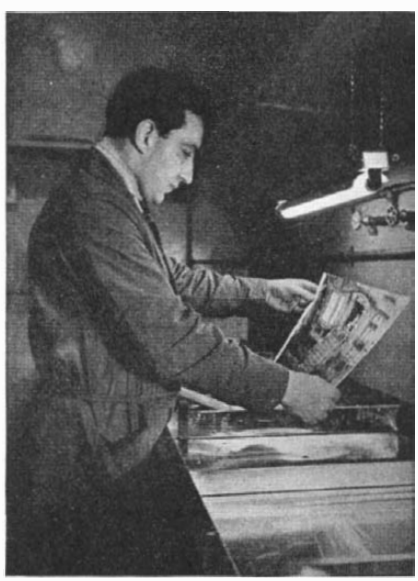
One corner of the film drying room in the Pavelle Laboratories

In order to obtain a cross-section picture of photo-finishing plants in general, we recently interviewed Leo S. Pavelle, head of Pavelle Laboratories, Inc., an organization offering specialized plus routine service, and Nat Derfler, head of Royaltone, Inc., which serves the routine snapshooter class. In the latter type of finisher, all work in the plant is geared to mass production—prints in seven hours—whereas the former stresses quality rather than the time element. Both types strive to do the best possible work under the conditions imposed.

A few statistics may provide some index to the volume and type of work turned out by the two kinds of finishers. Mr. Pavelle places the yearly average of film rolls processed at his plant at about 150,000, while Mr. Derfler's place develops about 250,000 annually. At Pavelle's, 75 percent of the film is in the 35mm class, while at Royaltone all but a small percentage are the usual amateur sizes other than 35mm. The latter averages 2,500,000 prints a year, 80 percent of the total printing business being contact, 20 percent enlarging. At Pavelle's, the greater percentage of the printing business calls for enlargements, a good portion of the orders being for postcard size enlargements from 35mm negatives.

A visit to the Royaltone plant was an eye-opener, in view of the stories we have been hearing about those awful "drug store" finishers. The 90-gallon temperature-controlled film developing tanks are continually being replenished to keep the solution top-notch; the tank is completely refilled every 16,000 rolls. Rinsing is done in a tank through which fresh water is running continuously. Fixing is done in two successive baths, the first a strong bath, which is thrown away and a new bath made every 4000 rolls, and the second a weaker hypo bath, which is changed every 12,000 rolls. Finally, the film goes through two washes. Drying is done in special rooms equipped with fans to circulate heated air. Printing is not the slapdash affair many persons have been led to believe it is. Each printing machine operator has before him a selection of six different grades of contact paper, from which he selects the proper grade to fit individual negatives. Also, timing is not the same for all negatives but is proportionate to the density of individual negatives. When the print reaches the developed stage it is inspected by the operator there, who may reject a print which has been printed for an insufficient period or on the wrong grade of paper. It is then sent back to the printer for a better print. In other words, the photo-finisher of the Royaltone class does just about what the careful worker would do in his own darkroom at home.

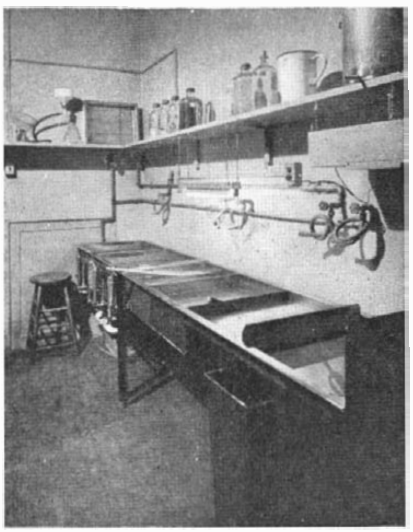
Maintaining standards of the highest order, the Pavelle plant offers a universal service, making prints ranging from contact to photomural dimensions. That the quality of its



Leo S. Pavelle inspecting an exhibiting print in the making

work and the universality of its services has been recognized is shown by the fact that among Pavelle's patrons are departments of the Federal Government, large business concerns, and individual workers all over the world, as well as a mass of amateurs in this country. From developing rolls of films for individual workers the Pavelle services go all the way to the preparation of complete photographic exhibits for large manufacturers of cameras, film, and paper.

One of the Pavelle plant's major activities is the preparation of enlargements intended for exhibition. For this purpose the Exhibition Department was created, in which from 100 to 200 exhibition prints a week



Large trays facilitate handling of prints for exhibition purposes

are turned out, most of them 11" by 14", a good percentage 14" by 17". Mr. Pavelle observes that there is a definite trend toward the latter size as the more popular among exhibitors. The prints are mounted on the regulation 16" by 20" matts required by salons. A wide variety of papers and surfaces are available in this department to match every good negative to the paper best suited to bring out the values and mood of the negative. Most of these prints are selenium or gold-toned. Mr. Pavelle says that the resulting tone is almost imperceptible but is enough to show a real difference, one of the valued results being the realization of better blacks.

One of the features of the Pavelle plant that helps in maintaining quality of service is the Research Group, a skilled staff which has at its disposal complete photographic laboratory testing equipment for testing ever-changing new developments in photography.

"As soon as anything new appears on the market that may be utilized photographically, be it a new light source, a new film, a new paper, or a new developer, it is immediately put through an accurate laboratory as well as practical test," Mr. Pavelle says. "Nothing is taken for granted. If the product proves of merit, its properties are carefully evaluated and it is applied, wherever indicated, to the processes used throughout the Laboratories . . . One outstanding example of the work accomplished is the compilation of complete sensitometric data for all 35mm films and all popular developers."

The Pavelle plant is the last word in modern high-grade equipment, all developing being done in stainless-steel tanks and all machines automatically controlled to process different types of film for the exact times of development, fixation, and washing as well as at a definite rate of agitation in each solution required for each film type. "Ours is perhaps the only still-film laboratory in the world," says Mr. Pavelle, "where daily sensitometric tests determine with scientific accuracy the activity of negative developing solutions. Our negative developers are kept at a constant developing potential by the addition of replenishing solutions in definite ratio dependent on the number of square feet of film that have been developed. Thus all films are invariably developed to a specific gamma in a given period of time."

Paper in Quantity

THE worker who takes advantage of economies in order to keep his photographic costs down, may be interested in the fact that the purchase of printing or enlarging paper in half gross or gross lots will effect a considerable saving. Of course, if only a few prints are made occasionally or if the worker likes to do a lot of experimenting with different papers, this may not be appealing. But those who have settled down to one paper and who do much printing will find that they can save as much as 20 percent or more by purchasing paper in gross lots rather than in packages of a dozen.

Cooling

A SUMMERTIME developing kink that may possibly be out of date by the time this appears in print (though it frequently happens that temperature runs rather high during some days even in the "cold" seasons of the year) comes to us by way of the picnic basket. A product known as Icit, a sealed can measuring about four by six by one inches and containing a liquid, is being sold for use in cooling the picnic lunch. The can is placed in the lowest ice-cube compartment of the refrigerator the night before the picnic. The next day it is frozen solid and is placed in the center of the picnic lunch. The use of Icit in photography is obvious. The can is placed in the developer tray and, according to the experience of Carlyle Trevelyan, will bring the temperature down to 65 degrees Fah-

Fifth Annual Scientific American

AMATEUR PHOTOGRAPHY CONTEST

[For Complete Contest Rules, See Page 94, August 1940 Scientific American]

OVER $1200 IN PRIZES

36 PRIZES *PLUS* Three Special Awards

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

DIVISIONS IN WHICH PRINTS MAY BE ENTERED

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

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

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

THE PRIZES

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

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

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

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

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

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

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

HONORABLE MENTION

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

2nd. Three Mimosa Perkino developing tanks.

3rd. Three Raygram Wood-Chrome Tripods.

4th. Three Fink-Roselieve Audible Timers.

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

THREE SPECIAL AWARDS!

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

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

THE JUDGES:

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

Address all Entries to

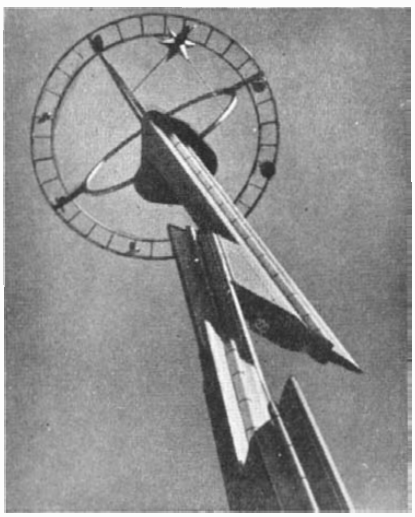
Photograph Contest Editor, Scientific American

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

renheit. Mr. Trevelyan says that when he used the method one night, he placed the can in the tray at 7 o'clock, when the temperature fell to 65 degrees, and by 12 o'clock the temperature had risen only six degrees. Naturally, the can has to be taken out of the tray when prints are inserted, but this is a negligible inconvenience considering the advantages.

General Electric Contest

EXCELLENT handling of a much photographed subject—the 129-foot stainless-steel symbolic lightning bolt and universe in front of the General Electric Building at the New York World's Fair—brought first prize for George Perry, of New York City, in the first half of the General



First prize, G. E. contest

Electric contest. The award was $100 in cash. A similar prize is offered in the second half of the contest for entries received until October 11.

Held under the auspices of the Photographic Society of America, the judges consisted of Adolf Fassbender, F.R.P.S., Chairman; Robert W. Brown; Morris Germain, A. R. P. S.; Carlyle Trevelyan; and Jacob Deschin, A.R.P.S.

Color Handbook

A "HANDBOOK OF COLOR," containing a complete description of every type and make of color camera, lighting, equipment, chemical, printer, color film, and so on, will be published by Fotoshop, Inc., in the near future. Copies, at 25 cents each, may be reserved by writing to the Color Department of Fotoshop, Inc., 18 East 42nd Street, New York City. The contents will also include laboratory instructions for all color processes; technical data on film, filters, and so on; a basic course in the fundamental principles of color photography, and a book-review supplement. The book will contain four-color illustrations. It will have a moisture-proof cover and spiral

binding; the contents will be cross-indexed with manila separators for ready reference.

The Rhyming Publicist

IF prose seems inadequate to the task of singing the excellence of one's ware, try poetry, thinks Eleanor F. Brown, of Burke & James, Inc. So once in a while we receive from her such a missile as

"Any day is washday
For the fellow making prints
So here's a brand new washer
That will give the world's best rinse!"

Then she goes on in prose to give particulars concerning the Luxor Water Powered Tank.

Another time, snappy, readable prose describing the Watson 35mm camera is preceded by this lilting introduction:

"For a candid with color correction,
Other features that really are slick!
Let the Watson be your next selection.
It's priced so your purse cannot kick."

Under Water

A TRICK by which contact printing can be done without drying the negative, is used, we understand, by some old-timers when the necessity for seeing the result speedily is more important than print quality or permanency. Glass plates are used. After the plate has been fixed and washed, it is placed in clear water. A sheet of contact paper is then immersed in the water and placed in contact with the emulsion side of the plate. Firm contact is assured by carefully squeegeeing the water out with the fingers. Printing is done by an over-head light. We are told that by this method, washing of the print being very brief, the result of a developed plate may be seen on paper within two and one-half minutes.

Living Title

A CLEVER photographic idea for a magazine cover was recently reproduced on the cover of the magazine *Vogue*. A model in a bathing suit who was obviously expert at gymnastics was photographed in five poses, each one in imitation of one of the letters of the word Vogue. The five pictures, taken and reproduced in color, appeared at the top in the usual place for the magazine name. The main illustration on the cover was a repetition of the V pose except that the model's face was in profile, whereas in the magazine name itself her face was in three-quarter pose.

Darkroom Wiseguys

EVERY camera club probably has one, maybe more. The other day we heard of a chap who was developing some enlargements for perhaps the first or second time. At any rate, he did not know anything about it. After focusing the image on the easel, he gave an exposure of a few seconds, purely from guess (a guess based on total ignorance because guessers may often justify their practice on the basis of long experience) and developed the print for one half minute, after which he pulled it out of the developer and slapped it into the fixing bath. When someone suggested that it might be a good idea to make a test strip first to determine the required exposure time and furthermore that a half-minute developing time was not sufficient to provide a decent black with the paper he was using, he replied: "Maybe it isn't, but that's the way I like to do it." Perfectly silly reply, of course, and we are happy to report that this particular worker has now learned the error of his ways and is beginning to mend them. Those of his type who do not are best discouraged from continuing in the game altogether.

Boys' Clubs Contest

FIRST prize in the National Historical Photographic Contest held by the Boys' Clubs of America at the New York World's Fair, was awarded recently to Francis Hoesch, 14 years old, Boys' Club of Baltimore, Maryland. The picture, "Fort McHenry" (the American flag flying there during an attack by the British in 1814

"Fort McHenry"

was the inspiration for Francis Scott Key's "Star Spangled Banner"), is reproduced here. The prize was an all-expense-paid trip to the New York World's Fair, with a stay of one week, and a complete photographic outfit.

First Camera in America

IDENTIFICATION of the first camera in America and the first "fast action" camera in the world appears to have been made at long last.

according to an Associated Press dispatch from Hampden Sydney, Virginia. The old box-shaped camera left at Hampden Sydney College in 1839 by Dr. John William Draper antedates even the one used by Dr. Draper at New York University to make the first portrait of a living person. The Smithsonian Institution has accepted the camera as the first and will install it among its exhibits.

It took eight years of research by the Rev. Howard C. Cobbs, formerly a professional photographer, to provide the necessary proof. Mr. Cobbs found final proof in a letter by Dr. Draper addressed to *The Photographic and Fine Art Journal,* published in 1858. In that letter he told of working with sensitive plates before Daguerre's and Talbot's announcements, and of experimenting with a large aperture, short focus lens. However, he related that the "first portrait" was made with the help of Daguerre's more sensitive plates and methods.

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WHAT'S NEW

In Photographic Equipment

NEW KODAK 35 ($47.50): With coupled range-finder and Kodak Anastigmat Special lens *f*/3.5 in Kodamatic shutter. Range finder of split-field military type, in which two halves of large image are lined up as lens is focused. Focusing range 4 feet to infinity. Focusing by means of control wheel. Lens mount rigid tubular type. Shutter settings for time, bulb, 1/10th, 1/25th, 1/50th, 1/100th, 1/200th, plus delayed action. Advancing film automatically winds shutter and brings into view small red signal indicating all is ready for next exposure. View finder of optical eye-level type, built into range-finder housing. Slight shift brings eye from range-finder eyepiece to view-finder eyepiece.

RAYGRAM PHOTO COLOR KIT ($1.25): New medium for coloring photographs, transparencies, and lantern slides, devised in laboratories of Joseph Dixon Crucible Co. Enables coloring all positive photographic materials without preliminary sizing or final fixing of colors. Claim: Layman, not trained in art of coloring, with little practice, can neatly and easily do work heretofore attempted only by professional. Kit includes eight colors and shades.

SOLAR TRIPLE SLIDING LENS BOARD ($4.75): Attaches to all models of Solar enlargers except Junior, replacing standard lens board. Slides easily back and forth, permitting instant placement of any lens in optical center of enlarger. Measures 9¼ by 2¾ inches. Sliding member takes three lenses, allows ⅝-inch clearance at back. Board accommodates lenses up to 7¼ inches focal length. Diameter of threaded opening on three lens flanges 1½ inches (38mm). Reducing flanges available at extra cost.

F-R STAINLESS STEEL THERMOMETER ($1): Made of 18-8 stainless steel. Dark blue spirit in glass column shows distinctly against etched calibrations to give accurate readings. Scale registers from 40 to 90 degrees, Fahrenheit. Special clip offers wide use with trays and tanks.

ELECTRONIC PHOTO TIMER ($12.50): Automatic timing control for contact-printing, enlarging, time exposures, and other photographic darkroom operations. Operation simple as ordinary stop watch. Operates on both AC and DC; entirely electronic (no springs, no clock, no motor); silent in operation; easily set, instantly reset; always under control; makes possible printing of 1 or 100 identical pictures from same negative. Strongly built; finished in gray crackle painted cabinet with engraved Bakelite panel.

SUPERFLASH MIDGET PRESS 25 (15 cents): Bayonet base bulb two inches high; output 25,000 lumen seconds and same long-peak characteristics as other Wabash hydronalium wire element bulbs. Permits three or four new bulbs to be carried in same space formerly required for standard bulb of 1937. Other features: Special construction for use in new "concentrating" reflectors; scientific "even light" shape; double jackets of lens-clear safety coating; patented blue Safety Spot. Packed in new ten-bulb Pocket Pack fitting jacket pocket.

KALART MODEL F RANGE FINDER ($24; installation, $27.50): Adjustable lens-coupled range finder featured exclusively on Speed Graphic cameras now available for other filmpack and plate cameras. Adjustable for all lenses from 10.5 to 30 cm; will focus sharply at all distances from 3½ feet to infinity. Installation at Kalart factory. Following is list of filmpack and plate cameras to which Model F can now be fitted: 6 by 9 cm—Bee Bee, Ihagee, Maximar, Recomar, Linhof; 9 by 12 cm—Avus, Ideal, Ihagee, Maximar, Recomar, Welta, Linhof; 10 by 15 cm—Bergheil, Linhof.

TURRET-HEAD FILMO AUTO MASTER, 16mm ($195): Announced by Bell & Howell as first multi-lens magazine loader in industry, who add: "Here is the easiest-to-operate camera in the world—offering instant use of three lenses, automatically positioned view-finders, interchangeable film magazines, and freedom from sprocket threading." Price includes Taylor-Hobson *f*/2.7 lens and view-finder objective. Important features: rotating, three-lens turret, upon which any three lenses may be mounted—wide angle, speed, or telephoto; automatically positioned view-

——CAMERA ANGLES——

finders (mounted directly on turret beside each lens is corresponding view-finder objective); "Steady Strap" handle detachable, screwing into tripod socket on bottom of camera; new built-in exposure calculator said to give at a glance correct lens setting for both Kodachrome and black and white film—Kodachrome figures in red, monochrome in black.

SUPERFLASH PRESS 50 (18 cents): New size Wabash flash lamp, with 50,000 lumen-second output plus standard Superflash characteristics of split-second synchronization, extra long peak flash, and adaptability for all cameras, Compur or focal plane shutters, and all synchronizers. Standard No. 2 lamp stepped up from 56,000 to 70,000 lumen seconds; dropped in price to 22 cents.

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THE ROUND TABLE

Questions Answered for the Amateur Photographer

Q. **Can you suggest a method of making glass diffusers?—C. J. K.**

A. You can make your own glass diffuser by obtaining plain glass squares and scratching parallel lines with a glass cutter. Use a ruler as a guide. The closer the lines are to each other, the greater the diffusing effect obtained. You might cut one glass with lines 1/16 of an inch apart, and another with lines 1/8 of an inch apart. If you wish to use only one glass, space the lines 1/16 of an inch and expose through it for only part of the total exposure time.

Q. **I would like to know what kind of developer and the process to use to make a negative print from a negative film.—E. H. T.**

A. This is known as the Paper Negative Process. A contact or enlarged print is made from the negative in the usual way, and the paper print is placed in contact, emulsion to emulsion, with another sheet of print paper. Exposure is made through the back of the positive print just as if it were an ordinary negative. A positive print from the paper negative may then be made by placing the paper negative in contact with another sheet of paper. Processing and developer are the same as usual. Single-weight paper should be used, although the final positive or negative, whichever is the final result you want to achieve, may be printed on double-weight paper if desired.

Q. **I would like to make black and white prints from some of my Kodachrome transparencies. Will you explain the procedure?—R. D. B.**

A. Make a negative by contact or enlargement, the latter method being preferable because you can then use a colored filter to emphasize or repress certain colors. Slow panchromatic film should be used. The process is

similar to that employed in making ordinary prints. However, the film is much faster and the proper safelight should be used, namely, the green, preferably no light at all. The final paper print is then made in the usual way.

Q. **I am using a twin-lens reflex and find that in attempting architectural shots in which it is impossible to photograph from a distance, much vertical distortion occurs. I have wondered whether anyone has devised the use of a prism in front of the lens to correct this condition, the device possibly installed on a vertical axis in a filter mounting.—E. P. G.**

A. We have not heard of any such device and doubt its usefulness. Cameras of the miniature type are designed for general photographic purposes and are made small and compact for convenience, the resulting negatives usually being enlarged. When architectural shots are attempted, the camera is tilted up, correction of the consequent vertical distortion being done under the enlarger by tilting the easel on which the paper lies in the direction opposite to the tilt in the negative. Enlargers are now also available that have a tilting negative holder, which facilitates this work.

Q. **Can you recommend a fine quality sensitizing material which can be applied to glass so as to get a good print?—E. C.**

A. The glass is first coated with the following solution:

Gelatin .....42 grains
Potassium bromide 26 "
Distilled water .... 1 ounce

The gelatin is first allowed to swell in the ounce of water for a full hour. The temperature may then be raised gradually until the gelatin is thoroughly dissolved. While the solution is still warm, add the bromide. In a separate dish, prepare a bath of 32 grains of silver nitrate and one ounce of distilled water. In the darkroom, by red light, slowly add the silver nitrate solution to the bromide gelatin solution. This mixture is then ripened by heat (100 degrees Fahrenheit) for one hour. The emulsion is poured into a glass beaker, the latter then being placed in a 110-degree water bath. Stir frequently and when ripening is complete, add slowly two or three times as much gelatin as was used originally. When this added gelatin has dissolved, place the beaker in cold running water until the emulsion jells, when it is cut into squares with a toothpick. The pieces are then tied up in a cloth bag and suspended in running water to wash for two hours. All this is done in the absence of white light. When the washing is complete, the emulsion may be remelted for coating. Pour a pool of the warm emulsion in the center of the glass and spread it into the corners with a glass rod bent L shape. When dry, expose, develop in D-72 diluted 1 to 4, and fix and wash as usual.

Our Book Corner

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

YOUR CAREER IN BUSINESS

By Walter Hoving

YOUNGSTERS just entering business will find this discussion enormously helpful. It faces squarely that vital social problem of how to get a job and then how to make a success of it. The author, President of Lord & Taylor, gives the answers to those puzzles faced not only by the youngster but also by many who have long been in business but have become mere cogs. Some chapter headings will indicate scope: Business Has Many Facets; Find Out What You've Got—and Use It!; The Thing Called Personality; Apprenticeship; The Square Peg; What's Your Attitude?; The Person Behind The Job; and others equally pertinent. (211 pages, 5¼ by 7½ inches, unillustrated.)—$2.10 postpaid.—*F. D. M.*

COMPLETE GUIDE FOR THE DEAFENED

By A. F. Niemoeller

THE ear; kinds of impaired hearing; causes of impaired hearing; colds, catarrh, diet, glands, drugs, diseases, tonsils, teeth, allergy, psychic factors, otosclerosis, heredity, marriage, swimming, noise, shocks—all in regard to hearing; earaches; occupational deafness; ear wax removal; head noises; ear discharges; oils for the ears; hearing tests; audiometers; re-education; lip reading; how to hear the radio, movies, conversation, telephone, lectures; voice culture; organizations for hard of hearing; periodicals; quacks and frauds; books on deafness; personal adjustment—these indicate the scope of this book which deserves a wide appreciation by the 15,000,000 Americans whose hearing is not perfect. (256 pages, 5¼ by 8 inches, one illustration.)—$3.10 postpaid.—*A. G. L.*

MAKE YOUR PICTURES SING!

By Paul Louis Hexter, A.R.P.S.

WRITTEN in lively, unpretentious style, this book takes the beginner in photography, as well as those more or less advanced, through the entire photographic procedure. Because of its clear language and many illustrations, facts which may have been difficult to grasp are made easily understandable and therefore usable towards the "perfection of technique" that is the aim of Mr. Hexter's book. As a guide to the type of negative the worker should strive for, Mr. Hexter has included in his book an actual negative, from which the reader may make prints or enlargements. (6¼ by 9 inches, 188 pages, many illustrations.)—$3.10 postpaid.—*J. D.*

TURRET LATHE OPERATOR'S MANUAL

By J. R. Longstreet and W. K. Bailey

WAR orders for all manner of guns and ammunition make it imperative that this country have expert lathe operators—more than we have had for years. This complete volume is a course in lathe operation, starting with an historical review and proceeding through classifications of turret lathes, elements, care and maintenance, speeds and feeds, and then taking up the grinding and setting of cutters, drilling, reaming, boring, forming, threading. Other subjects covered are chucks and holding devices, tooling principles, special tools, estimating. Pertinent data are given in a number of tables. (240 pages, 7¼ by 10¼ inches, numerous illustrations.)—$2.60 postpaid.

—*F. D. M.*

THE AIR AND ITS MYSTERIES

By C. M. Botley

IN no sense a text-book, this informal, friendly work treats scientifically the ground that usually is treated in texts. Its scope: the air, the winds, the clouds, rain, thunderstorms, weather, climate, atmosphere and light, sound, upper atmosphere. People who would like to understand the action of the elements will find this elementary book a good place to start. (302 pages, 5¼ by 8 inches, 52 illustrations.)—$3.10 postpaid.

—*A. G. I.*

LET'S FLY

An ABC of Flying, by Lieutenant Ernest G. Vetter

USING the personal pronouns "I" and "you," Lieutenant Vetter gives the illusion that the reader is receiving a course of elementary flight instruction. The course is logical, clear, and in just the right sequence. The book will serve two purposes: to give the lay reader an excellent idea of what is involved in learning to fly; and to give the student pilot an admirable guide which he can read again and again,

—OUR BOOK CORNER—

no matter what formal instruction he may be receiving. The student pilot will find that the text is not only stimulating but technically correct and above all stresses the elements of safety. (116 pages, many illustrations.)—$1.60 postpaid.—*A. K.*

ELEMENTARY PHOTOGRAPHY

By Gilford G. Quarles

A SUBSTANTIAL work "designed to fill the growing need for a text on photography intermediate between very elementary ones and those of an advanced, technical nature," Mr. Quarles' book is thorough and complete. Starting with a discussion of lenses and cameras, the Assistant Professor of Physics at the University of Alabama immediately plunges into the actual photographic process and carries it to completion. About half the book is then devoted to the technical side of photography, in which the serious worker will find guidance in improving his results. Paper negatives, print toning, print coloring, natural color photography and lantern slides and transparencies are discussed. There is a long bibliography and a useful formulary. (6¼ by 9¼ inches, 350 pages, photographs and diagrams.) — $3.10 postpaid.—*J. D.*

THE PIN-POINT PLANETARIUM

By Armand N. Spitz

FOR each month this book contains a south-facing and a north-facing star chart with constellations. You remove each chart, cut some gores in it, curve it, paste it and thus create a kind of concave chart, through which you prink pins for each star indicated. Then you hold these concaves against the sky and thus you are "inside" of a really analogous chart, instead of outside and hind side backward as with a celestial globe. This is a relatively easy way to learn the constellations. The book also contains constellation facts, a little very elementary astronomy, a list of sky sights (eclipses, planetary positions and happenings) up to 1946, and a glossary. (110 pages, 10 by 8 inches, illustrated.)—$2.10 postpaid.—*A. G. I.*

FIREARMS IN AMERICAN HISTORY—VOLUME II—THE REVOLVER, 1800-1911

By Charles Winthrop Sawyer
Reprint Edition by Lt. Charles Edward Chapel

IN every part of the English-speaking world, arms engineers, gun collectors, historians, museum curators, history students, and teachers bought and praised Charles Winthrop Sawyer's 1911 edition of this publication as the outstanding text on origin and development of revolvers. The edition sold out rapidly and today it is next to impossible to obtain a copy. The firearms world, therefore, owes a debt of gratitude to Lt. Chapel for undertaking to reprint this valuable and

——OUR BOOK CORNER——

instructive volume, under exclusive permission of the author and copyright owner. This second edition is limited to 1000 copies bound in red cloth with gold stamping and printed from type, not reproduced by off-set or photo-lithography processes. (216 pages, 5½ by 8 inches, 7 plates.)—$4.60 postpaid.—*A. D. R., IV.*

WOODCRAFT

By Bernard S. Mason, Editor, The Camping Magazine

A COMPREHENSIVE book on woodcraft. Trail shelters, teepees, bark shelters, beds, duffel, fire-craft, campfire gadgets, axmanship, caches, bark-craft, woodcraft rope and cordage, woodcraft knick-knacks, woodsy furniture and camp fixings, calumets, rawhide, buckskin, horn, feathers, gourds, tin-can-craft, totem poles—these indicate the scope, which is broader than in similar books. The emphasis is heavily on Indian lore and on the practical: how to do and make. (580 pages, 6 by 9 inches, 294 illustrations.)—$2.85 postpaid.

THE WORLD UNDER THE SEA

By B. Webster Smith

POPULAR oceanography. Introduced by 64 pages of general background matter about oceanographical instruments, the sea bottom, submarine earthquakes and volcanoes, the physics of the sea, currents and tides, this readable book is mainly about life in the sea—marine plants, sponges, jellyfishes, corals, crustaceans, molluscs, starfishes, deep sea fishes, common food fishes, sharks, marine reptiles, mamals, birds. (230 pages, 6 by 9 inches, illustrated.)—$3.10 postpaid.—*A. G. I.*

THE HUNTING RIFLE

By Colonel Townsend Whelen

EXPERT riflemen or mere tyro, the first 15 pages of this book will convince you that it is the finest work of its kind ever published. The author's lifetime of practical rifle experience imparts authority to the easy simplicity of his style. Practical and semi-technical, it clearly and understandingly covers the fields of elementary ballistics, design, selection, use and marksmanship of the American rifle, often termed "The King of All Weapons." This book is virtually indispensable to those who are learning about guns, invaluable to those who know them. (463 pages, 6 by 9 inches, 89 illustrations, index)—$4.85 postpaid. —*A. D. R., IV.*

ORGANES ET APPLICATIONS DU VOL ANIMAL

By Paul Amans M.D., Sc.D.

A CONDENSED treatise on the essential mechanical principles of animal flight, written in French. (200 pages, 6 by 9½ inches, 74 illustrations.)—$1.50 postpaid.—*A. G. I.*

TELESCOPTICS

A Monthly Department for the Amateur Telescope Maker

Conducted by ALBERT G. INGALLS

OF Springfield type mountings for reflecting telescopes, in contradistinction to the real McKay, which is the straight Springfield originated by R. W. Porter, described in the instruction book "Amateur Telescope Making" and revised by him in its sequel, "Amateur Telescope Making—Advanced," there are no end, each different and each ingenious. The one in Figure 1 was made by Robert Phillips, 3448 Greenview Ave., Chicago, Ill. He says the mounting was made from two Buick front wheel assemblies welded together at right angles with struts and cemented into a 5" pipe. Setting circles are marked on the rims of the brake drums and, these being 36" in circumference, it was easy to mark off the divisions, ¼" equalling 2½° in dec. and 10 minutes in R. A. The tube is made of ½" maple dowel stock on rings of plywood—too light according to standards, Phillips says, but he adds that he had no trouble with it. Total cost of telescope was $25.

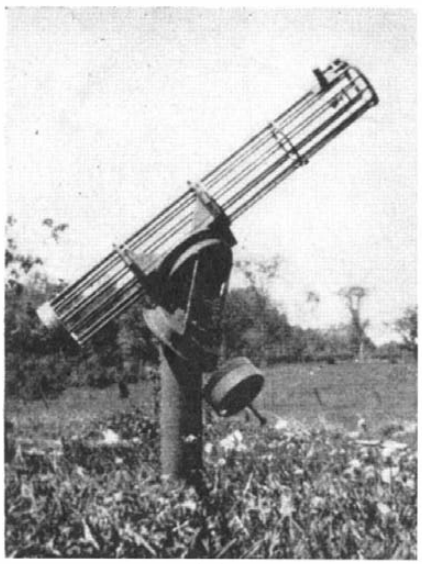


Figure 1: **Phillips mounting**

Another ingenious version of the Springfield type is that in Figure 2, an 8" with Micarta tube and an external framework of structural aluminum angle—a kind of exoskeleton. Carl Oman, 433 Springdale Avenue, East Orange, N. J., is the maker.

When, once before, as above, we called something the real McKay, somebody wrote in to say that the correct expression was "the real McCoy," referring to the late boxing man, Kid McCoy. That, however, is a corruption—one that, in fact, is not the real McKay—of the correct expression. That expression had reference to a fancy whisky once made by McKay in Scotland, pronounced McEye. Anyway, the virtual McCoy-McEye in Springfield mountings, except for its modified counter-weight support, is shown in Figure 3. You don't see many of them because it's a real job of work to make all the necessary patterns, castings, and machined parts. Yet the end-product looks sweet enough to justify the pains if you have the equipment to do the making. Charles F. Pope, 621 Courtland Ave., Park Ridge, Ill., sends in the photograph and says the telescope was made by Richard Traub of Park Ridge. Figure 4 shows Pope's observatory dome, of 20-gage sheet steel over wooden frames.

FLATS are preferred by many, instead of prisms, as diagonals in reflecting telescopes. In the following note Cyril G. Wates, 7718 Jasper Ave., Edmonton, Alta., Canada, discusses the subject pointedly.

"When the amateur has completed a really fine parabolic mirror, and has finished gloating over the beautiful optical 'doughnut' which the Foucault test reveals, he finds himself faced with the problem of diverting the reflected rays through the side of his telescope tube into the eyepiece. Shall he use a right-angled prism, or shall he use an aluminized diagonal? I fail to find that sufficient emphasis has been laid upon the relative merits of prism and diagonal, either in these columns or in the pages of 'ATM' and 'ATMA.' Perhaps there is a tendency among TNs to regard the two as optically equivalent, but this is far from being the case.

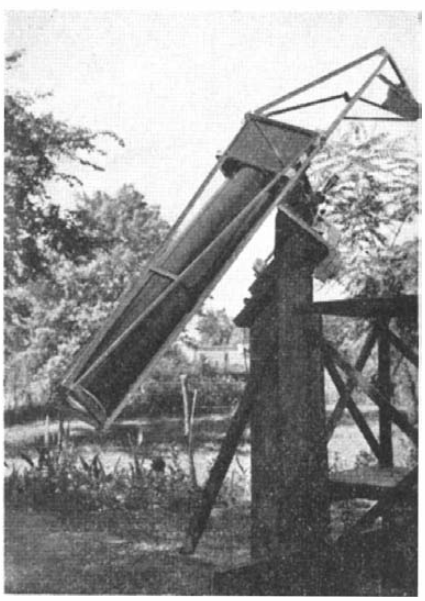


Figure 2: **Oman's mounting**

"Taking the diagonal first, it has one outstanding advantage. Any diagonal mirror, no matter how much its surface may deviate from a plane, is absolutely achromatic. Suitable diagonals with surfaces correct to one quarter wavelength are not too difficult to make, or may be purchased quite reasonably in the smaller sizes. This degree of accuracy is sufficient to insure realization of the fine qualities of a good objective, according to H. H. Selby and others ('ATMA,' p. 131). In the days of silvered surfaces, amateurs were justified in fighting shy of diagonals, but modern methods of aluminizing remove all objections to these little mirrors. Those who make their own diagonals may bear in mind, as I have pointed out in this department (September, 1938), that for long-focus mirrors the difference between a circular diagonal and a 'correct' ellipse, is purely academic. The light cut off by the unused part of a circular diagonal is infinitesimal.

"Turning to prisms, there is one bit of advice which should be burned into the brain of every aspiring amateur —*avoid inferior prisms as you would the plague.* A diagonal mirror has only one place at which it can display defects; the surface. The prism has six: three angles and three surfaces. While it is as easy (and as difficult) to figure the diagonal surface of a prism to the required standard, this perfection will be largely nullified if any of the angles are incorrect, or either of the other surfaces imperfect. A right-angled prism with an accurate diagonal face, but with the other surfaces irregular and the angles incorrect, is exactly equivalent to a bit of cheap plate glass interposed between the eyepiece and the objective. Lack of parallelism between the faces of such a piece of glass would cause color fringes, and irregular surfaces would result in distortion and bad definition.

"Even a perfect prism or a perfect 'plane-parallel' (the two are optically equivalent) causes color dispersion, an effect which, according to Pierce, is quite visible even with a focal ratio of *f*/8. This dispersion, which

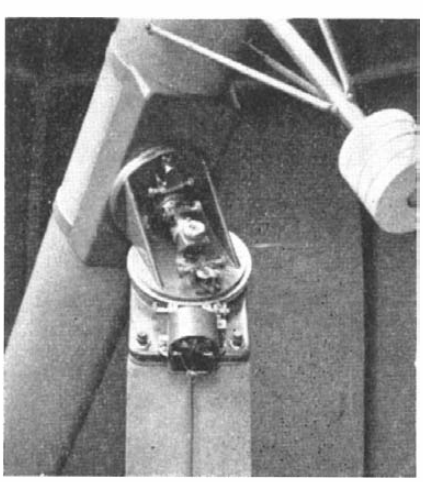


Figure 3: **Pope's Springfield**

appears as a faint fringe around such objects as the Moon and Venus, is unavoidable, but is so unobjectionable that the amateur need have no hesitancy in using a prism, provided it is a good one. Reputable dealers will, of course, supply just what is ordered, and it is unreasonable to expect a Grade A prism for the price of a discard. A fine prism is necessarily more expensive than an equally good diagonal, for the reasons already

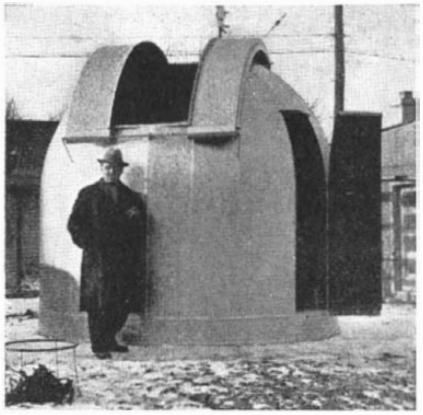


Figure 4: **Pope and observatory**

stated. For short-focus mirrors, such as the RFT, it might be wise to decide upon a diagonal and avoid any possibility of color fringes, which are much more objectionable with a wide cone of rays.

"What is the standard by which a prism should be judged? First, *all* surfaces should be correct to a quarter wavelength. Second, the angles should be accurate within not more than 3 minutes of arc (Martin). The familiar 'split image' test ('ATM,' p. 54) may be made extremely accurate, especially if a circular diaphragm or washer is used between the eye and the prism (Pierce); but this guarantees the correctness of the right-angle only; it is perfectly compatible with gross errors in the other angles. If you are in doubt, go to the physics department of the nearest university and get them to measure the angles for you.

"A word with regard to collimation of a prism. The prism mounting must be adjustable in *all* directions. Push-pull screws are hard to beat, combined, of course, with a rod sliding in the boss of the spider. Eliason's method of reflection from the eyepiece face of the prism is excellent ('ATMA,' p. 272), but does not go far enough. The eyepiece face may be at right angles to the optical axis of the adapter tube, yet the mirror face (of the prism) may be hopelessly out of adjustment.

"It is advisable, therefore, to extend Eliason's adjustment by some such method as that shown in Figure 5, which has worked out well in practice. A disk of cardboard is attached to the mirror end of the tube. In the exact center of the disk is a hole (at least ¼", to avoid diffraction), with two heavy black lines drawn diagonally through the hole, as shown.

The disk is illuminated by means of a flashlight, the end of the tube being covered by a black cloth.

"The prism is first adjusted to the eyepiece adapter by Eliason's method. It is then further adjusted by watching the reflection of the diagonal lines and eyehole, in the mirror face of the prism. When this adjustment is correct, the push-pull screws *must not be altered again.* If the prism no longer responds to Eliason's test, it

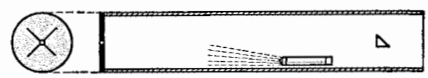


Figure 5: **Suggested by Wates**

must be corrected (1) by sliding the prism mounting in its collar, (2) by rotating the prism, (3) by altering the alinement of the eyepiece adapter. If this method is pursued, *both* square faces of the prism will be exactly at right angles to the axes of both tubes.

"If, after the prism is squared up as described, the mirror is not centered as seen through the adapter tube, the prism is probably bad, and Porter's method for warped mirrors should be tried ('ATM,' p. 287).

"Finally, by all means use a prism if you can afford a really good one, but remember that bad collimation may cancel all the perfection for which you have parted with your hard-earned dollars. If funds are somewhat limited, use a diagonal, especially with short-focus mirrors. For absolute freedom from color effects, the diagonal is certainly the choice, but even a hard aluminum film is delicate and subject to scratches. A prism is free from this objection. So there you are!"

Wates calls for prisms flat within a quarter wavelength and with angles within better than 3 minutes of arc from perfect ("pyramidal error 3'," the professional would term this). Just how good is this, compared with the prisms amateurs have been buying? Definite data are not available on the quality of all the prisms sold to amateurs in the past but here are some criteria. The Perkin-Elmer Corporation, professionals, rate prisms as follows: A-quality-precision, 1/8 wave or better and 5″ pyr. error, or better. A-quality, 1/8 to ¼ wave and 1′ pyr. error or better. B-quality, ¼ to ½ wave and 5′ or better. C-quality, 1 wave and 10′ or better. Thus, the prism Wates asks for is, after all, nothing especially superlative, falling in Class B and costing, for a prism with one-inch-square face, between $3 and $5. How many, if any, Class D, E, F, G . . . X, Y, Z prisms have amateurs purchased in past years?

Your scribe recalls his first telescope, which had a prism picked up free because it was a reject. You could have thrown a cat through the gap between its face and a try-square, yet the telescope provided a big thrill, at least for a little while, even if the prism did make of it almost a spectroscope. At that time, 1926, the amateur telescope making hobby was a cub with burrs in its hair. Porter's statement, in "ATM," page 54, written also at about that time, that "the right angle of the prism need not be exactly 90° for our purpose," didn't seem and then wasn't much out of place. It is literally true today—within the tolerance quoted by Wates from Martin, but the language will be altered in future reprintings. Also by this test a prism could have a perfect right angle, yet the other angles might be, say, 44° and 46° respectively, without the tester being the wiser. Pierce claims that, with the prism held at 30″, the split image test is good to 34 seconds of arc. If made with a small telescope this accuracy would be correspondingly multiplied, he points out.

WATES next continues with the description of a diagonal support of his design:

"The 'classic' method of adjusting the diagonal by means of one or more slots in the tube is not only poor mechanical construction, but also has the serious objection that, when the screws are moved in the slots, the diagonal is swung away from the optical center of the tube. My earlier design, which appeared in the October, 1935, number, is satisfactory for a prism, but is too bulky for an elliptical diagonal mirror. The design shown in Figure 6 has been used in an RFT and can be adapted for any size telescope. Because of the spherical surface between *A* and *B*, the diagonal moves as though pivoted on the optical center, thus greatly simplifying adjustment.

"The diagonal is mounted in a brass tube, as described by Hindle in 'ATMA,' except that the space between the glass and the plate *A* is packed loosely with coarse steel wool. The top surface of *A* is turned to a

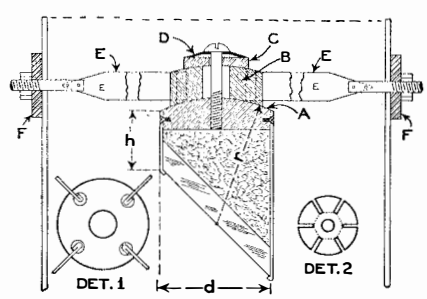


Figure 6: **Wates' support**

spherical surface with radius *r*, which could be measured with a caliper, but may be more accurately determined by the use of the equation

$$r = \sqrt{h^2 + hd + \frac{d^2}{2}}.$$

"The method of attaching the four vanes *E* to part *B* is shown in Detail 1. The slots in *B* are cut carefully with a fine hacksaw. Note that the slots are slightly off-center. Half an inch of the ends of each vane is softened and tinned. One eighth inch is folded over, to fit into the holes in *B*, which

is then heated and the holes filled with solder. The tube of my RFT being sheet aluminum, the wrought iron ring *F* was used for stiffening.

"*D* is a spring steel washer, shown in Detail 2. The diagonal and its mounting can be moved in any direction without changing the position of its optical center and, when correct, the screw is driven home.

"In turning the three disks, *A, B,* and *C,* templates, both concave and convex, should be cut; one pair to radius *r* and the other to radius *r* plus the thickness of *B*. After turning to correct curve, the various surfaces may be ground together with fine Carborundum.

"To forestall the criticism that there is no provision for longitudinal adjustment I will say that, although such adjustment can be provided, it is quite unnecessary. If the spider ring is accurately mounted on the tube, the center of the diagonal will be in line with the center of the eyepiece tube. If not, the ring can be moved until it is correct, and then permanently fixed."

IN the May number of *The Journal of the British Astronomical Association,* F. J. Hargreaves describes his pet polishing lap—wax on pitch, as follows: "The wax-on-pitch polisher consists of an under-layer of pitch supporting wax facets on a netting foundation. The wax does not yield or flow under pressure, and therefore the grooves between the facets do not fill up in use, as with polishers of pitch only. The pitch under-layer, however, can yield or flow to allow the wax facets to make contact uniformly with the surface being polished. This under-layer can therefore be made as soft or as hard as desired, according to circumstances, leaving the wax-polishing layer unaffected." Grim are the circumstances under which this is reported in summer, from a meeting on the banks of the Thames.

FROM S. L. Walkden, father of the RFT or Richest-Field Telescope, who lives in London, came, in the midst of the liveliest bombardment, a long letter about telescoptics and not a syllable about the war except to say that, London being permanently blacked out, he found with rejoicing that he could see fully three magnitudes of stars that previously were invisible, and with his own RFT he had found some thrilling Milky Way views.

Your scribe lives in a New Jersey suburb on a corner surrounded by eight street lamps and bathed by three flood-lamps from a filling station, and the only time he ever even *sees* the Milky Way is when out of town.

IN CASE you are planning to use the King test ("ATMA," p. 269) and have intended to use the sugar and water solution suggested, don't; it won't work. Other liquids—oils—have been substituted. Write in and ask, if especially interested.

LEGAL HIGH-LIGHTS

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

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

Preparedness

A RECENT amendment to the patent laws is intended to reënforce the preparedness program. The amendment grants to the Commissioner of Patents the right to withhold the publication and granting of a patent for such period or periods of time as in his opinion the national interest requires, where the publication of the invention would be detrimental to the public safety or defense. In this way inventions dealing with ordnance, bombs, or other military or naval weapons may be kept secret so as to prevent them from falling into the hands of foreign agents.

Heretofore many important inventions of this character were patented. Upon the issuance of the patents the inventions were published and were available for reference. The withholding of a patent might possibly work a hardship upon an inventor since he can only collect profits and damages for infringements occurring subsequent to the granting of the patent. In order to protect the inventor the amendment to the law also contains the provision that an applicant whose patent is withheld by the Commissioner shall tender his invention to the government and thereafter he shall have the right to sue for compensation in the Court of Claims, the compensation to begin from the date of use of the invention by the government. Thus it will be seen that the inventor can recover, from the government, compensation for the use of his invention occurring even prior to the granting of the patent.

Caruso

COMPETING manufacturers of food products were involved in a controversy over the right to register as a trade mark the name of the famous tenor, Enrico Caruso. The original user of the name Caruso had registered it in the United States Patent Office in 1918 as a trade mark for macaroni and similar food products. The other manufacturer registered the name as a trade mark for canned tomatoes and tomato paste in 1923. Subsequently the original user brought proceedings to cancel the later trade-mark registration of the other manufacturer.

It was argued by the second registrant that he had the right to maintain his registration because he had received permission from Mr. Caruso to use his name and picture in connection with his food products. The Patent Office and Court of Customs and Patent Appeals found that both registrants had received permission from Mr. Caruso to use his name and picture. It was held, however, that this *per se* was not controlling. The right to register a trade mark is controlled by the federal statutes relating to this subject and a person may not register a trade mark which is likely to cause confusion in trade. It was held that the registration of the name Caruso by the second registrant was likely to cause confusion with the trade mark of the first registrant and accordingly it was ordered to be cancelled.

Superman

A CARTOON strip relating to a fictitious character of superhuman strength identified as Wonderman was held to be an infringement of a copyright relating to a cartoon relating to a superhuman character identified as Superman. Each character was represented as being the strongest man in the world, as being the champion of the oppressed and as battling against evil and injustice. Each was represented as performing similar feats of superhuman strength such as crushing a gun in his hands and as catching the bullets or shells from a gun and throwing them back to the place whence they emanated. It was contended by the infringer that the copyright was invalid because the cartoon character Superman was merely a comic Hercules. This argument was rejected by the Court for the reason that an original production or creation, however poor in quality, is entitled to copyright protection.

In this connection, the Court stated: "But if the author of 'Superman' has portrayed a comic Hercules, yet if his production involves more than the presentation of a general type, he may copyright it and say of it: 'A poor thing but mine own'."

Ascap

A NEBRASKA statute which would have destroyed or seriously handicapped an organization through which a large number of authors, composers, and publishers of musical compositions receive substantial income for the production of their compositions was recently declared unconstitutional by a Federal Court. This statute declared it to be unlawful for authors, composers, and publishers to form any society, association, or

similar combination wherein the members constituted a substantial portion of the authors, composers, and publishers within the United States and when at least one of the objects of the combination was the determination and fixation of license fees.

The statute provided further that thereafter all license fees fixed by such a combination were null and void and that authors, composers, and publishers should specify on printed copies of their musical composition the license fees charged for private and public renditions of the composition. Upon payment of the specified fee the purchaser of the composition could use or render the composition without any further obligation.

The statute also provided that if the author, composer, or publisher failed to specify a license fee on printed copies of the composition then any purchaser thereof was free to use and render it without the payment of any license fee whatsoever.

The American Society of Composers, Authors, and Publishers, an association of approximately one thousand composers and of 123 publishers, commonly known as Ascap, brought suit against the Secretary of State of Nebraska to enjoin the enforcement of the statute on the grounds that the statute was unconstitutional. The Court held that the provision of the statute requiring the owner of a copyrighted musical composition to offer it for sale in a certain manner, i. e., by specifying a license fee on printed copies of the composition and the provision depriving him of any compensation if he fails to offer the composition for sale in the manner specified was in violation of the Federal Constitution and also of the Federal Copyright Act in that it denied the copyright proprietor due process of law.

Bacteria

THE lowly bacteria which has been accused of causing many of the human woes and illnesses has now been deprived of the benefits of our patent law.

The patent law provides in part that anyone who has invented or discovered any new variety of plant which can be asexually reproduced is entitled to receive a patent. Under this section of the law an attempt was made to obtain a patent on a new form of bacteria. The Patent Office rejected the application for the patent on the grounds that a bacteria was not a plant within the meaning of the patent law.

An appeal was taken to the Court of Customs and Patent Appeals and the court ruled that while scientifically a bacteria was a plant, Congress intended that the word "plant" should be given its popular meaning and this did not include bacteria. The Court accordingly sustained the Patent Office in refusing to grant a patent for bacteria.

CURRENT BULLETIN BRIEFS

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

PLASTICO ROK SERVICE BULLETIN is a pamphlet showing a wide variety of uses for the mending and patching plastic material which was described on page 222 of the April 1940 issue of Scientific American. *Technical Supply Co., Palo Alto, California.—Gratis.*

THE DENSITOMETER AND ITS USE IN COLOR PRINTING is a manual published for use with the Marshall Densitometer. However, it offers valuable information to all interested in making color prints. Text and illustrations are non-technical. The manual covers, in comprehensive form, such important points as: instructions outlining the general requirements of good color prints, how to make accurately balanced separation negatives, how to use gray scales, general use of densitometers in color work, how to check separation negatives, etc. Included are time-gamma charts, filter factors, etc. Gratis to purchasers of Marshall Densitometer; 25 cents to others. *Albert Specialty Co., 231 South Green St., Chicago, Illinois.*

RESEARCH LOOKS TO NEW HORIZONS is a 32-page booklet, illustrated in colors, showing the progress of research and industry from early horizons to the present day. Specific examples show the startling results that have been obtained by research intelligently applied. *Department of Public Relations, General Motors Corporation, Detroit, Michigan.—Gratis.*

TENITE is a 28-page booklet that describes this plastic material and illustrates many of its uses in a wide range of industries. The book is of particular interest to manufacturers, molders and designers. Please request it on your business letterhead. *Tennessee Eastman Corporation, Kingsport, Tennessee.—Gratis.*

DU PONT'S PARTNERSHIP WITH THE FARMER is a booklet which shows clearly that both products for the farm and those made from farm products have been made available through chemical research. The booklet also shows how many farm products, after processing, go back to the farm either for direct use or as aids in the preservation and marketing of other farm products. *Agricultural News Letter, E. I. Du Pont de Nemours & Co., Inc., Wilmington, Delaware.—Gratis.*

THE WORKING OF S. A. E. NICKEL ALLOY STEELS is a 16-page pamphlet of data compiled from the practice of 34 leading fabricators. It covers effects of heat treatment, and gives practical instructions for machining, grinding, welding, and gas cutting. *The International Nickel Company, Inc., 67 Wall Street, New York, N. Y. —Gratis.*

"HAM GUIDE" was written specifically to tell the radio amateur how to use RCA transmitting tubes to best advantage. It also includes constructional articles, giving complete details for building two medium-power amateur transmitters. More than 70 illustrations and over 30 transmitting circuits are presented. *Commercial Engineering Section, RCA Manufacturing Company, Harrison, N. J.— 15 cents.*

A NATIONAL TRANSPORTATION POLICY, by Senator Clyde M. Reed, is a 14-page booklet that outlines the problems of transportation in the United States and presents facts aimed toward their solution. *Association of American Railroads, Transportation Bldg., Washington, D. C.—Gratis.*

ALPHA SYSTEM OF BRIDGE DESIGN is a 26-page illustrated booklet that describes a system of steel and reinforced concrete construction relating particularly to bridges. It is claimed that this system combines the rigidity of reinforced concrete with much lower cost and gives the accuracy, simplicity, and rapidity of steel construction. *Porete Mfg. Co., North Arlington, New Jersey.—Gratis.*

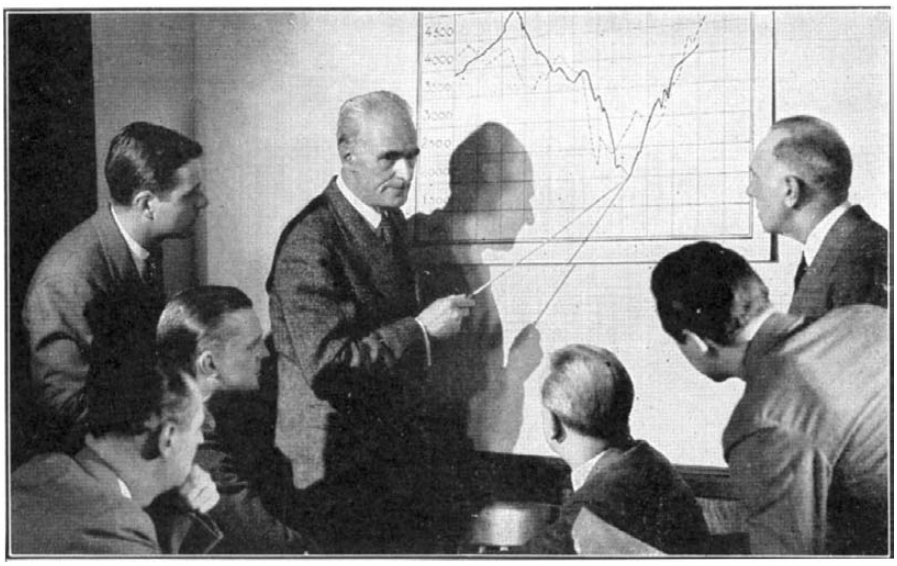
PLATING AND FINISHING GUIDEBOOK comprises 136 pages of practical information in the plating and finishing industries, plus 70 pages of advertising and "quick-mailing coupon service" for readers. The text consists of a series of articles covering all phases of plating and finishing. *The Metal Industry Publishing Co., Inc., 116 John St., New York City.— 25 cents.*

G-E HOME WIRING HANDBOOK is a 24-page pamphlet that is essentially a guide for planning electrical wiring for homes. It outlines wiring requirements and specifications, shows how to determine the adequacy of wiring, and gives a chart of residential outlet requirements. *General Electric Company, Bridgeport, Connecticut.— Gratis.*

CUT STEEL PROFITABLY WITH KENNAMETAL TOOLS AND BLANKS is a 6-page folder describing this tool alloy. It includes tables of comparative physical properties and recommended speeds for machining steels of various hardnesses. Illustrations show typical turning, milling, and shaping operations. Bulletin 740. *McKenna Metals Co., 341 Lloyd Ave., Latrobe, Pa.—Gratis if requested on business letterhead.*

C. P. CHEMICALS AND ACIDS is a 158-page catalog of "Baker's Analyzed" laboratory and technical chemicals. *J. T. Baker Chemical Company, Phillipsburg, New Jersey.—Gratis.*

Printed in the U. S. A. Press of the Wilson H. Lee Company, Orange, Connecticut.



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THE FARMER has always been among the first to reap the benefits of automotive progress. The automobile ended the isolation of farm life. The motor truck made it easier for him to get his produce to town, opened up new markets, allowed the profitable farming of lands far from other means of transportation. And the tractor made it possible for him to do a better, bigger job of farming — relieved him of drudgery and gave him more time to enjoy life.

In recent years, the high compression principle, already developed in automobile and airplane engines, was adopted by the farm machinery industry. Engines were redesigned to take advantage of the new improved gasolines, and great increases in the power and flexibility of tractors resulted. This was an important factor in the evolution of the present compact, inexpensive tractor.

The modern high compression tractor provides an outstanding example of the importance of recognizing the engine and its fuel as a single unit. Its development resulted from the type of coordinated research in the automotive and petroleum industries that is expected by engineers to produce another bumper crop of power developments in the next ten years.

Already laboratory experiments with supercharged engines and engines having super-compression ratios show the possibilities of future automobiles, buses, trucks and tractors which will render obsolete present standards of performance. The practical production of such vehicles will depend upon further cooperative research in many fields — engine design, metallurgy, ceramics, lubricants and fuels. The engine designer must plan for fuels of tomorrow, and the petroleum refiner must evaluate fuels in terms of tomorrow's engines.

That's why we of the Ethyl Gasoline Corporation, through our Research Laboratories in Detroit and San Bernardino, are engaging in joint programs with the automotive, aircraft, tractor and petroleum industries—and through our field staff we are assisting the users of fuels and engines in the practical application of laboratory findings.

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