Who Have the **HIGHWAY ACCIDENTS?**

SCIENTIFIC AMERICAN

JULY
1938

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a Copy

Including:
A DIGEST OF
SCIENCE & INDUSTRY

SCIENTIFIC AMERICAN

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NINETY-FOURTH YEAR • ORSON D. MUNN, Editor

CONTENTS · JULY · 1938

FLEET maneuvers and close study of airplane operations in the world's current wars have shown the capabilities and limitations of aircraft in naval use. Thus in recent years, officers and men of the U. S. Navy have become more and more air-minded, and today all are convinced that aircraft are as definitely a part of the fleet as are surface and sub-surface units. Captain Ingram makes this clear in his article on page 9. Our cover photograph—Official, U. S. Navy—symbolizes the close co-ordination between air and sea units.

The SCIENTIFIC AMERICAN DIGEST

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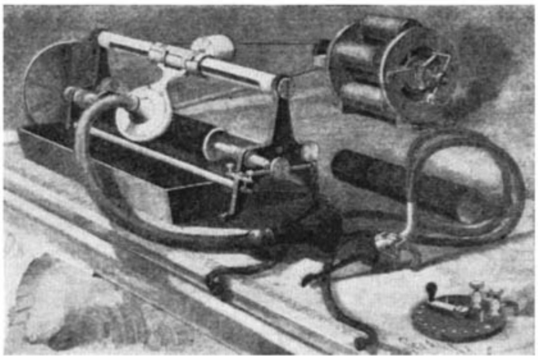
50 YEARS AGO IN . . .

SCIENTIFIC AMERICAN

(Condensed From Issues of July, 1888)

AIR CORPS—"The French squadron, now gathering at Toulon for the regular summer evolutions, has with it an aerostatic corps charged with work of a wholly novel kind. Captive balloons are to be sent up from the ships to heights of 300 meters—about 1,000 feet— . . . A topographer will go up with the balloon to make a sketch of the underlying country, with special reference to roads and woods or the position of a supposititious enemy."

GRAPHOPHONE—"The graphophone, which is shown in the annexed engraving, is, as its name indicates, a recorder and reproducer of sounds. It is the invention of Mr. Charles Sumner Tainter, and is the result of several years' experimentation and the subject of many patents, several of which were issued in May, 1886. In its construction, efficiency has, of course, been the first consideration, after which the matters of simplicity, facility of management, and the practical handling of the records or messages have been disposed of. The machine is an exceedingly simple thing. . . . The record cylinder consists of paper wound in a peculiar way, to cause it to maintain its cylindrical form, the outer surface of the paper being coated with a specially prepared wax. . . . The groove constituting the record is microscopic in size, it being only three thousandths of an inch wide and about two thousandths deep. One hundred and sixty grooves to the inch are cut on the cylinder. . . . The machine is driven by connection with any power having a fairly uniform speed. In the engraving the machine is represented as being driven by a small electric motor."



IN THE HAREM—"The women in the Sultan's seraglio, at Constantinople, have just been vaccinated, to the number of 150. The operation took place in a large hall, under the superintendence of four gigantic eunuchs. The Italian surgeon to whom the task was confided was stationed in front of a huge screen, and the women were concealed behind it. A hole had been made in the center of the screen, just large enough to allow an arm to pass through."

PAPER ORGAN—"A very original musical instrument has recently been constructed at Milan—an organ whose pipes, instead of being of metal, are of paper pulp. . . . It is generally agreed that the instrument possesses great power, and a sweetness of tone not found in organs hitherto constructed."

STEEL—"The United States and Great Britain produced last year three-fourths of the steel and two-thirds of the iron made and consumed among enlightened nations. The pig iron output was 20,820,771 tons, of which Great Britain produced 7,441,927 tons and the United States 6,417,148 tons."

SPEED—"The first specially fast express train ever run was in 1846, on the Great Western road . . . known as the 'Flying Dutchman,' which name it has since retained. It made the distance of 193 miles from London to Exeter in four and a half hours, with five stops, the full running speed of the train between stations being at the rate of 63.9 miles per hour. . . . One of the best authenticated tests of locomotive performance was a trial in 1885, over the Bound Brook route from Jersey City. In this test . . . the indicator cards gave a speed as high as a mile in 46 seconds, or equal to 78.26 miles per hour."

ATLANTIS—"The Dominion steamer Alert recently left Halifax, N. S., with men and material for the erection of a lighthouse, for the third time, on the west end of Sable Island. . . . The rapid disappearance of this remarkable island is one of the present marvels of the North Atlantic. Year by year it lessens in extent, threatening soon to be submerged, and its existence at no distant day promises to be as great a mystery as the location of the mythical Atlantis."

SIGNALLING—"Admiral Sir W. Hunt Grubbe has recently made some interesting experiments at the Cape of Good Hope on the sending of signals by means of the rays of an arc lamp reflected by the clouds. The luminous fascicle from a 100,000 candlepower arc lamp was directed against the clouds by means of a reflector, and interrupted according to the heliographic code. The dispatch could be read with ease at Cape Town."

CROTON—"The great aqueduct for carrying the water of the Croton River basin to the metropolis, in quantity adequate to supply its wants for years to come, is now fast approaching completion."

CASH—"Machines for registering the amount of cash received are among the new appurtenances of well regulated retail establishments in this city. The operator presses a key, which turns the register, counts and records the amount paid into the money drawer. When the day's work is done, the machine shows the total amount of cash received, and the cash in the drawer should correspond with the figures on the register."

METRIC—"Ten mills make one cent, ten cents make one dime, ten dimes make one dollar, ten dollars make one eagle. This is the metric or decimal system. It is easily understood by everybody, has been in use, in respect to our coinage, ever since the foundation of the government. How desirable it is that it should be substituted for the old system in all our expressions of weights and measures."

BRAKE—"A marine brake has been invented by M. Pagan, and was recently tested on the Seine. It consists of a cable having attached to it a series of canvas cones which open out by the action of the water, and exert an enormous retarding force on the vessel. Thus the steamer Corsaire, running at a speed of 13 knots, was stopped by this appliance in 7 seconds, 34 seconds being required when she stopped by reversing the engines without making use of the brake."

AND NOW FOR THE FUTURE

¶The tales that skeletons tell, by Prof. Wilton Marion Krogman.

¶Weight tips the scales of industry, by Roger William Riis.

¶High pressures and their effects on the properties of matter, by Prof. P. W. Bridgman.

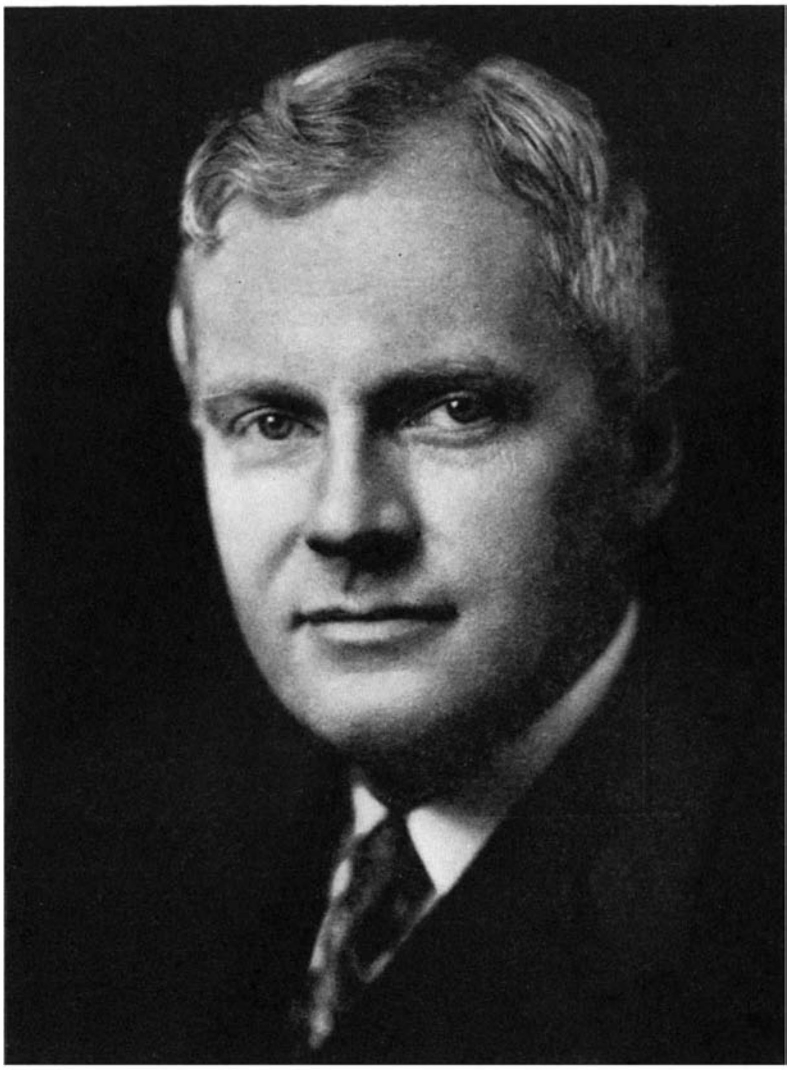
¶Can commercial diamonds be made synthetically?, by Lewellyn D. Lloyd.

Personalities in Industry

NOT only industry but professional groups as well have a responsibility in developing a real public understanding "as to the nature and value of the technological gifts which society is continually receiving," according to Dr. Paul Dyer Merica, who shares with the late Marconi the distinction of being one of the two youngest men ever to have received the John Fritz Medal. Awarded annually by the four major engineering societies of the United States, this medal was conferred on Dr. Merica recently on the occasion of his forty-ninth birthday, the citation being in "recognition of important contributions to the development of alloys for industrial uses."

Dr. Merica has come to this honor and has evolved this sense of the professional man's responsibility to the public through a distinguished career which has included both the seclusion of research and testing laboratories and the hurly-burly of industrial conference and direction. A native of Warsaw, Indiana, he studied first at De Pauw University and then at the University of Wisconsin which granted him an A.B. degree in 1908. Chinese friends whom he made while at Madison interested him in teaching "Western subjects" in the Chekiang provincial college at Hangchow. Going to China in 1909, he spent the next two years there, and it was during this period that he introduced laboratory instruction in chemistry and physics.

Matriculating at the University of Berlin in the autumn of 1911, he received his doctorate *magna cum laude* three years later. This German experience included study of electrochemistry and metallography in the Technische Hochschule at Charlottenburg. Dr. Merica later returned to the United States to join Dr. G. K. Burgess in the newly organized Division of Metallurgy of the U. S. Bureau of Standards. His arrival in Washington coincided with the outbreak of the World War, and the resulting interest in light alloys for aircraft construction led to his study of aluminum alloys and thus to his remarkable discovery of the mechanism whereby quenched duraluminum hardened on merely standing for a time at room temperature. This research, which has been described as "the metallurgical shot heard 'round the world," led to the formulation of a general law of precipitation hardening and was subsequently found to apply to a wide range of steels and alloys.



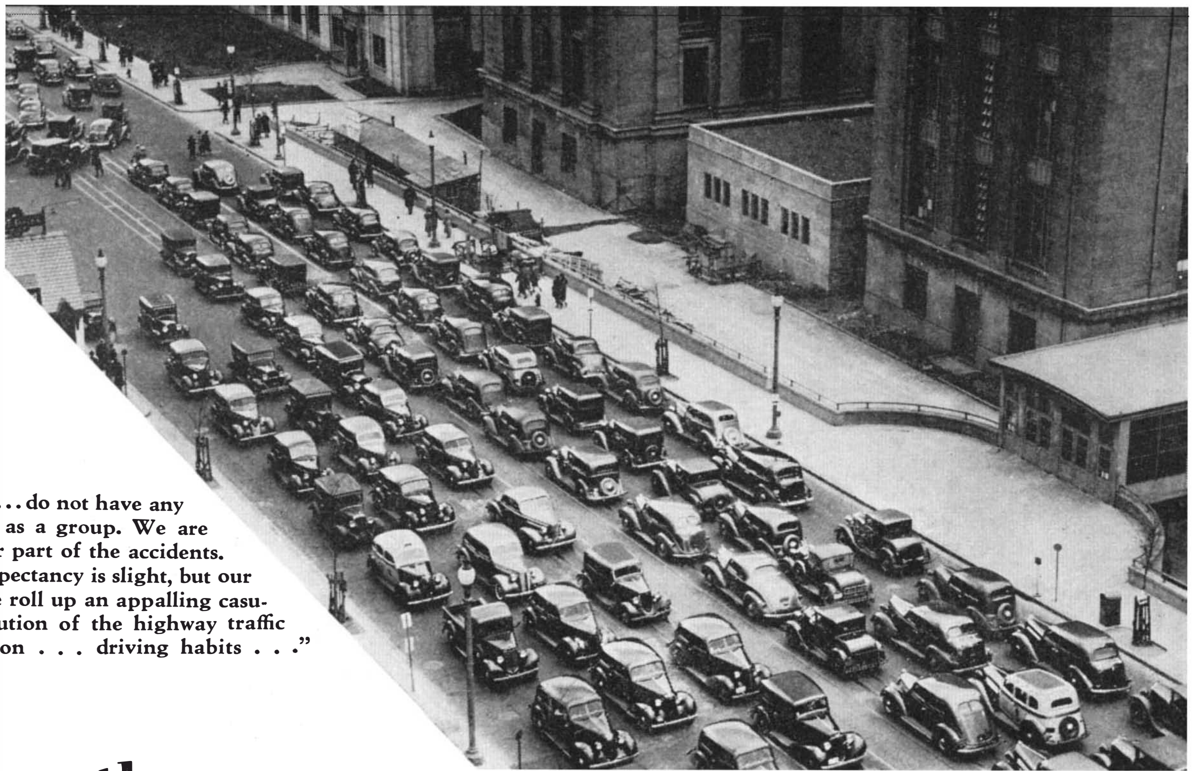
PAUL DYER MERICA

But Dr. Merica's work during his five years at the Bureau of Standards was by no means limited to the metallurgy of aluminum. He correctly diagnosed the metal failure in the disastrous explosion of a boiler on the S.S. *Jefferson* and prescribed methods for eliminating the hazard. He successfully tackled the problem of spontaneous failure through stress corrosion of the brass valve stems used in the Catskill Aqueduct. To provide a background for the study of rail and similar failures in the United States, he made a comprehensive study of foreign specifications for materials used in railroad construction work.

Dr. Merica's transition into the world of industry came in 1919 when he was offered a position in the physical laboratory of the International Nickel Company at Bayonne, New Jersey. There he first devoted himself to improving the melting practices employed for nickel and Monel and to other plant problems. Then, in 1922, he was brought to the New York office of the company as assistant manager of the development and research department which was being established to find industrial uses for nickel and its alloys. As director of research for this department, he laid the groundwork for the present development of alloy cast irons and for improvements in the physical properties of the nickel-copper alloys of the Monel type. Becoming technical assistant to the president in 1930, he developed the series of Nickel Information Bureaus in world industrial centers for better co-operation between industry and research. In 1935 he was elected a director of the company, and a year later he became a vice-president.

NIGHT SAFETY ACHIEVED WITH BUTTONS

AROUND the curve and over the hill, the highway edge is picked out, for hundreds of yards ahead, by the glow of one's own car's headlights reflected from simple button reflectors made of the plastic Lucite. The installation shown above, and discussed in the Digest section of this issue, was made on a highway between Detroit and Lansing, Michigan. The driver does not have to guess the location of the highway.



Courtesy
U. S. Bureau of Public Roads

"... the great majority of us ... do not have any salient traffic characteristics as a group. We are the ones who have the larger part of the accidents. Individually our accident expectancy is slight, but our numbers are so great that we roll up an appalling casualty total. The ultimate solution of the highway traffic safety problem depends upon . . . driving habits . . ."

Who Have the HIGHWAY ACCIDENTS?

By
R. W. CRUM
Director, Highway Research Board

Three Groups of Drivers . . . By No Means a Hopeless Prospect . . . Good Teaching Produces Safé Drivers . . . The Key to Accident Prevention

THE driver is the key to the traffic accident problem. Without his wrong acts there could be few accidents. The sole responsibility is not his, but everything that is done in the interests of safety must be based upon the effects upon drivers' behavior. Builders of vehicles and roads must share the responsibility, but they must take drivers' characteristics into account.

The driving population may be divided into three significant classes: A relatively small group of high-accident individuals, a larger group of comparatively accident-free persons, and the majority of the drivers among whom are those who have the bulk of the accidents without being especially susceptible by reason of proneness to accidents or lack of experience.

It has long been known that certain persons are prone to have mishaps while driving motor vehicles. It may not always be possible to show definitely that they are responsible for particular accidents, but for some reason they have the unhappy faculty of being on hand when such things happen. Although there has been extensive popular supposition that such accident-prone individuals are responsible for a major part of the accidents, there has been no certain knowledge of the relative number of them in the whole driving population.

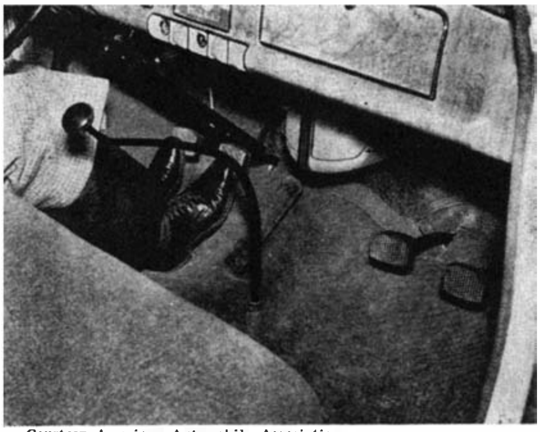
In order to discover the facts of this situation and in the hope that the information secured might point the way to some effective measures for combatting the rising tide of highway traffic casualties, the Highway Research Board and the U. S. Bureau of Public Roads in cooperation with the Commissioner of Motor Vehicles of Connecticut studied the accident records of 29,531 Connecticut drivers, selected at random, for the six-year period 1931-1936. In the six-year period these 29,531 drivers had 7082 reported accidents. However, 23,881 drivers had no accidents and 4503 had one accident, leaving only 1147 who had two to seven accidents each. Nineteen percent of the drivers had all the accidents and only 3.9 percent repeated within the six years.

IF the 7082 accidents had been distributed impartially among the 29,531 drivers without regard to personal identities or histories, it can be computed mathematically, on the assumption that the accident rate per operator is a constant, that 23,234 would not have had an accident, 5572 would have had only one accident and 725 would have had two or more accidents. Since the accidents did not occur in this way it is apparent that they were not distributed by chance but that the distribution must have been affected by some systematic influences.

There were 647 more drivers who had no accident than could be accounted for by chance and 1069 fewer drivers who had only one accident than could be accounted for by chance. The better-than-to-be-expected results in these two groups indicate that there must be a fairly large group of drivers in the population who are more than ordinarily free from traffic accidents.

On the other hand, the fact that there were 422 more accident repeaters than expected indicates the presence of a smaller group who for one reason or another are more than ordinarily susceptible to traffic accidents. This excess may be taken as a measure of the relative proportion of really accident-susceptible drivers. Thus, in the six-year period studied, 1.5 percent of the population who had about 15 percent of the accidents appeared to be accident prone. With longer experience this figure might increase but it is hardly to be expected that many truly accident-prone individuals would stay unrevealed for six years.

Since the comparison of the actual number of accidents in each group with the expected number was based on chance distribution without regard to identities or histories of the drivers, the accident-prone group thus defined may contain some individuals who are more than ordinarily susceptible to accidents on account of excessive exposure to hazards, in addition to those who have an inherent tendency that way. These can,



Courtesy American Automobile Association

Training by doing. Interior of a driver-training car, showing dual pedals by means of which an instructor can maintain control of the car if the student should become panic stricken

of course, be segregated by further investigation; in any case they constitute a dangerous element.

Between the accident prone at one end and the fortunate ones at the other are the great majority of us who do not have any salient traffic characteristics as a group. We are the ones who have the larger part of the accidents. Individually our accident expectancy is slight, but our numbers are so great that we roll up an appalling casualty total. *The ultimate solution of the highway traffic safety problem depends upon the driving habits we develop and upon the attitudes we take toward our responsibilities.*

ANOTHER significant fact disclosed by the investigation is that the younger drivers—16 to 25 years old—have nearly twice as many accidents as would be their share in proportion to their number in the population. Of the 7082 recorded accidents of 29,531 Connecticut drivers during 1931-1936, the drivers younger than 25 years had 1.83 times as many fatal accidents, 1.53 times as many non-fatal personal injury accidents, and 1.47 times as many property damage accidents as might have been expected from their relative number.

There were 2467 drivers involved in fatal accidents in Connecticut during 1932 through 1936. Of these, 316 were less than 21 years of age and had 1.72 times their share of the accidents. In eight yearly samples studied from Massachusetts and Connecticut the drivers under 21 had from 1.24 to 2.10 times their share of fatal accidents.

The net result of these studies has been to point out three groups in the driving population toward which corrective measures should be directed: (1) The accident prone; (2) The younger drivers; (3) The great majority who are not accident prone nor susceptible to accidents because of lack of experience.

What of the accident prone? Before anything can be done to protect us against the accident-prone driver he must be identified as an individual, because in the nature of things this problem calls for clinical approach rather than general educational methods. These people probably think they are careful in spite of their bad records, and that their mishaps are due to the faulty acts of others. But waiting for the persistently bad driver to reveal himself through a series of costly accidents is at best a poor expedient: The hope is that some means may be found for determining a person's driving proclivities in advance.

Tests for individuals have been developed, notably by Lauer at Iowa State College and DeSilva at the Harvard Bureau for Street Traffic Research, to such a point that it is possible to determine a person's relation to the average for a number of traits that presumably should have some influence upon his ability to drive a motor vehicle safely. In theory a person's ability with respect to such attributes as hearing, seeing, resistance to glare, angle of vision, reaction time, coördination, color blindness, physical handicaps, intelligence, and others should give some indication of his potential ability as a driver. Through the co-operation of Dr. Lauer, Dr. DeSilva and Michael A. Connor, Connecticut Commissioner of Motor Vehicles, we recently applied the tests to about 3000 drivers with ascertainable records. It is hardly to be expected that any one test will give a reasonable estimate of general ability to drive safely, and our data in the present incomplete state of analysis seem to bear this out.

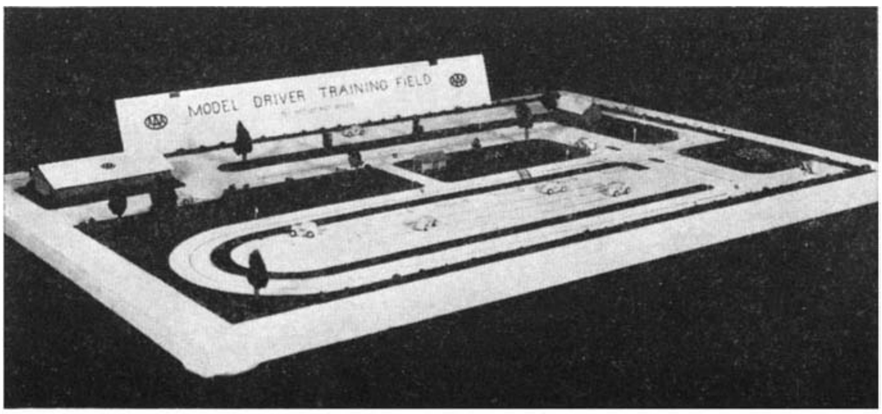
There can be no question of the value of such tests for educational purposes. If one has defects in skills that are related to driving a car, knowing them should at least make him more careful and thoughtful about his driving habits. But even after the accident-prone individuals are identified, there must be a third separation: Those of the accident prone who are amenable to re-education must be separated from the incorrigibles.

When this point is reached we will be ready to act. Those whose hazardous tendencies can be corrected may be reclaimed; the others must be eliminated from highway traffic. This is by no means a hopeless prospect. Much has been gained when the avenues for research are so clearly indicated.

The youthful drivers constitute a group we can go to work on right away. We know who they are and where to find them. We do not know from statistical data whether the principal factor in their bad record is lack of experience, immature judgment, excessive exposure, or lack of proper training. There is, of course, no substitute for experience, but immaturity can be corrected by time and certainly poor training can be changed for the better.

WITHOUT waiting upon further study of cause and effect, driver training should receive the serious attention of the nation for it is one obviously remedial measure that promises effective results. Present methods of training motor vehicle drivers are by far too haphazard. In 14 states anyone of lawful age may drive without examination. In only 30 states is some form of examination compulsory. And even then the applicant is not required to demonstrate much more than his ability to handle the vehicle under ordinary circumstances, his acquaintance with the motor vehicle and traffic laws of his jurisdiction, and the fact that he is reasonably sound and in working order physically. The examiner finds out little about his attitude, judgment, or behavior in the face of emergency.

When we consider that each new driver has either been self-taught or has been taught only the mechanical manipulation of the controls and steering apparatus, and has been left to him-



A step in the right direction. Model of a driver-training field, where the novice can make mistakes to his heart's content, without endangering lives of others

self to develop his real driving technique and attitude, is it any wonder that bad driving habits so often have their effects at crucial moments?

The hope and necessity for the future lies in teaching the boys and girls how to drive correctly as they come to driving age. Much is already known about what to teach and how to teach it. Professor Heyhart of Pennsylvania State College has demonstrated that *good teaching produces safe drivers*. The big problem is one of ways and means: What agencies should give the instruction? Where should it be given? How should a tie-in with the licensing authority be effected? What provision should be made for practice grounds?

It should be apparent by now that there is no cure-all for traffic ills, and this becomes even more certain when we examine the great unclassified group. Even if the accident-prone group could be liquidated altogether the larger and tougher part of the problem would still remain. What can be done to lower the accident level for the great majority of the drivers? Make the vehicles and roads as safe as possible for reasonable use; in some way instill into the whole population a knowledge of better driving practice; arouse all drivers to a less individualistic attitude and to an assumption of greater personal responsibility. Most of us drive prudently most of the time but enough of us do wrong things every day to kill 100 people, to say nothing of injuries and damage to property.

As a class we are collectively horrified at the situation, but individually we are indifferent because we do not expect to have an accident ourselves and, drunk or sober, we are convinced we are good drivers. This is a serious fact that must be taken into account.

There is another compelling reason why the proper training of new drivers is so important. If all new drivers could be properly trained as they arrive it would take only 25 or 30 years to clear up the whole problem of driver education. When adequate training facilities are provided, their use should not be restricted to new drivers. The motor-vehicle administrators will find many who need retraining and many older operators will welcome an opportunity thus to improve their driving habits.

In the meanwhile, of course, the educational efforts being made by towns, cities, states, and many public spirited organizations must be supported and encouraged. Results, though perhaps slow in appearing, must ensue.

It would help if we could all adopt the frame of mind that we must be in some way at fault ourselves whenever we get into a risky situation or are involved in even a minor mishap. There is considerable truth in the thought: "Good drivers do not get into tight places." Some people can adopt such a judicial attitude toward their own acts; for others it is difficult and for many it is mentally impossible. Nevertheless the point is worth making.

Much can be done to lower the accident rate through control of traffic, but there is urgent need for unification of practice throughout the nation. The driver is entitled to uniform rules, regulations, and practices in everything that affects driving habits: He is entitled to freedom from conflicting and meaningless laws and regulations. When these conditions prevail universally it will be reasonable to expect wide-spread improvement.

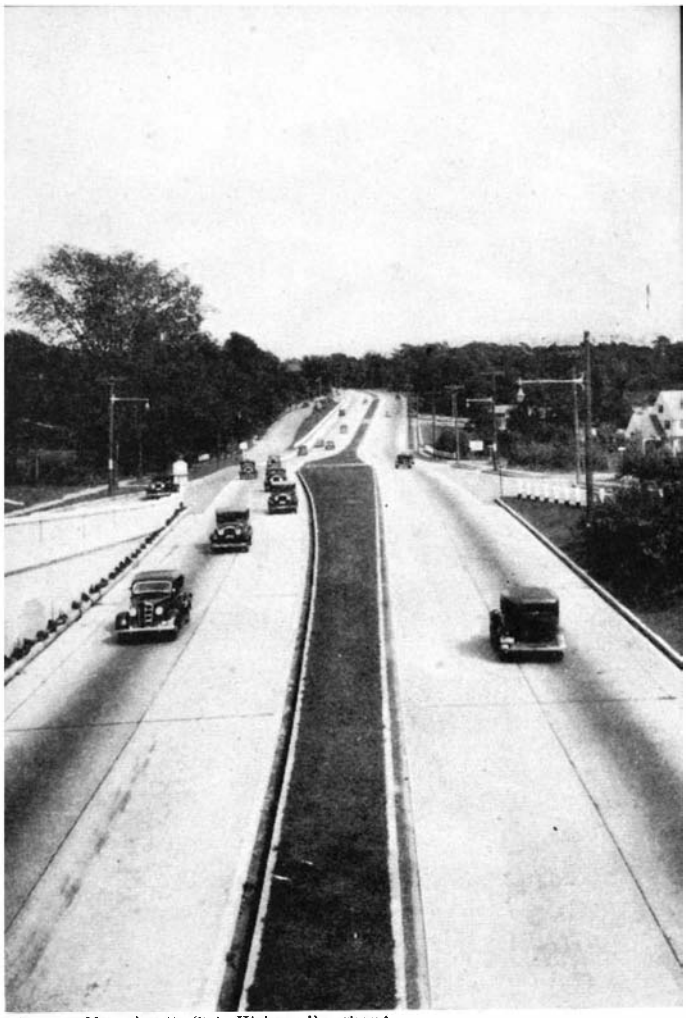
Law enforcement is a necessary adjunct to traffic control but it is axiomatic that no law affecting the entire population can be enforced without popular support. It follows, therefore, that regulatory measures that are needed for safety must be sold to the public. Remarkable results have been secured in Evanston, Illinois, and several other cities by using police power from the standpoint of accident prevention; through this type of activity the law-enforcement agencies may contribute much toward lowering the accident rate. Drivers en masse do not seem to be influenced much by reading in the papers the record of arrests, convictions, and license revocations, but most of us can be impressed into carefulness by frequent sight of uniformed policemen. More patrolmen on the road should have salutary effects.

The biggest objective is to get the drivers trained so that they will instinctively do the right things, and thus avoid conflict with the law.

This is the story about the driver but it cannot be ended without noting that the responsibility is not all his. The other three factors—vehicle, road and man on foot—must be brought into proper relation with safety before the job will be done.

It is perhaps needless to say that the driver is entitled to a vehicle which is originally safe for reasonable use, and that thereafter he has a responsibility to others as well as to himself to keep it in safe condition.

". . . The driver is entitled to roads that are safe for reasonable use . . ." A divided highway on which the drivers are protected by separation of traffic in opposite directions



Courtesy Massachusetts State Highway Department

The victims of two out of five traffic accident deaths are pedestrians and in a large proportion of the reported cases they are at fault. A significant fact is that of 1238 pedestrians killed in Connecticut during 1932-1936 inclusive, only 48 were operators of motor vehicles. This shows the necessity of impressing upon the non-driving public the difficulties of handling motor cars in heavy traffic and the fact that although a walker can clearly see an approaching vehicle, conditions may be such that the driver may not see him. It is quite possible that a man may be within the visibility range of a car's headlights and still the driver may actually not see him until it is too late.

The driver is entitled to roads that are safe for reasonable use, and he is entitled to some measure of protection against the hazards beyond his control—the acts of other drivers, acts of pedestrians, and blind intersections. He is entitled to a national system of signs and signals, the meanings of which are exact and unmistakable.

Enough has been said to show that the lowering of the accident level is a task of great magnitude, but not an impossible one. It will take continuous and widespread concerted effort for a long time. Speeds are too great, vehicles too mobile, and men too fallible for us to expect entire freedom from accidents, but it is self-evident that the accident rate is far above an inevitable minimum.

OUR POINT OF VIEW

Changed Conditions

THAT the airplane has pushed the first line of defense of our shores 500 to 1000 miles out to sea, Captain Jonas H. Ingram clearly shows in his article beginning on the opposite page. That it has voided the protection of the "narrow seas" for Great Britain is pointed out in a lengthy editorial in our conservative contemporary, *The Engineer*, of London.

With ill-concealed longing for the days—centuries of them—when Britain's policy "could be different from that of every other European power," the editorial reviews the changes that have been wrought since the World War, and ends on a note of what might be called optimistic resignation: too bad it had to happen this way but let's be cheerful, become acclimatized, and learn to carry on efficiently. "After living for nearly nine centuries in a land which had never been invaded, a land armed and protected by the sea, we are now obliged to recognize that our island is vulnerable and to accommodate ourselves to a new state in which the possibility of hostile attack must constantly be envisaged. . . . We are become as the rest of Europe; a country with violable frontiers. That is a condition which we do not fully comprehend; in time we shall become accustomed to it as men become accustomed to a singing in the ears and cease to notice it. We must remember, too—it appears to be often forgotten—that the effect is reciprocal. . . . If a continental army could strike at us in an hour or two, it is equally true that we could strike at it. If armadas of the air have brought for us a new danger, they have for other European powers increased an old one, thus augmenting their anxieties." There is much too much for quotation here, but we might add this from the conclusion: "But when we have grown accustomed to it, when it is just as much of our normal existence as it is now of all European powers, we shall pursue our course hardly aware of it."

Here is British composure in concerned mood. Changed conditions, indeed! Almost too long did the British wait; and now they find themselves faced with a problem difficult for them to understand. They had, therefore, to revamp, almost overnight, their armaments program and simultaneously devise a new approach to international problems. Would not this situation explain the mystery of some of the recent commitments and political maneuvering of Britain's international experts?

In expressing the hope that Britain will, as usual, find her way safely out of the morass, let us not be too cocksure about our own position. Britain's situation teaches its lessons. We, too, have waited almost too long. Until very recently, we had built comparatively few new naval vessels, had neglected our defenses. Our frontiers may not be violable as are Britain's, but that "first line of defense" has been our pet delusion for years, it has been very lame. Perhaps planes may not for years—or decades—violate our continental frontiers, but sooner or later such a possibility must be faced. In the meantime, our sea frontiers—vital to our continued peaceful existence and well-being—must be reinforced by new ships of the sea and air lest some daring aggressor covet them. Our new naval building program and the air-mindedness of the brains of the Navy, which Captain Ingram discusses, constitute a splendid start toward taking up the lag and helping us out of our own morass—of self-sufficiency and vaunted invulnerability—in which we wallowed for years.—*F. D. M.*

Creakily We Move Along

IF someone has been in an accident and lost an arm or a leg, it never occurs to others to regard him with different esteem than before. Luck was to blame and the same ill luck might have hit any of us.

Similarly, if one has lost the use of one of his senses, people do not think of holding this against him—why should they? To do so would be crazy. Apropos of this, in that delightfully frank and honest book, "Louder Please," Elmo Calkins has pointed out the rational attitude toward deafness. Himself deaf, he sees no reason for hiding it, he says.

Or suppose one of our internal organs has gone out of whack, no one then dreams of blaming us, for we deserve no censure.

Now suppose another internal organ, the brain, ceases to function properly. We call this insanity and for some reason we seem to regard this organ's dysfunction uniquely in the light of something akin to disgrace. Physicians tell us the last fact they can pry out of their patients is the existence of insanity in their families. Not, however, that this attitude on the part of the individual is irrational. Indeed, it is an entirely logical and necessary defense against a world which seems to regard insanity as blameworthy or at best in an exaggerated light. Here, it is the world itself which is possibly a little bit "insane."

Because a coming newer enlightenment is thereby indicated, it is encouraging to learn that cured mental patients in Illinois are now forming an association of former patients of psychiatric institutions, and will engage in a public educational campaign for the purpose of changing the attitude of the community toward mental disease. We offer them our comments as a contribution to that campaign.

There was a time not very long ago when the insane were punished. Today we look upon this odd attitude with horror, but we incline to think of our own modern attitude as enlightened. Perhaps, however, it is not even yet quite so fully enlightened as we appear to think it is.—*A. G. I.*

Today—Tomorrow

AN event of vast significance for the future was witnessed late in May by a large group of educators, publishers, and others vitally interested in the promotion of cultural activities. At that time was dedicated, at Oglethorpe University, Atlanta, Georgia, a crypt in which is to be sealed, for 6000 years to come, a comprehensive record of the civilization of today. A far distant generation will be the beneficiary.

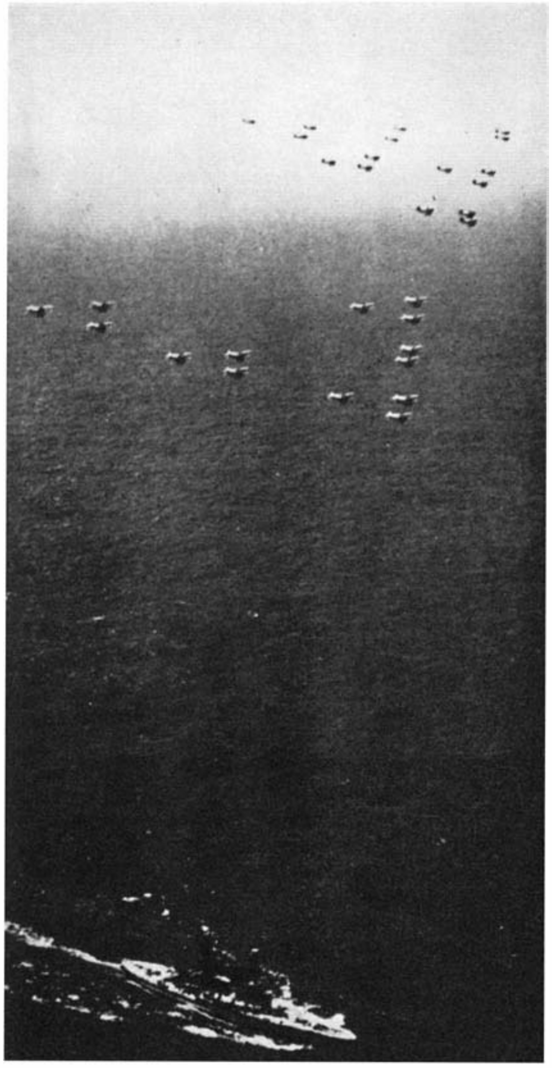
Every possible contingency has been foreseen in planning this gift to future archeologists. Far-reaching and world-wide changes will take place while these records lie untouched, ready to spread their information to an unknown people of the future. It is possible, indeed, that the language of that distant time may not be English; even this possibility has been considered and steps have been taken to make available lessons in English for a people which may have lost all record of our present tongue.

First proposed through Scientific American by Dr. Thornwell Jacobs, President of Oglethorpe University, the idea of providing such a sealed and guarded history of our age has rapidly gained momentum. The list of individuals and organizations which will contribute to the success of the project is much too long to include here. But we must pay tribute to the far-seeing generosity of Dr. Jacobs, whose boundless faith and indefatigable efforts have guided the plan far along the path toward completion. The first crypt is now being filled; it is hoped that others will follow. To Dr. Jacobs goes the heartfelt thanks of all thinking people for providing the basis for an altruistic and unselfish gift to the world of 6000 years hence.—*A. P. P.*

AN AIR-MINDED FIRST LINE OF DEFENSE

Naval Air Force Efforts Directed Toward One Main Objective—to Increase the Efficiency and Striking Power of Whole Fleet

By **JONAS H. INGRAM**
Captain, United States Navy



THE startling events of the past few weeks, preceded by the militant actions of great nations for the past two years, offer a tragic demonstration of how quickly an unprepared country may be subjected to the will of an unscrupulous outside force in total disregard of written treaties, law, morality or justice.

Recently, the President of the United States addressed a message to the Congress recommending authorization for an increase of the U. S. Navy of approximately 20 percent. This proposed naval expansion is to provide adequate national security and to aid in insuring peace. Following this important declaration by the Chief Executive, the Secretary of State enunciated the foreign policy of the United States, but added that "no policy would prove more disastrous than for an important nation to fail to arm adequately when international lawlessness is on the rampage."

The catastrophic developments in international relations have aroused the people of this country from an apparent apathy in regard to our own defense to such an extent that there is more active interest being taken in our Navy than has been shown in a decade.

This reborn public interest has aroused open discussion of the fundamental principles of security as applicable to the Navy. Many opinions have been expressed by radio commentators, pacifist organizations, and other well-meaning but poorly informed sources. The result has been that the citizen who wants to know the facts and who is entitled to the information is more or less bewildered as to what we have and what we need, not only to provide security, but to maintain this country in a peaceful and non-aggressive status.

The Naval Affairs Committee of the House of Representatives have held extensive and illuminating hearings on the Naval Expansion Bill. The testimony is lengthy but if every citizen had the time to read it, he would be convinced that the professional naval officer knew much more of the subject matter than expressed by most others appearing before the committee. Furthermore, the evidence is conclusive that weight should be given to the opinions of these men who have consecrated their lives to the study of war at sea and who are much better equipped to settle such controversial subjects as "plane versus surface ship."

Contrary to general opinion, the Navy is air-minded to the *n*th degree. A modern naval officer not air-minded would be just as antiquated as the old veteran familiar only with square riggers and muzzle loading carronades. The naval officer has, indeed, been a pioneer in the development of American aviation; and there are several naval fliers on the active list today who received their first training from the Wright brothers and Glen Curtiss. On the active list today are officers and men who made the first Navy transatlantic flight soon after the World War.

THE naval air force has expanded quickly and has contributed much to the development of aviation in general. The naval aviator has co-operated with the civilian designer in the progressive developments of planes, engines, control instruments and safety devices while working in his own field in designing catapults and plane carriers and using ingenuity to devise tactics to accommodate the various types of naval planes.

When aviation progressed to the point that a plane could be successfully catapulted from a man-of-war, could be picked up in a seaway, refueled and sent off again, the Navy knew it had something worth while. This is a weapon of inestimable value.

A splendid training school for naval aviators was established at Pensacola, Florida. Ground aviation was incorporated in the curriculum at the Naval Academy, where midshipmen were given instruction in ground aviation, gunnery, aerial navigation, and communications.

Each graduating class is subject to a rigid physical examination for aviation. After two years at sea, a certain percentage of those found physically qualified are selected for flight training. After an intensive year's training course, those successful in passing all the tests earn the coveted "wings" of the naval aviator. Many older officers of all grades were given the same course of training. The net result is that the Naval Air Force is manned by *regular naval officers.* There has been an exception to this re-

The opinions or assertions contained herein are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the Naval Service at large.

cently when some college men have been taken in as cadet aviators, given flight training, and now have flight duty only.

An accompanying table indicates the percentage of regular line naval officers who are qualified first class aviators, their paramount duty being aviation. These statistics are enlightening and may be surprising. At any rate, they go a long way to substantiate the statement that the Navy is air-minded; indeed, they show that great numbers in the regular establishment are actually engaged in duty connected with the aviation arm of the fleet.

THE non-flying naval officer has watched the progress made by naval aviation. The Commander-in-Chief of the Fleet, his subordinate Commanders and Captains of individual ships *know* what service the Air Force can give them. The gunnery people on board ship know what valuable assistance the Air Force can provide in the control of gun fire. The Air Force is valuable in so many fields of endeavor that it is a component part of the fleet; it works in close conjunction with the fleet but, on the other hand, is also dependent on the fleet.

As a consequence, the Navy has the same confidence in the air component as in the other categories that go to make up the fleet.

The Air Force in the fleet is commanded by a flying Admiral. The big plane carriers are commanded by flying Captains who are also regular naval officers. A recent Commander-in-Chief of the United States Fleet has been a flight officer and the present Commander-in-Chief of the United States Asiatic Fleet, Admiral Harry F. Yarnell, is a qualified naval aviator and has been Commander of the United States Fleet Air Force.

A fleet to be efficient must be in material readiness with a trained personnel ready to fight on 12 hours' notice or less. In view of the fact that it takes from two to four years to build a large surface ship and from one to two years to build up the air force to the strength necessary, we cannot hope to have the desired naval effectiveness prior to 1942, though the psychological effect of this building program on any probable foe would certainly act as a deterrent to any contemplated hostile activity against this country.

Experience has proved that airplanes are not capable of operating independently over vast areas of the open sea. For this reason, no fleet operating at sea, at great distances from land, can be assured of the vital assistance afforded by airplanes unless it provides within the fleet itself the means of basing, maintaining, and efficiently operating such airplanes.

Every combatant ship of our fleet, except destroyers and submarines, carries its complement of airplanes, varying in numbers from 78 operating aircraft on the carriers to two to four on other ships. Constant training has developed tactics for harmonious and efficient co-operation between air, surface, and sub-surface units to a point where aircraft in fleet operations are as much an indispensable part of the whole as any other type of ships. Airplanes have not supplanted ships, but they have added enormously to the power and efficiency of the fleet as a whole.

There has been presented to the public (but not by the Navy) the controversial issue of the superiority of the plane over the surface ship. This same discussion has been aired before by the supporters of submarines and torpedo boats when these innovations came into effective being. The answer is the same in all three cases. A lone battleship would be at a serious disadvantage if attacked in force under ideal conditions by any one of these three types of units.

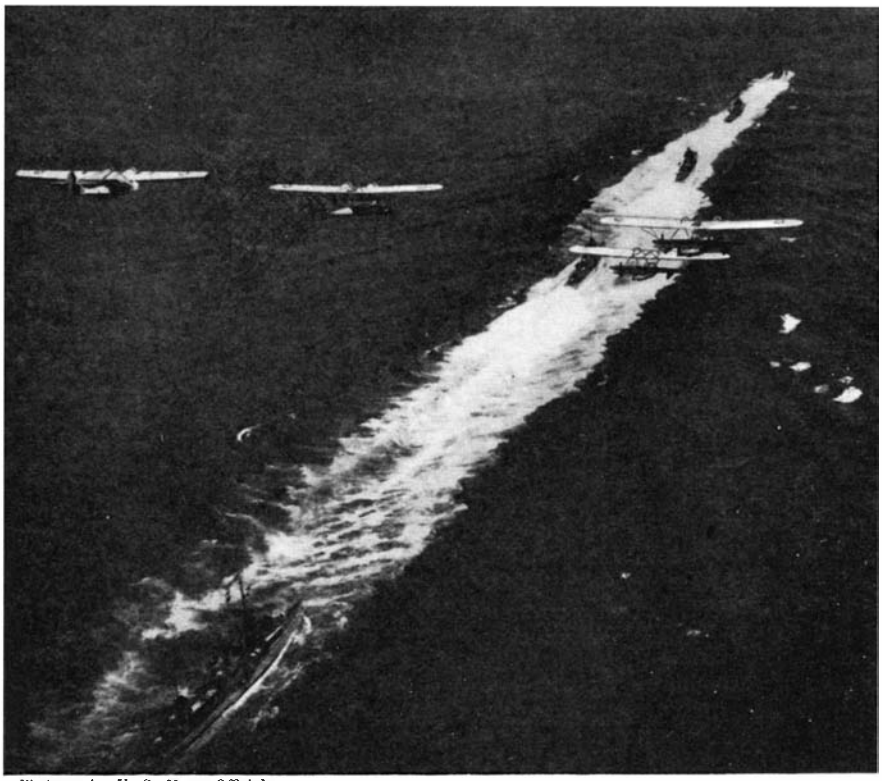
A lone battleship or lone battle line attacked by a number of submarines would be at a disadvantage. Some of the pre-war ships might have been sunk by one torpedo hit. To obviate this, the construction of ships was complicated by extra compartmentation and blisters so that a ship might receive several torpedo hits and still be able to maneuver and deliver effective fire. In addition to this, the destroyer screen was developed so that battleships might cruise in submarine waters with no grave danger.

A lone battleship at anchor, if attacked by a number of planes, would undoubtedly be hit. New horizontal protective and splinter decks would withstand many direct hits, and her blisters and compartmentation would protect against the near hits. The battleship's heavy anti-aircraft battery would certainly do damage but could probably not beat off a heavy air attack.

It is, however, hardly conceivable that a lone battleship or lone battle line would ever be allowed to be subjected to such an attack unsupported. The defense against an enemy air raid is, first,

Aviation in

	No.	*%*
1. Total number of line officers in the regular Navy, January 1, 1938	**6327**	**100**
2. Naval aviators—1st line active duty		
Admirals 3		
Captains 15		
Commanders 52		
Lt. Commanders....162		
Lieutenants 441		
Lieutenants (jg)....337		
Ensigns 1		
Warrant Officers.... 8		
	1019	**15.9**
3. Line officers having had benefit of ground aviation or flight training·but not in naval aviation at present......	**4531**	**71**
4. Line officers not regular aviators who have flown in naval planes in unofficial or semi-official capacity (estimated)		**95**
5. Estimated percentage of line officers who feel		



Photographs U. S. Navy, Official

Aircraft are as much a part of the fleet as are surface vessels

our own air force. If we are strong enough in the air they won't break through. If we are equal to the enemy, it is fair to assume that in the ensuing dog fight few enemy planes will break through and those that do will meet a warm reception from the anti-aircraft batteries of the heavy screening force as well as of the battle line itself.

Bombing a moving ship is much more difficult than bombing a town or other area on shore. Actual bombing records under target practice conditions, where no opposition is involved and conditions are usually ideal, show that the accuracy of bombing against a ship target, small in area and free to maneuver at high speed, is much less than with a target on shore and naturally decreases

the Navy

		No.	%
that naval aviation is a great asset to our fleet and who are air-minded to a high degree			99+
6. Number of enlisted men qualified pilots		396	
7. All other enlisted men in aeronautical organization		18,796	
8. *Flying cadets:*			
In fleet	406		
Pensacola	341		
Total		747	
9. *Training:*			
Naval aviators	97		
Naval aviator pilots	140		
Cadets	341		
Total		578	
10. Number of serviceable planes in commission October 31, 1937		1134	
Number of planes on order		652	
Total planes		1786	

with the altitude of the bombing planes. The higher they fly, the poorer their accuracy. The lower they fly, the greater their exposure to anti-aircraft fire.

When the fleet is disposed in a cruising formation or for battle the number of highly efficient anti-aircraft guns that could be brought to bear on an enemy air raid literally amounts to hundreds. Actually there are more than 800 five- and three-inch anti-aircraft guns in the fleet. This battery, which is probably the largest in the world, is capable of putting into the air more than 8000 rounds of shrapnel a minute. Surely enough to make the overhead spaces very dangerous for any type of plane, bumpy enough to jar the most intrepid ace. Their effectiveness cannot be discounted; they are capable of placing a barrage at a greater height than 20,000 feet and they are effective for direct hits against a fast moving target at from 12,000 to 15,000 feet. They can put out a terrific fire against dive bombing.

More than simply "eyes of the fleet"; aircraft are "hornets" as well

There are, therefore, three main defenses against aircraft raids on our own fleet. The first and most effective consists of breaking up raids by our own air striking force. The second is concentrated anti-aircraft fire from the entire fleet. The third resides in the armored deck protection, compartmentation, blisters and maneuverability of ships.

Under present-day conditions it may be reasonably assumed that no foreign fleet could cross either great ocean and arrive with sufficient air strength to wrest control of the air from our *proposed fleet.* And with control of the air in the area of operations, our fleet should be in a position to effect a sudden termination of the campaign.

In this connection, it should be noted that the advent of the airplane has changed both defensive and offensive tactics. For example, if the Navy is called upon to protect a section of our coast the first line of defense must be projected seaward 500 to 1000 miles or more to prevent effective launching of an enemy air attack that far from the coast or to prevent the enemy from establishing a shore base from which they could initiate an air raid.

The component parts of a well-balanced fleet are: (1) The battle line, consisting of heavily gunned and armored ships, the backbone of the fleet—able to take and give heavy punishment, the loci of all offensive and defensive operations; (2) The air force, consisting of the plane carriers, carrier planes, ship's planes, and the tender shore-based patrol planes; (3) The cruiser force; (4) The destroyer force; (5) The mine force, minelayers, and sweepers; (6) The submarine force; (7) The fleet auxiliaries—fuel ships, supply ships, repair ships, hospital ships, and others.

If the veil of secrecy could, for reasons of national security, be raised from this fleet so that every one could see the practical tests demonstrated by a great naval maneuver at sea, the points made in this article would be apparent. Any doubt as to effectiveness of the various elements of the fleet would be removed. There would be no question as to the need for all the elements that go to make up this fleet. Respect for the battleship would be re-established. Admiration for the air force would be expressed. The casual observer would agree with the naval officer that our Naval Air Force has no peer in the world for its size—and its size will soon not suffer by comparison.

THE Navy makes no attempt to evaluate the relative effectiveness of each type component of the fleet. They all have certain limitations. The statement that any type is superior to any other type is misleading.

No one knows better than the Navy, the uses, potency and desirability of a powerful air arm. Our fleet without the air arm would not be a fleet, nor would it be a fleet with only an air arm.

The Navy will, therefore, do all in its power to maintain the proper proportion of aircraft to keep our fleet balanced. Our people may rest assured that aviation in the Navy will receive enthusiastic, intelligent, and sympathetic support that will produce an even greater and more effective air arm.

What concerns the Navy most is that we may have the ingenuity, initiative, and sufficient appropriations to keep our fleet second to none, for it is the unanimous opinion of your trained naval officer that such a fleet will not only provide this country national security but it will be the means of maintaining for us the everlasting peace which we so desire.

THE COOLEST STARS

Results of the Recent Successful Search for Faint Exceptionally Red and Infra-red Dwarf Stars . . . How The Temperatures of Such Stars are Ascertained

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.

WE considered last month the question of the Sun's temperature—finding, perhaps to our surprise, how many ways there were of defining it, and of getting some sort of average value for the different layers of hotter or colder gases from which the light comes to us. The question, How hot is a given star? is clearly an even more important one for astronomers; but, unfortunately, we have a much smaller number of ways of answering it. Except in a very few cases, we cannot use the reliable method depending upon the total amount of heat radiated per square mile of the surface, for the heat is too small to measure, except for the brightest stars, and the diameter can be observed for only a very few. The last difficulty prevents us, too, from making the alternative calculation depending on the amount of light of a given color which is emitted per square mile. We have to depend upon the more complicated conception of the color-temperature. It is not hard to measure the color of a star's light—that is, its relative brightness in any two known wavelengths; and it is very simple, theoretically, to calculate how hot a standard radiator would have to be to give out these kinds of light in the same proportion. The trouble is that the gaseous surfaces of the stars are unlikely to behave like a standard solid hot body. Even so, we appear to get good results, so far as we can test them, for most stars.

To save circumlocution, the writer will at this point—with due apologies—put in just a little algebra. It can be shown from the general law of radiation that, if a perfect radiator of radius R times the Sun's, and temperature T (on the usual Kelvin scale) were viewed as a star, at the standard distance of ten parsecs, and its stellar magnitude M measured in light of wavelength λ, the result would be $M = A + \frac{B}{\lambda T}$, where A is a constant depending on our zero-point of measurement, and B has the value 1.535×10^8, provided that λ is measured in Angstrom units as usual. (This is not an exact formula, and must be corrected for very hot stars—with which, however, we are not here concerned.) Introducing the known value of M and the approximate temperature 6000° for the Sun, it is found that for visual observations, for which the effective wavelength is a little less than 5400A, $M_V = \frac{28500}{T} - 5 \log R + 0.08$. For photographic observations (λ4300) $M_P = \frac{35700}{T} - 5 \log R - 0.56$. The difference between the visual and photographic brightness, called the color-index, is $M_P - M_V = \frac{7200}{T} - 0.64$, or, re-written, $T = \frac{7200}{M_P - M_V + 0.64}$.

The calculation of the temperature at which a standard radiator would give out light of the observed color of the star is thus made very simple. For a star like Vega, for example (Class A), $M_P = M_V$, and $T = 11{,}200°$ (closely enough).

The temperatures calculated in this way range from over 20,000° for the blue-white stars of Class B to about 3000° for the red stars of Class M. Evidence that this temperature scale is not seriously wrong is afforded by the few stars for which we know the diameters, and can use the other methods, and also by the various degrees of excitation of the atoms (as discussed last month) which are shown in the spectra.

THERE are some cases, however, in which the results are obviously wrong. The very red stars of Class N give out almost no ultra-violet light. If one tries to calculate the temperature by comparing their visual brightness, in the green, with that in the ultra-violet, the results come out something like 1000°—an impossibly low value, since the spectra show that great quantities of carbon vapor are present in the stars' atmospheres. Wildt has pointed out that these atmospheres, full of molecules of various compounds, should absorb ultra-violet light very strongly, while the corresponding effect in the green and yellow, though present, is much weaker. Since stellar magnitudes increase numerically for faint objects, these atmospheric effects increase M for both kinds of light, but much more for the ultra-violet than for the green, and it follows from our equation that the calculated temperature will be too low.

For the commoner type of red stars (Class M) the absorption bands of titanium oxide are very strong in the green and yellow, and not prominent in the violet, so that the effect works the other way, and the calculated temperatures are too high.

It is obviously desirable to get at least partially clear of these difficulties—and this may be attempted by measuring the magnitudes of the stars with other colors of light. It would be of little use to go into the ultra-violet—the Earth's atmosphere absorbs more, and so do the atmospheres of a large proportion of the stars. But it is worth while to go the other way, into the red and infra-red.

Modern photographic plates are sensitive to regions far beyond anything that the eye can see, and some of the newer ones are fast enough to give good images of the stars with a reasonable exposure time.

Successful work has been done in this way by several observers—notably by Dr. Hetzler at the Yerkes Observatory. With suitable plates and color filters, he has secured numerous photographs with light of average effective wavelength 8500A, and a smaller number at 9300A, and has worked out and tested photometric methods for determining "infra-red" magnitudes of the stars. The zero-point from which these magnitudes are measured was adjusted so that they agreed with the ordinary visual magnitudes for a star of spectral class A0 (for which the photographic magnitudes are also adjusted to agree).

If we let $\lambda = 8500$ in our first equation, and adjust the constant A so that the results agree with the other magnitude systems for $T = 11{,}200°$, we find by very simple algebra

$$M_I = \frac{18100}{T} - 5 \log R + 1.01.$$

The difference between the visual and the infra-red magnitude, which Hetzler calls the infra-red index, comes out $M_V - M_I = \frac{10400}{T} - 0.93$ or, solving for T, $T = \frac{10400}{M_V - M_I + 0.93}$. Similarly, from the photographic and infra-red magnitudes, we find $T = \frac{17600}{M_P - M_I + 1.57}$.

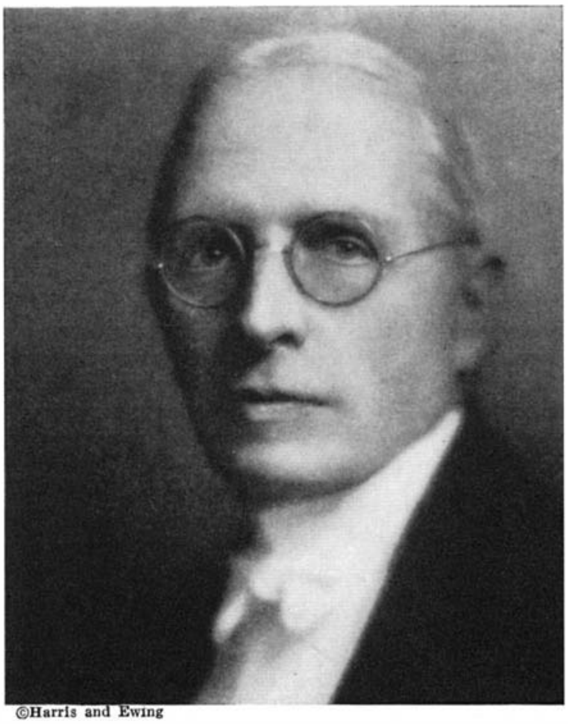
We have now three ways of getting the temperature of a star—but not three independent ways (for the third equation may be derived from the other two by "clearing of fractions" and adding). For a star which radiated like a standard "black body" the three results should come out the same, barring the small influence of errors of observation. If the results from good sets of magnitude observations do not agree, it is clear that the star does not radiate like a black body. We may then be able to apply whatever other knowledge we have to decide which of the three values is most nearly right. For example, for an ordinary giant star of Class K, $M_P - M_V$ is about 1.0 and $M_V - M_I$ about 1.5, whence $M_P - M_I = 2.5$. Applying our equations, we get temperatures of 4390°, 4290° and 4340°, respectively. The rather outrageous simplification which substitutes a hypothetical uniform solid surface for the combined effect of the hotter and cooler layers of gas at different depths in the star's atmosphere works remarkably well in this case.

FOR the redder giants, of Class M, $M_P - M_V$ averages about 1.8, $M_V - M_I$, 3.0, and hence $M_P - M_I$, 4.8. The corresponding temperatures are 2950°, 2650° and 2750°. The agreement is not so good; but we know that for these stars the band absorption makes M_V too faint (numerically, too big) without affecting either of the others as seriously. Hence the first of the calculated temperatures should come out too high, the second too low, and the last be little affected.

These are, however, commonplace objects. The most interesting feature of Dr. Hetzler's work must have been the successful search for exceptionally red stars. With the Yerkes 24-inch reflector, and the 10-inch Bruce camera, (which has a good, sharp, focus for the infra-red) stars are occasionally found which stand out on the infra-red plates, but are almost invisible on plates taken with yellow light, and often quite invisible on ordinary plates, sensitive only to the blue and violet.

A good many stars have thus been found which have infra-red indices ($M_V - M_I$) of 6^m or more, and a few values run up to 9^m or even 10^m. A star which is 10,000 times brighter in infra-red light than to the eye must be a remarkable object. Our equation would give a temperature of 1500° for an index of 6^m, 1170° for 8^m, and only 950° for 10^m. It is probable that in these extreme cases the visible light is greatly cut down by opacity in the star's atmosphere, which has less effect in the infra-red. But, making all allowance for this, it is clear that this infra-red survey has introduced us to cooler stars than had ever been known before.

Many of these very red stars are previously known variables, mostly of long period—which was to be anticipated since it was already known, from measurements of the total heat radiation, that typical stars of this sort had temperatures of the order of 2000°, and often less at minimum. The variation in the infra-red is much smaller than in visible light. This is to be attributed partly to the direct effects of temperature—which, as our equations show, should produce a range 60 percent greater in the visible than in the infra-red, and partly to increasing band absorption in the visual region as the star grows cooler. A considerable number of the very red stars discovered in the new survey have already been found to be variable, and more will probably turn out in future to be so.



©Harris and Ewing

At various times regular readers of Professor Russell's monthly articles on astronomy have requested the editors to publish his photograph. This is now done without his knowledge, since he is on the high seas at the time of insertion

The newly discovered "infra-red" stars all have small proper motions—as is indicated by comparison of recent photographs with others taken many years ago (on ordinary plates). This indicates that, like the long-period variables, they are giant stars much brighter than the Sun visually, and still brighter in infra-red light. It is likely to be a good while before accurate determinations of proper motion, and hence of distance and real brightness, will be practicable; but there can be no reasonable doubt that they must be bodies of very large size. One more look at our equations shows that, if differences of temperature alone were at work, the change in actual brightness of a star, even in the infra-red as its temperature decreased, would be almost twice that in the infra-red index. A liberal allowance for selective absorption still leaves us with the conclusion that these stars give out much less light per square mile than any others. Hence it is probable that they are of enormous dimensions—with diameters very likely exceeding that of the Earth's orbit.

HETZLER notes that, in a careful survey covering about 300° square degrees (1/14 of the whole heavens), no infra-red indices greater than ten magnitudes have been found. He suggests that this fact may have some astrophysical significance. One possible explanation is this: It is probable that these very large indices arise in considerable part from obscuration of the visual light by bands in the spectrum, as the stars grow cooler. If, near some limiting temperature, these bands reach a maximum of intensity, cooling down to this point would produce a rapid change in the index, as the bands increased, and further cooling would have a much smaller effect.

It would be of great interest to observe the spectra of some of these very cool stars. Observations of the red end, with great reflectors, should easily be possible; but it is doubtful whether even the greatest telescopes can collect enough light to make a photograph of the visual part of the spectrum possible.

In addition to these giant stars, Dr. Hetzler's list includes a few red dwarfs—specially observed. Barnard's star, for which $M_V = 13.7$ corresponding to a luminosity 1/3500 of the Sun's, has $M_V - M_I = 3^m.0$ which would indicate a temperature of 2650°. With this value we may go back to our equations and deduce $\log R = -0.58$, corresponding to a radius one quarter of the Sun's.

For the faintest known star, Wolf 359, $M_P = 18$, $M_V = 16.5$, and $M_I = 11.5$. The temperature comes out 3300° from $M_P - M_V$, 1750° from $M_V - M_I$ and 2200° from $M_P - M_I$. The last value is probably the best. It gives $\log R = -0.35$, and makes the radius 45 percent of the Sun's.

Neither of these values is likely to be very accurate, but they are enough to show that these extreme dwarf stars are so faint, not because they are very small, but because they are cool.

Modern Plant 'Wizardry'

Breeders Maintain and Improve Plant Heritage . . . No Magic; Persistence and Patience Get Results . . . Art and Science of Great Economic Value

By KEITH C. BARRONS

WHILE riding on a train not long ago I happened to engage in a conversation with an electrical engineer. After discussing a number of subjects, he casually asked the nature of my business. When I told him I was a plant breeder he replied: "Oh yes, you make crosses between different plants and that sort of thing."

Yes, we do make crosses between different plants, but "that sort of thing," as expressed by the engineer, represents the remainder of our work. It signifies the great mystery concerning the art and the science of plant breeding existing in the minds of most individuals. Exactly what does the breeder aim to do and how does he accomplish his purpose? What is plant breeding, anyway? These questions in one form or another have been asked of every plantsman time and again.

Plant breeding involves more than the cross-fertilization of different individuals, or hybridization, as it is technically known. Indeed, it involves more than the so-called creation of valuable new varieties. Any effort on the part of man to maintain or improve the heritage of plants is rightly classed as plant breeding. Note these two phases of the breeder's work: to maintain and to improve the heritage of plants. The maintenance of varieties at their original hereditary level is not as spectacular as the creation of new strains, but its importance is unsurpassed. Without careful propagation and seed-growing methods, and without the continual elimination of off-type plants known as rogues, the best varieties would soon "run out" and lose much of their usefulness.

Although cultivated plants vary in size from radishes to giant forest trees, in botanical relationship from mushrooms to sunflowers, and in utility from wheat to orchids, the same principles of genetics govern the transmission of hereditable characters from parents to offspring. There are also fundamentals of breeding practice applicable to all plants and certain other basic methods which may be used with plants within a certain group. If one understands these underlying principles of breeding, which are based on a sound knowledge of genetics and the various branches of botanical science, he has only to "know his plants" in order to be an efficient breeder. By knowing his plants, I mean that he must first of all be familiar with the types and varieties within the species with which he is working. It is imperative that he understand the morphology and physiology of the flowering parts of his plants and have access to the existing literature on the genetics of the particular species involved. Perhaps most important of all, he must know what improvements would be desirable—in short, what to save and what to throw out in breeding operations.

I once had a mongrel dog that, for my purpose at least, was better than any pedigreed member of a highly publicized breed. But he grew old, and being of an extremely complex genetic make-up it was useless even to attempt to breed another individual with the same temperament and physical characteristics. Finally, the old mongrel died, and his kind was lost forever. Even with so-called pure-bred strains of animals, no two individuals are exactly alike, and we must take our chances on transmitting the desirable traits of individuals to their offspring. But with many plants it is different, for, in addition to reproduction by seed, the practice of asexual, or vegetative, propagation makes it possible to perpetuate indefinitely the desirable individuals of most woody and many herbaceous species. Fruits and nuts propagated by grafting, potatoes grown from tubers, flowers increased from bulbs, and countless other ornamental plants grown from stem cuttings are examples of plants increased by vegetative means.

Snapdragon breeding. Plants with desired characteristics are fully caged to insure their self-pollination

IF I could have amputated my old mongrel's leg and from it grown another dog identical with the first, except for minor variations due to differences in environment, my act would have been comparable with these vegetative propagation methods. No sexual process is involved; so, regardless of what kind of a mongrel a plant may be, it can be increased year after year with no perceptible hereditary change with the exception of relatively rare bud sports or mutations. The winesap apple, for example, originated as an off-type tree grown from seed (a seedling, in the terms of the breeder) over two centuries ago. Like my mongrel dog, this seedling was superior to other members of its species, and before it died someone grafted its buds on other apple root stocks. Thus each tree in the vast winesap orchards today is a vegetative descendant of the original. In fact, genetically speaking, each tree is a part of that first winesap seedling.

A seed, like an embryonic animal, is the result of the union of sperm and egg cells. When the winesap apple is asexually reproduced, hereditary variation is no more likely to occur than at any other period in the growth of the plant, but if one plants seed of this same apple a wide variation in the seedlings will result. This variation is due not only to the possibility of the seed having as the male parent a variety other than winesap, but chiefly to the segregation or sorting out of the genes that control heredity. These tiny entities, present in every cell, account for both the likenesses and differences of parents and offspring. With plants, as with animals, one has to expect bad as well as good combinations of genes.

The story is told of a beautiful English lady who was a bit over-optimistic on the matter of gene combinations. She addressed a letter to George Bernard Shaw as follows: "Dear Mr. Shaw: You are by far the most intellectual man in the entire empire and I am considered the most beautiful woman. Would it not be fine if we were married? Our children would have your intelligence and my beauty."

A few days later she received a curt reply signed G. B. S., "Madam: What a calamity it would be if they had your brains and my figure."

When plants are grown from seed, their reproduction is comparable with that in animals except for the fact that, with few exceptions, they may be self-fertilized. Most individual plants possess both male and female sex organs which makes it possible to inbreed much more closely than in animals. In the case of many plants, self-fertilization is the rule rather than the exception, while others are naturally cross-pollinated.

It is well to emphasize the fact that plants grown from seed are often divided into two groups. The first group includes those that are naturally self-fertilized, such as beans, tomatoes, and wheat. Because of continual selfing, generation after generation, plants in this group are inbred to the extent that they are genetically pure, or homozygous in the terms of the breeder. As a rule, seed saved from individual plants will breed true for all inherited characteristics, and there will be no loss of vigor if new strains are started from individual plant selections. When a breeder is working with these naturally selfed plants, he does not have to isolate a variety being grown for seed purposes from others of the same species. Furthermore, individual plant selections do not have to be bagged or caged as neither wind nor insects will carry the pollen to any appreciable extent.

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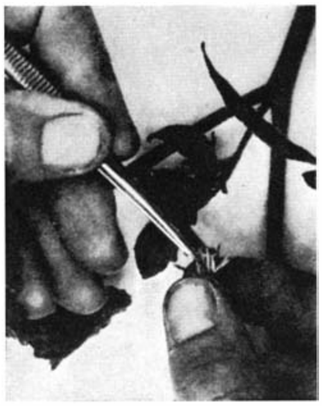

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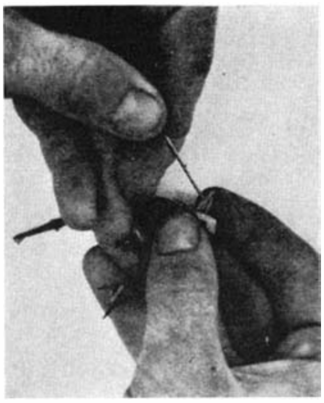

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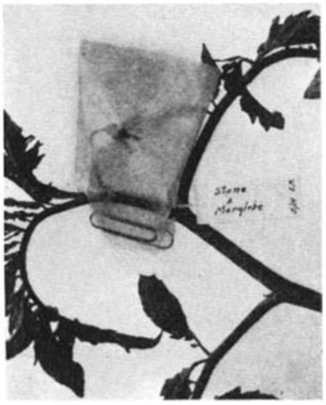


Steps in cross-pollinating a tomato flower. Cluster is trimmed (1) to leave chosen flower. Its pollen sacs are removed (2). Then pollen is secured from a male parent (3) and used to pollinate the chosen female (4); after which it is labeled and covered (5) with glassine bag

The second group includes those plants that are naturally cross-pollinated. Corn is a fine example, as its pollen is blown about by the slightest movement of air. When working with these naturally crossed plants, the breeder must control pollination by some form of isolation either of the entire plant or individual flowers. When he self-pollinates to secure a uniform inbred strain, vigor is often lost just as when brother and sister matings are made with dogs or farm animals. Lost vigor then has to be regained by crossing back with other inbred lines which are similar to the first with respect to those desirable characteristics the breeder wishes to have in his new variety. Due to their habit of cross-pollination, it is difficult to maintain absolutely pure strains of plants in this second group. There is usually some hereditary variation from plant to plant; therefore improvements can often be made merely by selection of individuals possessing the most desirable characteristics. Because of their great uniformity, selection alone is not as valuable a technique with varieties that are normally self-fertilized.

PLANT breeding is not unlike natural evolution. As expounded by Charles Darwin, there is a constant struggle for existence among all forms of life. Most individuals "can't take it," and only the fittest survive. This natural selection of the fittest has been called the guiding factor in evolution. When breeding plants, man largely eliminates the struggle for existence by proper cultural practices; however, natural selection remains as a guiding factor and is extended by man's selection of individuals and types that fit his needs. All in all, the plant has as tough a time surviving in the hands of the breeder as in nature, for we are ruthless when discarding individuals and lines. The difficult part of breeding plants is not in securing new and different things but in choosing the best and eliminating the mediocre and inferior. From a few crosses anyone can obtain variation in succeeding generations, but which of the variants are desirable? Which individuals should be saved and which discarded?

Selection of individuals is the basis of all plant-breeding work. Hybridization is but a means of increasing variation, a method of producing new combinations of characters. Hybridization must be followed by selection to be of any value. Progeny tests must be grown

A corn test plot where very important variety-testing is conducted

from plant selections of the seed-reproduced species in order to determine whether or not they will breed true. The establishment of true-breeding lines is far from the final step, as they must be thoroughly tested in order to determine their worth. For example, a tomato breeder may save seed from 100 plants that appear outstanding in a hybrid population. The following year 100 rows are grown, each from a different plant selection. Perhaps 20 of these lines appear to be breeding true; that is, each plant in the row seems to possess the same hereditable characteristics. Eight of these twenty lines appear outstanding on the basis of general appearance, so the other twelve are discarded. A breeder cannot introduce eight new varieties to tomato growers all at the same time. Perhaps the differences between them are very slight. Which will he save as the progenitor of a new desirable tomato variety? Answering such questions is one of the most difficult tasks of the breeder. Promising new strains must undergo rigorous tests for many things such as yield, quality, and resistance to disease before their value can be established. They must be compared in great detail with existing varieties in order to determine whether they would really make a worth-while addition to an already lengthy list.

WHEN testing plants for resistance to diseases, breeders have the aid of plant pathologists who have learned how to produce artificial epidemics. Thus the plants are subjected to natural selection of the most rigorous sort. Natural selection is a valuable aid to the breeder in developing varieties resistant to winter injury and drought, but again he sometimes out-does nature by exposing plants to artificial cold and drying winds to determine their true reactions.

In nature, plants did not evolve from lower to higher forms because of the factors of natural hybridization and selection alone. The genes controlling the development of distinct new hereditary characteristics did not exist at the bottom of the evolutionary ladder. They were formed by sudden changes called mutations from one kind of gene to another. Thus, step by step, new plants arose by successive mutations, or sports, as they are often called. It is the continual occurrence of such mutations that makes it possible for breeders to create plant varieties possessing characteristics entirely unknown before. The new characters made possible by mutations are by no means all desirable. For every mutation that results in a valuable new

Insects cannot further pollinate this hand-pollinated squash blossom

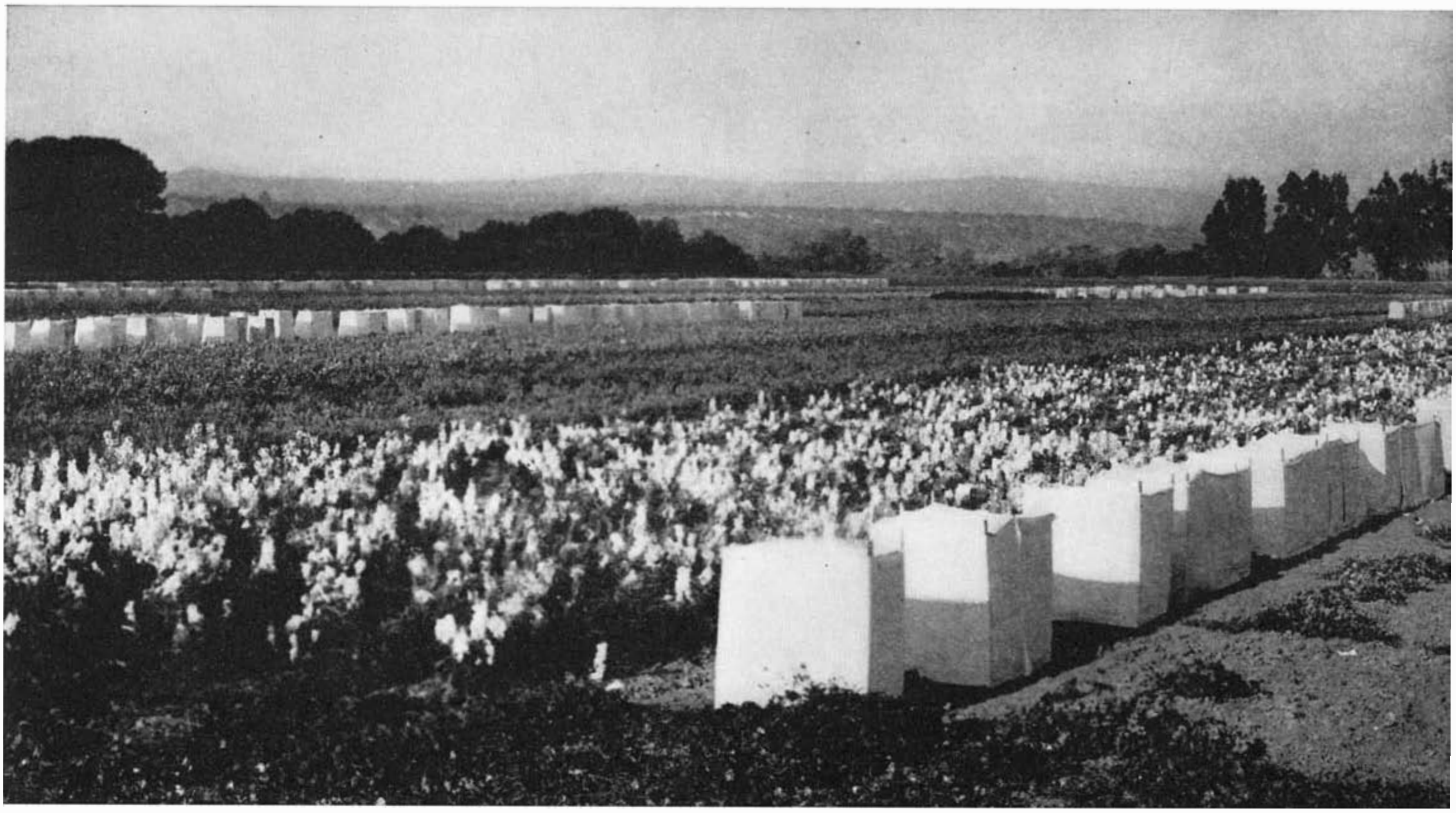
variety there are hundreds that cause a step down the evolutionary ladder, a reversion toward an ancestral type. Still others produce freaks or weaklings of no value other than scientific interest.

So-called "running-out" of varieties may be due to disease in many plants such as those propagated by cuttings, bulbs, and other vegetative means. In such cases, a systemic disease is carried from plant to plant in the vegetative part used for propagation. In seed-grown plants, running-out is usually due to a change in heredity rather than to disease. It may be brought about as the result of mechanical mixtures of seed, natural crossing with other varieties, or mutations to undesirable forms. These are the three things seedsmen have to fight continually. The off-type plants or rogues due to mechanical mixtures may be reduced or eliminated by care in harvesting, storing, and planting. Rogues due to natural crossing may be prevented by isolating crops being grown for seed, but rogues due to undesirable mutations can be reduced to a minimum only by the constant selection of desirable plants as a starting point for future seed crops.

DURING the course of a conversation with an English literature professor not long ago the subject turned to the plight of the southern tenant farmer and the legislation designed to aid him. "Why don't these farmers get some mares and raise their own mules rather than buy them from out of the state?" the professor inquired. "I should think they could save a considerable sum that way." I explained that horses do not thrive in the lower South due chiefly to climatic factors, and that they require more care and attention than the average tenant farmer would give them. "But I am talking about mules, not horses," the professor protested. "Why don't they get mule mares and raise mules from them?" I concluded that Shakespeare and Chaucer had sadly neglected the biology of the mule and hurried the conversation along to another subject.

Like the first generation cross between the jack and the mare, which results in the sturdy and vigorous mule, many plants resulting from crosses between two individuals of unlike heritage are notable for their hybrid vigor. Some, like the mule, are sterile and, therefore, of no value in themselves unless they can be propagated by asexual means. Many vegetatively propagated plants owe their

Self-pollinating cabbage plant by hand. Afterwards a large hood will cover and protect it



A flower breeding "work-shop" that covers acres and in which flowers may grow under natural conditions of soil and weather. The many scattered cages enclose individual nasturtium plants which have been saved for breeding purposes

existence as worth-while varieties to the fact that they possess outstanding hybrid vigor which can be carried on indefinitely.

With seed-grown plants, hybrid vigor can be of commercial importance only when it is practical to make crosses on a large scale. This has been done in a minor way with such plants as the tomato and eggplant, both of which yield a relatively large number of seeds for each hand-pollination, but corn is the outstanding example of the utilization of first-generation crosses as commercial seed. Corn is very easily cross-pollinated on a large scale merely by the alternate planting of varieties which have been found to make good parents; that is, varieties which, when crossed, will produce a first generation that possesses considerable hybrid vigor as well as other desirable characteristics. The tassels are removed from all plants of the strain being used as the mother parent so there will be no self-pollination and all seed produced on these de-tasseled plants must be from cross-pollinations. This is the seed that is sold so widely today as hybrid corn. In addition to possessing exceptional vigor, hybrid corn is noted for its great uniformity. The parents used in producing such corn are usually inbred lines which have been found to transmit especially desirable characters and remarkable vigor to their offspring.

MODERN plant-breeding work as conducted by the state and federal experiment stations is not a "lone-wolf" affair. Men with diversified technical and scientific specialties often co-operate on one breeding problem. The improved variety which results cannot be called the production of one man, sometimes not even of one institution. For example, let us look at Thatcher wheat, a new variety from the Minnesota Agricultural Experiment Station which combines excellent milling and baking quality with high yield and remarkable resistance to the dreaded black-stem-rust disease. Thatcher is truly a monument to scientific co-operation. It is the product of years of cumulative effort on the part of specialists in the field of breeding, in plant pathology, and in cereal chemistry to produce a highly rust-resistant variety, the grain of which would make flour to suit the most exacting baker and the most fastidious housewife. The breeders did the hybridizing and selecting necessary to the production of a new variety, but working alone they could never have accomplished the results that have been realized. Milling and baking specialists made thousands of tests of grain from different strains the breeders had selected. From these small samples they ground flour and made loaves of bread so the breeder could be informed which of his selections would meet the millers' and bakers' requirements. The plant pathologist had to develop a method of creating an artificial epidemic of the rust disease in the breeding plots so the selections could be tested for resistance each year and not have to wait for a natural epidemic to come along. A grain variety must yield well or farmers will not grow it even if it does resist the rust which so often ruins their crop. Thousands of selections had to be tested for yield in various parts of the spring wheat belt. Dozens of wheat specialists co-operated in this routine testing. Samples of grain from small areas were weighed and yields in bushels per acre calculated from these figures. The particular cross which resulted in Thatcher was made in 1921, but the history of this variety goes back much further than that. Each of the parents of the Thatcher cross were hybrids themselves, one made between the varieties Marquis and Immulo, a durum wheat, in 1915, and the other between Kanred and Marquis in 1918. But the breeding of Thatcher really had its beginning long before these crosses were made. Back in 1907, following a great rust epidemic which swept over the spring wheat belt, the Minnesota Agricultural Experiment Station and the United States Department of Agriculture began a search for a wheat like Thatcher. Thus Thatcher is the result of 30 years of uninterrupted effort.

EVEN after the state and federal experimenters had passed final judgment on this new variety, and after millers in Minneapolis had said, "It's O.K." on the basis of car-lot grindings of flour, the job was not finished. The task of the agricultural extension people, the farm organizations, and the farm magazines had only begun. They had to tell the grower about Thatcher, tell him what it would not do in certain localities. It was their job to put Thatcher across to the farmer. It was up to the seedsmen to grow and distribute this new variety in the same pure form in which it was first released by the experimenters. Indeed, the successful plant breeder today must first of all be a good co-operator.

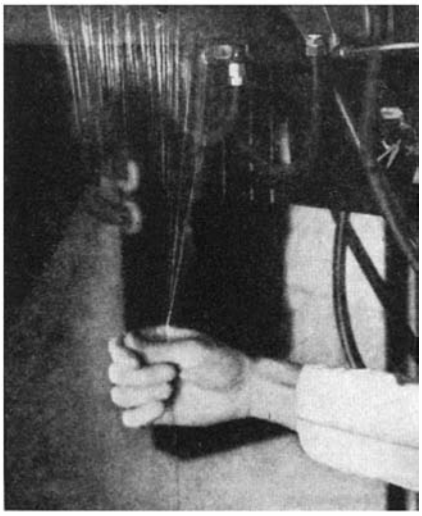
Photographs courtesy Agricultural Experiment Station, Auburn, Alabama; Associated Seed Growers, Inc.; Bodger Seeds, Ltd.; Ferry-Morse Seed Company.

This is the second of two articles by Mr. Barrons. Readers interested in some of the actual results of plant breeders' work are referred to his former article "Streamlined Plants" in our March issue.—*The Editor.*

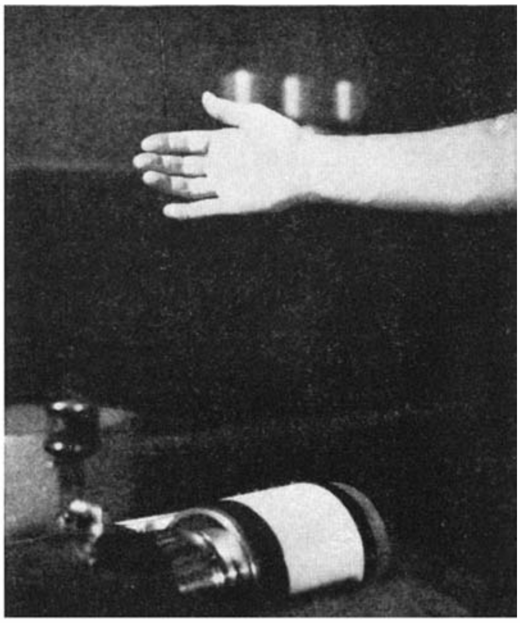
MIRACLES FROM MARBLES

By A. P. PECK

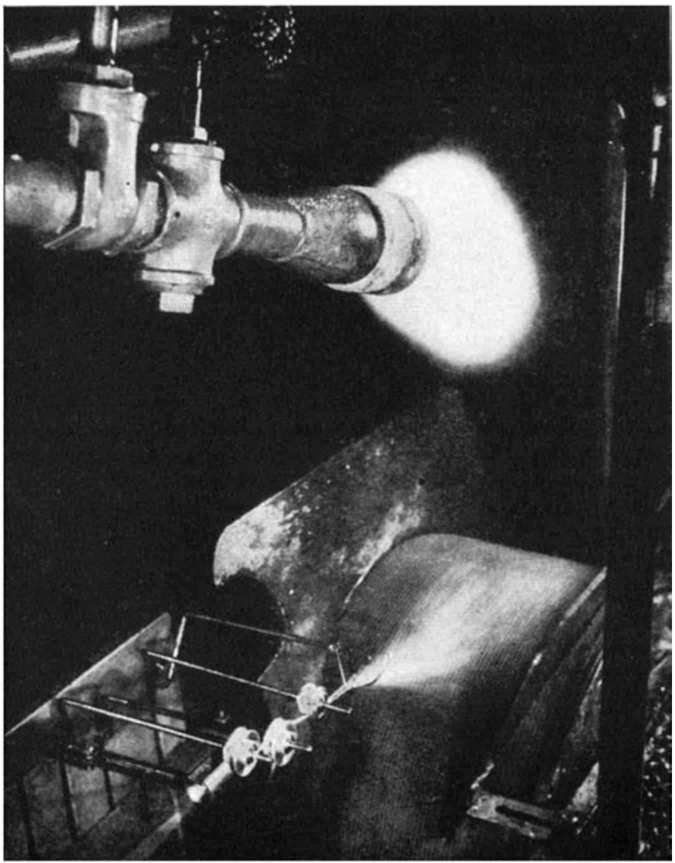
1 Fibrous glass, not new but now available for numerous applications through American ingenuity directed toward perfection of production, is made from "glassies", delight of schoolboys. Marbles are of convenient size and shape for feeding to melting tanks in both of the speed processes described here for making practical glass fiber



2 *Left center:* Glass marbles are fed automatically to melting tanks. In the "continuous filament" method of producing textile glass, the molten marbles flow downward from the tank through 102 holes in the pot. Thus a filament of glass emerges from each hole, to be grasped by the operator and attached as a bundle to a rapidly revolving steel drum or spool

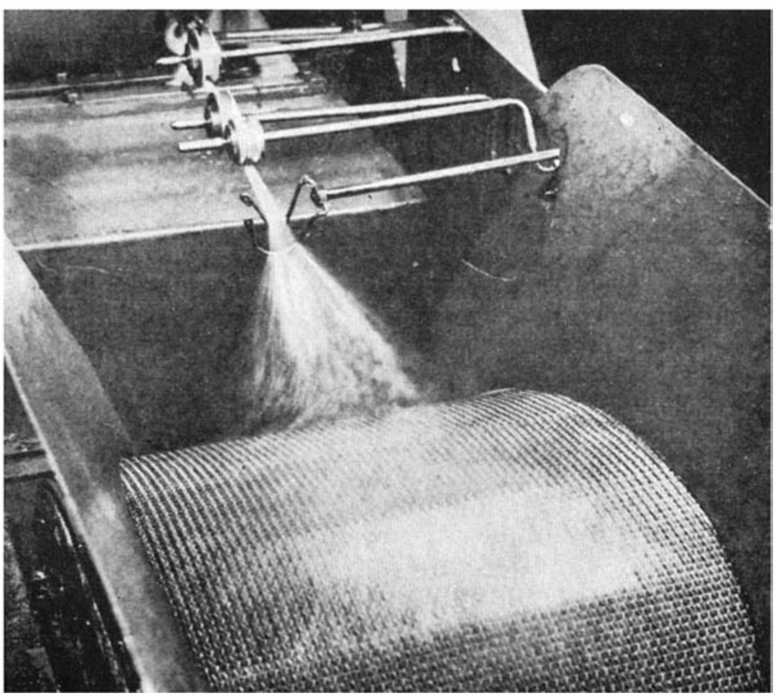


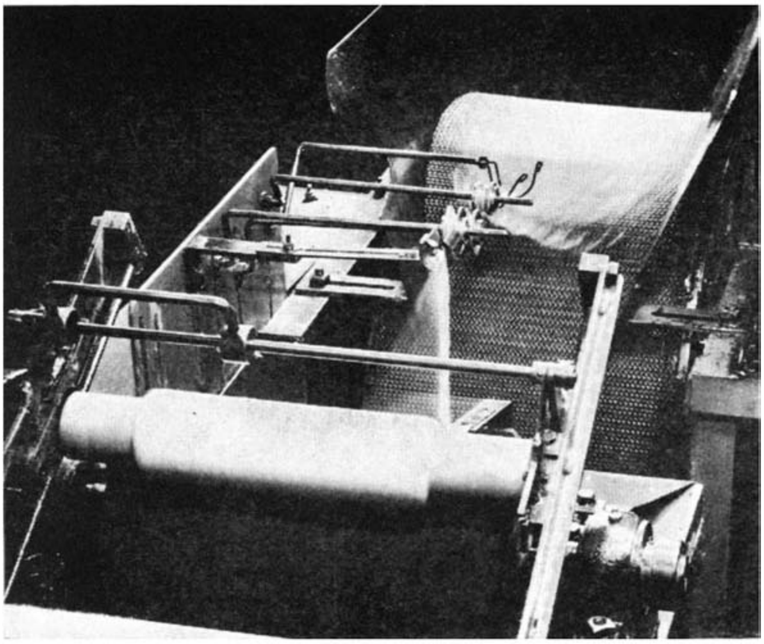
3 The combined filaments of glass, each only .0002 of an inch in diameter, are spooled *(right)* at a rate of a mile a minute. A ten-mile length of filament is assembled on each spool. A ¼-ounce glass marble can be drawn in filament form to a length of exactly 159.375 yards



4 In the "staple fiber" method of production, the melted marbles are blown by live steam under high pressure. The filaments, averaging 15 inches in length, pass through a gas flame *(left)* to dry out moisture caused by the steam, and to a conveyor

5 As the dried fibers are blown to the conveyor, they are picked up and drawn in a cobwebby mass over a series of forming wheels *(below)* which bunch the fibers into a loose strand known in the textile world as "sliver" (pronounced "sly-ver"). The photographs were taken while the machinery was in motion



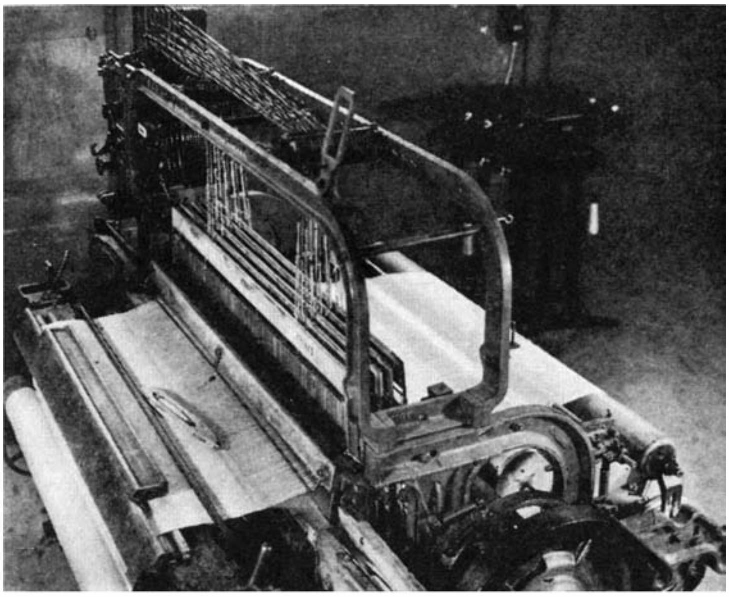


6 Emerging from the forming wheels, the strand of sliver is wound up rapidly on spools. From this point on through the processing of fiber glass, most of the equipment used is identical with that employed in the processing of other textile fibers such as silk and cotton

7 Whether continuous filament or staple fiber, the textile glass is now transferred to twisting equipment. Here two 102-filament strands are combined to form a single thread. Four strands so twisted are about the size of No. 50 cotton thread

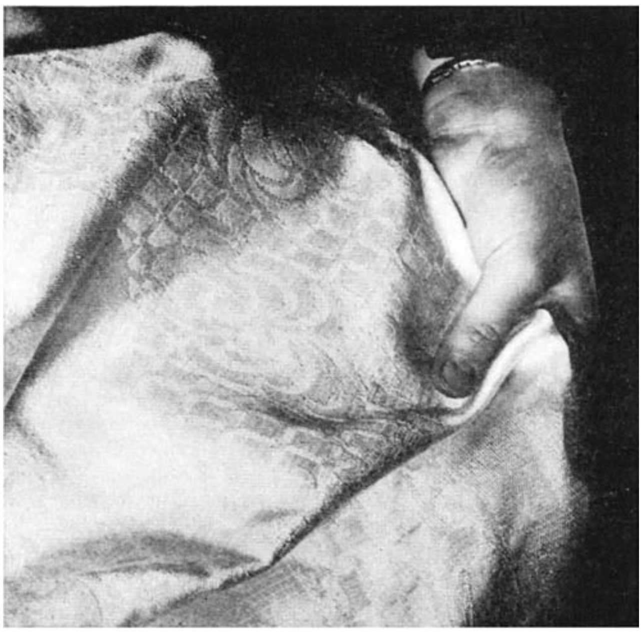
8 One end of a broad loom on which glass textiles are woven is shown at the left. The roll of glass thread seen at the bottom of the photograph is wound to the desired size from spools such as are shown in illustration 7 (above, right)

9 *Right:* An over-all view of the broad loom. Glass thread from roll, right, passes toward left through shuttles and reeds. The fabricated cloth is on the roll at extreme lower left of picture



10 From marbles to cloth is a story of applied science opening a whole new field for an old-new product. The soft, satiny, pure-glass fabric shown below illustrates the possibilities. Present applications, however, are largely industrial rather than domestic; glass clothes, for example, are still in the future

11 *Below:* Sewing glass cloth with glass thread, making, for the first time in history, a completely inorganic fabric. Fiber glass, made by Owens-Illinois Glass Company and licensees, is fire, vermin and moisture proof, is finding wide use in industry for electrical and thermal insulation, in textile and unspun fibrous forms. Its light weight is an added advantage



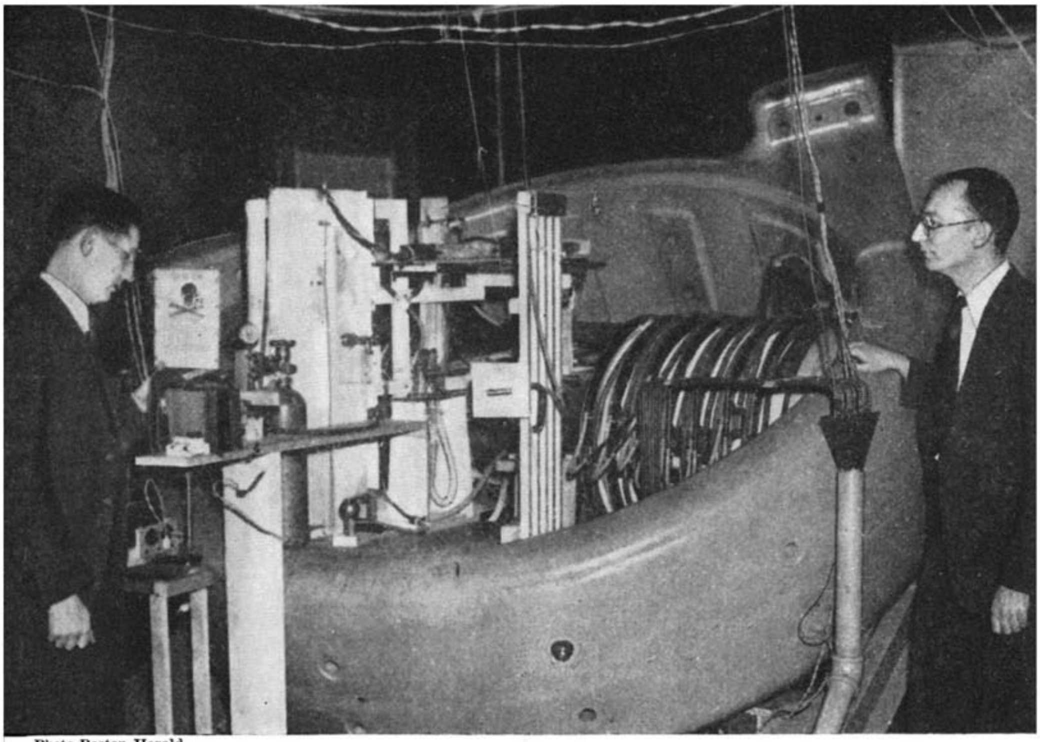


Photo Boston Herald

Dr. Edward C. Stevenson (at left) and Dr. Jabez C. Street, both of Harvard, the co-discoverers, with Anderson and Neddermeyer of California Tech, of the X-particle and the first to measure its weight; also the Harvard automatic cosmic-ray camera which photographs the tracks of incoming rays, including an occasional cosmic X-particle. Metal ring is part of a big magnet

And Now the X-Particle

Newest Applicant for Membership in the Atomic Family May Really be New or Merely an Old Friend in Disguise... Every Day Brings New Data in this Most Intriguing Puzzle of Current Atomic Physics

By JEAN HARRINGTON
Wellesley College

THE latest addition to the atomic family has been a somewhat unwelcome one. Like the sixth child in a household which has barely managed to struggle along with five, the new particle has forced many readjustments upon the physicists, who have been hard put to find a place for it, to know what to do with it, or even to give it a name.

Discoverers of this foundling of unknown origin were Carl David Anderson and Seth H. Neddermeyer of the California Institute of Technology. When Dr. Anderson tracked down the positron in 1932 and thereby won the Nobel Prize, he was looking for the tangible trace of a particle which had already been theoretically predicted. Not so with this latest interloper. It simply thrust itself into the field as the only possible solution to an otherwise baffling phenomenon.

The original clues came from experiments with cosmic rays, suggesting that the X-particle was in some way associated with those mysterious electric charges which stream in upon the earth from the depths of outermost space. When Anderson and Neddermeyer read a paper on cosmic radiation at the International Conference on Physics at London in 1934, they hinted, ever so slightly, that certain peculiar quirks in their data might need a new and startling explanation. But it was not until May, 1938, that, backed up by additional experiments, they came out flatly for a new particle.

In the meantime, Professors J. C. Street and E. C. Stevenson of Harvard had arrived independently at the same answer to the same problem; and their corroboration, appearing only two weeks after the Anderson-Neddermeyer pronouncement, launched the X-particle as the newest and most intriguing puzzle in atomic physics.

JUST as a commuter uses up energy in shoving his way through a subway crush, so does a cosmic ray particle in traversing the crowded atoms and molecules of any substance. In the atmosphere, for instance, the particle collides with a molecule of hydrogen here, glances off and bumps an oxygen molecule there, losing energy at each encounter, playing havoc with whatever it hits, and perhaps even breaking itself up in a final head-on collision.

For a long time scientists have been trying to find out at what average rate such a particle loses its energy. They have attacked the problem with high-powered mathematics to figure out what it should do in theory; and they have studied it in the laboratory to discover what it actually does do.

Around 1934, Bethe and Heitler, two of the great theorists of contemporary atomic physics, arrived at a solution which made both the experimenters and the arm-chair physicists happy. It's all very simple, they said. The rate at which a particle is losing its energy at any moment is, in fact, directly proportional to the total energy it has at that moment. Paradoxical as it sounds, it only means that if two particles start out with the same energy, they lose it at the same rate—that is, the same loss per centimeter of their paths through a substance. But if one particle is more energetic than the other, then its rate of loss is greater to begin with, though decreasing as the total energy decreases.

Anderson, Neddermeyer, Street, and Stevenson were among those who tried to test out this theory in the laboratory. Their procedure was to set up a cosmic ray "telescope"—an arrangement of counters and lead shields allowing only those rays with a given minimum energy and direction to pass through. At the far end of the telescope is a Wilson cloud chamber, that famous device which makes it possible to photograph the track of a charged particle as it whizzes through a gas.

The next step in the experiment was to place the cloud chamber between the poles of a strong electro-magnet. Under its influence, the electric charges are swerved from their straight line flight, and their tracks show up on the film as slender curves. Through the center of the chamber runs a known thickness of metal. This shield completely stops some of the tiny projectiles and slows up the rest. By comparing its curved track on both sides of the shield, the experimenters can tell how much energy a particle has lost in colliding with the atoms of metal.

The two California physicists and the

two from Harvard have measured hundreds of such tracks. Two facts emerge from their research: first, that one group of particles fits into the curves of the Bethe-Heitler theory of energy loss with comforting snugness; second, that another group has a definitely lower rate of loss than the law allows, and is consequently far more penetrating. Such particles zip through depths of atmosphere or shields of lead impassable to the others. A further distinction between the two groups is also apparent. The law-abiding category consists almost entirely of "shower particles,"[1] while the others occur singly, rarely even producing showers.

There were similarities, however, as well as differences. All the particles were obviously electrically charged, like electrons or protons. Their tracks were there to prove it, for the uncharged neutron or photon leaves no such visible trace of its passage through a cloud chamber. Then again, all the tracks were of comparable width and length.

FROM previous studies, the shower particles were known to be positive and negative electrons. It seemed logical to suppose that the more penetrating group also consisted of electrons, or at least closely related particles, since their narrow tracks were so much alike. Had they been protons or other more massive or more highly charged ions, they would have cut a broader swath through the cloud chamber. Moreover, protons would need tremendous energies to produce the six or seven centimeter tracks observed for the X-particles. Yet the curvatures measured indicated a much lower energy range. And again, like electrons and unlike protons or any other known particle, the new group had both positively and negatively charged components.

Here, then, was the problem: Given two apparently similar particles, why should one behave in a normal, orderly fashion, while the other shatters theories right and left? Why should one travel through space in single splendor, the other in the company of showers? If both are really electrons, as they seem, why should one be far more penetrating than its twin? From what source does it derive its extra liveliness, and what special, innate quality distinguishes it from its more sluggish brother?

In the quantum theory, charge and mass are the only two parameters which characterize the electron. The experimenters were sure that their new, swift particle bore the same unit plus or minus charge. That left them only the mass to vary. What if the X-particle were simply a "heavy electron", its weight intermediate between that of the normal electron and the proton which is roughly 1850 times as heavy?

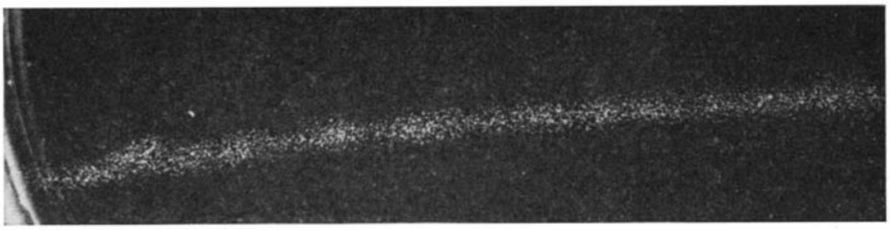
There was one logical way to test such an hypothesis, and that was to weigh the X-particle. Street and Stevenson, its co-discoverers, were the first to think up and carry out that delicate experiment. If the particle were really heavier, they argued, it should leave a more dense track than a normal electron of the same energy—not so much denser that it could be detected at first glance, but enough so that it might, with care, be measured.

The tracks themselves consist of ions, atoms which have had an electron or two knocked from their outer structure by a particle shooting through the cloud chamber. The usual procedure in photographing such cosmic ray trails is to gear the camera shutter to click almost simultaneously with the passage of the particle, so that the lines are clear-cut and sharp. Street and Stevenson timed theirs to take the picture a second or so after the traversal. In the interval the tracks spread and diffuse a little, so that one can see and count the ions individually.[2]

The mass can be figured out from a complex, relativistic form of the simple and familiar equation, $E=\frac{1}{2}mv^2$. E, the energy, can be calculated from the curvature of the track or the length of its range. The number of ions per centimeter of track gives the clue to the velocity, v. Having computed these two quantities, Street and Stevenson proceded to solve the equation for its only unknown, m, the mass of the X-particle.

Out of some thousand photographs, they found only two tracks of unusual ionization. One was the easily identifiable trail of a proton. Subjected to the above calculations, the other particle proved to weigh about 130 times as much as an ordinary electron at rest.

In the meantime, other physicists have been at work trying to "weigh" other X-particles. Notable among them are Dale R. Corson and Robert B. Brode of the University of California, and A. J. Ruhlig and H. R. Crane of the University of Michigan. The latter two photographed a densely ionized cosmic ray track, made by a particle which they figured weighed some 120 times as much as the electron. At the date of writing, Corson and Brode had obtained and measured two more significant tracks. The masses disclosed for these were, by Street and Stevenson's method of calculation, 185 and 200 times normal. They believe, however, that the values should be even higher, based on a different relation between ionization and velocity from that used by Street and Stevenson. Dr. Corson and Professor Brode are carrying out further experiments to clear up their disagreement on this technicality. But whatever the results, they will not dispose of the X-particle dilemma.



The trail of a cosmic ray X-particle, photographed by Corson and Brode at the University of California. By measuring the curvature of the track and by counting under a microscope the number of ions per centimeter, they figured that the particle must weigh at least 185 times as much as a normal electron

The trail of a normal cosmic ray electron, photographed by Corson and Brode under exactly the same conditions as the one above. Note how much less densely ionized the track is, compared with that left by the heavier particle

OUT in St. Louis, Dr. George E. M. Jauncey, an able Washington University physicist, had an attractive idea. If cosmic rays contain what appear to be heavy electrons, perhaps some of the fast electrons shooting out from radium—the so-called beta rays—might also be heavier than normal. If so, that was a possible answer to the "beta ray paradox" which has long annoyed everyone connected with the study of radioactivity.

The paradox is briefly this. When a

[1]A cosmic ray "shower" is a burst of from two to hundreds of particles, chiefly positive and negative electrons. Sometimes they are all exploded simultaneously from the same nucleus by the violent impact of a cosmic ray projectile. But more commonly the showers are cumulative, building up in steps from a single impact. In this case, an incoming electron interacts with a nucleus in its path to produce a photon (particle of radiant energy). The photon interacts with another nucleus to produce a positive and negative electron pair. The pair goes on to radiate new photons, the photons produce new pairs, and so on until all the original energy is dissipated.

[2]Strictly speaking, it is the condensation of moisture on the ions, forming tiny fog droplets, which makes it possible to photograph and count them.

radioactive atom spontaneously throws off radiation, it disintegrates into another variety of atom. There is a perfectly definite difference of intrinsic energy between the two kinds and, according to the conservation law, the radiation emitted should carry off exactly that energy difference. But in cases of beta ray disintegration, this is not always true.

Assuming that all the electrons taking part in any given transformation have the same mass, then they should also start out with the same velocity. Instead, they vary through a whole spectrum of speeds less than that required. To account for the missing energy, the "neutrino" was invented. This tiny particle was supposed to be electrically neutral, and to have just enough mass to make up for what its electron partner lacked in speed. Unfortunately, no one was ever able to discover the neutrino experimentally or prove that it actually existed.

But let us return to St. Louis and Dr. Jauncey. Last fall, he became entranced with the idea that the neutrino might not be a separate particle at all. Suppose its weight were incorporated, so to speak, in the body of a heavy electron. If he could thus neatly dispose of the dubious neutrino and identify the puzzling X-particle by the same maneuver, that would indeed be a coup d'état.

THE experiment he devised to prove his point used radium E as a source of beta rays. These electrons he filtered through a velocity selector—a tube with electric and magnetic fields crossed at right angles, allowing only particles of a certain speed to pass on through into a magnetic field alone—and thence to a photographic plate. Electrons with the same velocity and mass should all experience the same pull in the magnetic field, and all land on the same place on the plate. But electrons with the same speed and *greater* mass should deviate less in the field and leave their mark on a different part of the plate.

When Dr. Jauncey developed his films, he found, as he hoped, that the electrons had not all landed on the same spot. Indeed, they had scattered themselves in such a way as to indicate that some weighed as much as two and a half times normal.

The reactions to Jauncey's theory and experiment have been warmly critical, and the pages of the august *Physical Review* have for months been the scene of much polite wrangling over the X-particle. C. T. Zahn and A. H. Spees at the University of Michigan immediately pointed out that they had entertained the same notion before Jauncey did, had tested it with extensive experiments remeasuring the ratio of charge to mass for beta rays, and had found no significant variation from the classic value. Jauncey retaliated by saying that, in their experiment, their apparatus would automatically exclude "heavy electrons", leaving only ordinaries to be measured. Zahn and Spees retorted that Jauncey had misinterpreted his own data, and that the extra lines on his film were in all probability caused by leakage and scattering of electrons of other speeds in his velocity selector. Dr. Arthur Holley Compton of the University of Chicago, Nobel Prizeman and an outstanding cosmic ray authority, looked at first with sympathy on Jauncey's experiment and his interpretation of it, then changed his mind and offered an alternative explanation in agreement with Zahn and Spees.

Dr. Carl D. Anderson, "Cal Tech" Nobel Prizeman, particle finder

Another blast came from the south, where Arthur Ruark and Creighton C. Jones had been doing conservation of energy experiments at the University of North Carolina. They remeasured 15 excellent tracks showing collisions between beta rays and electrons, photographed by Champion at Cambridge University in 1932. Fourteen gave perfectly clear-cut evidence that the beta particles were normal electrons. The fifteenth, while apparently not conforming to the conservation law, was probably a different kind of collision, and in any case could not be explained on the hypothesis that the beta particle in question was extra heavy.

At the University of Michigan, H. R. Crane sounded still another note of discord. He reported negative results on an experiment trying to prove that some beta rays were more penetrating than others, as they should be were they analogous to the penetrating X-particles in cosmic rays.

Though somewhat dizzied by all these attacks and counter-attacks, the layman can nevertheless accept the X-particle as a physical reality and as a component of cosmic radiation. On the question of whether or not it is a universally occurring heavy electron, he had best keep an open mind, at least for the present.

What about the origin of the X-particle? Dr. Jauncey believes that it acquires its extra weight by collision with a photon, absorbing at the impact part or all of its radiant energy in the form of mass. He computed that the particle weighed by Dr. Street, for instance, must have absorbed a photon representing an energy of 4,000,000,000 electron volts to account for its avoirdupois. Dr. Neddermeyer suggests that, since positive and negative X-particles occur in approximately equal numbers, they are perhaps created in pairs like ordinary electron secondaries exploded from a nucleus after a violent collision. But these are only guesses, and, at this early stage of the game, one guess is as good as another.

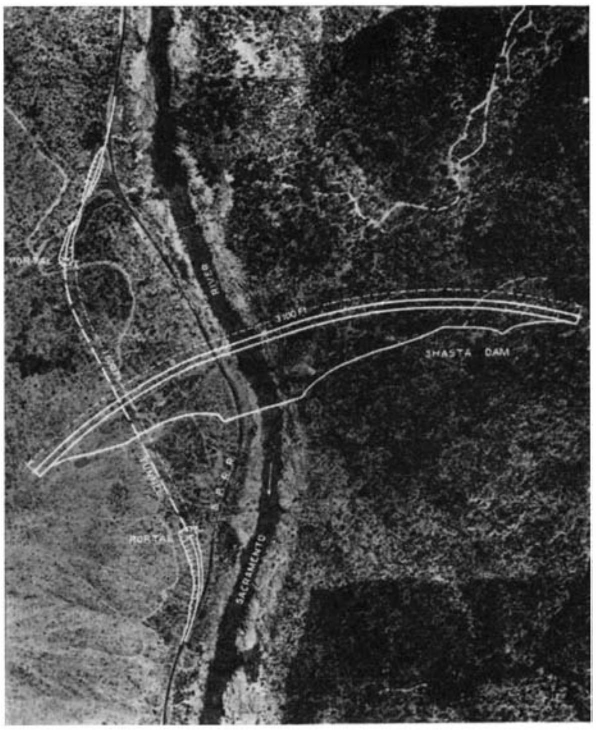
NO more is known about the fate of the X-particle than about its origin. The logical continuation of Jauncey's theory would demand that the extra mass absorbed from a photon be released eventually in the same form of radiation. On the other hand, Dr. Street has found that a heavy particle whose original energy lies somewhere in the billion volt range will retain its great penetrating power for a while, losing its momentum gradually and regularly until it reaches a critical value at about 400,000,000 volts or less. After that, a chance encounter with another particle may set off an explosion that blows them both to bits. When and why this happens, and what the final cataclysm is like, Dr. Street does not know yet.

It is also too soon for anyone to know whether or not the X-particle's mass is always the same. The values obtained have varied all the way from Jauncey's 2.4 to Corson's 200. The measurements made by counting ions at least give results of the same order of magnitude, but, as Neddermeyer points out, it would be all but impossible to detect a particle only slightly heavier than the electron by this method.

Jauncey, of course, believes that the mass *is* variable to any extent, a necessary adjunct to his anti-neutrino theory. Others have suggested that the quantum theory may apply, and the mass may vary only by units.

Every month, every week, every day brings further data to bear on the problem of the X-particle—what it is, how much it weighs, where it comes from, where it goes. If Jauncey is right, if it is really only an electron in disguise, then revolution is imminent in atomic physics, spectroscopy, quantum mechanics, and all the related fields where the constancy of the rest mass of the electron has been a basic tenet. If Jauncey is wrong, one can still expect radical changes in the theories which must now account for an atomic family of six instead of five fundamental particles.

SHASTA DAM



Site of Shasta Dam, at left; and, above, the plan, with dimensions. Note the luxuriant vegetation

Will Be World's Second Highest . . . Primary Function—to Conserve and Regulate Water Resources of Sacramento River Valley . . . 560 Feet High

REVISED plans for Shasta Dam, key unit of the vast Central Valley project in California, will make it the second highest concrete dam in the world.

The design approved by Bureau of Reclamation engineers calls for a straight-gravity concrete dam approximately 560 feet high and 3100 feet long, to be erected across the canyon of the upper Sacramento River, 13 miles north of Redding, California. The dam will back up the waters of three rivers—the Sacramento, Pit, and McCloud—a distance of 35 miles to create a conservation reservoir with a storage capacity of 4,500,000 acre-feet.

As originally planned by state engineers, Shasta Dam was to be about 500 feet high, creating a reservoir of approximately 3,000,000 acre-feet. On the basis of recent comprehensive studies of the economic height, considering the water resources and the manifold requirements, Chief Engineer R. F. Walter, of the Bureau of Reclamation, approved a recommendation for a reservoir of 4,500,000 acre-feet.

This storage capacity at the selected site requires a dam with a crest elevation 543 feet above the present lowest bedrock determined by foundation exploration. After excavation for the necessary cut-off wall below bedrock, the dam will rise probably about 560 feet above the lowest foundation.

Shasta Dam's only rivals in size will be mighty Boulder Dam on the Colorado River and Grand Coulee Dam under construction on the Columbia River, both under the jurisdiction of the Bureau of Reclamation.

IN height, Shasta will be second to Boulder, which is 726.4 feet high. Grand Coulee will be 553 feet high. On the crest, Shasta will be more than twice as long as Boulder—3100 feet compared with 1282 feet—but not as long as Grand Coulee's 4200 feet. In mass, Shasta will require approximately 5,700,000 cubic yards of concrete, which is considerably more than the 4,360,000 cubic yards in Boulder Dam and power-house, but hardly comparable with the 11,250,000 cubic yards now being placed in Grand Coulee Dam and power-houses, now under construction.

Next to these three giants is the Chambon Dam in France, 450 feet high, followed by Hetch Hetchy Dam, a part of San Francisco's water-supply system in the Sierra Nevadas, which recently was heightened to 427 feet, and Owyhee Dam in eastern Oregon, another Bureau of Reclamation structure, which is 417 feet high.

Walker R. Young, of Sacramento, the Bureau's construction engineer for the Central Valley project, who also was the construction engineer on Boulder Dam, said Shasta Dam will require concrete enough to build a solid monument a city block square and slightly higher than New York's Empire State Building. He said it would take a freight train more than 200 miles long to haul the cement to be used in mixing this concrete; and that Shasta Reservoir, when full, will hold water enough to cover the entire city of Chicago to a depth of 35 feet.

Incidental to the primary functions of Shasta Dam will be the generation of about a billion and a half kilowatt-hours of electricity annually. The initial hydro-electric installation will be for 280,000 kilowatts (375,000 horsepower) capacity, with provision for future enlargement to 350,000 kilowatts (470,000 horsepower).

Shasta Dam will be one of two large concrete dams on the Central Valley project. The other, Friant Dam on the upper San Joaquin River east of Fresno, California, will be 260 feet high and 3330 feet long, creating a reservoir of 450,000 acre-feet. Shasta and Friant Reservoirs will be operated to conserve and regulate the principal water resources of the combined Sacramento and San Joaquin River valleys to serve a fertile agricultural empire partially threatened with reversion to desert by drought and salinity. More than a million acres in the Sacramento and San Joaquin basins face an acute water shortage which is expected to be relieved by the Central Valley project.
—*The Reclamation Era.*

ALUMINUM CAN BE PLATED

Long Resisted All Efforts to Plate it . . . Final Success . . . Process is Cheap, Fast, and Practical . . . Will Greatly Expand Uses of Light Metal

By RAYMOND F. YATES

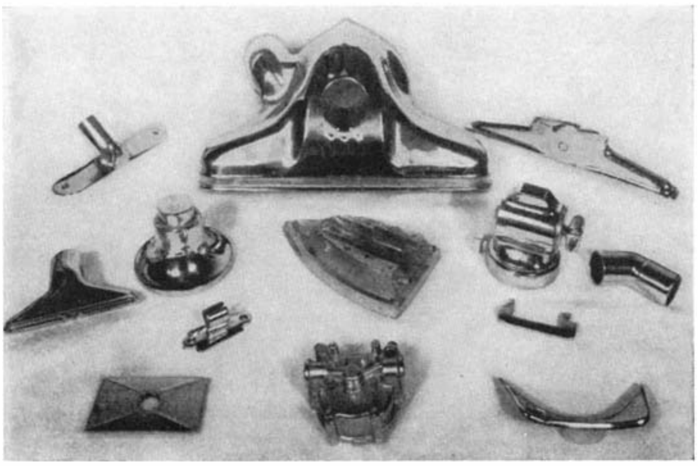
MUCH like television, electroplating aluminum by a practical, fast, and inexpensive method such as used for the modest metals, has been "just around the corner" for some 30 years. During this time, chemists, near-chemists, and tinkers, spurred on by the large financial rewards that have unquestionably awaited a solution to the problem, have gone about their many and devious ways to discover a method that would be commercially practicable. Aluminum has been doggedly recalcitrant; for years it has successfully and completely resisted every effort of the inventors.

Yet the industrial world has waited hopefully, and not without good reason, for it has been known that the application of aluminum in everyday use could be widened immensely and profitably if its chemically sensitive surface could be covered by a less chemically active metal such as nickel, copper, or chromium. Aluminum, like magnesium and the members of the alkaline group of metals, has a perfectly gluttonous appetite for oxygen and this alone has been the bugaboo, for the oxygen forms a plating-resistant coating of aluminum oxide as fast as fresh surfaces are exposed. Also, this oxide, this thin skin of rapidly formed Al_2O_3, is anything but agreeable, especially in cases where articles must be handled. In such cases, the hands of the user soon become covered with a gray, greasy-like substance that suggests lead. This is true not only for virgin aluminum but also for its more "hardboiled" alloys. Moreover, other base alloys having even a small percentage of aluminum demonstrate a healthy and convincing resistance to electroplating.

AT the present time, the world consumes about 375,000,000 pounds of aluminum annually. It is estimated that this figure could be greatly increased by a chemically resistant plating. Aluminum, after all, is more abundant in the surface of the earth than iron. One of the things standing between it and a much-anticipated Aluminum Age is the persistent film of oxide less than a thousandth of an inch in thickness. Charles Hall's gift of cheap aluminum to humanity was great and good but its complete utilization has been blocked by a "dog in the manger" skin invisible to the naked eye.

Nearly 20 years ago, an obscure chemist, William J. Travers, working in his small laboratory, vowed to break down this skin, to give aluminum a bright, lustrous coat that would place that metal higher in the esteem of the world. The dogged persistence of the man was inspiring. Failure followed failure so rapidly that a person with less perseverance would have cracked under the strain of disappointment. But not Travers. He had an Edisonian philosophy about the matter; he was one of those psychologically strange fellows who thrive on failure. Indeed, each of his failures narrowed the possibilities and helped to isolate the final answer. He could plate aluminum early in the game, but the process was a painfully slow and costly one not reducible to commercial practice. He aimed at forming a plating sisterhood between aluminum and brass, copper, and the other easily plated metals. Others had plated aluminum before him but every process was a precarious wedding of metals always faced with the likelihood of an easy divorce.

Travers' efforts continued and were finally rewarded when the United States Patent Office issued patent number 1,971,761 wherein was recorded the culmination of 20 years of devotion to a single cause. At last aluminum could be admitted in volume into an ordinary plating establishment; and the electroplater could use the methods that were employed in the normal course of plating the common metals.



A large variety of common aluminum products may now be plated to stop corrosion, permit handling without smudging

One of the strange features of the process which is now beginning its commercial début is that it is initiated by stimulating the very thing that it sets out to defeat—the formation of what is known as an anodic oxide film. It so happens that oxidation of aluminum surfaces can be immensely accelerated by having the aluminum form the anode in an electrolytic bath made up of one of a number of solutions that will yield oxygen. Preparation for this anodic process, which leaves the aluminum surface mechanically hard and resistant, is made by a brief immersion in a cleanser such as sodium cyanide. After rinsing in clean water, the freshly anodized aluminum is placed in an alkaline bath for a second time but here mere cleaning is not the object; rather, the inventor has found that this second exposure to the alkaline solution modifies the anodic oxide film and prepares the surface for plating by the ordinary process. Once the aluminum emerges from this second bath in the alkaline solution and is dipped in clean water, it takes its place beside either brass or copper and, indeed, goes through the same process of plating with the same time element, the same solutions. Usually it receives a base coating of nickel, like other metals, before it is re-plated with its ultimate covering of chromium, silver, copper, or zinc, as the case may be.

In a sense, Travers really overshot his mark in plating aluminum. For some mysterious reason still not understood by chemists, the plated surface of aluminum often shows more resistance to removal than do plated surfaces on other common metals. Corrosion tests with salt spray, as specified by the United States Navy, yield amazing results as regards time of exposure. Then, too, chromium-plated aluminum pieces have been shuttled between refrigeration, at 30 degrees below zero, and hot spray cabinets for weeks on end without showing up any the worse for wear, although the uncoated metal was known to heave and twist in the throes of contraction and expansion. Here an uncanny factor appears to enter the calculations. The bond between the metals is obviously a new one. Therein may lie a new and important discovery in plating, once the chemistry and physics of the matter are known.

The field for the application of the Travers process is so wide as to be almost unbelievable. Designing engineers may now, for the first time, proceed to employ aluminum sheets and sand or die castings with the same abandon as they formerly employed in making use of castings of bronze, brass, or iron. Especially interested will be the manufacturers of articles wherein weight and eye appeal have heretofore fought a hard-to-decide battle to determine the prime factor. Already a large camera manufacturer has recognized the Travers process as offering a solution to a really light, strong, and attractive pocket-size article that will not make the carrier appear as though he has curvature of the spine. Many of the streamline trains that are now flashing over the countryside have their dining cars serviced with glistening trays of chromium-plated aluminum that no longer soil the hands of the waiter or leave streaks of gray on the spotless linen.

MILADY also stands to benefit from easy-to-clean chromium-plated ware that needs only the damp cloth to restore fully its pristine luster. After three years of use over a gas flame, a tea kettle emerges from the experience as fresh, as clean, and as beautiful as its still-unsold counterparts in the stores.

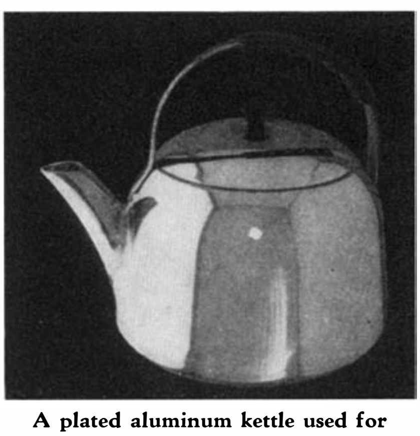
Already, the airplane manufacturers are turning to this new plated aluminum. After all, aluminum is the true "sky metal." For a given tensile strength, it has minimum weight, costs less to carry aloft. It would also have been widely used in the cabin trim of cruisers in the past had it been able to retain its buffed luster. One large manufacturer of planes has already employed chromium-plated pistons in pneumatic brakes. In such service, the chromium surface is ideal; it shows a great resistance to wear and insures a tightly sealed cylinder.

From the standpoint of weight, of course, the aluminum piston is the ideal for the gasoline motor. Cast iron pistons—six or eight to the motor—are great wasters of power in a reciprocating machine. Such pistons move with high speed within the cylinders and they must be arrested in their motion and reversed many times a minute. In such cases, the laws of momentum and inertia have been found to be brutally uncompromising. Being lighter by less

Soldering to chromium plated on aluminum to show tenacity of bond

than one half, the aluminum piston provides a greater output in power and gives greater acceleration. However, the bare aluminum piston does not wear well and, after a few thousand miles of travel, brings about oil dilution and heavy carbonization. In a few cases, such pistons have been given an anodized surface and, while this process does increase the useful life of such articles, it does not supply the final answer.

When the Travers process was first announced, automotive engineers employed by several of the largest producers immediately interested themselves in the prospects of a chromium-plated aluminum piston. At the present time, tests are being conducted along this line. First, these engineers sought to find whether or not the high heat and the factors of expansion and contraction would adversely affect the plating. Long experiments have shown that it does not. A recently issued report from the experimental laboratory of one of the



A plated aluminum kettle used for three years without injury to surface

large automobile manufacturers has this to say about the tests that have been conducted in connection with Travers-plated pistons:

"A set of pistons was sent to Mr. Travers and plated. These pistons were ground .006 of an inch undersize on the skirt, .004 to .006 of an inch undersize on the lands and .002 of an inch oversize on the ring groove width.

"On previous tests with chrome-plated aluminum pistons, it was found that the chrome plate flaked off after a 25-hour run at 3800 revolutions per minute full load. The expected failure did not materialize and the pistons were subsequently given 25 hours full load tests at 3000, 2000, and 500 revolutions per minute. Pistons were inspected after each 25-hour test and found to be in good condition. Cylinders numbered 3 and 4 were then pre-ignited for 10 minutes at 3000 revolutions per minute with no effect other than to improve the polish on the pistons.

"Piston clearance was checked with feelers when the pistons were installed and again at the conclusion of the above tests. Results given below are pounds pull on a .002 of an inch feeler.

Piston	*Before Test*	*After Test*
1	12 pounds	11 pounds
2	15 pounds	10 pounds
3	20 pounds	11 pounds
4	7 pounds	2 pounds
5	16 pounds	14 pounds
6	20 pounds	14 pounds
7	16 pounds	11 pounds
8	16 pounds	12 pounds

"FOR further work, four of the plated pistons were replaced by production pistons in order to serve as an index of the severity of the scuffing tests. The first test consisted of 2½ hours of full-load operation at 500 revolutions per minute with the choke closed as much as would still permit the engine to fire regularly. This gave excessive dilution and presumably greatly reduced the viscosity of the oil upon the cylinder walls. The engine was then used for several weeks in the cold room for carbureter starting tests. As the pistons were still in good condition, the bleed holes in the connecting rods were plugged. The engine was returned to the cold room and subjected to 24 starts in accordance with the normal scuffing procedure. It was later given a more severe test in which the engine was started 24 times and operated at full load at 400 revolutions per minute as soon as possible.

"At the conclusion of these tests, the aluminum pistons showed some scuffing, but the chrome-plated pistons appeared to be in perfect condition."

This one example of results gives the key to some of the future possibilities of electroplated aluminum.

Out Where the Vets Begin

Work of Modern Veterinarians Vital to Human Health . . . People "Catch" Many Serious Animal Diseases . . . Vets Study and Rigidly Control Them

By EDITH M. STERN

SOME years ago in Georgia, an inspector of the Bureau of Animal Industry ordered a group of farmers to dip their cattle for ticks. Suspiciously, the Georgians watched him mix the dipping solution. Still more suspiciously they looked on while he drove the animals through the vat. After the last cow had been dipped, so the story goes, one of the farmers wheeled about and shot the inspector.

Millions of animals have been inspected by government veterinarians since, and there have been plenty of other instances of opposition as bigoted and sensational. Dipping vats have been blown up by dynamite; guns have been used to force inspectors off the premises. In New York State, a die-hard old farmer took his cows, among the last that were to be tested for tuberculosis in that area, into the barn and killed them just before the veterinarian arrived.

These incidents, however, have never deterred the Bureau in the campaign it has waged since 1884 to make the animal kingdom safe for our democracy.

Though you may never have been nearer a farm than Broadway, this work directly affects your life. It was one of the Bureau's employes, Theobald Smith, who proved in 1890 that cattle fever was transmitted by ticks. Not only was his discovery the first step in the present victory over a disease costly to livestock owners—ticks, according to the Bureau, "carry off more cattle than the old thieves did"—but it first established the now familiar fact that every insect carries disease germs. Old timers in the Bureau like to recall how often Walter Reed, when he was doing his work on yellow fever, used to drop in at their offices to confer with them; how his tracing it to mosquitoes was a direct outgrowth of their colleague's findings. Likewise, knowledge that typhus fever and bubonic plague are carried by fleas grew out of Smith's research in a disease of animals.

Thanks to the Bureau, the milk you drink is practically free from tuberculosis germs; thanks to 800 veterinarians who work in its meat inspection division, the government-inspected meat you eat is free of disease, decay, and dirt; and the animal pharmaceutical products your physician prescribes, such as insulin, thyroid, and pepsin, come from healthy animals.

The results of its work in animal health have been quite as amazing as those in the field of human health. Eleven of the 35 most important diseases of livestock are today completely absent in this country and, because of the rigid inspection maintained at ports, unlikely ever to be imported or re-imported. Not a single case of dourine (horse syphilis), for example, was found last year. Imported from France into Illinois in 1886, it spread quickly to Montana, and by 1902 it was found as far south as New Mexico. Through the slaughter of infected animals, gradually it became restricted to only a small area of Indian territory in northern Nevada. Today even that area, in professional terminology, is "clean."

SEVENTEEN of the 24 remaining diseases are either effectively controlled or approaching complete eradication. Southern cattle fever, formerly prevalent throughout 15 states, has been reduced to negligible proportions. Unremitting attacks, since 1906, with "Dip that tick" as the battle cry, have restricted it to small sections of two states, 4 percent of the area formerly affected. Hog cholera has been cut 60 percent by means of preventive serum. For many years losses from this malady alone cost swine owners $40,000,000 annually, and in the years of greater prevalence they rose as high as $70,000,000.

Perhaps the most widespread and complete of the Bureau's triumphs has been the virtual eradication of bovine tuberculosis. In 1917, when tuberculin tests were first made, it was found that, on an average, 5 percent of cattle were tuberculous, and in some sections the average was as high as 30 percent. It was not unusual, in those days, for the test to disclose that even on a gentleman farmer's model dairy farm, 80 percent of his pure-bred herd was infected. Today, in 46 of our 48 states, tuberculosis is present in less than 0.5 percent of cattle. Compare this situation with that in some European countries where 50 percent of the cattle are diseased. Compare it with England, where over 5 percent of all human deaths from tuberculosis are caused by infected milk, and 25 percent of all cases of non-pulmonary tuberculosis are traceable to this source. In the United States, although at least half the milk consumed is unpasteurized, humans who have contracted bovine tuberculosis are now so rare that medical schools find difficulty getting cases for clinical demonstration.

Two annual or three semi-annual tests which show a herd clean, entitle the owner to a certificate for having an accredited herd. However, most owners have become so convinced of the benefits of the test that, for their own reassurance, they continue to have their private veterinarians apply it. Getting a herd clean is one thing; keeping it so is another, and vigilance pays. Tuberculosis can be introduced into a clean herd by a bull imported for breeding. Its germs can lurk in barnyards for a long time and start up fresh troubles. Once the disease has gained a foothold, it increases progressively.

Pride of the tuberculosis eradication division of the Bureau is the herd at the Soldiers' Home in Washington. It was first tested—and found heavily infected—in 1918. Infected members were eliminated and it became the first accredited herd in the United States. Frequent tests have shown that it is still clean.

That there is today always a waiting list of herd owners eager to have their cattle tested, that 99 out of 100 farmers co-operate with the Bureau, is not only because they have seen results, but because of the Bureau's thoroughgoing educational as well as enforcement campaigns. It issues 67 publications on animal disease, of which 1,000,000 copies are annually sent out in answer to requests. Thirteen motion pictures dealing with disease control and livestock health were shown, in one year alone, to 80,000 people. These educational services promote public health while aiding farmers.

Skilled laboratory research lies back of the strong-arm work of inspection, testing, giving "shots," and dipping. For the modern D.V.M. (Doctor of Veterinary Medicine) is a scientist, and the old-fashioned horse doctor is as outmoded as the buggy his patients drove.

Not only members of the Bureau's staff, but any veterinarian who now is graduated from a veterinary school, must have at least a year of college work and four years of training in a school of veterinary medicine. Knowledge of bacteriology, pathology, and materia medica is as much a part of his equipment as it is of the physician's. Like the research worker in human diseases, he uses rabbits, guinea pigs, and mice as experimental subjects.

MOREOVER, his work is effective. High on a hill in Beltsville, Maryland, at the animal disease station, there is a herd of cows that look healthy enough, yet every one of them is afflicted with infectious abortion (Bang's disease). Some of them are about to calve, and white-coated, rubber-gloved men are watching eagerly to see how many of the calves come to a live birth. For three years now, fortified by a special appropriation, they have been waging intensive war against this highly contagious malady. Preventive vaccination has worked so far, and Bang's disease has been reduced two thirds by the energetic campaign of the last three years.

Veterinary medicine was kept alive by the Arabs during the middle ages, but it did not reach the dignity of an established profession until the first veterinary school was established in Lyons, France, in 1761. London followed with a school in 1791, and Berlin the next year. It was not until 1852, however, that a short-lived school was chartered in America. Other schools supplanted it and, until 1920, veterinary medical education was almost entirely in the hands of private commercial interests. Courses of from two to three years' duration were given, often without any educational prerequisites. When the Bureau was founded in 1884, there was great difficulty in assembling 18 qualified men for its staff.

Civil Service requirements for government positions, increasingly rigorous licensing, and higher professional standards showed up the inadequacies of the private school, and in 1928 the last of them closed its doors. Ten well equipped and competently staffed state institutions prepare veterinarians for their work today.

That work is highly complex. Though hog cholera, for instance, occurs only in swine, bovine tuberculosis takes its toll among swine as well as cattle and, to complicate matters still further, swine are more susceptible to the avian form of tuberculosis, which chickens have, than to the bovine! Quail are subject to an intestinal disease called ulcerative enteritis; chickens are not. Foxes in captivity have some of the same diseases as dogs, but take others that have never been observed in dogs or other domestic animals. The normal blood count differs in different species. And a mere list of the diseases which one classification of domestic animals alone may have is staggering. The Bureau's publication, *Diseases and Parasites of Poultry*, contains 69 pages of fine print and includes ailments with such fantastic names as bumblefoot, limber neck, and edema of the wattles, as well as the more familiar maladies like gout, paralysis, and malaria.

Because such herds of milkers are carefully inspected, bovine tuberculosis among humans in this country is kept very low

Small wonder that the Bureau's work abounds in specialties. For the past decade Dr. J. E. Shillinger of the Bureau of Biological Survey has been devoting himself exclusively to pioneer work in the field of wild-life disease. Though technically his department is not part of the Bureau of Animal Industry, his problems are related to theirs. Domestic and wild animals using the same pastures can infect one another; the wild, not having developed the immunities of the domesticated, are peculiarly subject to infection.

Attempts to control epidemics that periodically ravage wild animals and birds are prompted by more than nature lovers' sentiment. Infectious diseases introduced among foxes and minks can decimate fur farms; sometimes, after a show, half the valuable animals are wiped out. Quail breeding is still kept from being a practical and complete success because, although breeders have learned to maintain the adult birds under pen conditions and more eggs are laid than in the wild state, brooder pneumonia, ulcerative enteritis, and blackhead take heavy toll among the game farm stock.

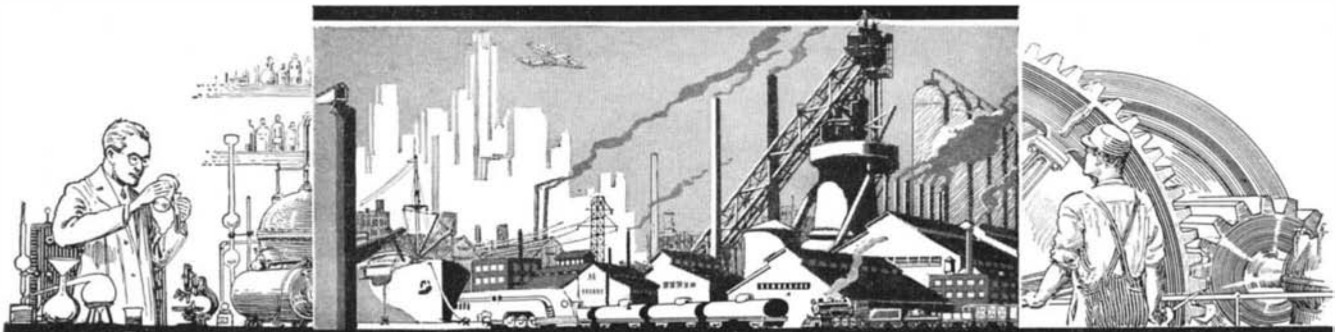
Even the diseases of undesirables like rodents are now being studied. Within the past few years, bubonic plague has been found among ground squirrels in the west. Their fleas can spread it among humans, and Dr. Shillinger and the Bureau of Public Health are co-operating in a campaign of feeding them poisoned grain.

Wild or domestic animals' diseases are of direct concern to humans, and it is often difficult to draw a line between the domain of the veterinarian and the public health officer. Anthrax, rabies, glanders, and tularemia (rabbit fever) are infectious diseases of man as well as of animals. Typhoid, septic sore throat, diphtheria, smallpox, and tuberculosis are spread through milk from diseased cows. There are also human diseases which closely resemble corresponding animal maladies, though the exact relationship is not yet fully understood. And there are diseases, like undulant fever, which have the same causal agent as animal diseases with quite different manifestations.

Behind the inspectors and the laboratory scientists, is the presiding genius of Dr. John R. Mohler, chief of the Bureau since 1917 and perhaps the leading veterinarian of the world. President of the International Veterinary Congress, Dr. Mohler has been many times offered posts, at far more than his present salary, by various European nations.

DESPITE the increasing importance of veterinary work, there is only one veterinarian to every 13 physicians, to every 500 livestock owners, and to every 20,000 animals. For the time being, veterinary medicine is one of the few professions where the demand exceeds the supply. Whether this condition continues will depend upon what appropriation is given to the Bureau of Animal Industry, which now absorbs nearly a third of the doctors of veterinary medicine in the country. There is no lack of young men willing and eager to practice in a field of such economic importance to both livestock owners and consumers, so vital to public health. Schools of veterinary medicine are turning away thousands of applicants whom they cannot accommodate.

The veterinarian who sits up in a draughty barn all night with a sick animal, who jabs hypodermic needles into bulls, attends hogs when their backs are arched with cholera, or peers through his microscope, trying to isolate a germ that is taking heavy toll among pigeons, may not be coming in for his share of front page publicity, but he has the satisfaction of knowing that his work has a vital bearing on human life.



SCIENCE AND INDUSTRY

A MONTHLY DIGEST

Conducted by F. D. McHUGH

Contributing Editors

ALEXANDER KLEMIN
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D. H. KILLEFFER
Chemical Engineer

NIGHT SAFETY

JUST as Michigan a quarter of a century or so ago assumed the leadership and became the world center for the manufacture of automobiles, so it has taken the lead in the installation of ultra-modern reflectors on one of its main highways for the promotion of safety in night driving. It is the only

Close-up view of one of the new "retro-directive" reflector units

public highway equipped with these new reflectors anywhere in the world. (See frontispiece, this issue, where a stretch of the highway is shown, outlined with the reflectors. In the photograph directly above may be seen one of the reflector standards as it is installed for service.)

This installation has been made on U. S. No. 16, an 85-mile stretch of main highway from Detroit, the state's largest city, to Lansing, the capital of the state, and was dedicated on the night of April 6, 1938. Headlights of the 40 or more cars carrying the dedication party beamed into new-type reflectors, 10 times as powerful as any heretofore in use, and outlined the highway far ahead of the drivers.

The new reflectors are a radical departure from those in more general use. They are made of Lucite (methyl methacrylate), the plastic recently perfected by duPont, that is water-clear, flexible, and non-shattering. This plastic molds much more accurately than glass and retains permanent transparency. It does not change color, but remains stable in service over a long period. The reflectors are set 100 feet apart on each side of the roadway, except at curves where they are slightly closer. The headlights from an automobile make it possible, as they are thrown on the reflectors, to outline the highway sufficiently for safe night driving.

Importance of the new reflectors to lessen night accidents is indicated by the fact that 60 percent of the fatal accidents in the United States and 48 percent of the personal injury accidents occur after dark, although only one third of all driving is done during this night period. Cost of the entire 85-mile project approximated much less than the average cost of a single grade separation. Operating costs, which are heavy for usual lighting projects, are eliminated by this new reflector method.

In these "retro-directive" reflector disks, no silver or metallic reflecting surfaces are used (which might deteriorate) because the cube corners themselves, although transparent, are none-the-less perfect prismatic reflectors.

The highway units are assembled for distribution by the Signal Service Corporation.

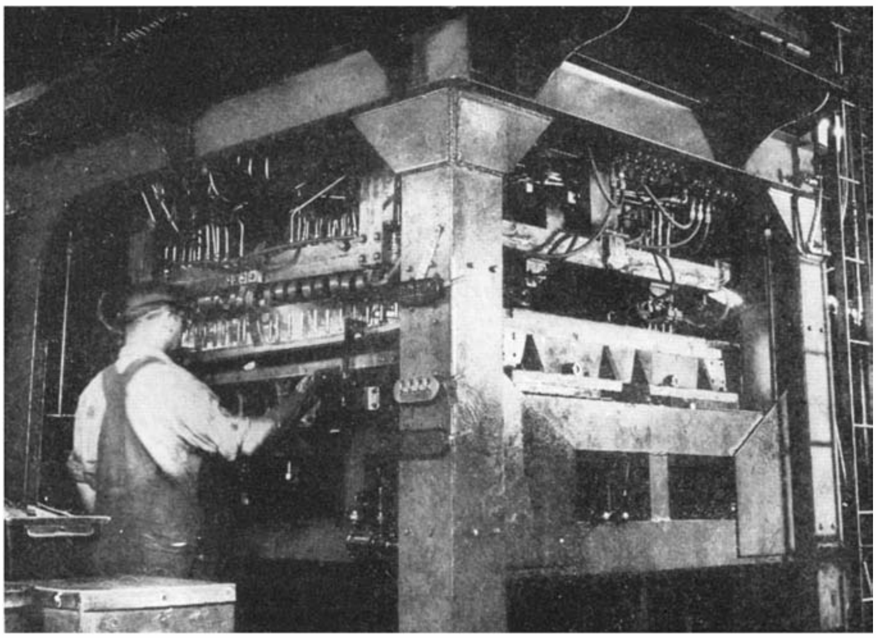
TWO PLASTICS FROM SOY BEANS

BY changing the moisture content of the protein of soy-bean meal, two different types of plastics can be made from it. With a moisture content below 5 percent, the plastics are like those made from zein, the protein of corn. If water be added to the protein, the plastic product resembles those from the casein of milk.—*D. H. K.*

LAST WORD IN WELDERS

ELMER WERK pushes a button in the body plant of the Hudson Motor Car Company, sparks begin to fly, and in exactly 22 seconds a total of 192 welds are completed.

The machine that does this work is known as a Multi-Hydromatic Welder. It welds re-



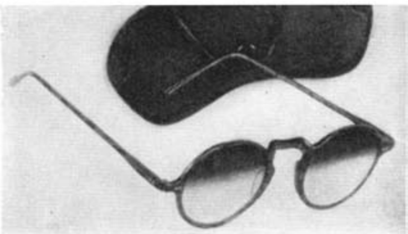
A total of 192 welds are made in 22 seconds with this new automatic welder

inforcements and wire clips to the underbody panel. The welds are completed on 14 major parts and five small parts on this panel, in one operation.

The push on the button by the operator automatically moves the table carrying the work into position, starts the welding, and, at the proper instant, 22 seconds later, stops the welding. Releasing a lever returns the table to its original position. It takes 38 seconds to remove the welded unit and set the machine for the next weld.

Safety Goggle for Motorists

AN ingenious product to combat effectively and practically the dangerous direct glare of headlights is the new goggle of the American Spectacle Company, Inc., called Moto-Glas. Wearing it, motorists can



Tilt the head for night safety

safely and easily banish the fear of "direct glare" headlight blindness.

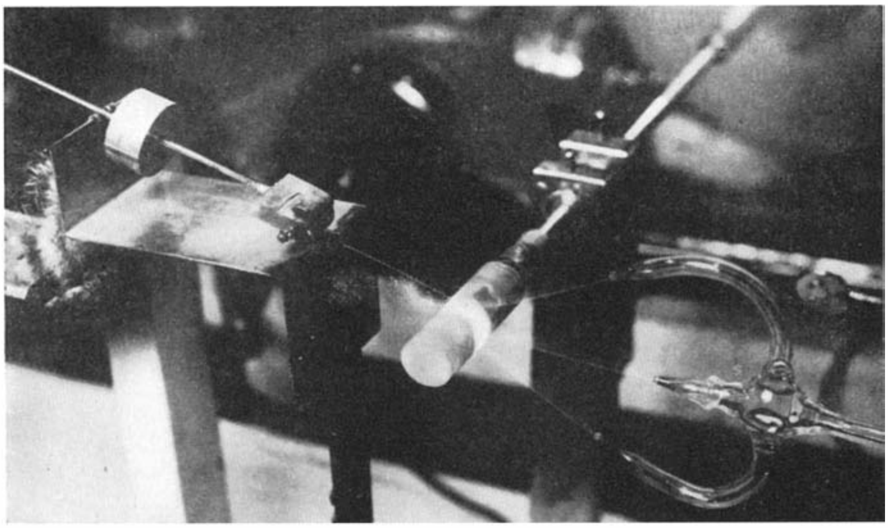
The method of operation is so simple that no instructions are needed. The glass itself is of one piece—the lower portion perfectly clear and the upper part gradually shaded from the center to the top of the lens, where the density is dark enough to dim the most blinding headlight, yet allowing the driver to see the side of the road and the oncoming car. The driver assumes a normal position of looking straight ahead while the road is clear. When approaching headlights flash across the eyes, just a slight downward tilt of the head affords glare protection and high visibility at the same time. As soon as the car has passed, the driver assumes a normal position and has clear vision through the clear portion of the glass.

> **DAMS**
>
> **MORE than 2,800,000 farm and range-land dams have been built under the supervision of Soil Conservation Service engineers in the past three years.**

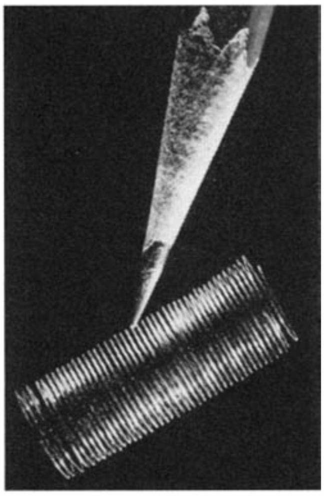
Glass-Like, But Springy

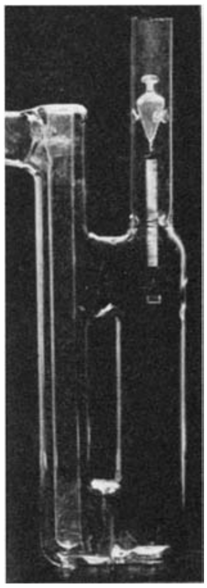
BECAUSE it excels the best spring-steel in several respects, glass-like, clear, fused quartz is being used as springs to indicate minute differences in weight in the General Electric research laboratory at Schenectady.

Briefly, springs made of hair-like filaments of quartz can be stretched to ten or more times their original length and will return exactly; steel springs would undergo a permanent stretching. Quartz has an extremely high melting point, and quartz coils can be used at elevated temperatures; steel springs



***Above:* How coil springs of quartz fiber are wound. The three flames impinging on the fiber from the right soften it. *Right:* Quartz spring supporting glass "boat" within a tube. *Below:* One of the coils compared with a pencil**





lose their temper at a relatively low temperature. Quartz spirals are not affected by any degree of humidity; steel is subject to corrosion. Quartz is practically invulnerable to the multitude of chemicals encountered in a laboratory; many affect steel. And, finally, quartz coils weigh far less than, and have resulting advantages over, corresponding steel springs.

In the laboratory investigations the quartz springs are usually suspended within a glass tube which is maintained at the desired temperature by immersion in an oil bath. A small glass "boat" suspended from the coil holds the sample under investigation. As the suspended sample varies in weight, so does the length of the quartz spring; and since the length of the spring is proportional to the weight, readings of length give accurate weight values. Measurements are made within an accuracy of a milligram, or 1/28,350th of an ounce.

The quartz springs are used in measuring weight changes of various materials, under different conditions of heat and humidity. In measuring the moisture absorption of cotton, the sample is suspended from the spring in a vacuum, and the stretch of the coil noted. As water vapor is introduced at different pressures, the amount of absorption can be determined by the increase in length of the spring. Another application has been in measuring the rates of decomposition, in high vacuums, of such materials as organic resins.

The quartz coils used in making the measurements are produced in the G-E research laboratory, out of rods of the fused material as produced in the Thomson Research Laboratory located at Lynn, Massachusetts. In the glass-blowing department of the laboratory at Schenectady a small section of a quarter-inch rod of the quartz is heated to more than 3000 degrees, Fahrenheit, with an oxyhydrogen flame. A sudden, straight pull is then applied, whereupon the quartz pulls out into a fiber of about six one-thousandths of an inch diameter—much as molasses candy stretches into threads. These threads, 15 or more feet in length, are calipered, and those within a quarter mil of the desired diameters are saved.

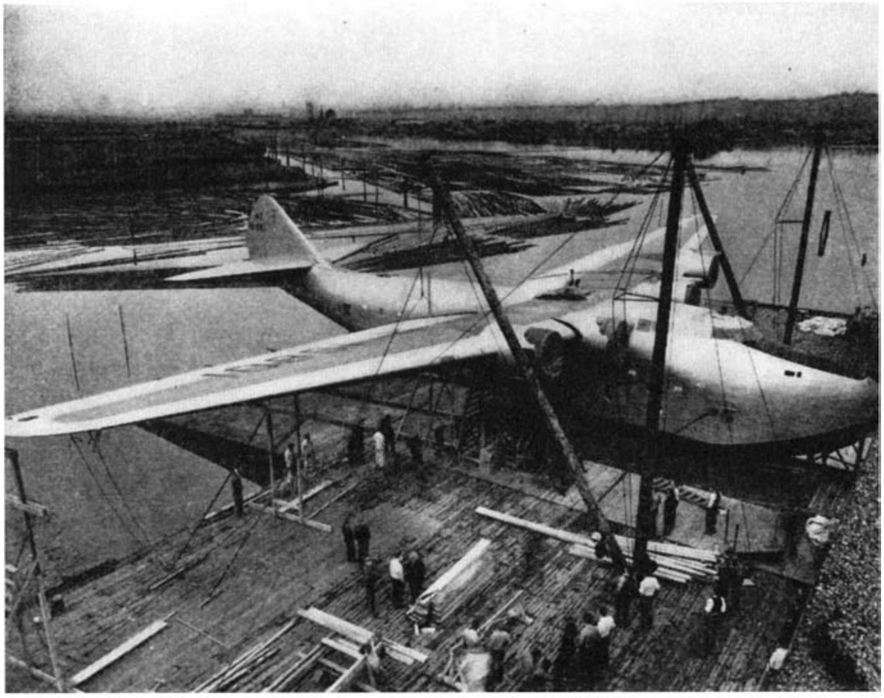
The thread is made into springs by placing it in a long, brass trough leading to a mandrel of the desired diameter. Three small flames of hydrogen in air, giving a temperature of 1800 degrees, Fahrenheit, soften the thread so that it can be coiled on the mandrel, which is being rotated at two revolutions per minute.

Some of the coils measure ⅜ of an inch in diameter and 1½ inches in length and have 50 turns to the inch; others are of ⅝ or ¾ of an inch diameter and have as many as 80 turns to the inch.

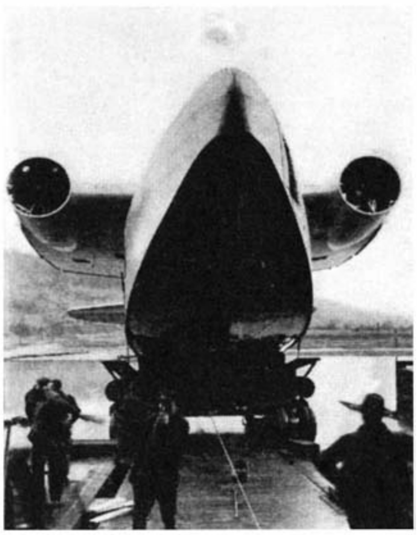
The Boeing Clipper Progresses

THE hull of the world's largest flying boat, now being built by Boeing Aircraft for Pan-American Airways, has emerged from its construction scaffolding into the open. Accompanying photographs show the hull and wing center section of the 41-ton Clipper.

Six of these flying boats are to be constructed. One hull after the other will be put on a 15-ton eight-wheeled cradle of



The Boeing Clipper, with wings attached, resting on its special dry-dock. *Below:* View of the hull, showing the two inner engine nacelles



structural steel, with a series of air tanks to give it buoyancy, prior to launching.

The hull looks so large that it gives more the impression of a surface vessel than of an airplane. The hull measures 109 feet from bow to tail. It has an outside surface, glistening in aluminum, of 4000 square feet, and an inside volume equal to that of an average five-room house. The height of the hull is 19 feet. The tail surfaces measure 49 feet from tip to tip, the dimension of a fair-size wing. The gross weight will be 82,500 pounds. Each of the four engines (twin-row Wright Cyclones) develops 1500 horsepower; they are the largest of their type ever built. The propellers, of the constant-speed automatically-adjusting type, will have three blades and an over-all diameter of 14 feet. Fuel tanks in the wings and in the stubs, or wing stabilizers of the hull, will hold 4200 gallons of gas. Cargo holds in the center section of the wings and in the bow compartment will carry five tons of mail and air express. High speed will be approximately 200 miles an hour and cruising range will be 4000 miles with 40 passengers on board. There will be a crew of eight men. Roomy sleeping quarters are provided for the 40 passengers, with accommodation for 72 day passengers as an alternative.

A spiral staircase will connect the flight bridge or control quarters on the upper deck with the main deck which will contain a series of spacious passenger compartments, dining room, lounge, private suites, and so on.

We marvel to-day at the luxury and equipment of the *Normandie* and the *Queen Mary.* Some day our transatlantic flying boats may be a source of even greater wonder.—*A. K.*

The Russian Polar Weather Station

WHY did the Russian scientists endure the danger and discomfort of establishing a weather station on the ice floes of the north polar seas? Because the whole secret of weather is to be found in the high altitudes, and in the investigation of the travel of polar air masses. Everyone talks of polar mass analysis, but the fundamental principles of this new applied science are not generally understood. Following an exposition by Dr. Spilhaus, of New York University, we can set down the elements of the subject and show that it is not so very complicated after all.

The equator receives a great deal of the sun's heat, the air expands and flows to the polar regions. At the poles the warmer air collects, and drives the cold air downward until a rough equilibrium of heat exchange is established. Of course, millions of tons of air are involved in this gigantic equalization process. The study of these mass movements from equator to the poles, from the poles at high altitude to the equator, is the main concern of the modern meteorologist, and has enabled him to analyze and predict weather in a fashion which is infinitely superior to that of the old time weather man with his rudimentary notions of pressure gradients and with no real key to the phenomena involved. The Russian weather station was established mainly for a study of these air currents, but its members discovered some disconcerting facts which make the possibility of trans-polar air transport flight from Russia over the North Pole to northwestern America seem a little remote. The "warm" months in the Arctic are cursed by intolerable fog conditions. The winter months are equally cursed by very stormy weather, sometimes combined with fog.

What we need now is a string of weather stations along the Arctic fringe of Canada. Data from such stations, together with similar data now being gathered in northern Russia and Siberia, would in the end go far toward solving the secret of the cradle of the weather in the northern hemisphere. A beginning of this study has been made by the inauguration at Point Barrow, Alaska, of regular observations by automatic "radiometeorographs" attached to pilot balloons. —*A. K.*

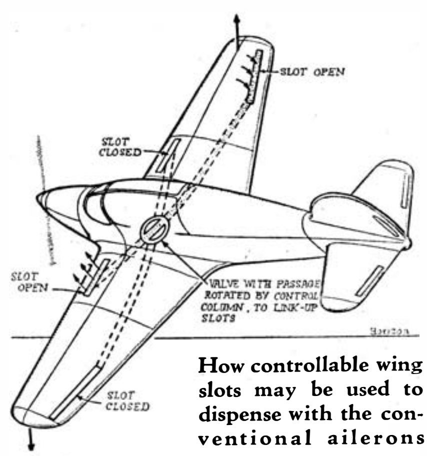
Airplane Control Without Moving Surfaces

BASIC new ideas in the aerodynamics of the airplane are comparatively rare. When we hear of a really new idea, we naturally feel some degree of excitement.

Ailerons give rise to flutter; they do not provide efficient control over the entire speed range; beyond the stall they may even give reverse control; as aircraft get larger, it becomes more and more difficult to actuate them.

A British patent, issued to Vickers Ltd. and D. L. Ellis, suggests the possibility of making use of the differences in pressure which exist over the surface of the wing, to dispense with moving ailerons entirely.

Over the leading edge of the wing there exists a pronounced degree of low pressure. Over the rear upper portion of the wing, there is less suction or even some degree of pressure. Why not interconnect the two points and secure lateral control thereby? The idea is illustrated by the diagrammatic sketch, reproduced by courtesy of the *Aeroplane.* A slot at the leading edge is connected through suitable conduits and a valve situated in the fuselage to a slot at the rear on the opposite wing. When, as shown in the sketch, the two slots are interconnected by the valve the following occurs: Lift is lost at the front slot, but increased at the rear outer slot. Since the outer slot has a greater leverage about the center line of the



How controllable wing slots may be used to dispense with the conventional ailerons

machine, a rolling couple or banking couple is created which is equivalent to the action of the ailerons.

Of course a patent only outlines such an idea. A great deal of experimentation would be necessary before it could be realized in practice. But the principle is correct, and it is our experience that when the aerodynamic principle is correct, the practical difficulties can eventually be conquered.

There is no reason also why the idea should not be extended, so that the suction of the front slot could be made to act on slots in the elevators and rudder. In that case, all moving surfaces would disappear.—*A. K.*

A Novel Idea in Jet Propulsion

THE aircraft engine radiator is always regarded as a source of air drag and of loss in performance. But two technical officers of the British Royal Aircraft Establishment have patented an idea whereby the cooling air passing around the radiators and cooling fins of the exhaust pipe will actually contribute to the thrust. Like all real ideas, this one has the merit of simplicity.

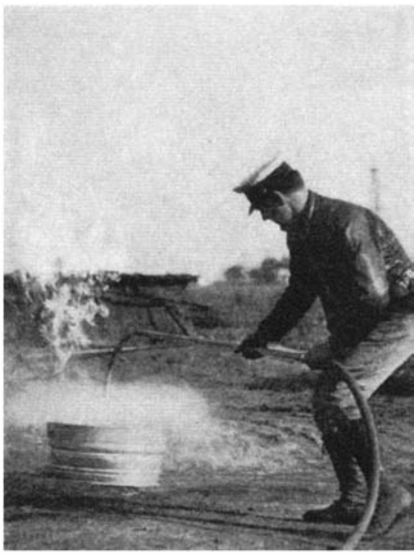
The entire engine with its exhaust manifolds is enclosed within the airfoil. Ducts in the leading edge allow slightly compressed air to enter the wing. The air then passes over the internal radiators and the finned exhaust pipe. In so doing it gathers heat, expands, and increases its speed. Then it exhausts through passages of gradually increasing area, so that its speed is converted into pressure. At exit the pressure is higher than that of the surrounding air. Therefore the stream exercises a backward thrust and a species of jet propulsion is produced. The heat released in cooling the engine is actually put to work! Of couse the device is hardly worth while for slow airplanes, but at speeds of over 300 miles an hour, the plan has considerable possibilities.—*A. K.*

Full Feathering Propellers

MANY of the new "hydromatic" full feathering propellers have been installed by United Air Lines on its transport

A full-feathering propeller with blades feathered through 90 degrees

When a stream of water, above, is directed on a gasoline fire, it has little or no effect. When a fog of water, however, is forced through a special nozzle (below) burning ceases almost immediately



planes. One of our photographs shows a pilot and a stewardess examining the blade of one of these propellers, "feathered" through a full 90 degrees, so that in flight it would be edgewise to the wind. Such 90-degree "feathering" has two great advantages: There is no "windmilling" or slow rotation of a propeller when the engine is not firing, and the head-on resistance of the feathered blade is reduced to a minimum. The importance of lowered resistance of the propeller in flying a twin-engined airplane with one motor out of commission is obvious.—*A. K.*

Fighting Fire With Water Fog

FIRE is a terrible danger in an airplane hangar. Hundreds of gallons of gasoline may be stored in the tanks of every machine. Fire in one aircraft may be followed by explosions in one ship after another, with enormous damage and great hazard to life. Roosevelt Field, Mineola, and other famous flying fields have been too often the scenes of disastrous fires. The use of water from an ordinary hose is useless; chemical fire extinguishers do not always prove effective. Since Los Angeles is perhaps the leading center of the aircraft industry it is entirely appropriate that Fire Chief G. Griswold of Los Angeles County should have developed a method of fighting fire with "water fog" which is proving remarkably effective in exhaustive tests.

The principle involved is simple. If wheat kernels are sprayed onto a fire, combustion of the wheat is slightly faster than that of wheat in bulk. When flour is shot into a fire through a nozzle, however, it explodes—combustion is instantaneous. Similarly when a stream of water is forced into a fire, there is but little effect. The water cools the surface of the material and reduces the production of burning vapor, but not rapidly enough. Chief Griswold's basic principle is to shoot two streams of water from nozzles in such fashion that the streams impinge upon one another, producing an exceedingly fine spray. The fine spray presents an enormously greater heat-absorbing area than the solid stream of water. Production of steam is instantaneous. The latent heat of steam—that is, the heat absorbed in turning water into steam—is relatively enormous. Thus in the production of the steam there is an exceedingly rapid absorption of heat. The burning vapor, in losing heat so rapidly, increases in density, oxygen is displaced by the downward motion of water fog, the mixture of air and burning vapor becomes too lean, and combustion ceases.

Water directed against burning wood may be an effective agent. Water directed against gasoline merely agitates the combustible matter and may actually increase the rate at which the fire spreads. But when the water impinges on gasoline in the form of steam, or water fog, combustion ceases very rapidly in spite of the low flash point of the gasoline.

These statements are supported by innumerable experiments of the Fog Nozzle Company. Because of the small quantity of water used, and the rapidity of the extinguishing process, material damage is reduced. This lessening of damage will be appreciated by anyone who has suffered damage to household effects following even a small fire.

Thus the sciences of hydraulics and of thermodynamics combined have given the airport an entirely new and effective method of fire fighting.—*A. K.*

Perfected Fluorescent Lumiline Lamps

INVISIBLE sunrays, imprisoned within tubular glass bulbs, and bombarding chemical powders which serve as energy transformers, are now being used to produce

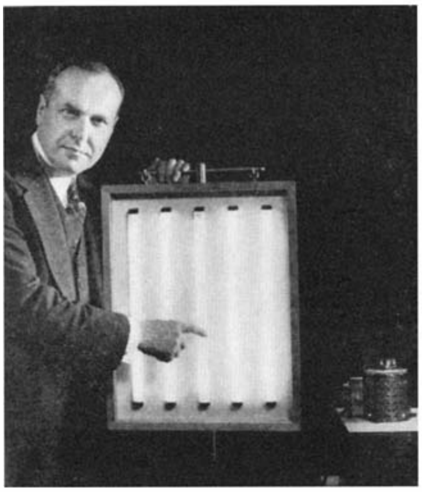
cool light sources that duplicate all the pastel tints of the rainbow.

The new light sources, designated as fluorescent lumiline lamps, provide hitherto unobtainable tints of colored light with, in some cases, as much as 120 times the illumination, for the current consumed, as filament lamps of the same color, and with only a fraction of the heat. One of them produces the nearest approach to natural daylight ever achieved by any artificial illuminant.

Fluorescent powders, compounded in the Nela Park laboratories of the General Electric Company and specially heat-treated, hold the secrets of efficiency and color-producing qualities of the new lamps, it has been revealed. Activated by ultra-violet, and functioning as transformers, the powders absorb the short, invisible ultra-violet rays and re-radiate this energy in those higher wave-bands that comprise the color range of the spectrum. Each powder has its own characteristic wave-band with which it responds to the ultra-violet, thus forming its own particular color of emitted light.

Within the bulb of the new fluorescent lamp is a trace of mercury, a small amount of argon gas at low pressure, and a coating of the fluorescent powder. When the current is turned on, the argon serves as a "starter," and in a fraction of a second a feeble blue light with a large component of invisible ultra-violet radiation is generated inside the tube. The ultra-violet radiation strikes the fluorescent coating and is re-radiated in the visible range of the spectrum. Like all electric-discharge light sources, the fluorescent lamps require special transformers, or chokes, which serve as valves in controlling the flow of electric current. Unlike some other types of mercury-vapor lamps, however, they attain full brilliancy in a few seconds.

Among the many fields of application for



***Left:* Coating the inner walls of a new lumiline lamp. The fluorescent powder in solution is poured in; the excess is poured out. *Above:* A set-up of five of the new lamps**

the new fluorescent lamps might be listed the following: theaters, hotels, specialty shops, stores, beauty parlors, art galleries, architectural built-in lighting in many forms, railway cars, and so on.

SILVER

NEXT to the United States Mint, the Eastman Kodak Company is the largest single user of silver bullion in the country. To make photo-sensitive films and papers, that company uses five tons of silver bullion per week.

Celluloid Pipe Coatings

SEVERE corrosion of the outside of pipe lines carrying oil and gas across country requires special measures to be taken to prolong the life of the pipe. Cellulose nitrate plastic (Celluloid) has been successfully applied as a covering on cross-country pipe lines. The sheet of Celluloid is softened in a solution of ethyl acetate, alcohol, and water, wrapped around the cleaned and painted pipe and allowed to dry. The coating shrinks in the process and fits tightly around even the irregularities of the pipe. This apparently expensive treatment is justified by the much longer life of the pipe in service.—*D. H. K.*

Biblical Plagues Still Weaken Egypt's Health

THE Biblical plagues still afflict the land of Egypt.

Far from being a never-repeated reign of terror, the plagues with which Moses frightened a Pharaoh into releasing the Israelites were fearful because of their familiarity. And they still recur in more or less serious form.

The sequence of health hazards which the Nile brings each year was deplored recently before the World Federation of Education Associations by a physician of the government health service in Cairo, Dr. Isabel Garvice.

Pointing out the Biblical antiquity of these conditions, Dr. Garvice said that every August, then and now, the rising Nile turns blood-red from its load of heavy mud.

To drink this water is to invite sickness and death. Yet the Egyptian peasant is convinced that drinking well water would turn his hair gray and make him old before his time. Rather than risk such calamities, he clings to his year-'round habit of drinking from river or canal, and the blood-red water brings the plague of boils. The children, says Dr. Garvice, often have 10 to 20 boils on face and body.

As the flood waters lessen, come the plagues of frogs, flies, and death to the babies.

Even the three days of darkness, which enveloped the earth in the Bible siege of plagues, is still experienced. The darkness takes the form of sandstorms, which are still terrible in upper Egypt and still usually last three days.

"All these things," said Dr. Garvice, "are put down to the will of God and accepted with resignation by the peasant."

But the Egyptian government is determined to cope with its plagues. Children, under compulsory schooling, are being taught health habits and given medical attention. Rural villages are shown hygiene films. Medical centers are established. The conquest of the plagues is advancing—slowly.—

And it Still Burns

STRANGE experiences have been undergone by Mazda lamps, but none, within knowledge, like that recently survived by the one shown at right in the accompanying photograph. Nor, in the opinion of Nela Park engineers, is it likely ever to be duplicated.

Used in a drop cord in an Oklahoma City ice-cream plant, the lamp was burning when a fire broke out. During the blaze, an ammonia tank exploded, crashed through the wall of the building, tore through an empty barn on the opposite side of the alley, then burst through the kitchen of a house on the near side of the next street, finally coming

An incandescent lamp, subjected to intense heat in a building fire, bulged but remained burning. It is here compared with a standard bulb

to rest on the front lawn of the house whose kitchen it had reduced to a shambles.

When the smoke and fumes cleared away, there was the lamp, which had been directly in the path of the explosion, still burning, although the combined heat and pressure had softened and distorted the bulb to its present odd shape. Had the heat blast been of longer duration by even a fraction of a second, the glass would have melted, with resultant lamp failure, say lamp experts.

The lamp, which continues to burn, is being preserved in a collection of lighting oddities in the General Electric Institute at Nela Park.

TRANSITION

STEAM enters a modern turbine at a temperature hot enough to set fire to a piece of wood and .03 of a second later leaves it at a temperature too cool for a comfortable bath.

Yerba de la Pulga

RECENTLY the Pan American Society of Tropical Research notified us that they have been successful in bringing back to this country nearly three million seeds of the species of plant known by its native name as "Yerba de la Pulga." Extensive experiments and observations indicate that this plant possesses exceptional insect-repelling qualities, and it is the Society's belief that the plant not only contains, but actually exudes, sufficient quantities of the drug "rotenone" to make a single growing specimen of the plant repellent to practically all forms of insect life in an area of some 15 to 20 square feet.

Since the Society desires to distribute these seeds to all who wish to experiment, they have asked us to say that they will send a small package to all readers requesting them between July 1 and August 1, provided a stamped self-addressed return envelope is enclosed with the request. The Society states that there is absolutely no obligation attached to this offer.

Anyone wishing to co-operate in this experiment may do so by sending the stamped envelope as requested to the Pan American Society of Tropical Research, Post Office Box 1698, New Orleans, Louisiana.

Hand Work by Electricity

TOOLS for cutting metal sheet and plate have been immensely improved in recent years, in the opinion of *Nickel Steel Topics*, both through ingenious design and the use of proper materials. This fact is well exemplified by the Unishears, manufactured by the Stanley-Electric Tool Division. This device is illustrated in one of the accompanying photographs.

Electrically driven, the Unishears are produced in three portable sizes capable of cutting thicknesses of from 18 to 12 gage in hot-rolled steel. It is stated that they will do any job that can be done by hand snips, and with much greater rapidity, up to 2400 shear cuts per minute. This high speed ob-

Electrically driven, these portable metal shears have many applications

viates distortion of metal, burrs, irregularities, and other causes of wasted metal. Cuts are accurately made in straight, curved, or angular lines. The device is available for all voltages.

Similar "companion tools" are shown in two other illustrations. One of these shows the new Stanley Safety Saw, built for carpenters, builders, and plant maintenance men. This may be used as either a rip or crosscut saw for many kinds of hand work. It comes in varying voltages from 110 to 250.

The second "companion" is the new Car-

An electrically driven plane speeds up many wood-working operations

ter "Wasp" Plane, which is adapted for use in many operations, such as fitting doors, window sash, screens, shutters, drawers, inside trim, and so on. Running at 18,000 revolutions per minute, the patented spiral cutter leaves a smooth, waveless surface. This device comes in voltages of 110 or 220 as specified, and the motor is universal.

Correction

UNDER the head "As Others See Us," we published in our June issue a brief item attributed to the *Sphere* of London commenting upon various facts concerning the population, production, and banking resources of the United States. This particular item had been reprinted in a number of places, each of which had given credit to the London magazine for original publication. It appears, however, from a note in the *New York Herald Tribune*, that this was originally published by a publication also called the *Sphere* but published in Washington, D. C. This fact voids the title of our brief item, though it does not in any way alter the facts or the opinions that were presented.

Three Miles Down!

FOR years oil men have been talking about drilling a well three miles deep. Three miles is exactly 15,840 feet. Now there's an oil well at Wasco, California, which has been drilled to, and is producing from, 15,010 feet below the surface!

Drilling began about 16 months and $300,000 ago. On January 31, 1938, the well

Ripping or cross-cutting may be done with this portable power saw

equalled the world's record, 12,876 feet, and drilling was halted by temperatures of 225 degrees, and up. Difficulties were overcome, however, and drilling was resumed at the rate of 50 feet of six-inch hole a day. On April 12 last, the presence of oil indicated that the $300,000 had not been entirely wasted, and that eventually oil in paying quantities might be brought up through the 175 joints of steel casing, each 90 feet long.

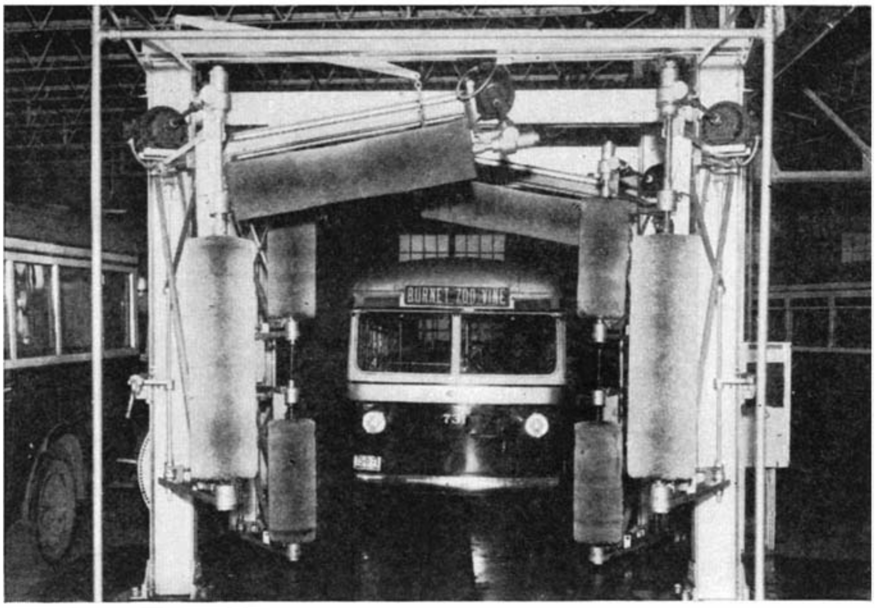
It will require the sale of 7,500,000 gallons of gasoline, equivalent to the annual consumption of 10,000 passenger cars, to pay the cost of drilling—alone. That is, if the seller can make as much as the tax collector --four cents a gallon!

Silver Lined Cans

INVESTIGATIONS are being made of the possibility of lining cans for foodstuffs with silver in preference to tin. Even though silver is far more expensive it may be more desirable for some purposes.—*D. H. K.*

Copper for Diabetes

AN inquiring German physician, Dr. R. Schnetz, recently discovered that with the aid of copper, diabetics will be able to eat whatever they wish, according to an announcement by the Copper & Brass Research Association. Through experiments covering three years, Dr. Schnetz found that even though a diabetic consumed an un-



Courtesy Leeds, Tozzer, and Co., Inc.

When a bus of the City Transit Company in Cincinnati, Ohio, is to be washed, it is driven to this "laundry." The driver turns on the headlights of the bus, the light from which strikes a photo-electric cell and starts the machinery. A spray of water thoroughly drenches the bus while motor-driven brushes scrub the sides, windows, and roof simultaneously as the bus is driven slowly through the washer. When the headlights are turned off, the washer stops. It requires only about 30 to 40 seconds for the job

usually large amount of sugar and starches, a small dose of copper kept the sugar-content of the blood at the right level. Insulin requirements could be materially reduced and, in slight cases of diabetes, might be dispensed with entirely if 10 to 20 milligrams of copper were substituted.

FLAMES

THE highest solar prominence ever recorded, observed by Mount Wilson Observatory recently, rose to a height of just under 1,000,000 miles from the sun's surface. Its highest rate of rise was 124 miles per second.

How Acid?—How Alkaline?

SUPERIOR to the old well-known litmus paper in many cases, a new wide-range test paper has just been placed on the market by R. P. Cargille. Its color changes total five, ranging from very strongly acid, which is red, and then through orange, yellow, green, to the strongly alkaline, which is deep blue. For the sake of convenience a color label is provided.

Such a test paper should prove valuable in many laboratories for process control, product testing, and analytical procedures.

It Weighs the Weather!

WHAT happens to a rain drop? That's exactly what the government is spending millions of dollars at the 8000-acre Coshocton (Ohio) Hydrologic Study to find out. For, involved in this apparently simple question is the whole problem of floods, erosion, and soil conservation. Here they are trying to find out how to make the valuable top-soil "stay put"; how to make it absorb a maximum of water. They are trying to find out how much rainfall evaporates, how much soaks in, how much runs off on various surfaces and types of soil. It is anticipated that to get an answer may involve 15 to 20 years of work.

To gather the vast amount of scientific data, it was necessary that a number of new testing devices be developed. One of the most interesting and important of these is the Toledo Lysimeter Scale.

This device can best be described by outlining the method of installation. The first step is to sink what amounts to a coffer dam around a block of soil approximately 7 by 15 feet. This goes down to a depth of 11 feet. The net result is that this block of soil is separated from the surrounding ground—yet its surface and composition is in no way disturbed. A supporting structure is placed around it and the unit mounted on scale levers. The accompanying photo was taken while construction was going on and gives some idea of how the device appears from the surface. The entire weighing mechanism is, of course, underground, and when construction work is finished, very little evidence of the device is apparent from above.

From a weighing standpoint a number of interesting problems were introduced. A mass of earth of this size weighs approximately 100,000 pounds. Yet all the scientists were concerned with were the variations in weight caused by gain or loss of moisture. So the scale was back-weighted for this 50-ton dead weight, and a dial of only 5000 pounds capacity was needed. Also they wished to have readings automatically taken at half-hour intervals. This is accomplished by the use of a continuous-strip Printweigh which has a special time-interval mechanism. As a result, the whole unit functions automatically and continuously.

What do they propose to learn from these records? Suppose during a rainstorm 50 pounds of water falls on this "miniature farm." There may be five pounds run-off from the surface. This is collected in a rain-gage for measurement. Another 20 pounds may seep through the soil (and be collected in another rain-gage at the bottom). That accounts for a total of 25 pounds. Then by checking the continuous strip record of the Printweigh it is found that the block of soil is 20 pounds heavier than before the rain. In other words, the soil has retained 20 pounds of moisture. This leaves five pounds unaccounted for—this being the amount that has evaporated. Through this equipment, every change in the moisture content of the soil is recorded.

By placing Lysimeters in various types of surfaces (grassy, plowed, eroded, etc.), a vast amount of information can be collected that will aid still further in putting agriculture on a scientific basis. And by finding which type of surface holds the maximum amount of moisture much can be done to prevent erosion and to control floods at their source.

Weighing the weather will be accomplished with this scale

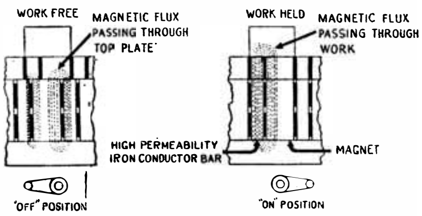
Magic Eye in Chemistry

ELECTRON-RAY tubes, familiar in modern radio sets as the "eye" which shows when the set is in tune, are being applied to faster, more accurate chemical analysis. Changes of color of certain dyes have been traditionally used to indicate the completeness of reactions measured in analysis. Because of the insensitivity of the dyes and of the eyes of the analyst to the color changes, attempts have been made to avoid their use. Most recent of the improvements in apparatus for chemical analysis is the inclusion of an electrical system operating an electron-ray tube which blinks at the exact end-point of the reaction measured.—*D. H. K.*

Magnetic Chuck

A NEW magnetic chuck that does not require electric current and is readily portable has just been developed by Brown & Sharpe Manufacturing Company. This new device is equipped with a permanent

Above: **The non-electric magnetic chuck in use.** ***Below:*** **How the magnetic flux is diverted from work**



magnet so that there are no wires, no heating, and no running costs. It is adapted to wet as well as dry grinding, as it is so completely sealed that coolant cannot enter the internal parts.

One of the accompanying illustrations shows the manner in which the magnetic flux is diverted, when the lever is on the "on" position, through the workpiece, thus holding it firmly during grinding or chiselling operations. When the lever is in the "off" position, the magnet's conductor bars and separators are so shifted that the magnetic flux completes its circuit by passing through sections of the top plate inserts without going through the work itself.

Beef Blood Powder in Hemophilia

A POWDER from beef blood which stops dangerous bleeding in hemophilia was reported by Drs. Frederick J. Pohle and F. H. L. Taylor, of Harvard Medical School and Boston City Hospital, at a meeting of the American Society for Clinical Investigation.

The ever-present danger to a person suffering from hemophilia is the fact that his

blood clots so slowly that he may bleed to death from a small cut. The condition is hereditary, affects only males, but is transmitted through the mother.

The powdered substance from beef blood checked bleeding from external wounds and following tooth extractions in five hemophilia sufferers, Drs. Pohle and Taylor reported. The substance itself is a protein called globulin and was obtained from the fluid, or plasma, of beef blood. It is effective only when applied as a powder to the bleeding surface. It failed to hasten the clotting of the hemophiliac's blood when given by mouth, or to stop bleeding when used locally in solution.

This life-saving material, the scientists pointed out, is not yet available in large enough amounts for general distribution.—Copyright, 1938, by *Science Service.*

CLIPPERS

IT is not so many years since everyone marveled at the construction of 20-ton airplanes. They have become commonplace. Now Igor Sikorsky predicts that it will not be long before there will be constructed 1000-ton flying clippers capable of carrying thousands of passengers.

Aluminum Motion Picture Film

OF particular value for educational and archive purposes is an aluminum motion picture film developed by the Fischer Film Corporation. This film, being opaque, must be projected by means of reflection, a principle which is well known and which gives good results both for picture projection and for the reproduction of sound tracks. Existing transparent negatives may be used for printing metal positives. Some of the advantages claimed for the new aluminum film are that it is not flammable and does not produce any gases, as is the case with certain standard Celluloid base films. Aluminum film is reported to be virtually indestructible; samples have been projected 1500 times without any perceptible wear. The metal film is permanent; there is no shrinkage and it never cracks or grows hard. It can be used in all climates from frigid to tropical, resisting dampness, mold, heat, and cold.

Because the film base is opaque, both sides may be used, thus cutting in half the number of feet of film required for a certain projection time. The cost is reported to be extremely low, not only because of the cheapness of the film base but also because of the fact that only 50 percent as much footage is required.

Automatic Radio Control

COMPLETE remote control—tuning, volume, and turning the set off and on—is one of the features of a new radio set called the Telematic, produced by E. H. Scott Radio Laboratories. By means of a small push button panel, the operator can select stations, turn the volume up or down,

Buttons on a small panel give complete remote control of a radio set

turn the set off or on, and can also control the built-in phonograph. Additional loudspeakers and keyboards can be placed in various rooms of the home and operated at differing volumes.

The set is also so arranged that it will automatically select a group of programs over a period of 24 hours, being pre-set by means of plugs for changing the tuning of the receiver as often as desired.

Insulation for Plating Racks

CORROSION of the racks on which metal parts are hung in an electroplating bath is a serious problem with platers. Not only is the destruction of the racks themselves expensive but impurities introduced into the bath are likely to be objectionable. A new synthetic resin product which will resist the corrosive action of solutions used in plating nickel, copper, zinc, silver, and cadmium even at the temperature of boiling, can be applied with a brush or by dipping. It provides not only protection against corrosion but also insulation against the electric current.—*D. H. K.*

Do Flies Shun Blue?

WHETHER or not flies—house, horse, or blue-bottle—have any artistic sense can be of little interest to anyone but the flies. However, the observation that flies appear to dislike and even to shun rooms painted blue is of immediate personal interest to everyone who has ever had to share his ice cream with *Musca domestica*, the common housefly. Although the literature on the life and habits of flies sheds little light on the subject, there appears to be a well-founded belief in many countries that flies are unhappy in the presence of blue, particularly a medium or "implement" blue.

While traveling in France, G. B. J. Athoe, an English architect, found that the walls of most of the hospitals and clinics there are painted blue for the purpose of discouraging flies. Both architects and physicians in France supported the theory that a light blue is disliked by flies and is an effective method of keeping the insects out of sickrooms. Pursuing the subject further, Mr. Athoe found that abattoirs and factories built in Denmark by a distinguished Dutch engineer had bright blue interiors for the same purpose, a practice which the engineer had found successful in the kitchen of his own house.

A Frenchman some years ago conducted experiments on the color preference of flies, using a box, the walls of which were covered with squares of paper of various colors. Observations were carried on over a considerable period of time, and the box was turned in different positions in order to avoid error from other causes. After several days, a count of the flies in the box showed that 18 of the insects had chosen to rest on a clear green paper. The next largest number had chosen rose for their resting place, with clear yellow, azure, and clear red following in that order. Only one fly was found on the ultramarine blue. No conclusions were reached as to why flies chose azure blue rather than ultramarine.

As a result of his inquiries the English architect found that bright blue walls and ceilings have been found effective for keeping flies away in a number of English homes. One shrewd Englishman, suspecting that most flies enter the house via the kitchen, painted the walls and ceiling of that room powder blue, and found that this color barrier kept the rest of the house free of the flying pests. This practice is common in some South American countries and in parts of the West Indies where, in many instances, fly screens are not considered necessary when blue is used as a decoration.—*Technology Review.*

SPRINGS

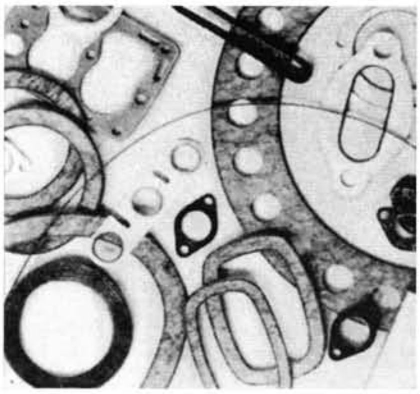
THE tiniest products of the steel industry are coil springs which weigh only 12 millionths of a pound each. Jewelers use them in necklace clasps.

Make Your Own Metal Gaskets

FOR the first time since the original gasket was used, it is now possible to make metal reinforced gaskets on the job, from any soft gasket material. The reinforcing is done with a channel-shaped, flexible strip of copper or other metal. This strip has serrated edges and pre-formed teeth and is fitted around gasket openings after the gasket has been cut. No special tools or skill are required. The teeth can be started, in most materials, with the fingers alone. The strip is cut from a coil as required, and ends may be either butted together or slightly overlapped. The flexible material is readily formed around sharp corners and irregular outlines.

When pressure is put on the gasket, the teeth are firmly imbedded and the material is completely metal clad at points where strength is needed the most. Any of the commonly used materials can thus be protected against pressure, corrosion, heat, or other factors that frequently cause rapid deterioration.

This strip, called "Bindedge," manufactured by the Azor Corporation, comes in 25 foot coils and three sizes, for binding material from 1/32 to ¼ of an inch thick. It



A variety of metal reinforced gaskets made with new binding material

is useful also for binding mounted maps, blue prints, drawings, and for protecting edges of many articles made from asbestos millboard, compressed or woven asbestos, fiber, felt, cardboard, paper, cork, rubber, fabric, lead.

EYE TEST DEFEATS FRAUD

A NEW eye test has been developed which will absolutely trap those who are fraudulently claiming damages for impaired sight in either eye.

According to Dr. J. F. Neumueller, director of American Optical Company's bureau of visual science, this new malingering test determines objectively, for the first time, the visual defectiveness of either eye without the person tested knowing which eye is under examination.

It is claimed this new test will have extensive use in professional and insurance offices for eye examinations and the detection of fraudulent or excessive claims for eye damages.

As explained by Dr. Neumueller, the test is dependent on the use of polarized light—rays that vibrate in one plane only. The test set consists of: (1) a spectacle frame containing two Polaroid lenses so inserted that the Polaroid axis in one is 45 degrees and 135 degrees in the other; and (2) a cross slide also equipped with a Polaroid disk which fits into a projector.

The polarized spectacles, the lenses of which look the same, are then placed on the person tested and he is asked to look through them at test letters projected on a screen. By manipulating a handle on the cross slide, the Polaroid axis may be changed from 45 degrees to 135 degrees, or vice versa.

When the axis in the slide is at right angles to the axis of one lens, the light coming from the projector through the slide lens will be completely polarized and the person tested will be unable to see the test letters with that eye.

By turning the handle, the axis of the slide can be altered so that it will be at right angles to the axis of the other lens and the person tested will be unable to see out of the other eye. This can be done without his realizing it.

In this manner, it can be quickly discovered whether he is shamming loss of sight in either eye since he is never aware with which eye he is seeing. In addition, the visual acuity of the malingering eye can be determined without his knowing it.

Conducted by JACOB DESCHIN

On Carrying a Camera

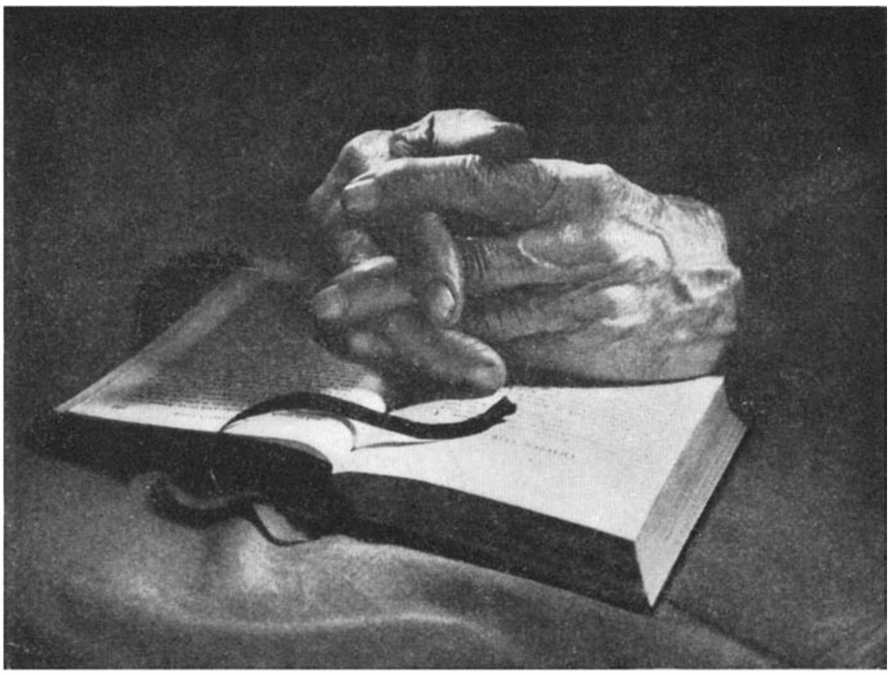
HOW do you carry your camera? Or perhaps you haven't given the matter any thought and simply stuffed your pocket (if you use a miniature) and went. If so, we suggest you mend your ways. It does not matter whether you paid much or little for your camera. The point is it's all you have and it's what you are using; therefore, you should give it every care and every attention.

Most persons generally agree that a camera should be carried in a case. Witness the great popularity of the ever-ready case, permitting as it does the use of the camera without removing it from the case. However, other camera users prefer to hold the camera itself, finding the case irksome for some reason. These latter, therefore, although they use a case of the ordinary type, often forget they have a case; after they once remove the camera in the course of a camera jaunt, they do not return it to the case until after the supply of film has been exhausted or they have decided to call it a day. This is a mistake. The camera should be returned to the case whenever there is a picture-taking interim of even short duration. Unforeseen accidents do happen and a camera that is dropped or banged when in a case will suffer but a fraction of the harm caused by a camera dropped without benefit and protection of a case. Of course, it is understood that the case you own or will purchase is well constructed and sturdy, with all edges and front strongly made to withstand hard knocks.

To minimize the danger of accidental knocks, some amateurs make it a practice to carry the camera case slung over one shoulder *inside* the coat. The coat prevents swinging of the camera and thus furnishes additional protection. Of course, this method is not convenient with the reflex types and larger cameras. In these instances it is suggested that the camera case (which we presume is carried suspended from the shoulder) be carried with the case shifted toward the front rather than the back of the body. This same method may, of course, be employed with the relatively "flat" types of cases.

Then there is the pouch type of case, usually a soft leather affair, that is carried in the coat pocket. This is fairly satisfactory if the camera is relatively light in weight, since the pocket of the coat provides the additional protection that is necessary. However, special care must be taken when carrying the camera in this manner to avoid accidental bangings. This type of

1st Prize Winners in



Calm, serene repose is ideally exemplified by this First Prize print submitted in our contest by Edward Canby of Dayton, Ohio. The photograph was taken with a Voigtlander Avus camera on 9 by 12 cm Agfa Superpan Portrait film

pouch is sometimes used for carrying small cameras "on the hip." This latter is certainly to be avoided, and for reasons of safety for the camera that it is not necessary to discuss here.

Carrying the camera slung from the neck and resting on the chest, with front of case opened and lens exposed without cap, is another of the don'ts. At least cover the lens if you *must* carry the camera in this way. Speaking of covering the lens, we make it a practice when working outdoors to keep the lens covered at all times when not actually shooting pictures, automatically uncovering the lens each time. And believe it or not, we have been doing this with one particular camera for about three or four years and haven't forgotten to remove the cap once. It's all a matter of habit; and it's a good habit.

The Miniature Camera's Rise to Fame

PHENOMENAL success always comes attended by questions as to the cause or causes that brought it about. And so it is with the miniature camera, which has inspired such questions as: "What do you believe is the reason for the meteoric rise to favor of the miniature camera?"

It is difficult to lay one's finger on any one cause or group of causes. One of the principal causes was probably the apparent inauguration of a new idea in photography, namely, that one could carry about one's person a diminutive camera which could be whipped out at a moment's notice to shoot a candid picture or stop a fleeting subject, and continue taking pictures to a total of 36 exposures before reloading. Another reason may have been the fact that, because of the fast lenses which could be used with these cameras, pictures could be taken in theaters, snapshots taken at night indoors and outdoors, and many other subjects attempted that had not been possible before.

But these are merely superficial causes; in themselves they are not sufficient reasons for a popularity that has lasted several years so far and bids fair to continue for some time to come. Photography as a hobby possesses a self-revitalizing force that will make it live forever; the miniature camera is but a spark that has set an old flame blazing anew. The miniature camera was born and survives not for itself alone but because of the many new applications it has introduced, because of the fresh and spirited viewpoints it has inspired.

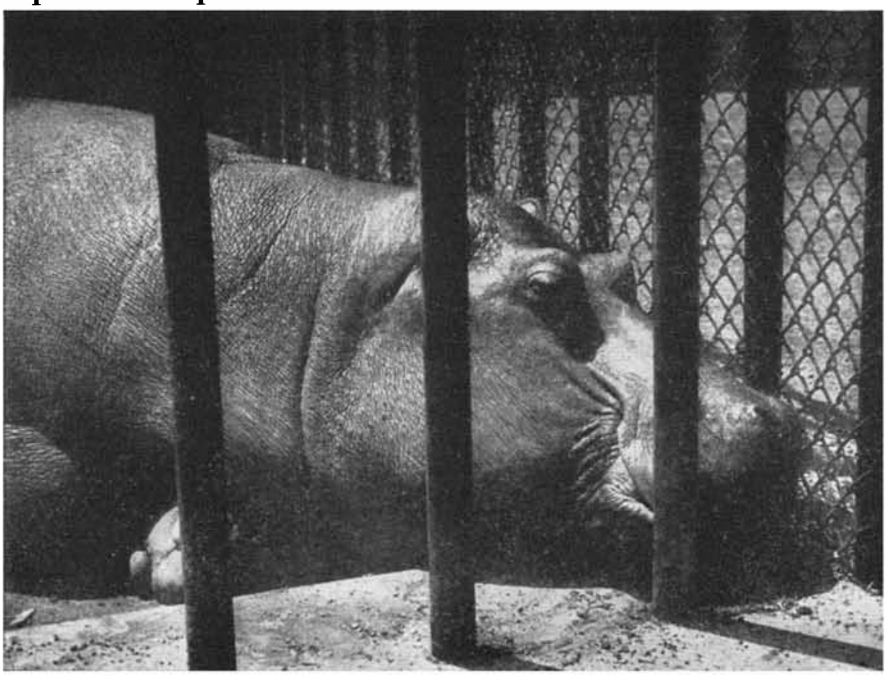
One of the chief contributions of the miniature camera has been in the technical and scientific fields where it has been of invaluable aid in recording the facts of science in a manner unequaled by any other method. Not only have records been made of facts known though not previously set down so graphically, but new facts have been uncovered and made indisputably true by the compelling proof of an image gathered by a lens and implanted on a sensitive film. This power of the miniature camera is being appreciated in various departments of science, industry, and exploration to such an extent that today we see a great and marvelously growing interest on the part of research workers in the use of this medium to aid them in their work.

All for Fine Grain

THE battle of the scientists for the ultimate in fine grain continues apace, a little inkling into the thoroughness with which this battle is waged having recently been afforded this department by the du Pont people.

"At the Redpath Laboratory at Parlin, New Jersey, where du Pont chemists are occupied in research on cameras and motion-picture films," they write us, "photographs with the microscope are found invaluable in the development of film itself—which there-

"Repose" Competition 2nd



Fine lighting and rendition of texture add to the repose theme of this Second Prize print submitted by Carlyle F. Trevelyan, Flushing, Long Island, New York. Taken with a Zeiss Ideal "A" camera on 2¼ by 3¼ Agfa Superpan film

by becomes an agent in the perfection of its own efficiency. Progressive enlargements of a negative from contact to 1000 times give a ready insight into the grain and clarity of the various experimental emulsions."

Now, who mentioned 15- and 20-diameter enlargements?

Natural Picture "Frames"

THE use of natural picture "frames" in photography was noted in this department some time ago in connection with the framing of a distant view by trees and branches in the foreground. Archways found in parks and public buildings provide other pictorial "framing devices" that furnish the answer to many a difficult problem in composition. As an example of this type of picture, we offer the accompanying illustration.

Through an archway

Substitute for Cotton

RECENTLY we had occasion to put to photographic use the familiar domestic accessory known as cleansing tissue, when our supply of cotton wadding was at zero just as we were getting down to some business of spotting glossy prints. You know, of course, that glossy prints may be spotted with pencil if the parts to be worked upon are previously treated to the retouching dope employed on negatives. A ball of cotton is ordinarily used to apply the dope and to rub it in. However, in the absence of cotton, we found the cleansing tissue was perfectly suited to the purpose and gave no trouble as to lint. As you know, the tissue is very soft and absolutely non-abrasive, making it ideal for photographic chores wherever it is desired to clean delicate surfaces, including the cleaning of the lens.

Baseball in the City

AS a picture describing an incident in a local baseball game, the sports editor would be fully justified in throwing this effort into the waste basket without a second glance. But we have a notion that the Feature Editor, looking for something to

"Baseball in the City"

illustrate recreation in the city, would feel more kindly disposed towards it. The spectators informally sitting about on the grass, the buildings in the distance and a baseball game in active progress—these are the elements which seem to us fairly accurately to picture a phase of city life on an off-day. Incidentally, don't you agree with us that the figures in the immediate foreground add immensely to the element of perspective in the picture?

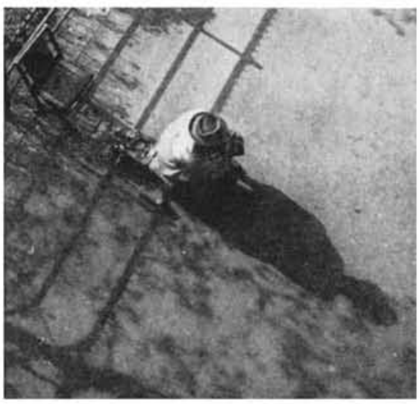
Lady Candid Shooter

Her husband doesn't like the idea but Rosa Rolando Covarrubias, wife of the famous caricaturist, is a dyed-in-the-wool candid camera enthusiast willing to face even dangerous obstacles if the reward ahead is a batch of good shots. In a recent interview with Helen Worden, of *The New York World-Telegram*, she told of some of her adventures.

On one occasion, after an attempt to photograph an Arab chief in Tunis, who, she relates, "didn't like it because he thought I was taking his soul," Mrs. Covarrubias started using an angle view finder attachment, which permitted her to take pictures of subjects while apparently looking in another direction. Thus she was able to snap Singapore dancing girls in the native quarter, Mexican peons digging in Mayan ruins, and ceremonies in unexplored temples.

Lucky Encounter

Here's a lucky composition. The figure not only is placed in one of the "strong points" of the familiar rectangle but is firmly held there by the diagonal line created by the shadow of the fence. Had it not been



"Jest Restin' "

for this counter diagonal, the shadows of the tree branches and leaves on the sidewalk, the lighting of the chair and the restful attitude of the figure, the main diagonal, carried perfectly through by the chair, the shine box, the figure and the long shadow of the latter, might have seemed almost stark. As it is, the picture has warmth and atmosphere. Taken from the stairway of an Elevated Railway station with a 35-mm miniature camera, the picture furnishes one more proof of the benefits to be derived from making a habit of toting the camera with you whenever feasible.

WHAT'S NEW
In Photographic Equipment

If you are interested in any of the items described below, and cannot find them in our advertising columns or at your photographic dealer, we shall be glad to tell you where you can get them. Please accompany your request by a stamped envelope.

A New Weston Meter

PROVIDING for 17 film speed ratings from 0.7 to 200 Weston, "meeting all present or future requirements of super-speed films," the "Weston Junior" ($15.50) makes its appearance on the market with a special dedication to the users of miniature cameras. The new meter employs the same type of photronic cell and sensitive instrument movement used in the Weston "Universal" and "Cine" models.

The new meter has a circular cell-window on one side, designed to cover a uniform angle of view, comparable with that covered by the normal camera lens. On the opposite side of the meter is a full vision dial. Thus, when the meter is held in viewing position, the user can take the readings while keeping an eye on the scene he plans to photograph. The dial lists 17 aperture stops from F:2 to F:32 and 27 shutter speed settings from 60 seconds to 1/1000th second.

Sensitivity of the new meter to low light values, the manufacturers report, is such as to provide readings where camera settings down to F:2 and ⅕th second are required on ordinary film.

Leica-Motor

THE Leica-Motor is being made available to permit Leica owners the facility of making several exposures in succession without rewinding. The device is so designed that successive exposures can be made at the rate of one or two per second, as desired, up to a total of 12, at a single winding of the fully enclosed spring motor.

This new Leica accessory is interchanged with the base-plate of the Leica and when attached to the latter the whole forms a compact unit. A key on the bottom of the Leica-Motor winds a powerful spring which enables up to 12 exposures to be made automatically, release of the mechanism being accomplished by pressing a lever conveniently located on the front of this accessory. A scale on the Leica-Motor makes it possible to set it beforehand to make automatically the number of exposures wanted.

Abbey Flashgun

INCORPORATING a number of new features introduced to bring it into line with modern advances in photography, the Abbey Flashgun ($18.75) numbers among its advantages a six-inch parabolic reflector, chrome mirror finished and adjustable for all standard sizes of bulbs; miniature magnetic tripper so thin that it can be left on the lens board when the camera is closed; switch at bottom of battery case to facilitate quick release after focusing, switch and focusing knob being located "in the span of a hand;" built-in side lighting outlet; flush connector receptacles and new type flat connector with prongs molded in solid rubber.

"Handi-Slide"

CONSISTING of ready made glass projection slides bound in red Bakelite and copper, the "Handi-Slide" ($1.50 a dozen) is one of the latest devices for the users of 35-mm projection transparencies. In use, the transparency is merely enclosed between the two plates of polished glass. The plates are then bound in the Bakelite frame by a copper sheath, and the slide is ready for projection. The transparency may be quickly removed and a new one substituted.

The Peanut Superflash

A PEANUT-SIZE Superflash bulb, designated as No. 0 (16 cents), about 30 percent smaller than the smallest flash bulb made prior to its introduction—in fact no taller than a package of chewing gum—is now on the market. Its total light output, the manufacturers state, approximates 22,500 lumen seconds, more than enough illumination for open and shut shots with average films, as well as synchronized speed shots with faster films.

Also announced is "Special Press 40,000," only slightly larger than the standard Superflash No. 1. The press Superflash has a total light output of 40,000 lumen seconds, produced in a wide-peak flash of great intensity and power to penetrate distance and cover wide areas.

Focal Plane Shutter for Makina

SUPPLEMENTING the regular Compur shutter, with speeds up to the maximum of 1/200th second, normally furnished with the Plaubel Makina II and II-S, the makers have now introduced a special detachable focal plane shutter ($27.50) which is inserted in the back of the camera (close to the film plane) whenever very high speeds are required. The speeds of the focal plane shutter range from 1/100th to 1/1000th second and one full turn of a knurled knob completes the winding of the shutter curtain.

This new accessory is attached to the back of the Makina in the same manner as the ground glass back, the film pack adapter, the film holders, and the automatic film-counting roll holder.

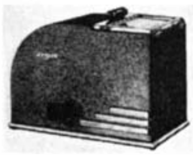
Coronet Vogue Candid Camera

Introduced as a "flyweight" camera, the Coronet Vogue Candid Camera ($7.50) weighs only six ounces, is only 4½ by 2⅞ by 1¼ inches in size, and produces pictures 2 by 1$\frac{3}{16}$ inches (50 by 30 mm).

Streamlined, enclosed in a Bakelite body with chromium fittings, the Vogue is ready for action in an instant. The Coronet Vogue is equipped with an F:10 Every-Distance Lens, an Ever-Set instantaneous and bulb shutter, and brilliant direct vision view-finder.

Argus Speed Printer

Moderate enlargements with the ease of contact printing is the principal feature of the Automatic Argus Speed Printer ($15.00), which makes 2¾ by 4¼-inch prints from 35-mm negatives directly, without focusing or trimming. Of modern design, the printer cabinet is all-metal, portable, weighs only 6¾ pounds and measures 7¾ inches high, 5¾ inches wide, 10½ inches long.



The Automatic Argus Speed Printer embodies a light source, a double condenser lens system, a double achromatic objective lens, and two first surface mirrors.

"Simply lay the ready-cut sensitized paper on the glass and press down the printer handle for a few seconds, which automatically makes the electrical contact and exposures"—this is the formula.

The manufacturers also announce the introduction of Argus Bromex paper, brought out specifically for use in the Argus Speed Printer, available in glossy, semi-matt, and silk surfaces and soft, medium, and hard contrasts, single weight and double weight. The single-weight papers come packed 36 sheets to a package while the double-weight papers come 24 sheets to a package (each 35 cents).

Foto-Flat Mounting System

Characterized as a scientifically developed membrane (a thermo-plastic material) that will mount prints without pressure and with low heat, the Foto-Flat method of mounting prints is now available. The sheets are sold in various sizes from 1¼" strips for 35-mm prints to 16 by 20-inch sheets and rolls 16 inches wide by 100 feet long. (Dozen 5 by 7, 15 cents; dozen 8 by 10, 20 cents, and at relative cost in the larger sizes.)

The low heat of an ordinary electric iron will fuse the print to the mount in suitable fashion; however, a special device called the Foto-Welder (small size, $1.50; large, $6.50) is available that is thermostatically regulated to maintain the low heat required.

CAMERA ANGLES ROUND TABLE

JACOB DESCHIN, *conductor of our "Camera Angles" department, will answer in these columns questions of general interest to amateur photographers. If an answer is desired by mail, enclose a stamped, addressed envelope. Queries should be specific, but Mr. Deschin cannot undertake to draw comparisons between manufactured products nor to advise on the purchase of equipment or materials.*—The Editor.

Q. Will you kindly tell me if there is a way to know when a desensitizer begins to work unsafely? Is there a mathematical rule to know the depth of focus of a lens at the different diaphragm openings, when we know the focal length of the lens?—Rev. R. T.

A. A desensitizer solution should last about six months if kept in a dark bottle. With use it will naturally oxidize gradually. One way to learn that the desensitizer is working unsafely is when films begin to show signs of fogging, but this may be due to using too much light; a safer way is to watch the color of the solution—when it grows lighter in tone, then it is time to mix a new solution.

For finding the depth of focus of a particular lens at various diaphragm openings, it is first necessary to learn the hyperfocal distance for the lens in question. Hyperfocal distance, which is the term applied to the nearest plane in focus when the lens is focused on infinity, is determined by the following simple formula: Multiply the focal length by itself; multiply the result by the circle of confusion (in your case, 1/250), the latter referring to the degree of unsharpness permissible because not perceived by the eye; divide the result by the F: value of the lens, say F:8, the latter multiplied by 12 to obtain a result in feet instead of inches. Thus, the square of 7.25 (focal length of your lens) multiplied by 250 equals 13,140; the F: number, 8, multiplied by 12, equals 96; 13,140 divided by 96 comes to 137 feet, the hyperfocal distance. Having obtained the hyperfocal distance, it is now possible to make up a depth of focus table for objects at given distances from the lens as follows: Multiply the hyperfocal distance by the distance focused upon. To learn the nearest point in focus, divide this result by the hyperfocal distance plus the focused distance; to learn the farthest point in focus, divide the result by the hyperfocal distance minus the focused distance.

Q. My camera is a Foth Derby with F:2.5 lens of 2-inch focal length. The focusing scale is marked in meters, as follows: 0.75, 1, 1.25, and so on. I have made up my own table in feet, as follows: 2½, 3, and 3½ feet, respectively. Is this correct? Also, will you please give me the depth of focus table for the following: Using stop F:2.5, distance focused upon 9 feet, 12, 21, 33 and infinity. Also, the table for F:3 and F:3.5 stops?—J. B.

A. Concerning your conversion of meter markings into feet, your first figure, namely, 2½ feet for 0.75 meter is correct, but the others are not. One foot is equivalent to 0.3048 meter. Therefore, one meter, as we figure it, comes to 3¼ feet, 1.25 meters to 4 feet, and so on down the line. As to the depth of focus (the correct term is depth of field) table, we suggest you consult our reply to Rev. R. T. above on the method of calculating near and far distances. By this formula, we find (figuring on a circle of confusion of 1/400) that 53.333 feet is the hyperfocal distance for your 2-inch lens wide open, namely F:2.5, and the near and far distances (in feet) in focus (depth of field) at the various distances focused upon, with the lens wide open, are as follows: 9 feet—near 7.7, far 10.8; 12 feet—near 9.8, far 15.4; 21 feet—near 15, far 34.6; 33 feet—near 20.4, far 86.5. As for infinity the nearest distance is, of course, the hyperfocal distance, namely, 53.333 feet. We understand that there is no F:3 marking on the lens in question. For the F:3.5 stop, the hyperfocal distance is 38.095 and the near and far distances for 9 feet are 7.3 and 11.8. With this, we leave you to carry through the rest of the calculations by yourself.

Q. In the handling of exposed film which has not yet been developed, if the fingers should accidentally touch the emulsion with no great pressure, is it likely that the latent image will be affected?—S. E. L.

A. If the fingers are perfectly dry, thoroughly clean, and no grit adheres to them, neither the film emulsion nor the latent image will be affected. However, this is not a good practice and should be avoided as much as possible inasmuch as the safety conditions prescribed seldom obtain. Hold the film by the edges is still the best rule to follow.

Q. Of what value are filters in free-lance work? What effect can they have on the pictures?—J. S.

A. Because of your reference to free-lance work and the wording of your first question, we presume that your second question refers to the possible effect that the use of filters would have on the increased salability of pictures made with filters. Filters are designed for three purposes—to correct partially, to correct fully, and to over-correct. By "correction" we mean, of course, the use of a filter that, in conjunction with a suitable film emulsion, will produce a negative and an ultimate print or enlargement that will more or less faithfully represent the original subject. For this purpose the light and medium density filters are employed. Such filters are mandatory in much outdoor and some indoor work and the free-lance photographer must equip himself properly on this score, the selection of filters depending on the type of work he plans to do. On the "over-correction" side, the dark yellow filter will be found useful when photographing multi-colored objects, as in flower photography, while a red or orange filter as well as the dark yellow will help greatly in producing striking landscape pictures. The free-lance photographer must produce pictures that will sell and for that reason his work has to be considerably above the average in order to compete successfully with other commercial photographers. Filters will go a long way in producing pictures that will please the paying customers.

***Q.* I purchase my paper by the half gross. Can you suggest a method by which I can avoid wrapping and unwrapping the entire batch every time I need a sheet of paper?—L. A. S.**

A. In the darkroom, by the usual printing light, slit one end of the heavy paper in which the photographic paper comes wrapped, and tear a small piece out of the center of this open end. This will permit you to take the sheets out of the package without unwrapping. Needless to add, one end of the box should remain sealed in order to serve as a "hinge" and the open end of the batch of paper placed at this end.

***Q.* What is a good method of removing abrasion marks from glossy prints? —N. D. O.**

A. Dip a wad of cotton in alcohol and rub carefully over the affected parts.

***Q.* I have a supply of chloride paper that has been lying on the closet shelf for about three years past its expiration date. Do you think it is worth while keeping?—O. D. M.**

A. Contact (chloride) papers are unusually stable and have much greater keeping qualities than the faster (bromide) enlarging papers. Try using the paper; it may surprise you to learn that it is practically as good as it was when you purchased it.

***Q.* Will you please send me any available material you have on founding a camera club in a high school?— K. T.**

A. The details of founding a camera club are generally the same as those involved in starting any other type of club, except where it is planned to inaugurate a "community" darkroom and (or) studio for the use of the members. There are also the questions of how to defray the expenses of periodical exhibitions, sponsoring of prominent speakers, and so on. Several magazine articles have recently appeared which may furnish you with some ideas along this line by persons closely associated with this type of work. "Your Minicam Club" by Frank Liuni appeared in the January, 1938, issue of "Minicam," and the winter edition of "Everyday Photography" ran an article on "A Club's Club," while in the February-March issue of the same magazine there appeared an article by Bill Seaman on "Keeping a Camera Club Alive." Other expert sources of information on this subject are The Metropolitan Camera Club Council, 106 West 13th Street, New York, New York, and the Camera Club, West 68th Street and Broadway, New York, New York, one of the oldest camera clubs in the country.

***Q.* Photography has recently become so imbedded in me that I intend to make it my life's work. Knowing of your ability along this line, I would like your advice on getting a foothold in this profession. I'll appreciate any suggestions you may make.—B. R.**

A. The first suggestion, and one which you must adopt immediately if you are to get anywhere at all, is to make up your mind as to the particular type of work you wish to undertake. Photography is a very general term including a multitude of different activities, all of which are classed as photographic endeavors. Presumably, you wish to go into one of the commercial branches of photography; but do you want to do studio work with models for advertisers, or turn out pictures for the press? In short, it is necessary to specialize in some one branch of photography because each presents its peculiar problems and methods. We presume, of course, that you already have some knowledge of photography and are seeking a "foothold," as you express it, in order to apply your knowledge to best advantage.

***Q.* In photographing a waterfall I have tried unsuccessfully to avoid the "white paper" effect. Can you suggest a method of photographing a waterfall so it will look natural?—L. D.**

A. Instead of giving the subject one full exposure for the time required, place the camera on a tripod and give several shorter exposures totaling up to the time required.

***Q.* How many films (No. 120) can be developed in one quart of the Eastman D-76 formula without increasing the development time? What increase in development time would you suggest, if it is possible to get good results in this way, after this number of films has been developed? The only difference between the Eastman formula F-5 for films, and F-1 for papers, is that the former contains 15 grams of boric acid. Would it make any difference in tone or keeping qualities if F-5 is used for paper or F-1 for films? Which of the two is better for use on both?—J. G. P.**

A. About 10 rolls is the maximum number generally recommended, with an increase of about one minute in developing time for each roll processed thereafter. Formula F-5 was introduced as a fixing bath in film processing because it was found to improve the contrast in negatives. Paper, however, is not sufficiently sensitive to gain anything in this regard, and for this reason it is pointless to use F-5 in fixing prints. However, if you wish to use the same formula for both papers and negatives, we suggest F-5 for the sake of the negatives.

Books

SELECTED BY THE EDITORS

BRASSEY'S NAVAL ANNUAL 1938

Edited by Rear-Admiral H. G. Thursfield

MORE has happened in connection with naval questions throughout the world during the past year than during any similar period for many years. With the new enlarged naval programs there will be even greater activity during this year. This 49th Edition of an old authority discusses the activities of the past year and serves to indicate the trend not only in amount of building but in design. As usual there are pertinent discussions as to the international situation, relative naval strengths, trends in design in various countries, aviation and its place in the naval scheme, and a chapter on the transatlantic air service. There is a large reference section on all types of armament, and as usual the book is well illustrated with scores of photographs, silhouettes, battleship plans and elevations. (521 pages, 6½ by 9¾.)—$12.50 postpaid.—*F. D. M.*

BRILLIANCE—GRADATION—SHARPNESS WITH THE MINIATURE CAMERA

By Harry Champlin

WHAT is the difference between an ordinary print turned out by a run-of-the-mill photographer and a superlative print of salon quality that immediately commands both attention and respect? According to the author, the difference lies mainly in those refinements of technique which all too few photographers will take the trouble to learn. In this fact is found the reason for the preparation of the present book in which are concentrated those aspects of technique in which the majority of miniature camera workers are weak. (160 pages, 5½ by 8 inches, numerous photographs and a few drawings and tabulations.)—$2.15 postpaid.—*A. P. P.*

LEGENDS OF GEMS

By Horace L. Thomson

THE author's earlier little book, "Gems—How to Know and Cut Them," now forms the second and minor portion of a new and larger book, the newer portion being on amulets, astrological birthstones, and on gems in their mystical or occult connections all the way from Aquarius to Capricorn! In it the author says, "There is more to the science of stellar influence in human affairs than is generally realized . . . before long the vibrations of gems and their powers will be better understood." This reviewer does not "understand" these "powers" but still recommends the older, non-occult and practical part of this book to gem-stone hobbyists who do not object to the pseudo-science of astrology. (124 pages, 6 by 9 inches, illustrated.)—$1.15 postpaid.—*A. G. I.*

THE ENGINEER'S SKETCH-BOOK OF MECHANICAL MOVEMENTS

By Thomas Walter Barber

TO use a hackneyed expression, this volume is a mine of information for the designing engineer, for it contains discussions and working drawings of practically every conceivable movement, device, appliance, and contrivance employed in the design and construction of machinery for every purpose. The illustrations, in fact, total nearly 3000 and everything is classified and arranged for easy reference. It is intended as a guide to enable the engineer to solve any mechanical design problem visually. (355 pages, 6 by 9.)—$4.45 postpaid.—*F. D. M.*

TELEVISION—A STRUGGLE FOR POWER

By Frank Waldrop and Joseph Borkin

TELEVISION is foreseen by the authors of this book as a power for good—or for evil; they appear to lean toward the evil side. They take the view that, just as the automobile replaced the horse, television will revolutionize all world standards of living. They may be right and, in any event, it does no harm to consider all the aspects of a coming scientific development. They assume that television is here. It is, in the laboratory. How soon it will invade the average home and just how effective it will be in supplementing or outmoding other forms of communication is still a problem which many authorities would hesitate to answer in as definite a manner as have the authors of this book. Good reading, whether or not you agree with the conclusions drawn. (300 pages, 6 by 8½ inches, unillustrated.)—$2.90 postpaid.—*A. P. P.*

SAFETY FIRST AND LAST

By Charles E. Dull

AUTOMOBILES are, in reality, powerful projectiles in the hands of people who have not been thoroughly schooled in their use. This book attempts to show proper use, so that the driver of each car may have reasonable assurance that he will not get himself into so tight a place that he cannot safely get out. The first 156 pages discuss driver problems in detail and show by drawings the proper way of passing on the road or at corners, parking, and navigating some of the odd by-pass intersections that have been constructed. It has also a much needed discussion of the car itself so that the driver may understand its capabilities. The last part of the book concerns safety in the home, on the farm, and in the factory and tells how to avoid such injuries as are commonly caused by use of ladders, fire, and electricity. The conclusion states that accidents *can be checked* and shows how it is up to you and me to solve this problem. (241 pages, 5¾ by 8½.)—$1.90 postpaid.—*F. D. M.*

BATTLES WITH MONSTERS OF THE SEA

By F. A. Mitchell-Hedges

NARRATIVE accounts of tussles with large jewfish, tiger-sharks and other sharks, queenfish, giant crawfishes, colossal turtles, eagle-rays, barracudas, tarpon, alligators, saw-fish, and numerous others. Slaughter, shock, horror, jungle of the sea, the "clutching death" (octopus), fight, fury, man-eater, adventure—such words chosen at random give the keynote of this book, in which a British sportsman tells of his searchings for excitement. He found it and put it into this book. Lively reading!—$4.20 postpaid.—*A. G. I.*

FIRST AID FOR THE AILING HOUSE

By Roger B. Whitman

ENTHUSIASTICALLY received by home owners everywhere in its first edition, this latest revision, enlarged and expanded in many of its aspects, should be even more widely acclaimed. It gives the latest information on oil burners and air-conditioning equipment, house insulation and plumbing, paints and enamels, and many other topics too numerous to mention, yet definitely indicated by the title of the book. (350 pages, 6 by 8½ inches, a sprinkling of drawings.)—$2.65 postpaid.—*A. P. P.*

KNOWING YOUR TREES

By G. H. Collingwood

FIFTY common trees of the United States—common but not commonly known—are discussed in this well illustrated book, which is a reprint of monthly features that have been running for some time in the magazine *American Forests*. Each tree is discussed in a single spread of two pages with one prominent picture of a typical tree of the type named, a photograph of the foliage or fruit, a photograph of the characteristic trunk, and a drawing of the United States showing by shaded sections the natural range of the tree in question. (109 pages, 8¾ by 11¾.)—$1.15 postpaid.—*F. D. M.*

SHEET METAL WORK

By William Neubecker, Instructor, N. Y. Trade School

A MANUAL of Practical Self-instruction in the art of pattern drafting and construction work in light- and heavy-gage metal, including skylights, roofing, cornice work, patterns for forced-air fittings, and so on. The treatment assumes that the reader already knows how to use tinsmithing tools. (360 pages, 5½ by 8 inches, 400 illustrations.)—$2.65 postpaid.—*A. G. I.*

TELESCOPTICS

A Monthly Department for the Amateur Telescope Maker

Conducted by ALBERT G. INGALLS

UNIQUELY, the richest-field telescope, or RFT, because of its special design, reveals in one view of splendor the greatest number of stars that can be made visible in any telescope, small or large, and the man who first worked it out, S. L. Walkden, of London, described its principles in "Amateur Telescope Making—Advanced," with a follow-up article in the present columns last January. In the following paragraphs he now proposes an RFT Cassegrainian.

"There is a proportion of keen designers and constructors always on the lookout for 'new worlds to conquer', to whom old-fashioned simplicity and ease of construction make an inadequate appeal, and some of these feel an exhilarating urge to pass over ordinary reflectors and wrestle with the troubles of Cassegrainian and newer types. They undoubtedly have hard and adventurous jobs before them, but these are precisely what they want.

"So, first, regarding the aperture, a inches, of an ordinary Cass RFT: If this is less than 4″, the convex and the hole are likely to rob the main mirror of more than 20 percent of the light, and that is rather too much compared with the 9 percent of the 4″ Newtonian. If, on the other hand, the aperture exceeds 11″, the constructor may need an eyepiece more than about 3″ in diameter. This really should not be allowed to matter, but 3″ is about the limit of what some seem to like or think practicable in ordinary instruments.

"Having settled the aperture, a inches, the mirror's focal length is made c times a inches, where c is the focal ratio. It is advisable to have c equal to about 4; for, if c is greater, the area of mirror put out of action by obstruction and by the hole is unduly increased, while if c is less the mirror and the convex are not easy to make of a quality to give good definition.

"With a and c both settled, and so of course with $F=ca$ inches (Figure 1), the proper distance of the convex within the primary focal point, or the distance d, is found from $d=F(\sqrt{20F}-2F/a)\ /\ (10a-2F/a)$ inches. Then $2r$, the diameter of the convex and of the hole in the main mirror, is given by $2r=F(F-d)\ /\ 5ad$ inches.

"The focal length of the convex, or f, is given by $f=d\ (F-d)\ /\ (F-2d)$ inches, though perhaps a 5 percent error in making it, especially 5 percent less, need not be worried about.

As to the eyepiece, it is to be made identical with one which would suit a plain refractor RFT of focal length equaling the F″ of the main mirror, but of aperture equaling only $2r$, the inches diameter of the *convex* mirror. Its particulars may then be arranged by methods like that outlined in 'ATMA,' but the extra diameter of the field lens, mentioned at the end of the footnote on page 633 and amounting to $F/50d^2$ inches (where a is *now and here* the diameter of the convex) may not have to be considered 'negligible'. The eye distance, too, may often be rather larger, at about $1\frac{1}{4}\times(F/14a+F/17a^2)$ inches, where the convex diameter is again inserted for a, as the '*virtual* aperture' in the Cass *eyepiece* calculations.

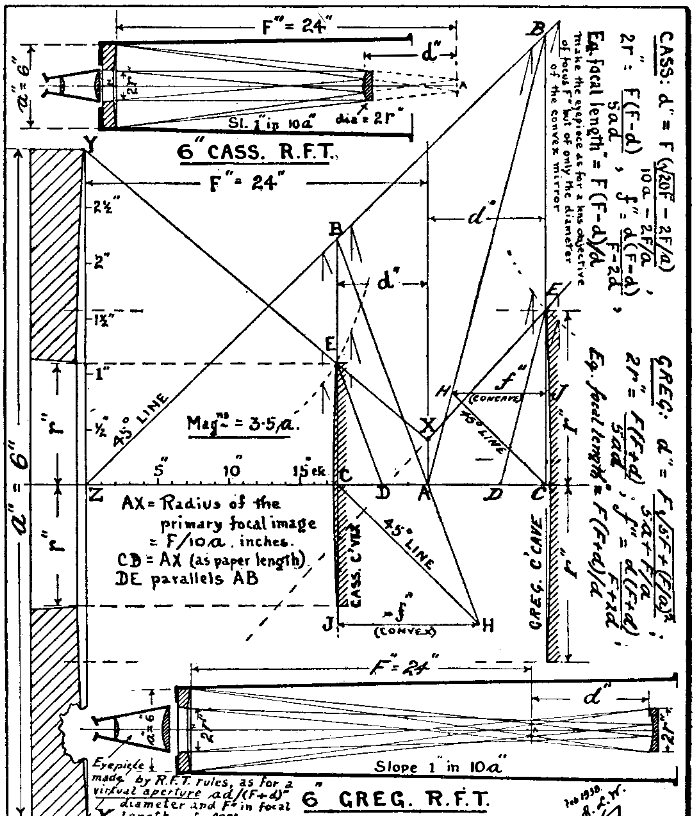


Figure 1: **Layouts for RFT Cass and Greg**

"There is an alternative graphical way of solving these problems of the Cass RFT, and it sometimes has advantages over mere inflexible formulas, and nearly always helps. It is illustrated in Figure 1, in its application to a 6″ aperture of 24″ focal length, for which, of course, $c=24/6=4$. The method is as follows: From Z draw ZA horizontally, equal, to scale, to the 24″ focal length of the main mirror. Again from Z draw ZY vertically, equal, to a much larger scale, to the 3″ radius of the mirror. Then from A draw AX equal, on the same larger vertical scale, to the radius of the main focal RFT image, or to $F/10a$, which in this case is 24/60, or 0.4″. Join XY, to tell the needed radius of the convex mirror for any distance d within the main focal point. From Z draw the 45° line shown. Now from A draw the 'triangular spiral' $ABCDE$ (by a little easy trial and error), having CD exactly equal to AX and DE exactly parallel to AB, and having its finishing point E on CB and *also* exactly on the line XY.

"Then we have found at C the proper place for the convex mirror, 17.6″ from the main mirror; and in CE we have found the proper radius of the convex mirror, 1.10″, and of the resultant field image, 1.10″, and of the hole to be made in the main mirror, 1.10″—and, within about ⅛″, the larger radius of the field lens of the eyepiece. As to the focal length, f, of the convex mirror, by drawing a 45° line from C till it joins BA produced in H, and noticing how far H is horizontally and to scale to the right of C, the focal length needed, or f, is found to be 10.12″; and that is 10.12/2.20, or 4.60, times the convex's diameter.

"Making the eyepiece according to the settled rules, as for a 2.2″ refractor of 24″ focal length, the field lens is 2.4″ diameter. The eye lens may be ¾ of that, or 1¾″, but will suit if not less than 1.4″. The lenses' distance apart, the usual $c/4$—that is, $F/4a$ inches—is 2¾″, and the eye distance will be about 1.4″ according to the formula before given.

"It might be asked: 'Why not design the convex an inch or more farther from the main mirror, and so have the convex only 0.99″ or less in radius?' The answer of the triangular spiral is that the resultant field image like CE, and therefore the hole in the main mirror, would swell up to 1.37″ or more in radius (see the dotted curve through E), so that no advantage could be reaped. Then, it may be oppositely asked: 'Why not design the convex an inch or more *nearer* the main mirror, and so have the resultant field image and hole only 0.90″ or less in radius (see the dotted curve through E)?' The answer of the XY line is that the obstructive convex needed would itself swell up to 1.21″ or more in radius, so that again no advantage could be reaped.

"The only real remedy both ways is to have a *very short* main focal length, say 9″, so as to have a delightfully small convex and hole, and the whole instrument as small and portable as a silk hat; but, at the present day, such short-focus remedy is more easily spoken about than put into practice, especially seeing that the convex needs to be similarly shortened in focal length and be formed like too much of the end of an egg.

"It is useful to notice that this graphical method equally well solves the problem of *any* ordinary Cass of 40° fully illuminated apparent field, even if not an RFT, provided we draw *AX*, the radius of the primary field image, 0.35 F/*pa* inches long, where *p* is the lowest power per inch of aperture which it is proposed to use.

"To the right of point *A* in Figure 1 is drawn the similar graphical solution for the corresponding 6″ Gregorian RFT, if only to show how unsuitable this type seems to be for RFT construction, for it should be noticed how large the concave mirror and the hole have to be. For this reason and because the diagram is similarly lettered to the Cass diagram (using slanting capitals), detail description is unnecessary; moreover, the chief formulas are written at the right of the drawing. In the Gregorian the eyepiece has to be arranged the same as for a common refractor RFT, of focal length equaling the F″ of the main mirror but of virtual aperture assumed to be only $ad/(F+d)$ inches diameter.

"At the top of the diagram is drawn, entirely to the horizontal scale, the sectional arrangement of the 6″ Cassegrain RFT, which certainly has the virtue of shortness; and at the bottom of the diagram is drawn to the same scale the 6″ Gregorian RFT, which certainly has more than the one defect of length. But, whatever defects either is here seen to have as described, these defects may easily be the longed-for challenges to the clever and energetic and further-discovering constructors before referred to, each acting on his belief that difficulties are only made to be met with and be triumphed over. So far as there is success there is again the reward, of the richest and loveliest views of the heavens yet seen by man, using the given apertures."

AS Kirkham showed here last month, the very simple RFT calls for a better-than-simple eyepiece—ideally an achromatized and costly Ramsden but at least a plain but very good Ramsden. However, when the market was canvassed it turned out that there was no wholly suitable eyepiece to be had if the rather ideal specifications—f.l. 1.12″, .92″ diam. field lens, as in "ATMA," 636—were considered. However, one dealer is making up a special lot having approximately these specifications. At the same time comes a letter from Walkden containing his own impressions regarding eyepieces for RFTs. First, he says: "If a telescopist thinks of employing a certain eyepiece of stated focal length *f*″, he should pay great regard to the caution in 'ATMA,' page 645, footnote 5, making quite sure, as by test, that he knows the *actual* focal length *f*″ of the eyepiece." In this he is quite right for, as Ellison has pointed out, many eyepieces differ quite widely from the focal length designated on them. He then continues: "Now the RFT is really a simple telescope of the lowest possible power of about 3.5 per inch of aperture, and its proper, *fully illuminated* apparent field of view is considered to be about 40°, as obtainable by a usual type of Ramsden eyepiece. From all this there follow certain consequences, one of which is that the field lens of the suitable eyepiece of *f*″ focal length should have approximately the diameter of $0.70 \times f$ inches and, indeed, could be about 1/10″ larger than that, because the lens is a little on this side of the field image. If the field lens is much smaller than that, the apparent field of view is likely to be correspondingly less than 40° in diameter,

and even then have the stars rather dim toward the margin of the field. The fault closely resembles that of the too-high-powered Galilean field-glass or telescope with small eyepiece.

"The diameter of the field lens being satisfactory, the eyelens' diameter should be about one quarter less. Though 0.6 times the diameter of the field lens is not in every case too small, it is usually a little in doubt. On no account should the eyelens fail to be a good deal wider than 0.3″, since that is about the width of the pupil of the eye.

"The eye-hole should be 0.4″ to 0.5″ in diameter and be at a proper distance from the eyelens, but those things are easily enough set right in the completed instrument.

"Speaking generally, RFT eyepieces are confined to the range of 1″ to 5″ *f.l.* Ramsdens of about 1¼″ *f.l.* are called for chiefly by the Newtonian RFTs of moderate apertures. Ramsdens of about 1¾″ *f.l.* are called for by the small, short refractor RFTs. Ramsdens of about 2½″ *f.l.* can convert the moderate length refractors into RFTs, and Ramsdens of about 3½″ *f.l.* can convert the ordinary *long* refractors into RFTs. The Ramsdens of 2½″ to 4″ *f.l.* can also help to complete Herschelian RFTs of moderate apertures, to which variety of RFT too little attention has hitherto been given." [Later we shall publish Walkden's specifications for several Herschelian RFTs, calling for eyepieces with field lens diameters all the way up to *five full inches!* Needless to say, no reasonable telescope maker can ask dealers to stock all these freak eyepieces—if, indeed, he stocks any that are larger than about 1.14″, so the would-be owner will probably have to take off his coat and maybe his shirt and make his own gill, pint, and quart eyepieces.—*Ed.*]

Continuing with regard to ordinary and medium sized RFT eyepieces, Walkden adds: "In all these cases the main focal length F″ of aperture *a″*, *made to suit the eyepiece*, is given by $F = 3.5 \times a \times f$ inches, just as $f = 0.286 \times F/a$ inches, and $F/f = 3.5\,a$; and for the Newtonians, an eyepiece focal length within about 15 percent of that of the table on page 636 of 'ATMA,' with the flat recalculated to suit the mirror and its actual focal length F″, will not result in any material increase in the flat obstruction. In effect, it evidently interests some correspondents that $a = 0.286 \times F/f$, and, indeed, that a is not greater than $0.285 \times F/f$ inches, where 'not greater than' stands for '*cannot be used greater* by the human eye than,' due to anatomical limitations."

SOMEONE—amateur, dealer or manufacturer—ought perhaps to canvass carefully the question whether it would not be profitable to put on the market, not for telescope makers or necessarily for real amateur astronomers alone, but for a larger market among that part of the public which has a less scientific but more emotional interest in astronomy, a compact, fool-proof RFT, probably a refractor, designed with studied care on the basis of the fixed anatomical and optical optimums stated in the chapter on the RFT in "ATMA" and in the January 1938 Scientific American. The American people are known to be especially susceptible to "mosts"—things that are the most this and the most that—and the RFT, showing as it does the most stars it is possible for any human being to see at one view, not even excluding a view with a 200″ telescope, ought easily to be dramatized and caused to be desired by far more than the few hundred dyed-in-the-wool amateur telescope makers who are dealing with it now.

LAST month Alan R. Kirkham showed in these columns that the old, conventional Cassegrainian telescope, with its hyperbolical secondary which was diabolical to figure, can be supplanted by a spherical secondary Cass with elliptical primary, which will be far less of a headache to make. A copy of Kirkham's article was sent to Walkden and in an immediate reply the latter points out that Kirkham's spherical secondary Cass also kills another bird, making practicable at last the short RFT Cass. The Cassegrainian, he points out, can beat the Newtonian RFT in illumination only by being very short, but this has previously meant figuring hyperboloidally, with much difficulty, that "end of an egg" mentioned above in his article. Now, however, with a merely spherical end-of-an-egg needed, we may go the whole hog, and Figure 2, redrawn from a rough sketch sent hurriedly by Walkden, is one example. One trouble with this stubby, chubby, and intriguing little Cass might be that, in the poor light of night, the owner's neighbors might think, as they watched him holding it aloft against the skyline, that he was tipping up a large bottle of some liquid, and might come to wonder about "this astronomy." "Altogether," Walkden writes, "many thanks are due to Kirkham for this well-timed help that places the amusingly short Cass RFT quite on the map."

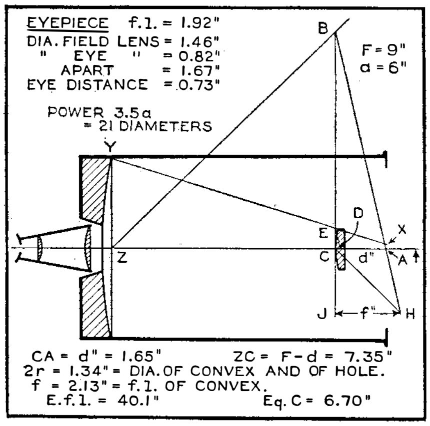


Figure 2: **One-gallon RFT Cass**

Credit for putting back on earth the spherical secondary Cassegrainian idea, which appears to have been described years ago but so far as is now known was never actually embodied in a telescope at that time, is shared by Kirkham and Dall, as mentioned last month. We discover that the little Cassegrainian shown on page 447 of "ATM" was Dall's first spherical secondary Cass. In the February 1932 Scientific American, where the same photograph first appeared, Dall described it as a "modified Cassegrainian."

WAX coating laps, Everest's method: "My method was to draw strips of tissue paper through smoking hot beeswax, cut these into squares after cooling, scrub the dry pitch lap with a clean rag slightly moistened with turps, lay the squares on the facets of the lap (channeled in the regular manner), and roll them down with a rubber roller in order to eliminate air pockets. However, I have discarded wax coating for figuring precision surfaces. It gives a beautiful *visual* polish, free from sleeks and scratches, but I have never seen the optical qualities in wax-polished surfaces that I have been able to produce with plain pitch. HCF is several times faster than plain wax, so I prefer to use it to produce a perfect *visual* preliminary polish and then take the necessary care to preserve this visual polish while figuring on pure pitch."

We occasionally hear from workers who complain that HCF leaves its marks on the figure. It does; but, as has often been pointed out, Everest does not recommend HCF for figuring ("ATM," 4th edition, page 149). For this he uses pitch, and states that the HCF marks disappear in about 20 minutes.

Everest makes his own pitch. Formerly he used the old rosin-turpentine mixture but found that laps made of this soon became "case hardened." To remove this shell the turpentine rag was used. The immediate effect of this was great stickiness. This disappeared some 24 hours later, after the surplus turps had evaporated off. From then on, and lasting a week or so, the lap worked splendidly until the turps had evaporated, when case-hardening became evident again and the same cycle had to be repeated. It now appears that turpentine in laps may be one of those blunders which have been perpetrated for years for the simple reason that someone back in the Dark Ages started the procedure—just as with the hyperboloidal secondary Cassegrain. Everest learned that castor oil would go into perfect solution with melted rosin and that the resulting mixture would be stable since the oil does not evaporate. "And we now make our pitch of rosin," he states. "It is first boiled hard to remove all traces of natural solvent and then is tempered with castor oil."

ON August sixth, which is a Saturday, the Thirteenth Annual Convention of amateur telescope makers from everywhere will be held at *Stellafane*, near Springfield, Vermont. Any person having an interest in telescopes is welcome. People begin arriving late Saturday morning, the afternoon is taken up with mutual and informal conversation, also with the examination of telescopes (bring your own), and there is a dinner at six, for which a dinner price is charged. Following this there are speeches for about two hours and then more informal "visiting." The majority leave during the evening but a few enthusiasts stay the night to use the telescopes. Those who remain meet Sunday morning for breakfast and by noon all are flown home. It all provides a fine chance to meet and talk with other "folks." Feminine family members can escape from telescoptical boredom by talking with other non-telescoptical family members who always come. It's a combination of convention, sewing circle, old home week and a three-ring circus. Places to camp if you wish to camp. Plenty of parking space. R. J. Lyon, 252 Summer St., Springfield, Vt., is the Secretary.

TO obtain data for compiling a relative rating of the general opinion regarding telescope supply dealers, the editor invites all readers to give confidential reports based on their experiences, good or otherwise. Please name the dealers.

CURRENT BULLETIN BRIEFS

(Bulletins listed as being obtainable through Scientific American can be supplied only by mail)

SHOE CONSTRUCTIONS, by Roy C. Bowker, contains brief descriptions of 40 individual shoe constructions and discusses their classification under eight main classes. The circular also discusses the value to the customer of marking shoes to show the type of construction, and touches upon the subject of shoe performance. Circular of the National Bureau of Standards C419. *Superintendent of Documents, Government Printing Office, Washington, D. C.—10 cents (coin).*

THE END OF REFLECTED GLARE IN LIGHT is a pamphlet that describes in detail Polaroid lighting, its principle and advantages. Drawings show just what takes place when light is reflected from a reading surface. *Write for Bulletin 738A, Scientific American, 24 West 40th Street, New York City.—3 cents.*

ACTION SNAPSHOTS, by H. Starke, is a 48-page illustrated booklet which shows the amateur photographer the best ways for taking action snapshots under the many conditions that will be encountered in the course of a day's photography. Beautifully reproduced photographs show the results of perfectly exposed negatives. *American Photographic Publishing Company, 428 Newbury Street, Boston, Massachusetts.—50 cents.*

QUIT YOUR SKIDDING is the title of a 32-page booklet which shows in detail the effect of tire treads on automobile skidding. It also gives valuable hints as to what to do to avoid skidding and—equally important—what to do when the car does skid. *Write for Bulletin 738B, Scientific American, 24 West 40th Street, New York City.—3 cents.*

BUTTERFLIES OF COLORADO, by Frank Clay Cross, lists 241 species of butterflies to be found in that state and is accompanied by several halftone illustrations. Volume XVI, No. 1, Proceedings of the Colorado Museum of Natural History. *Colorado Museum of Natural History, Denver, Colorado.—25 cents.*

THE NEOPRENE NOTEBOOK is a periodical devoted to the uses of Neoprene, a "synthetic rubber." It is of particular interest to engineers and industrialists who have occasion to make use of materials of this type. A request for this periodical will place your name on a mailing list to receive every issue as published. *Write for Bulletin 738C, Scientific American, 24 West 40th Street, New York City.—3 cents.*

ANNIVERSARY BULLETIN OF THE WESTERN PRECIPITATION CORPORATION gives some of the historical background of dust and fume control in industry, particularly in the field of electrical precipitation of suspended particles. It also tells of present work along these lines, presenting numerous photographs of modern equipment for the purpose. *Western Precipitation Corporation, 405 Lexington Avenue, New York City.—Gratis.*

PHOTOGRAPHIC ALMANAC gives valuable suggestions on how, when, and where to make pictures. It includes a handy exposure table, a guide to correct exposure, hints for better pictures, and the latest developments in photographic equipment. 128 pages. *Write for Bulletin 738D, Scientific American, 24 West 40th Street, New York City.—3 cents.*

THE USES OF MINERALS is an unillustrated brochure that lists alphabetically those minerals which are of the greatest value to industry and the arts, devoting a short paragraph to the general characteristics and uses of each. *W. Scott Lewis, 2500 North Beachwood Drive, Hollywood, California.—15 cents.*

PRACTICAL RADIO MATHEMATICS, by M. N. Beitman, is a booklet designed specifically for home study. It pre-supposes only a working knowledge of arithmetic and elementary algebra, attempting to clarify some points of elementary mathematics and to interconnect such knowledge with radio and allied applications. Illustrated with diagrams and charts. *Write for Bulletin 738E, Scientific American, 24 West 40th Street, New York City.—50 cents.*

NEGATIVE FILMS FOR USE IN MINIATURE CAMERAS is a 16-page pocket-size pamphlet which describes the characteristics of five different emulsions of 35-mm films. Exposure and processing data are given, including formulas for developers and fixing solutions. A tabulation of filter factors is included, covering 30 different types of filters. *Write for Bulletin 738F to Scientific American, 24 West 40th Street, New York City.—3 cents.*

ACCIDENT PREVENTION IN THE BELL SYSTEM, by W. P. Elstun, is an 18-page illustrated booklet that tells not only of the safety equipment used but also of employee training and the establishment of incentives for safety. *Bell Telephone Laboratories, Inc., 463 West Street, New York City.—Limited free distribution.*

AVIATION RADIO LOG contains valuable information for professional and sportsman pilots. In 132 pages it presents data for planning flights and for instrument flying. It also tells about aircraft radio, radio-compass flying, obtaining true bearings of broadcast stations, and gives a list of such stations together with their call letters and frequencies. A limited number of copies are available. *Aviation Radio Section, RCA Manufacturing Company, Camden, New Jersey.—25 cents.*

BEER AND BREWING IN AMERICA, by Warren M. Persons, is a study of the economic aspects of the brewing industry. The historical side and the development of brewing are discussed, together with production and consumption, taxation, benefits to allied industries, and so on. *United Brewers Industrial Foundation, 21 East 40th Street, New York City.—Gratis.*

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., LL.B., Sc.D.
New York Bar
Editor, Scientific American

Hybrid Patents

ORDINARILY, a patentee cannot describe an article of manufacture in a patent claim by the method of making the article.

There are four types of subject matter which may be protected by patents; namely, machines, articles of manufacture, methods, and compositions of matter. In a patent for an article of manufacture the claims should identify the article by describing the characteristics of the article. In exceptional cases, where it is impossible to define an article of manufacture by its characteristics, it is permissible to define the article in the claims by the method of making it.

In a recent case before the Court of Customs and Patent Appeals an inventor had filed a patent application for a method of cooking meat and the product or article resulting from the method. One of the claims described the resulting meat product by the method of making it and the Patent Office tribunals rejected this claim on the grounds that the article should be defined by its characteristics and not by the method of producing it. The Court reversed the Patent Office tribunals however, and found that the product could not be defined by its characteristics and could only be defined by the process of producing it. In this connection the Court stated the law relating to this subject as follows:

"If it cannot be otherwise defined, and it is new and inventive, a product may be claimed by the process of producing it."

One Minute

THE words "One Minute" are not descriptive of a washing machine, according to the Court of Customs and Patent Appeals.

A washing machine manufacturer sought to register as a trade mark for his product the words "One Minute." The Patent Office held that the words were either descriptive or mis-descriptive of a characteristic of the washing machine and refused to register the mark. In support of its ruling the Patent Office contended that the words "One Minute" indicated the speed of operation of the machine and that a prospective purchaser would believe that the machine would wash clothes in that time.

The Court of Customs and Patent Appeals decided contrary to the Patent Office and stated that the mark was neither descriptive nor mis-descriptive but was fanciful and arbitrary. The Court found that no washing machine could wash clothes in one minute and that the name "One Minute" would not mislead or deceive prospective purchasers of the machine. The essence of the Court's decision is to be found in the following quotation:

"Appellant's mark is clearly not descriptive of its goods. Is it mis-descriptive, and, therefore, deceptive? Would a purchaser, on seeing the trade-mark 'One Minute' on one of appellant's washing machines, be misled into believing that such machine would wash clothes properly in one minute? We think not."

Mal Ami

THE owners of the well-known trade mark "Bon Ami" for soap have successfully opposed the registration of the trade mark "Shav-ami" for shaving cream. The case was recently decided by the Court of Customs and Patent Appeals and the basis of the Court's decision was that the concurrent use of the two trade marks was likely to cause confusion.

The Court found that the manufacturer of the shaving cream used the trade mark "Shav-ami" from May 16, 1932, while the soap manufacturer had used the trade mark "Bon Ami" for many years prior to any use by applicant. The shaving cream manufacturer emphasized the difference between the goods and between the first syllables of the trade marks. The Court found, however, that the word "Ami" was the dominant part of the trademark and that variation of the first syllable would not, *per se*, avoid confusion. In reaching its conclusion the Court stated:

"It is true that there is a difference in the marks and a difference in the goods, but it seems to us that, since the mark 'Bon Ami' is for a product of everyday use which is widely known, and is unusual in its arbitrary character, confusion will be more likely to occur than under other circumstances. 'Bon Ami' means 'good friend'. The appellee uses the same word 'ami', pronounces it 'ah-mē', and pronounces the whole word 'shav-ah-mē'."

Legal Morality

THE publisher of one of the innumerable sex-inspired magazines brought suit against the publisher of a competing magazine, charging unfair competition in simulating both the name and contents of the magazine. The Court carefully considered the contents of both of the magazines and pointed out that something more than unfair competition was involved. The stories and pictures in both magazines were suggestive, if not obscene, and the Court held that under the circumstances a Court of Equity would not intervene to aid either party.

In reaching its decision the Court stated:

"The Court has no power to stop the publication of magazines of this type, in a civil proceeding, but neither will it lend itself to granting to one the sole right to publish such filth. Nor will it grant either magazine a cloak of respectability by issuing an injunction. These magazines can have no useful place in the world of literature, and the very selection of the names is indicative of the fact that the publishers' sole desire is a financial return for the dumping of obscene and filthy publications at a cheap price where the young, immature, and impressionable people can buy."

Books and Things

IN a recent suit the plaintiff, who was the owner of a circulating library, sought to restrain a former employee from soliciting, canvassing, and distributing books to plaintiff's customers. The plaintiff's business was conducted through the medium of route men who rented books to plaintiff's customers for 25 cents a week. The defendant was formerly employed by plaintiff as a route man and had been given a list of 450 customers. Proof was submitted that some of the customers had been solicited and that nine of plaintiff's customers were now dealing with the defendant. The Court found that defendant had not signed a contract with the plaintiff and that after severing his employment with the plaintiff he had a perfect right to solicit his customers. In this connection the Court stated:

"The defendant, upon the severance of his employment, had the undoubted right to compete in a fair manner with his former employer and to use any knowledge acquired by him in so doing so long as he violated no confidence. Mere solicitation does not constitute unfair competition in the absence of an express agreement to the contrary."

Collyrium

FOR many years a manufacturer of an eye lotion designated its product by the name "Collyrium." Within recent years a competing manufacturer used the same name in connection with its eye lotion and contended that it had a perfect right to do so because the name "Collyrium" is generic and signifies an eye lotion or salve. The question of the respective rights of the parties came before the New York State Supreme Court and the Court found that Collyrium was an English word meaning eye lotion or salve but that it was not a common word and was seldom used outside of professional circles. It found also that due to the long, exclusive use of the mark "Collyrium" by the first manufacturer the word had acquired a secondary meaning and indicated to the public the product of the first manufacturer. In reaching its decision the Court stated:

"The word 'Collyrium' can scarcely be included in even the broadest category of common or usual words ***. It is not a word of common English speech. It may with absolute propriety be catalogued with words capable of acquiring by long usage a secondary meaning when used in connection with a given product."

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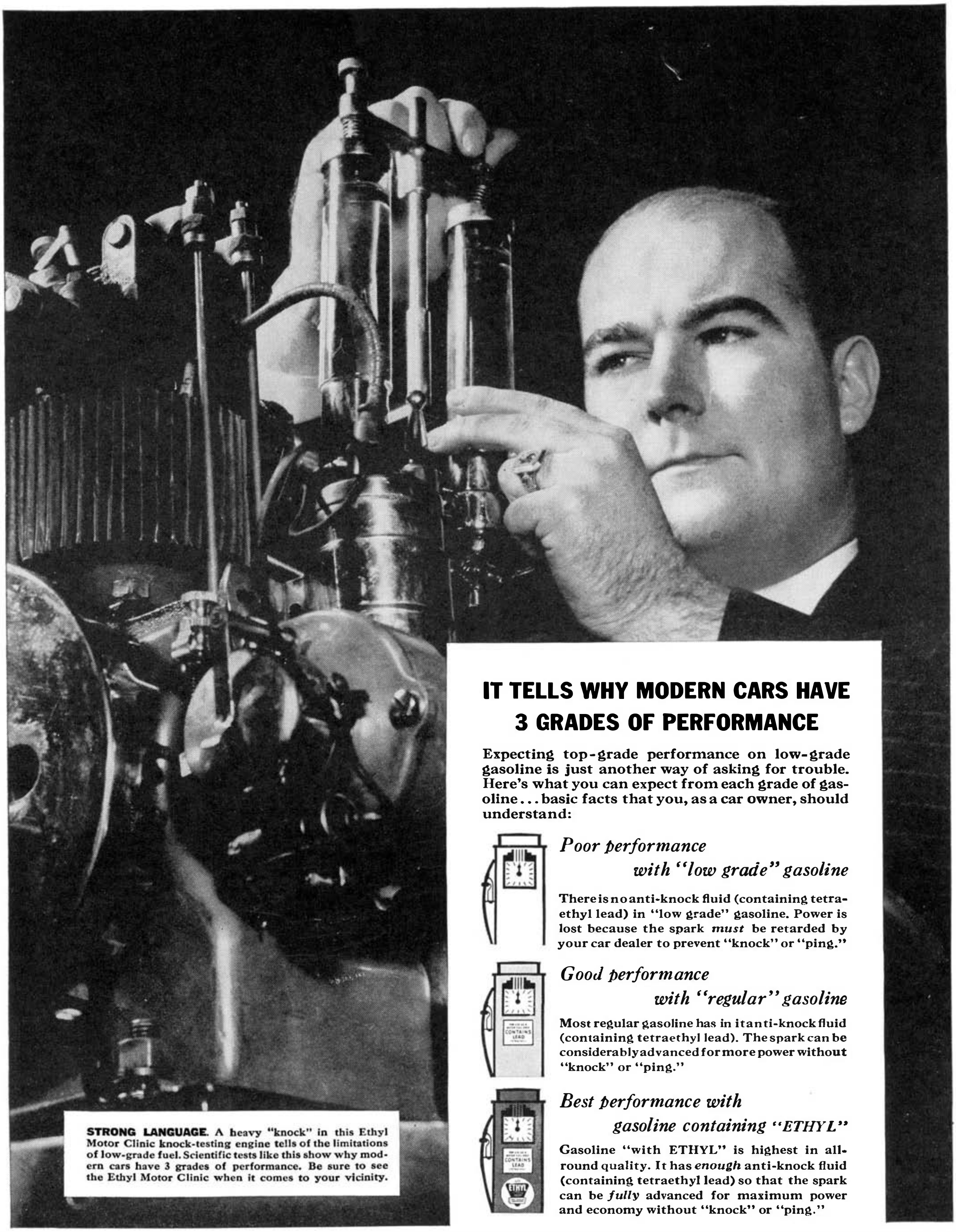

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