SCIENTIFIC AMERICAN

June
1933
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Birth Control and Bigotry

By C. C. LITTLE, Ph. D.

Applied Intelligence Is Needed in the Sphere of Human Reproduction

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A NEW TEST FOR TELEPATHY

Volume
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6

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EIGHTY-NINTH YEAR • ORSON D. MUNN, Editor

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SCIENTIFIC AMERICAN DIGEST

An index of articles appearing in back numbers of *Scientific American* is to be found in The Reader's Guide, Industrial Arts Index, Engineering Index, and Dramatic Index. These can be consulted in any large library.

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ACROSS THE EDITOR'S DESK

MANY readers have inquired about the results of the telepathy test published in our March number. In their eagerness to learn more about the subject, they forget that SCIENTIFIC AMERICAN readers are scattered throughout the world, that mails are often slow, that in many cases the test cannot be made immediately upon reading of it, and that it takes time and patience to analyze the results when they reach this office. Even at the time of writing these comments, test charts are still arriving in every mail. It is obvious that the best analysis can be made only when the greatest number of charts are available; therefore, we have been delaying the actual collation in order to allow time for all charts to be returned. We hope to be able to present at least an initial résumé of the results in our next issue—though this is only an expressed hope and is not a promise. If, in the judgment of the committee it is deemed wise to conduct further research, it may be necessary to withhold the announcement of results until the August number.

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"The study of cosmic rays has been described as unique in modern physics for the minuteness of the phenomena, the delicacy of the observations, the adventurous excursion of the observers, the subtlety of the analyses, and the grandeur of the inferences.' These rays are bringing us, we believe, some important message. Perhaps they are telling us how our world has evolved, or perhaps news of the innermost structure of the atomic nucleus. We are now engaged in trying to decode this message." Thus writes Prof. Arthur H. Compton in an article scheduled for publication next month. He goes on to present the clearest exposition on the subject of cosmic rays that it has ever been our pleasure to read. Compactly and concisely he presents the various hypotheses of the origin of the rays, and tells of the research that is in progress. This is the one pure science article which you cannot afford to miss.

●

Huge areas of marshland in the United States and Canada have been drained to provide room for agricultural expansion. In all, some 77,000,000 acres have thus been "reclaimed," but much of this land is of no value for agriculture. With the draining has come a change in the natural balance of wild life which is so essential to the continuation of many species of migratory birds. Hunters are not the only ones interested in the resulting problem, for it concerns everyone who is interested in our rich heritage of a bountiful nature that so many have squandered in the name of progress. What is to be done? The essential facts and the answer are contained in an article prepared by Paul G. Redington, Chief of the United States Biological Survey, to be published in the near future.

●

Buy a ticket good for innumerable journeys into new and strange lands! Such is the tenor of the first of a series of articles on microscopy as a hobby, which will appear next month. "Microscopy is . . . a scientific art. . . . It is not just the study of germs, for the amateur microscopist has the whole broad field of science in which to wander. . . . The basis of most of our natural sciences is the knowledge that the microscope gives." Sound interesting? More next month and for several issues thereafter, by acknowledged experts in their field.

●

How can chemical engineering possibly be linked with insurance? The two subjects appear, at first glance, to be as widely separated as any two things can be, but there is a definite linkage, and one that has a definite bearing on almost every line of industry in existence. Two chemical engineers have collaborated in preparing an article on the subject, which will open your eyes to practical applications of chemistry to insurance problems.

●

Milk is a food that is in wide general use, and one about which new facts are being learned almost daily. Did you know that milk is a source of at least 25 different minerals? That it contains strontium, vanadium, rubidium, and titanium? That the average milk supply usually possesses nearly one third of all the known chemical elements? These facts, together with many others, and their important relationship to personal health and physical well-being are forcefully brought to attention by James A. Tobey, Dr. P. H., in an article to be published next month.

Editor and Publisher

MEASURING THE EFFECTS OF LOADS ON THE "MACON"

THE operator at the eyepiece of the prism telescope of the "teledeflectoscope" described in the item entitled "Finishing the 'Macon,'" which appears in the Digest department of this issue. The prism arrangement allows the observer to work in a comfortable position, even though he is focusing on an object overhead. Mounted on various parts of the ship while under construction were arrangements of mirrors, scales, and the like, which could be observed from this station as parts of the ship were subjected to varying loads; deflections thus caused could be measured rapidly and accurately.

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Birth Control and Bigotry

By C. C. LITTLE, Sc. D.

Head of the Roscoe B. Jackson Memorial Laboratory for Cancer Research
Director, American Birth Control League
Past-president of the University of Maine, University of Michigan, International Neo Malthusian League, American Eugenics Society

WHETHER they realize it or not Americans are becoming scientifically minded. A daily newspaper of 30 years ago would probably have been full of the "screaming eagle" type of narrow patriotism but would have contained few such headlines as "New Circulation System Is Found," "1932 Harvard Class to be Six-footers if Present Trend in Size Continues," "Meteors Herald Advent of Leonid Shower," and the "Need of Social, Legal Agencies for Curing of Criminal Tendencies," which recently adorned leading pages in a large city daily picked at random.

The fact that economics and sociology are true sciences has only recently been generally recognized. People are rapidly accepting this point of view, however; thus today "supply and demand," "production costs," "intelligence quotients," "overproduction," and such terms, form part of the mental equipment of most, if not all, of our thinking citizens.

Out of this change in popular thought have come certain directive tendencies which are increasingly influencing the thought and actions of our people.

Overproduction is today recognized as a major economic problem—an unsettling influence of the first magnitude. It applies with equal force to any commodity essential to our modern civilization.

People themselves are no exception to the general rule. Their rate of production is a relative matter. A population growing at a very rapid rate may be an excellent thing for a young country with a huge reserve of natural resources, and a very poor thing for a stable country in which the balance between resources and their consumption is at a more precarious stage. From the point of view of labor, overproduction of workers in the United States has been recognized for some years as being a menace to our standards of living and social stability. Immigration of adults from other countries was the first and most obvious point at which a blow was struck following the recent economic pinch. Immigration of children from the unrealized stage to the condition of being economic liabilities, is the second level at which the economic conditions have forced a revision of our profligate, unthinking, and uncontrolled attitude.

AT intervals during the discussion of this topic the doctrines of Malthus have been dragged in by the heels and have been set up either as a god to be worshipped, or as a man of straw to be demolished by spectacular attacks accompanied by much growling and clouds of chaff. The present situation, however, is so very different in its practical factors from any purely theoretic approach to the question of population increase, that little good has been accomplished by attempting to jam all our problems into a purely Malthusian mold.

An overabundance of domestic tragedies, an enormous increase in the needs of charities, and a great growth in expenses for the care of defectives, have gradually impressed upon American citizens the need for care and intelligence in the sphere of human reproduction as well as in the realm of economic commodities.

Just as too much cheap labor rocked our economic structure, domestic maladjustments based on unintelligent and uncontrolled reproduction or on unnatural sex relationships have shaken the structure of the home. Unwanted and uncared for children spreading misery and disease have produced a flood of criminals and have disturbed the progressive development of a sane social structure. Defectives, insane, feeble-minded, habitual criminals, paupers, and others, have threatened the development of public educational programs by the extent to which they constitute a financial burden on the taxpayer and state.

In all of these situations the orthodox church, especially the over-orthodox sub-divisions, has acted in a highly emotional and obstructional way. It has insisted that human reproduction and the functions of birth, marriage, and death were moral problems. As such the over-orthodox Christian denominations hold them to be immune from scientific analysis and from conscious control by the intellect. It, for example, considers it murder to waste a human sex cell except by complete abstinence from sexual intercourse or by intervention of accidental or natural sterility.

The more progressive and intelligent branches of the Christian church take a very different view. They recognize that under certain circumstances man's sexual activities may have spiritual and ethical value for their own sake and in their own right. They realize that repeatedly by intelligent interference with nature, man has refined himself and not debased or prostituted his morals. They admit, for example, that unless Nature was interfered with and a prepared artificial food formula used, millions of infants would die annually.

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Nature has produced hundreds of thousands of women in whom normal lactation is impossible, or unwise, for health reasons. To nurse one's baby may be natural but in many cases it is inadvisable for valid reasons. Giving birth to children is a function open to the same qualifications and restrictions.

Parents habitually consult with the medical profession to determine the best form of nutrition for the new-born child. If the use of maternal milk seems unwise it is artificially pumped off and by entirely unnatural means the flow is dried up as quickly and as successfully as possible. It would be rightfully considered barbarous to neglect these precautionary interferences with Nature.

It is just as barbarous to leave to blind chance or to the damaging unfulfilled stimulation of continence, the exercise and consequences of human sexual activity. Medical men, psychiatrists, and intelligent people everywhere are recognizing this fact in numbers that are increasing with enormous rapidity.

If the approved methods of preventing conception were very complex, or if danger to health were involved, the case might be very different. Such, however, is far from the true situation. There have been methods, now antiquated, which may have been unsatisfactory or deserving of criticism on the grounds of health. These have, however, been replaced by others which are both simple and sanitary. There is still an organized and enthusiastic effort by those opposed on religious grounds to create the impression that all methods are dangerous. The method of gaining one's objective by fostering a compelling fear on the part of the ignorant, or by distorting truth, is one which has worked successfully in fields of theology. It is not being found so useful in matters where an actual test can be made of prediction in relation to performance.

This fact is proved by the high proportion of adherents to orthodox denominations who patronize contraceptive clinics in our various cities. The more progressive and liberal representatives of these faiths, observing the behavior and experiences of others in the modern civilization of which all are a part, habitually use their own judgment in matters of personal sex hygiene, realizing that it is an individual matter and not the common property of any official representative of a religious, social, or racial group.

The remarkable growth of clinics in all the larger cities is a very clear indication that control of human reproduction by means of contraception has reached a degree of public approbation from which it will not recede in spite of all efforts to the contrary.

One of the most frequently employed of these efforts is the announcement by adults—themselves out of touch with youth—that promiscuity and an uncontrolled orgy of sex would follow the general dissemination of contraceptive information. This assertion may be fairly met with the counter-claim that, without the fear of unwanted pregnancy, there would be a distinct increase in early marriage, as well as many fewer divorces on the grounds of sexual incompatibility and the whole grist of desertions and recourses to prostitution which follow in its train.

ANOTHER very unfair but—in the case of the ignorant—effective measure is deliberately to foster confusion between contraception and abortion. Criminal abortion can more correctly be considered the direct result of the *absence* of contraception than identical with it. Since abortion always involves the removal of a fertilized egg which has already begun to form a human embryo, and contraception means prevention of fertilization, it obviously follows that the two things *must*, in the very nature of things, be opposed to one another. It would be very much more accurate and fair to state that those who attempt to prevent the spread of contraceptive information were encouraging the continuation of a social system which makes abortion not only possible but of very common occurrence.

The question of separating the sex act from the reproduction of children is still seriously and solemnly argued in encyclicals and other similar documents. The question, however, is purely academic since humanity itself has already long ago decided that issue. The main point now remaining to be determined is whether the sexual act shall remain, as it was a century ago, an unfortunate hybrid between animalism and idealism, to be treated either as a secret or as a matter of obscenity.

In making the decision it is perhaps allowable to use analogy. Man has been given by Nature certain senses and perceptions. Among these the eye and the ear are the most remarkable. The human eye has distinct limitations. It was meant to see a certain distance and in certain detail. It was an animal function naturally developed by evolution. By the telescope and microscope, man has added to his eyesight a degree of perception, both in extent and in detail, that Nature never intended. The ways in which this development has enriched human life and civilization need not be mentioned. They are obvious and universal in their application.

The ear was made to hear sounds within a certain range and from a certain distance. By radio that power has become unbelievably increased and sound has been completely divorced from its source and material origin in the old sense. Everyone, no matter what his feelings may be concerning contraception, deigns to use this improvement over Nature.

The sexual function was designed by Nature to breed children. Its original natural scope was circumscribed and restricted. Civilization has removed human love from the literal animal procreative act to which human sexual activity once belonged. In savage tribes the forerunners of our own mores can be observed. As love has become gradually divorced from instinct and has increasingly assumed an intellectual and spiritual significance, the scope of physical contact between man and wife has progressively been broadened and idealized.

To attempt to drive mankind back to a stage where such contacts are allowed to develop to a certain point and then to cut them with the righteous sword of an outraged and hysterical celibate cult is now an absurdity.

The fact that the same group em-

ployed in the past the same technique to stifle other developments of man's intellect and freedom is probably indicative of the fact that it is incapable of change.

In a civilization in which social evolution is proceeding at a rapid rate an island of unchangeable social doctrines and restrictions is an interesting phenomenon.

As time goes on, the signs of disintegration of that religion will increase. Communities and states supported by taxation of an enlightened citizenry will refuse to hold themselves financially responsible for the increasing item of care of dependents and defectives produced blindly and heedlessly by any group which dogmatically says "Breed —breed." Concomitant with this will come a division of the burden, so that those who insist upon a disproportionate share in producing the crisis will be held responsible for meeting it from their own resources. When this happens democracy will be more nearly realized. It is only a pseudo-democracy that fails to use the best available scientific methods in analyzing and solving its existing problems. There are distinct signs that our civilization is passing through the crisis of rebirth. Such speed of change and progress is imminent that, not many years hence, the issue will be raised and settled.

There is no unfair discrimination in the situation as it is above outlined. No one would deny to any group the right to create as many problems or difficulties for itself as it desires. It will be agreed, however, that any group insistent on creating difficulties which are largely avoidable by the use of scientific knowledge should not continue to delegate or to transfer these difficulties to others for solution.

States have recognized compulsory vaccination as a reasonable control measure against small-pox. They do not, however, insist that anyone wishing to live in other regions where no such public health measure exists, shall not do so. There will probably, for some centuries to come, be backward areas on the earth where doomed social attitudes persist. Witch-doctors and their associates will still continue to exist. A decision, however, will eventually have to be made. This will involve a choice whether America shall progress as a free country where proper and complete restriction is placed on those who create problems by reproducing blindly a surfeit conglomeration of unthinking and over-emotional problem dodgers. The alternative is its deterioration to one of the backward regions of the earth.

The whole question involves far more than that of accepting or condemning contraception. This topic happens to be simply an indicator of the relationship between science and religion. It is rather a terrain on which a battle is being fought than it is the reason for the battle, or for the campaign of which it is a part.

IN this connection it is of prime importance to record two outstanding pieces of evidence of the inadequacy of certain types of religion as they are at present organized. The first of these involves data of the type presented by J. B. S. Haldane in his preface to the translation of Lange's "Crime and Destiny." Haldane cites figures that show for Great Britain that the number of criminals belonging to one particular faith is disproportionately high when compared with the incidence of people of that faith in the population as a whole.

The writer has found that no such data are available for the United States as a whole. These data should be collected and should involve the religion of the parents or guardians responsible for the early training of the criminal.

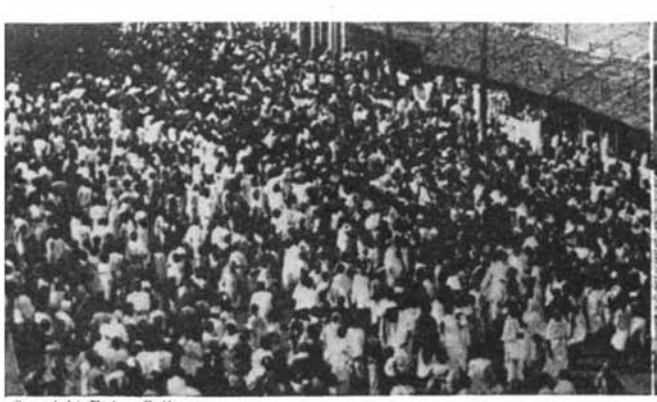
The other type of evidence consists of the proof of adequacy and success on the part of those who hold extremely unorthodox or liberal views as regards organized religion. There may be differences of opinion as to what constitutes a fair test of superiority. No one test will completely satisfy all the requirements that can be asked of it. The inclusion of an individual in such a publication as "Who's Who" is, however, an indication of a certain amount of fitness and distinction. The population listed there undoubtedly contains many mediocre individuals, but also includes most of those who have attained eminence in various fields of human endeavor in our country at any given period.

In a preliminary study made some years ago the writer found that those who described themselves as belonging to the more orthodox and bigotted subdivisions of the organized Christian denominations were present in a far smaller proportion than that represented by the same denomination in the population as a whole. On the other hand, the more liberal denominations or those with no expressed religious preference were disproportionately prevalent in "Who's Who."

Not only was this true, but among the conservative professions such as law or education there was relatively a higher proportion of the orthodox denominations than in the more liberal professions such as science or letters.

The combined evidence from these two sides of the question overwhelmingly proves that a narrow or bigotted conception of religion is a handicap in our civilization as it stands today. There is no sign that this tendency will change. The revolts which have occurred in Russia, Spain, and Mexico against ecclesiastical dogma are far more than straws showing the direction of the wind. They are themselves reflections of a force likely to become of hurricane violence. Hurricanes are never helpful. They are uncontrolled and destructive. It is far more intelligent and scientific to foresee their occurrence and to divert them into useful channels. Whether this is possible for America is a matter for conjecture. One person's guess is as good as another's.

It is, however, clear that the way in which we can do most to avert disaster is to encourage orderly liberalism, and to oppose and eliminate, wherever possible, the dogmatic and antiquated phases of a narrow type of Christianity. It will be well to remember how far this type of Christianity has departed from the simple radicalism and individualism of the great Teacher whose name is today taken in vain by the millions who dodge the responsibilities to which all of us are properly and immutably heirs.



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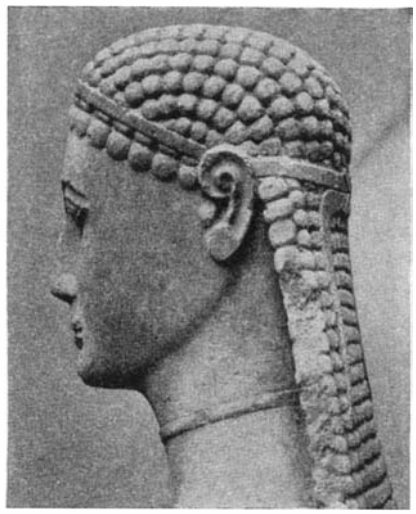
From the Archeologist's Note Book

Archaic Greek Statue

GREAT interest attaches to a six and one half foot marble Apollo-type now in the Metropolitan Museum of Art; first, on account of its great value —300,000 dollars (depression figure) or 900,000 dollars, normal value—and second, because the Greek authorities claim it was "smuggled" out of Greece in violation of the laws relating to antiques. The illustration at the right shows the head of the celebrated statue which dates from 600 B.C. It represents a slim, long-haired youth standing in a frontal pose. It is evidently of Attic origin of the period when Solon was introducing his reforms in Athens. Unlike most archaic Greek statues it was practically complete. How such a hefty statue could ever be smuggled is a tax on the imagination. The museum authorities secured the statue from a reliable dealer in antiquities.

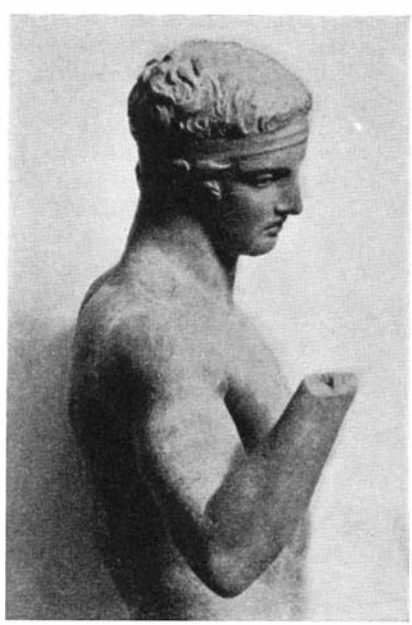


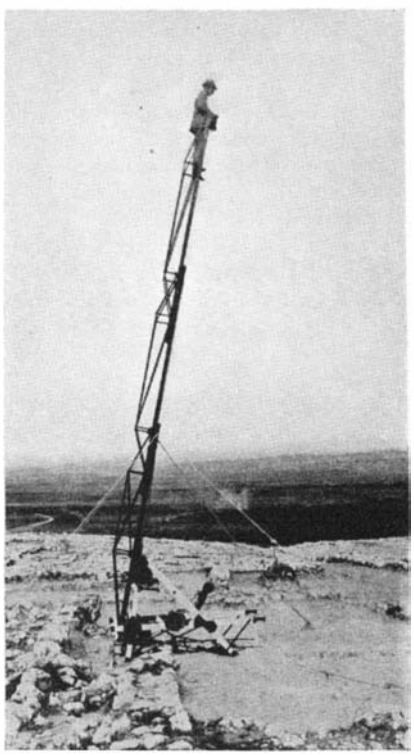
The Lansdowne Amazon

THROUGH the generosity of John D. Rockefeller Jr., the Metropolitan has secured the world-famous Lansdowne Amazon shown below. It formed a part of the Lansdowne collection which was dispersed in 1931, and is one of the outstanding sculptural creations of ancient times. Though the statue is a Roman copy, it is an exceptionally fine one, and it reproduces a Greek work of the developed period (about 440-430 B.C.) which on good evidence has been identified as by Polykleitos, the great Argive sculptor and contemporary of Pheidias. This statue is probably a copy of the statue which was adjudged the best in a competition in which even Pheidias took part, as related by Pliny. The poise is quiet and the design is harmonious. The wounded Amazon is leaning on a pillar but the wound near the right breast is not the central motive. The artist was clearly more interested in the composition than the subject itself. The first owner was Lord Shelburne, afterwards Marquis of Lansdowne, who pursued a policy of conciliation towards the American colonies while Secretary of State from 1766 to 1768. It is artistic justice that 160 years later the statue should be displayed in the country which, at the time of its discovery in Tor Colombaro on the Appian Way and primary ownership in England, was in the process of formation.

A Terra-Cotta Statuette

THE Metropolitan Museum of Art has recently secured the beautiful Greek terra-cotta statuette shown below. Only 11½ inches high and made in a two-piece mold, it is a copy of the work of Polykleitos, whose famous bronze of the same subject has been lost. It dates from the first half of the 1st Century B.C. The figure was probably gilded. This terra-cotta is a free-hand reproduction, in which the copyist embodied his own taste and conceptions.





Photography at Megiddo

THE work of the Oriental Institute at Megiddo, Palestine, is greatly facilitated by the use of an extensible ladder of the type used for cleaning street lamps. It can be extended to 32 feet and is used for observation purposes and for photographing small areas as shown above. For the photographing of larger areas a captive balloon is employed as shown in our issue for October, 1932, page 199, the camera shutter being operated electrically.

OUR POINT OF VIEW

The "Akron" Disaster

THE disaster to the airship *Akron*, with its irreparable loss of brave and highly trained men, has shocked the entire country, and a vigorous but ill-advised clamor has arisen in the press and Congress for the discontinuance of all rigid airship effort by the United States.

Certainly the record of large airships in the years since the war is a disastrous one. Our readers will recall the destruction of the *R-38*, an airship built for the United States Navy by the British, which broke in two over the River Humber on August 24, 1921. In 1922, the *Roma*, built by Italy for the United States, perished by an explosion. In 1922 also, the Army's largest non-rigid airship the *C-2* was destroyed over San Antonio. In 1923, the French airship *Dixmude* was destroyed over the Mediterranean with a loss of the crew of 50 men. The U. S. S. *Shenandoah* perished over Caldwell, Ohio, on September 3, 1925, in a series of violent vertical gusts with only 14 men of the crew saved by skilful free-ballooning with a part of the airship. The *R-101*, destroyed on October 5, 1930, near Beauvais, France, led to the dismantling of the *R-100* by the British and the discontinuance of all rigid airship effort by the British Air Ministry. The *Akron* disaster might seem to be the last blow so far as the efforts of the United States are concerned.

It is to be hoped, however, that not too hasty a decision will be made by Congress. The *Macon*, about to be completed, should certainly be put into service. At the inquiry, planned at this writing, where Admiral Moffett will be sadly missing as a doughty champion of rigid airships, it is to be hoped that someone will be found to recall a fundamental argument in favor of the airship as a naval weapon. Where long range war operations are conducted by a fleet, whether in the Atlantic or the Pacific Oceans, the airship, with its great speed as compared to surface vessels, with its enormous range and its ability to carry a number of fast scouting airplanes aloft, remains the most admirable source of information to the Fleet. Nothing can replace an airship for long range scouting and the Battle of Jutland would have had a far different termination had the British possessed a rigid airship of similar caliber to the one employed by the German Navy.

Barking Up The Wrong Tree

IN the preface of his newest popular book, "The Expanding Universe," the great cosmologist Sir Arthur Eddington has taken the trouble to forestall a variety of protest which he, like all who are connected with the publication of the news and views of science, including editors, evidently is receiving nowadays at an increasing rate. In the most vehement terms hundreds inform us constantly that the so-called "greatest" scientists of our times—Einstein, de Sitter, Eddington, Jeans, Lemaître and others—are undependable. These prominent thinkers, it appears, "do not stick to anything" but "keep changing their minds in a most disconcerting manner." Each new outstanding theory of the universe is made public by them, only to be recalled and altered or thrown out entirely. Yet each new theory is given out with the same air of dogmatic finality as the last. A year or two later it, too, has been junked and we are asked to embrace its successor, which doubtless contradicts it and which probably will be contradicted by the next. But at each stage of this course the public is supposed to rest assured that the question has really been settled.

Such, in real fact, must actually be the appearances which the average beholder sees from the sidelines. As a result, there is cynicism in these sidelines; and as another result, many are begging for a return to the "safe and sane, common sense science of a generation ago, when you could depend upon facts 'staying put' for more than a week at a time." They are misunderstanding the aims of science and this is the fault of the scientist himself.

All of this, as we said, must be the outward appearance. Yet our great cosmologists—our Einsteins who make these theories—are not dogmatic. They do not claim finality for their theories. They are modest men, not self-opinionated egotists.

Somewhere, then, there must be a discrepancy. Where is it?

The chief source of this misunderstanding is that the sideline does not often see the scientist directly but usually through the lens of the popular writer, especially the newspaper writer, and it is these which distort him.

New theories are usually first broached before gatherings of scientists. Here they are addressed to the other scientists who are present, not to the public, and not to the pressmen who attend. Now, when a scientist seeks to gain new knowledge, his method is first to make hypotheses (guesses, controlled by better general background knowledge of his subject than most of us possess); then partly to test these hypotheses; and at an early date make them available for other able scientific minds to test further. From past experience the scientist knows at the outset that most of these theories will prove wholly or partly wrong. They are only trial flights. All of his fellow scientists likewise take the same fact for granted because they understand the method involved, and he is not constantly at pains to repeat "this is only a hypothesis—merely a feeler—don't take it as established fact." To keep on repeating this to other scientists might seem a bit ridiculous. (But as an expedient this very procedure might prove well worth while.)

So the scientist ostensibly says to the other scientists "This or that is *so*"—meaning only "Let us assume that it is so and try to find out whether it is so or not." The reporters present take him at his word and the public is told in tomorrow's newspapers that Professor So-and-so has proved such-and-such. Then comes the later reversal and, of course, the cynicism mentioned.

Newspaper headlines, too, play havoc with science. However truthful a picture of fact is embodied in the news account written by the reporter, it can be and often is given a sensational and misleading slant by the headlines. Careful readers should bear in mind that headlines are put over dispatches in the office of each local newspaper, by a specialist known as the copy-reader or headliner. His job is to brighten up the news and he often improves on the science. Discriminating readers should not lay the blame for such "improvements" on the shoulders of the scientists.

Since there is no practical way to exclude reporters from scientific gatherings, and no way to obviate the false impressions conveyed by the copy-reader, the only remaining thing is for scientists who publish popular accounts of new hypotheses to explain clearly that these are only hypotheses. This is just what Eddington has now done. If all others would take the pains to do as much, the general public would not be misled, as it too frequently is.

WHY THE ST. LAWRENCE WATERWAY?

By ALTON DERMONT ADAMS

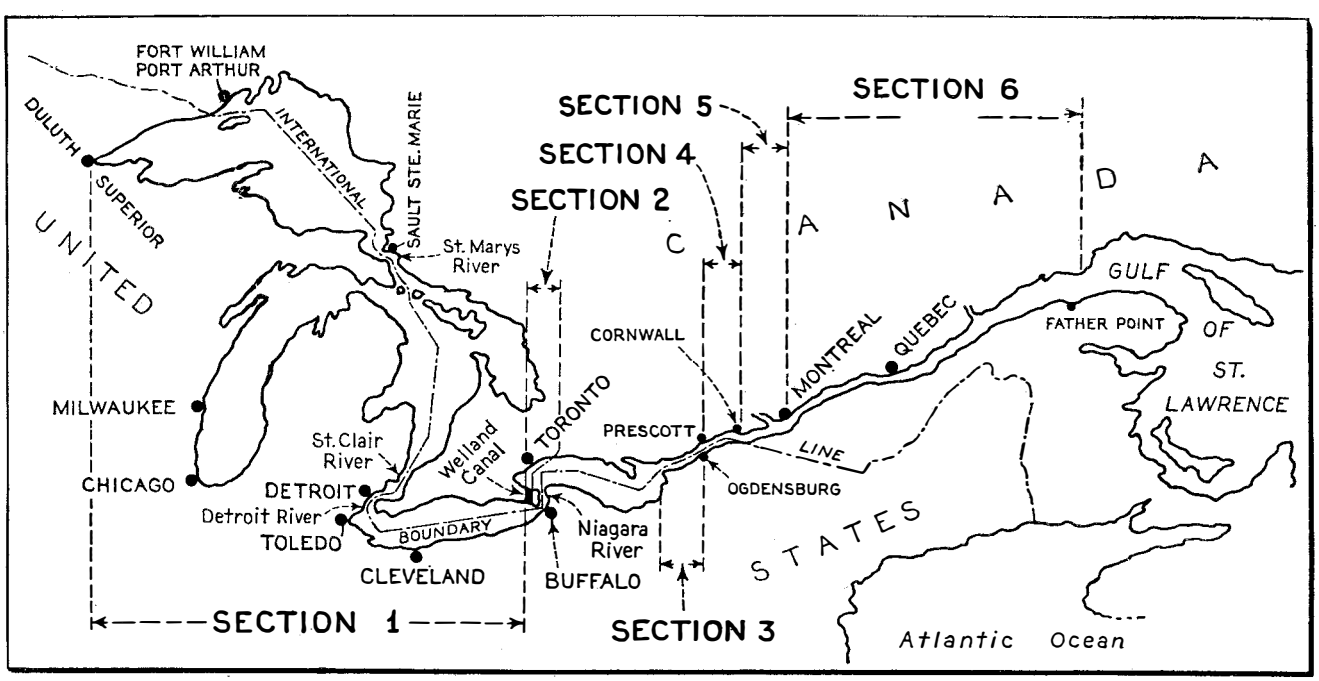
DURING the century and a half of its national life, the United States has not adequately developed navigation facilities between the Mississippi Valley and the sea, either by way of the Father of Waters or the Great Lakes and the Hudson River, the obvious routes in its own territory. One important factor in the neglect to develop these inland waterways has been the failure to reach an agreement suitable to both the Atlantic seaboard and the Valley. Eastern seaports have urged that the Federal Government develop facilities for inland navigation between them and the Great Lakes, while states of the Mississippi Valley have long insisted on a deep waterway down that river to the Gulf of Mexico, but neither plan has been authorized by Congress.

The United States Government has deepened some channels in the Great Lakes, including Saint Mary's Canal between Superior and Huron, to 24 feet; has constructed dams and locks for a draft of nine feet along the Ohio River between Pittsburgh and Cairo, and down the Illinois River from Lockport to its mouth; has dredged a nine-foot channel in the Mississippi below St. Louis; and is constructing dams and locks for a draft of nine feet between St. Louis and Minneapolis. But it has failed to provide a waterway deep enough to carry the bulk-freight boats of the Great Lakes to the sea.

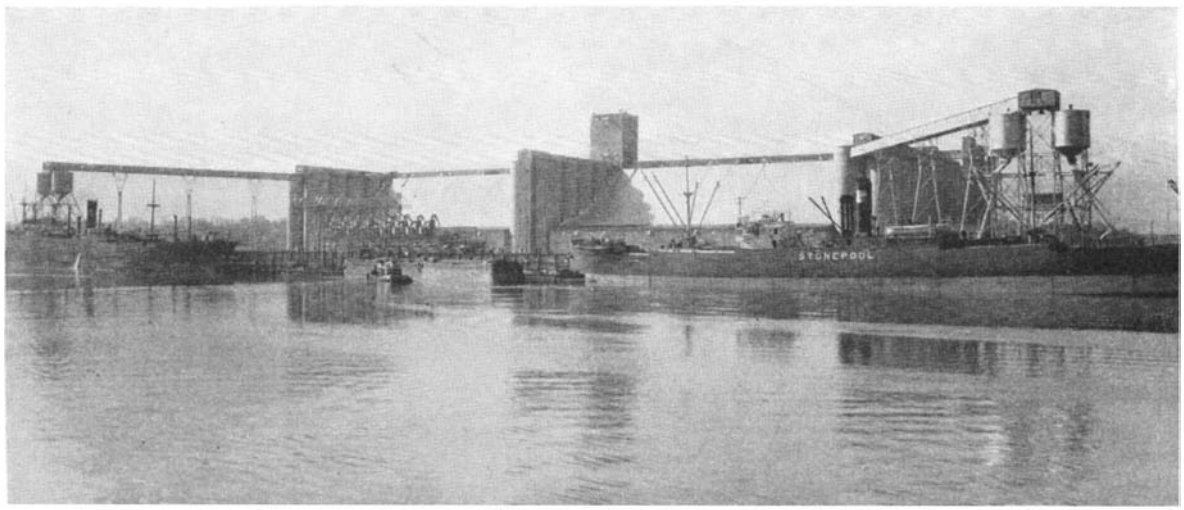
New York constructed the first canal between the Great Lakes and tidewater —the Erie from Buffalo to Albany— which was opened in 1825 and was, during some decades, the great regulator of rates on freight from the Mississippi Valley to the Atlantic seaboard. It contributed much to the commercial supremacy of New York City. After the Erie Canal ceased to control railway rates, because of its small width and depth of only six feet, New York state constructed the deepest artificial waterway in the United States, from the Mississippi Valley and Great Lakes to the sea. This was the Barge Canal, each lock of which is 45 feet wide, 328 feet long, and 12 feet deep, between Lake Erie and the Hudson River, partly along the route of the old Erie Canal.

THIS Barge Canal was opened in 1918, and, though inadequate in size to pass the bulk-freight boats from the Great Lakes—some of which are over 600 feet long and are loaded to a draft of 22 feet—has become a strong competitor of the railroads. It carried 3,722,012 tons of freight in 1931, compared with 1,238,884 tons in 1919. It is obvious, however, that a waterway about double the size of the Barge Canal must be provided between Lake Ontario and the Hudson River, to enable the largest bulk-freight boats of the Great Lakes to dock at New York, to maintain that city's position as to exports, and to provide low freight rates on products of the Mississippi Valley for the entire Atlantic seaboard of the United States.

Canada opened, in 1931, its Welland Ship Canal between Lakes Erie and Ontario, which is ample for the largest boats on the lakes, with locks 30 feet deep, 80 feet wide, and 800 feet long. By use of this canal, one of like size between Lake Ontario and the Hudson River could carry the largest boats of the Great Lakes to New York Harbor. Ocean steamers, also, could then go up to the Lakes, if they were able to compete with the bulk freighter, which is improbable.



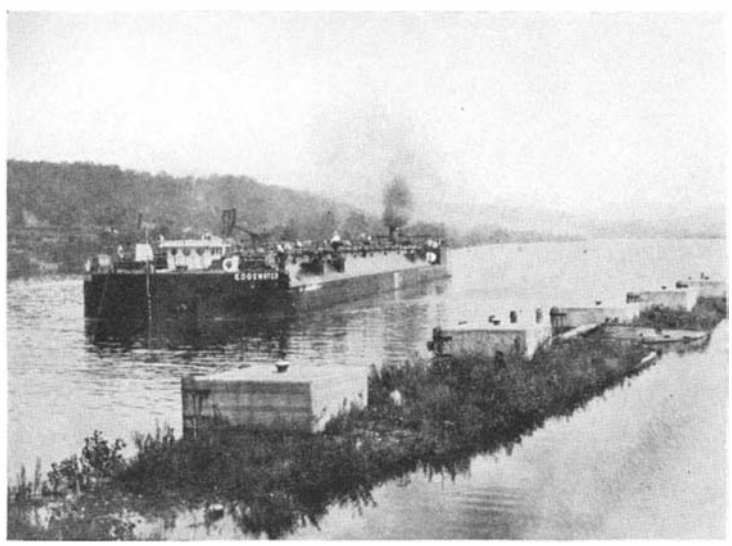
The St. Lawrence project. Section 1: Deepening of channels in St. Mary's, St. Clair, and Detroit Rivers and providing of a 30-foot lock at the Soo, a United States task to cost over 56 millions. Section 2: Canada's Welland Canal, already completed. Section 3: The United States is spending 461,000 dollars, and Canada is spending 772,000 dollars deepening channel. Section 4: International rapids, 48 miles. Ratification of treaty necessary to carry out construction. The United States to provide major portion of 27-foot channels and other works involving navigation and also the power facilities on the American side to develop 1,100,000 horsepower. The United States will spend 215,492,000 dollars and Canada 59,250,000 on two dams, three 30-foot locks, eight miles of canal, and two power houses at each dam. Section 5: Canadian waters on which Canada will spend over 82 millions. Section 6: Canada is deepening channel



Capable of handling huge shipments of grain: the grain elevator at the Port of Albany, largest single unit elevator in the world. This modern port could easily handle all the freight over a Lake Ontario-Hudson River Canal

Nearly coincident with the opening of the New York Barge Canal, in 1918, Canada completed enlargement of its St. Lawrence Canals between Lake Ontario and Montreal, to a depth of 14 feet. Following this increase in size of the St. Lawrence Canals, the tons of freight carried by them rose from 2,891,619 in 1919 to 6,036,980 in 1931. These Canadian canals along the St. Lawrence rapids, though two feet deeper than the Barge Canal in New York, are unable to carry bulk freighters from the Lakes to Montreal; hence the demand by Canada for a St. Lawrence Canal 27 feet deep.

The increase of depth to 14 feet in St. Lawrence Canals has enabled Canada to divert much export tonnage from United States ports. In 1915, Montreal received only 12.4 percent of the grain shipments to six eastern ports, leaving 87.6 percent for the United States ports of New York, Boston, Philadelphia, Baltimore, and New Orleans. But in 1930, Montreal got 36.7 percent of the total grain that reached these six ports, leaving only 63.3 percent for five ports in the United States.



The Ford motorship *Edgewater*, one of the largest type of ships operating on domestic canals from Detroit to Kearney, New Jersey

IF the proposed St. Lawrence Canal is constructed with a draft of 27 feet, and no corresponding canal provided in New York, Montreal will absorb the grain exports that might otherwise go to Atlantic ports.

At this critical stage of the competition between Montreal on the one hand, and the American ports on the other, comes the treaty between the United States and Canada for the construction of a canal of 27-foot draft on the north side of the St. Lawrence River, and an electric power plant on each side of the international boundary, at an estimated cost of 543,000,000 dollars, of which the United States is to pay 272,453,000 dollars.

This St. Lawrence treaty subverts general and commercial interests of both the Atlantic states and the Mississippi Valley, because it tends to prevent construction of a waterway large enough for the bulk freighters between Lake Ontario and the Hudson River, and because it also tends to prevent construction and operation of an adequate waterway from Lake Michigan to the Gulf of Mexico, one or both of which would be of greater importance to our people. Lack of these two waterways will ultimately cost the people of the United States billions of dollars in higher freight rates, and will divert much commerce from Atlantic ports to Canada.

Apart from any sentimental preference by people of the United States for a canal within its own limits, there are the cold facts that freight moved between the Great Lakes and either European or Atlantic ports south of Montreal, by the proposed St. Lawrence Waterway, must pass Anticosti Island, which is over 400 miles north of Oswego, and that due to ice, the season of navigation on this Canadian water route is a month shorter than that at Buffalo and Oswego, and on the Barge Canal. Furthermore, the water route from Buffalo down the St. Lawrence is four times as long as the water route down the Hudson to New York Harbor.

From Buffalo through the Welland Ship Canal, over Lake Ontario, and down the St. Lawrence River and the proposed canal to the Atlantic by the Gulf of Canso, and thence down the coast to New York City, is a voyage of 2070 statute miles. Considering the length of this Canadian route, the time required to navigate it, and the fact that it is open only about seven and one half months yearly, the Atlantic states would find it of much less use and to have smaller effect on freight rates between them and the Great Lakes, than the warmer, shorter route over a canal that could be built for bulk freighters between Oswego and the Hudson.

In contrast with 2070 miles by way of the proposed St. Lawrence Waterway, the distance from Buffalo to New York City by the Welland Canal, Lake On-

Photographs courtesy New York State Waterways Association

Two million bushel state grain elevator at Gowanus Bay, Brooklyn, New York. This port is also equipped to handle huge shipments from our middle west

tario, a ship canal between Oswego and Albany, and the Hudson River, is 506 miles, or one quarter the length of the Canadian route.

In a similar way, the all-water routes from any point on the Great Lakes to the Atlantic and Gulf ports of the United States may be compared with distances over the two routes. Every such comparison, for ports south of New York City, will show the route along Lake Ontario and down the Hudson River to be 1564 miles shorter than the voyage over the proposed St. Lawrence Waterway.

Furthermore, the proposed Canadian route is only a little shorter to Europe than that by New York City. The sailing distance from Chicago to Liverpool, England, is 4663 statute miles by way of the St. Lawrence River and Montreal, and is 5087 miles by way of the Hudson River and New York City. This excess of 424 miles by way of the Hudson River would make but slight difference in the ocean freight rate. Only a minor part of the freight movement, east and west, between the Mississippi Valley and the Atlantic seaboard is export or import business, so that rates on purely domestic freight are much more important than rates on freight carried to or from foreign countries.

Interstate rather than foreign commerce gives the Great Lakes more freight tonnage than any other inland waterway in the world. The major part, but not all, of this traffic passes through the Detroit River, which connects Erie with the upper Lakes, and puts this short stream in first place as a carrier of freight. This river carried 110,719,845 net tons in 1929, while the St. Lawrence Canals carried only 5,718,651 short tons in 1929, the difference between the two roughly representing domestic traffic.

For people of both the Atlantic states and the Mississippi Valley, a Lake Ontario to Hudson River Ship Canal, with a draft of 30 feet in locks, like the Welland Ship Canal, would save tens of millions of dollars annually in freight charges. This saving would come with the entry of the bulk-freighters to New York Harbor, and with freight rates per ton-mile that would be only one fourth to one tenth of railroad rates and are such as ports on the Great Lakes now enjoy.

The proposed St. Lawrence Waterway, besides involving a voyage of 2070 miles between Buffalo and New York City, with some 840 miles on the open Atlantic, can give only a minor fraction of the reduction in freight rates between the Great Lakes and the eastern states that may be had by an Ontario-Hudson Ship Canal on an inland route only 506 miles long between these cities.

The St. Lawrence route would be far less effective to reduce freight rates because of its colder climate and shorter season of navigation, because it is longer than the Hudson River route to New York City, and because the bulk freighters of the Great Lakes, the most economical carriers in the world, would hardly brave voyages of 840 miles on the stormy Atlantic.

THUS we see that the St. Lawrence Waterway Treaty subverts, alike, the interests of the Atlantic states and the upper Mississippi Valley in annual savings of tens of millions of dollars on freight carried between them, by preventing construction of a canal for the bulk freighters from Lake Ontario to the Hudson River. After spending the estimated 272,453,000 dollars on the St. Lawrence Waterway, the United States will be slow to invest other millions in a ship canal to the Hudson.

View of Waterford flight of locks on the Erie Canal, showing a motorship just leaving the distant lock 4 and approaching lock 3 in the foreground. There are five locks within two miles in this group which raise or lower a vessel some 169 feet

Flies Raised To Test Death Sprays

By ANDREW R. BOONE

HOUSE flies in large numbers are captured and allowed to breed in a novel "fly farm" atop a Los Angeles building. Dr. P. W. Jewel raises the insects in droves in order to have them instantly available to be used as victims in tests to determine the potency of insecticides.

Dr. Jewel keeps the flies on the roof of a laboratory building where odors of ripening mash in which fly eggs are hatched do not conflict with the potent aromas from test tubes and miniature distillation and refining units of the oil company he represents. Since he keeps the flies closely caged they do not add to the number of pests at large.

Surprising as it may seem, this worker has found after many experiments that to produce hardy flies that would adequately test the lethal qualities of a new insecticide, he must keep conditions "ideal." Temperatures must be right, the bran mixes of the proper consistency and, above all, the food—milk and sugar—have to be supplied in sufficient quantities to prevent starvation.

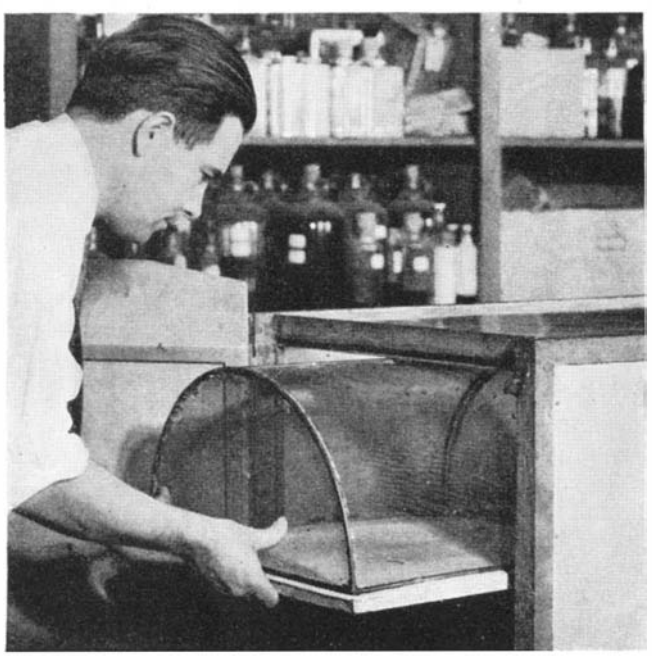
The "fly farm" consists of breeding cages, mash jars in which the eggs are hatched, sand boxes for the pupae, hatching cages, and the wire cages in which the insects are to be exterminated. Flies ordinarily do not lay eggs until eight days old, which accounts for the fact that flies placed in the breeding cages are at least that old. A bran mash is placed in these cages in which the flies lay their eggs, the eggs being placed daily in the jars of mash.

IN 24 hours the eggs hatch into maggots. Five days later the maggots are placed in sand, where they transform into pupae. In the pupa stage the maggot is encased in a capsule-like coating, which changes in color from a cream shade to a brownish red as the maggot develops into the fly. Every four days the pupae are strained from the sand and placed in the hatching cages. From two to five days later, depending upon the temperature, they hatch into flies. Pupae will not hatch in a low temperature, which explains the absence of flies during cold months.

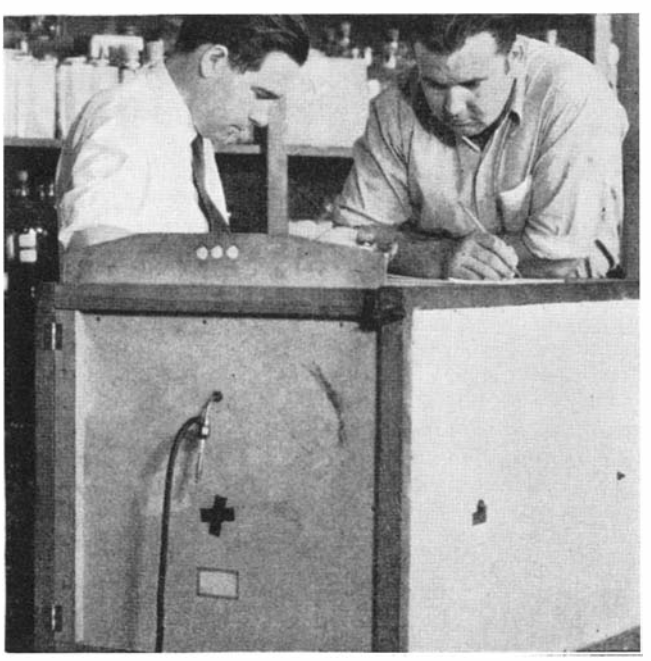
In order that all insecticide tests may be uniform, Dr. Jewel uses only five-day-old flies for the execution test. The execution chamber consists of a board-base, glass-covered cage into which is inserted a wire trap. The trap contains the flies. An atomizer is fitted into the door of the chamber, and to this is attached a small vial of the insecticide to be tested. One hundred flies are used in each test and the dead are counted each 10 seconds following the atomizing. From these counts it is possible to prepare a graph showing the toxicity or poisoning power of the fly spray under test.

"As spring comes on," Dr. Jewel said, "people should remember that flies are not killed instantly by insecticides, but when a spray fills a room they are 'knocked out,' to die later from the effects. . . . To make an insecticide that will kill insects the moment they are sprayed, it would be necessary to include ingredients harmful to fabrics and human life."

Looking down into one of the jars of mash in which eggs are hatched. This is an essential part of the "fly farm" in which victims are raised for testing new insecticides



When flies are five days old, they are removed from their cages with this trap and placed in the execution chamber



The execution chamber. Insecticides are sprayed into the box through the atomizer; the dead are counted at intervals

THE LITERARY VALUE OF MATHEMATICAL TABLES

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

THE historian, the archeologist, and the man of letters, now and again find themselves faced with questions which the astronomer can help them to solve, and the astronomer in his turn may apply to the historian or the classical scholar for aid in the interpretation of ancient observations. Sometimes these questions are intricate and demand heavy algebraic and numerical work.

The classical example is found in the ancient eclipses of the sun and moon. For many years the surviving records of these phenomena appeared to be so inconsistent that their reliability was doubted, and order was brought out of chaos only by the researches of Dr. Fotheringham of Oxford. Starting with the classical scholarship which enabled him to judge for himself what interpretation should be given the ancient manuscripts and other records, he deliberately acquired the considerable mathematical knowledge necessary for an independent discussion of the motions of the sun and moon, and was thus able to show that the assumption of a slow and extremely reasonable retardation of the earth's rotation by tidal friction reduced the apparent confusion to order, and confirmed the reliability of a large majority of the historic records. Historians thus found themselves the richer by a number of definitely ascertained dates, accurate not only to the day but to the hour, while astronomers rejoiced in important information regarding the scale by which we have to measure time.

THE calculations involved in work of this sort are heavy, but occasions arise in which much simpler ones suffice. For example, a few years ago Professor Root, a university colleague of the writer and a Chaucerian scholar, came to him with a very pretty problem. Scholars have differed for many years regarding the date at which the great English poet wrote the "Troilus and Criseyde," some placing it as early as 1376 and others ten years later. No one had noticed that a great thunderstorm which kept the heroine from departing and changed the fate of the lovers, is ascribed by the poet to the influence of a conjunction of the "bente moone" (that is, the crescent) with Jupiter and Saturn all in the sign of the Cancer. Chaucer must have been familiar with the astrological opinions of his day, according to which this particular conjunction should have led to violent tempests. But when he described it in his poem was he drawing on his imagination or on experience? Here the astronomer comes in.

A few hours' work with the planetary tables showed that Jupiter and Saturn were in conjunction in the spring of 1385 and that on May 13 of that year the crescent moon and the two planets were close together, well visible in the evening sky and in the sign of Cancer. Moreover, no conjunction of the two planets in Cancer had occurred during the previous 600 years! Conjunctions happen every 20 years but they all fall in other parts of the ecliptic.

CHAUCER, then, was either astronomer enough to forecast this conjunction and apply it for his poetic purpose, or else he saw it happen and used the event—which must have interested hundreds of others and is indeed recorded in surviving chronicles—as part of his pictures. There can be no doubt that the latter is the right alternative. The date of the poem, which is referred to in another poem written not later than 1387, is thereby fixed within a year.

Not long afterward another of the writer's colleagues brought in a horoscope of a great medieval hero—was it not the Chevalier Bayard?—and asked at what dates the planets were in the positions stated. It appeared that one date and only one met the data but, unfortunately, this hypothetical birthday came only a dozen years or so before the time at which the famous warrior is known to have commanded in battle. Evidently some hero worshipper had ransacked the list to find a day auspicious enough to suit his idol and assigned it to him regardless of the facts!

There are many other problems depending on the positions of the planets. The Mayas of Yucatan had an elaborate system of chronology—much of which is still understood—which depended upon planetary configurations.

The astronomical part of all such questions can be answered with the aid of the standard planetary tables. But these were prepared mainly for accurate calculation of the positions of the planets during the last few centuries and the prediction of their motions for future nautical almanacs. To meet these requirements with all desirable precision and to take account of an enormous number of small terms which appear in the theoretical formulas they have to be very bulky. Sets of these large quarto volumes are to be found in all astronomical libraries and in a few others, but they are beyond the reach of private libraries except of a few experts.

FOR historical purposes this accuracy of calculation is quite unnecessary. It is quite sufficient to work out the apparent place of the body among the stars as closely as it could be put in upon a rough sketch made without instrumental aid. For all ordinary purposes—though not for eclipses of course—it is enough to get results to the nearest degree. This vastly simplifies the situation, for we may ignore altogether the multitudinous perturbations arising from the planets' attractions on one another, and treat them as if they moved in simple elliptical orbits. When this is done a complete set of tables, sufficient for the calculation of the position of the sun and the five bright planets at any desired date between 2500 B.C. and 2000 A.D., occupy only a dozen pages. Such tables have just been published in the *Astronomische Nachrichten* (No. 5937) by Dr. Neugebauer of Berlin, and suggested the present discussion.

For the sun, matters are simple. If the year were an exact number of days in length he would return to exactly the same longitude on the ecliptic at the same date and the simple table would be good indefinitely. Actually we correct for the uniform excess of the year above 365 days, by the insertion of leap years at intervals, and a small auxiliary table takes care of this fact. The eccentricity of the earth's orbit can be allowed for in the main table. Its slow changes from century to century, and the inaccuracy of the old Gregorian calendar (which ran wrong about 3 days in 400 years) are allowed for by

printing a new column for every 200 years. Even so, tables sufficient to calculate the sun's position at any time within 4500 years, with an accuracy of one fifth of a degree or better, occupy only two pages. If the orbits of the planets and the sun were circular and in the same plane it would be ridiculously easy to calculate the positions of the latter. Conjunctions with the sun would occur at precisely equal intervals—116 days for Mercury, 584 for Venus, and so on. At any given number of days after conjunction the planet's apparent elongation (distance from the sun) would always be the same. Two tables, one to find the number of days elapsed since conjunction at any given date and the other to give the elongation, would be required and would take a half page for each planet. To allow for the eccentricity of the orbits and the changing distances of the planets from the sun extends the tables to six pages for the first five planets taken together.

So far we have considered only the longitudes measured along the ecliptic. Another table, covering less than a page, gives the latitudes as seen from the sun. To get those observed from the earth a calculation is necessary, which can be done in a minute or two with an ordinary slide rule.

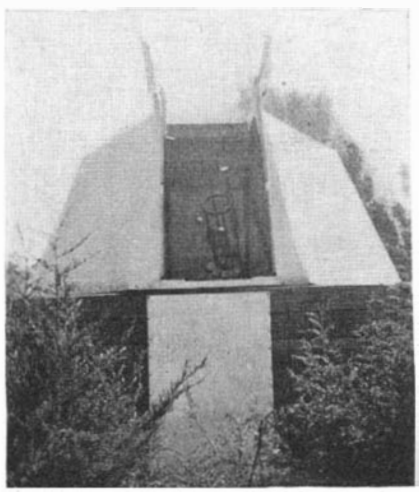
DR. NEUGEBAUER completes his dozen pages with a table from which the brightness of a planet at any date can be found, and one which takes account of the "great inequality" of Jupiter and Saturn—a perturbation which may affect their longitudes by a fraction of a degree. All told there is here, in a form which can literally be folded up and put into one's pocket, all the information needed to put the planets on the map (of the stars) at any date within 45 centuries.

The great advantage of such tables, whether in pocket or in quarto form, lies in the fact that they have been carefully checked to eliminate all errors. The mere statement that the period of Mars is 686.9797 days, makes it a matter of simple arithmetic to calculate on what day of 1933 or 1934 it was in the same position relatively to the sun in which it stood on the day when Caesar was murdered. But to work out the actual number of days between that famous crime and the date of writing is not so easy the first time. One loses count of the leap-years.

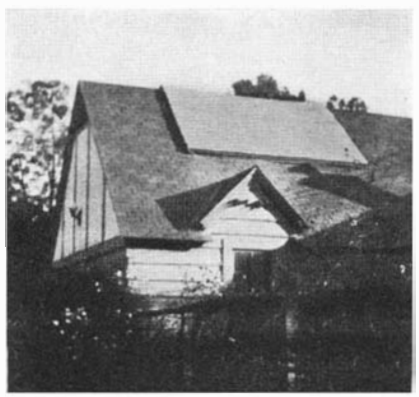
Not only are the tables most carefully checked, but they are made as nearly fool-proof in the using as possible. For example, things are so arranged that all the numbers taken out of the individual tables have to be added together in order to get the next result in the process. If some had to be subtracted there would be a chance of an error in sign. This is done by a trick so simple that one forgets how clever it is. Suppose, for example, that we have three quantities to add, one ranging from 1000 to 5000, another from 450 to −450 and the third from 120 to −120. All sorts of combinations of signs are possible, and as many mistakes. But if we take 450 away from the first and add it to the second, and the 120 away from the first and add it to the third, then the numbers in our tables run from 430 to 4430, zero to 900, and zero to 240, and we never have to subtract. It is upon just these little matters that the value of astronomical tables largely depends, just as the usefulness of an ordinary table of logarithms depends so much on the legibility of the figures and their convenient arrangement on the page. —*Princeton University Observatory*, April 5, 1933.

AMATEUR ASTRONOMERS' HOME-MADE OBSERVATORIES

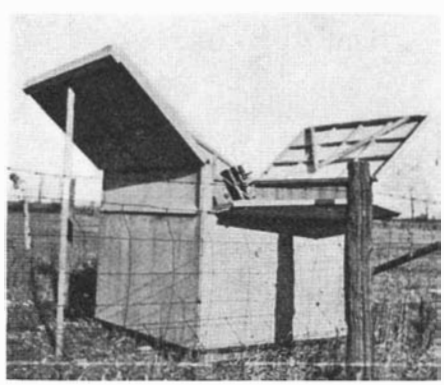
Astronomical telescopes of the size usually used by the amateur observer may be set up in the open and taken indoors again, but where the owner can construct even a simple permanent observatory he will discover greatly added comfort and convenience. The trim one at the right, also the telescope inside, was made by Rev. J. G. Crawford, Wakefield, R. I., known as "The Vicar of Wakefield." He is also a graduate engineer, and came from Northern Ireland



Dr. J. W. MacQueen, 310 Empire Building, Birmingham, Alabama, observes from his attic, two sections of roof being hinged. Each section weighs 800 pounds



The sheet metal observatory of Franklin B. Wright, 155 Bret Harte Road, Berkeley, Cal. One shutter part lowers, as shown



In some ways the best of all observatories is a simple box with roof flaps having hinged support poles. Made by F. H. Reynolds, of 47 Lerdy Street, Potsdam, New York. The side walls are made of light wooden framing covered with Celotex. Total cost 18 dollars

Fly Fast—Land Slow

By
REGINALD M. CLEVELAND

High Speed and Safety Are Essential to Aerial Transportation: How Both Ends Are Being Gained

AIR travel in the United States is an established reality. In the face of declining business for all other forms of transportation, this young industry has been able to make manifest its vitality by gains of substantial proportions. One reason that this has been so is because the designers of airplanes and the men who operate them, having sensed the public response to speed, have been wise enough to provide still more speed.

Four years ago cruising speeds were more often below than above 100 miles an hour. Less than 200,000 passengers and 300,000 pounds of goods then rode the airways in a year. Last year more than half a million passengers and 1,600,000 pounds of air express traveled our roads of the sky. They cruised at an average rate of about 120 miles an hour. This year, with the new planes which have either begun to be delivered or will shortly be in service, passengers, mail, and freight will be wing borne at cruising speeds of from 145 to 180 miles an hour. What the loads of the future will be it is for the still unturned pages of the months to come to disclose, but it is by no means rash to predict a million passengers and more than two million pounds of air express for the domestic lines in 1933.

BUT something has been transpiring in airplane design—which of course has included striking engine improvement—in addition to mere increases in the cruising and top speed figures. For the long view of aviation, this something is probably more important than acceleration. It is an increase of the speed ratio; the relation between maximum flying speed and minimum stalling speed, which latter is closely akin to landing speed. As a corollary, this change means shrinkage in the necessary length of runways, broad extension in the number of available emergency landing places, and greatly increased safety.

The beholder can but marvel at the sheer speed of the modern racing planes, the small-winged, projectile-like conquerors of the continent and the pyloned course, which hurtle from Pacific to Atlantic in ten hours and a fraction, or cover a triangular racing course at better than 270 miles an hour. But if it has been his privilege to see one of these mechanical meteors land, he must wonder still more at the skill and daring of the men who fly them. They are "hot ships." The men at their controls are rolling dice with death.

If only this speed, or a substantial measure of it, could be combined with landing and take-off qualities which do not require a combination of a huge airport and the deft hand of genius on the stick. This has been the hope, the dream of the designer—and it is coming true.

BEST of all, it is coming true all down the line, from big air transports to ships with racing characteristics. Few men have played more daringly with speed in the air than Lt.-Commander Frank M. Hawks; but although he is delighted with the high "top" of his new plane with which he expects to break transcontinental and other records, it is its low landing speed that most impresses this man, who has set down "hot ships" on scores of major airports here and abroad.

"When I wrote the specifications for the Texaco *Sky Chief*," says Hawks, "I thought I was giving the bidding manufacturers a mighty knotty problem. I asked for an airplane that would carry fuel enough for at least 2000 miles at more than 200 miles per hour. It had to be equipped with radio transmitter and receiver, large baggage compartment, carry full complement of night flying equipment such as flares and running, navigation, and landing lights; and I was insistent that the airplane have a landing speed not to exceed, under any conditions with an hour's supply of fuel, 70 miles per hour.

"Heretofore all fast airplanes had a landing speed in a ratio from 2½ or 3 to 1, and I was modestly asking the manufacturers to improve that ratio to at least 4 to 1. It was their problem, however, and when The Northrop Corporation of Inglewood, California, said they could solve it, I sat back to wait for results.

"The Northrop solution was immediately and obviously satisfactory after the new *Sky Chief* had been taken up for a few flights. Tentative performance figures showed a top speed of 250 miles per hour, and a cruising speed, with a conservative throttle setting on the Wright Whirlwind 14-cylinder motor, of over 200 miles per hour. Conclusive performance figures showed a landing speed of from 40 to 50 miles per hour, or a ratio of 5 to 1.

"The improvement of the ratio was obtained in my plane by the use of large wing flaps or air 'brakes.' The lower side of the trailing (or rear) edge of the wing is split from the top side for about 20 percent of the wing chord. Attached to the wing proper by hinges, this lower side or flap or brake or whatever we choose to call it, is raised or lowered by means of a geared shaft actuated from the pilot's cockpit.

"Coming in for a landing, the pilot lowers the flap and immediately the speed of the plane decreases noticeably. With the flaps down to their limit, which is about 45 degrees, there is set up a drag or resistance of over 300 percent. The gliding angle of the plane is cut down from 15 to 1 to 5 to 1, which permits a very safe landing over any tall obstacles which might surround the field. The distance required in which to land the plane is cut down to about one third of the usual run.

"These flaps are also very effective in reducing the take-off run. They cannot, however, be dropped to the entire 45 degrees because obviously the 300 percent drag would not in any way assist the plane in getting into the air. However, putting them down 15 to 20 degrees changes the aspect-ratio of the wing, giving greater lift, and it was found that the take-off run was reduced between 300 and 400 feet.

"'DOES the center of gravity change and how is the lateral control of the plane affected with these flaps down their full 45 degrees?' asks everybody in the aviation industry. Strange as it may seem, the center of gravity is not affected in any way, and it has been found through tests that there is more effective control at stalling speed with the flaps down than at stalling speed with the flaps up. This seems to be effected, when the flaps are down, by a greater volume of air being spilled over the top of the wing where the ailerons are fastened, and their being in a cleaner air flow produces a more effective control.

"Interpretation of the speed ratio of my ship as applied to air transport means that we now have an airplane adaptable for mail, express, and passenger service capable of fast flight for long range with a safe landing speed. Where once transport ships had a cruising speed of 100 to 120 miles per hour and a landing speed of 50 to 60, they may now fly at 175 to 200 miles per hour

with no increase in their landing speed, and most probably a substantial decrease. Such airplanes, similar to my own, are at present being built by Northrop for the Transcontinental & Western Air system. All this means that air transport may soon be operating on coast-to-coast schedule of 18 hours for passengers. Dawn-to-dusk travel across our continent is not far away for anybody who desires to utilize air travel."

Another great flyer, whose field has been that of exploration and distance flights, rather than that of exceptional speed, bears testimony to the same effect. Bernt Balchen, conqueror of the Atlantic and the South Pole with Byrd, who will go as pilot of the Lincoln Ellsworth Trans-Antarctic Expedition to the cold wastes of the Ross Sea this year, also is flying a ship with air "brakes" in the form of split flaps. Ellsworth's Wasp-powered Northrop has had a thorough trial under conditions which approximate those in the Antarctic above snow-bound Canadian fields.

"I can get in almost anywhere," said Balchen, when he came back from these tests. "The flaps work wonderfully, and help not only in landing the plane in the way of cutting down speed, but also, when one learns to use them, materially assist in getting over obstacles if one has not calculated quite correctly the approach to a strange landing area. When the flaps are down for a landing, one can actually get a hurdling effect by raising them somewhat, and thus in effect stretch a glide."

Those who know the quiet, earnest Balchen—a Knight of St. Olaf, for his exploits in the air—realize that he is not given to overstatement.

Flap "brakes" have been fitted also to another famous plane for another speed and distance flyer; the Gee Bee racer with which Major James H. Doolittle brought the land speed record back to America last year at 296 miles an hour, and which Russell Boardman will pilot on transcontinental speed flights.

BUT interesting and important as is the application of these and similar devices for the racing pilot and the explorer, or any other type of flyer who will demand special performance from his aircraft, the real significance of the auxiliary air foil, increasing the speed ratio, lies in its effect upon the transport airplane and the plane for the every-day private flyer. At its marvellous testing ground at Langley Field, Virginia, the National Advisory Committee for Aeronautics has given deep study to various air foils of this character. Different devices naturally produced varying results, but all of the several devices tested—which included a fixed air foil mounted in front of and in advance of the leading edge of the wing, and many movable devices applied to the trailing edge—had this in common: that they markedly decreased landing speed, increased speed range, and cut top speed either comparatively slightly, or not at all.

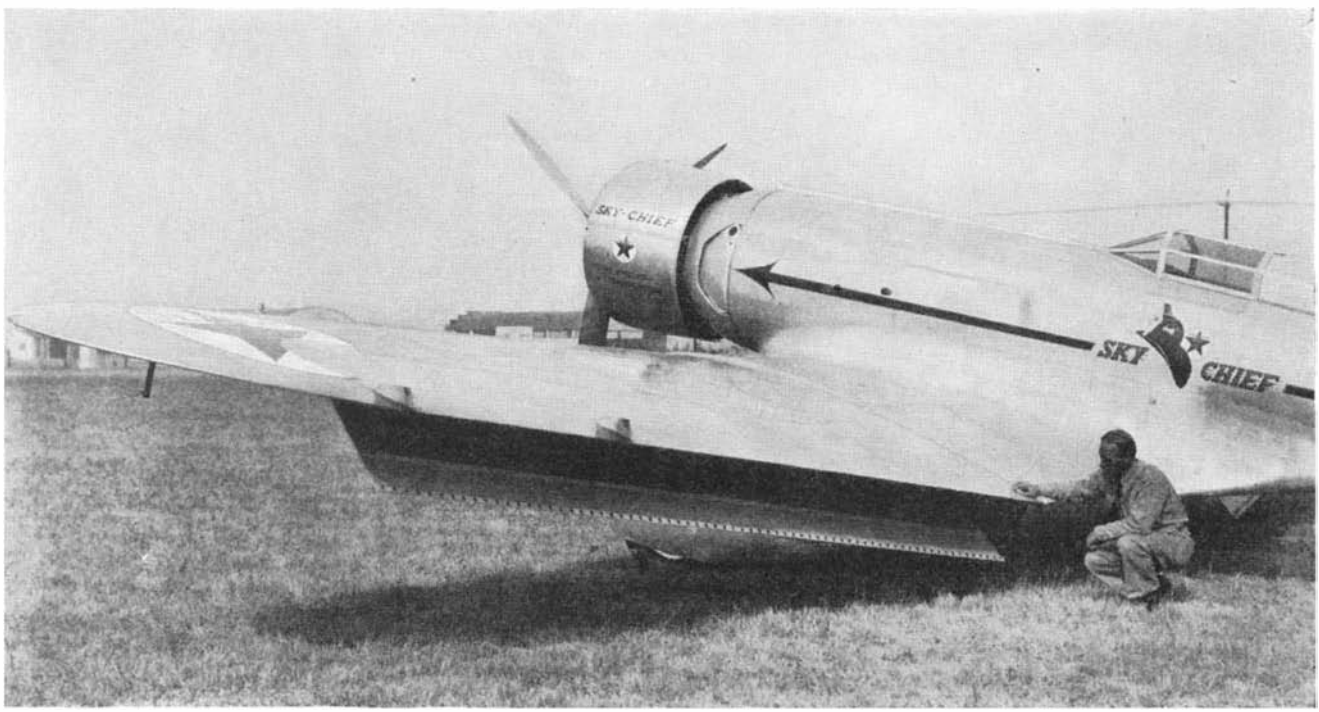
Translated into terms of practical utility for the average flyer, this means that devices of this character which are found satisfactory from a construction and operative point of view will enable him to make use of smaller fields, to land and take-off over higher obstructions, and to meet those critical points of flight, the departure of the landing gear from the ground and its reunion with it, with a measurably increased factor of safety.

Although a comparatively small number of transport airplanes are as yet using auxiliary air foils beyond the familiar Handley-Page slots, flaps, and spoilers, there is abundant evidence that designers, even as a preliminary to this step, which seems destined inevitably for wide adoption, have given an increasing measure of thought to the question of low landing and take-off speeds. They have given it successfully. For example, the new Curtiss Condor, a 15-passenger transport to carry, in addition, three in crew and 600 pounds of baggage and goods, has a top speed of 170 miles an hour, a cruising speed of 150 miles an hour, and a landing speed of 49 miles an hour. The new Boeing monoplane—twin-engined as is the Condor—which carries 10 passengers, crew of three, and 800 pounds of additional pay load, has a top of 182 miles an hour, cruising speed of 165 miles an hour, and lands at 58 miles an hour.

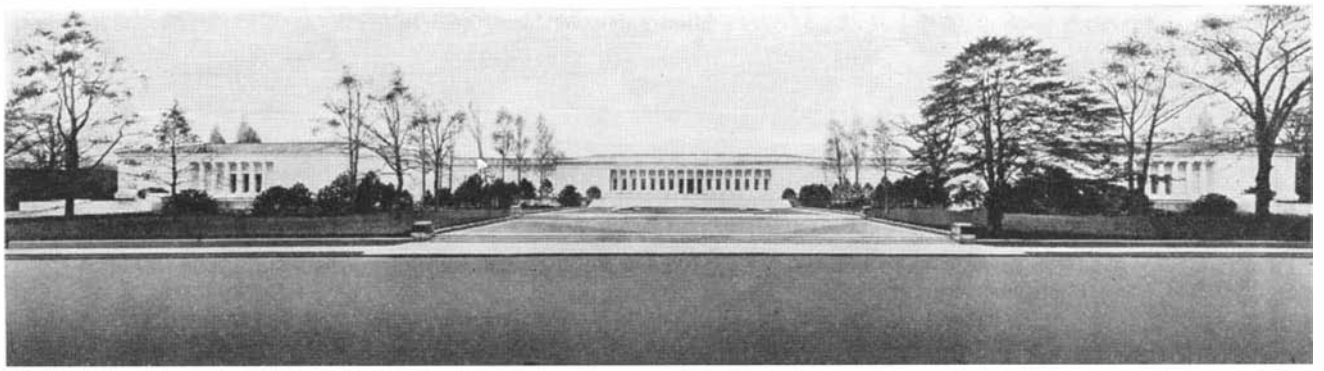
The emphasis is at last and decidedly in the right direction. It is not enough merely to fly fast. In this period of emergence of air travel from the faults of adolescence and of its widespread public acceptance, we are learning to land slowly.

●

The recent disaster of the dirigible Akron *has not shaken Germany's absolute faith in airships for regular transoceanic service. An article to appear in July, based on the record of the* Graf Zeppelin *during 1932, tells of this service and its future possibilities.*



One of the wing flaps on Hawks' *Sky Chief*, described in the accompanying article



The Toledo museum in its beautiful setting

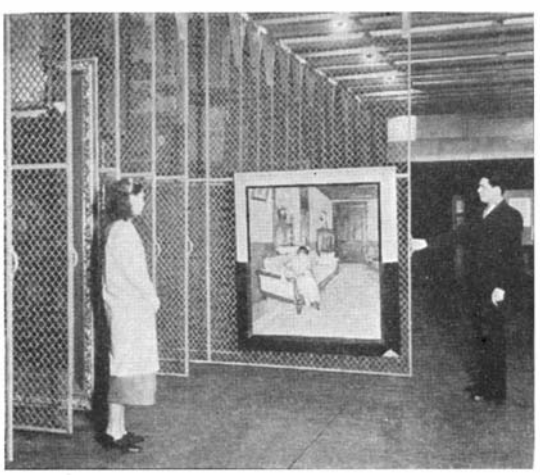
A 'Different' Art Museum

Photographs courtesy Dr. Blake-More Godwin, Director

One of the corridors in the School of Design, showing the evenly diffused illumination from the panel lighting system

ART museums in general are so often thought of as somewhat stereotyped exhibition halls that their main purpose in life is frequently lost to sight. In the case of the Toledo (Ohio) Museum of Art, however, museum technique has been improved to a point where the earnest student of art is offered every possible facility to aid him in the pursuit of his studies.

One of the accompanying illustrations shows a part of a long corridor that serves a dual purpose. Not only is it a connecting link between rooms, but it is also an exhibition gallery for projects or for the work of students. In the Toledo museum there is a total of 800 feet of such corridors. The lighting arrangement was designed to afford the best possible illumination of the walls as well as for embryo artists who desire to copy displayed paintings, designs, and so on. Placed in lateral and transverse polished aluminum alloy troughs are banks of 40-watt lamps spaced nine inches apart. A special type of glass is placed in front of the lamps, having been selected for its high diffusing and low absorbing qualities. Each lighting section is so connected that it may be operated at either half or full intensity, depending on the type of display.



Wire panels in the painting storage room permit study of individual paintings at will

The wet and sticky canvases of painters in oil constitute one of the great problems of an art museum. In most cases, it is solved by allowing the painter-student to take his unfinished work home. At the Toledo museum, however, are provided lockers which are large enough to house normal-sized stretchers and to hold them in a safe position. Room is also available for the various artist's implements.

Museum paintings are usually so great in number that they can be exhibited only in rotation, a few at a time, and the rest are kept in storage where it is a lengthy operation to unearth a certain one that is desired for reference. The storage question was settled in a systematic manner at the Toledo museum where the un-exhibited paintings are hung on wire panels held in frames that can be pulled out when desired.

Although the city of Toledo is 19th in population in the United States, this museum of fine arts ranks sixth in size among institutions of its type, and although only 21 years old, the museum is exerting a tremendous cultural influence in the middle west, the effects of which are far-reaching.

Storage lockers for wet paintings accommodate the work of pupils

A Mechanical Cow That Breathes, "Gives Milk" and Moves Her Head, Eyes, Ears, and Jaws in Lifelike Fashion

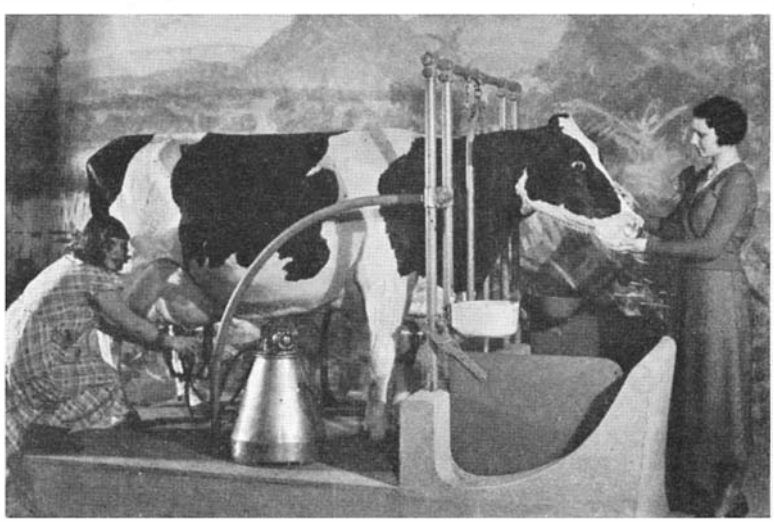
THE most expensive cow in the world, a joint product of nature, art, and invention, was "built" to demonstrate a milking machine at the "Century of Progress" Exposition. First a pedigreed Holstein cow was secured as a model for the sculptor. After the cow had been modeled in clay, a plaster mold was made which served as a basis for a life-size papier mache model which was built up in layers so that the shell, made in six sections, was three quarters of an inch thick. The pieces of the shell were dried for about four days and then assembled. Iron pipes in the legs of the model were inserted to support the motor platform which carries the "works."

The model was then removed to the machine shop where various "surgical operations" were performed to permit movement of the head, jaws, eyes, ears, belly, and tail. The mechanism was so cleverly designed by the constructors, Messmore and Damon, that only two motors were required, the plurality of motions being secured by an ingenious series of cams. The head sways, the eyes blink, the ears move lazily and the jaws go through the process of cud chewing, all with little or no suggestion of mechanical means. Even the "moo" was recorded and is reproduced at intervals. The sides go through the movement of breathing by expansion and contraction of the belly and flanks. The tail swings from side to side and at intervals gives a vicious switch.

WHILE the mechanism was being assembled, the cow herself was slaughtered and the hide carefully removed so that no seams would be visible when the model was covered. After the hide was dressed so that it would remain soft and pliable, it was applied to the model on which had been placed properly shaped sections of sponge rubber to build up "muscles" and to permit the moving parts to function in a natural manner. Where it was necessary further to conceal the joints of the hide, individual hairs were cemented to the seams with a solution of latex.

On one side of the cow a "trap door" had to be provided so that the attendant can oil the machinery. A cut was made along the irregular edge of a large black spot on the hide so that the edge of the "trap door" is effectually concealed when the flap is down.

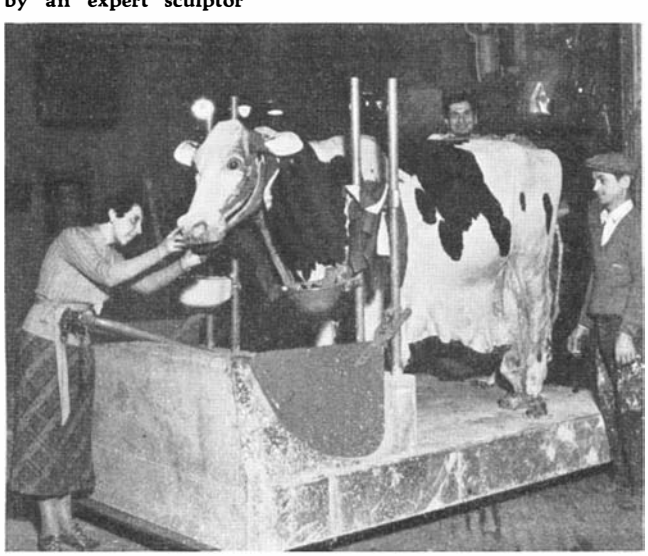
Simulated milk is pumped from the base on which the model stands, through a pipe to the udder and thence through the teats and milking machine. Glass tubing in the delivery hose allows spectators to watch the flow of the "milk" through the machine.



Right: **The life-like model cow and the milking machine form one of the exhibits at the Chicago "Century of Progress." A real cow hide has been applied to a modeled frame**

Below: **The "trap door" in the side of the cow discloses the mechanism, actuated by two motors, which gives motion to head, eyes, ears, mouth, and tail. Even breathing is simulated. The milk which the cow will "give" is a soluble oil circulated by a motor-operated pump**

Below: **The treated hide being draped over the papier mache form made from a clay model of the cow, which had been modeled from life by an expert sculptor**



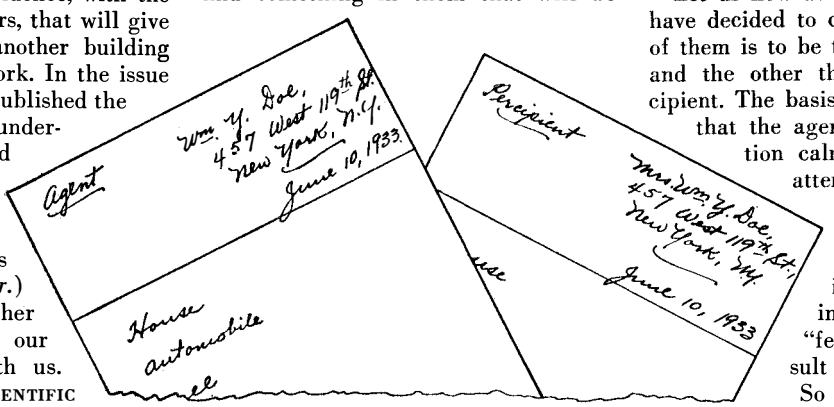
THE SECOND SCIENTIFIC AMERICAN TEST OF TELEPATHY

Paper and Pencils Are All That Is Required for Conducting This Series of Experiments That May Open a Large Field for Study

IN any study of what we may broadly term the functions of the human mind, research workers are usually handicapped by the lack of "tools" with which to work. That branch of psychic investigation concerned with telepathy is no exception. There is no tool or instrument with which we can take apart the mechanism of telepathy —if indeed such there be—and find out what makes it go. No known standard of measurement can be applied to the conscious or unconscious workings of the mind in order to show the extent of these workings. In fact, in the case of telepathy, there has never been developed sufficient evidence to prove to the satisfaction of science that the phenomenon itself actually exists.

In an attempt to provide a working basis for a further study of telepathy, SCIENTIFIC AMERICAN has undertaken to collect a mass of evidence, with the assistance of our readers, that will give psychic investigators another building block with which to work. In the issue for March, 1933, were published the details of a test to be undertaken by readers and which to date has been very successful. (See page 307 of this issue for other remarks on this first test. *Editor.*) We now propose another test and request that our readers co-operate with us. In this investigation SCIENTIFIC AMERICAN is acting as a means of spreading the request for data and as a collection agency for the reports of results. This is not a contest in any sense of the word but a serious attempt to amass a volume of evidence. As stated in connection with the March article referred to above, we are not offering any prizes or other remuneration, but the tests have been so arranged that you will find them interesting and instructive. When you complete the present test and send the report of your results to SCIENTIFIC AMERICAN, you will have the satisfaction of having done your share to add to the sum total of knowledge regarding one of the moot questions of science.

In this test, as in the previous one and in others to come, we wish to stress one point. When you have completed the experiments in accordance with the directions given in the following paragraphs, and condensed at the top of the opposite page, do not hesitate to send them in if, in your opinion, they do not give evidence of any telepathic powers. Every scrap of evidence offered by intelligent people and gathered under test conditions such as those outlined, is of value to the psychic investigator. Even if your results should appear to be absolutely negative when casually considered, there is a possibility that the trained mind of the investigator may find something in them that will be evidential in one direction or another.



How reports of results in the second *Scientific American* test of telepathy should be rendered

In the present test it is proposed that one person shall attempt to transmit telepathically to another certain forms of simple mental impressions without there being any form of communication between the parties involved except that which may be accomplished by some as yet unmeasured mental process.

It is first necessary that the two persons who are to co-operate with each other and with SCIENTIFIC AMERICAN in this test, thoroughly realize that this is a serious attempt at investigating a comparatively unknown field. It is not to be confused with the dramatic hokum of the professional "mind reader" or with the "parlor trick" methods of "finding the hidden object" and the like. The test should be undertaken with the idea in mind that the results are to be reported, regardless of what they may show, and that it will be conducted in accord with the method outlined.

IN order to put the entire experiment on a scientific basis so that the results may be properly co-ordinated and analyzed, it is desirable that the participants all follow the same general system in arriving at and recording their results.

Let us now assume that two persons have decided to conduct this test. One of them is to be the "sender" or agent and the other the "receiver" or percipient. The basis of the experiment is that the agent is to fix his attention calmly and without any attempt at severe mental concentration upon some object and that the percipient is to await the mental impression which he "feels" arrives as the result of the attempt.

So that undue mental strain or fatigue may not vitiate the efforts of the experimenters, it is advisable that the desired total of 30 trials for each couple be divided into three groups of ten trials each, and that separate records be kept of each group. These three groups may be conducted on three successive nights, or spaced two or three nights apart.

When the couple is ready to conduct the first experiments, each one is provided with a sheet of paper and a pen or pencil. Each writes his own name and address, the date of the experiment, and the word "agent" or "percipient" according to the part which he or she is to act, at the top of the sheet. Each party then composes himself in a com-

How to Conduct the Second
SCIENTIFIC AMERICAN TEST OF TELEPATHY

IN order that the results of *Scientific American's* second test of telepathy may be of the greatest value to science, it is essential that *Scientific American* readers who conduct the test do so in a uniform manner. The accompanying article puts forth in detail how this test is to be carried out. For convenience we summarize in the following paragraphs the essential points:

(1) This test is to consist of a series of 30 experiments arranged in groups of 10 each. Since the groups may be made on different dates, the records of each group should be dated to indicate the sequence of the experiments.

(2) The experimenters shall be two persons who will complete the series, the agent and percipient continuing in their respective rôles throughout. Then, if an additional series of tests be made, the original agent and percipient may exchange rôles.

(3) Before each group of the series is started, the agent writes his name, address, the date, and the word "agent" near the top of a sheet of paper about half business size. The percipient writes his name, address, the date, and the word "percipient" near the top of a sheet of the same size. All is now in readiness for the test.

(4) The agent and percipient make themselves comfortable but in positions where they cannot see what is being written on each other's paper. The two experimenters should preferably be seated at separate tables separated by the width of the room, and not directly facing each other.

(5) The agent writes on his sheet the name of some familiar object which he can clearly visualize in his attempt to send his thought to the percipient. Agent then allows his mind to dwell calmly upon the object which he has named.

(6) The percipient, in a relaxed mental and physical condition, now awaits reception of the impression until he feels that the thought has been received. He then writes the word on his sheet. The reception of each thought may take several minutes and the time allowed for conducting a group of experiments should be arranged accordingly.

(7) After each word has been transmitted, agent and percipient cover all writing on their papers with a blank sheet in order to avoid conflicting impressions before the next transmission takes place.

(8) When 10 words have been transmitted, one group of the series has been completed. The other two groups may be completed at any time, preferably separated by one or two days in order to prevent any effect which mental fatigue may have on the final results.

(9) When the three groups have been completed, mail the six sheets, arranged in the order in which the tests were completed, to *Editor, Scientific American, 24 West 40th Street, New York, N. Y.*

fortable position where he can relax mentally and physically and where neither one can see what the other is writing. The agent first writes on his sheet the name of some simple and familiar object which he can readily visualize, and then keeps this mental picture in mind. When the percipient receives the impression, he in turn writes on his sheet a word or words that describe his own mental image. Then each party covers with a blank sheet of paper all writing on the record sheets, the agent writes another word, the percipient receives and the process is continued until a group of ten words is completed.

IN selecting objects to be transmitted telepathically to the percipient, the agent should be careful not to select objects which are in the room where the experiment is being undertaken. If by chance he should do so, there is a possibility that he might unconsciously direct the percipient's attention to that object by glancing at it while transmission is taking place. The results will be more definite and indicative when all such possibilities of unintentional clues are eliminated. It might even be wise for the two parties to sit so that they cannot see each other's faces during the experiment.

At no time during the course of completing a group should the agent and percipient compare notes, and all undue conversation and outside distractions should be avoided. Turn off the radio, dim the lights if that will help you to compose yourself, and avoid any attempt at what is commonly known as "concentrating." If you try to force your mind into certain channels you will probably find your attention wandering afield and you will be defeating the express purpose of the test.

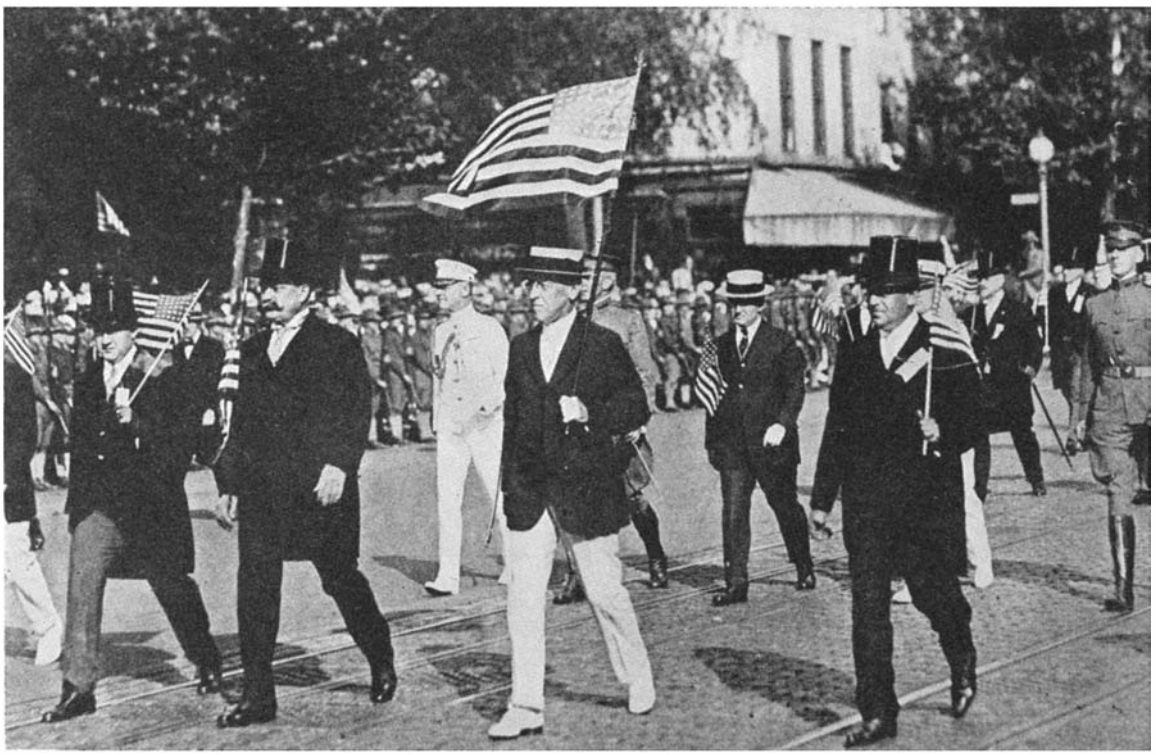
If the agent will calmly fix his attention on the word that he has just written and keep the object in mind, he will be doing his full share. The percipient will be doing the same if he lets his thoughts wander as they will—just as if he were relaxing and resting after a day's work—until he gets a distinct impression that seems to come from outside. Then is the time to write. Don't get discouraged if the impressions do not seem to come simultaneously with the writing of the word by the agent. They probably won't. It may take several minutes before the "transmission" is received.

It may be that when the percipient receives the impression, he may not be able to record it intelligently in one word. In such a case, by all means write a short description of what has been received, so that the record will be complete.

After a group of experiments has been completed, notes may be compared and discussed, but in no case should changes be made in either list. First impressions are what count in research for telepathy, and any changes in the record will only be rendering false evidence that will be of no value. When the three groups have been completed, mail the six sheets to the Editor, SCIENTIFIC AMERICAN, 24 West 40th Street, New York, N. Y. Be sure that each pair of records is dated the same so that there will be no possibility of confusion in analyzing the results. If you desire to make any comments, we shall be glad to read them, but we cannot undertake to enter into correspondence in all cases.

A report of the results of this experiment will be rendered through these pages as soon as possible. Those who co-operate should keep copies of their submitted records for comparison with the final published analysis.

REGULAR readers of SCIENTIFIC AMERICAN will notice a similarity between the present test and those conducted with Mrs. Upton Sinclair as the percipient, reported in some detail in the March, 1932, issue. Those who have not already done so should be sure to read this article, as it may give added information as to the methods pursued in telepathic investigations. In the Sinclair experiments there was only one percipient; in the SCIENTIFIC AMERICAN experiments there is a potential group of thousands of percipients and agents from whom may be gleaned a mass of evidential data that should be invaluable to the study of telepathy. Attention is also called here again to the article announcing the first SCIENTIFIC AMERICAN test of telepathy in the March, 1933, issue. Those who desire to read more fully of the reasons for accumulating thousands of records of telepathic experiments will find them in that article. Other articles on the same subject appeared in April and May, 1933, issues.



The campaign cry during Wilson's second Presidential campaign was: "He kept us out of war." He was, however, eventually convinced of America's perilous position and led parades to arouse his fellow citizens

AUTOCRATIC VERSUS DEMOCRATIC DIPLOMACY

By CAPTAIN W. D. PULESTON
United States Navy

CROMWELL, unable to re-establish civil government in England, divided the country into military districts and placed a major general of his army in charge of each area. As long as that stern soldier lived, he ruled England efficiently, but the severity of his military rule prejudiced the whole English people against the army and bred a horror of a military autocracy that exists to this day in every English-speaking community in the world.

During the events preceding and during our revolution, the British Army became associated in the minds of our ancestors with oppression and tyranny, and in spite of the fact that it was the British Army that expelled the French from Canada, and Washington's Army and the French Navy that finally enabled us to overthrow the British rule, there was a distinct prejudice against the military in the American generation that framed our Constitution.

In addition, the fear of creating another despotic government caused our constitution makers to divide the powers of our government into three co-ordinate branches: executive, judicial, and legislative. This division of authority accomplished the desired result, but it adds to the difficulty of managing our foreign affairs and our military establishment. And it has only been the usual willingness of the legislative bodies to co-operate with the executive department on foreign affairs that has permitted any continuity to be given to our foreign policy.

The supremacy of Parliament over the Crown in England has tended to introduce confusion into British foreign policies, which has been reduced by a gradual agreement of the leading English parties upon the same general principles of foreign affairs. In both England and America, notable exceptions to this rule of general co-operation have occurred and European chancellories have complained of the inability of these governments to make definite foreign commitments.

It is true, however, that autocratic governments change their foreign policies on the whims or fears of a czar or emperor, and that democratic England during the past century and a half has proved a more reliable ally than autocratic Russia.

After their experiences under Napoleon I and Napoleon III, the French, naturally a military people, conceived such a fear of the military that frequently they have hurt their own power of defense by needlessly subordinating their military leaders to their civilian leaders. France has also suffered from the inability of a government to carry on without the continuous vote of confidence from the deputies, and her foreign policies have been affected by her domestic politics. But since 1870, her foreign policy has been notably steadied by her desire for security against Germany.

When modern Italy was established,

The opinions and the facts in this article are the personal ones of the writer. They are not to be construed as official or reflecting the views of the Navy or the Navy Department.

it adopted, with the parliamentary institutions of western Europe, the parliamentary prejudices against the military, although the unification of modern Italy resulted mainly from military action.

If a student, solely intent on the truth, seeks to learn why Germany and her allies were able to fight the whole world from 1914 to 1918 and almost win, he should begin by studying the faulty relationship between the civil and military leaders in the parliamentary countries of Germany's enemies.

WITH the future of England, France, and Italy, we are only indirectly concerned, but when we recollect that Jefferson and Madison led us into the War of 1812 unprepared; that McKinley let the Spanish War cost us entirely too many lives; that Wilson's failure to prepare the Army and Navy in 1915 and 1916 caused Hindenburg and Ludendorff to risk unrestricted submarine war in 1917 and force us into the World War, it is plain that the American people have paid too much in blood and treasure for the sake of unduly subordinating the military to the civil, and they should seek a truer balance.

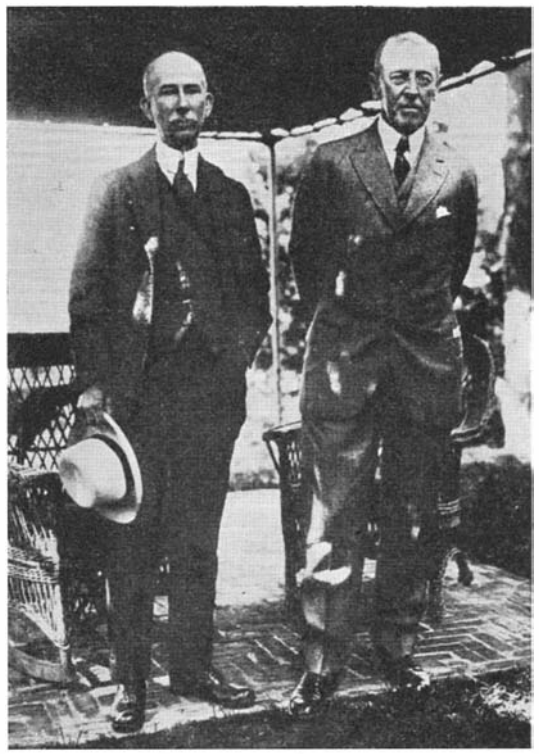
In Germany, on the contrary, it is quite evident that the military dominated the civil. The Kaiser repeatedly and truthfully stated that his family were placed on the Imperial throne by the German Army and it was to the bayonets of his army that the head of the house of Hohenzollern looked for support. And it naturally followed that the Kaiser listened to the chiefs of that army more than he did to the Reichstag or his civil ministers.

Von Hindenburg and Ludendorff, ignoring civilian advice, made fatal decisions

It is also plain that, although Germany's military machine was superior to that of her enemies, the lack of political sagacity of her military leaders largely nullified, and finally cast away the fruits of these victories by continually creating new enemies that could not be overcome.

Now it would seem that somewhere between the system in vogue in Germany and that in France, England, and the United States, there must be a system where a balance between the statesmen, the admirals, and the generals can be found that will enable the United States to escape more avoidable wars and be better prepared for the very few really inevitable wars.

There can be no doubt of the desirability of finding a better balanced system, for every serious student or observer of the World War, pacifist or militarist, soldier, sailor, or statesman, has agreed that war is the supreme test that can be applied to the institutions of a modern state. Also the memoirs of leaders, civil and military, who shouldered the responsibilities entailed by the World War, agree that the various situations they faced from 1914 to 1918 were perplexing and dangerous beyond any peace problems.



President Wilson and Colonel House planned world peace; our unpreparedness invited attack

THE testimony of these modern leaders confirms the experience of the ancients, as numerous old proverbs and long quoted maxims attest. So we can be assured that in the future, war is the supreme trial all states must meet, our own included.

Throughout all these accounts by prominent actors in the World War there runs a continuous note of disagreement between the civil and military agents of the same government. In England and France, where the civil authorities were dominant; and in Germany, Russia, and Austria, where the military were supreme, the same disagreement is found. It may safely be assumed, therefore, that domestic misunderstandings were almost universal in Europe during the World War.

This discord took various forms. In 1914, during the critical period of strained relations preceding hostilities, Bethman-Hollweg found his hand forced by the military on the ground that the risks to Germany were so overwhelming, if Russia were allowed to mobilize, that Germany also must be allowed to mobilize, although the Czar personally assured the Kaiser that Russia would not attack Germany.

In Russia, the Czar was seeking to localize the conflict but his General Staff insisted that part of the army could not be mobilized to operate against Austria alone. If it later became necessary to mobilize the whole of the army, the General Staff asserted, the mobilization plan was not sufficiently flexible to permit a smooth mobilization of the army groups that were intended to operate against Germany. For this reason and on the solemn representation of his Chief of Staff that partial mobilization would leave Russia helpless to resist any sudden attack by Germany, the Czar signed the mobilization decree against Germany.

IN England, the collective Cabinet refused to recognize the imminence of war in the last week of July, and except for the boldness and wisdom of Churchill and Grey, the British Fleet, happily for England carrying out a test mobilization, would have been dispersed. The next British incident did not develop so fortunately and a lack of understanding between the Foreign Office and the Admiralty contributed to the escape of the *Goeben* and *Breslau* from the British Mediterranean Squadron.

After the war was in full sweep, the differences between the civil and military authorities continued to increase; in Germany, the military, predominant but not in absolute charge, were gen-

erally advocating a more vigorous prosecution of the war even though such procedure would offend neutrals, and their actions kept the Chancellor, Bethman-Hollweg, busy mollifying the injured neutrals. Similarly, the British naval authorities were very impatient with the restraints placed by Edward Grey upon their activities against neutral trade.

It is obvious that the most momentous decisions during war demand a sound evaluation of both civil and military considerations. And this requires, first, a sympathetic understanding between the military and civil agents of the governments who together must recommend the course of action to the highest authority and, second, a true appreciation of all the facts bearing on the situation.

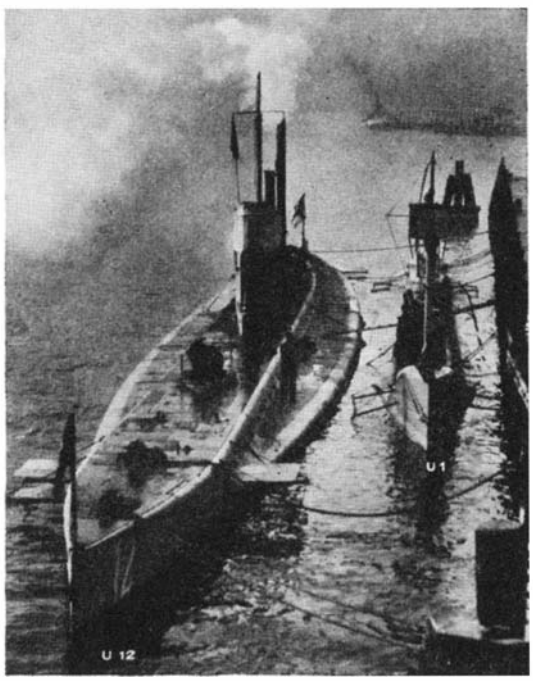
A very dramatic example of this dual responsibility was the decision made in the castle of Pless on January 9, 1917, when the most trusted leaders in Germany gathered to consider launching an unrestricted war on merchant ships with their submarines. The question was not new; ruthless submarine war had been urged since 1915 by the German naval authorities, but had been successfully opposed by the civil authorities.

IN the summer of 1916, Admiral von Scheer, with the prestige of the battle of Jutland fresh upon him, reported to the Emperor that the unrestricted employment of the submarine offered Germany her only hope of breaking England's grip upon the sea. Such warfare had been resorted to on at least three previous occasions. But the protests of President Wilson had caused it to be abandoned without a thorough test.

In December, 1916, Admiral von Holtzendorff, Chief of the German Naval Staff, previously opposed to the plan, finally proposed to the Emperor that ruthless submarine war be undertaken, and exhibited detailed tables, prepared with German care and based upon records of previous submarine sinkings, to show that decisive results could be obtained in five months. General von Ludendorff estimated that it would require a year for the United States to land five or six divisions of soldiers in Europe; he thought that munitions had already reached their maximum production in the United States, and asserted that our entry into the war would not increase the supply of munitions reaching the Allied western front.

Field Marshal von Hindenburg, more conservative, thought the submarine would be decisive within a year, and he believed the German Army could hold out for that length of time *provided* the submarines materially reduced the flow of munitions to France from the United States and England.

Chancellor Bethman-Hollweg, the only civilian official participating in this conference, reported that the Allies had rejected Germany's peace proposals; he had no hope that President Wilson's offer to mediate would be accepted by the Allies. He stated there were no prospects of obtaining separate peace with any of the allied states, and, most surprising of all, he could see no evidence of the collapse of any of Germany's enemies. Emperor William thereupon decided in favor of unrestricted submarine warfare.



Unrecognized in 1914, U-boats such as these finally bore the fate of the German Empire

Meanwhile, in the United States, President Wilson, although his party managers had used the slogan "He kept us out of war," knew better than any other person in the world that, unless peace came quickly to Europe, the United States would probably be involved in the world struggle. Time pressed, so soon after Wilson's re-election, in a last effort at mediation, he tendered the good offices of the United States to the belligerents only to be rebuffed by the Allies, who unjustly suspected our President of helping the recent German peace move launched early in December, 1916, and who correctly appreciated that a negotiated peace at that time would be a virtual victory for Germany.

Woodrow Wilson had entered upon his Presidency in 1913 with high hopes of accomplishing an ambitious program of liberal domestic legislation; he resented very bitterly the intrusion of foreign problems on his plans, and his idealism became apparent to the world in his treatment of the Mexican situation bequeathed him unhelped by Taft.

His first reaction to the European conflict was mainly that of surprised horror; he next concluded that any addition to our armed forces was unnecessary, opposed the efforts of various patriotic societies and some members of Congress to obtain a small measure of preparedness, and finally he broke with his own Secretary of War Garrison on the same question.

During 1915, Wilson silenced all efforts at preparedness with phrases such as "You shall not turn America into an armed camp," but he learned from his experience that military force has an important part in the affairs of the world. During 1916, in a speech at St. Louis he demanded an incomparable navy, and marched afoot down Pennsylvania Avenue in a preparedness parade, doing public penance for his terrible delay in preparing his country for war.

DIRE results follow as inevitably from mistakes in national policy occasioned by high motives as from those caused by stupidity or selfishness. And, in January, 1917, the mistake of Woodrow Wilson joined with that of William Hohenzollern to force the United States, until then unscathed by the war, to take her turn in the fiery furnace.

Had Mr. Wilson given more heed to his military and naval advisers, the cold-blooded decision of the German General Staff would never have been made. The German press would have writhed a little more, drawn a few more cartoons of Uncle Sam with his sheckels, and possibly composed a few more songs of hate, but the German leaders would have been wise enough to leave the United States at peace.

The governments of Germany and the United States furnished an interesting contrast at this crisis; Germany in the full stride of successful land war, absolutely dominated by her two great army leaders, Hindenburg and Ludendorff, after taking counsel with her State, War, and Navy experts, deliberately decided upon the only course that would surely lose her the war. She was led into this error principally by the unprepared condition of the United States, which was mainly caused by the idealism of the President of a republic in which political custom had gradually excluded its military leaders from its higher councils.

Looking back upon this situation, we realize that the German military leaders could not understand the idealistic mental processes of President Wilson. Nor could Woodrow Wilson, who from the

(*Please turn to page* 345)

How Beer is Brewed

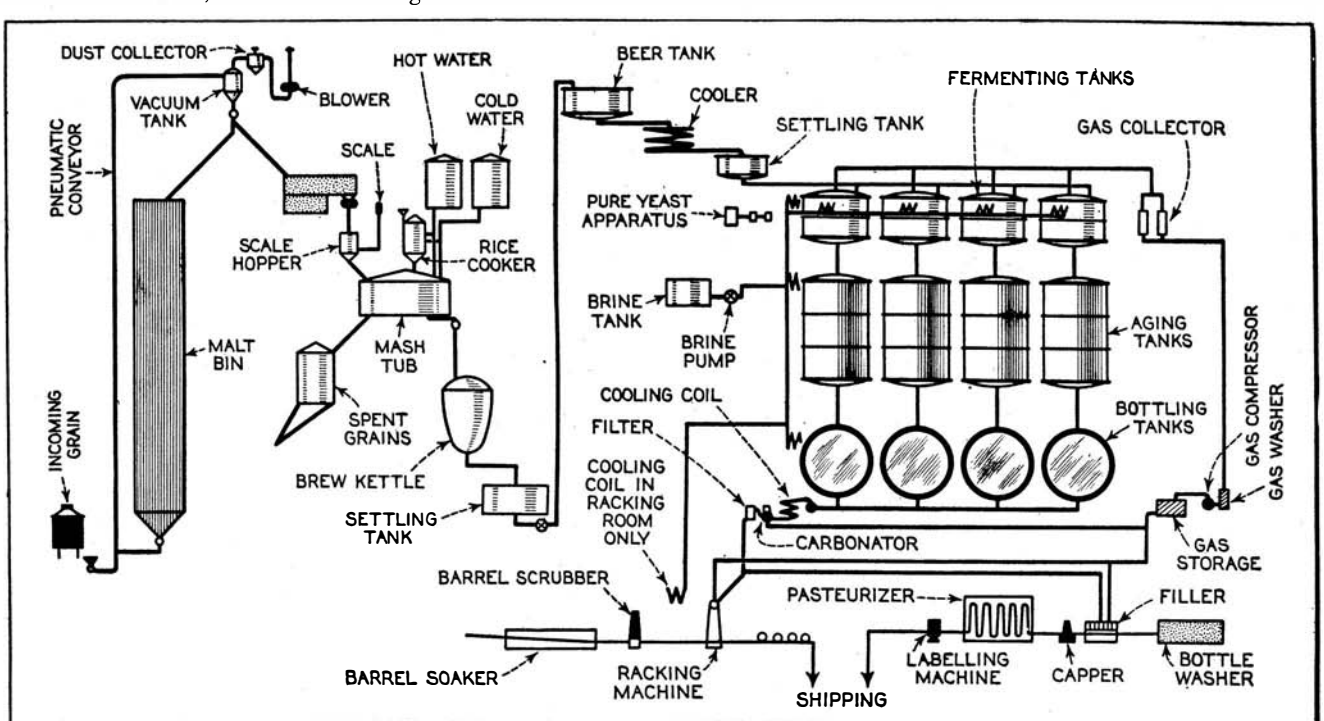
THE basis of beer is malted barley and hops, although other cereals, mainly rice, are used. The malt is either made by outside maltsters or is sprouted and kiln-dried in the breweries' own malthouse. The object of the malting process is to soften the walls of the grain so that the starch becomes accessible and can be resolved into malt sugar (maltose) and dextrine. In the process the barley is steeped in water and then allowed to sprout, the grain being turned from time to time. This usually consumes about eight days. The sprouted barley is then dried in kilns and is elevated from storage bins or loading platforms to the top of the brew-house where dirt and dust is removed. The malt, after grinding, is fed by gravity to a cylindrical "grist hopper" in readiness to be weighed before going to the mash-tub beneath. Meantime rice has been ground and cooked and is also held in reserve.

Brew kettles hold 350 barrels of extracted malt which when "hopped" and fermented makes beer

All of these operations have been carried on with a view to the chemical reactions which are to follow, assisted by mechanical means. The malt-grist and rice are run into the mash-tub, water is added and live steam is admitted, the mixture being constantly agitated by means of mechanically driven paddles. When the brew-master decides that the conversion of starch to sugar has been carried out sufficiently the solubles are filtered off and the solid residue is then drawn off to be made into cattle feed.

The remaining liquid, known as "wort," drains off into huge brew kettles and cooks for four hours. The hops are added to the liquid, one and one-half to two hours before the end of the boiling. The action of the hops is to give a slightly bitter and stimulating taste to the beer and also to promote the keeping quality of the product. The work of the hops ended, they are removed and brew is pumped into receiving tanks, cooled, and prepared for fermentation, which is accomplished in steel and glass enameled tanks. Yeast in the proper quantity is added at this point. Here the sugar is transformed into alcohol, carbon dioxide gas being given off and saved for future carbonation of the beer.

THE fermentation process takes from 12 to 15 days. Then the beer is aged in tanks, usually enameled lined, in cool vaults for two or three months. From bottling tanks the beer, still cool, is divided for kegging and bottling. The barrels are soaked, scrubbed and filled; the bottles are washed, filled, capped, pasteurized, and labeled. Both kegged and bottled beer are carbonated.



Courtesy The Pfaudler Company

Flow sheet showing path of materials through the various processes of manufacturing beer

THE WORLD'S

HIGHLY efficient machines have been and are the dream of every mechanical engineer, manufacturer and user of machinery. To keep the machine running the greatest possible number of hours with the least possible time and expense for repair is the constant effort of all engaged in the mechanical arts.

If then, a pump was found that would run up to a hundred years, or even more, without ever the loss of even a few minutes for repairs; would tolerate an enormous overload for days at a time; could be accelerated to three to four times its normal speed and still keep going; and if the valves leaked, could increase its efforts enough to compensate for the leaks, and still do good work—would not the designer and user think they had realized their dream?

A pump that will do all of the things mentioned and more, is already at work in every part of the world. Perhaps you have guessed by this time that it is the human heart.

Most of the facts of the great mechanical loads carried daily by the human heart are well known, and this interesting data will be omitted.

IN health the heart goes on its regular duties unnoticed, and does all of the work of maintaining the circulation, and thus carrying on the absolutely necessary labor to make life itself possible. It is not so much to the ordinary everyday functions of this tremendously interesting pump that it is desired to direct your attention, as it is to the fact that even so efficient a machine as the heart can be damaged and broken down by improper treatment, even as can the best machine of metal. Everyone will be the better off if he knows a little about this pump on which he is so absolutely dependent for his very existence, to say nothing of his happiness and efficiency.

The heart and blood vessels are the part of the body called the circulatory system, and it is impossible entirely to separate the heart from the rest of this system. As the whole thing is designed to work together, something must necessarily be said about the whole system, but it is mainly to the heart itself that we shall direct our attention.

The heart is a double force pump built of very powerful muscle, and with the most remarkable control system known. It is not very large—about the size of the owner's fist—and yet it works on, day and night, for years, taking its rest and time for repair only between beats or strokes. Valves prevent the blood from returning when once it is started on its way, and the speed of action is nicely adjusted to the load. If there is a sudden need, not only does the number of beats increase, but the strength of each beat is augmented to meet the needs at the time.

With such a perfect mechanism it would seem that little more could be added to make it function satisfactorily. But there is much that can be done, for even very efficient machines need care. A good watch will sometimes run a number of years without attention, but it will do a much better job if it is regularly cleaned and oiled. So the heart will give marvelous results through the years under the utmost neglect. But much better results will be obtained, especially in later life, if certain simple rules are made into habits.

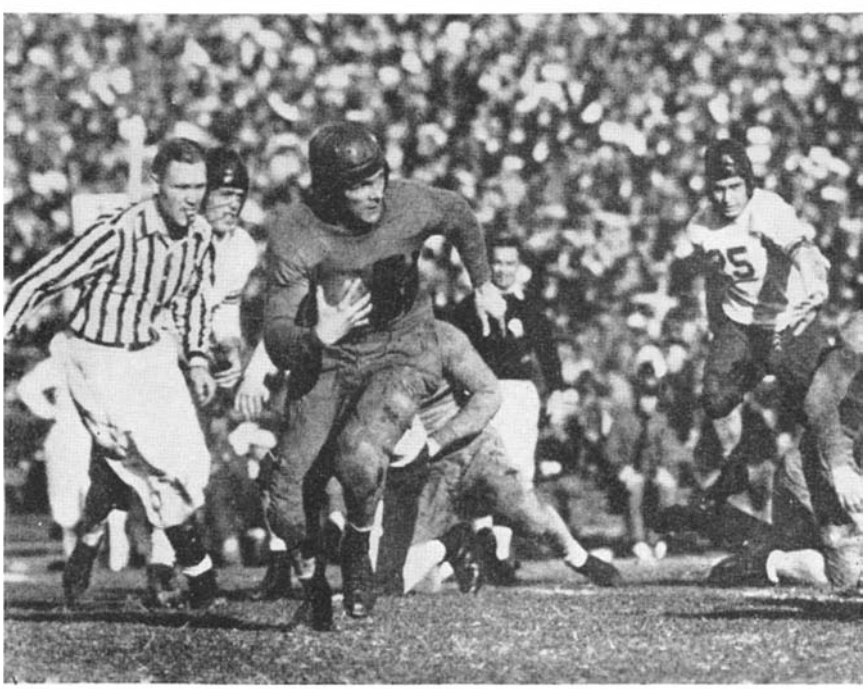
MANY heedless persons, as the author of the accompanying article points out, give their own heart far worse mistreatment than they would dream of giving any machine they possessed—even though the machine can if necessary be torn down and given an overhauling, or even junked and replaced. To paraphrase a familiar advertisement: He spends hours fussing with the valves of his motor car and demands from them the smoothest performance; he refuses to overheat them, fearing to burn them out. Yet he ignores the valves of the one engine he cannot hope to replace—his heart.

—The Editor.

In recent years there has been much discussion in daily papers and magazines about the increasing death rate due to heart failure. This does not mean that the hearts of today are not as good as those of yesterday. But it does mean that some new condition has developed which has changed the conditions under which the labor must now be performed; and that, if we would restore the efficiency of other days, we must find out what the changes are and how to meet them satisfactorily.

The causes operating now that tend to induce heart troubles are many. First, possibly, is rheumatism—the inflammatory type—which is very likely to leave the heart damaged. As this disease is more frequent in youth, recovery to some extent usually takes place. But the difficulty is that the recovery is never complete and that, while the damage remains, it may be overlooked; very often, in fact, the patient apparently has completely recovered and goes on with his regular work, or even with quite heavy athletics, for some years. But trouble develops, in the fourth decade as a rule, and in the late forties or early fifties the person with this sort of heart breaks down.

THEN there is the excessively rapid pace of present-day business life. The young heart withstands it all right but, as years increase and the constant tension of many years of work begins to tell, "blood pressure" develops, and this in turn increases the work on the heart very materially. In time its factor of safety is used up and permanent dam-



A man who could safely do this kind of thing at 20 may not see why he should not do it at 40. He feels as young as he ever was, but his heart is aged 40

Most Efficient Pump

By G. A. SKINNER, M. D.
Colonel, Medical Corps, U. S. Army

age is done which, if nothing more, will restrict the physical activities of the possessor very considerably.

Certain methods of life tend to use up the reserve of the heart with undue rapidity. Perhaps one of the most serious of these is the more or less common custom of trying to get a month's exercise in a day. Many men are at their desks all day nearly every day. Then occasionally they take a day off and exercise very strenuously on that day, possibly up to the point of exhaustion, and they figure that they have made up the necessary exercise. It is most serious when a physically untrained man starts out on a hunting or fishing trip and immediately goes into competition with guides and men who are physically active much of the time. He is too proud to admit that he ought not to keep up with them, and does it—but often at the cost of a serious heart strain from which he may not recover for a long time or at all. Youth will withstand much more of this sort of strain than will middle and late life, as the elastic limit of the circulatory system is much higher in youth than later.

The same sort of strains take place in comparatively young men who have been splendidly trained athletes in college and then, in the strenuous days of getting established in business and home life, have let all training go. In the course of ten years or so they have acquired a fine income, a family, and probably 30 or 40 pounds of surplus weight. Then they decide that something must be done about the expanding waistline, and start in on physical exercise. If this is done in moderation and gradually increased as the body becomes accustomed to it, the results will usually be excellent. Often, however, the same vigor is used right at the start that was the habit of college days, and trouble is almost certain to come.

IN order to remain at the greatest efficiency, all muscles must be used regularly and enough to keep up their ability to perform easily the work required of them. To this the heart is no exception for, as was said at the beginning, it is a muscular organ. If a reasonable amount of exercise is not taken regularly, the great reserve of the heart muscle, built up in active days, is gradually lost, and this muscle like all others gets "soft" and unable to withstand sudden or prolonged strains. Hence the disasters that are likely to follow the methods of exercise described above.

If the individual takes a fair amount of exercise daily he is always in training and the heart will withstand astonishing loads, even in late life. It is this type of man who can play tennis and handball in the late sixties or even the seventies, apparently without harm. While it is not wise for older men to indulge in these strenuous sports, it is suicide to do it if they do not keep up a constant training. There is no set time that a man becomes old, but long observation and experience has set the time as about 50 for him to commence to slow down in every way, but particularly in strenuous physical exertions. He may boast that he is as good as he was at 25, but he is not, no matter how much he may feel that way.

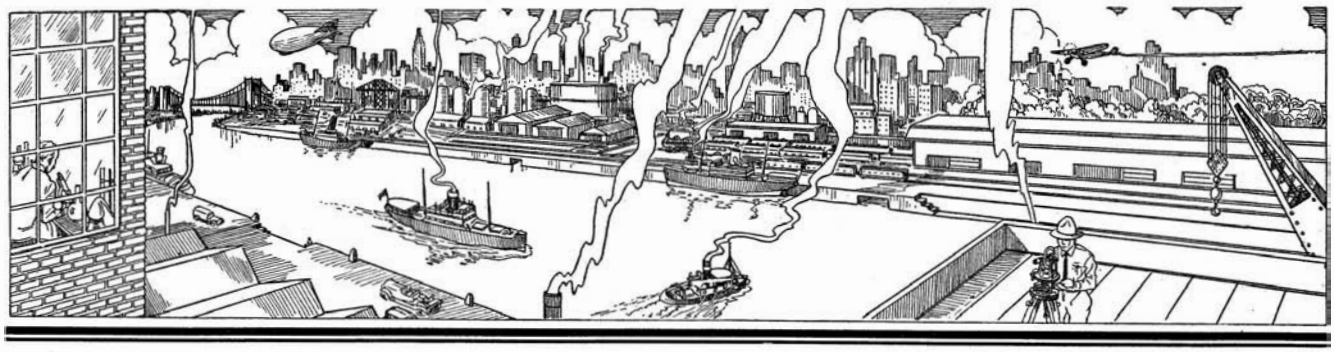
If a man suddenly becomes aware that there is something wrong with him, and that his "pump" is not as good as it was, he should not become panicky and conclude that his work is done. Far from it. It is just here that the marvelous power to withstand punishment shows itself in this remarkable little machine. The valves may be leaking from a former trouble, the nervous control may be out of order, and the heart may miss like a car with one or two spark plugs shorted, the speed may be 50 or even 100 percent too fast for a time, yet the man may make a fair come-back. The same thing is true of high blood pressure. Neither of these conditions is desirable, but if given half a chance this heart of ours will do perfectly unbelievable things. There is, however, a limit, and when that is reached we go the way of all worn out machines.

While the heart may not be taken out, the valves ground, a new set of wires installed and worn parts replaced, yet much can be done to keep the damaged heart working. This is best done under the direction of the physician who has an opportunity to study the individual and meet the needs as they arise. But, in general, moderation in all life functions is highly desirable for all who are in middle life, and is absolutely essential after there is circulatory damage. The avoidance of sudden strains of all kinds, mental and physical, should be absolute. Taking time is an element in the safety of the heart, as it permits adjustment to loads that could not otherwise be accommodated.

Pain is not frequent around the heart, but when it comes it is a serious warning, and should be investigated immediately. Sometimes other organs are at fault, but one must make sure of this, as such a warning from the heart itself may not be safely overlooked.

IN this little portion of our anatomy, then, we have one of the most wonderful of all mechanical devices. It will withstand a most unusual amount of punishment, but when so much of life's usefulness and happiness depend upon its proper functioning it should have at least reasonable care, enabling it to do its best for the many years of work for which it was designed.

Trying to get a month's exercise in a day. A man who has sat at his desk all winter puts in a whole day of fishing and hiking. The result may be serious



THE SCIENTIFIC AMERICAN DIGEST

Conducted by F. D. McHUGH

Contributing Editors

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Is Beer Nutritious?

NOW that 3.2 percent brew is legal in many states of the union, people are concerned with the moot question of the nutritional value of beer. Below are quoted a question and answer that appeared in a recent issue of the *Journal of The American Medical Association:*

"*To the Editor:*—A recent newspaper item warned women that daily consumption of beer is fattening. Will you kindly advise me whether, in your opinion, there is any scientific basis for this statement?

M. P.

"ANSWER.—Obviously, if beer contains 3.2 percent of alcohol having a calory value of seven per gram, and 10 percent of nitrogenous and carbohydrate extractive materials having a calory value approximating that of sugars, protein and dextrin, i. e., four per gram—and assuming that these 'extractive materials' present in beer are utilized in metabolism—a quart of beer will have a value of at least 500 calories. This is five sixths of the calory value of a quart of milk. One need only ask oneself what the effect of adding 500 calories a day to the diet of a sedentary person already ingesting a ration of liberal food-fuel value would be, to answer the question. It is impossible to answer the inquiry more intelligently without knowing what is meant by 'the daily consumption of beer,' and whether beer is considered as replacing or supplementing any part of the daily food allowance. Experience shows that usually it is a supplement to an already adequate ration."

Why Plants Are Green

CHLOROPHYLL, the mysterious substance that colors growing things green, is believed to be capable of transforming the sun's energy into matter. Scientists would give a great deal to know the mechanism of this process and, to that end, are studying the properties and behavior of chlorophyll in an effort to learn its secret.

Professor O. L. Inman, of Antioch College, has established the fact that the action of chlorophyll is independent of the presence of living matter. He ground up green clover leaves to a fine pulp, filtered the mixture through close-meshed cloth to remove all living cells and leave nothing but the chlorophyll and the once-living cell contents in a mixed and fluid condition, and then turned light upon it, under various conditions of temperature, acidity, and so forth. Luminous bacteria, that shine when oxygen strikes them, were used as sensitive detectors of chemical activity of the chlorophyll mixture. Their shining showed that the mixture, though certainly dead by all common criteria, was still able to work with light to produce the raw materials of food and fuel.

Cheerful? Watch his smile! It's contagious these days. But he has something besides 3.2 to be happy about: an easily handled hand truck on air tires made by General

The chlorophyll problem is being studied by the United States Department of Agriculture, at the Smithsonian Institution, at Harvard University, at Antioch College under the auspices of the C. F. Kettering Foundation for the Study of Chlorophyll and Photo-synthesis, and at the University of Munich.—*A. E. B.*

Sugar from Wood

CONVERTING the leg of a chair into a lump of sugar would make the reputation of a magician, but it's all in the day's work for a couple of German chemists, Fredenhagen and Cadenbach, who have developed an interesting method of making sugar from wood. Their process is based on the solubility of cellulose in water-free hydrofluoric acid, producing a clear, colorless solution. Dry, gaseous hydrofluoric acid is passed over chips of dry wood, causing it to shrink to a brittle cake which is then broken up and extracted with water. Acid is removed by precipitation with calcium carbonate and wood sugar is obtained by evaporating the solution in vacuum. The resulting sugar (polyglucosan) may be used as cattle feed or it may be converted into glucose and used in the regular manner.—*A. E. B.*

Garabed Again

A GHOST out of the past stalks through the halls of Congress. It is a wily, strangely compelling ghost that at once casts suspicion upon the Patent Office and consumes the time and energies of our elected representatives at a time when national issues of utmost importance demand immediate attention. It is the ghost of "free energy," a sort of perpetual motion which was laid in 1918 by scientists after having been taken up seriously by Congress as a possible means of obtaining limitless power with which to end the war that was to "end all wars." This "free energy" idea is again being taken up seriously by Congress because Garabed T. K. Giragossian, the "inventor," "claims to have discovered or invented a method whereby unlimited energy can be utilized with practically no expense or labor," and Garabed evidently doubts, as he did in 1918, the integrity of our patent laws and of our Patent Office. He wishes favored treatment at the expense of tieing up necessary legislation, and Representative McLeod, who has introduced a Joint Resolution to consider granting him a patent, is willing to give it.

There are many facetious remarks that might be made anent the impossibility of perpetual motion or anything akin to it—except, of course; the tongue-wagging and gullibility of some Congressmen. This Garabed "thing," however, is serious. How can Congress seriously contemplate doing what this man asks? How can any Congressman justify the proposed bill? What persuasion did Garabed use on Representative McLeod? The wily Armenian has gone Bret Harte's mining camp Chinese one

better! But because he can fool a Congressman doesn't mean that he can fool the Patent Office or the scientists who know that what he proposes is impossible.

In 1918, we said: "And so, after all, it turns out to be nothing but our old friend the fly wheel and its family of pulleys—that will-o'-the-wisp of the perpetual motion crank. . . . Despite its ridiculous termination, this farce is not without its lessons. Mr. Giragossian's honesty of purpose is demonstrated beyond measure of doubt, but it seems absurd that, in this day and generation, a man with no better idea of the fundamental laws of physics can gain the ear of Congress and have a special measure passed through for the protection of his so-called 'great discovery.' The patent laws of our country are amply able to protect any honest inventor, and it was the suspicion of Mr. Giragossian that they would not give him this protection that led him to seek special favors from Congress. Such an attitude should have been discouraged, but Congress, by its unprecedented attentions, actually fostered these suspicions and cast a slur upon regular legal means of protecting inventors which are provided by the Patent Office. Had Mr. Giragossian applied for the patent in the usual way, he would have been shown very promptly by the Patent Office the fallacy of his reasoning."

Is Congress now determined to perpetuate an absurdity?

Surplus Corn for Motor Fuel?

SHALL American motorists be required to afford relief to American farmers by supplying a market for surplus grain? That is the question being argued in Washington, as legislators consider the project of requiring the admixture of 10 percent of alcohol in all motor fuel, in order to provide a new market for the farmer's corn. A bushel of corn will produce, by fermentation and distillation, about 2½ gallons of alcohol at a cost of about 24 cents a gallon (assuming corn at 45 cents a bushel). The addition of 10 percent alcohol, at this price, to gasoline, would increase the fuel cost to the user by several cents a gallon.

It is believed that any law requiring alcohol in motor fuel would be unconstitutional so the proposed legislation will probably be framed to lay a tax on fuel *not* containing alcohol. Two such bills are pending in the House as this is written. It is certain that the proposal will have serious consideration by the new administration, pledged to an early effort to solve the surplus grain problem.

Proposals of higher percentages of alcohol unquestionably will meet opposition on many scores. The petroleum industry will fight 10 percent to the limit. Such mixtures require carbureter adjustments, certainly introduce corrosion troubles on storage containers and automobile parts, necessitate use of a third constituent for blending, and increase the cost.

In discussing this question, *The Lamp*, organ of the Standard Oil Company of New Jersey, states that it is chemically and physically impossible to obtain a stable blend of 10 percent commercial ethyl alcohol in gasoline without the addition of a blending agent, such as benzol or one of the higher alcohols.

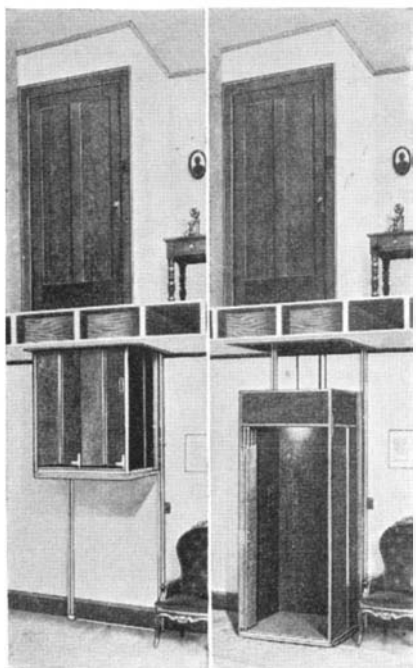
The proportion needed in a 10 percent commercial blend would be 20 percent, making the final mixture 10 percent alcohol, 20 percent benzol, and 70 percent gasoline. Benzol costs on the average 15½ cents a gallon at point of manufacture. Gasoline, wholesale, in Iowa is about 5½ cents a gallon. . . . A sufficient supply of benzol also could never be developed in this country, as 3,200,000,000 gallons would be needed, while the annual output has never exceeded 100,000,000 gallons.

The statement also calls attention to the fact that absolute alcohol "is a veritable camel for absorbing water" and that slight absorption of moisture by the alcohol would result in "layers" of alcohol, water, and gasoline.—*A. E. B.*

Home Elevator

CLIMBING stairs is hard work. To some people, it is a real effort. Others, by reason of their physical condition are confined to a single floor and cannot enjoy their entire home. A new elevator, the Shepard Home Lift, is a practical, economical answer to this question of climbing stairs.

The Shepard Home Lift is automatic and may be operated from house current supply. The shaft is totally enclosed on the second floor but no well of any kind need be cut in the first floor, as the car comes



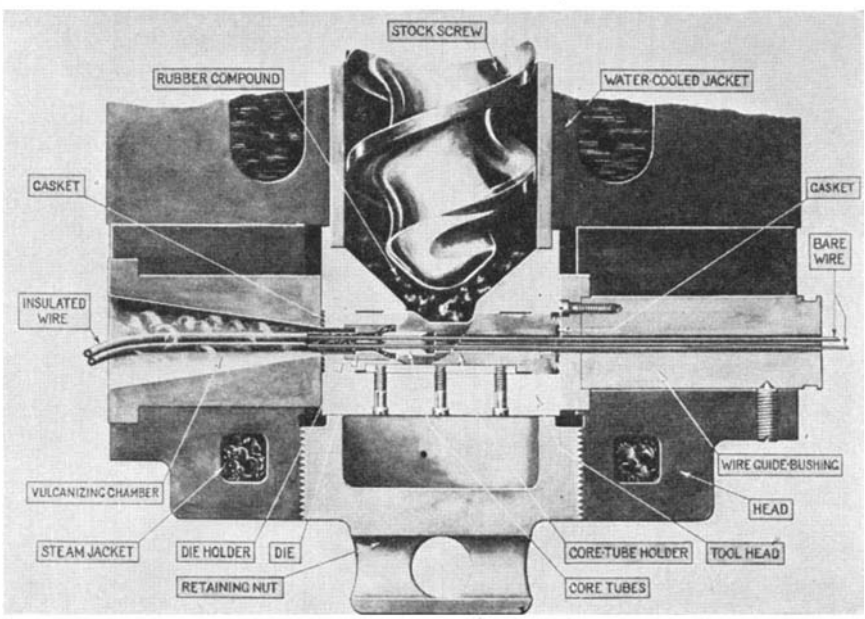
Two views of the home elevator. *At left:* The car in mid-position; and *at right*, resting on first floor

to rest flat upon the floor. When not in use it normally is kept on the second floor, but a push on the first floor button brings it down for use. It is 100 percent safe, as the upstairs door and the door of the car are both locked when the car is in use. Children or animals may play on the floor beneath the elevator, and in case it should descend upon them, it will automatically stop without injuring them.

Surrounding Wires with Rubber

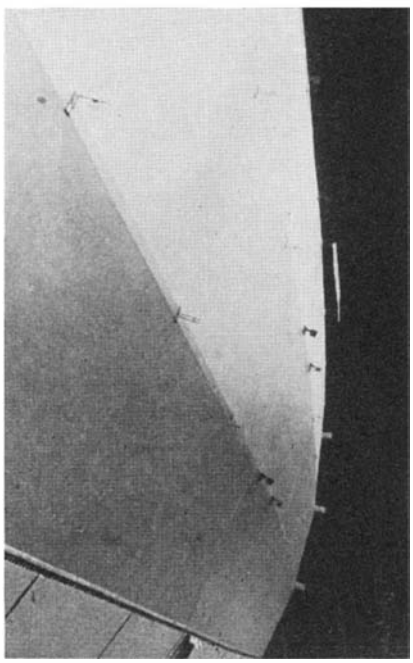
RUBBER-INSULATED wires are extensively used by telephone companies in connecting up apparatus and equipment and are of several diverse types for various duties and changing climatic conditions. At the Point Breeze Works of the Western Electric Company, not far from Baltimore, a new type of non-stop manufacturing is employed in producing rubber-covered wire. Rubber-covered wire is old but the new process, which is continuous, employs a rubber compound which is vulcanized in 17 seconds, whereas the old process of curing requires hours.

The crude rubber, sulfur, whiting, and other ingredients are all assembled after being accurately weighed and are fed into an internal mixer. Each ingredient is accurately clocked before the digestion time of the next ingredient arrives. After the mixing process is concluded, the compound is cooled on large rollers, then forced through screens to produce a spaghetti-like product which is next squeezed into a flat sheet, and an accelerator is added which speeds up the vulcanization of the rubber far beyond what is possible if sulfur is used as the sole vulcanizing agent. The compound is stripped from these rollers in ribbons which are conveyed to the continuous



The ingenious mechanism for surrounding electric wires with rubber

insulating and vulcanizing machine which is shown in our illustration. A stock screw forces the compound to surround the bare wires as they are drawn through a die and they then, as insulated wire, pass into the vulcanization chamber. When the wires reach the exit end of the vulcanization chamber or tube, they are cooled, passed through a fault locater to detect possible rubber compound defects, and are then ready for the braiding which serves to protect the rubber. The wires are then weatherproofed and finished, receive a final test by



Various types of testing "targets" mounted on the hull of the *Macon*

machinery and are wrapped ready to ship. The machines are condensed to a remarkable degree and the continuous running conveyors join the operating functions of over 300 machines.

Vitamin A in Milk Depends on Hay

HOW much vitamin A there is in milk, and in the butter made from the cream depends to a considerable extent on the kind of hay the cow gets. So reported Dr. E. B. Meigs, A. M. Hartman, and H. T. Converse, of the United States Bureau of Dairy Industry, before the meeting of the American Chemical Society recently held in Washington.

Dr. Meigs and his associates found milk and butter produced on a basis of good alfalfa hay to be definitely richer in this essential vitamin than similar products based on a poor grade of timothy hay. High-grade alfalfa fed to dairy cows is reflected later in a rich natural yellow in their butter, indicative of a high vitamin-A content.—*Science Service.*

Finishing the "Macon"

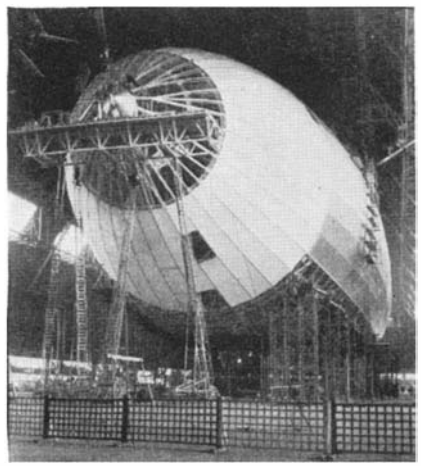
CHRISTENING ceremonies were completed early in March and the *Macon*, the new giant airship, began her flight trials under Navy supervision early in April. After completion of the trials the ship is to be stationed at the Naval Air Base in Sunnyvale, California.

The test flights are not just a matter of the captain and the crew taking charge and flying away, but are very carefully thought out, will take 85 hours total flying time, and will be divided into four to six individual flights. Before final acceptance, the Naval Bureau of Aeronautics will check speed and deceleration; measurement of turning circles; climb; interior ventilation; fuel consumption; stresses and strains within the structure; and will test auxiliary electrical, mechanical, radio and telephone systems, and so forth.

An interesting part of the scientific work on the *Macon* is the so-called "teledeflectoscope" system. One of our photographs shows a number of quill-like gadgets, mounted in some 300 places around the airship. These are standards bearing either a system of lenses and prisms, rule scales, target plates, or mirrors. The observer has his eye glued to a telescope which can be moved slowly from side to side, swung about a vertical axis, and pitched up or down. (See page 308.) With the aid of the sighting and reflector system and the adjustable telescope, the research engineers were able to measure, both accurately and rapidly, deflections of the structure under load, to the accuracy of 1/100 of an inch. The computation of the stresses of an airship is a difficult matter, and from the deflections the loads borne by various parts of the ship may be accurately checked.

The *Macon* has the same dimensions as the ill-fated *Akron:* length 785 feet, diameter 132.9 feet, capacity 6,500,000 cubic feet of helium. However, as a result of experience gained on the construction of the *Akron*, the *Macon* is cleaner, faster, and lighter, which in turn means more useful load. For example, the outriggers carrying the propellers have been faired in with "pants" like the wheels of an airplane. The radiators are built into the sides of the hull and can be swung in completely when not in use.

The telephones have been converted to the dial automatic system and include 17 stations. The trapeze for hooking-on airplanes has been considerably improved. A giant trap-door, 25 by 30 feet in the bottom of the ship is raised when airplanes are taken aboard or released.



Applying outer cover to the *Macon*

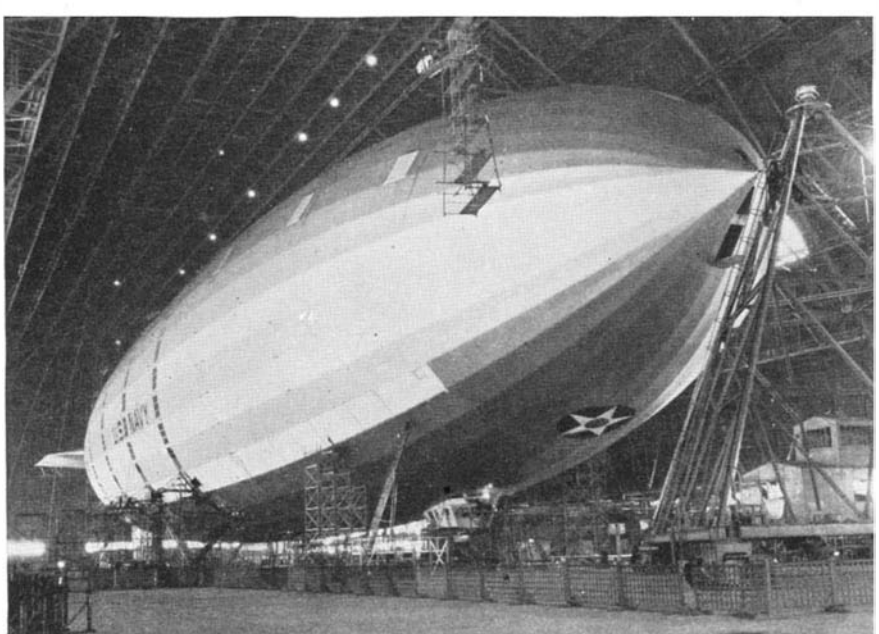
During construction there were 10 main towers along each side of the ship and 25 intermediate towers. The last of these towers was removed after the ship was launched or air borne, the ceremony being similar to releasing chocks under a surface ship and allowing it to slide down the ways.

Another photograph shows the application of the outer cover and gives an idea of both the towers and portable ladders employed during construction. The front three-quarter view shows the movable mooring mast to which the bow of the ship is fastened when she is ready to be moved out of the hangar.

The launching of an airship is in every way as momentous and exciting a job as the launching of a giant ocean liner.—*A. K.*

"Shooting Down" Airplanes

UNDER regulations of the Department of Commerce, no transport flyer may land or take off at an airport until he has received a definite signal. The signaling is generally by means of radio, but at ports where radio signaling is not possible, a light signal is employed. This process of light signaling is termed "shooting down airplanes." The "gun" with which this is done is a small, extremely powerful search-



The new giant of the air, the *Macon,* nears completion at Akron, Ohio

Using the "plane-shooting" light

light and the projectile is a beam of light.

The Westinghouse Electric and Manufacturing Company has just developed this "gun," which is 8½ inches in diameter, 16 inches long, and weighs only 7 pounds, although it has an approximate beam candlepower of 350,000. Its small size and light weight reduce operator fatigue in an extended period of traffic control. This is a factor to be considered; for example, during the National Air Races in Cleveland, the operator using a gun gave landing and takeoff signals to airplanes at the rate of five a minute. The light gun "is equipped with two pistol-grip handles, and is as carefully balanced as the finest revolver."

The projector must be aimed carefully, since it shows a beam of light which is only 12 inches wide. The beam however, is so powerful that it is normally visible 10 miles in the daytime and 15 miles at night.

The directing beam may be made white, red, or green by pulling the front trigger of the searchlight. As the pilot of the plane is circling the airport, the traffic manager shoots it with the beam. If red, the pilot stays up, if green, he comes in. In shooting airplanes, the operator aims at them by means of a sighting tube at top of the projector.—*A. K.*

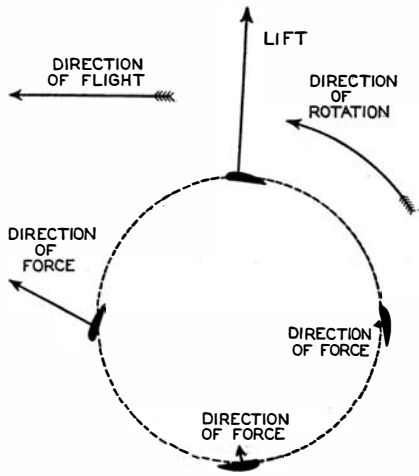
The "Paddle Wheel" or Feathering Airfoil Aircraft

IMMENSE interest has been aroused by the announcement of a "paddle wheel" or feathering airfoil aircraft developed by Dr. Rohrbach of Berlin. The original announcement stated that the development work had been carried on for two years; that no propeller of the conventional type was employed; that the ship would be as controllable as a mosquito; that it would be capable of vertical ascent, of hovering in the air, of turning while stationary in the air, of flying backwards, and of vertical descent with the motor shut off. It was further claimed that with loads comparable to those of an ordinary airplane the top speed would be about 150 miles per hour. The wings were to revolve about a horizontal axis and feather or oscillate during each revolution. By these early descriptions the hope was immediately aroused in the public mind that the perfect helicopter had at last arrived.

Helicopter designs have hitherto employed the principle of revolving airscrews rotating about a vertical axis. The problem of vertical lift with such aircraft may be said to be satisfactorily solved. Granted that the lifting airscrew is of a very large diameter—three or four times as large as the ordinary airplane propeller for the same horsepower—very powerful lift per horsepower can be obtained. The diameter of the lifting airscrews must be large because in vertical ascent the air striking the screws from above has comparatively little velocity and therefore a large mass of it has to be handled. This in turn means that the disk area swept out by the airscrew blades has to be considerable.

Inventors and designers of helicopters sometimes make the mistake of believing that once the necessary vertical lift has been achieved, the problem of the helicopter has been solved. Unfortunately, there remain quite a number of things besides lift to think of. A huge airscrew so efficient for lifting purposes does not have much efficiency when inclined forward so as to give a propulsive as well as a lifting force. There is another difficulty to be overcome in meeting the torque of the huge airscrew which, action and reaction being equal and opposite, tends to turn the whole craft around. That is why in all helicopters two screws rotating in opposite directions have hitherto been employed. Again, with the airscrew rotating about a vertical axis, the pitch of the blades has to be reversed when the motor stops and the helicopter comes down supported as by a giant windmill. The reversal of the pitch introduces mechanical complications. Again, the ordinary controls such as the elevator become completely inoperative when the helicopter is either ascending slowly or hovering. Gearing down from the rapidly revolving motor to the slowly moving blades is another mechanical problem of some importance.

It would seem very rash to say that a helicopter with an airscrew revolving in a horizontal plane cannot yet be achieved. There is no doubt that with some more effort and closer aerodynamic and mechanical study this type of aircraft could be built and flown to a practical extent. The history of the air shows, however, only very indifferent achievements thus far. The maximum altitude achieved by any helicopter is of the order of 50 feet. The flights recorded do not exceed three miles in length. The forward speeds have been very low. Attempt after attempt has been made and gradually abandoned.



The working principle of the queer new feathering airfoil aircraft

It is yet too early to say whether the feathering or paddle wheel machine is certain of success. It appears, however, to have a very sound aerodynamic basis. By automatically and suitably adjusting the feathering, the paddle wheel can be made to give thrust in any direction—vertical, forward, downward, backward, or in an inclined line partaking of several of these directions. Elementary calculations seem to indicate that the paddle wheel will give not only sufficient upward lift but also efficiency in forward flight. Moreover, by adjusting the feathering independently on each side there is a possibility of complete control about all three axes of the craft—pitching up and down, rolling sideways, and finally turning about a vertical axis. There is, therefore, a possibility of control under all conditions.

Our photograph shows an artist's conception of the wind-tunnel model of the Rohrbach design flying at a high altitude. The paddle wheels on each side are three in number, long and narrow and all connected by spiders to a central driving shaft. The machine has a fuselage of normal appearance and of light weight. Inside the fuselage, accessible during flight, are to be placed two 130 horsepower Argus inverted-cylinder engines.

The crankshafts of the engines are connected by a short shaft passing through a gearbox or, if the drive is transmitted

Artist's drawing of the "paddle wheel" aircraft in the air

through a perpendicular shaft, to a transverse shaft about at roof height. This latter shaft passes out left and right in a tapering tubular casing and is extended about 20 feet right and left of the fuselage. On these outside shafts are secured three radially disposed lines of struts. Each row of these struts carries on top a blade-like all-metal wing which is pivoted on the struts down the center of its length. Besides these supporting struts, each blade or paddle is provided with a connecting rod gripping a shaft inside the blade and located a little ahead of the center line. The lower end of the connecting rod is guided by cams on a sleeve surrounding the drive shaft of the system. This sleeve with the cams upon it can be regulated by the pilot and serves to incline the blades on their pivots. Therefore, during the rotation of the whole system, each blade continually changes its angle relative to the supporting struts. This feathering is illustrated in a sketch, which shows diagrammatically how the forces on the blades change as they rotate under the cam control. At the top of the stroke the force is large and upwards. On the left-hand side the force is mainly forward. When the blade is down or at the right, the lift forces are insignificant. Further, in the arrangement shown, the paddle wheel exercises both a lifting and a propulsive effect. The complete theory of the feathering is rather complicated but it will be readily admitted that, granted correct feathering, the utmost flexibility in the direction of the resultant force is possible.

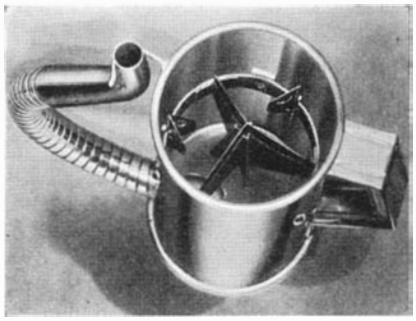
The diameter of each rotating system is 11½ feet; the revolutions per minute are 300. The rotary speed of the blades is therefore about 125 miles per hour. Should the engine fail, the feathering will be so adjusted that the paddle wheel will behave in the same manner as the rotating airfoil system of an autogiro.

The mechanical difficulties surrounding this device are, of course, considerable. Gearing, cam systems, drive shafts, cantilever support of the blade, are all of by no means negligible difficulty, but granted correct aerodynamic theory, mechanical difficulties can always be overcome.

The Rohrbach machine is somewhat similar in principle to the Voith-Schneider feathering propeller which has been successfully employed in ship propulsion, especially on the big passenger boats operating on Lake Constance, in Switzerland. These boats with the feathering propeller are wonderfully maneuverable and can be turned around almost at a standstill. In the United States, Kirsten has been working on a cycloidal propeller system which is not unlike that of the Voith-Schneider.

It is also gratifying to know that another American, Mr. H. H. Platt, has for some years been working solidly and ingeniously on a feathering airfoil system which has been tried out in the wind tunnel of New York University. Another American worker in the art is a Mr. Laskowitz who also has secured American patents. Space will not allow us to deal with the specifications of these two inventions but it can be safely said that the American workers show ingenuity and inventive ability at least equal to the German inventors. Serious study and a long interval of time will no doubt be required to establish priority of invention. Moreover, it should be noted that the application of the paddle wheel to aerial navigation is an old idea which has been brought forth from time to time for many years. Mere ideas are of little value. The credit for such an invention goes to the most persistent, rapid, and successful developer.

Well-informed opinion is that these devices have immense interest and great promise. If a paddle-wheel aircraft could be built in line with the above prognostications it would not influence transport aviation very much but it might revolutionize the whole situation as regards the general service and private flying airplane.—*A. K.*



A can of oil is opened by pressing it down upon the knives shown

The "Pilgrim" in the Smithsonian

THE Smithsonian Institution in Washington has added the Goodyear airship *Pilgrim* to its thousands of other exhibits.

The *Pilgrim* has the distinction of being the first airship designed for inflation with helium gas, and was completed early in 1925. The bag is 109 feet 6 inches long and 31 feet 6 inches in diameter. It has seating capacity for a pilot and two passengers. From its completion early in 1925 to its retirement from service on December 30, 1931, the *Pilgrim* had made 4765 flights carrying 5355 passengers, flown 2880 hours, and covered 94,974 miles. It has, therefore, probably flown more miles than any other non-rigid airship. Its power plant was a three-cylinder Lawrence "8" engine of 60 horsepower.

Our photograph shows the *Pilgrim* as it is installed in the Smithsonian with some airship girders appropriately close by. The neat cabin made very comfortable flying quarters, and mishaps with the *Pilgrim* were unknown. The Goodyear Company now operates a fleet of similar small airships in a number of cities, and they invariably attract much attention.—*A. K.*

Canned Oil Foils Bootlegger

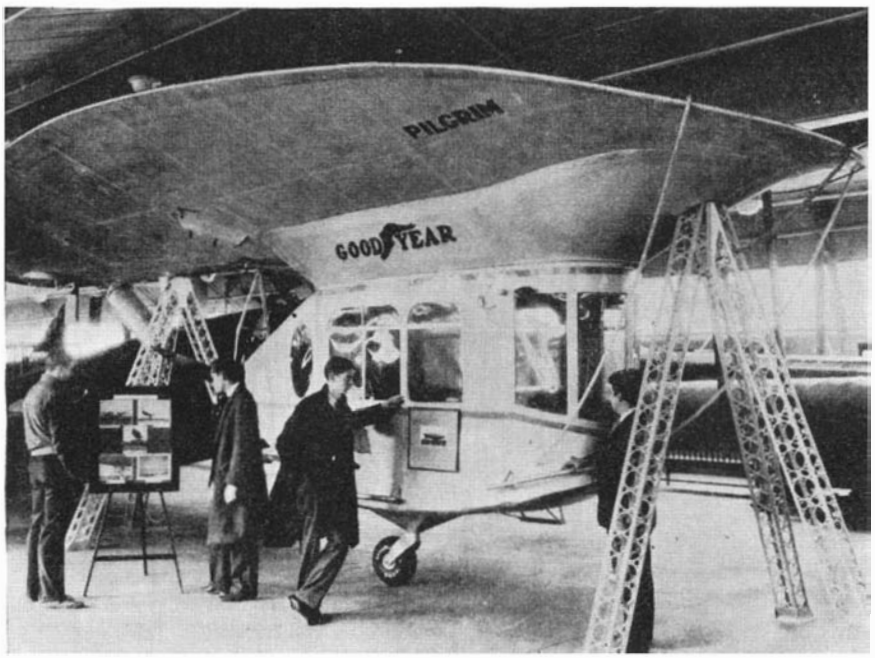
CRANK-CASE drainings sold as new motor oil; inferior grades sold as the quality product of well-known, reputable refiners; 15- and 30-cent oil sold out of the same pump; light-weight oils sold as heavy-weight oils—this was the situation which the petroleum industry and the motorist faced at the hands of unscrupulous dealers, the bootleggers of the gasoline station business.

Now, due to an invention of one of the major manufacturers of tin cans, the "gypping" can be successfully and absolutely stopped. The refiner seals his motor oil in cans and a new dispenser makes it possible for the attendant to open the can instantly at the station.

From the outside, the dispenser looks like the usual measure, with goose neck spout. But inside is an arrangement of knives and blades. When the attendant presses a sealed quart of oil into the dispenser, these blades rip open the can and drain it instantly, completely destroying the container so it cannot be used again. The oil falls to a chamber below the knives and is put into the breather pipe in the customary way.

Safeguarding the Propeller

THE metal propellers used by modern aircraft are the result of a wonderful piece of engineering. Rotating at 2000 revolutions per minute, delivering a steady thrust of several hundred pounds, such a propeller may have an efficiency of as high as 85 percent; in other words, 85 percent of the horsepower of the engine is usefully delivered to the airplane. A marine or motor boat propeller is more likely to have an



The Goodyear airship *Pilgrim* in the Smithsonian Museum in Washington

efficiency of only 50 percent. Such marvellous efficiency is only to be obtained by making the airplane propeller both relatively thin and narrow, much thinner and narrower in proportion to blade length than the marine propeller. In spite of the large strains and enormous centrifugal loss, and the whirling parts, such thin blades are amply strong enough for the task imposed on them, but if there is an indentation or even a deep scratch in the blade, cracks and ultimate blade breakage may follow.

In warning operators of this danger, the Department of Commerce recommends that when a plane is inspected, the propeller also should be thoroughly checked. Any sharp corners, nicks, or scratches should be removed. This may be accomplished with a file or with a piece of rough wire cloth. The amount of metal removed should be no more than is necessary to convert sharp nicks into smoothly rounded indentations.

Aircraft safety is being built up just as much by such homely precautions as by new inventions and engineering methods.—*A. K.*

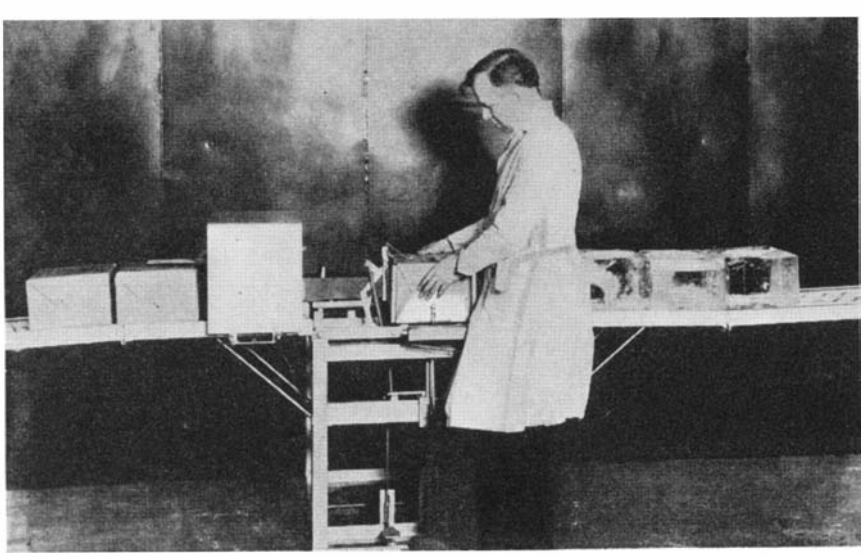
Mosquito Extermination

BEING in the habit of spending our vacation in New Jersey, we can readily believe that if anybody knows anything about mosquitoes, Jerseymen ought to. Thus it was with considerable interest that we read of the work of Joseph M. Ginsburg, bio-chemist in entomology at the New Jersey Agricultural Experiment Station, where for some time experiments have been in progress in an effort to develop effective mosquito exterminators that would be harmless to wild life and vegetation. The result of this work is the suggestion of a larvicide containing pyrethrum emulsified with kerosene. Heretofore, fuel oil has been widely used.

In a paper by Doctor Ginsburg and Robert L. Vannote, the disadvantages of fuel oil are given as: injurious to fish, water fowl, and plant life; tendency to stain; and deteriorative effect upon various forms of rubber. The disadvantages of pyrethrum larvicide are: its lasting qualities are less than for fuel oil; more is required to cover a given area (except on polluted water); it is less effective where much debris, such as dead leaves, is present below the surface. They find the advantages of pyrethrum greatly to outweigh these disadvantages, however, in that it may be used in safety in water used for bathing and without harm to wild life; it does not discolor or stain; does not decompose rubber; does not retard filtration where sewage disposal is involved; stronger solutions may be used where necessary without damage to fish or fowl; and the low kerosene content eliminates the fire hazard encountered in fuel oil. The larvicide is said to kill larvae of mosquitoes breeding in grass along the edges of streams, whereas oil would have to be applied repeatedly to be effective. The cost of the new larvicide is said to be lower for equal effectiveness than that of fuel oil.

The preparation of the larvicide is as follows: About four or five ounces of soft soap, such as potassium oleate or coconut fatty acid soap, are dissolved in one gallon of water. The solution is then transferred to a container provided with an agitator and mixed for a short time or until appreciable foaming takes place. If no mechanical agitator is available, an ordinary bucket pump can be used. Two gallons of kerosene extract of pyrethrum are gradually poured in while the agitator is continuously working. After all of the kerosene has been added, the mixing is continued for five minutes or longer. The emulsion is then allowed to settle until the foam disappears and is kept as stock larvicide.

A highly concentrated extract (pyrocide No. 20), one gallon of which is sufficient to make 20 gallons for application, is a commercial product.—*A. E. B.*



On the Pacific coast, ice in waxed manila paper packages may be purchased from outdoor "booths," 25 pounds for 15 cents, by depositing coins in the slot. Above is shown one of the vending machines and below is the machine which wraps neatly cut blocks of ice. The paper wrapping is fastened by gluing, General Electric cartridge type heating units being used to dry the glue

Water Filter Kills Germs

FROM the Pasteur Institute in Paris comes the announcement of a new type of filter possessing extraordinary power in destroying common bacteria. It utilizes the oligodynamic effect of silver and is constructed by introducing silver chloride into clay before firing. The resulting filter has metallic silver distributed through its interstices in finely divided form. Water filtered through the device has no detectable amount of silver in it, yet it retains its germicidal value for several days afterward, according to Georges Lakhovsky, inventor.—*A. E. B.*

Half of Future Babies to Live 75 Years

HALF of all the babies born in the future will live to be at least 75 years old, Dr. Louis I. Dublin, vice-president and statistician of the Metropolitan Life Insurance Company, recently predicted. This means adding 10 full years to the present life expectation. Part of this will be accomplished by further reduction of infant mortality.

"But more important is the real possibility of reducing the unnecessarily high mortality of persons in the middle ranges of life," Dr. Dublin said. "The present mortality of persons between 50 and 65 years of age can be reduced by at least 30 percent through the application of known principles to personal hygiene. There is every reason to believe that this will be accomplished in the course of the next generation during which time emphasis will be placed more and more on what the individual can do for himself in leading a hygienic life."—*Science Service.*

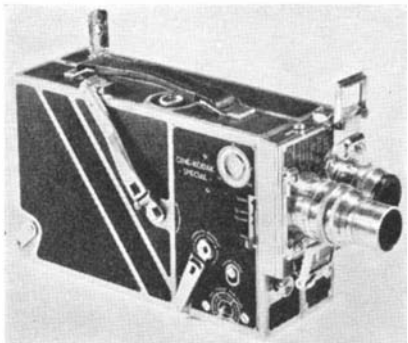
Flux Applied Like Paint

SOLDERING of most of the commonly used metals except aluminum and its alloys is said to be readily accomplished through the use of a new flux, recently introduced under the name of "Flosal Cream." This has been developed for applications where the prevention of rust is of vital importance. A thin film of flux is applied like paint and neither runs nor spreads.—*A. E. B.*

Synthetic Vitamins

SCIENCE will soon be able to produce synthetic vitamins from relatively cheap and abundant sources, Dr. George Oliver Curme, Jr., declared recently in a lecture at Columbia University.

Pointing out that vitamin research is still largely in the laboratory stage, Dr. Curme



Versatile amateur movie camera

asserted that it is not yet possible to visualize the exact course of development in the future. He explained, however, that vitamins A, B, and C have been found to be closely related to substances of complex molecular structure, so that synthesis "seems entirely possible."

"In the case of other vitamins less is known," Dr. Curme continued, "although it would be surprising from the information now available if they were beyond the range of synthetic chemistry. Accordingly it appears that adequate supplies of vitamins will soon be available from relatively cheap and abundant sources and that under the guidance of physiological chemists and dietary experts synthetic chemistry will be able to add another triumph to its many past successes."

Versatile Amateur Movie Camera

A NEW 16-millimeter motion picture camera that will "do everything" and then a few tricks more, the Ciné Kodak Special, has been announced by the Eastman Kodak Company. This camera has been introduced because of the belief that 10 years of amateur cinematography have prepared the way for a 16-millimeter camera of maximum versatility. The appeal of the new camera will probably be to advanced amateur movie makers, motion picture clubs, engineers, manufacturers, doctors, laboratory technicians—classes of cinematographers having use for 16-millimeter equipment with a professional camera's range of abilities.

Production arrangements provide that the new camera shall be precision-made by individual skilled labor. Fabrication will be entirely on a custom-made basis, which allows for modifications when any special requirements present themselves. Although in itself the most complete 16-millimeter instrument ever built commercially, the Ciné-Kodak Special will serve in many cases as the basic model for the even more elaborate custom-built motion picture camera which cinematographers may desire.

The basic model incorporates provisions for double or multiple exposure, dissolves, slow motion, fades, masking, interchangeable film chambers, variable speed, and framing and focusing through the main lens system of the camera. It has a variable shutter, a two-lens turret, and provision for either spring motor drive, hand cranking, or attachment of an electric motor drive. In addition to these features of the basic model, additional equipment or alterations will on special order be applied to the camera in process of manufacture.

With the advent of the Ciné-Kodak Special, viewers of amateur motion picture film may no longer be surprised to see one person appearing in several places at once on the screen, to see all the possible tricks of dissolving and fading and appearance from nowhere, to see Niagara Falls slowing down or speeding up at will instead of maintaining its accustomed rate of fall, to see a "long shot" dissolve into a close-up at a swing of the turret, to see all types of "animation," including the appearance of animated subjects in the same scenes with living subjects, to see scenes interestingly masked, to see a man's legs walk out from under him, to see many slow motion effects, to see—as the Ciné-Kodak Special can record it—large views of very small subjects that were only an inch or two from the camera.

Animal Research Aids Medical Science

RESEARCH with animals has frequently provided valuable information in the treatment of human disorders. The common treatment for hookworm is a case in point. As a result of research work in

A trick with the new camera: the same person is "shot" twice in a single frame of the movie film

the prevention of hookworms in dogs, more than 15,000,000 treatments of human beings have been used effectively since 1921 when the remedy was discovered.

The drug, carbon tetrachloride, developed for the purpose by the Bureau of Animal Industry, United States Department of Agriculture, has been found to be effective also for the removal of various species of parasites in other animals such as horses, cats, and foxes. Carbon tetrachloride is also used in practically all parts of the world for the treatment of liver-fluke infestation of sheep. This condition alone requires millions of treatments each year.

Since discovering the treatment, Dr. Maurice C. Hall, in co-operation with Dr. J. E. Shillinger, both of the Department, found that tetrachlorethylene, a similar chemical, was a safer drug for the expulsion of hookworms from small animals and for that reason it has largely replaced carbon tetrachloride for the treatment of small animals in veterinary practice, and is being used to an increasing extent for the treatment of human hookworm disease.

Sound Reproduced in Perspective

AT a recent private demonstration in the American Academy of Music, Philadelphia, engineers of the Bell Laboratories displayed the results of two years of research on a problem of sound transmission by wire. On the stage of the auditorium were three sets of loudspeakers, three units to the set. Three transmission lines connected the reproducers to three microphones placed in a distant room where the Philadelphia Symphony Orchestra was playing. The reproduced music was perfect in every respect, could be built up to a volume greater than that of the original, and displayed perspective effects that enabled the audience to visualize the position which the various instruments would occupy if they had been on the stage.

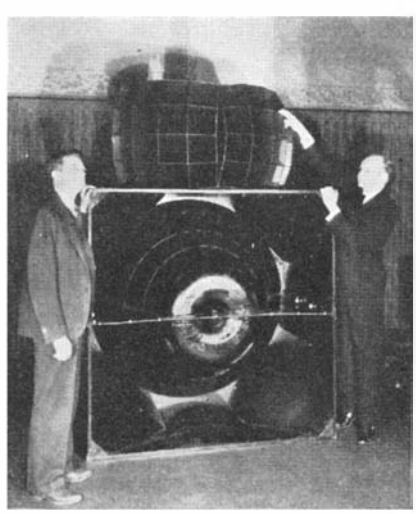
To demonstrate the perspective effect more strikingly, various demonstrations were given. In one, a "spook" tambourine flitted from one end of the stage to the other, and from stage level to high in the air. Actually, the tambourine was being shaken before the microphones some distance away, but the loudspeakers on the stage so reproduced the sound that the illusion of perspective was perfect.

The new transmission system permits reproduction of frequencies covering the entire audible range at maximum efficiency, and the new loudspeakers can handle power that reproduces as a mere whisper, or as a greater volume than the original sound. The power output can vary over a range of ten million to one. Thus the auditorium can be filled with music beyond human power to produce, and striking effects of crescendo produced. A control board in the auditorium made it possible to regulate both volume and pitch as desired.

The instruments employed in this system were designed by engineers of the Bell Laboratories, in co-operation with Leopold Stokowski, conductor of the Philadelphia Symphony Orchestra, who presided at the control board at the initial demonstration.

Transparent Vulcanized Rubber

TRANSPARENT vulcanized rubber can be made from latex, the juice of the rubber tree, by a process described by a German rubber expert, Dr. R. Dittmar, in *Chemical and Metallurgical Engineering*. The latex is evaporated down to 40 percent, in which state it gives a film, as clear as glass, that can be used as dipping fluid. The articles are dipped at 40 degrees, Centigrade, followed by vulcanization in a bath made by dissolving 100 grams or more of



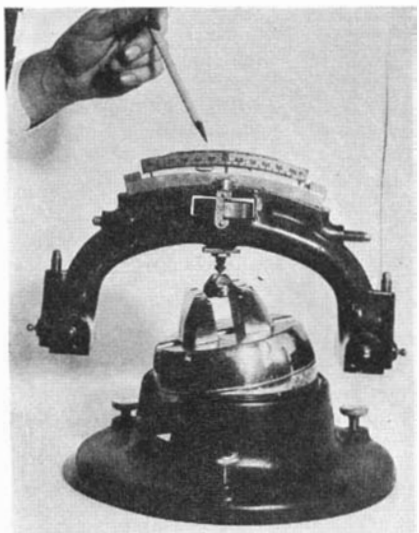
One of the three complete units in the perspective reproduction of sound. On top are the loudspeakers for high frequencies; below is the loudspeaker for low frequencies

the finest sulfur in 1000 cubic centimeters of benzol.

To promote the reaction, 20 grams of zinc di-ethylene carbonate is used as an accelerator. A dip of from 6 to 12 seconds in this solution is used, followed by vulcanization for 30 to 40 minutes at 122 degrees, Centigrade. The use of concentrated latex and the elimination of added activators and protective colloids result in a perfectly transparent film of extra long life.—*A. E. B.*

Pendulum Measures Hardness of Metals

RESEARCH engineers of the Westinghouse Electric and Manufacturing Company determine the hardness of beryllium by means of a Herbert Pendulum. The



pendulum hardness tester is also used with thin sheets of metal, very brittle metals, case-hardened metals, or other materials that cannot stand the rigors of hardness testing by the Brinnell or sceleroscope methods.

A tiny spherical steel ball, 1/25 of an inch in diameter, supports the heavy pendulum upon the test specimen. The spherical ball sinks farther into soft metals than hard metals, lessening the amount of the swing but increasing the time required for it. An air bubble in the curved tube on top of the pendulum indicates on the scale above the tube the extent of the pendulum's swing, and from this data the specimen's hardness is computed.—*A. E. B.*

Waterproof Book Binding

A NEW development in lacquered fabrics for bookbinding, which has the appearance and feel of cloth, can be worked like cloth, and can take the colors and designs of cloth, while at the same time have the durable, moisture-proof, washable qualities of the lacquered material, has been perfected by the Fabrikoid Division of E. I. du Pont de Nemours and Company. The new material has already been used by 32 of the leading publishing houses on recent books. It is expected that it will create a revolution in the binding of books, especially school and library books, because of its great durability. It has been produced and is made available at prices which equal those of cloth.

The process used in developing it permits an extraordinary variety of finishes ranging from textures which are rough and rugged to those which are as soft as silk. It owes its qualities to a new selection and treatment of base materials and new methods of manufacture and application of the pyroxylin finish.

Water Through the Ages

IMPERIAL Rome used some 50 gallons of water per capita daily, according to *The Industrial Bulletin* of Arthur D. Little, Inc. Medieval Paris used but one quart. Today, Naples uses about 20 gallons; Paris, Berlin, and London about 45; and larger American cities range from about 48 gallons daily, at Fall River, to 430 gallons at Tacoma, averaging some 140 gallons.—*A. E. B.*

New Welder for Railroad Maintenance

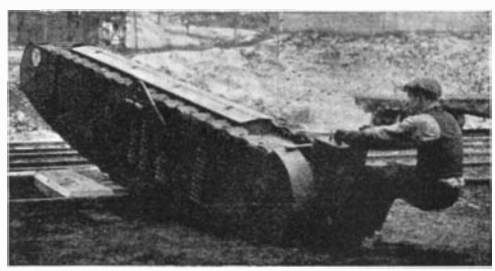
AS a result of extensive tests, the Lehigh Valley Railroad has purchased six tractor welders from the Westinghouse Electric and Manufacturing Company for track maintenance work. Developed to fill the need for a mobile power supply unit which does not require frequent transferring to and from the track for movement from one point to another, this ingenious welder eliminates the use of long and expensive cable leads and does not interfere with traffic or signal operations. It is capable of operating along the shoulder of the track entirely clear of trains, can ascend slopes up to about 35 degrees and is stable in operation on side slopes of 45 degrees.

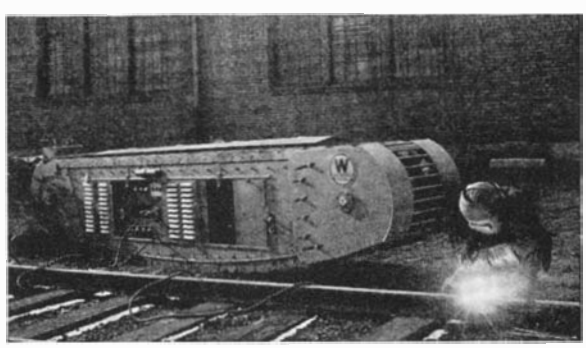
Designed particularly for reclaiming battered rail ends, crossovers, switches, frogs, repairing bridge structures and for other welding operations, it is also useful for auxiliary power for maintenance-of-way tools such as rail grinders, drills, slotters, and so on. The welding and power units are entirely self contained, furnishing welding current for one operator, power for tools, and power for propelling the tractor.

The gasoline power unit is a Buda, six-cylinder, 65 horsepower engine with force-feed lubrication. Provision is made for cranking the engine through the side of the tractor. This is accomplished by using a 3 to 1 gear ratio arranged to engage and disengage with the engine crankshaft. To simplify lubrication of gears, provision is made to disengage them after engine starts.

The two propulsion motors take their power from the variable voltage, constant current, welding generator.

Left: **The pendulum for testing hardness of metals. The pencil points to the scale and to the indicating bubble in the curved tube**





Above: **The mobile power-supply unit for arc welding, mounted on a tractor chassis, is ideal for operation in railroad yards.** ***Left:*** **The unit beside a track which is under repair**

Lacquer Protects Wall Paper

A DRAMATIC demonstration of the protection afforded wall paper by lacquer was recently reported in *Solvent News* by the U. S. Industrial Chemical Co., Inc. A small room was covered with paper of ordinary good quality, applied in the regular way with starch paste. Afterward the paper was given a coating of lacquer and the room closed up to dry.

Several days later, a furnace fire was started and steam escaping from the room disclosed the fact that a radiator valve had been left open by accident.

The room was soaked with condensed water, and the freshly painted window trim and floor blistered. Ordinarily the wall paper would have been peeled off the wall and ruined. But the lacquer had so well protected the paper that it dried quickly without discoloration and without loosening.—*A. E. B.*

Opax Ware

A LINE of new products, termed Opax ware, has been evolved through research at Mellon Institute, Pittsburgh, on an Industrial Fellowship sustained by the F. N. Burt Company, Ltd., Buffalo, New York.

Milk bottles of this new material, as made commercially, are first molded in one piece from cellulose, without joints, to the shape of the standard half-pint, pint, and quart glass milk bottles. They are then impregnated through their entire wall thickness with Opax, a tasteless and odorless, wax-like material. These

(*Please turn to page* 344)

CURRENT BULLETIN BRIEFS

UNITED STATES EARTHQUAKES 1931 (Serial No. 553, Coast and Geodetic Survey), by Frank Neumann, is a summary of earthquake activity in the United States and the regions under its jurisdiction for the calendar year 1931. *Superintendent of Documents, Washington, D. C.—5 cents (coin)*

L. L. BEAN'S CATALOGUE FOR 1933 is more than a trade catalogue; it is a sportsman's handbook and will be welcomed by sportsmen young or old. Anybody who is thinking of fishing or camping will find much of interest here. *L. L. Bean, Freeport, Maine—Gratis.*

TOURISM is a bi-monthly bulletin of information relative to travel in Netherland India and is sent free to interested persons. *Travellers Official Information Bureau No. 36, Noordwijk—Batavia—C.—Java.—Gratis.*

D. S. (Vol. 1, No. 1, January, 1933) is a monthly magazine published in the interests of the Department of Sanitation of the City of New York and is edited by the employees of this department. There is an excellent article in this issue on the sewage disposal plant on Ward's Island which will be finished in 1935. *Room 1256, Municipal Building, New York City—$1.00 a year, single copies 10 cents.*

A WELDED BRIDGE TRUSS (Engineering and Science Series No. 40), by Richard E. Burt, describes a Warren truss bridge which is particularly adapted to modern welding practice. Only one all-welded railroad bridge has been fabricated and put into use in this country to date—on the property of the Westinghouse Electric and Manufacturing Company at Chicopee Falls, Massachusetts. The pamphlet is a critical study. *Rensselaer Polytechnic Institute, Troy, N. Y.—Gratis.*

INKS (Circular of the Bureau of Standards, No. 400), prepared by C. E. Waters, outlines briefly the history of iron gallotannate writing inks and has something to say about the aging of writing and the restoration of faded inks. After this comes brief discussions of several other kinds of inks, with formulas. The 38 pages are crowded with information and there is an excellent bibliography. *Superintendent of Documents, Washington, D. C.—5 cents (coin).*

AIR CONDITIONING, a monthly magazine, refers to the simultaneous control of at least three of those factors affecting both the physical and chemical conditions of the atmosphere within a structure. The factors include temperature, humidity, motion, distribution, dust, bacteria, odors, toxic gases, and ionization. There has been a need for a business paper devoted to this one of our newest industries. Air conditioning is an opportunity for the future. *Heating Journal, Inc., 167 Madison Avenue, New York City—$2.00 a year, single copies 20 cents.*

THE AMATEUR ASTRONOMER

Conducted by ALBERT G. INGALLS

HERE is a bit of romance in the world of the amateur telescope maker:

Last July we published a very popular description of the new Ritchey-Chrétien aplanatic compound telescope which is expected to give star images even superior to those of telescopes having paraboloidal mirrors. It was pointed out that the curves of aplanatic mirrors are not conic sections but are not too difficult for the experienced worker to create, once their zonal radii are known. Here, however, was the fly in the optical ointment—one must be almost an Einstein, we hinted, to calculate these curves; in fact, we inferred, the abstruseness of the necessary mathematics rendered the Ritchey-Chrétien telescope practically a secret.

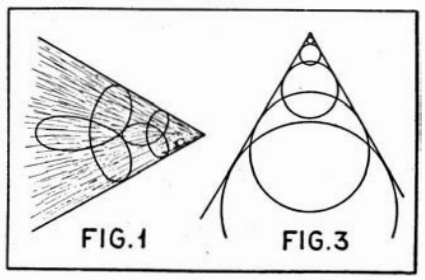
As was anticipated, this negative suggestion, like the one on page 65 of "Amateur Telescope Making," acted as a challenge, which two of the regular readers of this department promptly took up. These were Professor Arthur Howe Carpenter of the Department of Metallurgy and Geology of the Armour Institute of Technology and president of the Amateur Telescope Makers of Chicago, also Alan R. Kirkham of the Amateur Telescope Makers and Astronomers of Tacoma and author of two chapters in "Amateur Telescope Making." As each seemed to have an identical objective we "introduced" them by mail.

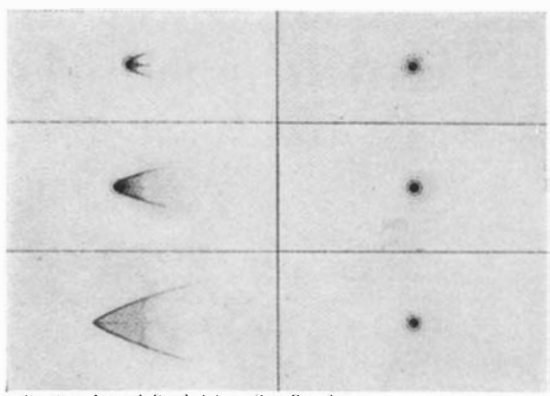
For the next few weeks we were permitted to see the many letters which were almost daily exchanged between these two, each letter containing evidences of progress toward the solution of the aplanatic curves. Together these amateurs have "busted the 'secret' wide open" and together they have now, at our request, prepared instructions for designing several types of aplanatic telescopes, which we shall present in three installments. After the process of laying out an aplanat has been described in abstract terms, the actual specifications (zonal radii, and so on) for three typical 12-inch aplanats will be given, in order that those who are not advanced workers and who do not care to follow the theory may also, if they wish, make aplanats. As the first installment goes to press both authors (also co-operating, Harold A. Lower of San Diego) are making 12-inch aplanats.

Well meant, even if a bit "highhattish," advice to the new beginner is to make at least one common Newtonian and one common (paraboloidal) compound telescope—itself advanced work—before attempting an aplanat, for the latter *is advanced billiards.* It is a kind of super-refinement whose very advantages over paraboloidal telescopes he will be likely to miss, even assuming that he can create its peculiar curves, until he has gained both a general telescope making and a general observing background and thus educated himself up to it. Otherwise, if he attempts it, he may wish he had never been born. The aplanat is an adventure, even to the professional—though a number of advanced amateurs are now at professional level in practical ability.

The following is by Messrs. Carpenter and Kirkham:

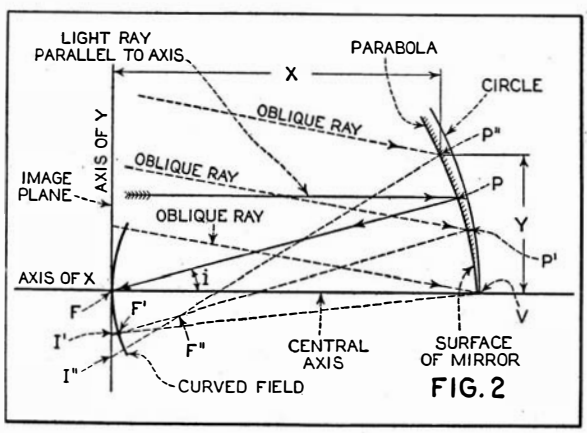
"ORDINARY types of reflecting telescopes—even including those having paraboloidal mirrors—do not focus perfectly the light received from objects in oblique positions; the light from such objects spreads over a part of the field. The form of image given is shown in Figure 1. The image is wing-shaped and hairy, that is, it has 'coma.' The point of the image is directed toward the center of the field. Drawings were given of the images of stars at different distances from the center of the field in Newtonian telescopes as compared to aplanatic telescopes in SCIENTIFIC AMERICAN, July 1932. (The same drawing is again reproduced herewith.—*Ed.*)





Courtesy Journal Royal Astron. Soc. Canada

Above, left: **Images at 2½', 5' and 10' off the axis.** ***Right:*** **Same in a Ritchey-Chrétien aplanat**



"The cause of this aberration or coma may be seen from Figure 2, which is a vertical section of a paraboloidal mirror. The arrow represents the path of rays of light parallel to the axis. These come to a sharp focus at F. Thus, for objects parallel to the axis, the paraboloidal mirror gives a perfect image and leaves nothing to be desired. But the paths of three typical oblique rays are indicated by the broken lines reaching the mirror at the zones, P", P' and the center V. The rays reflected from P' and the center V come to a focus at F' on the opposite side of the axis, but not in the image plane. Rays from the outer zones—for example, at P"—do not pass through the secondary focus F' but, crossing the pencil at F", they reach the image plane at I". H. C. Plummer (*Astronomical Journal*, May 1898; *Monthly Notices*, Royal Astronomical Society, March 1902) shows that the points, P', F, and F' are points on a circle. This means that the image field of a paraboloidal mirror is the surface of a sphere; its radius of curvature is equal to one half of the focal length of the mirror. (Bell, "The Telescope," page 95.) These facts are usually ignored when testing the zones of paraboloidal mirrors at the center of curvature.

"The 'comatic image' is often shown as a series of circles tangent to the sides of an angle of 60°, Figure 3. Actually it is quite a complicated series of curves. They were worked out and traced by Plummer, Crockett and others and were reproduced by Chrétien in his 26-page article on 'Aplanatic Telescopes,' in the French publication *Revue 'Optique*, January and February, 1922. Professor Ritchey states that this spread of light is sufficient to reduce by two magnitudes the light of faint objects near the edge of the field in large telescopes, and is an important consideration in the study of star clusters, faint nebulae, and planetary detail.

"This aberration is inherent in the paraboloidal curve and cannot be overcome by any form given to a single reflecting surface. K. Schwartzschild, in *Proceedings of the Königlichen Gesellschaft der Wissenschaften* of Göttingen, 1905-06, made an exhaustive study of this problem and derived curves for two compensating mirrors on the Gregorian plan, so combined as nearly to free the field from the straying light up to two degrees or more from the center. His equations are in the form of

a rapidly converging infinite series and are perfectly general, being applicable to any reflecting telescope having two mirrors. Abbé's sine condition and the fundamental concept of Hamilton that the paths of all rays through optical instruments must be of equal length, were taken as the basis of the investigation. Only thus could telescopes be stigmatic and aplanatic too. Through a beautiful mathematical analysis, Schwartzschild derived simple formulas which can be used by anyone to calculate two surfaces, compensated to give aplanatic images."

Messrs. Carpenter and Kirkham's explanation of the aplanatic telescope will be continued next month, and in the month following there will be especially calculated data from which those who do not wish to design their own aplanats can make one.

THE "Amateur Telescope Makers of Chicago" are planning big doings for the forthcoming national get-together of amateur telescope makers, which will be held at the Adler Planetarium in Chicago, from Wednesday, June 21 to Sunday, June 25. In the Planetarium there will be, not only during these few days but during the whole summer, a booth and shop devoted to amateur telescope makers, kept open by the members of the Chicago organization named, and this will serve as a kind of general headquarters of the amateur—a sort of "hang-out."

This will not be merely a fixed exhibit but an optical shop in actual use. There will be apparatus for tests of various kinds and at least two grinding machines, one designed by Zeiss and the other (so it is rumored), by the great inventor, Rube Goldberg. There will be apparatus for making small lenses, eyepieces, and so on; also a lathe. There will be polishing posts, not merely to look at, for someone will be there exercising mirrors on them. A fair-sized flock of telescopes made by Chicago amateurs will be on exhibit; likewise various mirrors, including a series of the new sputtered kind.

At the convention or get-together there will be but one day of formal meeting, to be announced later. This will be followed by a dinner. The secretary of the Amateur Telescope Makers of Chicago is William Callum, 1319 West 78 Street, Chicago. As the amateur telescope making movement has now reached large proportions the country over, a national organization of some kind is to be formed at this meeting. We have often been importuned during the past few years to attempt this ourselves, but have refused because we believed it would come spontaneously, and therefore actually be spontaneous, when the time was ripe.

RUSSELL W. PORTER writes that he expects to drive east from California for the national convention; John M. Pierce says he will drive to Chicago; Leo J. Scanlon of the Pittsburgh group says he will be there if he has to walk; your scribe, with some past experience as a hobo, will arrive quietly via the freight terminal. And everybody will be poor but happy. This will not be a high-hat convention, so leave your dinner coat in mothballs. And now—everybody on to Chicago—let's make it a crusade if not a hunger march. Beat the tom-toms, gather in your clans and come.

THE SCIENTIFIC AMERICAN DIGEST

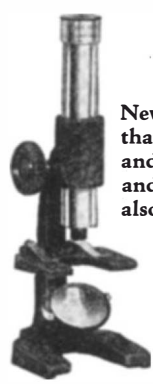
(*Continued from page* 340)

bottles will not break upon dropping on a concrete floor, will not soften under constant exposure to water or lactic acid, and will pass through all types of filling and capping equipment without any complicated change in the practice that is followed in filling glass bottles. Opax bottles are opaque, one third better heat insulators than glass, and can be supplied in any solid color; they take the standard No. 2 or No. 3 cap; but the hoods or other special sanitary caps can be eliminated by crimping over the pouring edge of the bottle, so that it is completely protected until the contents are poured out.

Cottage cheese containers and butter and lard tubs are made of the same material, which will not soften regardless of the length of time it is exposed to water or lactic acid. They can also be perfectly sealed by crimping.

New Low-Priced Microscope

FOR the low price of five dollars, the amateur microscopist can now obtain a microscope that magnifies 100 times, the product of Wollensak Optical Company. With rack-and-pinion focusing and removable mirror, the instrument stands over 7



New low-priced microscope that magnifies 100 times and is equipped with rack-and-pinion focusing and also a removable mirror

inches high when extended, about 6½ inches high when collapsed. The finish is crinkle lacquer and chromium plate. Two glass slides and a case are included. The optical system is of excellent quality.

For mounting microscope specimens, a new set for amateurs, recently announced, contains alcohol, xylol, Canada Balsam, specimen box, preserving jar, 10 mounted specimens, 10 glass slides, cover glasses, dropper and 2 dissecting needles in a case. The entire outfit is compact enough to carry into the field if desired. Heretofore similar mounting sets have been expensive and bulky.

Peculiarities of Pigs

STUDENTS of the habits of the hog, on the one hand, prefer left ham sandwiches, but students of physiology, on the other hand, prefer right-handed sugar. It seems, says *Food Industries*, that the swine in scratching himself exercises his right ham more vigorously than his left, making it tougher. As for sugar, the types that rotate polarized light to the right, such as dextrose, produce better muscular control.

This sidelight on the eccentricities of hogs suggests reference to a recent law-suit in which experts of the New York Central Railroad argued that the quality of pork may be influenced by pig psychology. The railroad was sued by Choice Boneless Ham Co., when the latter received a carload of spoiled hams. The experts ventured the theory that the hams were tough because the swine were terrorized on approaching the executioner's block.—*A. E. B.*

AUTOCRATIC VERSUS DEMOCRATIC DIPLOMACY

(*Continued from page* 328)

most altruistic motives voluntarily withdrew our Army from Vera Cruz in the face of abundant Mexican provocation, anticipate the controlling reasons that would sway the minds of the German leaders, solely intent on finding a successful issue from their dangerous but far from hopeless situation.

International crises such as these demand competency rather than brilliancy. There were competent civilians in Germany, well informed of the United States and its President, who could have warned the German military leaders of their error, and there were competent military men and naval officers in the United States who could have warned our President in 1916 that the German leaders would decide the question of the submarine warfare entirely upon the technical data indicating its success or failure.

The German government almost entirely submerged the civil view; our government practically ignored the military. Each fell into naturally resulting errors, and from these errors arose two courses of action that caused our country to enter a war, and to enter it with its army almost as naked as a new born child, and with a poorly equipped navy.

The impossibility of nations seeing themselves as others see them makes international negotiations difficult at all times and highly dangerous during international crises.

The German generation of the World War, in the full stride of a vigorous national life, whose unity was obtained only after three wars, who regarded the Army with a peculiar affection and their Navy with a glowing pride, could not understand the mood of their contemporary easy-going Americans indifferent to the national defense, and readily accepted the assurance of their press and leaders that the Yankees were interested only in chasing dollars. But the German leaders should have known better and Ambassador von Bernstorff who had a very clear comprehension of American civilization did repeatedly warn his government that it was underestimating the potentialities of the United States as a military power. All this was in vain, and the German leadership that had successfully conducted the greatest war their country had ever waged made their one irretrievable error.

The significant part of this experience for our American public, is that the very virtues of a nation, being misunderstood by another, may hasten the war it seeks to prevent. And Germany is not the only nation that fails to understand American

national psychology. It is extremely puzzling for the Japanese, with their just pride in their own Army and Navy and their unaffected pleasure in the practice of arms, to understand how we could allow the Mexicans to invade the United States and not inflict exemplary punishment. And at least one Japanese paper actually attributed our withdrawal from Vera Cruz in 1914 to the few losses we suffered during that minor campaign.

It is easy to see *now* that the German government in 1917 had mistaken the patience and forbearance of Mr. Wilson for fear, and had accepted his election as the apparent endorsement by our people of the slogan "He has kept us out of war." While the failure of the United States to make preparations for war lent them the false but comforting thought that even if this pacifistic American people decided upon war, they would be unable to intervene in western Europe in time to affect the decision.

The decision of Pless and its resulting effect on the United States shows that while two may be required to make a private quarrel, the acts of one state may force another peaceable state to take up arms. It also provokes a flood of reflections on mankind's inability to control human affairs wisely.

But some timely and homely facts emerge from a consideration of this situation that should impress themselves upon our American public who are primarily concerned with the future of the United States during the next decade. First, we have unduly suppressed our military and naval advisers until they have become practically without a voice in our peace-time policies. In certain other powerful countries the military element dominate the councils of their Cabinets. That is to say today in the world in 1933 the same opposing political structures exist that led us from a misunderstanding to war with Germany in 1917.

SOME foreign attachés and writers believe, and have already openly stated, that our desire for limitation of arms springs from no higher motive than a desire to avoid their cost. The fact that altruistic ideas inspire our people in their desire for peace is accepted with polite skepticism abroad.

It seems evident therefore that we, in our country, should, for the present at least, cease seeking Utopias where war has been entirely banished, and pursue the more moderate objective of making future American wars more remote, and unavoidable wars less costly in American blood and dollars.

This will require that our civilian leaders at least contemplate the possibility of war, and take more counsel with their military and naval advisers on means to prevent some wars and enter the unavoidable wars sufficiently prepared to play a man's part, so that we will not again send Americans to be lead by patriotic but semi-trained officers to modern battle-fields.

It is a reasonable conclusion that if there had been a better understanding between our military and civil leaders in 1915 and 1916, Americans might have escaped the World War, or, had we been dragged into it, we would have entered better prepared and been spared the loss of much blood and treasure. This under-

standing is necessary during periods of profound peace and periods of international tension, during the full sweep of the war and, perhaps most of all, in the last days of the war when it becomes apparent that an armistice and possibly peace is just beyond the horizon.

It can be said that during profound peace the civil should control but not exclude the military; during a period of strained relations the control should be almost evenly, quite nicely, balanced between the civil and the military, for both civil and military considerations are vital; when war is joined the military should predominate in the means of waging war while the civil should still dictate the ultimate object of war. As the war nears an end, successful or unsuccessful, the civil leader must suit his peace terms to the actual military situation, but he again resumes the predominant rôle, and the military leaders should loyally look to the civil for the peace directive.

These are simple well-known platitudes, but they can only be put into practice by team-work between the civil and military leaders. From our smallest town to our largest city, societies, committees, and groups of Americans of all kinds gather together for common action. Unfortunately, in the most important grouping of military and civil leaders—the grouping that is most essential for our continued existence as a great power—we have almost completely lacked team-work.

This deficiency results from the fundamental difference in the mental outlook of the military and civilian leaders. Yet both these groups are patriotic and intelligent. With rare exceptions, they simply do not understand each other, and do not appreciate the viewpoint of their colleagues.

IN the United States, the civil leader usually has been brought up in the political struggles that approximate warfare in their fierceness; he can give and take blows in a political campaign; he is usually an effective speaker, knows the value of the press, and is accustomed to presenting his point of view. And, according to his code, he is not bound to present his opponent's side of any question. He is a survivor of an extremely competitive career, in which one defeat at the polls or one failure in office is usually enough to prevent his reaching the stature of a cabinet officer. He brings to the Cabinet, or Congress, a full knowledge of domestic affairs, but scant information of Europe, Asia, or South America.

Compared with his civilian colleagues, the military officer has led a sheltered life. He has had to compete for his position, but under clearly defined rules and restricted by a long-established code. He has been brought up to "swear to his own hurt," is usually shy of newspaper publicity and quick to suspect a brother-officer whose name appears too often in print. He is generally suspicious of all civilian officials, whom he indiscriminately dubs "politicoes," regards most newspaper men as sensation-seekers and is prone to be very impatient with them.

The military officer is usually reticent except among old friends, and is rarely able to make an effective presentation before a Congressional committee. Any clever cross-examiner can confuse the average

military witness, and make sound testimony appear absurd. Then if a hostile press representative is present, the country at large gets a very distorted, reporter's view of the situation.

The dominant idea of the military officer is the fighting efficiency of the establishment; his earnest efforts to perfect the military or naval organization sometimes cause him to forget the necessity of economy, and expose him occasionally but rarely to just attack. He is also likely to forget that the American public is entitled to know about our armed forces, and may neglect to supply the press with news of the fleet or army.

It is quite natural, therefore, that, when civilian and military leaders with their diverse upbringings are called upon to work together in Washington, friction immediately occurs. Our past experience bears out this expectation. Our public debt, our huge pension list, our crowded veterans' hospitals, and our government cemeteries are reminders that we have been penny wise and pound foolish in problems of national policy.

Is there a remedy, or must coming generations repeat our tragic mistakes? Because Cromwell was a martinet and Gage fired upon some patriots in Boston, must our own naval and military officers be forever suspected of desiring a military autocracy and our country denied the full services of their trained minds in formulating our national military policies?

Naturally, if there is never to be any war, the military authorities need not be consulted. But, strive as they did, McKinley could not avoid the Spanish War, nor Wilson the World War. So it is probably true that in spite of our sincere efforts to bring about a warless world, future American generations will be called upon to shoulder arms.

THE average American is busy about his own affairs, and ordinarily gives scant heed to the conduct of his government, so there is no effective public opinion to remind those in authority that our national security is the vital concern of all Americans. Our press has neglected this subject and only a few papers devote any space to military matters, and then usually either to represent the extreme pacifistic or international view or to carry some bombastic statement about American invincibility.

The eventual remedy is an educated American public opinion that will insist upon their public servants—civil and military—working in closer harmony on matters of national policy. But that will not be possible until our American press gives more space to this phase of our government.

It is already a trite saying in our newspaper world that America is a world-power; some in their enthusiasm claim the leading place for our country. But how many columns do they devote to the statesmanship necessary if we are to take our proper place in world affairs, and be neither overbearing nor naïvely unsophisticated? The immediate duty of our press today is to insist upon a greater degree of co-operation between the civil and military agents of our government in order that our foreign policies may take on a reasoned reality, and that we neither be led into war by vain swashbucklers nor exposed to war by the unpreparedness of dreamers.

Books SELECTED BY THE EDITORS

THE ROYAL ROAD TO LEARNING

By G. Charney

THIS is a well-developed plan to extend cultural acquisition by means of group study of the better magazines. It is one that would seem to lend itself more fully where there is community interest and a desire for personal educational development along the lines of current news of educational value. Magazines are being recognized more and more as stimuli of definite value in coordination with other standard forms of learning, so the author's development is along quite sound and recognized lines. It is unfortunate that a sort of mystery is woven around the main idea which cannot be comprehended until 97 pages have been read. However, the general excellence of the writing more than atones for this.—$2.15 postpaid.

LIFE'S PLACE IN THE COSMOS

By Hiram Percy Maxim

THIS book is plainly an enlargement of the author's article "What it is All About," in the April, 1932, SCIENTIFIC AMERICAN. While it describes the solar system, galaxy and universe (in an elementary manner) its chief claim to fame is its speculations concerning the meaning of things in the universe: life—what it is; man—why he is; our reason, mentality and so on—what these signify; interstellar communication, and so on. Nobody can provide proved answers to these big questions but the author's attempts to do so make good reading and will start many an all-night debate between those who would like to find out "what it is all about" (if anything). 169 pages.—$2.65 postpaid. —*A. G. I.*

THEORY OF THERMIONIC VACUUM TUBES

By E. Leon Chaffee, Prof. Physics, Harvard

A COMPREHENSIVE theoretical treatment of the fundamentals of thermionic emission and of the vacuum tube. Not only the general properties of the tube but its use as an amplifier and detector are treated in detail. It offers much original material and the method of presentation is in many cases new. Some of the new material includes that on the path of operation, large-signal regeneration, regeneration in coupled circuits, detection, and non-linear elements. The work is based on several years of research and study.—$6.25 postpaid.

EXPERIMENTAL OPTICS

By A. Frederick Collins, F.R.A.S.

"BEING a series of simple and brilliant experiments with light, and how to make all kinds of optical instruments." Thus runs the description on the title page of this book. Substituting the word "many" for "all," in this blurb, it gives an accurate description. This book is elementary, as books on optics go, and covers about the same scope in an experimental way as a college physics covers (on light alone) in a theoretical way. It is very understandable and should interest the amateur student of optics. Many practical experiments are described, from which the amateur could derive a lot of fun and knowledge. 303 pages.—$2.15 postpaid.—*A. G. I.*

TELEVISION

By K. A. Hathaway, Executive Secy., Ins. of Radio Service Men

HERE is a somewhat "different" book on television. In the compact space of 169 pages, including a comprehensive index, it tells something of the history of the art, and gives a clear-cut picture of its present status. A valuable chapter is devoted to a discussion of the design problems of receivers for television use. Free from technicalities, this book is one that can be read with profit by anyone who has only a smattering of knowledge of things radio, but even the engineer will find much of interest and instruction.—$2.15 postpaid.—*A. P. P.*

DESIGNING FOR ARC WELDING

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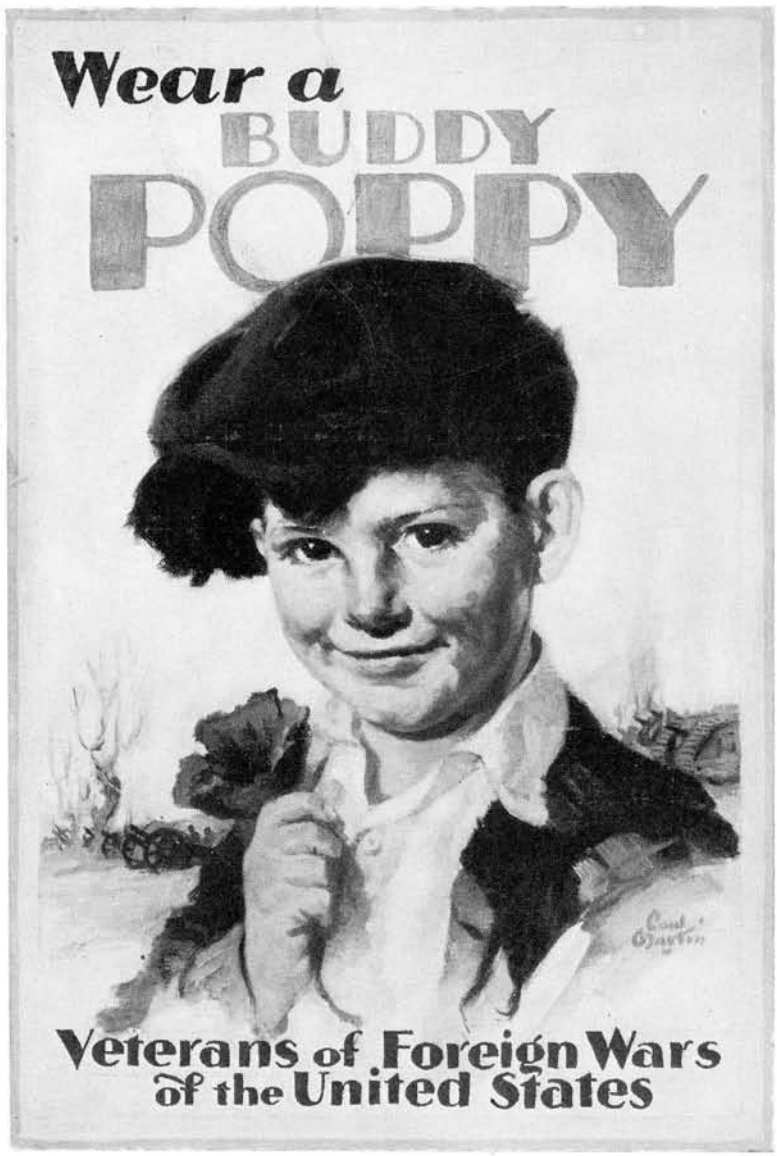

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