

# SCIENTIFIC AMERICAN

July  
1933

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## Has Telepathy Been Proved?

The Results of the First Scientific  
American Test Appear on Page 10

•  
COSMIC RAYS

By Arthur H. Compton

•  
MICROSCOPY AS A HOBBY

By Ernest H. Anthes

•  
AND A DIGEST OF APPLIED SCIENCE

Volume  
149

•  
Number  
1

## Science and Human Life

By J. B. S. HALDANE, F. R. S.

THIS is one of those books which your reviewer intended only to skim, but found himself reading from sheer enjoyment rather than as a task. It contains 23 stimulating articles or chapters (287 pages)—“a rather mixed bag of writings” the author calls it—on different aspects of science and modern life. Haldane is a leading biologist—one who has much to say, knows how to say it and always has a host of readers. And he isn't stereotyped in his opinions.—\$2.65 postpaid.

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By DAVID LASSER  
PRES. AM. INTERPLANETARY SOC.

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By HELENA WRIGHT, M.B., B.S.

THIS book is addressed to those who are about to be married, particularly men, but we see no reason why others should not read it, and many reasons why they should. Its main purpose is to forestall marriages wrongly conditioned and perhaps ruined at the outset by inexperienced, inept blunderers. It tells what to do and what not to do. There are more things to do and not to do than many think, a fact which all consulting specialists know full well.

A very practical, serious, scientific book on a subject which deserves as much attention as any subject of major importance in life.—\$2.00 postpaid.

## Chromium Plating

By E. S. RICHARDS

THERE has been need for a book on this subject and this one covers it thoroughly. It describes English practice. Application in automobile practice is probably the most conspicuous use, but there are innumerable examples where this plating is far more important and represents a much greater advance. The author issues a warning that this process is a difficult one to master, that it takes expensive equipment and infinite pains and attention. Diagrams show how to wire various shapes that are to be plated, layouts of economical shops and protection of workers, among all the details, are treated thoroughly.—\$3.65 postpaid.

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By H. LEVY, PROF. MATH., UNIV. LONDON

READERS who have a philosophical interest in the significance of scientific thought and its impact on modern life will like this restatement of the current aims of science. Among other things it contains a refutation of the views of Jeans, Eddington, Millikan and others concerning the freedom of the will.—222 pages.—\$2.15 postpaid.

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EIGHTY-NINTH YEAR

ORSON D. MUNN, Editor

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# ACROSS THE EDITOR'S DESK

OUR mail has been overflowing recently with correspondence prompted by the article "Sexual Abstinence as a Biological Question," which appeared in our May issue. Many readers have condemned us for publishing this article, and many have complimented us in no uncertain terms for presenting to intelligent people an authoritative opinion on a subject that is of prime importance to the human race. Of course, there are two sides to every question; in this particular case, the other side is supported mainly by the orthodox church. We have therefore requested a well-known Father of one of the large Jesuit universities to write for publication an article which will present the attitude of some of the churches on this important subject. We expect that this article will be ready in time for our September issue.

Caustic comment in the press as to the way in which the Bureau of Home Economics "fritters away" taxpayers' money in pamphlets telling how to space buttons on little boys' pants, has roused the ire of our old friend T. Swann Harding. In an article scheduled for our next issue, he expresses his bewilderment at the universal acceptance of the losses of breath-taking millions in "rotten investments backed by individuals that the advertising and business journals regard as the personified light of the world," while the expenditure of 200,000 dollars annually by a government department that has saved millions for the taxpayer—yes, even in boys' pants—is hotly condemned. His is a telling argument and it makes some manufacturers, who lavish money on radio programs in order to sell inferior products, look very sick indeed.


Those of us who like argumentative questions—and who doesn't?—will experience a rise in temperature when they read next month an article regarding Nordic superiority—assuming that there is such a thing. This is an old question brought to light again by recent events. Is the Nordic superior or inferior, or can there be a classification? We confess that we do not know. All we have is a private opinion and in publishing the article will keep this opinion to ourself. An editor very often publishes sentiments contrary to his own—to be fair

to the other side, to start people thinking, or to begin a controversy that may settle the question.

This month we publish one of a series of practical articles on the microscope and its uses. The present article is hardly more than an introduction, but the article next month will get down to brass tacks by studying the elementary optics of the microscope. We can not hope to make full use of that instrument unless we first understand how it works. In subsequent issues we hope to give our readers numerous practical articles on the subject.

Photography, while still an important and growing source of delight to the amateur "snapshotter," has expanded into many fields of science and industry at an astonishing rate. Nowadays photographic records are made of the progress on all sorts of structures for owners, builders, and contractors, and of factory operation and production methods. In conjunction with microscopes, X-ray equipment, stroboscopes, and the like, the camera has proved an invaluable tool in the hands of research workers in all the sciences. A wealth of interest and helpful information is contained in the article on practical photography which we have scheduled for our August issue.

Psychoanalysis has run the gamut of public interest, and has afforded material for countless discussions. Because of certain implications, however, some believe that it has fallen into disrepute and it admittedly has fallen, in many cases, into the hands of irresponsible practitioners. Despite these early misadventures in its youthful career, the basic principles of the science are sound, but they still are so poorly understood by some that we have arranged with Alfred J. Fox, M.D., for an article on the subject which will present the essentials of psychoanalysis in a clear, understandable manner. Further, Dr. Fox will outline a system of self-analysis that makes unnecessary the intervention of the usual second party. Possibly this article, to appear in August, will show you how to remove some inhibition that has been bothering you.



Editor and Publisher



LYMAN J. BRIGGS, Ph. D.

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THE Bureau of Standards on the outskirts of Washington is an immense institution composed of many large buildings devoted to many branches of scientific and industrial research. It is as extensive as a good-sized university and its director occupies a position as important as that of president of a university.

Dr. Lyman J. Briggs is the new director of the Bureau. He was nominated last December by President Hoover and renominated in March by President Roosevelt—a happy indication, many think, that the new administration intends to keep politics out of governmental scientific research and will not try to settle the question whether a Democratic physicist or chemist knows as much as a Republican physicist or chemist.

The Director of the Bureau of Standards

is essentially an administrator. He decides, among other things, which pieces of proposed research and investigation are, and which are not, worth doing. In order to do this he must be a scientific man himself, with much research experience of his own. Dr. Briggs was educated as a physicist and his entire life has been in governmental scientific service: first as head of the physical laboratory of the Bureau of Soils, then as head of the biophysical laboratory of the Bureau of Plant Industry, later as chief of the Division of Mechanics and Sound of the Bureau of Standards. He has also invented and devised, partly with others, a gyroscopic instrument for naval use, an earth-inductor compass for aviation, a method for studying fatigue in metals, and other developments. He has held various important positions in scientific societies.



By Burton Holmes, from Ewing Galloway

**. . . AND NEVER THE TWAIN  
SHALL MEET'**

**C**ENTURIES of calm acceptance of the hard fate of the lower classes of the Orient are reflected in the stoical features of this Chinese coolie water carrier. Plodding through the streets of Peiping with his load of water on a crude wheelbarrow, he is the living antithesis of modern sanitary engineering. At intervals along the streets of many cities of the East are public wells from which is drawn water for general use, to be carried laboriously to the point of consumption by some such primitive method as that shown. Note how most of the weight of the barrow is borne by the shoulders.



The author's cosmic ray camp on Mt. Cook in New Zealand, April, 1932

The Secret Message of the

# COSMIC RAY

By **ARTHUR H. COMPTON**

University of Chicago

**T**HE 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.

How can cosmic rays be detected and measured? One way is to measure the electrical conductivity of air. In our experiments we use a steel bomb, about four inches in diameter, filled with air or argon gas under high pressure. The cosmic rays make this gas slightly conducting, and the tiny electric current which flows through it is measured with a sensitive electrometer. The rays from radium and other radioactive materials also affect the gas inside this bomb. So we surround the bomb with a heavy shell of lead to keep out the undesired rays from the radium.

If such a bomb, protected by lead, is carried into a deep tunnel, the compressed gas inside is almost a perfect non-conductor of electricity. On the

ground outside the tunnel there is, however, a measurable current through the gas, due to the cosmic rays. If the apparatus is carried to the top of a mountain, or high up in a balloon, the current flowing through the gas rapidly increases, showing that the rays are much stronger at these high altitudes.

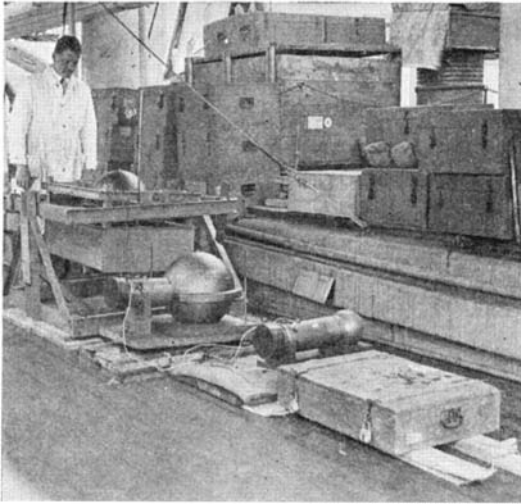
Last July we performed this experiment under very favorable conditions on the Central Railway of Peru, which has at its highest point a deep tunnel through a mountain, three miles above sea-level, a thousand feet higher than Pike's Peak. Inside the tunnel the effect of the rays was undetectable. Just outside the tunnel they came in strongly, and caused a relatively large current to flow through the instrument.

**A**NOTHER means of detecting the cosmic rays is the so-called "counting tube". This also consists of a bulb filled with gas, which is made conducting by the cosmic rays. But now, instead of measuring the current with an electrometer, it is amplified a million million times or more, and passed through a loud speaker. Each time a ray passes through the counting tube, a sudden "plop" is heard from the loud speaker. As ordinarily operated in the laboratory, some 10 to 50 such impulses

per minute are heard. Most of these are due to cosmic rays, coming from outside of the earth, no one knows how many thousands or millions of light years away.

One of the most distinctive characteristics of these rays is their remarkable penetrating power. We think of X rays as very penetrating. Will they not pass through a man's hand, or even through his body? Yet while it takes about one inch of water to absorb half of a beam of X rays, or a foot of water to absorb half of the gamma rays from radium, it requires some 20 feet of water to absorb half of a cosmic ray beam. That is how it happens that these rays will pass right through the heavy blanket of air that forms our atmosphere, through the roof and upper floors of a building, and affect our instruments surrounded by heavy shields of lead in the laboratory.

Attention both of scientific men and of the public was called forcibly to the importance of the studies of cosmic rays by Professor Millikan's suggestive theory of their origin, which he presented seven years ago. He developed the idea that the cosmic rays are produced during the formation of atoms in interstellar space, and presented evidence that this is one stage of a cyclic process through which the universe is continually passing. It will be worth while to dwell for a moment upon this theory and to describe other hypotheses



Dr. Hoerlin with three sets of Regener's cosmic ray apparatus mounted on board S.S. *Carl Legien*, en route around South America. The unshielded instrument is similar to that sent by Regener to an elevation of 17 miles by balloon

that have been proposed regarding the nature and significance of cosmic rays.

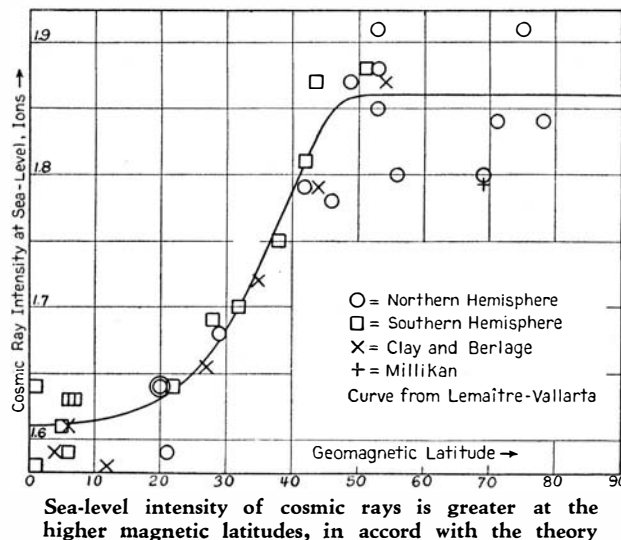
Millikan based his theory on the assumption that the cosmic rays are electromagnetic radiations, or photons, similar in type to X rays and gamma rays, but of shorter wavelength. This was a natural assumption, in view of the surprisingly great penetrating power which the cosmic rays were found to possess. Such rays, having the penetrating power of the most absorbable cosmic rays, he calculated should be produced if four atoms of hydrogen would suddenly combine to form one atom of helium, the energy released by the process forming one cosmic ray. Thus Millikan spoke of each cosmic ray as being "the birth cry of an atom" being born in the intense cold of interstellar space.

**I**N a similar process it was supposed that heavier atoms, such as oxygen, silicon, and iron, were formed, giving rise to the more penetrating components of the cosmic rays. Under gravitational forces, the resulting atoms would come together to form nebulae and stars. These in turn would radiate their substance away as light and heat. While coursing through the vast regions of space, this light and heat energy was in some unknown way transformed again into protons and electrons, from which the simplest atoms, hydrogen, are formed. From here the great cycle of the universe starts over again—a world continuing forever.

Immediately following this hypothesis of Millikan's, Sir James Jeans suggested the alternative view that these

rays result from the annihilation rather than from the transformation of matter. Jeans noted that if they are photons, like light or X rays, the most penetrating part of the cosmic rays should have just the energy that would be liberated by the sudden coalescence of the electron and proton in a hydrogen atom. That is, whereas Millikan pointed out that the least penetrating cosmic rays have the energy to be expected from the formation of helium atoms out of hydrogen, Jeans found that the most penetrating cosmic rays correspond to the annihilation of hydrogen atoms themselves. This appeared to Jeans as one more way in which the universe was running down.

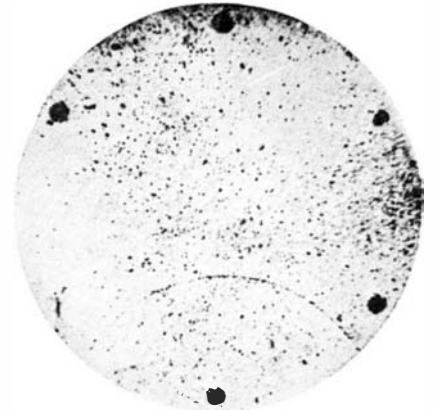
An alternative theory regarding the nature of cosmic rays has been proposed by a young French physicist, Dauvillier. This is not based on the idea of cosmic rays as photons, but rather on the conception that they are electrons shot toward the earth from the sun. This theory is thus somewhat similar to that of Störmer, in which he accounts for the aurora borealis as due to electrons thus shot toward the earth. Dauvillier finds evidence for strong electric fields existing in flocculi on the surface of the sun, estimated at thousands of millions of volts. These powerful electric fields, he supposes, serve to eject the electrons in all directions,



some of which would approach the earth. Near the earth they would be affected by the earth's magnetic field and cause at the same time the auroral displays, which are concentrated near the earth's magnetic poles.

Perhaps, however, the most romantic theory of the origin of the cosmic rays

is one very recently proposed by the Belgian physicist, Abbé Lemaître. The powerful telescopes and spectroscopes of Mt. Wilson Observatory have revealed the fact that the very remote heavenly bodies seem to be moving rapidly away from us. Lemaître has woven this observation into a theory of the universe according to which some thousands of millions of years ago the universe was much more concentrated than it now is, and started to expand with explosive violence, so that the distant nebulae continue to fly away with ever increasing speed. At the time of this



A cloud expansion photograph by Anderson, showing the track of an electron associated with the cosmic rays. It is the passage of such particles through a counting tube which is heard in the loud speaker

primeval explosion, he conjectures, not only nebulae and stars were thrown out, but also atoms and electrons and photons—the tiniest pieces of matter. According to his theory it is these elemental pieces of the original world-stuff, still flying around in space after thousands of millions of years, which constitute the cosmic rays.

Before it is possible to select which if any of these theories is correct, it is necessary for us to learn whether these cosmic rays are electrically neutral photons, as Millikan and Jeans assume, negatively charged electrons, as Dauvillier supposes, or a mixture of different kinds of rays as Lemaître concludes.

About five years ago, two German physicists, Bothe and Kolhörster, did an experiment with counting tubes which convinced them that the cosmic rays are electrically charged particles. If this conclusion is correct, it means, however, that there should be a difference in intensity of the rays over different parts of the earth. For the earth acts as a huge magnet, and this huge magnet should deflect the electrified particles



as they shoot toward the earth. The effect should be least near the magnetic poles, and greatest near the equator, resulting in an increasing intensity as we go from the equator toward the poles. A series of half a dozen different experiments designed to detect such effects resulted in inconclusive data. Most of the investigators found no differences where differences had been predicted. J. Clay of Amsterdam, however, thought he could detect a difference between the strength of the rays in Holland and Java.

It was highly important to find out definitely whether any such variation of cosmic ray intensity with magnetic latitude occurs. If not, it would mean that Bothe and Kolhörster's conclusion was wrong, and that there is no appreciable part of the cosmic rays that consists of electrically charged particles. If, on the other hand, a variation of the predicted kind occurs, it would mean that a part at least of the cosmic rays is electrical in character.

Accordingly, with financial help from the Carnegie Institution, a group of us at the University of Chicago have organized nine different expeditions during the past 18 months, going into different portions of the globe to measure

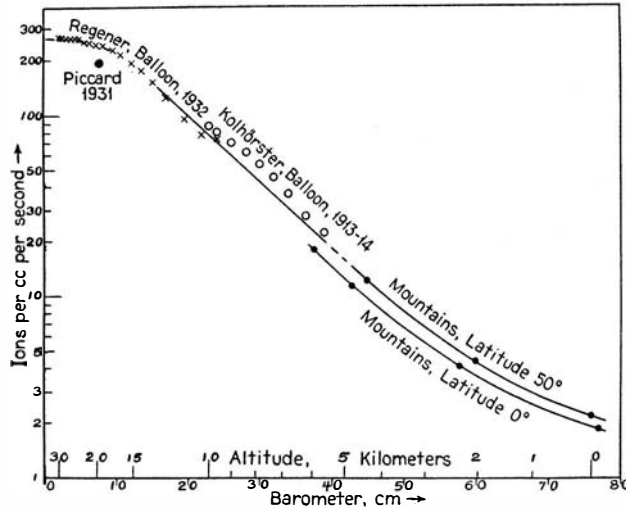
sea-level to the tops of mountains nearly four miles high in the Andes and the Himalayas. Two capable mountaineers, Carpe and Koven, lost their lives on a glacier on the side of mighty Mt. McKinley in Alaska, but they got the highest altitude data yet obtained for latitudes so close to the pole.

that which is assumed in Lemaître's explosion theory of the origin of cosmic rays. It is not necessary for us, however, to suppose that these atoms and pieces of atoms have been flying through space since the beginning of time. Swann, Gunn, and others have suggested ways in which the stars may act as huge high-potential generators which would serve as continuous sources pouring such high speed particles into space. It is thus too early to draw positive conclusions regarding the significance of these particles.

**A** WORD should be said regarding the tremendous energy represented by individual cosmic rays. Let us take as our unit of energy the electron-volt. About two such units are liberated by burning a hydrogen atom. Two million units appear when radium shoots out an alpha particle. But it requires ten thousand million of these units to make a cosmic ray. Where does this tremendous energy come from?

In the answer to this question lies perhaps the solution of the riddle as to how our universe came to be. Perhaps its answer will tell us how nature liberates power of which we now have no knowledge. Shall we be able to tap and use that power? We know not. The physicist has, however, been entrusted with the job of finding, if he can, the answer to this mighty riddle. This article is merely a report that he is making progress.

●  
*“The question of Nordic superiority has come up again and is as fruitful a source of debate as ever. Next month's number will contain an article: “The Nordic—Superior or Inferior?”*”



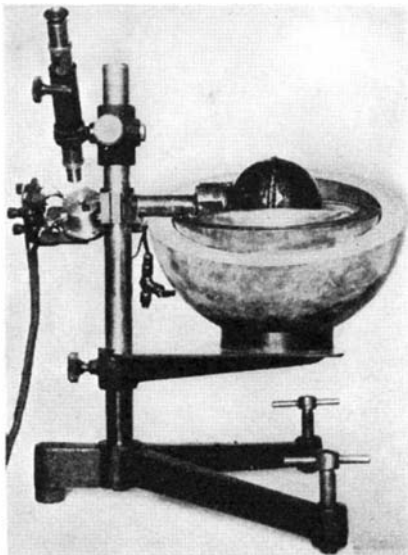
Graph showing varying intensity of cosmic rays at different altitudes, as observed on mountains and in balloons

On bringing together the results of these expeditions, it was found that the cosmic ray intensity near the poles is about 15 percent greater than near the equator. Furthermore, it varies with latitude, just as predicted, due to the effect of the earth's magnetism on incoming electrified particles. At high altitudes the effect of the earth's magnetism is found to be several times as great as at sea level.

At first, when this result was announced, Professor Millikan thought it was contrary to certain data which he and his collaborators had taken. Further examination of his measurements seems to have satisfied him, however, that his data are in accord with ours.

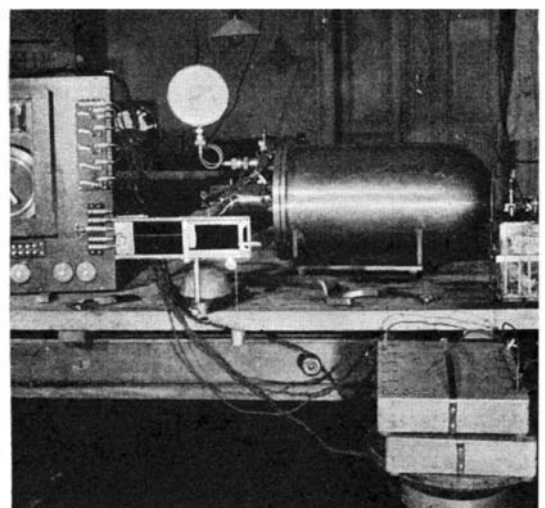
These results show that a considerable part, at least, of the cosmic rays consists of electrified particles. Some of the cosmic rays, however, are not appreciably affected by the earth's magnetic field. Other types of measurements, such as those of Piccard and Regener in their high-altitude balloon flights and Bothe and Kolhörster's counter experiments, lead us to the conclusion that very little of these rays is in the form of photons, like light, but that there is probably a considerable quantity of radiation in the form of atoms or atomic nuclei of low atomic weight.

This conclusion is exactly



A small, portable Compton-Bennett cosmic ray apparatus with its upper hemispherical shield removed

cosmic rays. These parties, including some 60 physicists, have worked on all the continents except Antarctica, and that is included in our plans for the current year. The tropics of the eastern and western hemispheres, the arctic seas and the southern parts of Africa, America and New Zealand have been visited. The observers have gone from



Steinke's cosmic ray recording apparatus, its 3000-pound lead shields removed. The large volume ionization chamber gives it precision

# THE ART OF A HARD, CRUEL PEOPLE

Might and Power, Typified by Lions and Bulls,  
Guarded the Gates in Mesopotamia



Pair of winged mythological figures with human heads, bodies of (left) bull and (right) lion. They were sides of a gate and supported an arch. The figures each weigh about five tons



winged lion, and a number of slabs found a temporary home in Dorsetshire; eventually these masterpieces of Assyrian art were secured by a dealer. They were then sold to Mr. Rockefeller

IT IS now possible for the visitor to the Metropolitan Museum of Art to trace back the complete family tree of art for the last 5000 years. Thanks to John D. Rockefeller, Jr., the final gap in a great collection of works of art has been filled. This missing link in the chain was Assyria. The ancient culture of Mesopotamia persisted through political changes and now in New York are displayed a number of splendid examples of Assyrian art. In the first half of the 19th Century, Sir Henry Layard resurrected Assyrian art from oblivion and made a splendid addition to the limitless wealth of the British Museum. Sir Henry was related by marriage to a great English ironmaster who undoubtedly financed the excavations and as a result a colossal winged bull, a

who generously gave them to the Museum in New York.

Naïvely practical, the Assyrian had a very simple conception of the supernatural. To him, as to the Egyptian, might and power were most forcefully typified in the lions and wild bulls of the desert plains and hills, and demigods were men with wings who were not tied like mortals to the earth. Hence, winged lions and bulls with human heads were the mysterious guardians of the city, and their gigantic figures stood against the jambs of the gateways, prepared to ward off not only terrestrial enemies but pest-laden evil spirits of the unseen world. A magnificent pair of such guardian beasts welcome the visitor to the Assyrian section. To save weight the old quarrymen cut away

much of the stone, leaving only enough stock for the primitive sculptors to work on. The figures were connected by a circular arch.

The king's victories in war and in the chase constituted one of the Assyrian artists' chief themes. Always literal and practical in these compositions, the artist was in a very real sense a war correspondent whose success was in making every detail as circumstantial as possible. As time went on, the artist made elaborately ambitious attempts to show pictorially the landscape settings of the campaigns and sieges.



Relief in alabaster showing a Median bringing a tribute of horses. From the palace of Sargon II. (722-705 B.C.)



Assyrian cavalymen fording a stream and crossing a mountain. Palace of King Sennacherib (705-670 B.C.)

# OUR POINT OF VIEW

## Reforestation—At Last!

FORMER industrial workers, storekeepers, barbers, clerks, electricians, miners—these and unemployed men from many other walks of life are the direct beneficiaries of the new federal reforestation program. A quarter of a million men will be paid for their reforestation work, will be assured their subsistence for the next few months, and will get the healthy, outdoor work that will help to make them physically fit and restore their mental equilibrium weakened by past privation and despair. No less direct will be the benefit to the entire American people.

The wisdom of reforestation is beyond question. Authorities agree on the principle involved; hence there can be no argument. SCIENTIFIC AMERICAN has for years urged reforestation and has repeatedly pointed out the error of the extravagant American policy of slashing our forests. Besides the crop value of our forests—which runs into hundreds of millions annually and which only wise forethought can perpetuate—there are flood-prevention and erosion-retardation to consider. Floods cause millions of dollars damage to crops and property each year, and erosion carries off billions of tons of fertile topsoil so that lands become less suited to agricultural purposes and often, indeed, quite barren. Forests help to control floods and to minimize losses from erosion.

We cannot, therefore, too strongly commend this reforestation program. In a way it is very definitely linked with the future prosperity of the country. Our hope is that it will act as an object lesson to private owners so that, once the federal government completes its present work, both reforestation and afforestation will continue to be carried on on such a wide scale that we need not fear further depletion of our forests.

## Favoring American Ships

"THERE is a rapidly growing sentiment for travel in American ships on the Atlantic among the people I know," was the remark overheard by the writer in a rather select group recently. Why should this not be so! As this is being written, an American ship which is as fine as anything afloat, the *Washington*, is on her maiden voyage to Europe. With this ship and her sister, the *Manhattan*, we can compete with the ships of any other nation, not for a

mythical blue ribbon for speed nor for the bizarre in decorations and size, but for comfort, safety, and downright American service.

In spite of this, Walter Runciman, President of the Board of Trade of England, ridicules American ships and protests against our mail subsidies to shipowners. Englishmen have a splendid reputation for sportsmanship, but Mr. Runciman's remarks, timed by our recovery of a measure of our former glory on the sea, belie the reputation; they seem tinged with more than a little jealousy. Strange it is that when one country, tired of supporting the ships of other countries by shipments of goods and by enormous passenger travel, decides to build its own, criticism of this sort should be forthcoming.

In view of this and other intolerant remarks pertaining to American principles; in view of the defiant attitude of France regarding the war debts (while at the same time expecting the expenditure of several hundred American tourist millions in France this year); in view of foreign lack of co-operation with us in attempting to straighten out present difficulties—is it any wonder. . . . Well, what *is* the answer?

## Won't Take No for an Answer

THE angle trisectors plainly will not down. They thrive on discouragement as a goat thrives on an ungarnished diet of tin cans. Able mathematical authorities have stated time after time that the angle cannot be accurately trisected except in certain special cases, and these statements have been spread widely in the public press, especially during the past year or two since this age-old question was revived. To the everlasting regret of the editors, solutions of the trisection problem have poured in on them by the basketful and they continue to pour.

When mathematicians assert that the angle cannot be trisected they do not mean merely that they have never been able to do it. They mean that they have *proof positive* that it cannot be trisected. Were it not reading matter which the majority of readers would find dull, and some perhaps abstruse, we should publish the existing proofs that the angle cannot be trisected. However, real downright, case-hardened aspirants toward trisection solution fame are advised to see Chapter VII in L. E. Dickson's "Elementary Theory of Equations," 1914, or better yet, Chapter II

of Beman and Smith's "Klein's Famous Problems of Elementary Geometry." The latter, unfortunately, is out of print. These books show why the trisection feat cannot be done.

"What? Cannot be done!" reply the aspirants aforementioned. "I can do it." Evidently such negative assertions act only as a strong tonic on some kinds of temperament—not exactly the modest type but perhaps the type which would best enjoy "showing up" the authorities.

The editors do not, therefore, at all imagine that the above comments will dam the stream of solutions to the problem which has run through their lair for the past year or so. Doubtless, instead, this mention will merely sow a fresh crop of dragon's teeth, just as the one on page 285 of the May number did. Well, they should have return postage and, by the way, none will be examined.

Of course, we know what these indefatigable solvers of the insoluble have in the back of their minds. They know how many insolubles have been solved in the past. One recalls aviation with heavier-than-air vessels. At the turn of the century the great scientist Simon Newcomb was publishing here and there his "proof" that such airships never would be a success. After adducing the old surface-volume argument to show that an airplane of appreciable size could not fly, he said: "The demonstration that no possible combination of known substances, known forms of machinery, and known forms of force can be united in a practicable machine by which we will fly long distances through the air, seems to the writer as complete as it is possible for the demonstration of any physical fact to be. May not our mechanics . . . be ultimately forced to admit that aerial flight is one of the great class of problems with which man can never cope, and give up all attempts to grapple with it?"

Today we fly. What fun it would be to take Simon Newcomb aloft!

Even in the face of this, however, and in the face of many other practical demonstrations that the impossible is possible when it has been made so by someone who would not take no for an answer, we continue to assert that the trisection of an angle will never be solved. That is our story and we will stick to it, but we hope that if this intriguing problem is ever cracked open, it will be after our own day. We should not want anyone with malice aforethought to invite us for a "ride in an airplane."

# THE RESULTS OF OUR FIRST TEST OF TELEPATHY

- The Charts Received Have Been Collated and Analyzed Mathematically. Results Appear to Point to the Operation of Something Other Than Chance. The Findings of Experts After Studying the Data •

ALTHOUGH interested readers are still sending in charts showing their experiments in telepathy, conducted as directed in our March issue, we have gathered together the first 120 sheets returned, and have conducted a thorough analysis of the results. A compilation was made, as shown in Table 1 reproduced here, and submitted to three persons, all deeply interested in mental phenomena, who studied the data independently and made separate reports without consulting each other. They were unanimous in their opinions that the test results show something that cannot be ascribed to pure chance and that certain of the findings should be followed up for further and more comprehensive study. This will be done and, if the results warrant, they will be reported through these pages.

The three persons co-operating with SCIENTIFIC AMERICAN in this study were: Dr. Walter Franklin Prince, Research Officer of the Boston Society for Psychic Research and Contributing Editor of SCIENTIFIC AMERICAN; Professor Gardner Murphy of the Department of Psychology, Columbia University; and Joseph Dunninger, Chairman of the Universal Society for Psychic Research, and well-known exponent of telepathy.

The first SCIENTIFIC AMERICAN test of telepathy, as proposed in March, consisted of having two persons act as agent and percipient in a series of tests involving 500 throws of a die. The agent was instructed to shake the die and concentrate on the uppermost number. The percipient was then to "guess" the number aloud and the agent was to record the fact of "right" or "wrong" on a prepared chart. As the charts were received in this office, they were recorded and entered on a compilation sheet, the final

tabulation of the first 120 charts appearing in Table 1.

The next step was to calculate mathematically, according to the theory of probabilities, the expected frequency with which charts showing a given number of correct "guesses" should appear in a series of 120. By expanding the formula  $(P + Q)^n = (\frac{1}{2} + \frac{1}{2})^{50}$  the calculated frequencies shown in Table 2 were obtained. Since the curve

cess as a whole with calculated theoretical success as 16 $\frac{2}{3}$  in 100. The difference as shown seems slight, but with such a large number of cases it is really enormous.

One of the "high spots" in receiving the charts from readers was one purporting to be 100 percent correct. The manner in which the chart was filled out, and the letter accompanying it, pointed toward something other than a desire to co-operate sincerely in our test and, therefore, it was not included in the compilation. In his submitted opinion, Dr. Prince deals specifically with this particular case. The following paragraphs are quoted directly from Dr. Prince's report:

"One of the charts is undoubtedly, as you declare it, of spurious character and not to be taken into account. I am confident that . . . it represents a delusion or is the quasi fraud of an abnormal person. No man of intelligent cunning would make the claims found in the accompanying letter, such as 'I can speak to each and every person in each and every part of the world by mental telepathy.' And the man is in solemn earnest, expecting to be believed. . . . It is a case involving megalomania.

"In view of the rather large number of casts, 60,000, the excess of even 1.91 percent over chance expectation would strongly suggest that there was a 'nigger' or several of them concealed in the chance wood-pile.

"A more feeble indication looking in the same direction, just enough to suggest the presence of the same 'nigger,' is to be found in the following figures: The expectation of chance hits per chart is about 84. I find that of the 120 charts here tabulated (Table 1), the number which reveal 25 or more correct guesses less in number than the expectation of 84 are 3, while those which have 25 or more hits in excess of the same are 13. Also that those which show 10 or more hits less than 84 are 12, while the number of charts showing 10 or more in excess of 84 are 28. The number of charts which show less than

Number of Correct Guesses	Number of Charts												
21	1	70	1	79	3	86	7	93	5	103	2	197	1
49	1	71	1	80	5	87	3	95	2	109	1	198	1
55	1	73	2	81	6	88	5	97	1	112	1	202	1
60	1	74	2	82	4	89	4	98	2	122	1	207	1
61	1	76	2	83	6	90	1	99	1	146	1	217	1
66	1	77	5	84	9	91	3	100	1	152	1	219	1
69	2	78	4	85	7	92	4	101	1	159	1	223	1
120 charts analyzed		48,859 incorrect guesses											
60,000 total trials		18.57 percent correct											
11,141 correct guesses		81.43 percent incorrect											
Expectation of chance—10,000 correct or 16.66 percent													
Expectation of chance on one chart (500 guesses)—83.33 correct guesses													

of the results is not Gaussian, and fractions were dropped as not affecting the final result materially, these figures cannot be taken as being absolutely accurate. They are, however, close enough approximations to reveal that the results obtained are not mere coincidence.

If, on the same basis, the figures be taken as a distribution of individual records, then:

$$\begin{aligned}
 N &= 120 \\
 \text{Observed } M &= 92.84 \quad \text{Calculated } M = 83.33 \\
 \sigma_{\text{dist}} &= 32.97 \\
 \sigma_M &= 3.01 \\
 \text{Diff.} &= 9.51 \\
 \text{Diff.}/\sigma_M &= 3.16
 \end{aligned}$$

The chances are 99,921 in 100,000 that the mean is significantly higher than chance would provide. This is based on comparing the observed suc-

10 divergences in either direction from the chance expectation of 84 are 83.

"The charts showing fewer hits than the 84 of chance expectation diminish by steps never greater than an intervening 6 points until we reach the lowest, 21, which is only a quarter of chance expectation and is separated by 28 points from the next highest report. Of course this very low figure is quite possible by chance and yet it raises a doubt whether something else than chance is not operating here also; it is possible that the recorder was confused by the rapidity of the operations or that he set down the letter 'W' a number of times when he should have written 'R', or did the same because of 'cussedness.'

"I have examined only the 10 charts of highest record. They represent the results obtained by 3 pairs of experimenters; Mr. and Mrs. J.M.S. furnish the three best charts, Messrs. J. and H. the next best. Mr. and Mrs. J.M.S. the next three, Messrs. S. and V. one considerably inferior to the foregoing but sufficiently striking, and Mr. and Mrs. J.M.S. the ninth and tenth in rank, the tenth falling below the 150 mark. I am satisfied by my own methods of analysis that all these charts were filled out in good faith. The education and understanding of Mr. J.M.S. are evident. J. and H. are college students.

ONE is, of course, struck by the high percentages of success in all of the Mr. and Mrs. S. charts which, as the experiments went on from day to day, showed an irregular rise from 29.4 percent in the first 500 to 44.6 percent in the last. I had rather expected that in consequence of weariness, if a large number of casts of the die were made at one sitting and any telepathy seemed to be involved, it would be less in evidence as the series progressed. Hence I studied results for each evening separately. On the first evening there were 300 casts, and per hundred, successively, the correct guesses were 38, 29, and 23, while the first half of the set of 300 had one run of three successive hits and eight runs of two, but the second half only two runs of two each. It seemed as though my expectation was to be realized but the casts of the next test told the reverse story, for the hits per hundred, successively, now were 26, 30, and 32, while the first half of the set showed six runs of two each, but the second half nine runs of two and two runs of three.

"The first hundred of the next series dropped back to 26 hits followed by 30 and 32. In fact, no rule relating to weariness is discoverable in the 4000 of the Mr. and Mrs. S. sets; sometimes the work was better in the early part of an evening's group but more frequently it was better later. Never on the second evening did any score per hundred drop as low as 26. On the other hand, on

none of the six subsequent experimental evenings was there anything like the astonishing 50 percent groupings of the second hundred of the third series.

"The J. and H. series of 500 throws of the die at one sitting resulted in 41.4 percent of successful guesses. Here again it is surprising to find no evidence of variation through weariness. The hits per successive hundreds were 23, 38,

might be made, the guesser unaware of the underlying facts because only 'right' and 'wrong' are registered. This seems a rather desperate theory.

"It would be very desirable that the most successful persons could be induced to try further series of experiments of precisely the same type." (See first paragraph of this article. *Editor.*)

"If three or four couples out of the total number which responded have given distinct and unquestionable signs of possessing telepathic powers, it is a larger percentage than I would have expected."

In Professor Murphy's report he points out that, as is to be expected, there are possibilities of error in any such test as this. He writes as follows: "From a strictly mathematical point of view the results are overwhelming in favor of a positive result. There are 99,921 chances in 100,000 that the actual guesses are due to something other than the factors ordinarily involved in legitimate guessing. I think there was probably some experimental error—careless glancing at the dice, use of worn dice, whose 'feel' was detected by the subject, and so on. There are dozens of possible violations of the rules. But the high standing cases must be followed up. This is important. I think you have something interesting."

THE third party whose opinion we sought on the results of our test was Mr. Joseph Dunninger who is widely known for his practical demonstrations of telepathy. Although in many cases these may savor of showmanship, this mere fact cannot be held to militate against Mr. Dunninger's judgment. We felt justified in requesting his opinion because of the deep study which he has made of various phases of mental phenomena. Mr. Dunninger writes as follows:

"I am highly pleased with the results obtained in the first SCIENTIFIC AMERICAN telepathy test, and feel that much credit is due to the many readers who gave their time and efforts in a serious endeavor to provide data on which to base a scientific analysis of the possibilities of telepathy by normal persons, under normal conditions. Of course my own experiences have positively convinced me that, under certain conditions, it is possible to produce telepathic results. You no doubt are familiar with the nationally known experiments which I have attempted from time to time, all of which have been successful. In most of these, however, I have achieved results that, so far, cannot be explained by any of the known laws of science. You no doubt will remember my recent experiment in projection of thought, in which I projected a mental picture of a drawing, a name, and a  
(Please turn to page 45)

**TABLE 2**

Number of Correct Guesses	Theory of Probability. Calculated Frequency	Actual Observed Frequency
6—15	0	0
16—25	1	1
26—35	2	0
36—45	5	0
46—55	8	2
56—65	12	2
66—75	16	9
76—85	17	51
86—95	16	34
96—105	13	8
106—115	10	2
116—125	6	1
126—135	4	0
136—145	2	0
146—155	1	2
156—165	0	1
166—175	0	0
176—185	0	0
186—195	0	0
196—205	0	3
206—215	0	1
216—225	0	3
	113*	120

\* See text for explanation of discrepancy in this figure.  
 † This lack of symmetry is partly due to arbitrary steps of ten units each. Even so, the curve is abnormal.

43, 46, and 48. In the course of the whole number of 500 casts there were six runs of five, one of six, and one of nine.

"To wager that nine guesses beginning at a particular point in a series of 500 will be correct would not be at all the same thing as to wager that such a run would occur somewhere in the series. The first wager would have one chance in 10,077,696 of winning.

"S. and V., achieving 31.8 percent of successes in their 500 trials did rather better during the first half than the second, but since the J. and H. results improved as hundred casts were added to hundred casts, while some of the Mr. and Mrs. S. charts tend in one direction and some in another, we can find no law here.

"I presume that machines which make dice make them uniformly. If a die were more likely to turn up on one side than on another and the percipient developed a number-guessing habit to correspond, a large percentage of correct guesses

# THE MISNAMED "PLANETARY" NEBULAE—

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

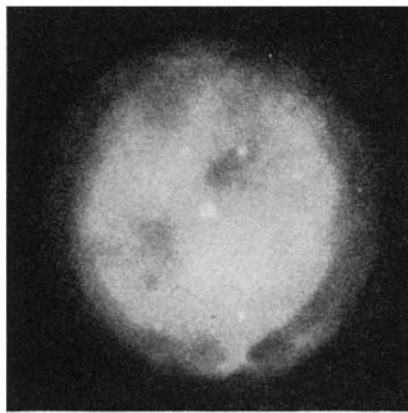
AMONG the thousands of nebulae which strew the heavens there are a few score which are distinguished by their greenish color, roundish form, and definite outline. These have been known for a century as the "planetary nebulae." This name was suggested by the fact that some of them in small telescopes appear as round or oval disks; but this is unfortunate, since they have actually not the least other resemblance to the planets, nor any relation to them.

That they are members of our galactic system, and not outsiders, is shown by a strong concentration toward the line of the Milky Way. That they, or at least their inside portions, are masses of luminous gas is evident from their spectra, which consist of isolated bright lines. Almost all of them have central stars so accurately centered as to make it very probable that they are really the inside of the respective bodies. This is proved to be true by their spectra, which are highly distinctive and full of bright lines or narrow bands. Most of the latter have been identified, and come from highly ionized atoms, indicating an exceptionally high temperature. This is independently confirmed by the fact that these are the bluest stars ever observed.

IS the star a mere incident in the nebula or perhaps a product of its development? Or is the star the parent, and the nebulous envelope its offspring? Twenty years ago this question appeared as hopeless as the famous one, whether a hen or an egg existed first, but we can answer it with confidence now. The star is the primary feature and without it the nebula would cease to shine. Bowen's beautiful discovery of the origin of the enigmatical nebular lines has long since been discussed in these pages, and we need only recall briefly here that the central star, being of very high temperature, radiates ultra-violet light of very short wavelength. This is absorbed by the gases of the nebula and ionizes them, often removing two or three electrons by successive action. The recombination of these ions with the liberated electrons brings about a steady state, and during the process light is emitted as the characteristic radiations of the gas. The density is so low that the separate atoms

are left undisturbed long enough to unload their whole store of energy by emission of the "forbidden" lines, which are difficult or impracticable to produce in the denser gas in our laboratory "vacuum" tubes.

All the energy which the nebular envelope radiates therefore comes from the central star. Now, to the eye or the ordinary photographic plate the nebula



Illustrations courtesy Mt. Wilson Observatory

Planetary nebula in Ursa Major, called the "owl" nebula because of its obvious owl-like resemblance

is far brighter than the star, hence the star must give out very much more radiation in the remote ultra-violet than in the visible region. The proportion of the two depends on the star's surface temperature and we have therefore a means at hand for estimating this. We can get only a minimum estimate, since the transformation of the invisible ultra-violet light from the star into visible light in the nebula is probably not complete. There are good reasons, however, for believing that the efficiency of the process, though not 100 percent, is fairly high; thus we can get a good idea of the temperatures of the nucleus. A careful study by the Dutch astrophysicist Zanstra led to the startling result that these temperatures range from 35,000 up to 100,000 degrees, Centigrade.

Now the hotter a body is, the more light it gives out. The rate of increase is slower for visible light than for the ultra-violet but, even so, a surface at 42,000 degrees (Zanstra's average) should shine more than 100 times more brightly per square mile than the sun's. We should expect, then, that the nebular nuclei would be bright objects. They

are actually extremely faint. Very few of them exceed the tenth magnitude and some are as faint as the 17th. Is this apparent faintness due to vast distance, or to small size?

This question can be answered only by measuring the distances of the nebulae, and here is a hard problem. Dr. van Maanen of Mount Wilson long ago put a number of the most promising of these objects on the observing list for parallax. The results of his observations indicated small but nevertheless measurable parallaxes, averaging about 0".012. The annual proper motions, however, approximately determined from the same plates, came out with an average value of less than twice this amount. Now the measures of radial velocity—which are easy and accurate for the bright lines in nebular spectra—indicate an average rate of motion equivalent to more than seven astronomical units per year; that is, the proper motion should be fully seven times the parallax. Here was a disturbing discrepancy. Either these nebulae were moving almost directly toward or from the sun, in about equal numbers—which is manifestly absurd, or else the measures either of parallax or proper motion were wrong.

THE utmost care and skill had been taken with the observations and the measures, but there was little doubt where the trouble lay. Measures of parallax demand the comparison of observations made at different seasons of the year and different times of the night. The slightest differences in the observing conditions—it may be in summer and winter—produce minute alterations in the results, which would be quite insignificant in other cases, but not here where the very limit of accuracy is sought. A slight difference in the arrangement of the density in the air in the hours after sunset and before sunrise, which caused the paths of the blue light of the nebular star and the yellowish light of the nearby stars used as points of reference to deviate by half an inch in passing through the 60 miles of atmosphere above our heads, would account for the whole discordance.

It is of no use to multiply observations in successive years, for the difference between the morning and evening observations, whatever its origin, would only repeat itself afresh. There is far less trouble to be anticipated in the determination of the proper motions,

# WHAT ARE THEY?

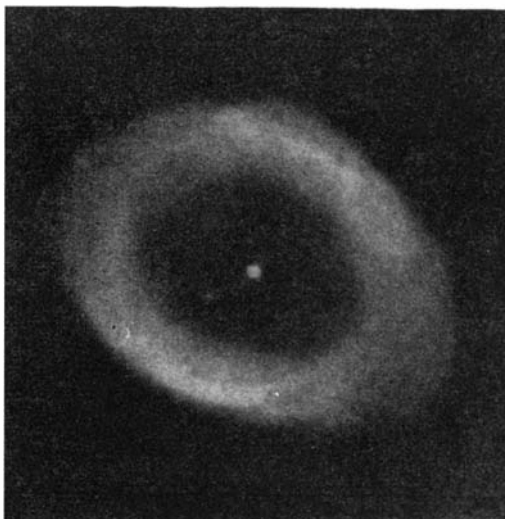
for these go on steadily in the same direction from year to year. The observations can be made at the same season and hour of the night and, what is more, they gave an accuracy increasing with the time. Even a very slow motion, if followed for many years, must ultimately amount to something measurable.

A decade or so ago Dr. van Maanen therefore started a special program of observations to determine the proper motions of as many planetary nebulae as possible. He has just reported on the results obtained for 21 of them, a number large enough to give a significant average. Plates taken 12 or 15 years ago were compared with recent ones, with every precaution to secure the utmost accuracy, and the measures showed unmistakable evidence of real, though very slow, motion.

**P**ART of this motion of the nebulae relative to the stars arises from the motions of the stars themselves, and especially from their drift due to the motion of the solar system in space. Fortunately it is possible to make an accurate allowance for this and to find the motions of the nebulae, referred to a fixed system of measurement. They are remarkably small, averaging only  $0''.007$  per year, and much less than the preliminary value found from the earlier observations which covered only a year or two. But, small as they are, they are reliable within some 15 percent of their own value. Small as they are they show definitely the systematic drift due to the sun's motion in space. Since the rate of this motion relative to the nebulae is known from the radial velocities, the average parallax of the nebulae can be found. An independent determination can be made by comparing the apparent motions at right angles to the solar drift with the "peculiar" radial velocities which remain after correction for the sun's motion and represent the motions of the nebulae themselves. The two agree as well as could be expected, and give a mean parallax of  $0''.0007$ , corresponding to a distance of some 4500 light-years.

This is the first reliable determination of the distances of nebulae of this sort and it leads to many interesting consequences. The average diameter of the nebulae in the observed list is  $45''$  which, with the given parallax, corre-

sponds to some 65,000 astronomical units or one light-year! If an exceptionally large and perhaps unusually near object is excluded, the mean for the remainder is  $29''$ . But even this is so great that it takes the light of the central star four months to reach the



The ring nebula in Lyra. This is overhead on summer evenings and its outlines can be made out with a six-inch telescope. While the central star is tiny—much more so than the sun—its mass is much greater than the sun's, like the tiny but massive companion of Sirius. The "ring" appearance is an illusion, for the nebula is spherical. We see through a greater thickness of gas near its periphery, hence its greater visibility at that point. Its diameter is about 4,000,000,000,000 miles, or two thirds of a light year, its distance 1500 light-years (data by Menzel)

periphery of the gaseous mass. Some are doubtless larger than this, and others smaller, but they must all be huge objects and it would be an insignificant one that did not have room within its boundaries for a hundred solar systems set edge to edge without overlapping of the outermost planetary orbits. If a typical example of these remarkable objects, in its wanderings through galactic space, should come as near as Sirius, its diameter would be twice the length of Orion's belt and its central star would appear brighter than Vega!

The central star of such a typical body gives out 15 times as much light, measured photographically, as the sun. To the eye it would have less than ten times the sun's brightness. Most of its radiation, as has already been said, is in the ultra-violet. Making allowance for this, van Maanen estimates the total energy radiation of such a star as

180 times that of the sun. With a temperature of 42,000 degrees this corresponds to a diameter  $\frac{1}{3}$  of the sun's. Many of these nebulae are conspicuously oval, and for these Campbell and Moore at the Lick Observatory find spectroscopically that one side is approaching us and the other receding, indicating a rotation of the vast mass. The observed rates of motion are a few kilometers per second. Without some central attraction the outer portions would fly off into space, and an easy calculation shows that to prevent this in an average nebula would require the gravitation of a mass over 200 times as great as that of the sun.

How much of this is in the nucleus and how much in the nebula is not easy to say. If it is practically all at the center the density of the nucleus must be 25,000 times the sun's and it must be a white dwarf star with its interior in the strange degenerate state predicted by the quantum theory. The smallest mass which can reasonably be assumed for the nucleus is six or eight times the sun's, if Eddington's mass-luminosity law is to be satisfied, and even this would make the density a thousand times the sun's; so that the degenerate character of the mass cannot well be doubted.

**H**OW much of the mass we may safely assume to be in the gaseous shell depends upon the laws of its equilibrium, which are still very imperfectly understood. If almost the whole of the mass were there—uniformly distributed throughout the vast volume of the nebula—this density would be  $4 \times 10^{-18}$ , that is, four milligrams per cubic kilometer, or one ounce to 1600 cubic miles! A wandering star—even a flying meteorite

might pass through this without the slightest disturbance. Yet in every cubic centimeter there would be more than 100,000 atoms (if on this average these were as heavy as oxygen). Whether particles of dust are present, as well as the gases which produce the spectral lines, we do not know. But the gases themselves are the very same that we take into our lungs at every breath—oxygen and nitrogen. Hydrogen is also present, and another familiar gas has just been identified. Boyce, Menzel, and Miss Payne (a most efficient team of younger investigators), in a report just made to the National Academy of Sciences, have identified the two strongest unknown nebular lines as forbidden lines of doubly ionized neon.

The similarity of the gaseous nebulae to thin air—very thin air—thus grows with our growing fund of knowledge. —Princeton University Observatory, April 5, 1933.



Part of a flock of snow geese near the Biological Survey's Lake Malheur Bird Refuge, Oregon

# KEEP MARSHLANDS FOR WILD FOWL

Much Reclaimed Marshland, Unfit for Agriculture, Should be Rewatered for the Benefit of Water Fowl

By **PAUL G. REDINGTON**

Chief, U. S. Biological Survey

**O**UTSTANDING among the causes of the great decrease in abundance of North American water fowl, has been the destruction of their natural habitat. Migratory water fowl nest and raise their young in the spring and summer months on marsh and water areas in the northern parts of the United States and in Canada. As fall approaches they journey southward in leisurely stages, feeding and resting as they have opportunity, many of them to take up their winter abode in favored places along the south Atlantic, Pacific, and Gulf coasts. With the return of spring, they migrate northward in the same manner, chiefly over the same flight lanes followed in the preceding fall, and the life cycle is again taken up on their northern nesting grounds.

When human settlement spread over the former domain of wild life, the first lands taken by the pioneer farmers were naturally those they could most readily till. Practically all land of this kind, however, had been pre-empted

more than a generation ago. Pressure for further agricultural development has become more insistent as the density of human population has constantly increased and as available lands have been appropriated for agriculture and other industrial operations.

Finally, the most attractive areas left for farming were such as could be obtained by drainage and irrigation. Although increased development of irrigation projects had a harmful effect upon the natural habitat of wild fowl, the real disaster to the birds came with the drainage of the marshes, shallow lakes, and ponds. About 77,000,000 acres have thus been drained, much of it without benefit to agriculture, and thus extensive areas of natural environment for migratory birds have been destroyed.

Thus, the resting and feeding grounds on the migration routes have not only in large measure disappeared, but now the birds can frequent such places as remain, only at great peril, by reason

of increased natural and human hazards. Ducks and geese can no longer journey in easy stages from one resting and feeding place to another. Instead of spreading out over a great range of country, where previously there had been many places attractive to them, they are now forced to settle in large numbers on relatively restricted areas. There they are even more greatly imperiled by hunters and by outbreaks of the diseases that are favored by their more dense concentrations.

**T**HE water fowl vicissitudes have been further increased by the fact that modern transportation facilities make it much easier for hunters to reach the areas where the birds can still congregate. The development of modern firearms also has made heavier the hunters' toll of the various species. Moreover, situations have arisen on certain of the western marsh areas of this country and in Canada where fluctuation of water levels has made these resting and feeding grounds death traps of disease to the birds. Though the Biological Survey has discovered the nature of the so-called "duck disease," it must be frankly stated that the losses can not be prevented where water levels on alkaline marsh areas of the west can not be controlled.

Sportsmen and conservationists soon



realized the danger in these varied conditions to a sustained abundance of wild-bird life. The rapid decrease in the numbers of water fowl encouraged first the passage of the Migratory Bird Law of 1913 and later the negotiation of the treaty of 1916 with Great Britain to protect the birds that migrate between the United States and Canada. This treaty was made effective in this country by the passage of the Migratory Bird Treaty Act of 1918, and in Canada by similar legislation. Under the provisions of the Federal legislation, spring shooting and market hunting of wild fowl have been abolished, and thus a major forward step has been taken looking to the conservation of these birds.

Co-operation in carrying out the terms of the treaty has been all that we could ask for from Canadian officials, both Dominion and provincial. They have problems akin to ours, some differing in degree, and they handle their own affairs as a joint party under the treaty obligation. From the states, as the years go by, heartier co-operation is being shown in the way of state aid in the enforcement of the migratory-bird regulations adopted by the Secretary of Agriculture and in the enactment of legislation conforming with the Secretary's regulations.

**C**ONVINCED that mere restrictions on hunting would not long save the birds, Congress in 1929 passed another act of equal importance in game conservation, known as the Migratory Bird Conservation Act. This authorized the appropriation of 7,875,000 dollars for the establishment of inviolate migratory-bird refuges, and contemplates that a nation-wide network of refuges shall be acquired by the Federal Government. Thus far, only a small part of the money has actually been appropriated.

In conducting investigations of proposed refuge areas throughout the country, and bearing in mind the former

great extent of favorable water fowl habitat, the Biological Survey has been impressed with the relatively small number of areas not pre-empted by agriculture or for hunting-club grounds that are still naturally attractive to migratory birds. In different parts of the country one or the other of these factors unfavorable to the birds may be dominant. Many lowlands have been unwisely drained for agricultural use. Some have been failures, and others only moderately successful. It is the opinion of many who are well informed that the failures, and possibly many of those places that have been only moderately successful for agricultural exploitation, should be restored to their natural condition.

**S**OMETHING along the line of restoration has been undertaken, but to correct great mistakes is costly. A few reclaimed areas have, through abandonment, reverted to a state approaching original conditions, but these are exceptions. Furthermore, many areas that have been abandoned have not yet returned to public ownership, the titles to the lands being still vested in persons who took them up for agricultural use. Though some are tax delinquent, their acquisition by the state is delayed by the great cost of conveyance and clearing titles, such, for example, as the bonded debts created in order to finance the development.

Two examples of efforts to correct unwise drainage and to restore the areas to something like their original condition are found in Thief Lake, Minnesota, and the Horicon Marsh, Wisconsin. Thief Lake originally covered more than 7000 acres. This area, together with Mud Lake, in the same locality and originally containing about 5000 acres, were among the finest breeding resorts for ducks and geese in Minnesota. Wild-fowl food plants, including wild rice and wild celery, annually at-

tracted thousands of canvasbacks, red-heads, mallards, widgeons, and other species of water fowl. In the days of the market hunter, literally carloads of water fowl were shipped from these lakes for sale. Not only were water fowl and other birds abundant in and around the lakes, but fish and fur-bearing animals also were found there in large numbers. Moose and deer were frequently taken in the vicinity, and the annual catch of muskrats was an important source of revenue to the farmers living near by.

More than a decade ago Thief and Mud Lakes were entirely drained, at a cost said to have been approximately 1,500,000 dollars. Two main ditches were dug directly through the lakes, and laterals traversed nearly every section line, covering an area about 20 miles wide and 35 miles long. This project, however, was a complete failure from the agricultural standpoint, and by 1929 approximately two thirds of the reclaimed lands had become tax delinquent.

**T**O rescue three counties from virtual bankruptcy, the state legislature passed an act to establish game refuges over a large acreage, through the expedient of issuing state certificates of indebtedness and reimbursing the counties. A steel-reinforced concrete dam has now been constructed to retain the water at Thief Lake. Opinions of well-informed persons differ as to its final success, but we are hopeful that in time this area will be restored to something approaching its original natural condition, and again provide an excellent habitat for wild life.

Horicon Marsh, which has been estimated to contain about 40,000 acres, in Dodge County, Wisconsin, was many years ago turned into an extensive lake through the construction of a dam, but in 1868 to help settle a controversy about land ownership, the dam was



Biological Survey field men collecting ducks suffering with botulism, a disease formerly known as "duck sickness"



Rescued ducks are allowed to recover in pens of clear, fresh water in sanitary surroundings, after which they are released



Making a wild fowl refuge indeed a sanctuary: sign erected at south end of Passage Key, Florida, to prevent boats landing and disturbing the wild fowl

torn down. By this act the lake bed was converted into a great marsh that extended about 13 miles on both sides of Rock River, thus providing one of the best breeding places in the country.

Two attempts were later made to convert the marsh into farm land by drainage, but neither was entirely successful. Though crop production on some of the drained land compared favorably with that on surrounding farms, there was a vast area too wet for agriculture, though not wet enough for water fowl. After several years' effort by the Izaak Walton League of America and associated groups and individuals, the state legislature in 1927 declared Horicon Marsh a wild-life refuge and authorized the construction of dams to raise the water level and maintain it at the stage existing prior to the drainage.

ONE of the places along the Atlantic flyway most famous as a resting and a feeding place for migratory birds has been the Back Bay-Currituck Sound region of Virginia and North Carolina. Though this area is not in the same category as Thief Lake and the Horicon Marsh, the modification of water conditions there has had results almost as disastrous to water fowl—in this case through removal of a canal lock. Formerly the aquatic plant life was so prolific, especially the species relished by the birds, that water fowl gathered there in untold numbers. Removing the lock increased the salinity and turbidity of the water, which in turn practically destroyed the plant growth attractive to the birds. The Biological Survey observed the changing conditions over a

period of many years, and long ago was convinced that something should be done in the interests of the water fowl. The theory evolved was that the desired improvements could be made by restoring the canal lock, and this has recently been done, by government engineers in co-operation with sportsmen and navigation interests.

The Biological Survey has recommended that conservationists throughout the country undertake to restore or establish small areas of marshland and water that have been attractive to migratory birds. Although such efforts would have chiefly local significance, they would serve to supplement the national program under the Migratory Bird Conservation Act for the preservation of the more extensive areas that still retain their water fowl attractions, and for the restoration of many celebrated water fowl resorts that have been destroyed.

The refuge program of the Biological Survey has been definitely formulated into a policy, which will be carried out when the funds authorized for appropriation under the provisions of the Migratory Bird Conservation Act are in fact appropriated. It will involve the purchase of numerous areas that have been drained without benefit to agriculture. Many of the refuges that up to this time have been established can be improved by restoring natural conditions and thus increasing their wild-life attractiveness. When the original purposes of the act are accomplished the serious conditions that confront our water fowl will be greatly alleviated.

However, not until we can record the establishment of hundreds of well-

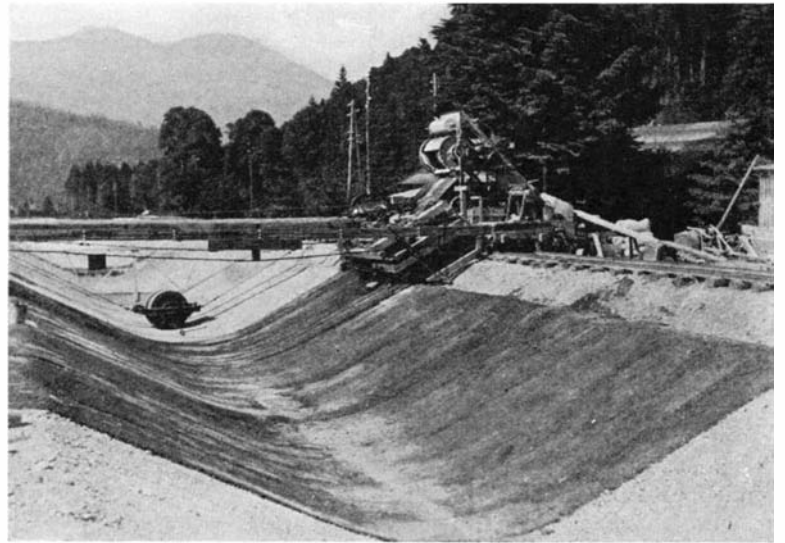
administered wild-fowl sanctuaries throughout the United States, not until we can reach the point where adequate enforcement of game laws and regulations is possible, not until more funds are made available to conduct research on conditions that face the water fowl—not until then can we be optimistic over the future of all species of bird life and anticipate the continued presence in significant numbers of ducks and geese. To reach such an objective there must be co-operation on the part of all concerned with the welfare of wild life. There must be constructive action by the thousands of gun clubs in the United States, co-operating with such organizations as the National Association of Audubon Societies, the American Ornithologists' Union, the Izaak Walton League of America, the American Game Association, and others. The work will also need the continued interest and support of those thousands of individual men, women, and children who are not shooters but who greatly desire as time goes on to see a plentiful number not only of our migrant water fowl but of the shore-birds and the non-game species, which also are protected under the Migratory Bird Treaty Act.

IN these parlous times we know too well that great trouble has come to millions of people throughout the United States. Unemployment is rife, and both the Federal and State Governments are endeavoring to formulate programs that may in some measure alleviate the situation. To some it might not appear seemly to compare with human distress the present plight of many of the species of migratory birds. On the other hand we are dealing with a natural resource of great value to the country. There are millions of people most deeply interested in the future of the ducks and geese. Large investments have been made for the acquisition and upkeep of game refuges and public and private shooting grounds. With a full realization of these matters, it would appear altogether logical to extend to the water fowl, in the degree necessary, such aid as will even now give them surcease from the harrying conditions that menace them in many parts of our great country. Moreover, providing thus for the birds may also be a means of furthering the programs for human betterment. I make a special plea, therefore, that those thousands upon thousands of people who see something of beauty and worth in the flight of the fast-winged teal and in the ordered movement of the honker, give thought to the needs of these birds and their kind, to the end that our wild fowl may continuously receive protection adequate for their present needs and to insure bountiful numbers in the years to come.

Flood control research in Germany. View of part of the 25 acres of the Forschungsinstitut für Wasserbau und Wasserkraft in the Bavarian Alps, Germany



Below: The engineers have ascertained how the Hwang-ho, which carries much mud, can be made to deepen its own bed by narrowing its high-water bed



Photographs courtesy German Tourist Information Office

A relatively thin asphalt layer is used, instead of concrete, to cover the beds of canals. The asphalt forms a tight, smooth, durable bed

## A Chinese River in Bavaria

PASSING through the upper Isar valley at the foot of the Karwendelgebirge, in the most beautiful part of the Bavarian Alps, one gets a view of the Hwang-ho. Coming upon it without warning, one might well be disquieted by the sudden fear that one's memory has failed. Surely the geography shows the Hwang-ho, the great Yellow River, as flowing through China.

So it does, and the river still flows there. What one finds in these Bavarian Alps near Walchensee is merely a model stretch of the river, 300 feet long, built by the Forschungsinstitut für Wasserbau und Wasserkraft (Research Institute for Waterways and Waterpower) at the request of the Chinese government to study ways and means of preventing the great floods and changes of course with which the troublesome stream so frequently afflicts China. The Institute, which was founded by Oskar von Miller, creator of the famous German Museum

in Munich, is at present arranging and studying the material gained in its experiments of the last few months, preparatory to making its report.

The Institute, which owns 25 acres of land and the equipment necessary to carry on such experiments on a large scale, constructed the stretch of the Hwang-ho strictly according to scale, and then set about creating the same conditions as in the river itself. Special attention was given to the volume of mud carried by the water and the amount deposited by it along its bed, both of these being the main factors responsible for the periodic inundations and destructive changes of river-bed. The water used to feed the model stream was charged with a coal mud of the same essential constituency as the Hwang-ho mud, and the volume of water was altered to produce all varying phases of the river.

After each spell of "high water" the river-bed was carefully studied to de-

termine how much mud had been deposited there or along the banks, and also at what points the water had carried away mud previously deposited. The chief end in view is to determine to what extent the Hwang-ho can be compelled to deepen itself by narrowing it and raising its banks. It is expected that the lessons learned by the engineers in these studies will be applied by the Chinese government to the Hwang-ho so that floods of that mighty river will be minimized.

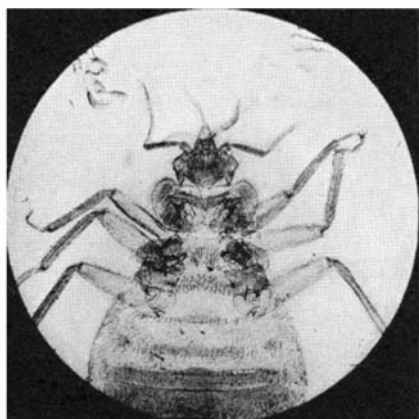
These experiments are but one phase of the work of the Institute, which carries on a constant study of the most important problems connected with regulating waterways and exploiting their power. One of the Institute's experiments has demonstrated, for example, that the usual method of constructing streets with asphalt can also be applied instead of concrete for lining the sides of canals.

**T**HE accompanying article is the first of a series which, it is expected, will carry the amateur microscopist pretty well around the horizon, covering not only the microscope as an instrument but various applications of it which the amateur may make; for example, photomicrography, the study of foods and fibers, the micro-aquarium, the microscope in the garden and in the field, in forestry, in chemistry, in selling, in industry, and so on. However, there will not be at present a special department in the magazine, devoted to the amateur microscopist, as has been urged by a number of readers. This may come later, depending upon the amount and kind of reaction to the present series.

The articles of this series have been prepared through the courtesy of the Bausch and Lomb Optical Company. This logical source of material assures the authenticity of the facts regarding the microscope and its use.—*The Editor.*

**H**AVING a hobby like microscopy is like having an unlimited ticket for journeys into a new land. Whenever you have an idle hour you can sit down at your microscope and go sight-seeing through a world so fascinating and interesting that even Mars could not compare with it. Seasoned with just a bit of imagination, the exploration of a tiny drop of water is as breathlessly exciting as a trip to the moon. Take up microscopy as a hobby and you have assured yourself of a wonderful vacation for every minute you can spend at your microscope.

Microscopy is not a science; it is a scientific art. Just as chemistry is not the study of poison, microscopy is not just the study of germs, for the amateur microscopist has the whole broad field of science through which to wander. Chemistry, botany, zoology, metallurgy—these and many more sciences all offer subjects for the microscopist.



Head of a bedbug, magnified 25 X

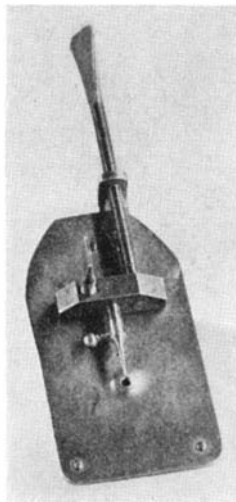
# THE AMATEUR AND

By **ERNEST H. ANTHES**

Manager, Bausch and Lomb Optical Co., New York Branch

In fact, the basis of most of our natural sciences is the knowledge that the microscope gives. At first, the amateur will survey all of these lands; later, perhaps, he will find himself following one path or another and finding in each twist and turn of that path new wonders, beauties, and drama to hold him at a high pitch of interest through many an evening.

Microscopy is a hobby worthy of the intelligent man, the layman who finds



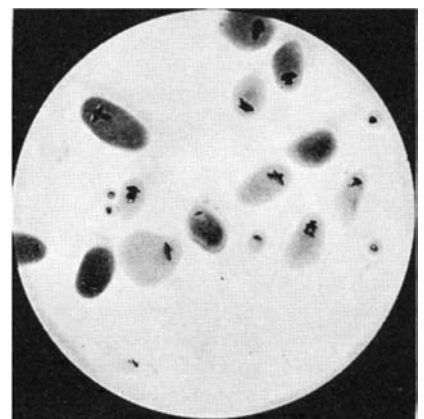
One of Anthony Van Leeuwenhoek's microscopes, made about 1673. This is the underside. Objects which were to be examined were placed on the point opposite hole

in the study of science a new interest and depth of life. And it is not a world which has been entirely explored by the scientist, where the amateur must necessarily follow only in the footsteps of the professionals who have gone before him. Throughout the history of all the natural sciences one finds the names of amateur microscopists now famous because of the contributions they once made, and there is still much to be done in this art which an intelligent man or woman with just a microscope, an inquiring brain, and a little ingenuity can do on a kitchen table, and do as well as the scientist buried like an ascetic in his white laboratory. Here, in this hobby, we who are tied to a workaday world can follow the trails of adventure and discovery that may perhaps lead us, the first of all men, to some new bit of knowledge of the world we live in.

Fifty years ago interest in the hobby of microscopy burned brightly throughout the world, but this interest was limited to the rich man, for then microscopes usually cost hundreds of dollars. Naturally, the interest died somewhat. But now on every side of us, since microscopes can be purchased for as little as five dollars, we find a new interest springing up.

**S**O many inquiries and requests have reached the *SCIENTIFIC AMERICAN*, that it has been decided to publish a series of articles dealing with the fundamentals of the art of microscopy, and introducing the amateur into the many sciences where the microscope can be applied. These articles will be written by experts who have spent years following some particular path along which their microscopes led them. There will be articles, first, on the microscope itself and how to use it. Other articles will tell you how you may see the unseen worlds that lie within your everyday world in the kitchen, the garden, the fields and ponds around you. These will not be involved articles weighted down with unfamiliar technical terms, but articles written by men who themselves are held by the fascination of microscopy and who know the questions the amateur will ask. They know, too, that the amateur microscopist has many other things to do, that he or she is primarily interested in the art as a hobby, an escape into a new world from the humdrum routine of our everyday lives.

Nor will these articles deal with thousand-dollar equipment, for the average amateur cannot afford to spend a great deal on his hobby. Indeed, mi-



Magnified grains of potato starch

# HIS MICROSCOPE—I

icroscopy is one of the more inexpensive hobbies. Once the original equipment is bought, there is practically no cost attached to it.

Of the original equipment, the most important item is the microscope itself which, as was stated above, can be purchased for as little as five dollars; or you can spend nearly 1000 dollars for it if you wish. Second-hand standard microscopes can be purchased for as little as 25 dollars, and there are excellent small microscopes on the market for 18 dollars. If you can afford it, however, one of the standard microscopes selling for between 75 and 100 dollars will give you a great deal more satisfaction, and will probably be cheaper in the end. These microscopes are so designed that additions can be made to them later on as you feel the need. All the parts of those made by the large optical companies are standard. Thus you can purchase a microscope for about 75 dollars which will give you magnifications ranging between 50 and 430 times; to this you can add, or have the manufacturer add, optical equipment or other accessories that will make your microscope complete for advanced amateur work.

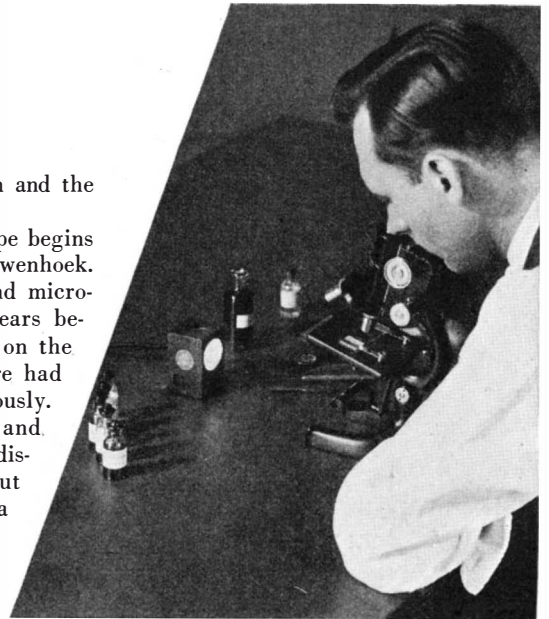
**B**ESIDES the microscope, the only other equipment actually needed is a small microscope lamp which you can either make yourself or purchase for about five dollars, some slides, cover glasses, a magnifying glass, a razor, some eye-droppers, and a few needles. Later you can add, a little at a time, other inexpensive items such as small bottles of dye, xylol, Canada balsam, immersion oil, bottles, and a few other things that all range between 50 and 75 cents each. The accessories you will need will be explained in detail in the third article of this series. Your specimens will cost you nothing

but the fun of collecting them and the interest in preparing them.

The history of the microscope begins with an amateur, Van Leeuwenhoek. Both the simple and compound microscopes were invented some years before Van Leeuwenhoek came on the scene, but only here and there had anyone really taken them seriously. The circulation of the blood and a few other things had been discovered with the microscope, but not until Van Leeuwenhoek, a petty official and linen draper in the town of Delft, Holland, took up microscopy as a hobby were the real possibilities of the instrument seen. Van Leeuwenhoek, with his enormous curiosity and patience, made his own lenses and then proceeded to peer into everything around him. Even the water in the rain barrel was not too absurd a thing for him to explore; and there, for the first time that we know of, a man saw the teeming life that swarms in that sub-visible world beyond the sight of our naked eye.

**V**AN LEEUWENHOEK, the linen draper, became famous, was made a Fellow of the Royal Society of England, was visited by kings and queens, and the great intellects of the world paid him homage. He seems, however, to have been a little ahead of his time, for after his death the microscope once again fell into oblivion until Pasteur, a French chemist, became curious about the spoilage of wine in his neighbor's vat. Van Leeuwenhoek's "little beasties," Pasteur found, were not as harmless as they appeared. For a man such as Pasteur, bacteria in a wine vat was but a step from bacteria in human beings, though he was a chemist and not a physician at all. So this amateur microscopist, Pasteur, turned from his chemistry to professional peering into the microscope and thus started the new science of medicine and the whole glorious history which the instrument has made since his day. Ever since his time human ingenuity has used the microscope for opening up new discoveries in biological, medical, and chemical sciences; it is a most valuable ally in technical fields and has practically revolutionized our daily life. Could the amateur ask for a more interesting hobby?

The microscope affords a source of inexhaustible entertainment to the amateur, because he finds in its use a highly

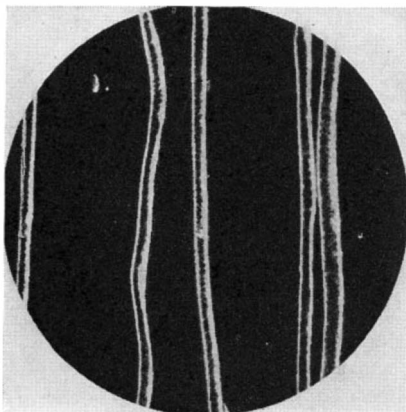


The amateur hard at it, with a small array of simple working equipment. Note little lamp

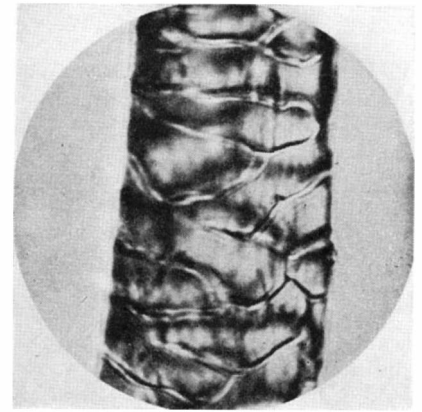
educational diversion which, unlike many other hobbies, is not seasonal and which can be enjoyed throughout the year. Through the spring and summer you have all the life in the field, pond, and garden; in these fields of investigation the microscope will show things of which you had scarcely dreamed before. In the winter months and on rainy days you can spend many an hour examining textiles, woods, food-stuffs or some of the many specimens you have collected on sunny days but found no opportunity to inquire into thoroughly.

The series of articles starting with this one will tell you the whereas and hows and whys. Next month Mr. L. V. Foster of the Scientific Bureau of the Bausch and Lomb Optical Company will explain that which so many of us take for granted, but which so few of us know—how a microscope turns "an ant into an elephant."

In the meantime, visit a scientific instrument dealer and ask him to show you his microscopes and accessories. You will find him glad to explain their details.

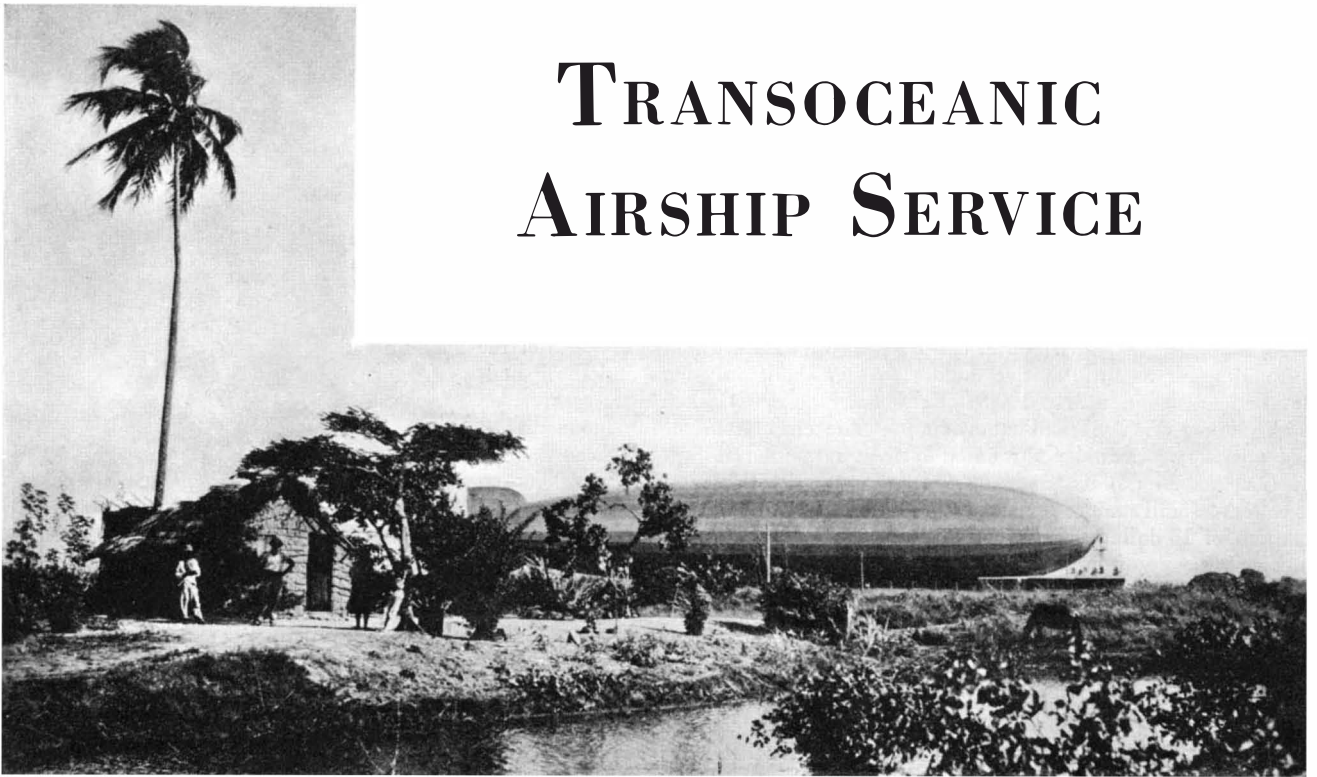


Wool fibers magnified 100 X



A wool fiber magnified 1000 X

# TRANSOCEANIC AIRSHIP SERVICE



The *Graf Zeppelin* at her mooring mast at Pernambuco, South America

By **WOLFGANG LAMBRECHT**

Manager, Aeronautical Division, Hamburg-American Line, New York

**W**HEN Count Ferdinand Zeppelin, to whose tireless energy and faith the development of rigid airships is chiefly due, successfully navigated his first airship in 1900, the vision of fleets of dirigibles spanning the sea in steady travel had already formed in his mind. This dream did not materialize during his lifetime, although Germany saw the commercial as well as the military possibilities of this new means of transportation.

As early as 1910 to 1914, six airships were placed in regular service, and terminals were set up at various points in Germany. These ships gave a remarkable demonstration of safety and dependability by carrying close to 40,000 passengers on 1600 trips without accident or mishap. This is an unparalleled record, and seems incredible when we realize what the rest of the world was doing with aircraft as a means of transportation 20 years ago.

**W**HILE the technical operation of these airships was in the hands of the Luftschiffbau Zeppelin Company, Ltd., in Friedrichshafen, which was the world's first air-transportation company, the management of the cruises, including the passenger and freight service, was entrusted to the Hamburg-American Line. Thus, the voyages were in every respect commercial as well as scientific ventures.

In the Zeppelin plant during the World War, standardized parts and efficiently trained workmen made it possible for the shops to turn out 88

**W**HATEVER may have been the causes of the fate met by several lighter-than-air ships in recent years, the record of the *Graf Zeppelin* in commercial service during 1932 shows that a properly designed and constructed airship, manned by adequately trained men, can meet and conquer the forces of Nature in transoceanic travel. Many lessons have been learned and more are ahead; the future status of airship transportation for passengers and freight is still in the balance. The present article tells what has been done, what is contemplated, and hints at the part which airships may play in world transportation in the not too far distant future.—  
*The Editor.*

airships at the rate of about one every six weeks, making a total of 115 from 1900 to 1918. Count Zeppelin himself died in 1917. He did not live to realize his ambition of passenger lines over the Continent and to America, but he witnessed, during the World War, the military value of the airships, in conjunction with the navy, in patrol, scouting, mine-sweeping and bombing operations. The War, as the great laboratory experiment in lighter-than-air,

was to bring about the development of airships beyond the boldest dreams of the inventors, and that progress once set in motion was not to cease with the signing of peace, but was to continue throughout the world.

**I**T was the coming of the *Graf Zeppelin*, in October, 1928, that marked the first step in regular transoceanic passenger, mail, and freight service by air. As a technical experiment the famous airliner has shown four things: first and foremost, that airship operations are practicable in all climates from the arctic to the tropics; second, that 96 percent of the flights were started on time; third, that flights once started were continued regardless of the weather; fourth, that in a mechanical breakdown at sea (when four out of five engines were disabled) and in another case of serious structural damage, the airship could proceed safely to the nearest port just as a steamship might do in similar circumstances. The *Graf Zeppelin* has met every possible kind of weather in her voyages to different parts of the world, including typhoons in the Orient, tropical cloudbursts off the coast of Brazil, and North Atlantic gales.

The year 1932 constituted a turning point in the development of lighter-than-air craft; on March 20, 1932, the first regular scheduled transoceanic air ser-

vice ever undertaken by any aircraft was inaugurated. Although the *Graf Zeppelin* had made many an adventurous voyage in the past and her operators were well aware of her great possibilities, never before had the general public considered it feasible to employ such an airship on a scheduled service. The publication of her schedule giving definite departure and arrival hours was generally regarded as hazardous, but now even the sceptics have been convinced by the results of the first series of nine voyages between Europe and South America during 1932.

**A** COMPARISON of the completed voyages with the advance sailing schedules shows that the airship frequently arrived ahead of time—for instance on the 62-hour record trip from Friedrichshafen to Pernambuco. Instead of the estimated 72 hours, the average time for the southbound voyage was but 68 hours. The homeward trips averaged only 90 hours as against an estimated 96. An even more remarkable fact is that, if the 18 different routes covered by the airship were charted on one Atlantic map, they would practically overlap. They differ only over the land, where they might be compared to a river delta, converging at Friedrichshafen. The story of the weather conditions encountered en route would be revealed on this chart. Over the ocean, meteorologic conditions have been so uniform that the most advantageous course could invariably be followed. Only in Europe weather conditions varied, and this brought out one of the greatest advantages of airship travel. The speed of the ship allows the navigators to choose their course, taking advantage of favorable winds and avoid-

ing storm centers through which a surface vessel is forced to fight its way.

From the time the *Graf Zeppelin* was first placed in service in 1928 until the end of 1932, the ship made 290 voyages, including 33 ocean crossings, traveling 330,000 miles in 5370 hours, at an average speed of 61 miles, and carrying almost 17,000 passengers, 35,000 pounds of mail, and 80,000 pounds of freight, without accident or mishap—indeed a remarkable demonstration of safety and dependability.

It is not surprising that the first transoceanic air service was established between Europe and South America, this being a route combining the greatest possible saving of time with favorable atmospheric conditions. There is considerable demand for a rapid transportation between Europe and South America, particularly as there is no regular express steamer service as on the North Atlantic; therefore this route should prove particularly advantageous. Mail traffic is naturally of special importance to the airship and plays a great part in making profits. The Luftschiffbau Zeppelin Company has always maintained that airship traffic to South America could be put on a profitable basis; in 1932, however, this could not be definitely accomplished for the following two reasons:

1) It must be remembered that, during 1932, the *Graf Zeppelin* made semi-monthly sailings, hence it was hardly likely that the airship would have a capacity payload. European business houses writing to South America and consigning goods there are not going to wait for two weeks after an order is received for the sake of making the trip in three days. If trips were made weekly, as they will be this year with two airships in service, the history of transportation both on land and at sea indicates that the business for each ship would be increased and overhead expenses cut appreciably. In other words, by adding another airship to the service, the income would at least be doubled, whereas expenses would be increased by only 40 percent.

2) The terminal at Pernambuco was not very advantageous for this service. The Zeppelin company real-



In one of the comfortable passenger cabins on the *Graf Zeppelin*; the upper berth is folded

ized this from the beginning, as few passengers would care to make an extra airplane trip to or from Rio de Janeiro. This was proved last fall when several of the voyages were extended to Rio de Janeiro. For example, 30 applications were made for the last trip from Rio to Friedrichshafen, some of which had to be rejected, as the airship can take but 24 passengers. Thus the Zeppelin company can count on capacity sailings on voyages extended to Rio de Janeiro, which would obviously place the service on a self-sustaining basis.

**T**HE total income from 24 passengers on one voyage would amount to 11,400 dollars. Income from the mails carried cannot be estimated definitely, but, based on last year's figures, which undoubtedly will be increased in time, it would amount to at least 14,000 dollars. Of course, a part of this income must be turned over to the German postal authorities to the amount of about 2400 dollars. This would bring the total income of one voyage to or from South America to 23,000 dollars, which estimate is more likely to be underrated than too high. As the cost of a voyage between Friedrichshafen and Rio de Janeiro has so far amounted to approximately 20,000 dollars, the net profit would be 3000 dollars.

Only one fourth of the cost is for operating expenses, while depreciation and upkeep of the ship are the main factors. However, as soon as a standard type airship can be produced and the service placed on a weekly basis, the trip cost will drop considerably, possibly to 15,000 dollars. This would make it possible to operate economical voyages between Europe and South Amer-



Photos courtesy Hamburg-American Line

Loading transoceanic mail bags through an open hatch in the under side of the airship

ica, even at the present passage rate of 475 dollars, although an increase in the fare would be quite justified, considering the saving of time and the prospect of improved business conditions.

In 1932, an average of only 11 passengers were transported between Germany and Brazil in either direction, which meant an income of approximate-

strategic location for international air traffic. From here the best connections can be made to all important points in central Europe, which will undoubtedly result in an increase in passenger traffic. Not only in Barcelona but also in Sevilla, mooring masts, hangars, and gas plants are being erected.

During 1932, nearly half a million letters were carried, besides a great

at Friedrichshafen would permit. Accommodations aboard are adequate, comfortable, but without luxury. Each stateroom, of which there are 12, is fitted with a table, chairs and one long seat which at night becomes a double-decked bed. Like most pioneers, the *Graf Zeppelin* has certain minor disadvantages. Because the ship is hydrogen-inflated, smoking on board is prohibited. Passenger accommodations are in an external cabin and reduction of wind resistance demanded that this cabin be restricted in size.

Passengers make allowances for certain shortcomings now, but they will expect certain things from regular airliners in the future beyond those that the *Graf Zeppelin* can now offer. No one expects the airship to furnish competition or even to become a dangerous rival of the first class passenger ship. The surface lines will always carry the great bulk of ocean traffic. The airship is designed to carry that small percentage of traffic for which time is sufficiently important to warrant excess fare.



The payload. Part of the freight to be carried by the *Graf Zeppelin*

**A** NUMBER of improvements are incorporated in the new leviathan of the air which is now nearing completion in Germany and which is to supplement the South American service of the *Graf Zeppelin*: roomier cabins, with running hot and cold water, more spacious and comfortable social rooms, bath rooms, promenade decks on both sides of the ship next to the outer walls, and a large smoking room, thus affording more freedom and ease of movement to the passengers than was possible on the early airships. This new airship, *LZ-129*, which is to be the world's largest lighter-than-air craft, will have a displacement of 7,070,000 cubic feet, and will be the first Diesel-propelled airship, equipped with powerful crude oil motors, developing a speed of more than 80 miles an hour. Fire hazard is eliminated by the use of helium gas, and of crude oil as fuel. The capacity of the ship will be 50 passengers and a crew of 35, with 10 to 18 tons of additional payload.

**T**HE airship and airplane differ in that the airplane is primarily a fast, comparatively short radius craft, while the airship is slower and reaches full efficiency only on long voyages, particularly across oceans. In the aviation of the future, there is every reason to believe that the airplane will find its place as the carrier for relatively shorter distances—even making contact with the dirigible as has already been successfully accomplished during the regular Germany-Brazil service of the *Graf Zeppelin*, and that the dirigible will be the vehicle of transcontinental and intercontinental travel.

ly 5200 dollars. The Zeppelin company is, of course, endeavoring to dispense with government subsidies, which have covered operating losses in the past, and to render the service self-supporting. With this in view, the Zeppelin company has negotiated with the Brazilian Government, which has always been most accommodating, for the construction of a hangar at Rio de Janeiro, and a sum has been appropriated for the purpose. This will make a continuous schedule possible, and obviously, if an airship service is to prove profitable, it must be operated throughout the year. Work has already been started on Rio de Janeiro's new airport, which will be the most modern in the world. It will cost about 500,000 dollars and will be located on Ponta do Calabouco, a small peninsula extending out into Rio de Janeiro Bay. It will be only three minutes from the heart of the downtown business district, which will bring the city and its airport closer together than those of any other large municipality in the world.

**F**RIEDRICHSHAFEN is also not ideal for airship sailings, as at this altitude winter fogs and low lying clouds would handicap the regular operation from there through the mountainous districts of southern Germany and France. For this reason, it has been decided to make Barcelona the winter terminal, and particularly because of its

deal of printed matter, packages, and freight. No less than 200 passengers took advantage of this ideal air transportation, cutting travel time down to three days from 12 on the fastest steamers and 20 on the slower boats. A German business man can have an answer to his letter to Rio de Janeiro in 12 days; a German traveler can take a three-week trip to South America, spending two weeks there. From Rio de Janeiro it is even possible to plan for a two-week absence, which will include a three-day visit in Berlin.

Connecting airplane services are operated by the Deutsche Luft Hansa, the largest European air transportation company, and its subsidiary, the Brazilian Condor Syndicate, from Friedrichshafen and Rio de Janeiro to all important points in their respective continents, thereby bringing the chief markets of South America within three to five days' travel from the trading centers of Europe. This combined airplane-airship service, which was carried out on a fixed schedule for the first time in 1932, may be looked upon as the nucleus of a growing air transportation organization which some day may link all the continents of the world.

The *Graf Zeppelin* was built, under the financial difficulties of post-war conditions in Germany, by popular subscription and in part with government subsidies. She was built as an experimental ship and as large as the hangars



# SNAP-SHOTS OF BULLETS IN FLIGHT

By C. T. ERVIN

**A**MMUNITION functioning is investigated by the Peters Cartridge Company by means of a special type of photography, termed spark photography. The duration of the exposure of spark photographs is approximately a millionth of a second. The illumination is provided by the light from an electric spark of controlled duration which determines the exposure time. To one unaccustomed to dealing in small fractions of a second, the exposure time may represent merely a figure, but—20,000 spark photographs would have the same total exposure time as one snapshot with an ordinary camera set at 1/50th of a second exposure.

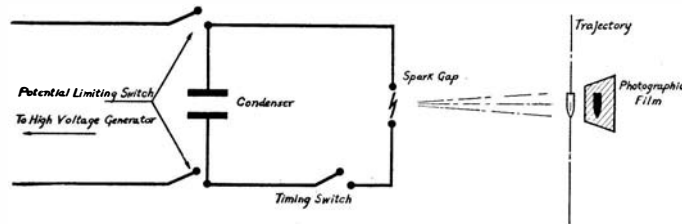
In the method of spark photography developed by Mr. C. V. Boys and Captain Philip P. Quayle, the procedure is carried out in a dark room. The apparatus and the film are set up as shown in the diagram. The condenser is charged to the proper voltage after which the potential limiting switch operates and disconnects the condenser circuit as indicated. When this operation takes place the condenser is charged to a voltage that will produce a spark at the spark gap on closing the timing switch. The timing switch is adjusted to discharge the condenser at the spark gap when the bullet is between the film and the gap. The time lag between the instant the trigger is pulled and the instant the bullet or shot charge reaches its position between the spark gap and the film—at which instant the photograph is made—must of

course be calculated beforehand. This calculation is based on the barrel time and muzzle velocity of the bullet or shot charge. The spark furnishes illumination to produce a silhouette of the bullet on the film as shown. The spark gap is of a special design to prevent the image from being unduly fringed or blurred. The flight of the bullet is not in any manner influenced by the timing or

chosen distance from the gun. The distribution of shot pellets from a shot-gun has been recorded on film by means of this equipment. Photographs of shot charges have been made at ranges up to 40 yards from the gun with this apparatus. The pellets are shown and their distribution along the line of flight can be determined. There are no other known methods of accurately obtaining the desired information. These photographs, 4 feet wide and 20 feet long, are probably the largest ever made.

One of the spark photographs reproduced here shows the leakage gas from a shot shell loaded with inferior wadding. All of this gas charge represents wasted energy that has been permitted to leak by the shot. Such visual records eliminate the necessity of guessing at the amount of leakage gas.

The other spark photograph is of a .30 caliber Springfield rifle firing a Peters boat-tail bullet. The "V" shaped lines from the nose and base of the bullet are sound waves. The section of the sound wave shown about one bullet-length back of the bullet is from the muzzle of the gun and it is approximately round in shape, being about 2 feet in diameter. The bullet was moving at a speed of approximately 1/2 mile per second when this photograph was taken.



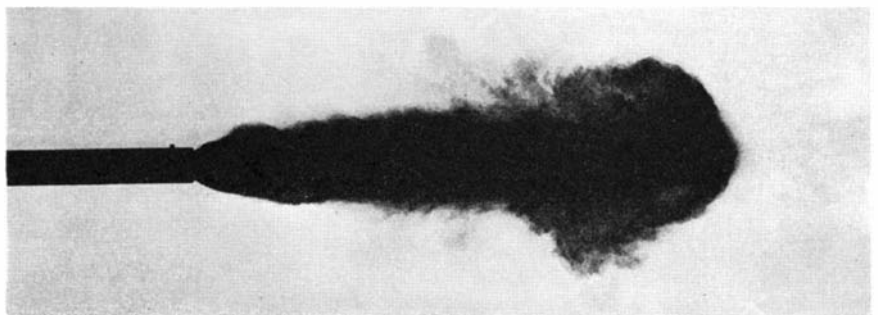
The set-up of the apparatus for photographing a bullet or shot charge in flight, on the photographic film at right

photographing operations. The exposure having been made, the film is developed and printed in the same manner as any other photographic film is processed.

In the same manner shot charges, leakage gas, gun functioning, and phenomena of a related nature can be photographed.

Photographs that are made by this method are used in locating troubles which develop in ammunition design and to show the effects of changes in the components of ammunition. Records of this sort show the exact position of all components of shotgun loads at any

**Right:** Leakage gas from shot shell with inferior wadding. **Below:** Bullet, propelling gas, and sound waves from .30 caliber Springfield. See text, above at right



# THE MINERALS IN MILK

By JAMES A. TOBEY, D. R. P. H.

CONSUMERS of milk recognize that it is a valuable food but they seldom realize that it is a natural source of at least 25 different minerals. Those persons who can claim some familiarity with the modern science of nutrition may know that milk is our best dietary source of the important lime salts, or calcium phosphates, and they may be aware that it supplies several other desirable minerals, but even these cognoscenti may be surprised to learn that milk also contains lithium, strontium, vanadium, rubidium, titanium, and germanium—all rare elements.

Although milk solids comprise only one eighth of the volume of cow's milk and the minerals constitute only a little less than 1 percent of its total bulk, the average milk supply customarily possesses nearly one third of all the known chemical elements. None of the many minerals in milk is visible because all are in solution or suspension, usually in various combinations with organic or inorganic substances. Some of these minerals are relatively abundant, while others are present in such small quantities that only unmeasurable traces of them can be detected by chemical analysis.

THE minerals of milk are separated from it by incineration at a low red heat. At the end of this process there remains a white ash which shows an alkaline reaction. About one eighth of this ash is calcium, a little more than an eighth is potassium, one tenth is phosphorus, another tenth-plus is chlorine, and about one twentieth is sodium. The residue contains appreciable amounts of sulfur, magnesium, and iron, in that order. Only traces are found of silicon, boron, and the group of minerals mentioned in the first paragraph above. Occasionally the analyst will encounter traces of barium, chromium, tin, and silver in milk.

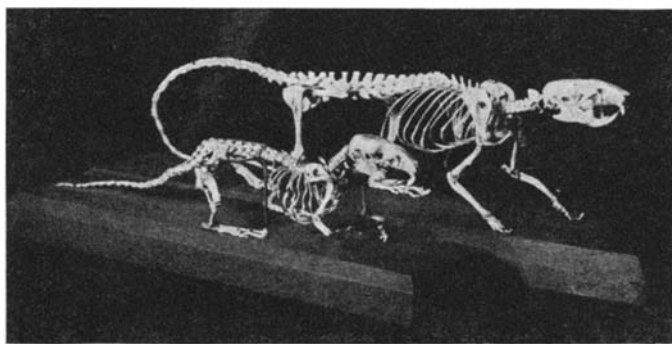
Since the minerals constitute only 1 percent or less of milk, the remainder of it is made up of organic compounds of hydrogen, oxygen, carbon, and nitrogen, which form the butter-fat, proteins, and lactose, or milk sugar. Sulfur and phosphorus are also represented in the three principal proteins in milk, the

nutritional functions of which are to replace and repair bodily tissue. Casein is the chief of these proteins, the other two being known as lactalbumin and lactoglobulin. Several others are also present, but in exceedingly small amounts.

The various minerals found in cow's milk are, in general, the same as those which occur in the human body. Our bodies are comprised of some 65 percent oxygen, 18 percent carbon, 10 percent hydrogen, 3 percent nitrogen, 1.5 percent calcium and 1 percent phosphorus. The remaining 1.5 percent is

needed to furnish the daily gram of the mineral is one quart, or 908 grams. The calcium in milk is, furthermore, in a form which permits of the most favorable storage in the body, for scientific investigations have demonstrated that this type of calcium is utilized more completely and efficiently than is the calcium that occurs in vegetables. The daily quart of milk has the advantage of supplying plenty of phosphorus, as well as protein and the vitamins which are so essential to growth and good health. The body needs about twice as much phosphorus as calcium.

The activator of calcium is vitamin D, sometimes known as the sunshine vitamin, because the ultraviolet rays of sunlight acting on the skin or upon certain food fats will stimulate the formation of this antirachitic vitamin. While milk contains some vitamin D, the quantity is not sufficient to prevent rickets. Dependence for an adequate quantity of vitamin D in the diet must, therefore, usually be placed upon other foods rich in this substance, such as cod-liver



Courtesy Prof. H. C. Sherman; from "Chemistry of Food and Nutrition," Macmillan  
**Skeletons of two animals—twin brothers—showing the detrimental effects of calcium deprivation. The larger animal received milk in his daily diet; the smaller did not**

made up of many different minerals, the functions of some of which are as yet unknown. The dietary duties of a number of the minerals in milk are also enigmatic, but they are probably in this food for a definite purpose.

Calcium and phosphorus are the most significant of the many minerals in milk, since these are the elements needed for the construction of the bones and teeth. If calcium is lacking in the diets of young children, growth is retarded. In cases of severe deprivation of this mineral and of the substances which cause it to deposit, a troublesome bone disease known as rickets will develop. Adults likewise need a supply of calcium, although not as much as do children whose skeletal structures are in the process of formation. Pregnancy and lactation increase the need for calcium.

Scientific experiments have shown that not less than one gram of calcium, or about half as much as there is in one front tooth, is required every day by the growing body. Since cow's milk averages 0.12 percent calcium, the minimum amount of this particular food

oil or egg yolk. The amount of vitamin D in milk may, however, be increased by scientific feeding of the cattle with irradiated yeast, or by irradiation of fluid or powdered milk. There are now on the market a number of "vitamin-D" milks, the proper use of which will prevent and cure rickets. The milk furnishes the necessary lime salts, and the vitamin D causes proper deposition of these minerals in the bones.

Another attribute of the calcium in milk is its favorable effect upon the assimilation of iron. While milk contains only 0.00024 percent of this particular mineral, or a little over two milligrams to a quart, what there is of it is of exceptionally high food value. The body itself has only 0.004 percent iron and requires a daily intake of only from 6 to 16 milligrams, or about as much iron as would be equivalent in size to the head of a pin. The higher figure is necessary only when the calcium intake is deficient.

Modern research has proved that copper functions with iron in bringing about the assimilation of iron to form hemoglobin in the blood. When there

is a deficiency of hemoglobin, the condition known as anemia results. Milk contains a small amount of copper—about 0.27 milligrams in a quart. Compared to other foods, such as liver, nuts, legumes, and cereals, the amount is slight. It is interesting to note, however, that a diet of whole wheat bread and milk supplies an adequate quantity of iron and copper for human nutrition. Such a combination is, in fact, a perfect diet from every nutritional standpoint, and will sustain life indefinitely.

**W**ITH the exception of iodine, the amounts of the minerals in milk are more or less fixed and vary only slightly in content. There is some recent scientific evidence to indicate that the calcium and phosphorus in cow's milk may be slightly increased by irradiation of the cattle with carbon-arc lamps, and that such milk will be more effective in preventing or curing rickets than ordinary milk. Although the content of certain vitamins in milk can be greatly increased by scientific feeding of cows, the important minerals in milk are, in general, not appreciably affected by such measures. The presence of some of the rare minerals may, nevertheless, be influenced by the chemical composition of the cows' rations.

Iodine can be increased in milk by feeding aliments containing iodine, such as kelp, to the cows producing the milk or by adding an iodine compound to the feed. Similarly, the iodine content of milk supplies in different parts of the country will vary somewhat, according to the richness of the local feeds in this substance. Since iodine is important in nutrition because of its influence on the thyroid gland and as a preventive of goiter, proposals have been made for a deliberate increment of this mineral in milk. Medical author-

ities believe that such procedures may be helpful so long as the administration of iodized milk remains under the control of physicians familiar with individual cases, but they are skeptical as to the value of, and lack of harm from, shotgun methods.

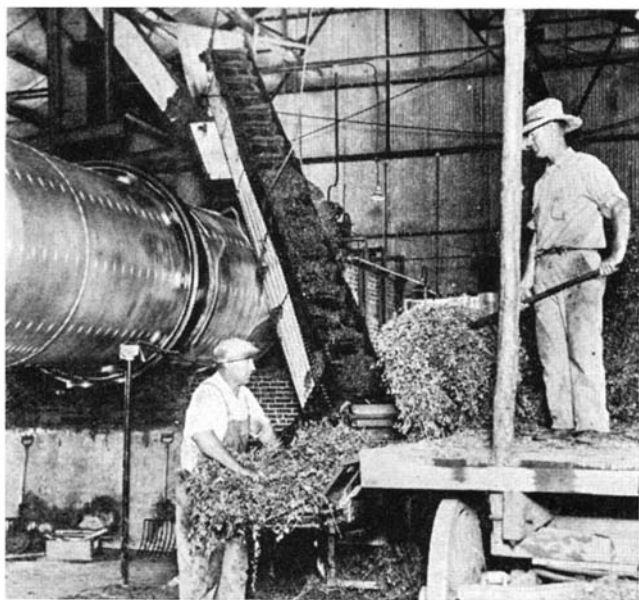
Regarding the prophylaxis of goiter, the *Journal of the American Medical Association* says: "Milk doubtless can be useful in such endeavors, as can other food products. The mode of preference should be left to the physician, however, and not to the food propagandist."

When milk is processed, as by pasteurization, condensing, or drying, it may acquire small quantities of metals from the apparatus employed. Thus, the drying of milk on steel rollers causes a slight increase in the iron content of the resulting milk powder, and the manufacture of evaporated or condensed milk in large copper vacuum pans may add tiny amounts of copper. Such increments are beneficial and not

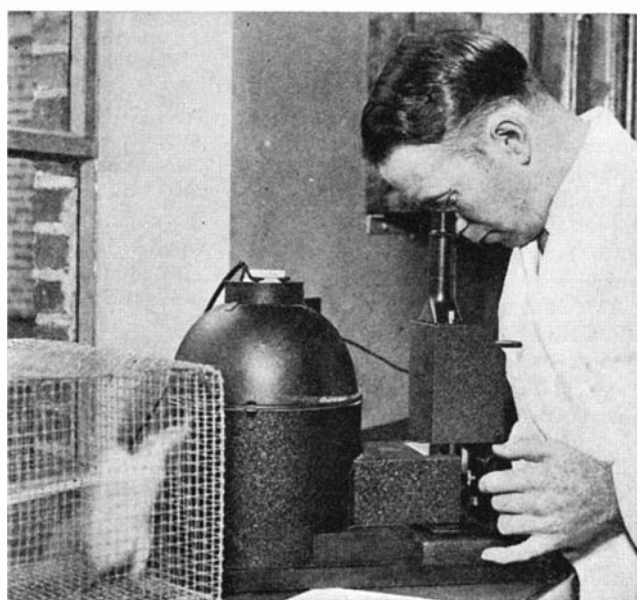
harmful, as the quantities are very small and the minerals involved are desirable. There is no evidence that canned milks acquire any appreciable amounts of metal from the tin containers in which they are packed. These canned milks are equivalent for all practical purposes to the best grades of pasteurized fluid milk.

Pure milk has long been recognized as the most important of the protective foods of mankind. Milk and green vegetables were given the appellation "protective" by Professor E. V. McCollum in 1918 because they provide ample amounts of calcium and vitamin A and thus serve to protect the body against the deficiencies of other common food-stuffs. Fruits and eggs were subsequently admitted to the category of "protective foods," but no other single food can equal milk in general nutritional value. Milk is our most nearly perfect food, and not the least of its virtues is its exceptional content of desirable mineral substances.

**The richness of milk depends very largely on the minerals, proteins, and especially the vitamins that are fed to the cows. Rapid dehydration of freshly-cut alfalfa tends to preserve these food elements for future use. At the Plainsboro, New Jersey, laboratory and plant of the Walker-Gordon Company, thorough investigations have been made of fodder problems. Right: Alfalfa being unloaded prior to drying**



Feeding newly-cut alfalfa into the dehydrator. The dried fodder is stored in silos and mixed with water when used



The vitamin-D content of milk as produced is determined in the colorimeter, by comparison with test samples

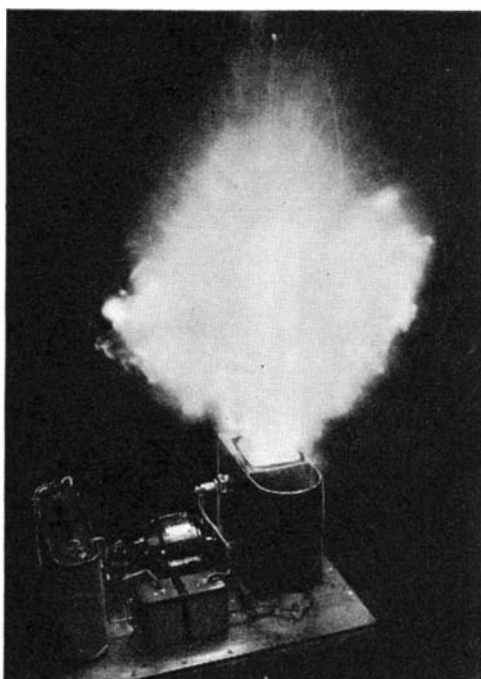
# CHEMICAL ENGINEERING

By

R. C. STRATTON

and

J. B. FICKLEN\*



Explosion of aluminum dust in chamber of tester of explosibility of dust in the air

tographs indicating some of the specialized equipment developed for taking care of such problems.

In one laboratory, many hundreds of samples of water are analyzed each year for plant operators of steam boiler equipment, who have Travelers insurance policies, to ascertain the kind and amount of materials present in the water which might be harmful in the operation of the boiler or boilers and attendant machinery. As practically all waters require treatment for use in boilers, usually it is necessary to suggest definite amounts of certain chemicals to be added to the water to soften or condition it so that it will be entirely satisfactory for

against failure of the system and resultant loss. Therefore, it is important to know when a leak develops in such a system. If this leak is in the brine tank, it is often either impossible or undesirable to drain the tank to locate the leak. For such cases, there has been developed, to send to the field, a kit which is provided with bottles for taking samples of the brine contained in the ammonia system and with ampules of acid for fixing the ammonia in such samples. Several samples are taken at suitable intervals of time and then these samples are returned to the laboratory and are analyzed to determine whether there is an increase in the ammonia content during the interval between samples.

The failure of electrical transformers is often caused by the transformer oil which may have become contaminated and thus had its insulating properties reduced. Samples of the oil are taken at periodic intervals from transformers insured under machinery policies and are sent to the laboratory where their dielectric properties are tested.

The presence of explosive vapors in the atmosphere of an industrial plant is of especial interest to the insurance chemical engineer. In this connection, a portable absorption unit for field use has been developed. This unit is ar-

ONE of the newer applications of chemistry and chemical engineering is to the problems confronting large insurance companies, particularly those writing "multiple lines." A "multiple line" company is one which underwrites not only the usual forms of insurance, such as life insurance, but also such forms as steam boiler, machinery, accident and health, liability, compensation, accident, group, products liability, fire, and many others too numerous to mention.

The widespread use and manufacture of chemicals in recent years, accompanied by the necessary or unnecessary exposure to them or the products resulting from them, may involve serious hazards. In general, through the intelligent and controlled use of materials which can cause trouble to workmen or machinery, the ill effects may either be minimized or entirely eliminated. Obviously the insurance company extending coverage must be vitally interested inasmuch as such operating conditions as may exist within a risk affect not only the rates which may be promulgated by governing authorities, but also the losses which may be expected or anticipated.

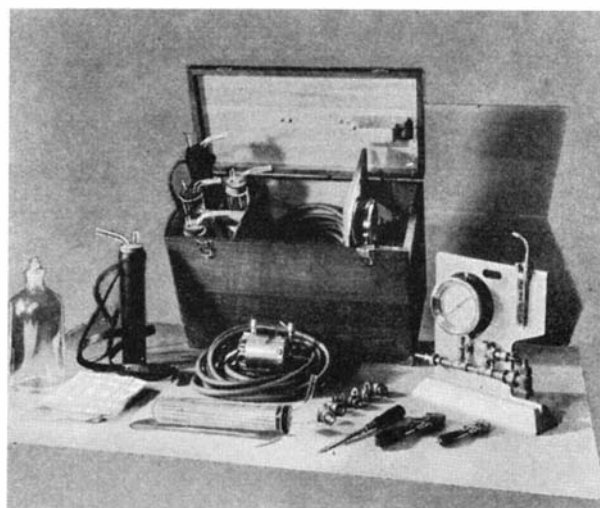
The control of the various specific applications of insurance to chemical manufacturing and to risks including chemical hazards requires the maintenance of a chemical engineering laboratory and trained staff; an example of which is to be found in the Travelers at Hartford, Connecticut. Some of the more specific applications of chemistry and chemical engineering to insurance are outlined here, together with several pho-



The glass "boilers" for testing the effectiveness of the treatments that may be prescribed for feed-waters

use. After the amounts of chemicals required have been determined from an analysis with special equipment, proportional amounts of such chemicals are added to a sample of the particular water, which is placed in the glass boilers of the interesting laboratory feed-water tester. The effect of the particular treatment is then observed. By measuring the action in these glass boilers, an index can be obtained as to whether the operating characteristics of the water have been benefited by the treatment.

Many refrigerating systems using ammonia are covered under indemnity policies



Apparatus for sampling the air to determine its dust content. This is the unit that does the actual sampling

\*Supervising Chemical Engineer and Chemical Engineer, respectively, The Travelers Insurance Company.

# AND INSURANCE

ranged so that a known volume of air, as a sample to be analyzed, can be sucked through it. This air sample is passed through suitable drying tubes, after which it goes through tubes containing either activated charcoal or silica gel for the absorption of the organic vapor. It will be noted in our illustration of this unit that there are three absorption tubes connected in parallel so that three air samples may be taken without disassembling the unit for installation of new absorption tubes.

It is often also necessary to determine the minimum explosive mixture of vapor in air given off by a complex mixture of organic solvents. This is accomplished by placing a portion of the liquid in the vaporizing bubbler as shown and diluting the vapor mixture with dry air until the minimum explosive limit is reached. By weighing the vaporizing bubbler before and after a run, the amount of solvent by weight in air—which just forms the explosive mixture—can be calculated, and this information correlated with the amount of vapor by weight actually found in the air as determined by the apparatus described in the preceding paragraph.

Recently much has been written and said relative to the physiological effects of various dusts on persons exposed to them. An insurance company through its chemical engineering staff and laboratory is in a position to acquire definite and first hand information relative to the kind and amount of these particular dusts in any given exposure.

To study this problem from the standpoint of the insurance company, there has been assembled a compact kit for

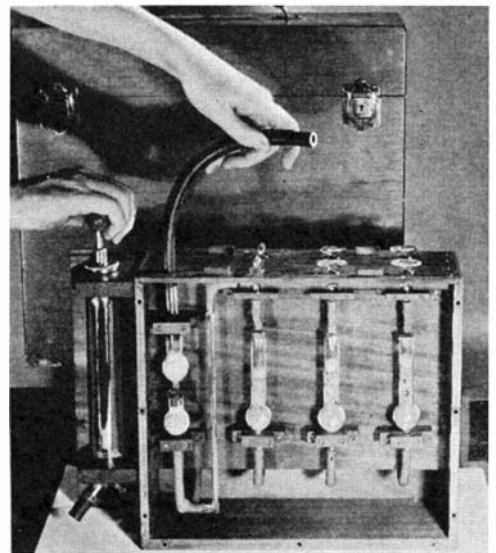
collection of certain dusts and vapors from the air. Space is provided for motor and suction blower, manometer, six sample bottles with suitable absorbing liquid, two impinger units of the Greenburg-Smith type, and necessary rubber tubing and accessories. The complete unit weighs only 26 pounds. The samples, after collection, are returned to the laboratory for quantitative analysis. Such a kit has a wide range of usefulness when it is necessary to determine the total amount in air of certain dusts containing lead, chromium, mercury, arsenic,



A compact kit for collecting certain dusts and vapors from the air

zinc, or other substances.

Where it is necessary to know the number of dust particles per cubic foot of air and the approximate size of the particles as is the case in silica dust exposures, then a much more elaborate apparatus is needed. The apparatus used for such analyses was patterned along the lines suggested by the United States Public Health Service. In this unit the air may be pulled through the impinger unit either by an electrically driven suction pump or by an air ejector, the latter being particularly convenient to use around quarries and sand blast cabinets where a source of compressed air is



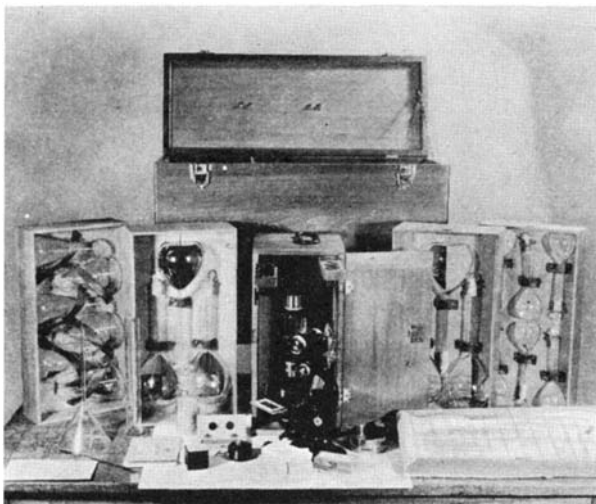
The absorption kit for the collection and determination of organic vapors in the air

readily available. After the sample of dust has been collected in the water, suitable dilution is accomplished in the flasks provided, then an aliquot is placed in a Sedgwick-Rafter counting cell and the number of particles counted under a definite magnification with a microscope. In this way the complete determination of the number of particles of dust per unit volume of air can be achieved in the field without reverting to the laboratory. All parts in this kit are stocked in duplicate in order to avoid any delay in its use when taken to distant locations.

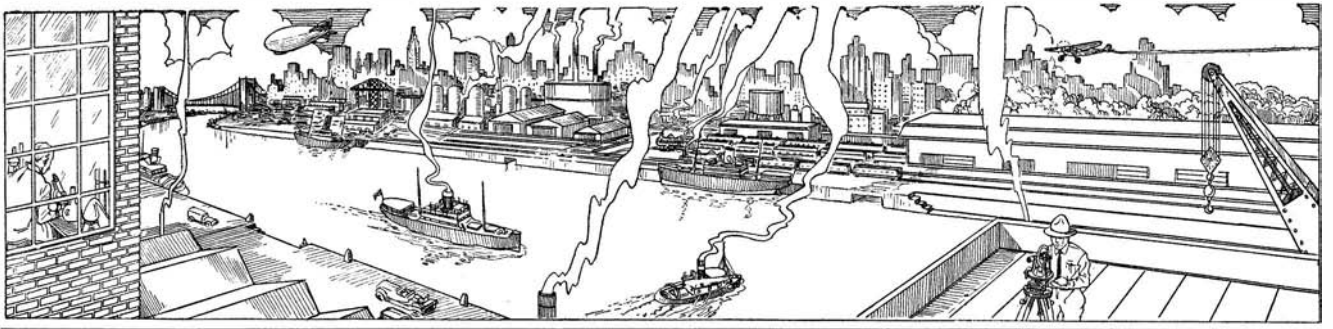
As shown in the illustrations, this apparatus has been divided into two kits—the one on the opposite page is the group of apparatus which is necessary for the actual collection of the dust, whereas the kit on this page contains the microscope and attendant equipment for counting. By dividing the equipment thus, one operator may take samples while another does the counting with a minimum of confusion.

Certain dusts—but principally organic ones—when finely divided and suspended in air, will explode if ignited. In order to test qualitatively the explosibility of certain manufacturing dusts, a small amount of any dust is placed in the chamber of the apparatus shown in the photograph at the head of this article. This chamber is provided with an impeller driven by an electric motor which beats the dust into a cloud. Ignition is provided by use of a spark plug.

No effort has been made in the foregoing to go into detail in the description of any of the apparatus or procedures used. The purpose is to indicate in a general manner some of the very practicable applications of chemistry and chemical engineering through insurance channels.



Companion unit to that shown at left. This kit contains all necessary apparatus for dust-in-air analysis



# THE SCIENTIFIC AMERICAN DIGEST

Conducted by F. D. Mc H U G H

## Lead Pencil Ends Scientific Search

**A**N ordinary lead pencil has ended a scientific quest lasting a quarter of a century!

Lead pencils were handled by two scientists many times a day, while they searched for a substance which would solve their problem. All the while the object of their quest was rarely out of their hands.

This story of the solution of a baffling engineering problem was recently told by Dr. Joseph Slepian of "de-ion" fame and



The "ignitron," in which a tiny current applied to a pencil lead controls enormously high currents

Leon R. Ludwig, research engineers of the Westinghouse Electric and Manufacturing Company.

"Ignitron" control is the name given the accomplishment of the two Westinghouse research scientists. Essentially, it is the positive control of huge current-carrying arcs by means of minute currents in a lead pencil or "igniter." Tiny currents in the lead pencil can control currents a million times greater in the arc, according to Dr. Slepian. It is comparable to controlling by the flip of a small wall switch in the home, the enormous quantity of current that would be required on the average by all the homes and industries of a city five times as large as New York!

"Positive" scarcely begins to describe the effectiveness of the new control. Figures given by Dr. Slepian state that it can start an arc in less than five millionths

## Contributing Editors

ALEXANDER KLEMIN

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

A. E. BUCHANAN, Jr.

Lehigh University

(5/1,000,000) of a second. It can not only start an arc sixty times a second but it can do so at any precise instant of the one sixtieth of a second interval.

Dr. Slepian reminds us that arcs can be struck by many methods. He points out, however, that the arcs cannot be effectively used for many purposes unless the engineer can maintain ultra-precise control over them. Such a method of control should combine sensitivity with spontaneity, Dr. Slepian continues.

The two engineers have solved this exacting problem with "ignitron" control. A small pencil lead is dipped into mercury contained in a vessel. The mercury is charged with electricity which will flow if a path is provided. When a tiny current is applied to the pencil lead, an arc capable of carrying huge currents leaps to an overhead terminal and puts the electricity to work.

Wear is unknown to the "igniter" despite its presence in the powerful electric arcs. Dr. Slepian tells of life tests now being conducted in which a number of the pencils have been "igniting" arcs sixty times per second, 24 hours a day, for over nine months. Although each of them have started more than 1,400,000,000 arcs, they show no sign of wear.

## Tiny Mosquito Fish Win

**I**N our May, 1926, issue, the late Professor David Starr Jordan described the little "mosquito fish," *Gambusia*, which eats the larvae of mosquitoes. Subsequently several experiments with these fishes were made in this country but it was found that they could not withstand the winter climate, at least in the northern states. The following account from *Science Service* indicates that the tiny fishes have now successfully completed a clean-up in Italy:

Malaria has been completely routed from the Italian province of Istria, at the head of the Adriatic, by a million and a quarter little American fishes, in a campaign that has lasted for seven years. Dr. Massimo Sella, Italian director of the Italo-German

Institute of Marine Biology at Rovigno d'Istria tells how.

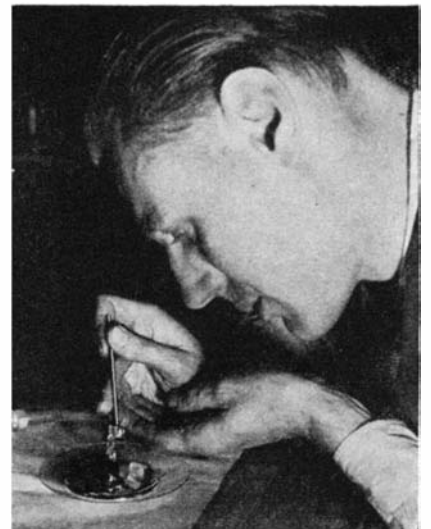
When the work was started seven years ago, he says, the prospects were downright dismal. In the region around Rovigno there were over 800 mosquito-breeding ponds, and 94 percent of the population showed symptoms of malaria. But every year some 200,000 of the American top-feeding minnow species *Gambusia* were dumped into some of the ponds, while the others were treated with Paris green. The "wrigglers" were eaten by the little fish or killed by the poison.

In 1927, there were still 147 ponds harboring mosquito larvae; in 1931 only 7; in 1932 none whatever. For the past two years no one in the region has shown clinical symptoms of malaria. The little American fish have scored another victory.

## Soybean Flour

**A** NEW type of flour, made from soybeans, is said to combine whiteness with a complete absence of the characteristic disagreeable soybean odor and flavor. The patented process of manufacture removes all but 1.7 per cent of the oil from the soybean. The protein content is 68 percent.

The flour, called "Nusoy," is finely ground and may be used in white bread and other baked goods, in sausage, bologna, wieners, macaroni, and other products



A pencil of lead or of Carborundum crystals demonstrates the principle of the mercury control tube

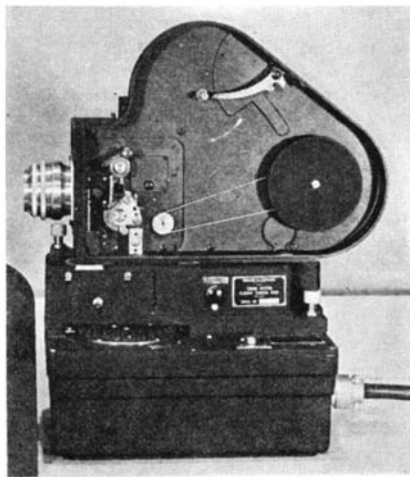
where water absorption and retention are important. When used in bread, 2 to 3 percent increases the protein content of the bread appreciably. And the bread has a good appearance, is tasty and remains fresh unusually long. For diabetic bread, the baker uses Nusoy to the extent of 9 percent with gluten flour to give an almost starch-free loaf containing double the protein content of ordinary white bread. The high absorption ability of the flour effects a 10 percent increase in the number of loaves, it is asserted.—A. E. B.

### High-Speed Timing Camera

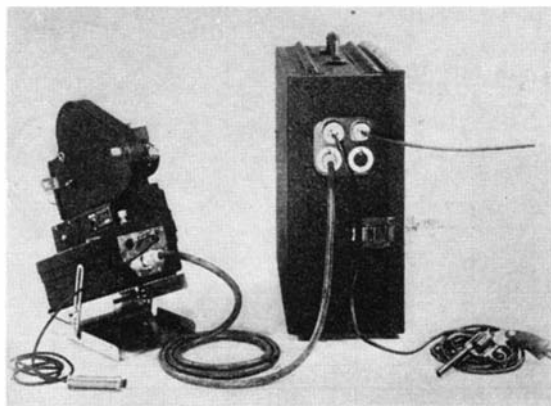
A PORTABLE high-speed camera and electric timer capable of photographing and timing objects moving with the speed of cannon projectiles were demonstrated recently by Electrical Research Products. The camera operates at speeds ranging from eight to 2000 frames per second. It photographs the object in motion and the time, as recorded by the timer in minutes, seconds and hundredths of seconds, on the same strip of motion picture film.

The timing system is a further improvement of the Kirby Race Timer, now approved by all sports governing bodies and used at the Olympic Meets last summer. It is a joint development of Bell Telephone Laboratories, Electrical Research Products, and the Eastman Kodak Company. The time is recorded by a precision electric clock driven by a current generator which consists of an electrically actuated tuning fork.

In cameras which operate at eight frames per second up to 250 frames per second the shutter is the disc type with a 120-degree opening, but shutters of less opening may be quickly substituted so that while the



The fastest timing camera in proportion to portability in the world. Its speed ranges from eight to 2000 frames per second; and it can, therefore, be used in the study (and timing by fractions of seconds) of races, of industrial operations and machines, of action times of swiftly moving objects in many branches of scientific research. Above is shown the camera with cover removed. At right: the complete outfit



picture-taking rate is at the predetermined speed the exposures may be very short indeed. Where necessary to stop motion photographically, with cameras operating from 250 frames to 2000 frames per second, the shutter is of the barrel type. The main lens is an f/2 of 1½-inch focal length with focusing scale running down to one foot so that close objects at moderate magnification may be photographed.

When the camera is used as a race timing device, as at the Olympics, a part of the system is the incorporation of an electric switch under the grips, in the butt of a Colt pistol. A two-conductor cord connects this with the circuit through the generator to the clock for starting same when the pistol is fired.

This system of photography has an advantage over the stroboscopic or strobolite methods in that a permanent record is available in this system and one can obtain a record of non-recurrent or transient phenomena. Photographs of luminous objects and objects out-of-doors may also be taken.

### Seeing the Berries in the Bottom of the Box

WITH a recently developed method of packing strawberries, the berries have no more privacy than a bowl of goldfish, says *Food Industries*. Known as the Elkin Pack method, the new way of handling the berries calls for wrapping them completely in transparent cellulose before placing them in the pint or quart boxes. This enables the purchaser to take them out and see the berries at the bottom and sides of the box as well as those on top.

Aside from its strong sales appeal, the cellulose wrapping keeps the berries in better condition, retaining much of the field freshness and flavor. Then, too, it prevents dirt from collecting on them while in the store.—A. E. B.

### Overdoses of Viosterol Dangerous

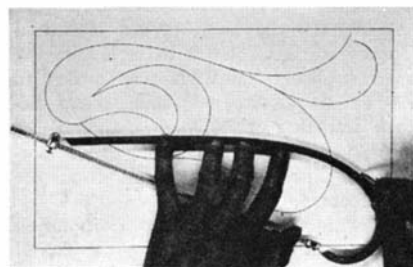
CAUTION against too large doses of viosterol, artificial vitamin D which is widely used as a preventive of rickets in babies, was urged by Dr. Agnes Fay Morgan of the University of California, before a recent meeting of the Federation of American Societies for Experimental Biology.

Dr. Morgan and associates reported a new method of studying bones to find out how they were affected by vitamin D. Dr. Morgan's studies with rats have convinced her that the largest safe dose of viosterol is very much less than previously supposed.

Overdoses of this substance seem to produce kidney injury, which Dr. Morgan believes is the cause of death of animals receiving too much viosterol. She emphasized that it is unwise and unsafe for mothers to buy this potent substance and give it to their children without a physician's directions as to the amount of the dose.—*Science Service*.

### An Automatic Irregular Curve Ruler

A NEW irregular curve, known as the Wade Automatic Curve, has been placed on the market by the Wade Instrument Company of Cleveland, Ohio. It consists of a flexible steel drawing edge that is automatically formed into perfect irregular curves by merely moving a con-



The new curve with which an infinite variety of curves is possible

venient slide. A thumb screw clamps the slide when the desired curve is formed. As every slightest adjustment of the slide forms a different and perfect irregular curve, the number of curves that can be formed is infinite. The steel presents a drawing edge that does not grip the pen or pencil. The drawing edge is backed by a strip of rubber that provides room for the fingers and prevents movement when drawing or inking.

This new instrument can be reversed to form opposite curves or turned end-for-end to form compound, "S," or "O-Gee" curves. It is made in four practical sizes and is durable, simple in construction, and attractively finished. No humps, flats, or circular arcs are possible, and no guesswork or skill is required in the use of this new instrument. The automatic curve, it is stated, serves a definite purpose that is not duplicated by any other instrument.

### Improved Motor Oils

IMPROVED motor lubricating oils which flow freely in cold weather, deposit less carbon, and are more resistant to oxidation have been developed by chemists of the Standard Oil Company of Indiana. While their confrères in the Standard Oil Company of New Jersey have been perfecting the process of made-to-order oils by hydrogenation, Messrs. J. M. Page, Jr., C. C. Buchler, and S. H. Diggs have worked out a different system for better lubricants which they describe in *Industrial and Engineering Chemistry*.

The new process consists of treating lubricating oil with a solvent which separates the desired type of oil from the undesired. Until quite recently, no practical solvent had been found to do the trick, but now a substance known as "dichloroethyl ether" has been put on the market in commercial quantities and at a low price. This solvent, "Chlorex," dissolves

practically no high-viscosity oil, but is miscible with low-viscosity oils. Thus, it is possible to separate the desired from the undesired, and when this is done it is found that the Chlorex treated oil is also superior from the standpoints of carbon formation and resistance to oxidation.

An experimental plant, which has been operated for a year at Casper, Wyoming, produces 500 barrels of extracted oil a day. The used Chlorex solvent is recovered by distillation and can therefore be used over and over again with little loss.—A. E. B.

**Pan-American in Asia**

SOME four years ago, Mr. C. M. Keyes (then President of Curtiss Aircraft) organized the China National Aviation Corporation as a Chinese affiliate of the Curtiss Export Corporation. Among other activities, the Chinese company organized a service up the Yangtse River, employing American aircraft and American pilots. In 1929 an air service was inaugurated between Shanghai and Hankow and in July, 1930, new operating contracts and important franchises were acquired from the government.

The Pan-American Airways Corporation has now acquired 45 percent of the capital stock of the China National Aviation Corporation, the remaining stock being owned by the Chinese government. The commercial and administrative departments of the company are to be directed by the Chinese, while the flying operations will be managed by Pan-American, who will draw on their vast experience over 26,000 miles of airways between North and South America. It is understood that Pan-American will introduce larger and more efficient equipment and will greatly extend the services between Shanghai and Peiping and develop the coast line towards Hong Kong.

The co-operation of Pan-American and the Chinese government has tremendous significance both for American aviation and American foreign trade. The accompanying map shows the operating Pan-American Airways lines and the projected ones. It also indicates the connecting airways operating and the connecting airways projected. The Pan-American Alaskan airways constitute a possible link in an American-Asiatic system taking in Tokyo and both north and south China. The Japanese lines would supply the link between Tokyo and

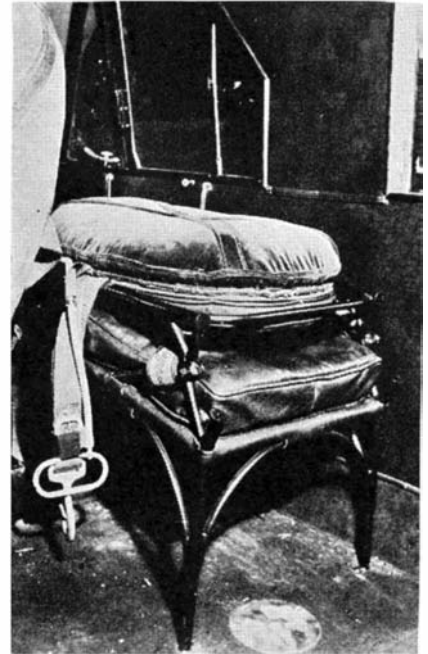
Shanghai or Peiping, and a Canadian system would, at St. Paul, make connection with airways in the United States. With the ever growing size and range of the flying boat, even the more southerly route across the Pacific is not impossible although the distances are great; thus from San Francisco to Hawaii is 2400 miles. Midway Island is 1320 miles from Hawaii; from there to Wake Island is 1260 miles, which in turn is 1500 miles from Guam; Guam is 1600 miles from Manila which is within 630 miles of Hong Kong. The southern route to Shanghai is 8000 miles long, or about 60 hours' actual flying. The northern route between North America and Asia is about a thousand miles shorter, but, of course, has climatic disadvantages. It is an open secret that Pan-American has been conducting technical surveys in the Far East since 1929.—A. K.

**What is a Solo Pilot?**

THE Department of Commerce is stiffening its requirements for transport pilots. Rightly or wrongly it is pursuing the same policy with regard to private pilots. A private pilot, one who is privileged to carry passengers but not for hire or reward, must put in 50 hours' solo flying, and pass some real tests. But an amateur flier may not meet these relatively high requirements and still be allowed to fly. He is then termed a "solo" pilot. Here is the definition for this lowest grade member of the army of the air: "Solo pilots may pilot licensed aircraft but shall not carry persons or property for hire in licensed or unlicensed aircraft. Solo pilots shall be in command of aircraft only when flying alone or with another solo pilot. Such pilots may operate aircraft, not for hire, carrying persons other than licensed pilots, only when a licensed transport, limited commercial, or private pilot is in command of the aircraft and is at the dual controls."—A. K.

**Parachute Chair for Transport Planes**

WITH an increasing volume of passengers carried on the airplane of today, there is frequent discussion of the use of the parachute as a means of still further increasing the safety of flying.

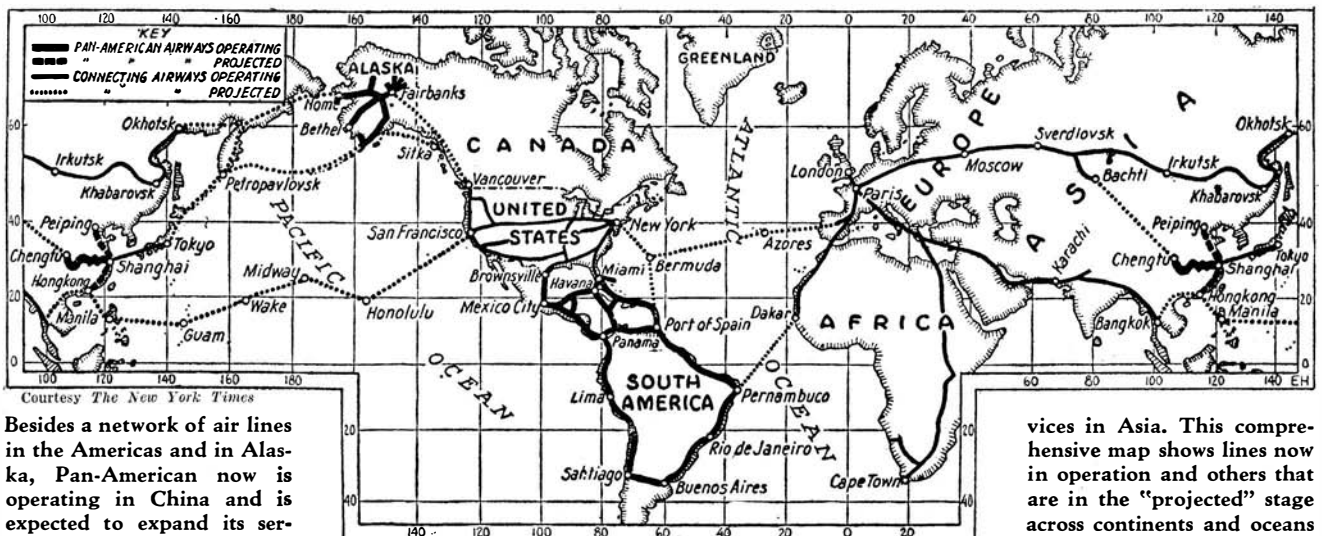


Close-up of the new parachute pack folded forward on a chair seat

Airline operators have not looked favorably on the use of parachutes for passenger operations for many reasons. The additional weight of the parachute, they claim, decreases payload. There is an increase of cost in the installation of the chute and in its original cost. There is questionable psychology in drawing passengers' attention to the dangers of flying by the very inclusion of a safety device. It is also argued that passengers may object to wearing parachutes because the harness may be uncomfortable.

Of course, the manufacturers of airplane parachutes have many counter arguments, and the Switlik Parachute Company has made a very practical and worth-while attempt to meet all of these objections by a new wrinkle in parachute equipment. They have constructed a parachute chair which is a simple frame in chrome molybdenum tubing, the back of which constitutes the parachute pack. This parachute pack may be folded forward with the supporting back frame.

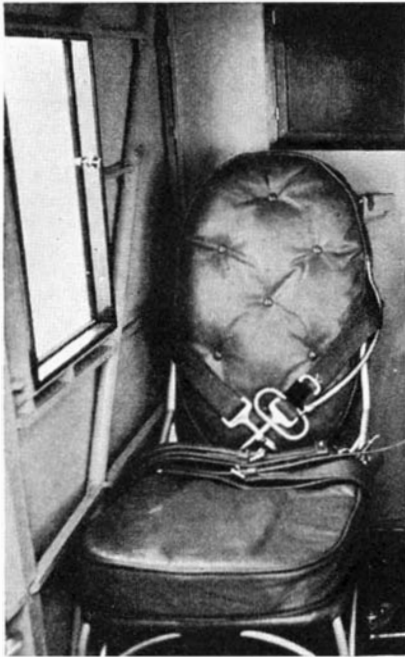
The passengers are provided with a harness of linen webbing pliable enough to allow full movement. This harness is



Besides a network of air lines in the Americas and in Alaska, Pan-American now is operating in China and is expected to expand its ser-

vices in Asia. This comprehensive map shows lines now in operation and others that are in the "projected" stage across continents and oceans





One of the new parachute chairs installed in a cabin monoplane

equipped with two connector rings, so that as the passenger seats himself, he may instantaneously attach the parachute, which is the chair back, by snapping two hooks into these rings. In this position, the parachute is completely attached. Since very little time is consumed in snapping the 'chute on, it need not necessarily be worn during the flight. When an emergency arises, the snapping of the hooks into the rings is but the matter of seconds; the passenger rises from his seat with the 'chute on his back. The weight of the entire installation is only 27 pounds, being ap-

proximately 14 pounds more than for the average airplane chair unequipped with parachute.—A. K.

### Aviation Research Progresses

IT has been said again and again that while the depression has slackened the pace of production in every industry, industrial research is still as active as ever. We believe that this is particularly true in aviation. For example, aircraft engines have in the last year or so increased between 10 percent to 15 percent in power for the same gross weight. A hydrogenated safety fuel has almost reached the point of practical utility. Direct injection of the fuel in the cylinder with elimination of the carbureter and gain in efficiency has been brought a good deal nearer. Higher compression ratios than ever before are currently employed because anti-detonating fuels have now become available through the efforts of the great oil companies. Finally, radial air-cooled engines of the double row type have come into being. In these engines two banks or rows of seven cylinders each are crowded on the same crankshaft, with a most important increase in power for a relatively small increase in weight, a very small frontal area for the power, and extreme compactness.—A. K.

### Crash-Proof Tanks

A CRASH landing may in itself involve no very serious accident. But if the tank should let loose or collapse enough to allow the gasoline to leak out, the hazard of fire must be faced. The Army Air Corps has at various times tried to improve the crash resistant qualities of gasoline tanks by the use of rubber coverings. Unfortunately, the use of rubber is objec-

tionable because it deteriorates rapidly in the presence of gasoline or gasoline vapor. A new product, however, called Thiokol (see description in SCIENTIFIC AMERICAN for July, 1932) is practically as elastic as rubber and is not affected by gasoline. It is entirely synthetic and is a compound of ethylene dichloride and sodium polysulfide.

Containers of this new material are moulded in one piece and under appropriate action of heat and pressure are made to embrace the gasoline tank completely. When tanks so protected were dropped 15 feet on a hard concrete floor, there was no leak; the rubber-like covering absorbed the shock completely.

From such an experiment we might conclude that all tank crash difficulties were eliminated. The difficulty is that an ordinary gasoline tank may weigh only .32 pounds per gallon; the same tank covered with Thiokol weighs 1.4 pounds per gallon. The problem still remains for our inventors and designers to build an elastically protected tank of light enough weight to make its use commercially possible. Every extra pound of weight added to an airplane cuts the payload and thereby renders more difficult the possibility of profitable operation.—A. K.

### Mergers in Aviation

AN announcement has recently appeared that General Motors Corporation has secured control of North American Aviation, and has merged this company with General Aviation of Baltimore, a subsidiary of General Motors. Through North American Aviation, General Motors has now secured control of the following important airlines: Transcontinental and Western Air, Western Air Express, Eastern Airlines, and Ludington Airlines.

The merger means that General Motors will now own a manufacturing company well fitted to make transport planes, together with a transport system which operates the highest mileage of scheduled airways in the United States and carries traffic second only to that of United Airlines.

It is a remarkable fact how early in the growth of the industry aviation activities have been co-ordinated into large and self-contained units. There are now three such self-contained and complete units in the United States.

First, there is United Aircraft. They control a splendid transcontinental route, United Airlines; the Boeing Airplane Company, one of the foremost builders of airplanes in the country; the Pratt & Whitney Aircraft Company, making the Wasp and Hornet engines; and the Hamilton Standard Propeller Company. In other words, United builds its own engines, builds its own planes, and operates them.

Then we have the Aviation Corporation, controlled by the Cord Corporation, closely tied up with Lycoming Motors, Stinson Aircraft, and the Airplane Development Corporation, a new concern building a very fast transport. Here again is complete coordination.

It remains to be seen whether this coordination of activities is a good thing for the industry or not. In some ways the idea has great appeal. The companies building planes and engines have a sure outlet for



Tests are now being conducted by the Westinghouse Electric and Manufacturing Company with half-wave radio aerials supported at great heights by the captive balloon shown in the photograph above. While balloon and kite supported aerial wires are as old as radio itself, the present experiments are taking a new course. Theoretically it is possible to reduce losses in transmission to an extremely low point if the aerial is raised to such a distance above the earth that a straight line may be drawn from the transmitting to the receiving aerial without touching the curved surface of the earth. Just how much of this theory will be of benefit to the radio art can only be found by test. In the present case, the balloon supports the aerial which is fed with energy from the transmitter through a light aluminum wire that also serves to anchor the balloon

their products and know how many units they should produce, since their requirements will be mainly fixed by the operating companies. Again, the information gained in airline operation will be immediately available for the manufacturers of the equipment. They will receive first hand and valuable guidance on the maintenance and reliability of their equipment.

The other side to the picture is that a certain element of competition is eliminated. It is true that the airlines will compete with one another and seek to maintain their equipment at the highest level, and that the American transport plane is making wonderful strides. Nevertheless it will be just a trifle harder for new ideas to break in.

It may be pointed out in justification of this co-ordination policy that the aviation industry has stood the depression far better than most other industries. Traffic over the airlines has grown consistently. It is current gossip that profits are being made by the operating units, and that general prospects in the industry are now sounder than ever before.—A. K.

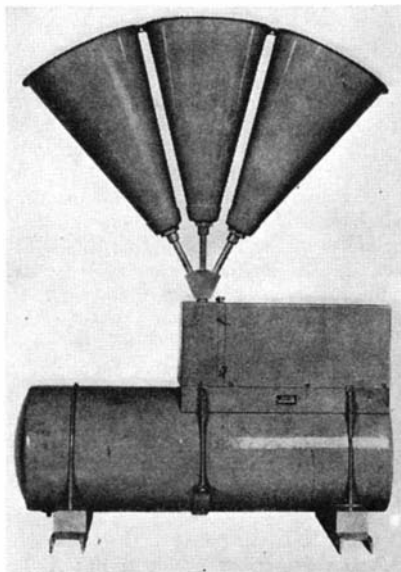
### Sonic Marker Beacon

ONE of our photographs shows a new type of airport boundary marker which helps a pilot to determine his position when making a blind landing. The new device is known as a sonic marker beacon. It comprises three high-pitched (3000 cycle) whistles, mounted in sending megaphones. A motor-operated cam interrupts the air supply to the whistles for the purpose of coding the signal. The coding serves the double purpose of giving the pilot additional information and of halving the air consumption of the device. The apparatus, which has been built by the General Electric Company, may be mounted on a truck with a suitable air compressor, where portability is desired, or it can be permanently located on the boundary of a landing field.

In recent tests made at Wright Field, Dayton, Ohio, signals could be heard clearly in a plane without any listening equipment at a height of 2000 feet, 700 feet before reaching the airdrome boundary. Sometimes the signals were heard at altitudes as high as 6000 feet.

In a typical installation of the sonic beacon, two of the beacons would be used as boundary markers. The coding of the two stations would be so arranged that the signals would combine to form a single note when the plane was equi-distant be-

tween the two. The aviator would pick up the local airport radio beacon system at a distance of five to ten miles, and would be guided by it to the airport. Selecting an altitude of 2000 feet he would be held by the radio beacon on a line over the center of the field. Then when he came within 500 feet of the boundary he would hear the first of the sonic marker beacon stations, pass into the middle zone, and after that hear the second marker. Circling, and coming back twice more, he would acquire an idea of the size and extent of the field, and



The sonic marker beacon

then, approaching at an altitude of 250 feet, could actually make a blind landing.

There is no doubt that with the radio beacon and the sonic marker beacon combined, we are yet another step towards the perfection of blind flying.—A. K.

### Synthetic Camphor in U. S.

CAMPHOR, to most people, means mothballs, but two thirds of all the camphor produced is consumed by makers of plastics, such as celluloid. For centuries practically all the natural camphor used in the United States has been imported, says the *duPont Magazine*. Originally, it was procurable from China, the East Indies, Japan, Formosa, and other far eastern lands where camphor forests were abundant. The trees were cut down, chopped into thin chips and subjected to steam distillation in small portable retorts. As the camphor volatilized, it was passed through a con-

denser—usually a bamboo tube terminating in a tub of cool water—and there collected as crude camphor and camphor oil. Unfortunately, this method of production destroyed the tree.

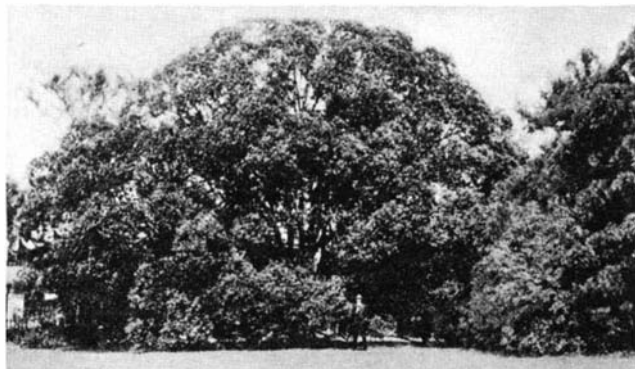
Synthetic camphor is now being manufactured by a new duPont process in a plant built last year at Deepwater Point, New Jersey, and it has been in production for more than a month. Turpentine is the raw material from which the camphor is made. The process is the outgrowth of a great deal of research and development work conducted in recent years by the duPont Company and The Newport Company of Carrollville, Wisconsin. The plant is said to be large enough to take care of a considerable part of this country's normal requirements for synthetic camphor.

The tariff law of 1930 gives synthetic camphor manufacturers a measure of protection which is conditional upon their success in earning it. The duty on natural crude camphor is one cent a pound; on natural refined camphor, and synthetic camphor, five cents. But the maintenance of these rates depends wholly upon the domestic manufacturer who must produce in quantity 25 percent of the domestic consumption of synthetic camphor in 1933; 30 percent in 1934, and 50 percent in 1935—and if he does not meet the production schedule, the tariff on synthetic camphor shall be reduced to one cent a pound. Because this is a new tariff principle, its operation will be watched closely not only by those directly concerned but also by the public at large.—A. E. B.

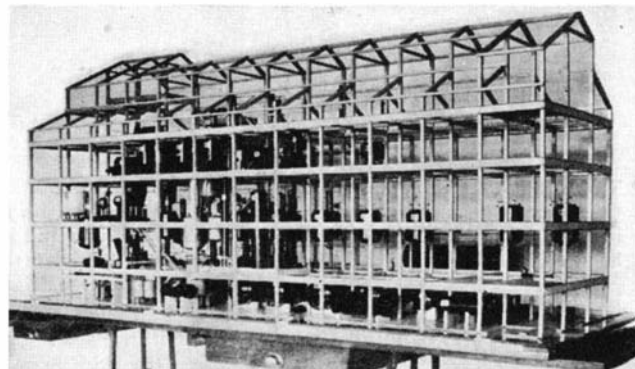
### Acidosis Not Caused By Acids

ACIDOSIS is not caused by formation of too much acid in the body, studies by Professor Yandell Henderson and Dr. Leon A. Greenberg, of Yale University, show. The theory that acidosis is intoxication by acid is definitely contradicted by facts and some other theory will have to be developed, Professor Henderson declared in reporting his and his colleague's studies to the National Academy of Sciences.

Lactic acid is the acid said to be chiefly concerned when, according to current theory, acidosis results from formation of too much acid in the body. In the Yale investigations, animals were treated with a drug which a Danish scientist has recently found makes animals incapable of producing lactic acid. The animals were then subjected to a condition of oxygen deficiency such as has been found to induce a state of so-called acidosis. The result was that all the features of that state were developed but



For many centuries the camphor tree was the only source of camphor. In the Orient it is also a fine shade tree



Not so beautiful, perhaps, but more efficient and economical is the first synthetic camphor plant in this country

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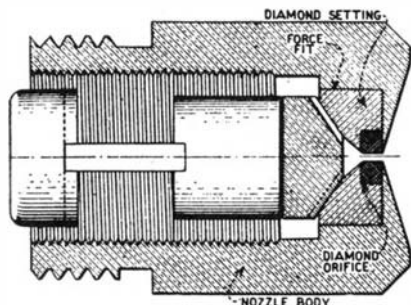
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without the formation of any increased amount of lactic acid.

The conclusion that the state called acidosis is not due to intoxication by excessive formation of acid, is in accord with the fact that giving alkalis to patients with acidosis, in diabetes, for instance, has not been found beneficial and has been generally abandoned.—*Science Service.*

### New-Born Babies Not Blind

**H**UMAN babies do not come into the world blind like young kittens according to Marjorie Van de Water, *Science Service* psychology writer. Infants' eyes, instead of greeting their new-found surroundings with the blind, innocent stare



Diamond-orifice nozzle, enlarged

which has previously been attributed to them, are actually able to see objects and to follow their movement. This was disclosed to the meeting of the Southern Society for Philosophy and Psychology by Dr. W. C. Beasley, of the Johns Hopkins University.

No one knows as yet just how his mother's face looks to the newborn, but evidence that he actually can see it has been found by Dr. Beasley even in infants only three hours old. Great differences were found in the visual ability of different individuals, and race differences were also detected.—*Science Service.*

### Diamonds in Oil Burners

**A**BOUT one family in every 30 in this country has an oil burner heating system. Most of the oil burners are of the so-called pressure type, in the operation of which the oil is shot from a tiny nozzle into the furnace in a finely atomized spray. The nozzle, ordinarily of some metal or alloy, is, unfortunately, subject to erosion and corrosion by the sulfur and acid content of fuel oils. The contour or diameter of the nozzle orifice consequently undergoes a change and the efficiency of the furnace is lowered.

To eliminate this trouble, a diamond orifice has been developed and is now being distributed in this country by the Ballofet Diamond Wire Dies Company. The type of diamond used for this orifice is the old familiar industrial diamond, a blood brother of the gem, clear light gray or clear light brown in color. Except for the color, it has all the physical characteristics of the gem, so that it is well suited to its new use: Extreme hardness; complete resistance to acids; resistance to intense heat without change, flaking, cracking, or becoming porous; resistance to abrupt, violent changes of temperature; ability to take an exact, precise contour and diameter and

hold them without wear from erosion or corrosion.

In a small diamond is drilled a perfectly round hole, very small in diameter, generally from 13 to 25 thousandths of an inch. This drilled diamond is then mounted in a special metal which is impervious to the acids in petroleum and relatively resistant to erosion. The nozzle mounting, with its tangential slots which assist in the atomization, is shown in the accompanying illustration.

Severe tests of the diamond-orifice nozzle, with Carborundum grains mixed in the oil used, indicate that the life of the nozzle may be figured at something like five years.

### Purer Iron Finds New Uses

**I**MPURE iron is the foundation of modern industrial civilization. From prehistoric days, when iron was used as a superior material for swords, knives, and spear points, until modern days when iron and its alloys are the most important materials of factory and farm, pure iron has been commercially unknown.

This impurity of iron imparts characteristics, such as great strength, upon which most machines and structures depend. Iron makers have learned to control the amount of impurity, within limits, and thus have met all requirements of users until recently. Now, however, growth in the application of electricity has brought new needs. Purer iron is desired because of its improved performance in electrical work.

With Swedish iron as the raw material, the Swedish Iron & Steel Corporation, through the use of several recently developed refining processes, has perfected a purer commercial iron than any heretofore known. This iron, called "Svea Metal," is suited to electrical work, particularly for magnetic and electronic applications.

High permeability is one requirement for magnetic applications. The other is low residual magnetism. The new metal has these qualities to a superior degree, giving

low magnetic losses and quick action in apparatus where make and break contact is employed. Combined with uniform purity and easy adaptability, its use is indicated for all sorts of magnetic electrical equipment.

For electronic apparatus such as radio tubes, a metal should have qualities including freedom from dissolved or occluded gas, high heat resistance, high heat conductivity, and freedom from oxidation. This purer iron has these qualities.

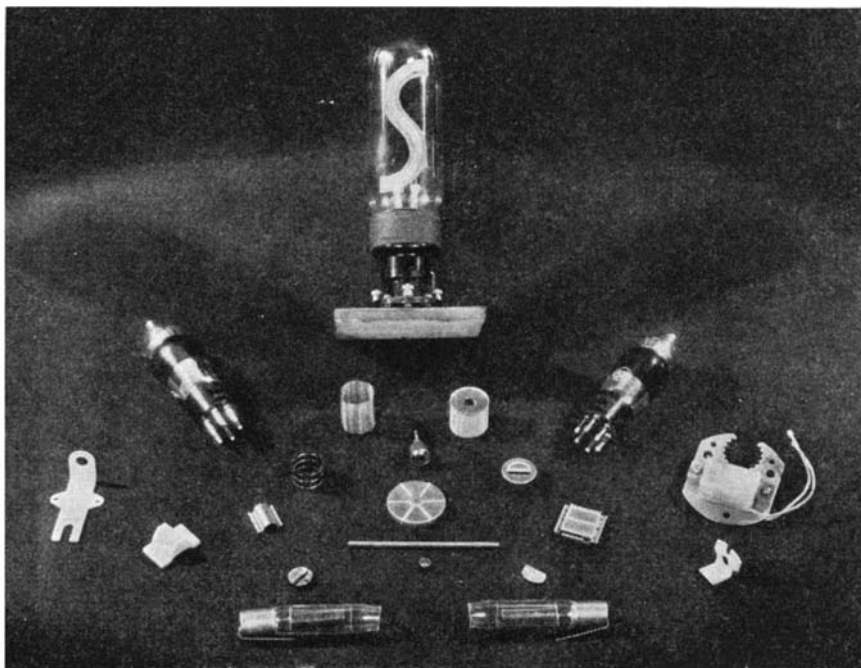
One other property, growing out of its extreme purity and high heat conductivity, is the ease with which the metal can be welded, either to itself or to other metals.

When to these advantages are added the fact that it is available at a lower cost than other materials for electronic uses and that it can be readily and economically formed into all sorts of shapes, its usefulness in electronic devices is apparent.

The new iron is already being used in radio tubes, neon lights, mercury and other vapor tubes, hot cathode crater lamps, and as filament supports in tungsten illuminating lamps. Experimental uses, not yet in the commercial stage, include resistance wire for coils; interior parts of photoelectric cells; many types of delicate and sensitive apparatus such as instruments, controls, meters, relays, temporary magnets and solenoids; telephones; news tickers; loud speakers; alarms, signals; signs; bookkeeping and other business machines; electric clocks; electrodes; induction coils; electric organs; spark coils; switches; X-ray apparatus; thermostats; transformers; and vibrator coils. In addition to these electrical applications, non-electrical uses for the metal are being developed.

### Camphor Preserves Glue

**C**AMPHOR acts as an excellent preservative for glue solutions, according to Professor Ernest Tauber, writing in *Chemiker Zeitung*. A few small pieces of camphor added to the glue preserves it



All the metallic parts in this photograph are of Svea metal, a new and purer iron which has made possible a new type of neon tube, and stamped, drawn, punched, and woven wire electrical parts of which this is only a small sample

for years. Care should be taken to avoid total loss of the camphor by keeping the solution in a closed vessel, or by the periodical addition of fresh camphor. Similar favorable results have been obtained with solutions of gum arabic and casein, the observations in this case having extended over about six months.—A. E. B.

**Still Another Hobby—Collecting Minerals**

A NUMBER of our readers have taken up the hobby of gem stone polishing, described in an article by J. H. Howard, SCIENTIFIC AMERICAN, March, 1932, and in addition there is a fairly widespread interest in amateur mineralogy and collecting, a hobby which takes one out of doors and on country walks. We have received the following note from the Director of Outings of the Rocks and Minerals Association:

“A cordial invitation is extended to the readers of SCIENTIFIC AMERICAN by the Rocks and Minerals Association, to attend their National Outing being held on July 9.

“On that day this association will hold a total of 20 or more field trip outings throughout the country and one in Canada, featuring the collection of mineral or fossil specimens and the study of rock formations. The outings will afford an opportunity for collectors to meet one another and, as each one is under the direction of a competent mineralogist or geologist, beginners will have a chance to receive some first-hand instruction.

“This is the first time an affair of this kind has been attempted and is an outgrowth of the very successful outing which the association held last year in New York state when 105 persons attended. Several State Geological Surveys have already expressed their endorsement of the affair, and the co-operation of all mineral clubs and many organizations is assured.

“Everybody is welcome without obligation. Those wishing to attend should write to Fred W. Schmeltz, 2510 Maclay Ave., New York, New York for full particulars. (Please enclose stamp.)”

**Good News for Lowbrows**

THE popular belief that a high brow indicates high intelligence was dealt a death blow by measurements reported to the American Philosophical Society recently by Dr. Ales Hrdlicka, curator of physical anthropology of the Smithsonian Institution. For more than 30 years Dr. Hrdlicka has been taking measurements of forehead heights in connection with his anthropometric work and has accumulated a great quantity of data on various racial and social groups. The “high brow” fallacy is an inheritance from the phrenologists. It has generally been under suspicion by anthropologists, but up to the present, measurements have been so few and so unstandardized that it could not positively be denied.

Among the groups measured were: A large standard group of “old Americans,” men whose ancestors on both sides for at least three generations had been born in the United States, and who were normal individuals in all walks of life; a sufficiently large group of northeastern Tennessee mountaineers who are among the most backward people in the United States; and



**Speechless...When a Few Words Would Have Made Me!**

*But now I can face the largest audience without a trace of stage fright*

THE annual banquet of our Association—the biggest men in the industry present—and without a word of warning the Chairman called on me to speak—and my mind went blank!

I half rose from my seat, bowed awkwardly and mumbled, “I’m afraid you’ll have to excuse me today,” and dropped back in my chair.

Speechless—when a few words would have made me! The opportunity I had been waiting for all my life—and I had thrown it away! If I could have made a simple little speech—giving my opinion of trade conditions in a concise, witty, interesting way, I know I would have been made for life!

Always I had been a victim of paralyzing stage fright. Because of my timidity, my diffidence, I was just a nobody with no knack of impressing others—of putting myself across. No matter how hard I worked, it all went for nothing—I could never win the big positions, the important offices, simply because I was tongue-tied in public.

And then like magic I discovered how to overcome my stage fright—and I was amazed to learn that I actually had a natural gift for public speaking. With the aid of a splendid new method I rapidly developed this gift until in a ridiculously short time, I was able to face giant audiences—without a trace of stage fright.

Today I am one of the biggest men in our industry. Scarcely a meeting or banquet is held without me being asked to speak. I am asked to conferences, luncheons and banquets as a popular after-dinner speaker. This amazing training has made me into a self-confident, aggressive talker—an easy, versatile conversationalist—a most overnight.

No matter what work you are now doing or what may be your station in life; no

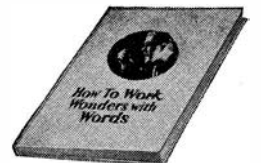
matter how timid and self-conscious you now are when called upon to speak, you can quickly bring out your natural ability and become a powerful speaker. Now, through an amazing new home study training you can quickly shape yourself into an outstanding, influential speaker able to dominate one man or five thousand.

**Send for This Amazing Booklet**

This new method of training is fully described in a very interesting and informative booklet which is now being sent to everyone mailing the coupon below. This booklet is called, *How to Work Wonders With Words*. In it you are told how this new easy method will enable you to conquer stage fright, self-consciousness, timidity, bashfulness and fear. You are told how you can bring out and develop your priceless “hidden knack”—the natural gift within you—which will win for you advancement in position and salary, popularity, social standing, power and real success.

You can obtain your copy absolutely free by sending the coupon.

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**What 20 Minutes a Day Will Show You.**

- How to talk before your club or lodge
- How to propose and respond to toasts
- How to address board meetings
- How to tell entertaining stories
- How to make a political speech
- How to make after-dinner speeches
- How to converse interestingly
- How to write letters
- How to sell more goods
- How to train your memory
- How to enlarge your vocabulary
- How to develop self-confidence
- How to acquire a winning personality
- How to strengthen your will power and ambition
- How to become a clear, accurate thinker
- How to develop your power of concentration
- How to be the master of any situation

members of the National Academy of Sciences, probably the most intellectual group in the country.

If a high brow indicated a superior brain, Dr. Hrdlicka holds, the relationship should be plain in a comparison of the leaders of American science and the backward, illiterate mountaineers. He found, to his surprise, that there was no measurable difference. The mean heights for all four groups were practically identical.

Among racial groups Dr. Hrdlicka found that the "old Americans," fairly representative of the white race, have a trace lower forehead than the American Indian, whose forehead, in turn, is exceeded in height by that of the American Negro and especially the Alaskan Eskimo.

If intellect were actually correlated with height of brow, Dr. Hrdlicka points out, the Alaskan Eskimos would rate as the world's supreme intellects, with the members of the National Academy of Sciences trailing far behind. Actually he has found them of good intelligence but by no means comparable to that of our foremost representatives of science.

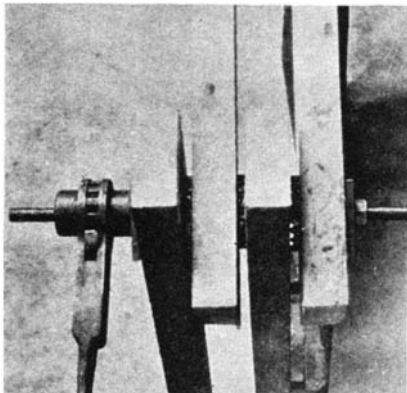
### Flashlight Battery Improvement

A NEW dry battery that requires no auxiliary exterior casing, and that is sealed with a material that will resist heat and dampness has been devised by a Mr. Simsinovici of Paris. It is expected that the battery will be placed on the market in this country shortly. The battery is a sealed unit into which screws a flashlight bulb. When the battery wears out, the bulb is removed and inserted in a new battery and the old one thrown away. It is reported that the new unit is simple and inexpensive to manufacture.

### Modern Connectors for Timber Joints

INTRODUCTION in this country of a method of making wood joints through use of metal connectors, strengthening timber at its critical point and thereby making it available for wider consideration in construction of major structures, is forecast in a handbook on "Modern Connectors for Timber Construction" issued recently by the National Committee on Wood Utilization, U. S. Department of Commerce, and prepared jointly by engineers of the Committee and of the Forest Products Laboratory, U. S. Forest Service, Department of Agriculture.

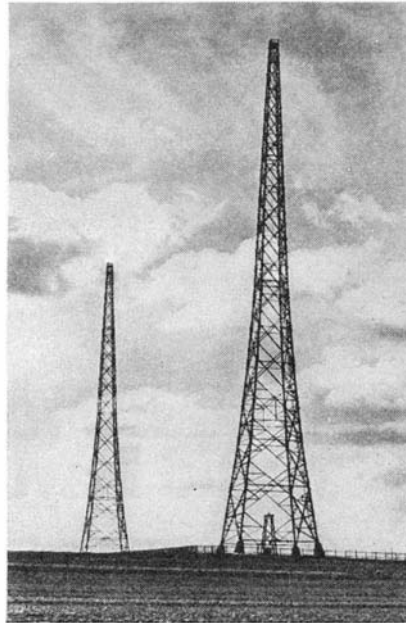
"The application of modern connectors



A ratchet wrench driving home one of the new timber connectors

for timber construction," said the Secretary of Commerce in releasing the report, "should be given careful study by architects, engineers, and builders. The principle involves economy in construction cost and increased service from building materials."

The handbook constitutes a re-introduc-



Two 330-foot radio towers built of yellow pine with new connectors

tion into this country, in modern, usable form and under economically favorable circumstances, of construction principles which were abandoned in embryonic and vaguely developed stages nearly half a century ago. As a result of war-enforced construction economies, these principles were adopted and advanced by engineers and constructors in the Central European and Scandinavian countries to the point where they have been satisfactorily and economically employed in hundreds of timber structures and major engineering projects.

The connectors which they employ consist principally of metal rings, plates, and disks, of a dowel type, or semi-dowel, with teeth on one or both faces. In general and in non-technical language the connectors are placed or forced into the faces of wooden members to be jointed. The members are then brought together and held by the accustomed bolt, but the bolt becomes primarily a binder and *only secondarily a load-bearing unit*. With their larger circumferences, the connectors take an increased load and distribute it over a larger area of the timbers, thus avoiding the undistributed high unit "edge stresses" frequently experienced under bolted connections where the small diameter bolt plays against a localized area of the timber face, crushing the timber at this point, and, together with bent bolts, accounting for slip with consequent sag in structures. On most conservative laboratory data, the load-bearing capacity of the new joint is increased from four to eight times—and in certain cases as high as twelve times—that of the ordinary bolted joint.

There are some 60-odd types of modern connectors used abroad, of which some six or eight are considered important to American practice. No one type will meet all engineering requirements, but it will seldom be necessary to go beyond one or two types

for completing a given construction project.

Pre-fabrication, similar to that employed in the use of other structural materials, becomes a natural step in the preparation of wood members for use with the new systems. Seatings and borings for the connecting hardware will be made with precision tools at the shop according to specifications, where the standards of materials themselves can also be checked against requirements by experts. Partly assembled, and assembled units will be shipped ready for speedy erection. Where intended use requires preservative treatment, this will be given after the borings have exposed new surfaces.

### New Light-Sensitive Compound

A DISCOVERY that may be the forerunner of a new kind of photography was announced at the recent meeting of the American Chemical Society by Drs. O. Baudisch and F. L. Gates. It is a new organic compound—piperidine vanadate—and its most interesting property is that it changes color when exposed to light. Normally white crystals of the substance turn black in the light. The discoverers make no predictions of its ultimate application.—A. E. B.

### Automatic Pistol Improvements

AN accompanying photograph illustrates a standard automatic pistol altered in several particulars. Two devices, patented by Mr. A. R. Brinkerhoff, of Los Angeles, make it possible to depart from conventional automatic practice and to obtain a well-shaped grip, a fast operating hammer, and a light trigger pull. The fast hammer is obtained by reducing the weight and friction



A new grip, fast hammer, and light trigger characterize this pistol

of several parts in the mainspring action, and the use of a helical spring.

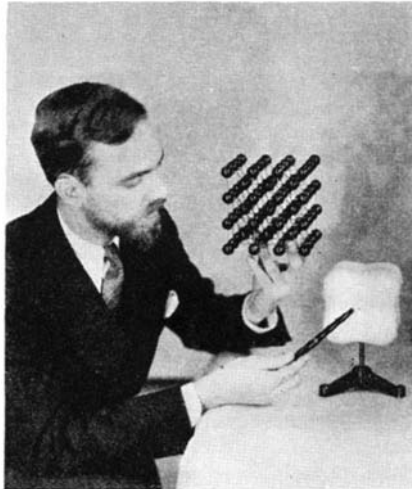
In the conventional arm of this type, it is impossible to obtain a light trigger pull with safety, because the jar of the slide as the pistol reloads is likely to cause the hammer to drop. In the new construction, the pressure of the finger on the trigger shifts, at the instant of firing, from the front of the sear to the back through a safety lock that absolutely prevents the hammer from falling until the trigger is released and again pulled. These changes in construction do not in any way interfere with the functions of the usual safety devices.

### Magnetized Atoms Oscillate

MAGNETIZED atoms of iron, the directional force of which was heretofore thought to be dormant, are now believed to be very much alive and active. Theory explaining the behavior of atomic structures when magnetized, universally

accepted for the past 50 years, was tossed on the scientific scrapheap by Dr. Francis Bitter, research physicist of the Westinghouse Electric and Manufacturing Company, in a recent address before the American Physical Society at Atlantic City.

Bitter offers evidence to prove that the direction of an atom's magnetic force, formerly thought to be stationary, is on the contrary constantly changing and that it os-



Dr. Bitter pointing to a model that shows magnetic properties of iron

cillates in the manner of an automobile's windshield wiper but much faster. Observation of the fact that the magnetization of an iron bar changed if the bar is twisted or strained in any way led to his doubt of the static theory. By the static theory, distortion of the metal's crystal structure should not affect the bar's magnetization.

To illustrate his theory, Bitter exhibited several models. A crystal of iron is represented by a large cube made up of many small black wooden balls, each ball representing one atom of iron. The magnetic property of a crystal is represented by a number of plaster casts, one for each condition of the magnetic field. The plaster cast should be thought of as a plastic mass which easily changes its shape to conform with the demands of the magnetic field or external forces acting upon the atoms of a solid. Metals illustrate his theory as follows:

When a crystal of iron is not subject to any external magnetic influence, its ease of magnetization may be represented by a plaster cube with rounded corners and a depression or hollow in each face. When an external magnetic field or other force acts upon the crystal the plastic mass conforms to its influence. As the field changes in strength and direction, the plastic mass changes its shape. Sometimes its shape is symmetrical and regular, other times grotesque and irregular, suggesting the work of certain futuristic schools of art.

As the plastic mass changes in shape, the hollows on it also change in shape, depth, and position. Usually there is one of greater depth than the others and this one determines the direction of the crystal's magnetization.

Many leading scientists agree that Bitter's developments, and the concepts of basic physical theory evolved from them, open up an entirely new field to scientists in exploring the properties of solids. His findings may profoundly affect the design

# Do Others Silently Criticize Your English?

**I**F YOU were introduced to an attractive, prosperous-looking man or woman who constantly made mistakes in grammar and pronunciation, what would you think? You could not help believing that this person was sadly lacking in education; you would feel that he, or she belonged on a lower social level.

And yet, unless you have made the correctness of your own speech a habit, you never can be sure that you are not unconsciously making errors which may cause others to lower their estimates of your education and refinement.

You may not make such glaring errors as *I ain't*, *you was*, and *between you and I*, but perhaps you commit other mistakes which offend the ears of those who know, and cause them to judge you unfairly.

## MAKE THIS TEST

In your every day conversation do you say? "I meant to *have written*," "I intended to *have gone*," "I should have been glad to *have seen him*," "Your statement can be easily *proven*," "I shall go *providing* I can leave some one in charge of my business," "He is very well *posted* on the subject," "I *loaned* him my silk umbrella," "I know a *party* who will make you the loan," "I am *through* with my work for the day," "This is not to be *compared* to that," "I do not *propose* to be imposed on," "What *transpired* in my absence?" "He worked *good* today," "I *expect* that you had better go East."

As indicated, these expressions sound grammatical to the ear accustomed to hear them and yet each contains an error, the correct forms being: "I meant to *write*," "I intended to *go*," "I should have been glad to *see* him," "Your statement can be easily *proved*," "I shall go *provided* I can leave some one in charge of my office," "He is well *informed* on the subject," "I *lent* him my silk umbrella," "I know a *person* who will make the loan," "I have *finished* my work for the day," "This is not to be *compared with* that," "I do not *intend* to be imposed on," "What *happened* in my absence?" "He worked *well* today," "I *presume* that you had better go East."



An important social gathering that could mean so much to their advancement—but their very first words showed glaring errors in English. All who heard them gained the impression that they were not accustomed to associating with people of culture and refinement.

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Here is the straight from the shoulder report which E. J. Anderson, Philadelphia, Pa., sent us. "This is the first course that I have ever taken by mail. I had but little confidence in any Correspondence Course, but I must say that, since studying Speechcraft, I have changed my opinion. Your course is just what you claim it to be. I've already overcome many bad habits in English. My one regret is that I did not know of your course sooner."

Another member of Speechcraft tells of her experience in this way: "Although I have completed only six lessons so far, the knowledge I acquired has aided me to detect errors of others in both business and social life. Some of the English which seemed intricate to me in high school becomes much clearer with each lesson. I value the written examinations because they afford a closer communication between teacher and student, and enable me to see how much I am gaining by each lesson in Speechcraft."—Marcella Lloyd, Lancaster, Pa.

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Many men and women who want to avoid Silent Criticism are taking advantage of Speechcraft Training, as it provides a new, quick means of mastering English at home, in their spare time. You, too, can quickly rid yourself forever of mistakes in grammar, spelling, punctuation, pronunciation, and be one of the many who are "Winning With Words."

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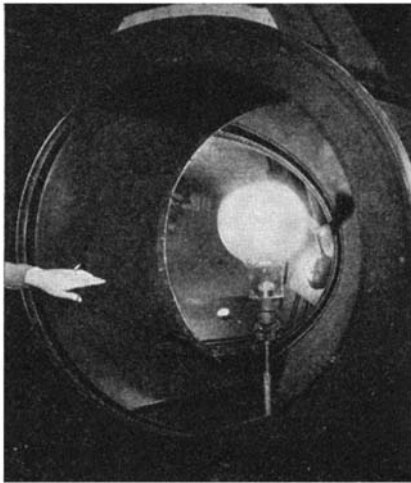
Age.....Occupation .....

of all kinds of electrical equipment, particularly those employing magnetic principles, and may even extend to metals in every mechanical or structural use, because his theory interprets the changes in crystal formation of metal when it is subject to twisting, bending, or other stresses.—*A. E. B.*

### “Electric Diamond” Operates Huge Lamp

**A**N electric sparkle from the tiniest mercury switch in the world, attached to the ring finger of a girl's hand, turned on a 10,000-watt incandescent lamp in a recent demonstration.

Known as the “grain of wheat” switch because, in size and shape, it actually resem-



The “electric diamond” switch shown before a 10,000 watt lamp

bles a grain of wheat, this tiny switch is really no larger than many solitaire diamonds seen flashing from the hands of our fair sex today.

“This tiniest of mercury switches,” according to J. L. McCoy, Westinghouse engineer on mercury switches, “consumes only five to ten milli-amperes and is far too weak to operate directly a powerful lamp which consumes 100 amperes of electricity such as that mentioned above which is the largest incandescent lamp made for commercial use. This tiny switch was made to operate a relay which stepped up the current and threw a large contact breaker that sent current through the powerful lamp, thus demonstrating the feasibility and simplicity of controlling electrical sources from a distance.”

Mercury switches operate by means of a tiny globule of mercury which rolls back and forth in a tiny glass tube. As the tube is tilted, the mercury rolls to and from the end of a “live” wire and thereby makes or breaks the electric circuit silently, eliminating the usual click that accompanies the ordinary mechanical switches.

### What? No Soap!

**N**OPE; No soap! Instead, we'll all be washing with “sulfonated higher alcohols” if a new German process now being commercialized in this country is as successful as the promoters hope. Three of the largest soap and chemical companies in the United States have joined forces for the development and commercialization of

the new detergent: Proctor and Gamble, E. I. duPont de Nemours & Company, and the National Aniline and Chemical Company.

Sulfonated higher alcohols are said to have properties closely approaching the ideal detergent. D. H. Killeffer, writing in *Industrial and Engineering Chemistry*, summarizes the process used for producing them and their advantages over ordinary soaps. The higher alcohols are prepared by the hydrogenation of fatty acids, accomplished by suspending a finely divided nickel catalyst in the hot oil and passing hydrogen through it, under pressure. The alcohols so produced are sulfonated by treating with sulfuric acid, the finished product being in the form of the sodium salt.

The sulfuric esters of the higher fatty alcohols have all the advantages of soaps and apparently none of their disadvantages. Thus, both the wetting-out power and the emulsifying ability of the new compounds are greater than those of soap, giving them much better detergent value. The sodium salts are soluble in acid, neutral, and alkaline media without decomposition into insoluble compounds. The calcium and magnesium salts are soluble in water and the presence of dissolved salts in the washing bath does not seriously affect the detergent power of the solution. Thus washing in hard or salt water, in acid or alkaline dye baths involves no loss of material or labor. The sulfuric acid esters do not turn rancid and, because of their high solubility, can be easily and completely washed out of fabrics so that no after effects are to be

plane; and provides the criminologist an infallible instrument to detect erasure and forgeries, was described by Samuel G. Hibben, of the Westinghouse Lamp Company to the members of the Illuminating Engineering Society at a recent meeting held in New York City.

“This invisible ‘black light’,” said Mr. Hibben, “is pure ultra-violet radiation, and is 99 percent free of visible light. It is produced by two new black bulb lamps, one consuming two amperes, and the other five. They are made of special cobalt glass. The bulbs of these lamps absorb 99 percent of visible light and transmit 80 to 85 percent of the kind of ultra-violet wanted. The resultant radiations are relatively long in wavelength—in the range of 3200 to 4000 angstroms.

“This long-wave ultra-violet lends itself to photographic and fluorescent effects. The radiations are rich in actinic value and this makes it possible to take photographs in complete darkness. Such a use has already been suggested by means of an automatic mechanism for the purpose of photographing a thief or intruder unawares. At the present time one lamp requires a time exposure of from five to seven seconds to take a photograph in the dark but, by increasing the amount of ultra-violet, a snap-shot photograph is permitted.

“Because they give off a luminous glow or fluorescence when irradiated by invisible ultra-violet, imperfect teeth, false gems, spurious inks, changes in pigments and paintings may be detected. Also the age of some materials such as marble and statuary may be determined and, in criminology it



Soap for a thousand and one baths! Slicing the finished product in a modern factory A new detergent, described here, is bidding for some of this business

feared from them. The sodium salts are miscible with soap and soluble in soap solutions so that the two can be used together, if and when it may seem desirable.—*A. E. B.*

### Invisible Light for Pictures in the Dark

**I**NVISIBLE “black light” which permits the taking of photographs in the dark; aids dentists in teeth inspection; increases egg production and weight of poultry; develops a red coloring in certain fruits, such as rosy cheeks on apples; guarantees good vision at night in the cockpit of an air-

plane is possible to match papers or fabrics or to discover forgeries and erasures. Fluorescence with ultra-violet is also useful in specialized advertising and for peculiar stage effects.”

### Indians Who Survived Scalping Were Outcasts

**T**HE Indian who in the old days was scalped as he lay unconscious and survived the experience, might better have died, since he was regarded as a ghost and was forever an outcast from his people, Dr. Melvin R. Gilmore, Indian authority  
(Please turn to page 42)



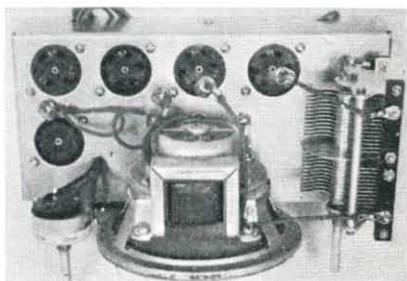
**CURRENT BULLETIN BRIEFS**

**ALUMINUM IN ARCHITECTURE** is perhaps the first treatise dealing with these uses of this metal. It has been compiled to place before the building industry an authoritative treatise on the subject which will prove of assistance and value in design and fabrication. *Aluminum Company of America, Pittsburgh, Pa.—\$1.00.*

**ADDRESS TO THE ENGINEERING ALUMINI SOCIETY**, by Dr. Edward R. Weidlein, deals with economics as related to new industries. Dr. Weidlein, Director of the Mellon Institute of Industrial Research, justly says that research is insurance against obsolescences of processes and products. *Mellon Institute, Pittsburgh, Pa.—Gratis.*

**THE SMALL-COMMUNITY MUSEUM**, by W. N. Berkeley, Ph. D. (Director of the Yonkers, New York, Museum of Science and Arts), describes how small communities may enjoy some of the benefits which accrue to visitors to museums in large cities. *J. P. Bell Company, Inc., Lynchburg, Virginia.—\$1.75 postpaid.*

**FIND-ALL "AUTOVOX"** is a powerful five tube receiver built up on a miniature chassis to fit into a cabinet 9½ by 4 by 6½ inches. The set is self-contained, including dynamic speaker. No remote control is necessary, since the receiver fastens to the instrument board of the car. The circuit



Top view of the "Autovox"

incorporates the newest automotive type tubes including the Raytheon duplex diode-triode and the two-in-one ER-79 class B output tube. Top and bottom views, schematic diagram, list of parts and additional data from *Allied Engineering Institute, Suite 541, 98 Park Place, New York, N. Y.—10 cents.*

**SUNDIALS** (Circular of the Bureau of Standards, No. 402). Elementary instructions for laying out a plain horizontal dial. *Superintendent of Documents, Washington, D. C.—5 cents (coin).*

**DIALLING**: (Vol. 1, No. 1 of The Industrial Museum), by J. Ernest G. Yalden, F. R. A. S. Instructions for laying out more advanced dials. *Museum of the Peaceful Arts, 220 East 42nd Street, New York, N. Y.—25 cents.*

**SUN DIALS AND SUN DIALLING**, by Russell W. Porter, in *SCIENTIFIC AMERICAN*, August 1928. Describes several dials for the advanced designer. *Scientific American Publishing Company, 24 West 40th Street, New York, N. Y.—35 cents.*

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# THE AMATEUR ASTRONOMER

Conducted by ALBERT G. INGALLS

WE continue this month the article describing the design of an aplanatic telescope, written by Messrs. Carpenter and Kirkham, which was begun in the June numbers:

IN courses in elementary algebra in high school the student is taught how to plot simple equations on coordinate (quadrilateral ruling) paper, by laying out two axes at right angles and measuring 'x' quantities in horizontal directions and 'y' quantities in vertical directions. The pupil also learns that the plot of simple equations of the first degree is a straight line, while those involving powers of the unknowns are curves, such as circles, ellipses, and so on—in some cases two lines that intersect. Referring again to Figure 2 (first article), if F is taken as being at the origin of x and y (point where they intersect), one can find equations for which, when plotted, the substitution of successive values for y and the determination of the equivalent values of x, will trace the parabola or the circle there shown. For the parabola this would be  $y^2 = 4 \cdot \overline{FV} \cdot x$  and for the circle it would be  $x^2 + y^2 = \overline{FV}^2$ . Here y is the distance of a point in the curve above the axis FV ('axis of x') measured perpendicularly, and x is the distance of that point measured horizontally along the axis from F. Constants in such equations mean that the curve is removed some distance from the origin; as, for instance, the distance FV in the above equations.

"M. Chrétien reviewed the derivation of the aplanatic curves mathematically and gave an example of the calculation of a large mirror and its secondary. His equations are identical with those of Schwarzschild, with a slight change in the case of the Cassegrain type. The plan of telescope proposed by Schwarzschild is generally considered the best possible, although it is inconvenient in arrangement and has not yet been built. In his best telescope he proposes the use of a secondary mirror with a diameter one half of that of the primary, which would intercept 25 percent of the incident light.

"Consider now Figure 4, which is adapted from Chrétien's drawing to show the theory of aplanatic mirrors: If we let: M be the distance from the vertex of the secondary mirror to the focus, F; E be the distance between the mirrors; x be the distance of point P measured from F along the axis F-V-N; x' be the distance of point P' measured from F along the axis F-V-N; y be the distance of point P measured vertically above the axis F-V-N; y' be the distance of the point P' measured vertically above the axis F-V-N; L be the diagonal distance from focus F' to point P' on the secondary; R be the diagonal distance from the point P' to P on the primary; u' be the angle the ray from point P' makes with the axis at F; and, finally, let the origin of x and y be at F, the focus—then the first few terms

of the series of Schwarzschild's equations may be written as follows:

$$x = M - E + \frac{1-M}{4E} y^2 - \frac{M}{32E^2} y^4 - \frac{M+4EM}{384E^2} y^6 - \text{etc.} \quad (1)$$

$$x' = M + \left( \frac{1-M}{E} - 1 \right) \frac{y'^2}{4M} - \left\{ \frac{1}{4E} - \frac{1-M}{2E} + 2 \frac{(1-M)^2}{4E^2} \right\} \frac{y'^4}{8M^3} + \text{etc.} \quad (2)$$

"For mirrors under 20 inches in diameter any further terms would not affect the movement of the knife-edge and pinhole moving together more than one or two thousandths of an inch, a distance much too small for even an expert to measure with certainty, unless conditions of temperature are rigidly controlled. At the focus the involved error would be only one half of this amount.

"The first equation is the curve of the large mirror and the second is that of the small mirror. When the figures for a given telescope are substituted, these equations will give the distance of any point x y from the focus, measured along the axis in terms of the radius y of any zone. M-E is the distance of the focus back of the surface of the primary mirror. The remainder of equation (1) gives the value of the sagitta for the zone y. It is plain that y has the same significance that r has in the familiar formula  $r^2/R$ .

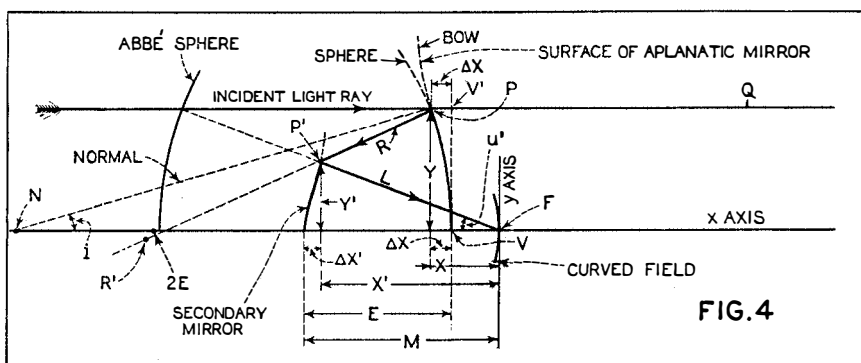
"The mathematically-minded amateur will at once recognize that the first terms of these equations are those of the parabola,

point at the focus F (Figure 4), and the other point on any zone P' on the secondary mirror. This is the distance L. Pivoting on P', swing the dividers around until the point that was at F coincides with the point R', and move the point on P' to P, the corresponding zone on the primary, adding the distance R. Pivot the dividers on P and bring the other point from R' to Q in the produced line of the incident light at P. Close the dividers to reach only to V' on the perpendicular at the center of the mirror, subtracting the distance  $\Delta x$  (the sagitta of the point P). If the calculations and the plotting have been done correctly, the points of the dividers will be just 2E apart, and would be so for all zones of the mirror.

"If we should trace rays of oblique light making an angle of three degrees or four degrees with the parallel rays, we would find the same law holding almost exactly; remembering, of course, that the field of the aplanatic telescope is still spherical. Professor Ritchey expects to eliminate the aberration of the curved field by the use of photographic plates spherically curved to conform to the image field.

"The curves cannot be considered as having any known form, and have no name. Because of the appearance assumed by them when y is greatly increased, it has occurred to one of the authors to call them 'bows.' The appearance of the bows was clearly shown in an illustration in SCIENTIFIC AMERICAN, July, 1932, page 22.

"Both Schwarzschild and Chrétien made their calculations and built their equations on the basis of taking the final equivalent



and that the added terms are quantities which deform it according to a given set of conditions. These conditions are embodied in the equations below, covering the fundamental dictum of Hamilton and the sine condition.

$$R + L - \Delta x = 2E \quad (3)$$

Where  $\Delta x$  is the change in the value of x as y changes.

$$y' = \sin u' \quad (4)$$

"Substituting numerical values for a given telescope in equations (1) and (2), and solving them for different assigned values of y, the meaning of equation (3) can be made clear as follows: Accurately plot the curves to a large scale on coordinate paper. Place a pair of dividers with one

focal length as unity and all other quantities as multiples of this unit. It is as if the focal length of the telescope were one meter and all dimensions were given as fractional parts of the meter.

"In an ordinary reflecting telescope one can place a plane mirror about half way to the focus and return the light toward the primary, turning it aside to an eyepiece at the side of the tube. The plane mirror would be one half the diameter of the primary, as in the Schwarzschild telescope, and would intercept 25 percent of the incident light from the stars. If the primary were figured to the aplanatic curve described above, and the secondary slightly deformed on the concave side in order to

compensate, a superior telescope would result. If such a telescope were figured to f/6, a 12-inch mirror would require a tube only three feet long. It would have the light-grasp of a ten-inch, and the resolving power of a 12-inch telescope, so far as double stars, planetary detail and nebulae were concerned.

"In principle, the calculation of an aplanatic telescope is simple. When the diameter of the primary mirror, the radius of curvature, the distance between the mirrors and the distance from the secondary to the final focal point are known, these quantities are transformed into proportional parts of the equivalent focal length by dividing each in turn by F, and substituted as such in equations (1) and (2). This gives the value of x in terms of y. Then, by assigning different values to y, the values of the sagittae for the different zones can immediately be determined.

"In order to determine the distance the knife-edge and pinhole or slit must move together at the center of curvature, we must know the point where the normals at the point x, y (centers of the zones) cut the axis—the point marked N in Figure 4. The formula for finding this distance is derived from equation (1) and can be written as follows:

$$VN = \frac{1-M}{4E} y^2 + \frac{1}{\frac{1-M}{2E} - \frac{M}{8E} y^2} \quad (5)$$

"This equation is solved for the different zones evaluated above, also for the case where y is equal to zero. This gives a calculation of the radius of curvature which one might expect would check the radius of the sphere when the mirror is completely polished and before figuring starts. Usually, however, it will not check exactly. In the calculations, some decimals will be dropped, hence the calculated radius will be slightly different from the radius of the polished mirror. This difference is too small to have any influence on the calculations of the zones themselves, but it indicates the need of an adjustment in the estimation of the corrections at the point where the knife-edge and pinhole move together. The differences between this calculated radius of curvature and the various distances FN, found for each zone, will be the corrections to apply—the distance to move the knife-edge and pinhole from the focus of the center zone.

"In the test the aplanatic mirror will appear similar to a parabolic or hyperbolic mirror, and care must be exercised throughout to maintain a smooth curve. In applying the corrections they must first be multiplied by the focal length of the telescope in inches.

"After the primary is correctly figured the Ritchey test on Cassegrainian telescopes is arranged and the secondary is figured to look perfectly flat under the pinhole and knife-edge.

"In this way an aplanatic telescope can be produced in which the star images two or three degrees from the center of the field are only very small diffraction circles or slightly elongated ellipses, entirely different from the winged, hairy shapes mentioned at the start."

**C** This completes the discussion proper. Next month the zonal radii for three aplanatic telescopes will be given.

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## THE SCIENTIFIC AMERICAN DIGEST

(Continued from page 38)

of the University of Michigan Museums stated recently.

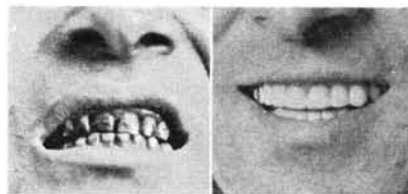
This taboo on living scalped men, common among the plains Indians, was not due to any malice against the unlucky warriors themselves, but to a belief that if a scalped man survived, some supernatural spirit had favored the warrior, and that the spirit might be offended if his human protégé associated with normal members of the tribe, Dr. Gilmore said. This idea of spirit favor was the more powerful, he stated, because a living warrior was never intentionally scalped, contrary to popular opinion. If a mistake was made, it was because the wounded one showed no signs of life, and a later recovery therefore seemed miraculous.

On field trips last summer Dr. Gilmore inspected a cave where these involuntary "ghosts" or hermits lived, far from their villages, and heard several accounts from old members of various tribes. Fifty years ago one of these outcasts, living near the stage route to Cannonball, North Dakota, amused himself by making startling night appearances to the paleface occupants of the stagecoaches.

### Beautification Dentistry

TEETH having badly discolored, disintegrated-looking enamel, or "mottled enamel" as it is called, occur much more commonly in people than is generally realized. In fact, recent research shows that such teeth are prevalent in the people of entire regions, due to the presence of fluorine in their drinking water supply. It has therefore begun to be an established measure of public health practice to control the fluorine content in the drinking water in these regions.

The effects of these measures will not be in evidence, however, for six or seven years, until the teeth formed (in children) subsequent to this change in the water supply will have erupted into the mouth. Meanwhile, however, comes news of an



Before and after: Mottled teeth repaired by process described below

advance in dentistry that makes it possible to restore the teeth of those persons already afflicted with "mottled enamel" to full natural appearance.

Dr. H. Kazis, of Cambridge, Mass., recently made such a transformation of the "mottled enamel" teeth of the patient shown in one of our illustrations, into the naturally beautiful ones shown in another illustration. The transformation is made by covering the discolored teeth with porcelain crowns. This porcelain "crown" covering is put on in a way that covers the en-

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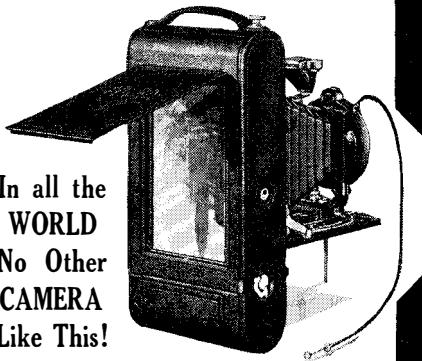
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tire exposed part of the tooth, and so seals and protects it completely. Porcelain being a hard, refractory material, the restored tooth therefore has all the durability, as well as all the beauty, of a natural one.

Such porcelain crown restorations have long been used by dentists to build up a decayed, discolored, or deformed tooth. But to restore all the teeth in a person's mouth, as is necessary in the case of people having "mottled enamel" teeth, was heretofore not thought possible. Dentists believed that porcelain restorations, if applied extensively on many teeth in the mouth, would not stand up. Also, the preparation of a tooth for porcelain restoration requires so much crucial, exacting dental work, that restoring a whole mouthful of teeth in this way was considered by dentists as more than could be endured.

These restraining considerations have, however, been swept away by Dr. Kazis' successfully restoring this patient's entire set of "mottled enamel" teeth with porcelain coverings. The patient in this case has been using his transformed teeth for over a year now, and finds them fully as enduring as they are beautiful.

The restoration of an entire set of "mottled enamel" teeth by porcelain coverings can therefore now be considered fully practical. In other words, not only does science henceforth make possible preventing "mottled enamel" teeth in the coming generations, but it also enables people already having "mottled enamel" teeth to have them all restored to the finest natural durability and beauty.

## Chemical Flowers

DEPRESSION flower gardens which have recently appeared in so many homes, which are being discussed in business offices, in the newspapers, and at teas where the ladies foregather, were described by Tenney L. Davis in a recent issue of the *Technology Review*. The "depression plant" is prepared by mixing:

- 6 tablespoonfuls of salt
- 6 tablespoonfuls of bluing
- 6 tablespoonfuls of water

1 tablespoonful of ammonia water, and pouring, after thorough mixing, over a clinker, a piece of coke or of brick in a broad bowl or dish. After the clinker (or coke or brick) has been wet with the liquid, drop on it a few drops of mercurochrome solution or of red ink or green ink. But do not use iodine, because this reacts with ammonia water to form the dangerously explosive nitrogen iodide, a black powder which is safe as long as it is wet but explodes with a loud report from very slight shock when it is dry. After the materials have been brought together, a coral-like colored growth soon begins to appear on the clinker. This increases rapidly.

The growth also tends to form on the edges of the dish and will climb up and over them unless they have been rubbed with vaseline. The growth will not extend beyond the vaseline.

The "depression flower garden" is a capillary phenomenon involving the tendency of ammonium salts to "creep." The saturated solution deposits crystals around its edges and upon the clinker where the evaporation is greatest. The crystals are porous and act like a wick, sucking up more of the solution by capillary action.

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The solution thus sucked up evaporates to produce more crystals, more wick, and more growth. The addition of a little more ammonia water to the dish will produce more growth after the first growth has stopped. Or the whole may be allowed to dry and may then be kept without further change.

The "mineral flower garden" which florists sometimes sell or display in their windows, depends upon an entirely different principle, that of osmosis or of osmotic pressure. A solution of sodium silicate or "water glass" is poured into a jar or globe, and crystals of readily soluble salts of certain metals which form colored and insoluble silicates are thrown in and allowed to sink to the bottom. Growths resembling marine plants spring up from these crystals and in the course of a few minutes climb rapidly upward through the liquid, often branching and curving, producing an effect which might lead one to believe that he sees exotic algae growing in an aquarium. The experiment works best if the solution of water glass is diluted to a specific gravity of about 1.10.

Ferric chloride produces a brown growth; nickel nitrate, grass green; cupric chloride, emerald green; uranium nitrate, yellow; cobaltous chloride or nitrate, dark blue; and manganous nitrate and zinc sulfate, white.—A. E. B.

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## The New Background of Science

By SIR JAMES JEANS

JEANS' previous book, "The Mysterious Universe," topped the world's record as a scientific best seller, reaching a sale of over 75,000 copies, probably because of its author's way of telling what he has to say and his really having something to say. If the present volume fails to equal that record this will be only because it is more profound and therefore will make a little less easy reading for the average man on the street, though it is about right for the average SCIENTIFIC AMERICAN reader. Its scope is space and time, mechanism, matter and radiation, wave-mechanics, indeterminacy, but the real essence of this book is not the specific ground covered, especially since others have covered much the same ground, but what Jeans says and the way he makes his reader think with him. Heavy stress is laid on the much-mooted question of determinism: Is every tiniest event in the universe the purely mechanical resultant of previous events, the whole forming an unbreakable chain of cause and effect (determinism), or is our own intervention from the outside (free will) possible? Within the past few years the mystics, including Jeans himself, have discovered Heisenberg's principle of indeterminism and exploited it to the utmost against this deterministic doctrine, but they have largely misunderstood it and even Jeans in this new volume now indicates a partial change of heart, though he still rejects the purely mechanistic belief held by many other men of science. Mysticism seems to be a deeply rooted trait in human nature—perhaps this is why Jeans' books have sold so widely. This is a great book, mainly philosophical in flavor. 296 pages.—\$2.65 postpaid.—A. G. I.

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## Successful Treatment for Strychnine Poisoning Found

STRYCHNINE poisoning may be cured by two modern sleeping potions, it appears from a report to the American Medical Association. Successful use of these two medicines in 11 cases is described by Drs. G. F. Kempf, J. T. C. McCallum, and L. G. Zervas of the Lilly Laboratory for Clinical Research, the Indianapolis City Hospital, and the Indiana University School of Medicine.

The two modern medicines are isoamyl-ethylbarbiturate, sometimes called sodium

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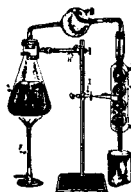
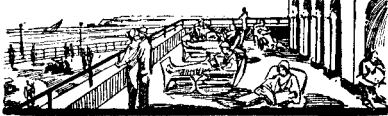
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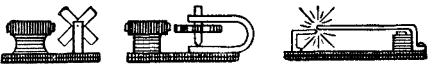
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amyltal for short, and sodium pentobarbital. They are known to induce sleep in restless, suffering patients.

Doctors have been searching for an antidote that would control the convulsions, get the poison out of the body, and supply oxygen so that the patient does not suffocate. Death in strychnine poisoning is due either to exhaustion or to suffocation, the Indianapolis physicians explained. The difficulty with most of the older antidotes for strychnine is that if much strychnine has been taken, the amount of the antidote necessary to counteract its effects would be fatal in itself.

Strychnine poisoning is not only agonizing and commonly fatal but rather frequent. During the three years 1926, 1927, and 1928, it was the cause of more than three deaths a week in the United States death registration area.

"The most prolific source of strychnine poisoning is chocolate or sugar coated household laxative or 'tonic' pills, which are left carelessly around the home and which look so much like candy that young children swallow them by the handful," the American Medical Association recently declared in stressing the need for adequate treatment for this form of poisoning.—*Science Service.*

## TELEPATHY TEST RESULTS

(Continued from page 11)

number composed of three digits, over the radio. This experiment was conducted over the N.B.C. network, and of the thousands of replies received from listeners in, more than 55 percent of them received the impressions 100 percent accurately. I am well aware of the fact that there is nothing supernatural connected with this, and that the day is close at hand when science will thoroughly analyze it.

"Therefore, it is my opinion that tests such as you are conducting will be the means of eventually giving us the fundamental foundation of it all.

"It is quite obvious that the results obtained by your readers show, in many cases, that something other than the law of chance is operating. Several of the charts show a preponderance of correct results that cannot reasonably be ascribed to chance. It is my opinion that, while many of the charts show negative results, others show positive powers of individual telepathic communication that might be developed to a high degree of successful regularity.

"I shall certainly be interested in watching the results of the various SCIENTIFIC AMERICAN tests on this same subject, which, from present indications, should furnish important data that will unquestionably greatly advance the study of telepathy."

**EDITOR'S NOTE:** *The second test of the SCIENTIFIC AMERICAN series was put forth in detail in the June issue. We will greatly appreciate the co-operation of any of our readers who will undertake the test and submit the results to us, regardless of whether or not they feel that these results point toward telepathy.*

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THOUSANDS of busy people have no time to acquire more than the vaguest ideas of astronomy, and lack the patience or incentive to study a textbook. Provided they do not aim to become professional astronomers, this is the book from which to get a good general authentic introductory survey of the main features of this science without going into details or falling

asleep. While it is not a juvenile book, any lad of 12 these days would also readily absorb its contents. It tells "just enough" in 226 pages, and it tells it well—in fact, bang-up well.—\$2.15 postpaid.—*A. G. I.*

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## STELLAR WONDERS

By *Charles Whyte*

THIS book of 190 pages contains 24 radio talks on general astronomy, which were recently broadcast over the radio from Aberdeen, Scotland. This, if really true, disproves the familiar assertion that the Aberdonians never give the rest of the Scots anything, not even "ether" vibrations. It is a mighty interesting short account of the science of astronomy, suited to readers who approach science for the first time. The publishers do not even "give" the price of the book, but it looks like about \$2.00.—*A. G. I.*

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TRAVEL and exploration through little known countries by two experienced observers furnish a wealth of detail and photographs of the interesting manners and customs which have seen little change for centuries. Based on the purpose of collecting birds, mammals and reptiles for the Harvard Museum, the scientific aspects of the various expeditions were always in the foreground. Valuable material was obtained which is the subject of later monographs, but this story is of particular interest from the adventurous side.—\$3.20 postpaid.

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## THE INTERNATIONAL YEAR BOOK FOR 1932

*Frank H. Vizetelly, Editor*

WITH a new and experienced editor, the editorial policy of this issue remains the same as in former years. Unemployment, the banking situation, prohibition, and farm relief are adequately covered. A special business review, athletic games, racketeering, as well as the advances in physics and chemistry receive proportionate treatment. The alphabetical arrangement and extensive cross-indexing provide quick reference for convenient consulta-

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# COMMERCIAL PROPERTY NEWS

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## Noted Inventor Dies

FRANCIS H. RICHARDS, at one time holder of more patents than any man in the United States except Thomas A. Edison, died April 29, 1933. He was born in New Hartford, Conn., on Oct. 20, 1850.

Mr. Richards, who in recent years was consulting engineer and designer for the Pratt & Whitney Company of Hartford, had 1000 patents to his credit, among them one for the manufacture of golf balls by machine. His remarkable inventions were regarded by the Stanley Company as the chief reason for the growth of its world-wide business.

For the United States Envelope Company he invented a machine which folded, gummed, counted and bound envelopes in one process, and for the Pratt & Whitney Company he invented an automatic weighing machine.

Among the inventions of Mr. Richards were an air-cushion door, a gas process, 256 patents for weighing machines, more than 200 for machine-shop tools and appliances, more than 100 for typographic machines and many for coke furnaces and door springs. In 1915 SCIENTIFIC AMERICAN credited him with 847 patents, second in number to the 977 then held by Thomas A. Edison.

## Foreign Dressmakers To Stop Copying

THE luxury dressmakers of Paris have recently organized a conference with delegates from various European countries in the attempt to secure co-operation for the suppression of illegal copying and sale of original dress models, according to a report from Assistant Trade Commissioner G. W. Berkalew, Paris.

Twelve representatives from Belgium, ten from Germany, and several official delegates from Italy met to discuss the adoption of protective measures against commercial espionage and fraudulent sale of designs and models.

It was recognized at the conference that advance fashion showings in the future would be exclusively limited in attendance to authentic buyers who would be required to show an identity card with photograph of the bearer attached indicating the firm represented.—(Department of Commerce.)

## 'Charles of London' Name Upheld

JUSTICE Wenzel in Queens Supreme Court recently granted a temporary injunction to Charles Duveen, son of Lord Joseph Duveen, well-known English art expert, restraining S. Karpen & Brothers, Inc., furniture manufacturers of Long Island City, from using the name "Charles of London" for their products.

Mr. Duveen testified that he had been

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

a designer and creator of fine furniture for 35 years and that he incorporated his business here under the name Charles of London in November, 1931. He said the Karpen company had no connection whatever with him.

The defendant argued that the name Charles of London had become so well known that it was synonymous with a type of furniture and therefore common property, like the names Chippendale and Heppelwhite.

"The court is in accord with the claim of the plaintiff that he has a property right in the name and regards as spurious the defendant's claim that it has become a generic term," Justice Wenzel said. "Charles of London still lives and does business and the public has a right to believe that furniture bearing his name, though perhaps not made by him, is at least of his design and stamped with his approval. Some day the name may belong to posterity, but today it belongs to the plaintiff."

## Government Workers May Keep Patents

FEDERAL employees who develop inventions need not assign the patents to the United States nor grant the government exclusive rights unless specifically assigned to work out the inventions concerned, the Supreme Court ruled in the suit of the government against the Dubilier Condenser Corporation.

The opinion, written by Justice Roberts, concerned three radio inventions by Francis W. Dunmore and Percival D. Lowell, while employed in the Bureau of Standards, and subsequently controlled by the Dubilier Corporation. (See also page 63, January, 1933, SCIENTIFIC AMERICAN.)

The inventions made possible the substitution of alternating current for direct battery current in radio apparatus; tended to eliminate "hum" in sets, and energized a dynamic type of loud-speaker with alternating current.

Originally the government sued the Dubilier Corporation as exclusive licensee, contending that the patents belonged to the government because Messrs. Dunmore and Lowell worked them out while employees of the Bureau of Standards. The Federal court for the District of Delaware dismissed the suits and was upheld by the Third Circuit Court of Appeals, these tribunals being sustained by the Supreme Court.

Justice Roberts held that Congress and not the courts should declare a policy with relation to governmental control of patents. He said that the courts were "incompetent to answer the difficult question whether the patentee is to be allowed his exclusive right or compelled to dedicate his invention to the public."

## New Steel Rail Joint Invented

A NEW method of joining steel rails has been invented in Germany, according to a report received by the Bureau of Foreign and Domestic Commerce, Department of Commerce, from Vice Consul Medalie in Stuttgart.

The inventor, named Rolshoven, it was stated, claims that the new method will eliminate jolting and defy sabotage. It was stated also that the German National Railways have successfully tried out this invention during the last six months and are considering its installation.

The Bureau announced that a report giving complete details, with illustrations, may be borrowed from its Transportation Division at Washington upon request, mentioning Exhibit No. 3174.

## Beverage Trademarks

IT was recently held by First Assistant Commissioner Kinnan that Bon Ton Beverages, Inc., of Chicago, Illinois, is not entitled to register, as a trademark for a nonalcoholic, maltless beverage sold as a soft drink, and syrup for making the same, the notation "Pop-Eye Punch," the word "Punch" being disclaimed, in view of the prior registration by The Popsicle Corporation of the United States, of New York, New York, of the word "Popsicle" as a trademark for lollypops, the same term in connection with the representation of a stick having candy on one end and the words "A Drink on a Stick," therebeneath as a trademark for nonalcoholic, maltless syrups.

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

In his decision, after noting that one of opposer's marks includes the additional features above mentioned, the First Assistant Commissioner said:

"It must be held however that the prominent and predominating feature of the opposer's mark used upon the beverages is the word 'Popsicle,' and that this is so nearly like the applicant's mark in spelling, appearance, and sound as to render confusion quite probable."

With reference to the goods, he held that nonalcoholic, maltless syrups recited in one of opposer's registrations and a non-alcoholic, maltless beverage recited in applicant's application are of substantially the same class.

## Outline of the Universe

By J. G. CROWTHER

THE whole universe, from electrons to stars, including life, is the scope of this book, which was written by the author of several rather recent articles in the SCIENTIFIC AMERICAN. There have been a number of books treating everything in the universe, so to speak, but we place this one on the top of the pile for it conveys the true atmosphere of science. Not only does it cover inorganic science—modern cosmology and astrophysics and atomic physics—but the organic world as well, from the sub-microscopic viruses to apes and psychology. And it is all pleasant reading, not dull, but bright and constantly interesting.—\$3.65 postpaid.

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