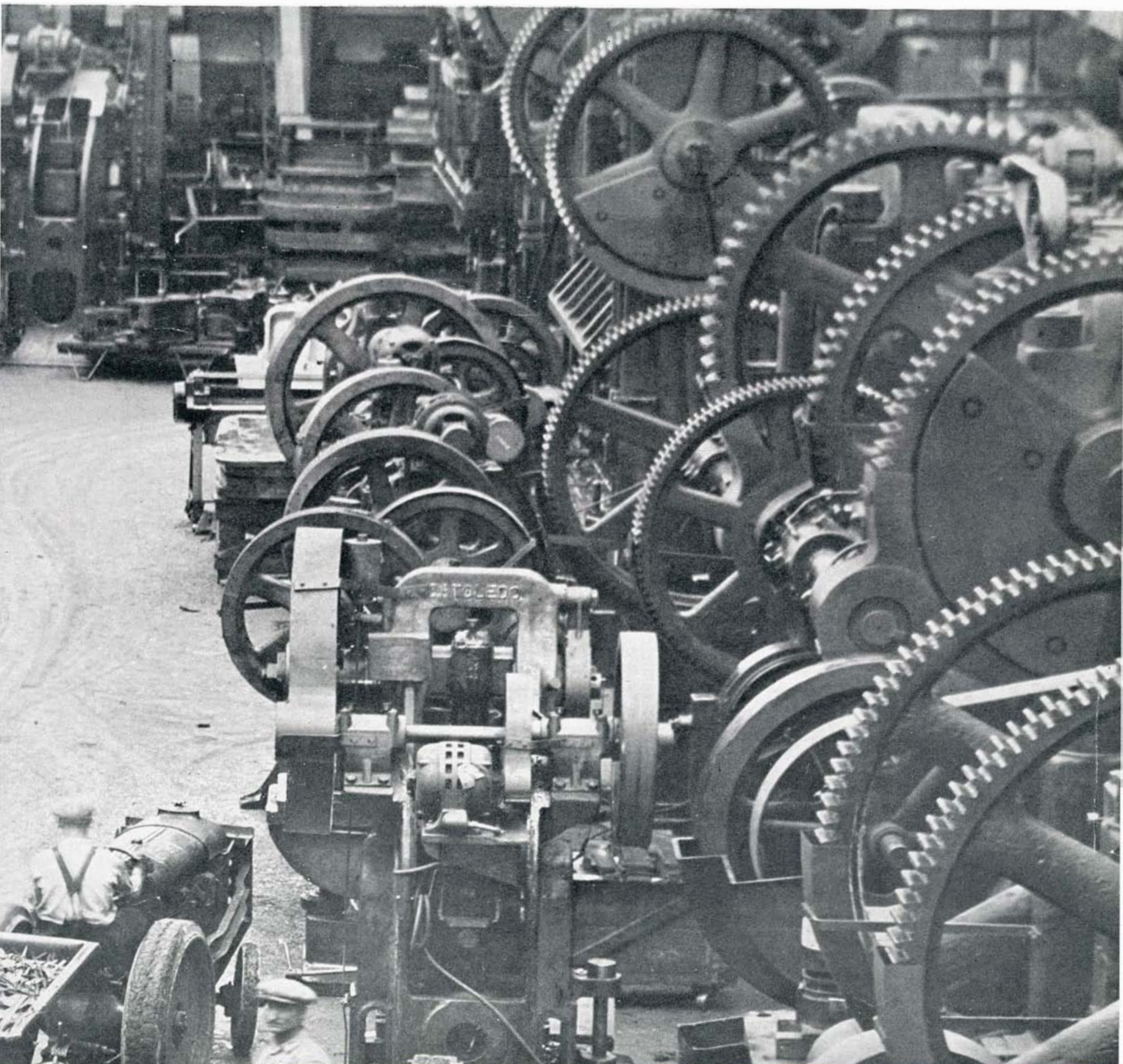
Bureaucracy and the Farmer

By Senator HARRY F. BYRD

SCIENTIFIC AMERICAN

Vol. 151 No. 2 AUGUST, 1934 35c a Copy



ph By Margaret Bourke-White

Has Man Betrayed the Machine? (See page 57)

SCIENTIFIC AMERICAN

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NINETIETH YEAR • ORSON D. MUNN, Editor

NRA CODE

CONTENTS · AUGUST · 1934

Cover

"THE machine has not betrayed us. We have betrayed the machine. . ." This is the essence of a statement by Dr. Glenn Frank, quoted in more complete detail in the editorial "The Century Ahead," page 65. Our cover picture, illustrative of man's dependence on machinery, typifies the wheels of industry. It was taken in the Chrysler plant, and shows one end of the huge stamping machines used in turning out fenders for the motor cars made in the factory so ably described by Professor Klemin in his article starting on page 61 of this issue.

SCIENTIFIC AMERICAN DIGEST

SCIENTIFIC AMERICAN, August, 1934. Vol. No. 151, No. 2, entered at the New York, N. Y. Post Office as second class matter June 28, 1879, under the act of March 3rd, 1879; additional entry at Greenwich, Conn. Published monthly by Munn & Company, Inc., 24 West 40th Street, New York City. Subscription price $4.00 per year. Canada $4.50. Foreign $5.00. Manuscripts are submitted at the author's risk and cannot be returned unless accompanied by postage.

ACROSS THE EDITOR'S DESK

SIR THOMAS LIPTON tried for many years to recapture for England the America's Cup, time-honored symbol of the best in the sport of yacht racing. Since the passing of that gallant sportsman, no challenger has appeared to question the supremacy of American yachtsmen until this year. Now, however, a worthy opponent has appeared on the horizon, and at the time of writing trials are being run to determine which of several American yachts shall be entrusted with the honor of defending the Cup. The Cup races themselves will be run in September, and the September number of SCIENTIFIC AMERICAN, available to readers in August, will carry a feature story of the details of the defender. We have arranged with Herbert L. Stone, editor of *Yachting*, to write this article for us. Mr. Stone knows yachts from stem to stern, from keel to masthead, and is in a position to give accurate and authentic information in an interesting and informative manner.

●

"IN the new Germany today, laws are being enacted which are designed to a large extent for the benefit of future generations, and usually with no regard for the approval or disapproval they may now find. In Germany all thinking and planning has as its aim the improvement of the health standards of the people through the application of biological science. May it not be that the sufferings and sorrows of the Germany of the past, of to-day and to-morrow may sooner or later become the concern of any other nation?" Thus is introduced an article on human sterilization from the German point of view, the third in our series, prepared especially for us by a prominent German physician. Regardless of what one may think of the politics of Germany, it must be admitted that she is making a brave struggle for existence; in this article the matter of sterilization is reduced to a matter of dollars and cents—or rather of Reichsmarks—a powerful argument in times of economic stress.

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ON page 82 of this issue starts an article entitled "Why the Battleship?" In it, Commander Jonas H. Ingram indicates the place of the battleship in the line of national defense, and shows how incomplete a navy would be if these dreadnaughts were eliminated from the fleet. Next month Commander Ingram will take up more specifically the battleship itself and its actual functions, thus rounding out an excellent answer to those more superficial thinkers who would ruthlessly junk all existing naval ships with the exception of submarines and airplanes. The two articles by Commander Ingram will enable our readers to follow more intelligently the international naval arguments which will appear in the newspapers in the future.

NEXT MONTH

¶ The defense of the America's Cup, By Herbert L. Stone, editor of Yachting.

¶ Donald A. Laird, Ph.D., on sleep and sleeping.

¶ An official statement regarding Germany's experiment with human sterilization.

¶ An advanced article on sun dials.

COMING

¶ The case against human sterilization.

¶ Details of the big guns which guard the Panama Canal.

¶ How 91 miles of 18-foot aqueduct tunnel are being bored through the mountains of California.

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WHAT kind of bedroom would you select as being more conducive to sound and restful sleep? A bright, cheerful room with frilly curtains and modernistic decorations on the dresser? Or spartan simplicity in a room with windows which can be flung wide to the four winds, and little or no decoration? According to Dr. Donald A. Laird, Director of the Colgate University Psychological Laboratory, you would be wrong no matter which of these extremes you selected. Indeed, says Dr. Laird, in an article scheduled for early publication, "if you would keep good health and spirits . . . make the sleeping room like a bear's cave—blue and green with deep shadows, sheltered from outer noise as with woodland leaves . . . and completely free from vagrant air currents which cause even the gentlest motion of, and therefore sound from, curtains, calendars, lamp shades, and other ornaments . . ." Many of your preconceived ideas regarding sleep are going to be upset by this article, backed by scientific research.

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AFTER ten years of work on the great Coral Reef Group, which is now approaching completion in the Hall of Ocean Life in the American Museum of Natural History, New York City, Dr. Roy Waldo Miner took his fifth expedition to the Bahaman coral reefs in order to make another underwater study and to compare the artificially colored corals that will be used in the group with the natural growths. Dr. Miner will describe his work in an article to be published soon, accompanied by a series of striking photographs taken by the expedition. When finished, the Coral Reef Group will be the equivalent of 30 ordinary museum groups in size and will occupy one third of the entire end of the Hall of Ocean Life, which is itself probably the largest museum exhibition hall in the world.

●

IN the second and final part of the article on "Excavations at Ur," the first of which starts on page 66 of this issue, Prof. C. Leonard Woolley continues his absorbing story of the recent archeological finds in Chaldea. There civilization has been traced back to the time of the Great Flood, and under the flood deposits have been found remains of the antediluvian inhabitants of the country. Professor Woolley's graphic descriptions of the finds that have been made, and the conclusions drawn from them, give to the reader all the mental stimulation that is such an important part of archeological exploration.

Editor and Publisher

Photo by Gerald E. McCord

THE LINK BETWEEN ARCTURUS AND THE FAIR

AS is widely known, the illumination at the Century of Progress at Chicago was last year turned on each night by means of rays of light from the star Arcturus, caught by a telescope at Elgin, Illinois, and converted photo-electrically into electrical impulses which were sent by wire to the Fair and amplified to operate relays. The same telescope is this year set up in the court of the Hall of Science at the Fair. This telescope is shown above with its maker and owner, Professor Arthur Howe Carpenter of the Department of Metallurgy at the Armour Institute of Technology. It has a 20½-inch mirror.

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Walter P. Chrysler

A research triumvirate famous in automotive circles. *Left to right:* Fred Zeder, Carl Breer, and Owen Skelton, who have developed a definite philosophy of research in industry

How RESEARCH Makes Possible The Modern MOTOR CAR

By PROF. ALEXANDER KLEMIN

In charge, Daniel Guggenheim School of Aeronautics, New York University
Associate Editor, *Scientific American*

IT may be safely said that those American industries thrive and advance which carry on research wisely and effectively. A recent visit to the Chrysler Engineering Laboratories gave striking confirmation of the truth of this statement. There is no industry more progressive than the automobile industry; no major factor in this industry better aware of research possibilities than Chrysler.

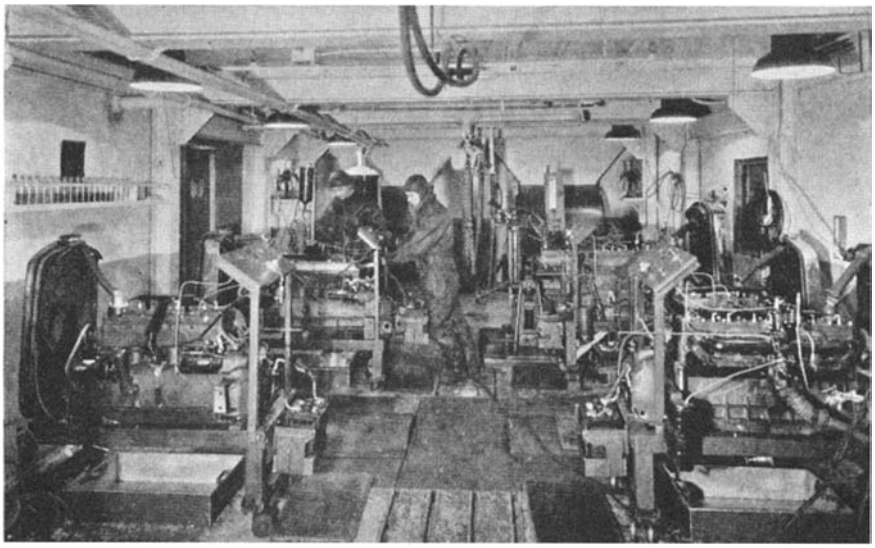
A reader of advertising matter might form the conclusion that Walter P. Chrysler, working with a few able men, produces a new design as a matter of pure inspiration. Chrysler is a broadly trained engineer who works along original lines and who inspires and gives full scope to able designers and investigators, but the creation of a new model actually comes as the result of arduous and patient effort, original and thorough research, followed by the most careful experimental construction.

MODERN technology provides abundant weapons for every type of research and experiment. Scientific instruments and apparatus, experimental machine shop practice, chemical and physical laboratories, methods of mathematical analysis, have all been developed to such a pitch of flexibility and perfection that these ends are today almost taken for granted; what is much more important in industrial advance is personnel and philosophy of research.

Prior to a fascinating and rather overwhelming visit to the laboratories, the writer of this article spent a few pleasant hours with the Chrysler research "triumvirate" to see whether a philosophy of research did indeed animate the organization.

The triumvirate is famous in automotive circles. Fred Zeder is rugged, impetuous, full of indomitable courage and vision, a graduate of the University of Michigan, who has driven a locomotive and uncoupled freight cars. Carl Breer, a Stanford University graduate mechanical engineer of wide experience, is above all observant and imaginative. Owen Skelton, an equally capable engineer, is calm and steady—the balance wheel. That the views of these men on industrial research have ever been set down in a cold formal document is as unlikely as that the British Constitution has ever been deliberately written. Nevertheless they do have a definite philosophy—coherent, clear, and applicable to every branch of industry.

Every piece of industrial research must be based on a definite hypothesis. The hypothesis must derive not from idle speculation or mere wishfulness, but from observation, service records and experience, the systematic study of public opinion, or the lessons of other fields of applied science. Granted that the fundamental hypothesis is sound in principle, no difficulties of execution can be allowed to stand in the way of realization. A sound and desirable mechanical or scientific idea can always be realized, given sufficient courage and persistence. Mere research for re-



Automobile engines undergoing severe tests in the "cold room"

search's sake is inadmissible in an industrial laboratory. The invention, experiment, or research must serve some definite commercial purpose. It must be put into a definite project form, pondered over, carefully outlined and budgeted like any other business undertaking.

In the selection of men for carrying out a given investigation, their personal preferences and interests should serve as a guide. In actual practice this means that departments are flexible and that various problems to be solved are allotted to those men who express in conference the greatest and most intelligent interest in such tasks. Further, although a budget and a general plan are essential, a line of research should be pursued with perfect flexibility and with no red tape.

This is a working credo which might well serve many another organization. It is faithfully lived up to by the triumvirate and the several hundred picked men who work under its direction.

IT is of interest to classify roughly the main objectives of modern automotive research. Such a classification can never be complete and will vary from year to year. Progress is never entirely a matter of rigid planning, and has an evolutionary growth which is sometimes a matter of accident, circumstances, discoveries in other fields, brilliant inspiration. Nevertheless it may be said that for the time being there is a concentration of interest along the following topics. First, increased speed or, alternatively, increased economy of operation at a given speed. Second, improvement of passenger comfort, as by the elimination of vibration and by a more thorough understanding of automobile dynamics.

Next there is a constant striving for greater safety and reliability. Metallurgical improvements and the use of special materials such as rubber are given constant thought. The application of the principles of industrial art to the automobile occupies the minds not only of specialists but of all the key men concerned with automobile design. Last but not least we find a vital interest in the problem of the selection and practical education of its present and incoming personnel.

This approximate subdivision of activity will serve as a guide in our brief survey of the research activities of this energetic, typically Detroit association.

PERHAPS the most interesting problem tackled in recent years by this group of engineers is the streamlining of the motor car. The inception of the present car is an illustration of the triumvirate's philosophy that progress comes from observation and imagination. Several years ago Mr. Breer, riding in a car near Port Huron, saw a formation flight of Selfridge Field pursuit planes. It occurred to him that it was a wonderful thing to see a heavily loaded, fully equipped army plane supported by thin air. Evidently the lift of air was powerful. Perhaps air force could be applied, not to lift a car, but to press it down more firmly on the ground at high speeds, and increase the steadiness of fast riding.

Rudimentary experiments indicated that the lift of an automobile was a negligible affair, but that the air drag was far greater than commonly estimated. Why not reduce the drag by streamlining? (It is curious to see here an instance of what frequently happens in research: An apparently erroneous conception leading in the hands of intelligent men to a correct and truly important development.) The streamline car did not then suddenly emerge. Hundreds of experiments conducted under the capable direction of Mr. Breer, first in a very small wind tunnel, then in a larger tunnel with frequent checks in still larger university tunnels, led to the best form that could be employed, with due regard to all the other requirements of the automobile.

It is a sophisticated thing to say that the Airflow car is not fully streamlined. Any aerodynamicist could in a very short time produce a number of shapes apparently fit for automobile use and having much less air drag. But in applying such streamline shapes it would very soon become apparent that compromises have to be made. For example, it is impossible to enclose the front road wheels, which must of necessity swivel. It is impossible to give the car an airship bow if the engine is to be placed in front and passengers at the same time are to be given perfect vision. It is impossible to lengthen the body indefinitely into fish tail form and still have a car which is practicable in congested traffic. Thus the Airflow car is an engineering compromise between ideal aerodynamics and practical automobile design.

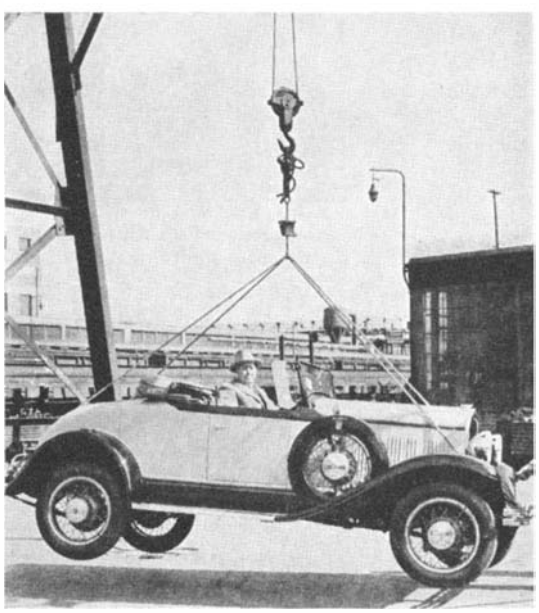
The chemistry laboratory of a university founded within the walls of an industrial plant

NOT so many years ago rigidity and great weight were considered essential in all forms of heavy engineering where varying forces and moments were encountered. In vehicles of transportation it was thought necessary to have immense weights, such as are still found in our steam locomotives and heavy Pullman cars. The heavier and larger the automobile, the steadier and safer it was supposed to be on the road. To a certain extent mere weight did eliminate vibration and give steadiness, but this meant expensive construction and

wastefulness in operation. With the growth of a new science—vibration engineering—we find a totally new tendency. It is now sought, whether in the automobile or the railroad train or even the prosaic trolley car, to eliminate vibration by more subtle methods and by a better understanding of applied dynamics.

Vibration dynamics starts with such readily understood phenomena as the swing of a pendulum and the oscillation of a spring with a weight suspended from one end. It ends with the mathematically complex problems of an automobile comprising an engine with varying torque impulses; powerful inertia forces occurring at varying times; mass distribution which must satisfy requirements other than those of vibration; springs which must be strong yet yielding; bumps in the road which encounter but one wheel at a given instant.

One of the leading exponents of modern vibration engineering is R. K. Lee, in charge of special research. The elimination of vibration has been with him not the result of sudden inspiration but of many years of purposeful effort.



The entire weight of the car is suspended from a rubber block between steel plates, showing strong adhesion of rubber to metal

It is impossible in this article even to outline the science of vibration. It is interesting, however, to mention some of the weapons employed.

First of all has come mathematical analysis. The equations of motion have been solved not only for the simple pendulum and the oscillating spring but for the complex dynamical systems of the motor car. Masses and their distribution moments of inertia, restoring forces, damping forces, centers of gravity, were all taken into account and the mathematical problem solved.

For the determination of the elements involved a number of devices were employed. For example, an entire engine was swung on ball bearings like a huge pendulum. From the observed time of swing it is possible to determine the moment of inertia of the engine. From its position of equilibrium the exact location of the center of gravity has been found.

In the study of engine torque impulses, the tortiograph was employed. This is a machine which is clamped on the front end of a crankshaft. One part of the tortiograph follows implicitly the vibration of the engine; the other has a smooth rotary movement. By means of reflected light the instrument traces on a photographic negative the relative displacements between the two parts and hence gives a faithful picture of the torsional oscillation of the engine.

IT is, therefore, the result of a truly scientific approach that the dynamics of vibration has been mastered in the modern automobile. Here, in brief, are the various ingenious developments which have given us easy riding cars of light weight and few engine cylinders.

First there is Floating Power with which every reader is familiar. The second outstanding achievement lies in the production of a perfect torsional damper. Between the front end of the crankshaft and the front bearing a rubber disk receives all the moments from steel to steel. The use of rubber as the sole connecting unit is made possible by the perfect adhesion of steel to rubber (a matter we shall come back to a little later). The interposition of a damping element such as rubber took out torsional vibrations, as shown by tortiograph records.

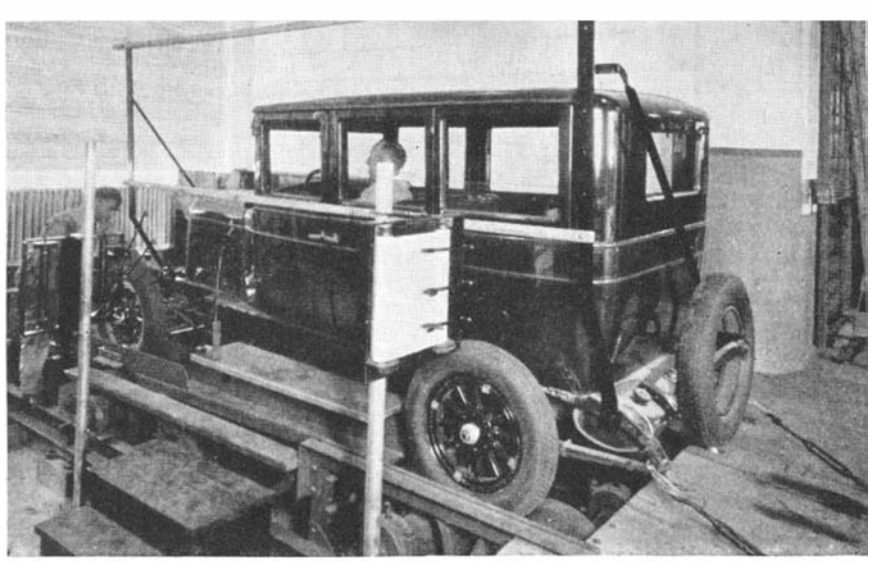
The next line of attack was in the distribution of masses in the streamlined car. The mass of the engine now rests squarely over the front axle; other heavy masses are over the rear axle. This is entirely logical in itself—heavy weights should lie as closely as possible to the points of support. There is another great advantage, however, in this spreading out of the masses from the center of gravity—the moment of inertia of the car about a transverse axis is greatly increased. This makes for a much slower period of oscillation in pitch and therefore more comfortable riding.

Again, because of streamlining, the passengers were moved considerably forward in relation to the rear axle and hence were placed much nearer to the center of gravity. Every experienced ocean traveler likes to have his cabin as near the center of gravity of the ship as possible, where motion is reduced to a minimum. In the Airflow car considerations of streamlining and of dynamics combined to give the occupants an ideal location.

Of course, this treatment of the vibration and dynamics of the modern car is superficial and touches only on a few of the "highlights." A serious study is not as difficult as a study of Einstein's Theory of Relativity, but requires nevertheless a rigorous mathematical and experimental approach.

ONE of the most interesting phases of our visit was the inspection of the mechanical laboratory, under the guidance of the Chief Engineer, Harry Woolson, whose motto is evidently "safety through destruction." No matter how carefully a part may be designed, no matter how well selected the materials employed, the ultimate safeguard lies only in indefinitely repeated

(*Please turn to page* 107)



The Belgian Roll subjects a car to greater stresses than the roughest of roads

Composing a Picture

By F. D. McHUGH

An excellent composition: a tree dominant and a bridge subordinate

TO the rank amateur, scenic photography is a simple matter. To the more advanced photographer, however, the problem becomes one of full appreciation of the various elements of a projected picture. Very often the advanced amateur will study a certain scene for hours, and sometimes will revisit a scene for days endeavoring to catch the lighting or cloud formations that will bring out most effectively the principal features of the composition. Often a pocket reducing glass is valuable for this job of composing because it will reduce and concentrate the entire picture to a closer approximation of its final size on paper.

The great secret of artistic work is simplicity, the avoidance of overcrowding, and the employment of the fewest lines and masses in the composition of your picture. Harmony and balance rank next in importance. Usually human figures fail to harmonize either in costume or pose with the subject. Domestic animals—horses, cows, sheep—can, however, frequently be introduced with success. If you must use human figures do not let them look directly at the camera, and see that they harmonize in every way.

Naturally there should be a reason for making your picture. It is made to preserve a record of some interesting place, some picturesque grouping of natural or man-made objects or both, to picture the beauty of some bit of land or sky, or to produce a picture which appeals to the observer purely because of its innate beauty of line or tone.

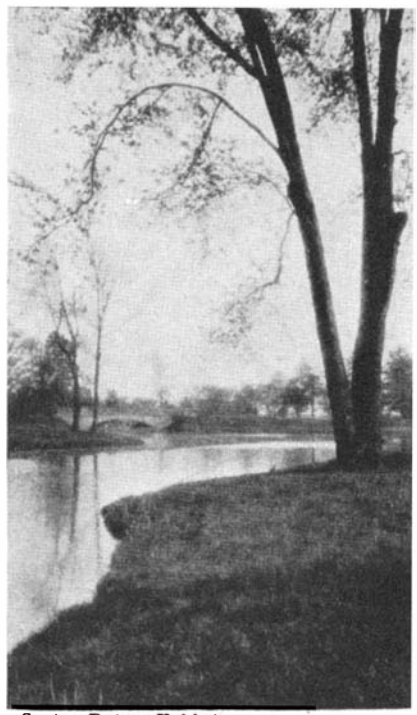
Composition is not an exact science that can be depended upon mechanically to produce results. We can, nevertheless, apply general principles that will aid us materially in avoiding the inartistic.

Bringing things together in an orderly and symmetrical arrangement is perhaps as good a definition of composition as any other. Selection naturally precedes composition and the first lesson to be learned is to leave out what is not required. A good rule is to seek first a good foreground—one that will lead the eye unobtrusively yet pleasantly up to the principal object in the picture. Choose your viewpoint carefully, for while the painter can eliminate what he desires, you have the advantage of being able to move your camera where you wish to secure the effect you desire.

YOUR picture must have a dominant figure or object to which all other parts of the picture must be subordinate. An object of secondary interest should be included for balance. For example, if your principal object is a clump of trees, a second clump a little farther away, or perhaps a woman playing with a child or watching an incoming boat—this constitutes the motif of your picture.

Remember always that the background must be subordinate and unobtrusive, also that there should not be two highlights or deep shadows of equal importance and that when possible the deepest shadow should meet the highlight. Furthermore, the most important position in a picture is towards the center either to the right or left. The exact center should always be avoided.

Of equal importance with the arrangement of the objects in your picture is the question of lighting, as the lighting determines the strength and position of lights and shadows. Beginners as a rule should have the sun behind the back or over the shoulder but the advanced amateur will try for more unusual pictures. He will frequently make photographs with the sun to one side and sometimes may enhance the value of his picture by having the sun in front of him—with the lens shaded of course!



Courtesy Eastman Kodak Company

The same scene artistically softened by the use of a light-diffusion disk

The horizon line, usually so conspicuous, should never divide the picture into two equal parts, but should be approximately one-third from the top or from the bottom. When this line is nearer the bottom, clouds in the sky are a decided advantage although to photograph them a filter is usually necessary. (The technique of using filters will be the subject of our photography article next month.)

The shadows should also have careful study. These should be transparent to a degree, always containing detail. Heavy black shadows are a detriment. When the sun is very bright and the lights are strong while shadows are black, the snapshot usually gives too great a contrast. This can be overcome with a very short time exposure and small diaphragm opening, resulting in a softening of the highlights and added detail in the shadows.

It used to be that most landscape photographers wanted "hair line" sharpness in all pictures. Now, however, softer lines are often preferred. As the amount of diffusion is governed by the size of the lens stop used, the effect desired can be easily obtained in certain subjects. Exactly the right degree of diffusion can be secured by using a diffusion disk over the regular camera lens.

OUR POINT OF VIEW

The Century Ahead

IS the world finished? Have we reached the pinnacle of progress already, with nothing outstanding ahead of us? The Glooms would have it so, but 500 leaders in science and industry believe otherwise; and, in no uncertain terms, proclaim, by inference, that today is our period of adolescence. They say the 21st Century will be the "Coming-of-Age" Century of mankind.

The occasion for the expression of this philosophy of achievement was a meeting in the Hall of Progress in the General Motors Building, Century of Progress Exposition, to which these 500 specialists were invited by Alfred P. Sloan, Jr. Were it not for the fact that these men are all hard-bitten realists who deal in facts rather than dreams, one might be inclined to suggest that they had allowed their imaginations to run away with them. Their predictions of what we may expect in future years were so amazing as to be almost beyond conception.

Such fields as housing, transportation, medicine, education, communications, radio, television, new consumable products, and new useful services came within the range of discussion by these learned men. One by one they spoke, and all agreed that science and industry are on the threshold of great achievements.

Airplanes will be powered from stations on the ground. Electric motors will run by sunlight. Infectious disease will be eliminated. Regular transoceanic airplane schedules will be run. Slums will be wiped out by low-cost pre-fabricated houses. Man will live to the Biblical three-score years and ten. All houses will be air-conditioned. Facsimile radio will "manufacture" your "newspaper" in your home. These are but a few of the suggestions of what developments to look for in the next decade, according to various authorities at the meeting.

SCIENTIFIC AMERICAN is thoroughly in accord with the statements of Mr. Sloan and others condemning the defeatist attitude that has, of late, become so prevalent. We have often voiced our opinion forcefully on that score. Dr. Glenn Frank, President of the University of Wisconsin, however, expressed this progressive viewpoint so clearly that we shall quote him:

"The machine has not betrayed us. We have betrayed the machine. Science and technology have given us the means by which we may emancipate the race from poverty, drudgery, and insecurity. If we now prove incapable of using these means to the full, the verdict of history upon us will be that we were a people strangled by our own success."

Progress has only just begun; we will *not* be forced to divide jobs at present available in order to live; and we will *not* be faced with acceptance of a lower standard of living.

Super Alchemy

IT took chemistry hundreds of years to discover in Nature all of the 92 chemical elements which Mendeleeff was able to predict in advance, through his great generalization, the famous periodic table. Now the Italian physicist Fermi has given us Element 93. Does this mean that, with Nature's normal 92 elements already found, we are at the beginning of a new series of discoveries of super-elements higher in atomic weight than those already known?

It has long been stated in a loose sort of way that there is no known reason why Nature stopped at 92, and that this number may represent only her liberality in that part of the universe with which we are familiar. Elsewhere, under different conditions, the scale might go higher, it was thought. But most of those who expressed such thoughts were not expressing real opinions—instead these were little more than logical speculations which could neither be proved nor disproved and hence were allowed to stand unchallenged. More recently, however, Sir Arthur Eddington, on better than merely speculative grounds, has expressed the belief that the number of possible elements is 136.

It must be kept clearly in mind that the new "discovery" (which was actually a man-made synthesis) of Element 93 had nothing to do with the earlier predictions. It was the logical outcome of research done recently by the French physicists, Irene Curie Joliot (daughter of the Madame Curie of radium fame), and her husband, Professor F. Joliot. These two announced early in the present year that they had created forms of nitrogen, silicon, and phosphorous by bombarding the nuclei of boron, magnesium, and aluminum with the cores of helium atoms. These elements of higher weight were thus synthesized from elements of lower weight, but they did not "stay put"—they proved to be radioactive and transitory. What the Italian physicist has done is really of a piece with their work.

Now that it has been done, what of it? Shall we some time be able to do something with it, run something, cure something, or tax it? The answer is, we do not yet know. Certain it is that "useless" discoveries of the past have almost always turned out to be extremely useful in some unexpected way—if for nothing else than as an approach to other discoveries which are useful. The world must wait and see.

Airplane Fatalities

TWO fatal air-transport crashes within ten days; three since the airlines recovered the carrying of mail; six crashes in all during the same period, three of them being of lesser importance but still serious enough to cause comment. This has been the recent record of the air-transport lines—twice as many fatalities as during the last six months of 1933.

SCIENTIFIC AMERICAN has frequently published articles telling of achievements in aeronautical engineering, often stressing the safety features to be found on modern aircraft. But all these advances are to no avail unless installed by the operators and used by the pilots. All of the crashes mentioned above were associated with bad weather, but the highly developed weather reporting system now in use should seemingly be sufficient to permit pilots to avoid storm areas or to keep to the ground until weather conditions were safe for flying.

It is possible that economies effected in operations, together with too severe competition, have caused planes to be sent into the air when conditions were not right. If this is so, more rigid control of air-transport companies should be exercised in the interest of public safety. If operators are going to continue to order planes to fly against what should be their better judgment, they should be held strictly responsible for their acts.

In the past, the results of investigations of aircraft accidents have not been published; the Rayburn bill, which should have the support of everyone concerned with the future of aviation, will make such publication compulsory. Then and then only will the public be thoroughly informed of the facts.

In the meantime, air-transport operators should take advantage of every available safety device; if they fail to do so, they will betray their public trust and should be outlawed from their chosen business.

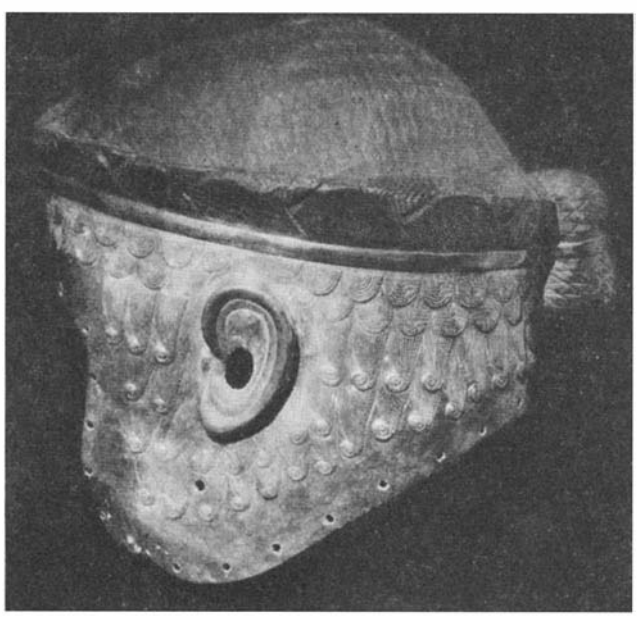
EXCAVATIONS AT UR*

By C. LEONARD WOOLLEY, M.A., Litt.D.
Director of the Joint Expedition of the British Museum and the Museum of the University of Pennsylvania to Mesopotamia

WE have done so much work at Ur during the last 11 years that I cannot possibly attempt to deal with all that we have found, and it becomes a question of selection. I have selected not so much a subject as a problem. I suppose that any new discovery produces more problems than it solves, and certainly the discoveries that we have made at Ur have tended to set scientists by the ears rather than to satisfy them with the new information obtained. There are many disputed points and there have been many surprises. I suppose that in archeology, a minor science, few surprises in recent years have been so great as that occasioned by the excavation of the great cemetery lying beneath the ruins of Ur. I am going to say something about that cemetery and then raise one or two of the main questions which have already been disputed by people interested in the subject though not always as yet in possession of the facts. I shall try to show how important the cemetery at Ur is in its historical relations to what was its past and to what became its future.

The first thing that was found, which threw a light on what was going to be discovered, was a dagger, which became famous as the dagger of Ur. It is, I suppose, familiar to many people. The sheath, beautifully worked, is of solid gold, the blade is of gold, and the grip of the handle is one piece of deep blue lapis lazuli with gold studs. When it was discovered it was an absolutely unique object: nothing like it had been known to come from the soil of Mesopotamia, and so strange was it to science that one competent and highly experienced authority declared that it must be Arabic work of the 16th Century A.D. That it should be regarded as Sumerian work of about the 33rd or the 34th Century B.C. seemed almost incredible, yet subsequent discoveries showed that, so far from being unique, this dagger was characteristic of the civilization and of the period to which it belonged.

At the very beginning of the following season there was produced from the grave of a member of the royal house—not a king, but a commander of the forces—a remarkable gold helmet, formed from one solid piece of gold, in the shape of a wig, with all the locks of hair standing out in relief and the individual hairs represented by engraved lines. It was a work of such technical excellence that we found, to our regret, that it was impossible to get a copy of it made by hand for the British Museum, and an electrotype reproduction was the only thing possible, because the skill and steadiness of hand shown by the craftsmen of about 3300 B.C. is not possessed by the workmen of to-day.



A remarkable gold helmet, formed from a single piece of metal, found at Ur and dating from 5000 years ago

Another extraordinary technical quality of these old people was their skill in casting. One weapon that we found, cast, as a matter of fact, in electrum, exhibited unusually well the marvelous degree of skill attained by them. It is a technique which was not learned by the Egyptians until comparatively late in their history, yet here we find it fully developed, in perfectly modern excellence and refinement, at what might seem to be the beginning of a civilization.

A gold goblet that we found, curiously unoriental in its outline, would seem rather to be the work of a Greek craftsman than the work of a Sumerian of the fourth millennium B.C. The work is paralleled by other gold vessels, such as plain bowls with handles of twisted gold wire, perfectly simple yet extraordinarily good in form and finish. These gold vessels were often relieved by fluting and by engraved patterns, and the conscientiousness of the workmen of that time is well shown by the fact that they carried the pattern on to the flat base of the bowl, where it would never be seen. Although, of course, goldsmith's work such as this may have been equaled often and in many countries at a later date, yet it has never been surpassed, I think, at any date or in any country, simply because it is as good as goldsmith's work can be.

TURNING to the musical instruments of this time—the oldest of which we have any knowledge—we found lyres made of wood and overlaid with thin silver plate. One such lyre had its sound box made of silver outlined by a narrow strip of blue and white mosaic; down the front were plaques of shell with engraved mythological pictures, and projecting from it was an extraordinarily fine cow's head cast in silver. The sound box itself represented the body of the animal in a highly conventional form, a sort of Cubist art! There are later texts which draw a parallel between the animal represented and the tone of the instrument. Rising from the sound box were the uprights of the crossbar, and short silver-plated tuning rods or bars, now seen lying at different angles against the crossbar, were put through loops in the individual strings and twisted round to tighten those strings for the fine tuning. Another lyre was of a more fantastic and unusual design. The sound box was of silver over wood, in the shape of a boat, on which stood the complete statue of

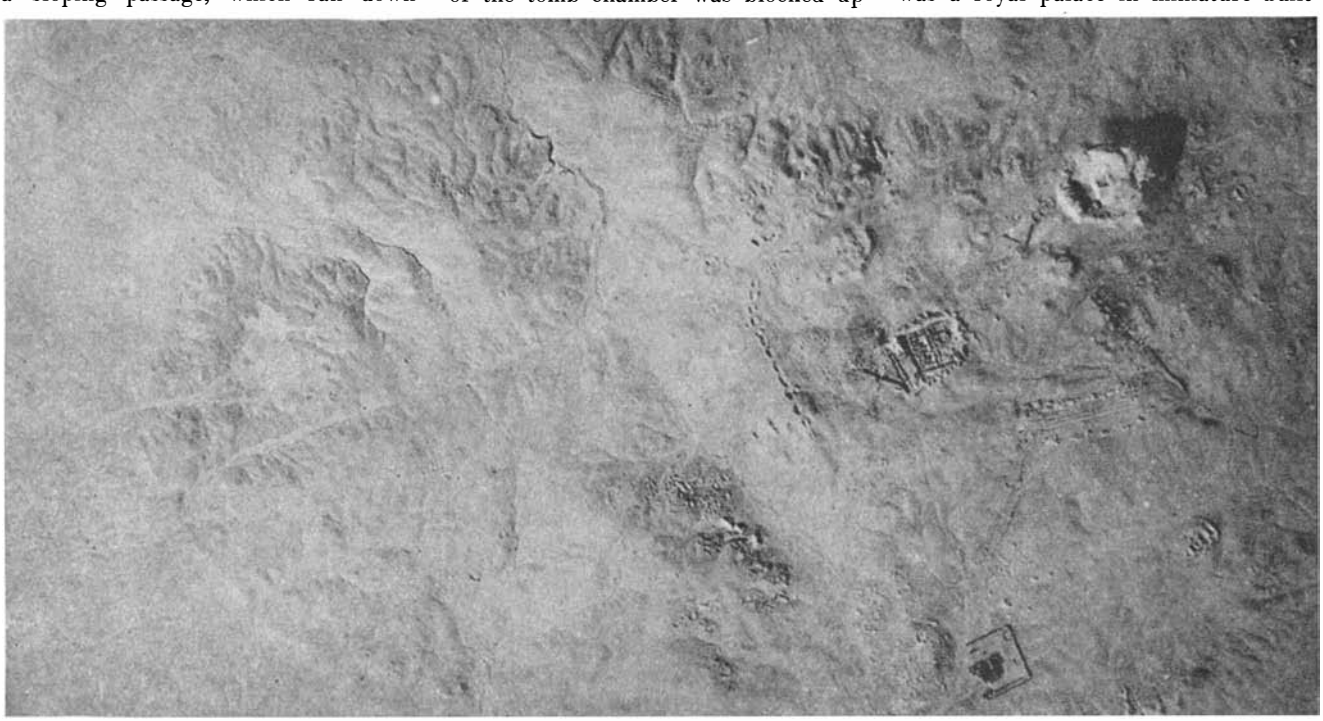
*Courtesy the *Journal of the Royal Society of Arts*. Photographs by the Joint Expedition.

an antlered stag supporting one of the uprights. The tuning bars or rods in that case had presumably been made of plain wood, not silver plated, and had therefore disappeared, but on the crossbar bands of different color could be distinguished, some black and some light in color, the black bands being due to the effect on the metal caused by the decay of the canvas loops which came at the top of the strings and were put 'round the crossbar; it was through those loops that the tuning bars went and were twisted 'round. Another lyre found was of wood, largely overlaid with mosaic of an elaborate design, with shell, lapis lazuli, red stone, silver, and gold. At the base there was a gap in the mosaic pattern, above which were eight short vertical bars; this was the hole through which the eight strings were brought to pass over the bridge and up to the crossbar.

THE best of these treasures come from royal tombs, though some, of course, from private tombs. I want to mention now certain details of those tombs. I have mentioned the objects we have found, and I am now going to try to show the relevance of those objects to history, but it is important to know where they were and how they were found. When the king died, first of all a rectangular pit was dug, going down some 30 or 40 feet into the soil, open to the sky and approached by a sloping passage, which ran down from the ground surface to the pit's bottom. At the time of the funeral there came into that pit all the people whose privilege it was to die with the king, his retinue who were to carry on their service in the next world. Therefore we find at the bottom of the pit soldiers of the guard, wearing their copper helmets and carrying their spears. We find the royal wagons backing down the slope, each drawn by oxen, with the charioteers standing by the wagons. There are servants, officers, and so on, some of them distinguished in their rank by carrying bundles of spears of copper or of silver or of gold. In one place lie women wearing rich headdresses, and servants line the passage which leads to the top of the tomb.

With regard to the tomb, while an ordinary citizen of Ur was buried at the bottom of a pit in a coffin of wood or clay or basketwork, or, if he was a poor man, simply wrapped up in a roll of matting, a king or queen had two special prerogatives. In the first place, instead of being buried alone, they were accompanied to the grave by a whole retinue of followers, who shared their fate in this world and their fortune in the next. In the second place, instead of being laid in a mere coffin, their bodies were placed in a built chamber. In the case of one such chamber that we discovered, the walls were of rough stone thickly plastered with mud, so that the stone was invisible. The door of the tomb chamber was blocked up as it was left by the mourners when the king's body had been laid inside. The top of the door was built of burnt bricks in the form of an arch, and, looking over the ruined top of the chamber wall, there could be seen what remained of the chamber roof, which again was composed of ring arches in burnt brick forming a barrel vault, the end of that vault taking the shape of an apse. That is an astonishing thing. Any textbook on architecture is prone to say that the arch, the dome, the apse, and the vault are comparatively recent inventions. It is often said that they were due to and probably originated by the Romans. No earlier than 1924 Mr. Dalton, in his book on "Eastern Christian Art," suggested that the arch was derived from Babylon, remarking that the earliest example of it dated from the time of Nebuchadnezzar; he put that view forward in opposition to Strygowski, who said the origin of the arch was in the country of Armenia, whilst some writers had suggested Egypt as the source of it; none had ventured to give an earlier date. Yet here we have the arch and the apse found complete and standing, built in Mesopotamia in the latter half of the fourth millennium B.C.

IN another royal tomb, a tomb of a much more ambitious kind, there was a whole succession of chambers opening one out of the other, so that it really was a royal palace in miniature built



Aerial photograph of Ur. The Ziggurat shows near the upper right-hand corner. The landscape is barren and is covered by a noticeable system of stream sculpturing. Mesopotamia is not rainless, about ten inches of rain falling annually, mainly during the winter. In that season the temperature is about comparable with that of Arizona; in summer with that of Hades. Archeologists do their work in winter. The 12 years work of the Joint Expedition of the British Museum and the Museum of the University of Pennsylvania, under the author's direction, has been finished and an elaborate book published. The Ur excavations far outrival Tutankhamen's tomb in historical significance. It now appears that civilization is more ancient in Mesopotamia than Egypt but the evidence is not yet wholly in. Long, long before civilization began in either place man lived as a barbarian or savage, his stone artifacts being found in Egypt and at Ur

underground. The limestone walls were originally well constructed and covered with a cement plaster which was burnished to the point of being lustrous. The chambers were covered with vaults of stone. In another instance our workmen dug down some 30 or 40 feet from the surface and laid bare a dome built with rough limestone blocks set in heavy stiff green clay. It is, I suppose, the oldest building erected by man which is still standing, with its walls and its roof complete, for it dates to about 3400 B.C., but a more important point is that it is a dome regularly constructed —rough on the outside certainly, but better on the inside—built on modern lines, and it carries back the history of the dome to this remote date. We therefore find that in the fourth millennium B.C., in the Euphrates Valley, every basic form of modern architecture was freely employed. And it was not forgotten; it was not invented simply to die out and be re-invented at a later time. The buildings are generally so far destroyed that the questions of roofing and so on are hard to solve, but we do find examples of arch, dome, and so on, at later dates, proving that the principles never dropped out of use but were handed down from one generation to another.

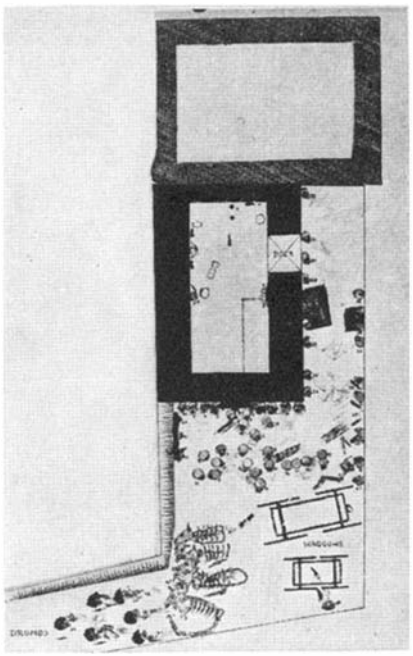
We found the doorway of a house of about 1930 B.C., much later than our cemetery, where the bricks fallen in the doorway preserved still the form of the arch which they originally composed: the joints are radial, thicker at the top than at the bottom, and with pieces of pottery put between the bricks to preserve that radial form. We were therefore able to reconstruct a house of the period of Abraham, showing the doors arched even in domestic architecture. We have found standing arches preserved from about 1400 B.C., and they were familiar in the time of Nebuchadnezzar in the 7th Century B.C. We have not found domes intact, but we have found plenty of evidence for them. We have found the vault still preserved and fragments of a dome still preserved in the 23rd Century B.C. We have no hesitation in saying that the arch, the vault, the apse, and the dome, used in Europe for the first time in the Roman period, are a direct inheritance from the Sumerian peoples of the fourth millennium B.C. at latest, and they may well go back to a date still more remote.

THE civilization of which I am speaking is, of course, an extraordinarily striking one, and it will be generally agreed that it is no new thing. The people who made those remarkable treasures of gold, mosaic, engraving, and so on, were not tyros. They must have had behind them long traditions, long apprenticeship, and the question arises: Where did they learn these things? Are we to regard this remarkable and finished civilization flourishing in Mesopotamia in the latter half of the fourth millennium B.C. as an isolated phenomenon? Are we to connect it with some other country or does it belong where we find it? In other words, was it brought in from outside by some wave of conquest or immigration, only to disappear, or was it so brought in ultimately to leave its stamp upon future ages? Or did it develop in the country where we find it? Is it really indigenous to the Mesopotamian soil? That it had its influence on succeeding generations nobody can possibly doubt, but the question of its origin is a very difficult one. The first thing to do is to dig in the field, not to form theories but to look in the lower levels of the soil to discover earlier phases of culture there and to see whether there was the thread of continuity or whether there was such a breach or such a succession of breaches as would imply an influx of an alien people, bringing in this civilization from some exterior and to us hitherto unknown place of origin.

Excavating at Ur. Readers often ask why ancient cities are found in layers. The houses were made mainly of sun-dried bricks, which frequently fell apart. Then the fragments would be leveled off and new houses built on top, with bricks brought in from outside the city. Centuries of this cumulation elevated the site

For our purpose we selected a spot within the walls of Ur where wind and weather had denuded the surface, destroying all the later monuments of times such as those of Nebuchadnezzar, Abraham, and so on, and laying bare a ground level which was virtually the ground level of 3200 B.C. We could date it tolerably well by excavation that had been done in the neighbourhood, where walls which we could assign to a definite period ran out to the surface and disappeared before they came into this denuded area. We felt that if we dug there, starting with 3200 B.C., digging down into soil where every spadeful of earth taken out would not only bring us deeper in point of place but take us earlier in point of time, we should soon outstrip the age of our cemetery, about 3500 B.C. maximum, and work back to something earlier than that, and so judge, with a fair ground of comparison, the earlier periods which preceded the cemetery treasure.

Starting at that point, we dug down ultimately to over 60 feet. It was not simply a matter of shifting earth; all the way down antiquities were encountered in a regular stratification, as clear as that of geology. Very deep down in the pit we found a wall built of large bricks made of concrete. We found, to our surprise, that concrete went back to the beginning of the fourth millennium and possibly into the fifth millennium B.C. At every stage we were discovering and passing through archeological strata. As soon as we began to dig we encountered walls which were built of mud brick and had perfectly good floors of beaten clay freely littered with the pottery which the last inhabitants left upon them. Often the bricks are laid in herringbone fashion, which was characteristic of this particular period, and the walls vary in thickness from five to 12 feet, so that they are the walls of



Plan of a royal grave, showing the tomb and the death pit, the team of oxen, chariots, copper helmets of the guards, and other details

buildings intended to last for quite a long time. One can imagine that in most cases they did last for quite a long time, so that to such a stratum as this one must assign a reasonable longevity.

YOU can take a photograph and then destroy the walls and dig through the floors, and immediately there come to light new walls of fresh buildings and a new set of clay floors, marking an earlier period quite unmistakeably. You destroy those in turn and a third wall appears. By the time we had gone something like 20 feet we had discovered, starting at 3200 B.C. at the top, no less than eight superimposed cities, to each of which must be given a reasonable life. Of those eight cities, the topmost three belong to the period of our cemetery. We could tell that by the pottery found, which was absolutely consistent with the pottery found in the graves. With the fourth level there was a change, though not a very marked change. At the fifth level we found lying about the floor pottery of a different type from that found in the graves in the cemetery; clearly we had got to a definitely earlier period. At the sixth level there was another change, and there came to light freely the polychrome painted pottery which is known by the name of Jemdet Nasr, after the site where it was first found, some 200 miles to the north.

With that pottery there appears to come a definite break, because nothing like it is found in the cemetery at all. As pottery is one of our best criteria, it seemed at first advisable to say: "Here is just that breach in history which implies a foreign source for the civilization that succeeded Jemdet Nasr." It was not the only break. We dug through 16 feet of solid pottery fragments; there was practically no earth at all, but merely potsherds. Buried amongst the potsherds at different levels there were the kilns in which the pots had been made. We had discovered a potter's factory that had been worked for an enormous length of time: all these potsherds were merely the fragments of waste pots that came out of the kiln distorted or cracked and had no commercial value, so were broken up and the pieces thrown on to the ground. The makers went on throwing them down until the kiln was buried and they had to build a fresh one, then that became buried and another one had to be built, and so the process went on until there were 16 feet of pottery measured vertically, and the kilns were reduplicated repeatedly one above the other. That factory must have gone on for many generations.

INCIDENTALLY, I might say that during the life of the factory there occurred a most extraordinarily important event. In all the upper levels all the pottery was made upon the potter's wheel exactly as it is made to-day. Then suddenly there came a change, and in the bottom 18 inches or so all the pottery was made by hand and the wheel was not known. In other words, early in the life of that long-lived factory men invented the wheel, or introduced it, and so passed in a moment from the age of pure handicraft to the age of machinery in which we are now living.

Then the pottery began to change. It was quite different from the Jemdet Nasr pottery, which is polychrome and made on the wheel. We were dealing with a simpler hand-made stuff with a certain amount of painted decoration. We worked down through it and suddenly came upon a mass, 11 feet thick, of water-laid sand and clay, perfectly uniform and clean, which was undoubtedly the silt thrown up by the flood—we can actually connect it with the flood which we call Noah's flood—against the flank of the mound on which stood the earliest and most primitive city of Ur. We dug through the 11 feet of flood deposit and underneath it we found the remains of antediluvian houses. Some were built of regularly moulded bricks and others were huts of reeds thickly plastered with clay. Digging through that again, we found that the lowest human buildings rested upon a thick bed of black organic soil, formed by the decay of vegetable matter, and that in turn went down below sea level to a bed of heavy green clay pierced with fibrous brown marks of the roots of plants. That was the bottom of Mesopotamia! It was really the bed of the marsh which spread over all this area before the waters were gathered together into one place and the dry land appeared. It ante-dated the advent of man into the lower valley of the Euphrates, because at that time there was no valley at all. We have gone back in our excavations to a time before human occupation of this particular part of the world's surface began, not to a time early in the history of man—it is all late in the history of man—but to the beginnings of history in the Euphrates Valley.

(To be concluded)

Cups and bowls found at Ur. Some of them are relieved by fluting and by engraved patterns and the conscientious makers even engraved their bottoms

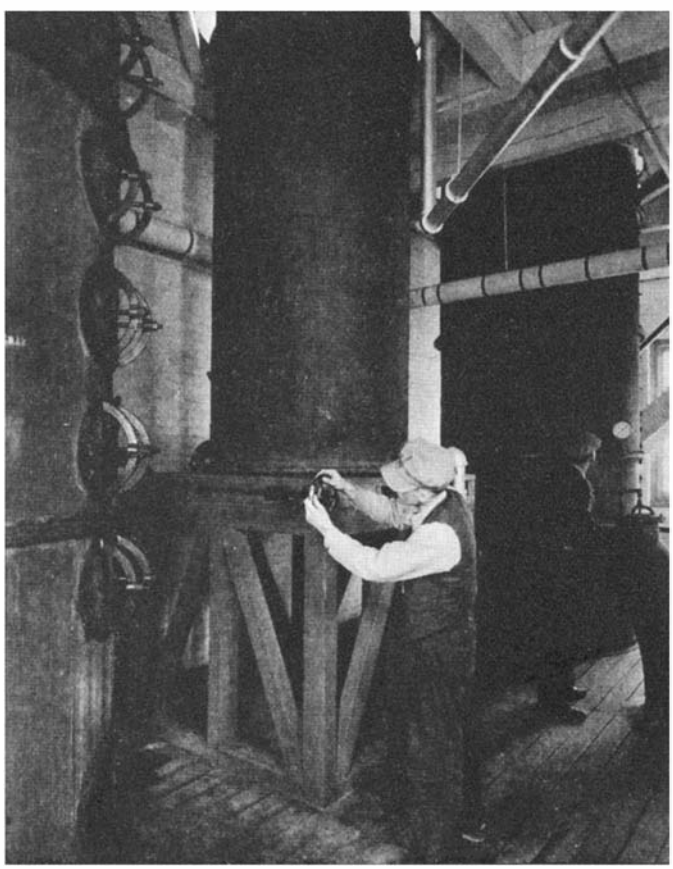
What Is Whiskey?

Down Through the Centuries, the Literature of Whiskey has been Scant; Here are Told Some of the Secrets of Real Whiskey

By EARL SPARLING

WHISKEY has been described often by poets and literary men, seldom by scientists. In all ages men have seemed to feel that this usquebaugh, this Celtic "elixir of life," the "most male of all beverages," deserved beautiful words rather than exact ones. So that there is probably no other article of common use about which the average man knows less, and in the manufacture and sale of which, as a natural result, there has been more shady dealing.

FROM as far back as 1577 come these quaintly glowing words set down in Holinshed's Chronicles: "Being moderalle taken it sloweth age, it strengtheneth youth, it helpeth digestion, it cutteth flegme, it lighteneth the mind, it quickeneth the spirits, it cureth hydropsie . . . it pounceth the stone, it expelleth gravell, it puffeth awaie all ventositie . . . it keepeth the weasan from stifling, the stomach from wambling, the heart from swelling, the bellie from wirtching, the guts from numbling, the hands from shivering and the sinewes from shrinking, the veines from srumpling, the bones from aking and the marrow from soaking." (In this modern age, no one would take these words seriously, written as they are with obvious poetic license.)



A continuous still for Bourbon whiskey which can be kept running even while being recharged with new grain mash

There are books on wine, a little library of them, and there are books on beer; literally, there is not one book in any language devoted to a technical study of whiskey. I have before me a weighty scientific German tome on distilled spirits; it devoted exactly a page and a half to American whiskies. Here on the desk also is probably the only book ever written on whiskey as such, but it is a wise and witty little volume, poetical, not scientific; Aeneas Macdonald, its author, titles it "Whiskey" and, after extolling Scotch whiskey and neglecting at all to mention Irish whiskey, he goes on to say that he understands Americans drink concoctions made from rye and corn which they ignorantly call whiskey. There is little wonder that it took Dr. Harvey W. Wiley two hours in 1907 to prove to President Theodore Roosevelt that plain alcohol was different from whiskey, and that a mixture of alcohol and whiskey was not whiskey, but adulterated whiskey—nor any wonder that three Cabinet Secretaries eventually ruled in 1910 that plain grain alcohol, artificially colored and flavored, was as much entitled to the name "whiskey" as real whiskey aged four years in the barrel.

To become technical: Whiskey is a product distilled from a fermented grain mash, and its distinctive taste and aroma come from the congeners, or so-called impurities (including total acid, esters, higher alcohols, aldehydes, and furfural) which pass over from the mash into the still. Alcohol, on the other hand, is exactly what the name denotes, plain C_2H_5OH, minus as many of the whiskey congeners as modern distillation can remove. Whiskey needs years of ageing before the raw congeners are transformed into the aromatic and agreeable substances which are the only differentiation between whiskey and plain alcohol. Whiskey contains plain alcohol plus these aged and transformed congeners. Incidentally, no chemist has ever been able to state exactly what changes take place in the congeners.

To destroy another popular myth, fusel oil (composed of the higher alcohols) forms an important part of whiskey distilled in any traditional manner, and when properly transformed by age, is a necessary part of true whiskey. Anyone who says that fusel oil should be removed from whiskey is talking not about whiskey but about some product of modern distillation which is neither whiskey nor plain alcohol, nor anything else worth drinking for that matter.

If you had a jug of fermented grain mash and a kettle on the stove you would certainly know what to do to make a distilled alcoholic beverage. You would put the mash in the pot and start boiling it, condensing the vapors in some sort of a receptacle. The first time you boiled the mash your recep-

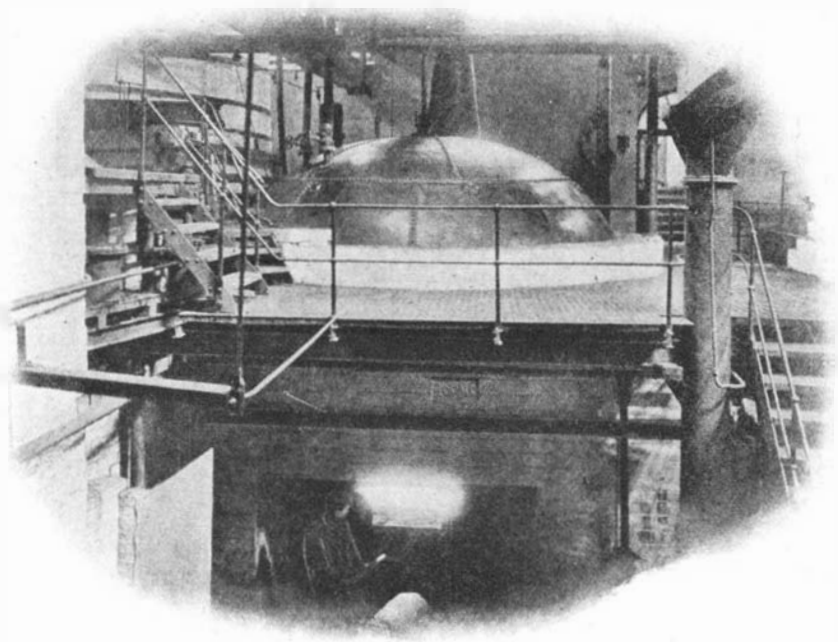
tacle would contain chiefly water (because, with such primitive equipment you could not control temperature), some alcohol (5 to 15 percent by volume, perhaps) and some flavoring congeners from the grain. To get more alcohol in the final mixture, you would re-boil the distilled mixture in your receptacle (cook is the old word, revived by American bootleggers who spoke of re-cooking denatured alcohol). With such primitive equipment you would have to re-cook your distillation several times to get as much as 20 to 30 percent of alcohol by volume—or 40 to 60 percent American proof. No matter how many times you re-cooked it there would still be congeners present, for the higher alcohols pass over even before plain ethyl alcohol which, of course, makes up the largest percentage of the whiskey's alcoholic content.

THE Irish, who are credited with the discovery of whiskey, to this day call their illicit moonshine liquor "poteen," which is proof enough as to how whiskey was made in ancient times. Out of that past came the method known as "pot still," which duplicates, on a commercial scale, the exact processes by which the original Irish usquebaugh was distilled. In preserving for posterity this ancient and honorable way to produce whiskey the Irish get all the credit. John Jameson & Son, Ltd., one of the oldest distillers of Irish whiskey, have distilled and sold unadulterated pot-still self whiskey for 134 years. Today it is available throughout the civilized world.

The pot-still method is the most costly commercial distillation process. It is relatively costly because in the first place the charge of mash must be put in and run, and the exhausted charge must be washed out before a new charge can be entered. No matter how the operation is speeded up with secondary stills and even when stills having a capacity of 15,000 and 25,000 gallons are operated, this old fashioned distilling method is a slow and costly business. Further, it is costly to pot-still whiskey in that the pot-still method allows the congeners to pass over in such volume that the whiskey must be stored and aged for at least seven years. Taking all factors into consideration, it costs approximately five times as much to produce a pot-still whiskey as to produce the same quantity of patent-still spirit.

The whole drive of modern distillation has been to reduce the amount of congeners passing over and to increase the amount of plain alcohol. The purpose has been to produce a whiskey which would be high proof in fewer operations and one which, because of fewer flavoring congeners, would require less ageing.

About 1830 the Coffey still was introduced in Scotland. The Coffey, or patent still, inaugurated continuous distillation. In between the old-fashioned pot still, even as modified, and the form of continuous distillation now chiefly used to produce cheap whiskies, stands the charged chamber still, usually of three or four chambers. In effect, the charged chamber still is one which benefits from part fractional distillation but still retains some of the benefits of the pot on the stove. In the chamber still a charge of mash is placed in the top chamber where it gets the least heat. After a period of distillation it is dropped by lever to the second lowest chamber, where additional distillation goes on, thence to the third chamber, and the fourth. As soon as the first chamber is empty a new charge of mash is entered. All the great American whiskies, whether Bourbon or rye, were produced by this fractional modification of pot distillation. But the chamber still is apparently passing out now; post-repeal American distillers have found the continuous still, descendant of the Coffey still, more profitable.



A typical modern pot still, in which only whiskey with a large quantity of congeners can be produced. The final product of this still requires long ageing

The continuous still is a tall, many-chambered column. The fermented mash goes in at the top, falls by gravity through as many as 20 to 30 chambers, and comes out denuded of all available alcohol. Usually the last steps of the process are accomplished in a doubler or analyzer column. The distiller is able at all times to regulate the amount of congeners passing over. A continuous still can be adjusted, by pressure, heat, and so on, to produce anything from a heavy whiskey which will require years of ageing to a nearly neutral spirit which will need very little ageing. The quality of the whiskey so produced depends on how the still is operated, on what proof the whiskey is distilled at, and the quantity of congeners allowed to pass over—and, of course, on the kind and quality of the grains that are used.

IT is evident that a truly neutral alcohol must come off at about 190 to 198 proof and must be virtually free of all the impurities which distinguish whiskey. Where does whiskey cease to be whiskey and become neutral alcohol? The American law has put the dividing line at 160 degrees of proof. If the spirit issuing from the last distilling operation is under 160 degrees of proof (80 percent of alcohol by volume) it is legally whiskey.

Many distillers, naturally, keep their continuous stills going under a pressure and heat which will produce a whiskey as near to this proof as possible and which will yet contain enough quickly maturing congeners to give the final product a whiskey color and taste. The point is that the pot still can seldom be pushed above 140 degrees. In many cases 130 degrees of proof seems to be the practical limit, which is also the practical chamber still maximum. Because such a whiskey is pulled off at such a low proof, it contains more congeners and is more truly a whiskey in the traditional sense.

The issue might be stated this way: the higher the proof at which the distiller takes off his whiskey for ageing, the fewer congeners it will contain but the more 90 or 100 proof bottled stuff it will make. The lower the proof at which he takes it off, the less whiskey he will have to sell, but the more connoisseurs will hunt for it.

MYSTERIES OF THE SOLAR CORONA

By HENRY NORRIS RUSSELL, Ph. D.

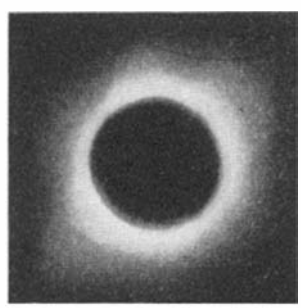
Chairman of the Department of Astronomy and Director of the Observatory at Princeton University. Research Associate of the Mount Wilson Observatory of the Carnegie Institution of Washington. Retiring President of the American Association for the Advancement of Science

TWENTY years ago a long list of "unknown" spectral lines tempted the astrophysicist with the prospect of new worlds to conquer. Bit by bit that conquest has been made.

First of all, a generation ago, helium, previously known only by its production of bright lines in the spectrum of the sun's atmosphere and corresponding dark lines in the hottest stars, was run to earth and became one of the most valuable materials of physical research. More recently the puzzling lines which shone so brilliantly in the spectra of the gaseous nebulae were shown to be emitted by atoms of the most familiar kinds, oxygen, nitrogen, and sulfur, under conditions which could be realized only in incredibly rarefied gases where these atoms were left undisturbed by collisions with others. At about the same time the strong green line in the spectrum of the aurora was found to be a similar forbidden line due to neutral oxygen atoms in the thin upper portion of the earth's atmosphere. The numerous bands which appear also, though less brilliantly, in the auroral spectrum were recognized as due to molecules of nitrogen.

ONLY today comes in a report from Dr. Kaplan that in a new type of nitrogen vacuum tube, and especially in the after-glow which follows for a moment the cessation of the discharge, he has found a number of bands, demonstrably due to nitrogen molecules, and identical with previously unknown auroral radiations. Another large group of unknown lines which appeared only in the very hottest stars have been almost completely identified, as a result of recent work with the vacuum spectrograph, especially the admirable researches of Edlén at Upsala, and found to arise from light atoms, carbon, oxygen, and nitrogen, in very high states of ionization. Many of the bright bands which characterize the spectrum of temporary stars as their light begins to fade are now known to be of similar origin, and the work of a few more years bids fair to clear up the rest.

Another, and quite different, field of ignorance was represented by the wide and conspicuous dark bands in the spectra of the greater planets. The work of Wildt, confirmed by the high dispersion observations of Dunham, showed that certain of these were undoubtedly due to ammonia in the planets' atmospheres, and others to methane. A month ago, at the Washington meeting of the National Academy of Sciences, a telegram from the Lowell Observatory announced that, in co-operation with theoretical workers at the University of Michigan, most of the other strong bands which appear in the outer planets are likewise to be attributed to methane. So that it appears that their atmospheres are very largely composed of what we in everyday parlance call "natural gas."



A photograph of the solar corona taken at the eclipse of August 1932, by John M. Pierce, amateur

One astrophysical spectrum, and only one, still remains mysterious—the bright lines of the solar corona. Accordant observations during many total eclipses, supplemented by the remarkable work of Lyot outside of eclipse, have given us good wavelengths for many of these lines, and shown that they are permanent features of the spectrum, though possibly with moderate variations in intensity from one eclipse to another. Yet we still know practically nothing of their origin. Reasonable suggestions, based on the modern theory of spectra, have recently been made that some arise from neutral, and others from ionized, atoms of oxygen and nitrogen. But it is not yet practicable to predict accurately where these lines ought to lie in the spectrum, and until this can be done the matter must remain undecided, unless, of course, some fortunate observer succeeds in reproducing some, at least, of the coronal lines in the laboratory. One red line, indeed, at 6374, coincides very closely with a laboratory line of oxygen, but the investigations of Frerichs show that this is closely related to other oxygen lines which do not appear at all in the corona, so that this must be an accidental coincidence.

These problematical radiations, however, form but a very small part of the total light of the corona. Recent measures by Grotrian, of photographs taken by a German expedition to the Sumatra eclipse of 1929, show that the green line, which is far the brightest of all, gives only one percent of the visible light. The other 99 percent shows a continuous spectrum, and considerable gain has recently been made in its interpretation.

VARIOUS facts which have long been known indicate that the continuous spectrum of the corona is not all of the same origin. For example, the light is polarized as it should be if reflected from very small particles. Close to the sun's limb, the polarization is incomplete, which is easily accounted for, since we get light from regions in front of the sun and behind it, as well as from those of the same distance, and the angles at which the light is scattered are very different in the three cases. But, at greater distances from the sun, the light should be more and more completely polarized, and this is not the case.

Again, the Fraunhofer lines of the ordinary solar spectrum are present, although faint, in the spectrum of the outer corona, while in the inner corona they disappear entirely. These lines must certainly be produced by reflected or scattered sunlight. Their faintness in the outer, and absence in the inner, corona suggests that they are diluted, or drowned out by light from some other source giving a continuous spectrum. It was once supposed that this continuous spectrum came from small incandescent particles heated by the sun's

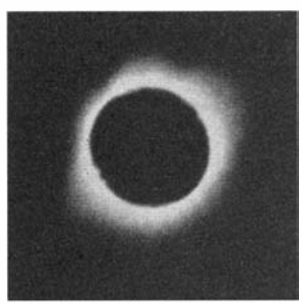
radiation. These particles would obviously not be as hot as the sun itself, and hence they would emit light of a redder color. Photographic observations, however, show that the coronal light is of very nearly the same color as that of the sun itself, thereby eliminating one more promising theory. Indeed, this simple fact disposes of two rival theories at once. It has often been suggested that the coronal light is scattered by a very thin gaseous envelope surrounding the sun. But light scattered by molecules or atoms of gas would be bluer than sunlight and of very much the same color as that of a clear sky. Here again the observations are decisive. The corona is neither red nor blue, but white (taking sunlight as our standard).

THIS narrows down very considerably the search for the sources whence it comes, but leaves two still available. A cloud of solid or liquid particles, larger than two or three wavelengths of light, will reflect all colors equally, and will, indeed, be as white as any ordinary cloud. At the other extreme of minuteness, a cloud of electrons will act in the same fashion, and scatter light waves of any length in the same proportion; so that an electron cloud again seen at a distance would appear as a white cloud. Nothing of the sort has ever been seen on earth. Fortunately for its inhabitants, clouds of intensely electrified material do not occur upon our planet. But we know that in the upper portions of the sun's visible atmosphere, ionization is very high and great numbers of free electrons must be present. Above the visible limit of the chromosphere and prominences there may well be great numbers of free electrons. A cloud of electrons, and a cloud of fine drops or dust particles, would reflect light of just the same color, and, with proper adjustment of their thickness, of the same brightness. What hope is there then of distinguishing between the two?

Fortunately for our study, there is one important difference. Electrons above the sun's surface are certain to be moving in all directions at very high speeds. In a hot gas the particles are moving rapidly, and the lighter they are the greater is their average velocity. At the temperature of the photosphere, the average speed of a hydrogen atom would be not far from 10 kilometers per second. Electrons with only 1/1840 of the mass would have a thermal velocity averaging 400 kilometers per second.

An electron at rest, or a great cloud of them, would scatter sunlight just as it fell upon them, and the scattered beam would show the ordinary solar spectrum, dark lines and all. But, in the light scattered from a moving electron, the lines would be shifted by the Doppler effect in the ordinary fashion. The motions just described are so rapid that they would smear out any ordinary lines completely and leave a practically continuous spectrum. The very widest solar lines, such as the great *H* and *K* lines in the violet, might still show faintly, and Grotrian has found that they actually appear feebly.

The truly continuous part of the coronal spectrum may therefore be attributed with some confidence to scattering of light by free electrons, but this does not settle positively the origin of the other part of the light, which shows the dark lines. If other electrons, with slow motions, were present, they could produce this spectrum, and so,



The sun's corona, photographed at the August 1932 eclipse, by Leo J. Scanlon, a Pittsburgh amateur

too, could light reflected from true clouds of vastly larger particles. Grotrian has made careful measures of the width of the dark lines in the coronal spectrum obtained in Sumatra, and also in the ordinary solar spectrum taken with the same apparatus. The measures show that in the corona the dark lines are shallower than in the solar spectrum, but not wider. The "shallowness" is obviously due to dilution of the spectrum with the continuum scattered by the free electron. Could this be removed, the lines would be found as narrow as ever. This shows that the scattering particles must be very much heavier than electrons. Even in the outer parts of the corona the temperature must be as high as 2500 degrees, absolute, and the motion of the electrons would be rapid enough to smear out completely any narrow dark lines in the light which they scatter. Isolated atoms would not be moving too fast, but they, as has been said before, would scatter blue light more strongly than red. Grotrian therefore concludes that the Fraunhofer spectrum of the corona is scattered by relatively large particles. These need not necessarily be solid, but might be tiny drops of liquid.

One difficulty remains. At the temperature even of the outer corona, almost all known substances would be completely volatilized, especially in an almost perfect vacuum There are some compounds, however, such as the carbides and nitrides of titanium, tantalum, and some other metals, which are exceedingly refractory, and melt only at temperatures approaching 4000 degrees. To what extent these substances would volatilize if held at 3000 degrees in a vacuum has not yet been determined. But it is not at all impossible that minute drops of these refractory materials may actually be formed by condensation in the outer corona, and remain there, held up by radiation pressure against the sun's attraction.

The microphotometric measures show that the depth of the faint Fraunhofer lines increases steadily with increasing distance from the sun. From this Grotrian concludes that at a distance from the moon's limb equal to one-third the moon's radius, more than 80 percent of the coronal light belongs to the continuous spectrum, and less than 20 percent to the "Fraunhofer" spectrum. At a distance equal to the moon's (or the sun's) apparent radius, the two contribute about equally. At the outer observable limit, 26′ from the moon's edge, only one-third of the light belongs to the continuous portion.

THE electron cloud around the sun therefore thins out much more rapidly than the cloud of larger particles. To the former Grotrian attributes the irregularities of the coronal form, including the arches and streamers which are such beautiful features of the photographs. The dust cloud appears to be much more uniform, and probably thins out gradually into the zodiacal light. Even at the longest eclipses, the corona can be seen only through a foreground of air illuminated by sunlight reflected from regions less than 100 miles away, where the direct rays still reach the earth. The corona dies out into this general sky illumination, while it is still very bright in comparison with the night sky, and something like 10,000 times as bright (for equal apparent areas) as the very feeble glow of the zodiacal light. The transition between the two is unfortunately inaccessible to terrestrial observation. The zodiacal light cannot be followed nearer than 30 degrees from the sun, since the twilight interferes. If the moon was only half as big again as it is, we might get eclipses in which all the bright inner corona was hidden, and the shadow spot on earth was so large that practically no scattered sunlight reached the center. But, with the moon as it is, even the best eclipses are not dark enough to reveal how the coronal light really fades out.

It is lucky for terrestrial astronomers that the moon is no farther off. Six percent increase in its distance would deprive us altogether of total eclipse, and of all knowledge of the corona.—*Princeton University Observatory, May 28, 1934.*

RATTLERS AND THEIR

By WILL C. BARNES
One time Secretary of the National Geographic Board, and assistant forester in charge of range management, United States Forest Service

TO any lover of outdoor life the question of snakes is a matter of vital moment. Forest officers, cowboys, sheep herders, and others constantly out in the open become accustomed to the thought that reptiles are part and parcel of their daily life and accept the hazard without much concern.

With the exception of two or three varieties, American snakes are harmless and quite as interesting in their ways as any of the wild things of woods or plains. First and foremost among poisonous snakes is, of course, the rattler. He is followed by the moccasin, the copperhead, and the coral snake. But their habitat covers a comparatively limited area of the United States, and deaths from their bite are few.

THE rattler, however, is found from the Gulf of Mexico to the Canadian boundary and from the Atlantic to the Pacific. Only in Maine and New Hampshire is he reported as being absent. He seems quite as much at home in Montana as in Florida, and he enjoys the desert of southern Arizona as much as the humid regions of the Atlantic coast. You will find him below sea level in the Death Valley country of California, and again close to timberline all over the Rockies.

According to Ditmars, there are 13 known species of rattlers in this country, ten of which are found in Arizona. Texas has four varieties. Don't get the idea, however, that the Southwest is headquarters for rattlesnakes. Authorities agree that as far as can be determined the center of rattlesnake population is in Pennsylvania, Massachusetts, New York, and New Jersey.

Many people, unaccustomed to camping out, consider it absolutely necessary to provide for protection against attacks of these reptiles which really mean them no harm and would gladly be friends if given the opportunity to show their true nature. The most they ask is to be let alone and allowed to go their way in peace. Sometimes, of course, it is otherwise.

Once an insurance agent tackled a Texas cowboy to take out an accident policy, stressing the uncertainty of life.

"You have all sorts of accidents, don't you?" queried the agent.

"Nope, nothin' ever happens to me," was the reply.

"No injuries? No hurts of any kind?" The agent was out for business.

"Well," said the boy, searching his memory for some incident, "there was a rattler bit me once."

"Wasn't that an accident?" commented the man.

"Hell, no!" said the Texan, "the danged snake did it a-purpose."

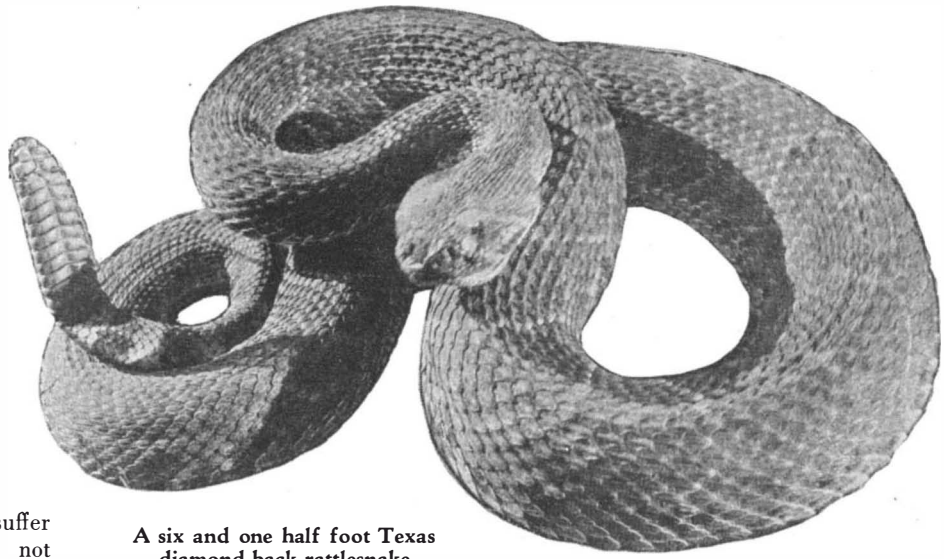
But unfortunately the snake family has a past and is paying the penalty for the single unfortunate act of one of its forebears. It was the Serpent that got our original parents into trouble and sent them in disgrace out of the Garden of Eden. Ergo, every one takes it out on snakes whether it be the pretty and absolutely harmless garter snake or the huge surly, quick tempered, diamond-backed rattler of the Florida swamps. The rattler, however, is a fair fighter for he always gives warning of his proposed attack, generally to his own undoing.

Guaranteed not to bite. This rattlesnake is only a model made for exhibition at the Field Museum of Natural History, to illustrate how the snake secretes and discharges its poison. It is being shown by Leon L. Walters, creator of the model

MORE than 40,000,000 people visited the National Forests and National Parks last year, the majority of whom camped out and tramped over the country fishing, picking wild flowers, taking pictures and exploring every available nook and corner. Yet the number attacked by these reptiles is practically negligible while the fatalities can probably be counted on the fingers of one hand. Unfortunately, there are no records of such accidents on our public playgrounds. They should be kept, just to reassure people that the risk is very low. Nevertheless, people like to be prepared for such an emergency, for it is the unexpected that always happens. The person bitten by a rattler cares little for statistics or percentages of deaths. To him, his case is a national matter. He wants help and wants it quickly.

Up to a few years ago there was but one known remedy for the bite of a rattler. That was alcohol. Whiskey, being largely composed of alcohol, offered the most available remedy. The effect

BITES*



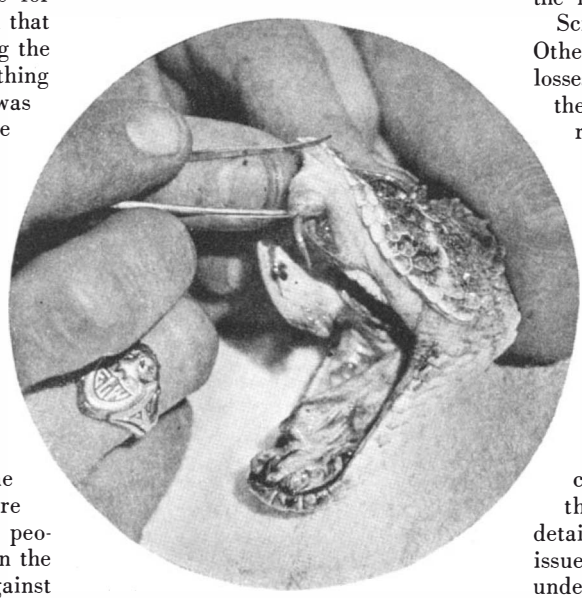
A six and one half foot Texas diamond back rattlesnake

of the venom from a rattler is to coagulate the blood and slacken its circulation. If it does not get into the venous system no harm results. This is why hogs are never killed by rattlers. Their venous system is protected by a thick layer of fat through which the poison does not penetrate. This is also the reason why many people struck by a rattler do not die or suffer serious harm—the venom does not reach a vein. It also accounts for the fact that the poison may be sucked from a bite and even swallowed without harm, providing, always, that the person doing the sucking has no cuts or sores on lips or mouth.

When planning outings years ago, plenty of whiskey was provided. If not needed for snake bites it afforded an attractive addition to the supplies for the trip. Then scientists discovered that the action of whiskey in stimulating the circulation was about the worst thing that could happen. The poison was the more rapidly carried into the venous system and its distribution made more effective.

So whiskey as an antidote for rattlesnake bites was declared taboo and went into the discard, except among a lot of old-fashioned people who always cling to their early training. About that time some chemist started the idea of using permanganate of potassium as an antidote for snake poison. This has been the approved remedy for the past 20 years. Kits for its use were sold everywhere and thousands of people are today carrying them, firm in the belief that they are an insurance against death from rattlers. Most forest officers and park rangers are provided with these kits. They contain two little glass bottles in a wooden case, together with a very small hypodermic. In one bottle is alcohol, in the other the crystals of potassium. Pour one into the other and you have a solution which when injected into the flesh at the wound does the business. I have seen it accomplished by simply pulverizing the crystals in a teaspoon, and after slashing the flesh around the bite, rubbing it into the wound.

But here in the last year or two come scientists who tell us we are all wrong; that permanganate is useless as a protection and positively injurious to the patient. Briefly, the claim is made that the action of the permanganate is to cause a sloughing away of the flesh around the spot where injected, forming serious sores that cause the patient untold suffering. The remedy seems worse than the disease. It is admitted, however, "that in the absence of other remedies permanganate may be used." Evidently a case of any port in a storm.



Pulling back the sheath which protects the hollow fang of a snake

In December, 1927, the Surgeon General of the United States made the following comment in regard to the use of the above material: "A very interesting article on first aid treatment for snake bites will be found in the *Texas State Journal of Medicine* for July, 1927. This article, we believe, pretty well disposes of the contention that permanganate of potassium is of value in the treatment of snake bites although it is realized that it is the orthodox thing to apply. It is believed that it would be of distinctly more value to make incisions at the site of the wound made by the bite of the serpent and to apply suction either mechanically or by the mouth."

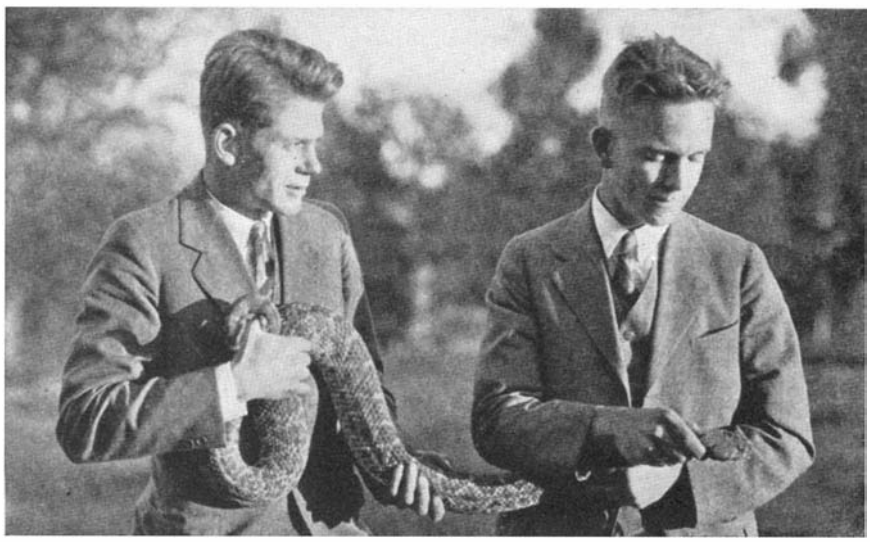
Science, however, never stands still. Other countries were suffering severe losses from venomous snakes. Study of the situation was begun, seeking a real remedy.

The latest and most successful method of counteracting the effects of snake venom is through the use of what is known as "Antivenin," or anti-snake-bite serum, a concentrated serum derived from immunized horses which have been gradually dosed with rattlesnake venom. This antivenin is the result of years of study and investigation seeking a satisfactory cure. It was carried on in Brazil by officials of that country who have made most detailed studies of this matter. It is now issued and sold in the United States under license from the United States Public Health Service. It comes in small convenient packets with syringe and full instructions, ready for instant use. Presumably it can be obtained at any large drug store.

THE results of hundreds of experiments on both humans and animals carried out under the direction of the Antivenin Institute of America, an organization devoted to developing means of preventing deaths from venomous reptiles, seem to prove conclusively the value of this latest method.

Concerning this new remedy the statement of the Surgeon General above quoted says: "In regard to antivenin, there is experimental evidence that it is of value—just how much value under

*Courtesy *American Forests*, magazine of the American Forestry Association, 1713 K Street, N.W., Washington, D. C.



A Texas diamond back rattlesnake. In the East, rattlesnakes are traditionally plentiful in the West. In the West the same kind of tradition relates to the East. Wherever you travel, the worst pests are always somewhere else but "not here"

clinical conditions one could not say."

By mechanical suction is meant the use of small affairs called breast pumps which are readily secured at any drug store and doubtless make a better job of the withdrawal of the venom than the mouth, without the possible danger to the person whose mouth is being used.

And so permanganate of potassium follows whiskey into the closed files and its place is taken by this new serum.

"These here now scientists," writes an old time cowboy friend, "they make me tired. First they took away our excuse for carryin' round a flask of whiskey and told us to bank heavy on permanganate of potassium. An' now when we are all broke to regardin' that stuff as the onliest thing ever for snake bite, along comes a new outfit an' tells us there's nothin' to it, an' that this here now old horse serum is the only sure fire stuff. Even you had to horn in on the thing and spoil the old time hair rope idea. Ain't there nothin' sacred to you fellers any more?"

NOW, of course, comes the natural question—what to do if bitten by a venomous snake.

First, of all times in your life, keep your head. Don't get excited. That only makes your blood circulate the faster and carries the venom into your system the quicker. Next, be sure you have been bitten. A snake may strike at one viciously but fail to reach his mark. If that part of the body believed to have been struck is covered with the usual clothing the chances are good that no harm has been done. Inspect carefully, however, the spot where you think the reptile struck you. The fangs are very short and sharp. If they have penetrated the flesh you will find a drop or two of blood oozing from the wound. Severe pains are felt within a very few moments after an effective strike.

The spot swells rapidly. There will be symptoms of nausea. The pulse is rapid.

If convinced you have been struck, get a doctor if possible. He will know best what to do. But if no doctor is available apply a tourniquet above the bite to keep the poison from entering the venous system. Anything will do—a rope, a shoe string, a handkerchief, or a necktie. Twist it with a lead pencil or piece of wood. About every ten minutes loosen the tourniquet for three or four seconds, then tighten. To keep it closed longer is not only painful but may bring about gangrene. Slash the wound a third of an inch deep, and an inch long. An ordinary safety razor blade is excellent and always available. Dip it first into boiling water or hold it over a flame to sterilize it. Make sure there is not a loose fang in the wound. They are often left by the snake. The excessive bleeding caused by the slashing washes the venom from the wound.

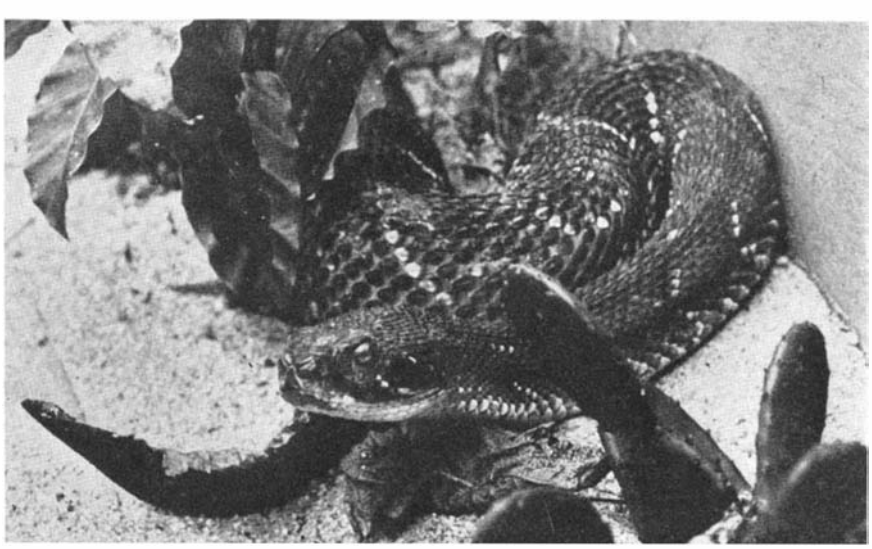
If the mouth is sound, no sore lips or gums, you, or a friend, can safely suck the wound to help eliminate the venom. If an ordinary breast pump is handy, use it.

If the antivenin serum is not available keep the wound wet with a 1:3000 solution of permanganate of potassium. Inject it hypodermically around the wound or rub the powdered crystals into it. If the heart is greatly depressed stimulate it with one thirtieth of a grain of strychnine or one one-hundredth of a grain of nitroglycerine. Lacking these, a teaspoonful of aromatic spirits of ammonia in a warm glass of water at about an hour interval will help. A cup of strong coffee will get heart action also.

POTASSIUM is, of course, to be used only when the serum cannot be had. It is used more to encourage the patient and build up his spirits and morale rather than because of its curative values. If the serum can be obtained use as directed even though from 12 to 24 hours have elapsed.

The tourniquet may be abandoned after a couple of hours or even sooner if the pain from it seems to be too severe. If the bite is on the face or where a tourniquet cannot be applied you must depend on the slashing of the wound and sucking the poison from it. As a matter of fact, all authorities agree that this process of getting rid of the poison is about 75 percent effective in nearly all cases. Above all, use no whiskey. Every investigator advises that persons who have been dosed with whiskey, and recovered, did so "not because of it, but in spite of it."

Don't get conceited and believe you can handle a rattlesnake without harm because the Hopi Indians in Arizona do so. They and their forbears have been handling rattlers for thousands of years. Coronada's men found them doing it as early as 1540.



Another Texas diamond back rattler, camouflaged by cactus and other vegetation. Rattlers almost always give warning but humans often court danger

SCIENCE REPLIES TO SECRETARY WALLACE'S ARTICLE:

'The SCIENTIST in an UNSCIENTIFIC SOCIETY'

HAS Science really failed in respect to "the greatest good for the greatest number," as Secretary of Agriculture Wallace asserted in his forthright article in our June issue? Should scientists now set aside a fellowship or start a foundation purely for a study of the social significance of its works? We, as the scientific mentor for laymen, should like to know.

In asking Mr. Wallace to write his challenge, we explained to him that, in probing for an answer, we would ask a number of scientists to give us their viewpoints. The accompanying group of comments is the result. Others will follow. At this point, however, we shall not attempt to analyze these statements, but shall simply present them for possible future analysis by other scientists!— The Editor.

By:

DR. CHAS. B. DAVENPORT
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Vice President, General Electric Company, in Charge of Research

EDWIN G. CONKLIN
Professor of Zoology, Princeton University

T. D. A. COCKERELL
Professor of Zoology, University of Colorado

DR. JOHN C. MERRIAM
Geologist, paleontologist, President Carnegie Institution of Washington

CHAS. F. KETTERING
Vice President, General Motors Corporation, General Director of Research Division of General Motors

DR. C. G. ABBOT
Astrophysicist, Secretary of the Smithsonian Institution

DR. DAVENPORT writes:

I HAVE read with interest Mr. Wallace's statement on "The Scientist in an Unscientific Society" and am writing down the thoughts that were aroused in me by reading it. It may, at least, reveal something of the nature of one of the scientific men to which group Secretary Wallace refers.

First, let me say that I am a biologist and that my contacts have been with biologists and other men engaged in pure scientific investigation, and I know very little about technology. Apparently, most of the specific cases of social trouble caused by discovery are really cases of the application by technologists of scientific discoveries. When Hertz discovered that electric waves go through the air, and attempted to measure them, he made it possible for technologists like Marconi and others to lay the foundations of a great industry which has given occupation to thousands of persons. However, if it should appear that broadcasting was being used to incite to crime, murder, bloodshed, and revolution, some might find that it were better had Hertz never been born. Others might think that the trouble was not with Hertz and his discoveries, but with the lack of social control of the application of those studies. Such social control would obviously, however, not be the work of Hertz.

As I say, I am only a biologist interested in discovery of biological laws. From my own standpoint (which I hope will not shock the pious) I think of the biologist as trying to discover the laws of Nature, which are the laws of God. I think the biologist believes that if we understood the workings of God, we would be in a better position to put ourselves in gear with this universe, and this I consider to be the essence of morality. We cannot, however, be fully moral if we do not know something of the laws of the universe. The moral laws of the primitive people who live on the mountains of New Guinea are very definite; only, since they are not based on a knowledge of the workings of the universe, they are apt to be in some cases unjustified. While in general the *mores* of any people are based upon experience of that people in their own habitat, some of them are based upon false interpretation of cause and effect. For example, the drought must be due to an evil spirit and sacrifices must be made to this evil spirit in order to appease him and put an end to the drought.

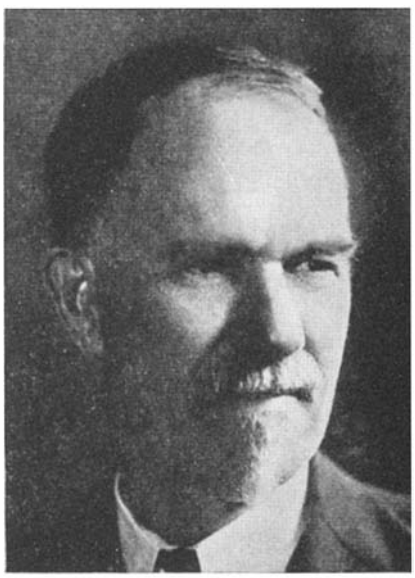
When the biologist learns how the child develops and the rôle that the genes and the cytoplasm of the germ cells play in that development; when he understands the effect upon that development of environmental conditions that are prejudicial to normal development even with the best equipped germ cells; then he is in a better position to state what matings are desirable, what undesirable, what physiological conditions surrounding the developing embryo are good and what are bad. Similarly the biologist may learn, in general, how animals and plants grow and what are the best conditions for development. He learns, too, about the laws of his own nature, and the relations to the bodily functioning of external conditions. This knowledge will place him in a better position to work most effectively, and the general spread of this knowledge will tend to increase the effectiveness and happiness of the population.

One does not see how the discovery of the laws of God in itself is a bad thing for mankind. It is pretty obvious that the trouble lies elsewhere, and "picking on" the scientist is "picking on" the wrong element in the trouble.

I am not only a biologist, but also a citizen and I have thought a little upon the varying economic conditions to which our population is subject. If, leaving science, I may turn attention to some of these contemplations I would set them down as follows:

One trouble with our economic condition is the general tendency of our people (like that of the peoples in other countries during the last two or three thousand years) to seek that which is bad for them; namely, ease, comfort, luxury. Beginning with the wealthy this ideal extends even to the lowest economic strata of society. If, having established ourselves comfortably in the easy chair provided by prosperous times, we suddenly find this easy chair pulled out from under us, we utter an indignant protest and demand that this ease be restored. I have seen among my neighbors many persons engaged in easy occupations who, when these easy occupations were removed as the result of hard times, instead of finding out what sort of occupation was a necessity to their neighbors and engaging in that (which would be sure to bring them some remuneration) did nothing but protest. Others made their way to the bread lines, or to the public relief agencies to get some help. It would be

better if every person with normal mentality had two or more occupations; an easy one for prosperous times and a more difficult, but more necessary, one for less prosperous times. It is one consequence of our love of ease that we demand higher monetary return for our labor. These demands, when put into effect, result in increased cost of production, and this leads to reduction in



". . .'picking on' the scientist. . ."
DR. DAVENPORT

consumption; so that the person who is not contented with a reduced income tends to dry up the only source of income available to him.

One source of our economic trouble is not referred to by Secretary Wallace. This may be illustrated by the fact that during the past 20 years the taxes upon my wife's farm have increased 20 times. In fact, the cost of government in the town and county in which I reside have increased about in the same proportion. Now why this enormous increase in the cost of government? It is superficial to attribute it exclusively to the politicians. More remotely it goes back to the whole system of welfare workers, of engineers, of technologists, perhaps, who are seeking to make life easier while they make it, at the same time, more expensive. Today, every school must have a policeman attached to it to see that the children are cared for in crossing the street in coming to the school, leaving it at noon and again in the evening. The policeman so assigned can do very little else. The suggestion that somebody else than a policeman might perform the function, even without pay, is indignantly repelled even by those who object to the high taxes. We must have subways and we object to paying for them; we must have bridges, then protest against a toll upon them; we must have concrete roads and parkways, though their building brings the county to the debt limit.

The expenses of government have thus multiplied due to the ever-increasing demands of the people, instigated by the welfare workers, the city planners, the engineers, and the technologists, who, through skilful advertising, create a public demand for their services and products. Where one-quarter of one's income is spent for government there is only a small fraction left over necessities for maintaining even a reasonable standard of living, and in times of reduced personal income without reduction in the cost of government we are, many of us, on the verge of starvation. What is needed is not a greater development of welfare agencies, or the invention of new methods of taxation, but rather the organization of a group of investigators who can show how the cost of government can be reduced, how we can simplify our social activities.

We hear much of the terrible situation to which hard times have brought us. If the view that our troubles are largely due to too much prosperity and love of ease be adopted, it might be concluded that hard times are really good times, that they encourage initiative, they keep people at work on necessities rather than the production of things which are merely contributory to ease. A period of great prosperity is calamitous to the social organization, tends to lead to a drying up of the population through failure of breeding, because, forsooth, the bearing and rearing of children is not comfortable. It interferes with our productiveness because work is hard and is to be avoided as much as possible.

In this final paragraph I would say that, from my standpoint, the discovery of the laws of the universe ought not to be interrupted. But the application of the laws discovered by the scientist to technological affairs is to be regulated. A diversity of training for useful occupations is to be encouraged in the young. A rigorous training in difficult occupations is to be afforded all of the young who are physically capable of such rigid training. Hard work and repression of the love of ease are to be inculcated. The luxury of rest is appreciated only by those who have tired muscles. Effort, fatigue, are our greatest blessings because they enable us to appreciate the better their temporary absence. Finally, extravagance in government under whatever pretext or however high the motive lays a crushing burden upon every civil member of the community and tends toward repudiation or revolution, or both.

From DR. WHITNEY:

IN the case of Secretary Wallace's article, I am unwilling to throw pebbles at new machinery, if I can control myself. I admit that this is a little difficult, because I have long felt that scientists, as they actually exist, have particular value to the public—primarily because of their high differentiation. They usually have to sacrifice their natural instincts by refraining from even such generalizations as political science, in order to make the best use of their specialization. I think that no

". . . pebbles at new machinery . . ."
DR. WHITNEY

group really does more for the public than the specialists in the different sciences.

I have often regretted that I could not do more to help the work of the SCIENTIFIC AMERICAN. I realize all too well that my bump of preoccupation is excessive.

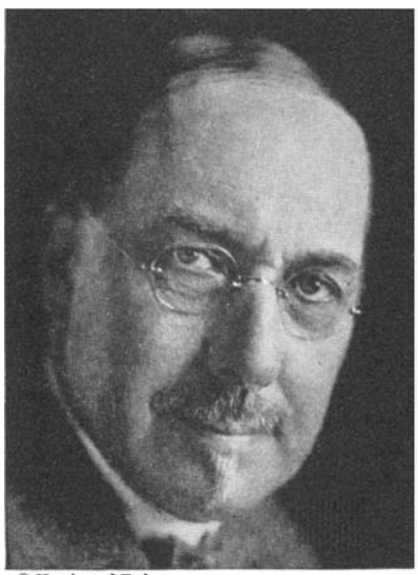
PROFESSOR CONKLIN writes:

I AM deeply interested in Secretary Wallace's challenging article in the June number of SCIENTIFIC AMERICAN, entitled "The Scientist in an Unscientific Society." In general I heartily agree with his criticism of scientists for not taking a larger interest in the problems of citizenship, but on the other hand I recognize that concentration on scientific discovery is not usually compatible with devotion to governmental or political problems. This is due not only to a lack of knowledge regarding such problems, but also to a lack of time and opportunity.

I think the most serious criticism that can be made of a certain type of scientist is that he has become infected with the spirit of commercialism. This applies particularly to those who are engaged in work of great economic importance.

Secretary Wallace does not tell us how scientists can correct the evils which science has made possible in modern society, and I can think of no

way in which this can be done, except by applying the methods of science to the reorganization of society itself. This is no easy or short remedy for present evils, but I believe that it is the only permanent and rational one. We need, in short, a new spirit of co-operation in society, a spirit of altruism such as once characterized the work of such scientists as Faraday, Pasteur, and Agassiz who



© Harris and Ewing

". . . things take their course . . ."
DR. MERRIAM

"had no time to make money," and who freely gave their discoveries to mankind. Such a return to the spirit of the heroes of science can be brought about only through the process of education. It is the problem with which ethics has always dealt—how to make men live up to the level of their best knowledge and instincts. The problem is really one of making an unscientific society scientific, and if there is any other method than that of education for accomplishing this I have not heard of it.

PROFESSOR COCKERELL:

SO far as I am able to judge, Secretary Wallace has presented a valid argument. It may, however, be useful to continue the discussion from the point where he leaves it. It is a question how far the shortcomings of the scientific man are inevitable, and how far due to scientific and social conventions. The "very best minds—the exact thinkers," as they were described in the editorial note at the top of the Secretary's article, may not always be competent in fields which they have not made their own by prolonged investigations. The scientific habit of thought, so foreign to the politician, should be a great asset in the study of social problems. Yet it always teaches caution, and warns us of the danger of reaching conclusions without adequate researches.

Thus, for the average scientific worker who accepts Secretary Wallace's criticism, the problem presents itself in this fashion: How far can I, in addition to my labors in a technical field, make myself expert in social problems, sufficiently so to feel justified in expressing confident opinions, and leading those who may wish to follow me. It may be replied that, in our society, organized as a democracy, we cannot evade these problems, and are doing something even by doing nothing. But the scientific man will reply: I do try to be a good citizen, and I do act in public affairs, but not feeling expert, I follow the lead of those who have given the subject more attention. His reaction to religion is apt to be very much the same, with the result that his economics, his morality and religion seem sometimes to be the product of a totally different sort of mind from that which is back of his scientific papers.

There is room for difference of opinion, and it is hard for the scientific man to visualize himself as a heaven-sent savior of erring mankind. Practically, it is very difficult for a scientific expert employed by the public (as in a state university) to be always sure that he is rendering public service. He deems it his business to supply information or give advice to the limit of his capacity, on request. Can he determine what will be done with this information or advice, or attempt to withold it if he suspects the possibility of undesirable results? He necessarily has to treat all comers alike, and cannot honorably do otherwise.

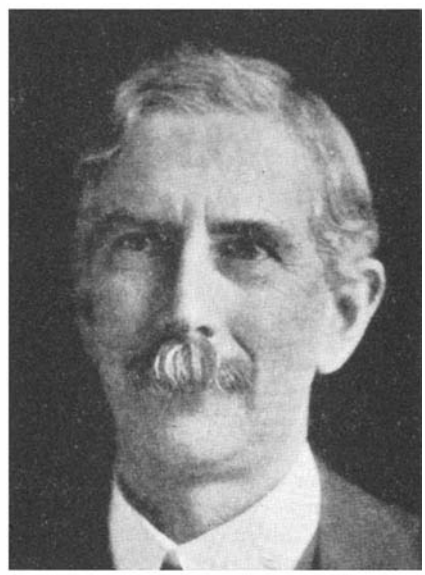
Having thus presented some of the difficulties, I hasten to say that in spite of them all, I have no doubt that the scientific habit of mind is essential if we are to deal wisely with our social problems, and that even some of our poorly trained (in a social sense) scientific men could be made very useful in the present emergency, having at any rate a knowledge of the technique of successful investigation.

DR. MERRIAM'S statement:

AS point of view is an important element in any discussion, it should be recognized that this is written from the position of one trained in science. But, dangerous as is exploration by a scientist in the field of human values, it is also true that unless students in scientific subjects join with investigators of human problems to study relations among the several regions of thought, there is small hope for solving some of the questions for which we most urgently need understanding.

In ways not yet devised we need development of research, education, and vision which will give us machinery making possible the continuing evolution of society through creative activity, but without increasing the dangers. Such a program will necessarily involve participation of science and engineering in its various phases, along with representation of all social interests concerned.

The control of new features will in many instances require a view such as can be obtained only by wisdom of the highest order. Perhaps we shall need



"Greed, dishonesty, distrust . . ."
DR. ABBOT

the collective judgment of many minds related in an exceptionally effective way. In other cases the necessary action may arise from individuals concerned. To depend wholly upon values remaining through survival of the fittest, allowing things to take their course unguided, will sometimes involve fate of the product and on other occasions the interests of the people. Errors of ignorance in handling of such situations will be multiplied by bad judgment, and may be increased almost infinitely by selfishness or neglect of the public interest.

MR. KETTERING observes:

THERE are many people who doubt if human progress can continue on its present standards. Still others think that we have to go back to lower standards of living because they see no way out of our present difficulty. There are, however, a substantial number who, knowing something of the development of civilization, do not regard the evidence presented as justifying either a static or a retrograding standard of living. We do not believe the world is finished or that we must curtail human effort and desire. The only way out of our present difficulty is forward and not backward.

To those of us who have spent most of our time in experimental and de-

(*Please turn to page* 107)

UNFORESEEN CONTROL OF INDUSTRY

By DANIEL H. KANE
N. Y. Bar

TWENTY years ago, not long prior to the beginning of the World War, the wheels of American industry were turning slowly. We were entering upon a period of business depression which, economists tell us, never reached its lowest ebb due to the industrial stimulus of the war. The popular hobgoblin of that era, which was generally regarded as the cause of all economic ills, was the giant of industry—the so-called trust.

This concept of the evil of monopolies was not a new one, for combinations in restraint of trade were frowned upon by the common law, and the Sherman Act of 1890 provided means for causing disintegration of such combinations or monopolies. However, it was generally believed that further legislation was necessary to prevent the additional concentration of industry in the hands of a few large concerns. This popular belief bore fruit in 1914 in the second session of the Sixty-third Congress, which was devoted largely to the consideration of additional anti-trust statutes and resulted in the Clayton Act which extended and further defined the anti-trust laws, and in the Federal Trade Commission Act which created an administrative board for carrying out some of the provisions of the anti-trust acts and for preventing those practices which it was believed inevitably destroyed competition and fostered monopolies.

THE Federal Trade Commission Act provides for the creation of a commission of five members not more than three of whom may be of the same political party. The most important powers of the Commission are those granted by Section 5 of the Act, which declares unfair methods of competition to be unlawful and grants the Commission power to prevent them. This section provides:

> "That unfair methods of competition in commerce are hereby declared unlawful.
>
> "The commission is hereby empowered and directed to prevent persons, partnerships, or corporations * * * from using unfair methods of competition in commerce."

The statute does not define the clause "unfair methods of competition" but a review of Vol. 51 of the Congressional Record shows that Section 5 was aimed directly against the creation of monopolies and that by unfair methods of competition was meant those practices tending to create monopolies.

The Act further provides that the Commission may institute proceedings where it has reason to believe that a person, partnership, or corporation has been using unfair methods of competition in commerce and where it appears that such proceedings "would be to the interest of the public." The party so proceeded against is given an opportunity to appear before the Commission to answer its charges. In such proceeding both the Commission and the party may take testimony and if the Commission after considering the testimony is of the opinion that the party has employed unfair methods of competition, it must make a report stating its findings as to the facts and must serve upon the party proceeded against an order requiring him or it to cease and desist from using the unfair methods of competition.

IT will thus be noted that the Commission is empowered to act in effect both as prosecutor and judge, and if its order were final and not subject to review there would be grave danger of injustice being inflicted upon some of the parties proceeded against, to say nothing of the question of constitutionality. The section, however, does provide for two methods for obtaining a limited review of the Commission's order by a United States Circuit Court of Appeals. Either the Commission, where the party proceeded against refuses to obey its order, or the party, may apply to certain of the Circuit Courts of Appeals, and the court, after considering the entire record of the proceedings before the Commission, may enter a decree modifying, affirming, or setting aside the order of the Commission.

However, in reviewing the Commission's order, the court cannot independently weigh the evidence and arrive at its own findings of fact since its powers of review are strictly limited by a provision in the Act that "the findings of the Commission as to the facts, if supported by testimony, shall be conclusive." In other words, if there is any conflict in the testimony, the Commission's determination as to what the facts really are, if supported by testimony, is final and binding upon the Circuit Court of Appeals regardless of the amount of evidence to the contrary.

The court may merely review the questions of law and determine whether the findings of fact of the Commission are supported by any substantial testimony. Thus it will be seen that while the Act provides for a method of obtaining review by the courts of the Commission's orders, it puts a definite limitation upon that review.

The provision that "the findings of the Commission as to the facts, if supported by testimony, shall be conclusive," is obviously unfair in all those cases where an important fact is in dispute and where both the Commission and the party proceeded against introduce evidence to support their respective contentions, inasmuch as it denies the party an adequate review before an impartial tribunal and makes the Commission not only the prosecutor but also the final arbiter of any facts thus in dispute. Naturally, a body having prosecuting powers is liable from time to time to become over-zealous and its enthusiasm as a prosecutor may occasionally affect its decision as an adjudicating tribunal.

More serious than this, however, from the standpoint of the average business man, is the fact that it places in the hands of the Commission a power which might enable it to exercise functions which Congress never intended it to exercise and become in effect the dictator of the proper meaning of commercial names and brands. It enables the Commission to step in when the meaning of a name or brand is uncertain or open to dispute, decide what in its opinion is its proper meaning, and order the party proceeded against to stop using it in any other manner.

IN such cases the Commission is not preventing those unfair methods of competition which tend to create monopolies but becomes in effect a bureau of standards with power to standardize the names and brands of goods used in commerce. However desirable it may be to secure the standardization of names, Congress certainly never intended to grant such powers to the Federal Trade Commission.

It is a far cry from preventing those unfair methods of competition which have a capacity and tendency to create monopolies, to standardizing and interpreting the meaning of uncertain and disputed names and terms. This unusual and unforeseen degree of control over industry which might result at times in depriving a business concern of the right to use a name which it has used in good faith for many years,

exists only because the courts are denied a complete review of the facts in each case.

There is a recent case somewhat at point. The Commission filed a complaint against a rug manufacturer charging that it manufactured and sold in interstate commerce certain rugs and misbranded them as Wilton rugs under the trade name "Bagdad Seamless Jacquard Wilton." Summarized, the findings of fact of the Commission were that the respondent had been selling its Bagdad rugs as and for genuine Wiltons; that the term "Wilton" as applied to a rug fabric implied a fabric having a weave construction in which the warp pile yarns, when not required upon the surface of the design or pattern, are continued in the sub-surface structure of the fabric, and that the respondent's Bagdad rugs were made under a process essentially unlike that used in making Wilton rugs and when made consist of a weave structure differing materially from that of Wilton rugs.

THE Trade Commission then made the conclusion of law that the sale of the Bagdad rugs as and for genuine Wiltons constituted an unfair method of competition in commerce having a capacity and tendency to deceive the public. Upon these findings and conclusion the Commission ordered the respondent to cease and desist from designating its Bagdad rug as a Wilton rug.

The Circuit Court of Appeals for the Third Circuit, in reviewing the order, found that no Wilton rugs manufactured today are similar in all respects to those originally termed "Wilton" more than 100 years ago. Both the Commission and the respondent introduced a great deal of testimony, the testimony presented by the Commission naturally sustaining its definition of a genuine Wilton rug, and the testimony presented by respondent sustaining its contention that the Bagdad rug had all of the essential characteristics of a genuine Wilton. The court in considering the conflicting nature of the testimony found there was ample evidence to support either the respondent's or the Commission's contention as to the meaning of the term "Wilton," but that since the Commission's finding as to its meaning did have evidence to support it, it was conclusive. In its decision the court made this significant statement:

> "Since the statute and decisions expressly confer upon the Commission and not upon the court the duty of determining the facts, it is of no consequence that if the Congress had conferred fact-finding power upon the court, it might have reached a conclusion other than that of the Commission."

Thus the court indicated that if it had full power to appraise the testimony, its finding as to the meaning of the term "Wilton" might have been different from that of the Commission. Under the law the court was forced to affirm the Federal Trade Commission's order.

Here is a case where no rug manufacturer makes rugs similar in all respects to the original Wilton and where there was substantial evidence sustaining both the Commission's and the respondent's contention of the proper meaning of the term "Wilton." There is the distinct possibility that the term "Wilton" was entitled to the interpretation which respondent sought to give it, and yet the court being bound by the findings since they were supported by evidence, could not make its own appraisal of the testimony to determine whether this were the case. The Commission was, therefore, both the prosecutor and the final judge of a vital fact regarding which the testimony was in conflict.

Where the meaning of a brand or name is not fixed and is subject to several interpretations and the respondent uses it in accordance with any one of its accepted meanings, he certainly is not guilty of an unfair method of competition within the meaning of the Federal Trade Commission Act; and yet if the Federal Trade Commission should decide that the brand or term, even though having been used for a long period of years, has a fixed meaning and designates a particular type of goods, and that the respondent was using the term to designate a wrong class of goods with an injurious effect upon competition, and should these findings be supported by evidence, they would be conclusive and binding upon a Circuit Court of Appeals regardless of the amount of evidence to the contrary.

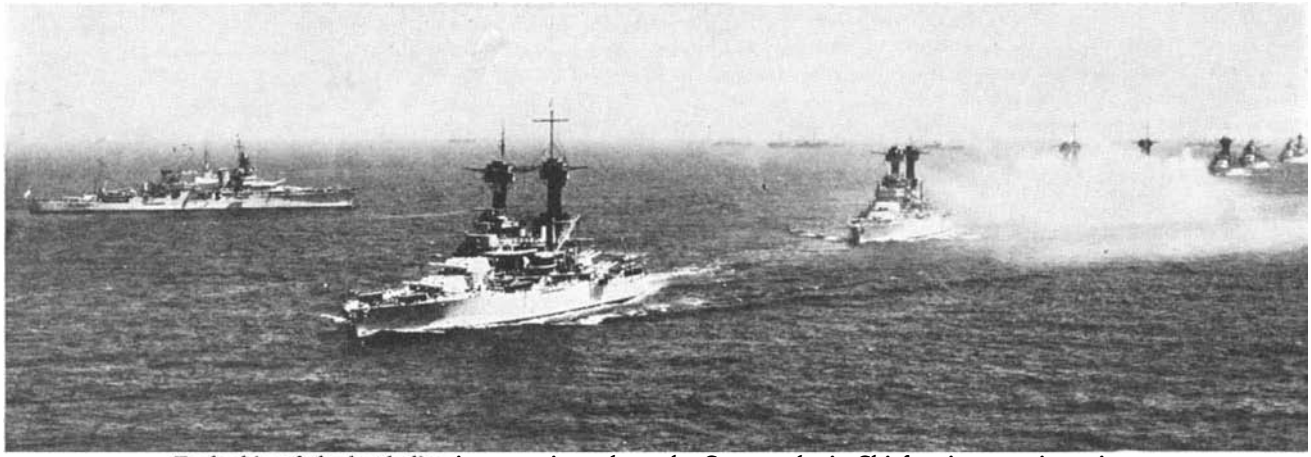
IN every case where the meaning of a name is in dispute, there are at least two sides to the question, and evidence can be adduced to support each side. The Commission in instituting the proceeding for the misbranding of goods indicates by its very action in instituting that proceeding that it believes the respondent is using the brand wrongly. Usually it should have little difficulty in securing evidence to sustain its position.

Where the respondent is using a brand or name subject to several interpretations or whose exact meaning is open to honest dispute, the provision that "the findings of the Commission, if supported by testimony, shall be conclusive," may lead to serious injustice. To prevent such injustice, to enable respondents in such cases to secure a complete and adequate review by the courts, and to prevent the Federal Trade Commission from overstepping the powers which Congress intended to give it and become in effect a bureau of standards with power to compel obedience with its standards, the Federal Trade Commission Act should be amended so as to give the Circuit Court of Appeals reviewing the Commission's order the power of independently weighing the evidence and making its own findings which is usually accorded to such a court in reviewing the decree of a court of equity.

The activities of the Federal Trade Commission are not confined to the regulation of public utilities, nor are its activities confined to the supervision of monopolies or trusts in spite of the fact that the Trade Commission Act was originally passed as a supplement to the anti-trust laws. Every business engaged in the sale of goods in commerce is potentially subject to the supervision of the Commission.

The American system of checks and balances to prevent the possible arbitrary use of power might well be applied to control the use of a power which affects the rights of so many people. Certainly it is not unreasonable to request that the same check be placed upon an order of the Commission which, it must be remembered, acts both as prosecutor and judge, as is placed upon a decree of a court of equity.

WOULD you, as a business man, care to have a government bureau decide upon the name or brand by which you may designate your goods? Should a government board or bureau be empowered to deprive business concerns of names or brands which they have used in good faith for many years? These questions are not merely hypothetical, nor are they based upon some imaginary grant of power threatened by some member of the so-called brain trust. The Federal Trade Commission, created 20 years ago, was granted power which enables it to do just these things. Its powers of regulation extend to every concern engaged in commerce. The accompanying article points out that in its proceedings the Commission acts not only as prosecutor but as judge, and the party proceeded against is denied adequate review of its decisions since its findings of fact or its interpretation of the evidence, if supported by testimony, are made binding upon the court reviewing its proceedings. It is remarkable that a board having such tremendous powers over all phases of industry should have attracted so little attention in the past.—*The Editor.*



Each ship of the battle line in succession salutes the Commander-in-Chief as it passes in review

WHY THE BATTLESHIP?

By JONAS H. INGRAM
Commander, U. S. Navy

IN recent years the American public has from time to time seen much controversial material relative to the battleship as an obsolete weapon of naval warfare and at the same time advocating the construction of aircraft and less expensive surface craft as the logical substitute.

As the time approaches for the next naval conference, the sequel to the Washington Limitation conference of 1921 that established the naval ratios, every American citizen should have an intelligent understanding of the issues to be faced at this coming world naval conference. The relative size and armament of battleships will undoubtedly be one of the questions of vital interest to our national welfare and security.

The viewpoint of the men who have been educated and trained in, and have given their life's work to, the subject of the nation's first line of defense, may be of interest to those who are formulating an opinion on this important subject.

In the naval service it makes little difference as to whether an officer wears on his uniform the wings of a qualified naval air pilot or observer or just the plain navy blue, as both occupy important positions in the first line. There is no argument between these men as to their relative importance in carrying out their respective assignments.

To those who have been in the Navy for years, the first submarine and the talk of how it would revolutionize sea warfare, the first torpedo boat, the first destroyer, the first battle cruiser—all to bring about a new order of things—are now but memories of the past. All these are important units in their place and to them it is difficult to assign numerical importance.

Now man has succeeded in mastering the air, with a powerful, elusive, and swift weapon that must be given due weight in the combat at sea.

As a result, the naval strategist has at hand many types, different in speed, weight, and vulnerability. He faces much the same proposition that a football coach does at the start of a season. He must build up a team that in order to be successful must have both offensive and defensive strength. He needs power and weight in the line that can take and give punishment, fast wings that can get down the field, catch passes, and still have defensive strength in turning in or blocking end sweeps. He must have backfield power that can make quick stabs and thrusts, with chances of breaking through; fast end runners; kickers; passers; and types adept at spinners and complicated reverses. These same types must be able to block, defend against passes, and be able to defend against any type of an offensive team. In a comparable manner we have types of ships and aircraft, all good in their place, but one excels the other, depending upon the offensive or defensive requirement.

HENCE a well-balanced fleet may be compared with a football team. There must be heavy powerful linemen —the battleships. The ends are the aircraft carriers and cruisers; the backs, cruisers; while heavy ships and destroyers are carriers for passing; submarines for trick plays and reverses.

To make up this fleet there must be sufficient replacements and substitutes, their use depending upon weather conditions and type of adversary. If we face an enemy who has only one type of offense, the answer to our problem is simple. But our most probable enemies are well equipped in offense with many types. They do not care to be hampered with eligibility rules as to their types and numbers, and in some cases there is a grave tendency to in-

WITH the manuscript of this article, the first of two on this subject, the author submitted endorsements of the battleship as the backbone of our sea power by Secretary Swanson, Admiral Standley, and Rear Admiral J. K. Taussig.

In command of the *Pennsylvania* during her modernization, executive and temporary Captain of this ship while she was fleet flagship of the United States Fleet in the Pacific, Commander Ingram knows battleships. He was also Senior Aide to Admiral Hugh Rodman in the *New York* while she was attached to the British Grand Fleet for 14 months during the war and Admiral Rodman's Assistant Chief of Staff when he was Commander-in-Chief of the Pacific Fleet.

crease their power and numbers and engage in a race for sea strength.

To face this situation, the men who carry the responsibility for the safe defense of this country cannot be stampeded or prejudiced against any particular type. They must take into consideration our probable enemies, effectiveness, strategy most likely to insure success, our naval policy, the economic problems, geographical considerations, the element of time, and have full deference for any limitations of armament treaty to which we may be a signatory.

It has often been quoted that a good offense is the best defense, but this country has never, nor probably will ever engage in a war of aggression, so our first need must be an adequate defense against any probable enemy.

In case of hostile attack, our directing genius must know the composition of enemy forces and from the circumstances determine the course of action; for the ultimate mission of our fleet is to seek, engage decisively, and destroy the enemy.

A GOOD modern naval officer must be air-minded to a high degree. He must be fully alive to the uses and effectiveness of our air service as well as its limitations, and, contrary to public opinion in general and some air-minded writers in particular, the average United States naval officer has a full appreciation of air values and their relations to the whole, the reason for this being that our airmen come from the same school and work in close harmony with their brothers on surface ships and submarines. They work out their problems together, discuss every phase so each has a comprehensive view of the other's problems and difficulties at sea. The air force operates as a part of the fleet in the same manner as the destroyer force or submarine force. Each makes his contribution to the team work of the whole fleet and, be it in offensive or defensive action, they all have equally important rôles to play.

Great problems are evolved to give each arm of the fleet an opportunity to develop. All branches join in the solving of the problem and as a consequence there is splendid teamwork in developing a strong and aggressive fleet prepared to cope with any situation it may be called upon to face. The responsibility for the strength and composition of this fleet rests solely with Congress. It is the duty of the Navy to advise and be on sure ground, with the best interest of the country at heart, in every recommendation to Congress.

On the other hand, our citizens should be alive to our situation at sea and have a general knowledge of some of the problems faced and not be in a position to be led astray by some popular catch phrase or some snap judgment opinion given by someone without responsibility. For example, quite a bit of publicity has been given the contention that the advent of aircraft has made obsolete all surface craft, particularly the battleship. This statement is not a fact and cannot be substantiated. Though a picturesque indictment may be made of the battleship or other surface craft by those not well informed, the problem is fundamentally a technical one and the rational discussion of the subject must be from this angle.

"The New Dealers for the Navy:" President Roosevelt, Secretary of the Navy Claude A. Swanson, Chief of Naval Operations Admiral Wm. H. Standley, and the Ambassador to Mexico, the Hon. Josephus Daniels, who was Naval Secretary under President Wilson—at President's review, New York, May 31, 1934

What is generally known as "sea power" comprises the total strength of a nation in (1) combatant ships (surface, sub-surface, and air); (2) merchant marine; (3) naval bases—all essential and important in the final analysis. We are known to be weak in both merchant marine and naval bases; therefore our combatant fleet must be built and maintained having due regard for these inherent weaknesses.

Lack of a merchant marine demands a different type of cruiser. Nations having fast merchant vessels have a great advantage, as these vessels may be easily armed and turned loose on the world's trade routes and make ideal commerce destroyers, scouts, and raiders. To combat this menace, our Navy must have heavy cruisers of great speed and large cruising radius, with superior armament, able to make safe our overseas commerce from such attack.

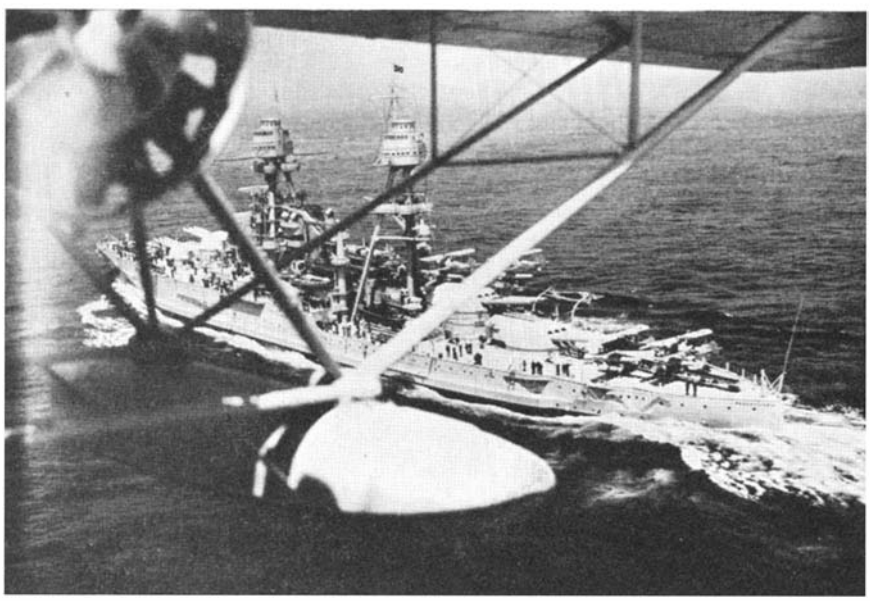
Lack of bases outside the continental limits have a direct bearing on our naval policy and strategy. The great distances between our coasts, the Panama Canal, Alaska, and our insular possessions, make it imperative that our combatant forces have great radius of action, seaworthiness, and the power necessary to make and maintain temporary bases to protect our light craft and aircraft from strong enemy opposition.

Full weight and consideration must be given to these factors by the men responsible for the design, construction, and numbers of the different types of fighting craft that make up this combatant sea force.

A reasonable question that is often asked is: If other nations wish to abolish or limit the size of battleships, why should the United States not agree? Great Britain has naval bases scattered all over the globe with a large, powerful, and swift merchant fleet and great numbers of small cruisers that are most effective when operating from convenient and well placed bases. Japan also has numerous island bases. It would be advantageous to both of these nations to have a definite limitation upon the number and size of battleships, which would react to the disadvantage of our own naval policy founded upon the battleship as its backbone. We have really only one location for such a real base on our west coast, far removed from Alaska, Panama, and the Hawaiian Islands.

IN the design and construction of a man-of-war the constructor faces a compromise from the minute he draws the first line. Our idea of offensive power is long-range guns of high caliber, speed, long radius of action, spotting planes, and latest fire control equipment. Defensively, there must be heavy armor, excellent water-tight integrity, protective decks, anti-aircraft and submarine defense battery, plus gas protection. Big guns and armor mean weight; ammunition adds to tonnage; every extra knot in speed requires more boiler power and machinery weight; intricate compartmentation is a weighty proposition; cruising radius means more fuel; fire control equipment, anti-aircraft and anti-submarine batteries will add to the total. Planes and catapults are big

items; space and quarters for a contented crew call for additional room; blisters and protected decks bring the total up to the point that, even after every cut and compromise, the naval architect finds he has a ship with a tonnage aggregating 35,000 tons, the limiting tonnage arrived at by the Naval Limitation Conference. Great Britain has two great ships, the *Nelson* and *Rodney*, that exceed this figure by about 6000 tons.



The U. S. S. *Pennsylvania*, flagship of the United States Fleet. This aerial photograph shows four planes and two catapults, also the hull's blister protection

At the time of the Washington Conference in 1921, the naval architects of the world were gradually increasing fighting strength by building ships of great gun power and greater tonnage. One of the outstanding accomplishments of this conference was the limitation in size of men-of-war and the agreement to curtail further building of battleships until the next conference in 1935.

WITH the limitation on tonnage, increased strength must come from superior skill in design, superior technical developments in engineering, metallurgy, and airplane spotting, increased efficiency in ordnance and fire control equipment, and increased protection from overhead and underwater attack. It really has put a premium on skill and scientific development.

The fact remains, however, that the battleship has not become obsolete and with due consideration given to the latest developments in heavy cruisers, air force, and submarines, the battleship yet remains to the Navy what the infantry is to the Army. The battleship has the greatest offensive and defensive power of any type of ship. It has great gun power to deliver the heaviest blows; heavy protective armor to withstand gun, torpedo, and bombing attacks; latest devices for withstanding attacks from the air, on the surface, or from under the water; and is so constructed that it can remain at sea in any weather for long periods and be capable of operating at great distances from bases.

In this discussion one should not consider the individual battleship but rather what is known in naval terms as the battle line. This consists of the units that would at all times accompany the battleships at sea and consists of battleships present, screening destroyers, cruiser screen, and aircraft carriers. This formation is strongly defensive against any attack and at the same time presents the greatest offensive power.

The battle line may at any time be augmented by the entire cruiser, destroyer, submarine, and air force and then we have a fleet concentration.

There are few problems in life to which history does not give the basis for the correct answer. The late war showed —in fact, all of our great peace-time naval maneuvers show—that the battle line, composed of the heavy ships of the line, is the focus of all offensive and defensive operations. No matter what the conditions of the problems or what types of units are involved, their offensive action radiates from the position occupied by the battle line; when the going is hard they invariably fall back on the battle line for protection.

The real command of the sea will be dictated by the strength of this battle line. Naturally it will have to be supported by the various other units that contribute their full share to the whole, but the final decision will rest with the capital ship for the simple reason that the force having a battle line supported by light forces having an adequate air force can "go places and do things" where light forces alone could not.

There are many practical illustrations to support this view. In the North Sea during the World War there was a vital supply of food stuffs coming into the British Isles from the Scandinavian countries—huge convoys of slow vessels coming from Bergen, Norway, to the east coast of England. Even in a relatively small body of water such as the North Sea, the Germans made successful raids, with light forces, on this convoy. In the end the British High Command ordered a squadron of battleships of the Grand Fleet to act as escort for this convoy on their slow passage across. This immediately stopped all raids as Germany could not afford to molest this convey with light forces—including battle cruisers—and, until the conclusion of the war, this convoy came in unmolested each week.

IN our own war games, one would only have to be present once and observe the results to see how powerless our light forces—including aircraft and our new eight inch gun cruisers—are when contact is made with our battle line.

The defense of the battle line against hostile aircraft attack is their accompanying aircraft, their anti-aircraft protection, and, finally, fine deck protection against the possibility of the enemy aircraft breaking through. From submarine attack the defense again is our own submarines, guns, aircraft, and destroyer screens—and battleship "blisters" should a torpedo hit be made. Hostile battle cruisers and light forces cannot afford to come within extreme range of the heavy caliber guns.

The result of this effectiveness of the battle line is that our first line of defense would be far-flung from our own shores, comparable to heavy entrenchments occupied by infantry. This line would be effective in breaking up air raids that must come by water-borne transportation from the sea, giving our own light forces a point to operate from and to fall back on when meeting superior strength. In fact, the battle line always has been and will continue to be the backbone of our seapower.

What the limiting size of the battleship of the future will be, no one can predict. It will in all probability be decided in conference with the sea powers of the world. Each country will have opinions of its own. The economic situation will have weight. The political situation existing in the world at the time will exert an influence. But it is safe to say that the United States with our extensive coast lines, distant insular possessions, the Panama Canal, and the Monroe Doctrine, cannot afford to give up a ship that embodies the greatest offensive and defensive power and is in reality the powerful line upon which our sea team and its strategy have been developed.

BUREAUCRACY AND THE FARMER

By HARRY F. BYRD
United States Senator from Virginia

I AM a Democrat. I believe in party government. I have supported many emergency measures granting great power to the President. I respect the high patriotism and benevolent intentions of the President and admire many of his great achievements; but there remains in me enough of the spirit of Thomas Jefferson to insist that extraordinary powers now granted shall be limited to the period of this economic emergency and that reasonable restraints shall be placed upon the exercise by Federal bureaucrats of dictatorial powers.

Holding this democratic faith I opposed amendments to the Agricultural Adjustment Act—urged for adoption by the distinguished Secretary of Agriculture—that would (if adopted) make the Secretary a supreme dictator over everyone who produces agricultural products and everyone who handles such products.

Congress approaches adjournment as this is written and the indications are either that these amendments will not pass at all or that most of their objectionable features.... (Amendments were defeated.—*Ed.*) However, the consideration of the powers sought for the Secretary of Agriculture illustrates the dangerous tendency of Washington bureaucrats to grasp and enlarge their powers and points the moral of this brief contribution to SCIENTIFIC AMERICAN.

I HAVE not hesitated to support legislation designed reasonably to assist the orderly and profitable production and marketing of farm products; but I opposed an amendment that gave the Secretary power to prescribe what a farmer may plant and what he may receive—even what turkeys and chickens he may raise—in his entire farm operations, once he has agreed to accept government compensation for reducing his planted acreage on any part of his farm, however small.

It was proposed that the farmer must obtain a license to farm his own land. The Secretary would then dictate the terms of that license and failure to observe the terms would be punishable by fines as high as 1000 dollars a day, if the hapless farmer were convicted.

After dictating the operation of the farm by the farmer it was contemplated by these progressive regulators that the Secretary dictate the terms upon which food products from the farm might be distributed. The distributor or handler of such products must also obtain a license and no one without a license could ship agricultural products in interstate commerce.

IN carrying out the declared policy of the Act it was provided that the Secretary might impose quota restrictions, with the approval of two thirds of the producers of a given commodity, and, even without such approval, the Secretary was empowered to direct to what markets and to what extent certain products might be shipped. Add to this the power to prescribe the quantity of each commodity such distributor might sell and the Secretary would in effect possess the power to fix the price of agricultural commodities.

The growth of the power of Federal bureaus has been remarked for years as a dangerous invasion of the liberty of the individual. Of course, commissions are necessary to the orderly administration of transportation and industry, operating on an interstate scale too vast and extensive to admit of effective regulation by state agencies. But this admission is not inconsistent with the insistence that powers vested in Federal bureaus are powers dangerous to the free play of individual initiative and individual enterprise and that the real Democrat must demand strict limitations on such powers.

Especially must the Democrat insist that such administrative commissions and bureaus keep strictly within the powers granted to them and that the courts be free to protect the constitutional rights of the individual when he suffers by subjection to the arbitrary decisions or acts of a Federal bureau.

I admire the many men who work hard and patriotically on these commissions. Most of them are benevolent in their intentions; but their immediate objective is to justify their official existence by manifest results. They believe in the beneficence of their work and they tend to absorb progressively the power they deem necessary to do their work.

The powers of many of these Federal bureaus are veritably kingly. One reason is that the gentlemen who preside over these commissions are delegated the authority to make regulations to govern their work and it is very difficult for the individual to persuade even the courts to extricate him uninjured when he is caught in the mesh of one of these regulations.

The complaining citizen will be told that Congress has delegated to the Commission the right to make regulations essential to efficient administration and that these regulations will be sustained if made in accordance with the law. Even more, the bureau's own construction of an Act of Congress will be sustained by the courts unless it is clearly erroneous. In theory, unconstitutional rules and unconstitutional legislation will be declared invalid by the courts, but, in practice, administrative rules of the bureau, effectively enlarging its powers, will be sustained unless clearly erroneous. Then, too, only the well-to-do citizen can finance a law suit to test his complaint that a great Federal bureau has invaded his constitutional rights.

THE complexity and magnitude of modern business require regulation by Federal bureaus undoubtedly; but it remains as true today as it was when Jefferson said it, that the individual possesses certain fundamental rights that are "inalienable." Even the King of England, in the old days of more absolute monarchy, could not enter uninvited the cabin of his poorest subject, and yet, many of these bureaucrats, attired in plain clothes, exercise more power under a straw hat than did the king of old adorned with a jeweled crown. Americans today must keep watch and ward over the liberty of the citizen to go about his own business with that degree of ordered freedom that has enabled him to develop here a strong nation of strong men happy in the enjoyment of liberty protected by law.

When you put men in regiments and drill their steps you gain power in mass momentum, but you stifle the initiative of every individual who may advance the progress and welfare of us all if given free play to his talents and enterprise. The modern American may have to surrender a measure of his independent action to the social necessities of these hard times, but he should never consent to be awakened each morning by the blare of a bureaucratic bugle and required to do his daily work to the tap of a bureaucratic drum.

Dispelling Popular Fallacies About

AIR CONDITIONING

By L. R. SMITH
Air Conditioning Division, Westinghouse Electric & Manufacturing Company

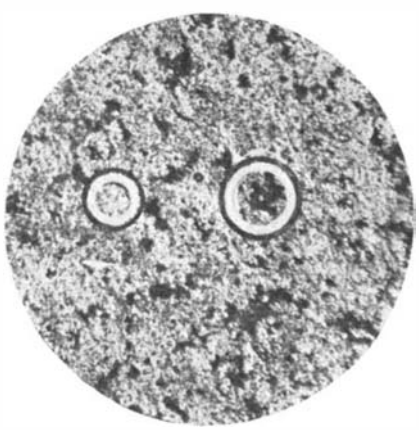
"It isn't the heat; it's the humidity"

THERE are many popular misconceptions regarding the new science of air conditioning. It has been promoted largely by partial truths or so-called "commercial truths." Such statements as, "Air Conditioner Complete for $25!" and "Our Complete Air Conditioner Requires Only Two Square Feet of Floor Space!", on investigation turn out to be descriptive of a humidifier, a fan, a heating cabinet, a cooling cabinet, an air filter, an odor remover, or even an air scenter. Much can be accomplished in combating such fallacies by supplying adequate equipment and by proper representation of air-conditioning products.

The public, in its search for information on air conditioning, may be likened to a group of blind men examining an elephant. Some feel the bulk of the air-conditioning elephant and say: "Air conditioning is temperature control"; others receive a spray of water from its trunk and declare it to be humidity control; still others feel the flap of its ears and are sure it must be air circulation. True and complete air conditioning is not to be confused with any one part of the whole.

One of the most difficult phases of air conditioning and one of the least recognized as such, is that of dust removal. Air filters are often guaranteed to remove 98 percent of the dirt in the air. Investigation usually discloses that a special dirt is used in the tests in order to obtain such high efficiencies. It is relatively easy to remove large particles, but the major portion of atmospheric dust in residential districts is extremely small. The unit of length used in dust measurement is the micron. (The micron is one millionth of a meter or approximately one twenty-five thousandth of an inch.) Much of our atmospheric dust is from 1/10 to 1 micron in diameter.

Dust particles, if composed of soot or material of like specific weight, and of one micron mean diameter, will fall freely at about the rate of six inches per hour. At this slow rate of fall, the particle follows almost perfectly the flow of air surrounding it. The impingement principle of dust filtering attempts

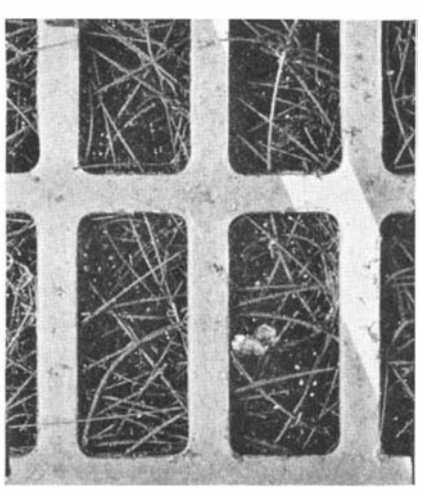


Photomicrograph showing dust after passing through a good mechanical filter. Large particle, in large circle, is 40 microns in diameter; other particles, as in smaller circle, average about one micron

to separate solid particles by substituting a new acceleration for that of gravity. The rate at which the direction of the air is changed must be extremely rapid in order to separate such small particles. This explains why, as yet, so few mechanical filters show good efficiency on atmospheric dirt. Water sprays are likewise relatively ineffective for these very small particles. People are perhaps the best filters, tests revealing that 100 percent of the dust inhaled under normal atmospheric dust conditions is retained.

In July, 1932, an investigation in New York City disclosed that approximately one pound of dirt existed in every 50,000,000 cubic feet of air in that city. In July, 1930, in the same city, the average dirt concentration was nearly three times that amount. Any well-constructed house will have an air infiltration equal to one complete air change per hour. This means that 42 to 100 ounces of dirt will filter into a 15,000 cubic foot house per year. It is difficult to imagine how many square feet of cotton cloth used in some air filters would be required to hold this quantity of dirt. This is not to discourage the use of any type of filter, as many air filters even of low efficiency will remove the larger dirt particles which readily settle out of the air. Avoiding heavy dust concentrations, but living in an industrial city, a person probably inhales from four to ten ounces of dust during his life span.

IN attempts to simplify the myriad aspects of air conditioning for human comfort, charts have been prepared. Valuable as such a chart is, its limitations should be recognized. First, the chart applies only when the people in the room are physically inactive. Second, it is for air conditions within a space where the surrounding objects are at the same temperature as the air. Comfort may be had at temperatures many degrees below those given in the



A good commercial air filter partly filled with dust from the atmosphere

chart provided that the walls surrounding us are at a higher temperature; similarly, cool objects around us permit higher air temperatures without discomfort. And third, effective temperatures are to be recommended as an indication of comfort only between the humidity limits of 30 to 70 percent.

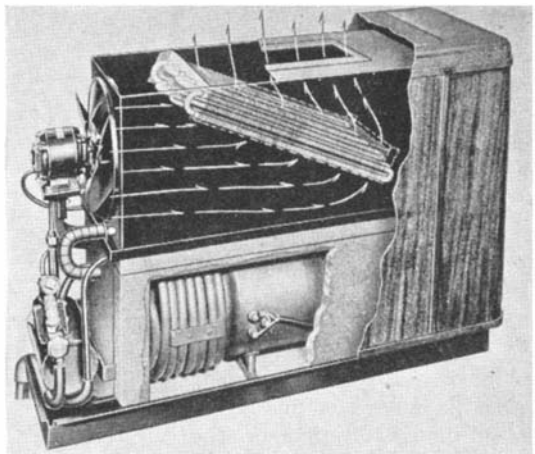
MANY people, upon inspecting a comfort chart, conclude that a substantial saving in heat may be effected by lowering the temperature, raising the humidity, and maintaining the same effective temperature. However, the heat required to evaporate water for maintaining a higher humidity was probably overlooked, and usually offsets the expected heat saving. The real way to save heat is by the use of proper insulation and a reduction in air infiltration.

A popular practice is to place pans of water about a room or on the hot-air registers to raise the humidity during winter. Actually, during severe winter weather, gallons of water must be evaporated per day to increase sensibly the humidity in even a moderate sized dwelling.

The quantities of coal, gas, or oil required to heat dwellings are roughly known to the public. However, most people are easy prey to salesmen selling a small box capable of holding, say 50 pounds of ice, for cooling rooms. Practically, any house of approximately 15,000 cubic foot capacity, located where the temperature often becomes 95 degrees, Fahrenheit, requires about 50,000 B.t.u. cooling per hour for real comfort; which corresponds to the melting of approximately 350 pounds of ice per hour!

To produce adequate cooling with electrical mechanical refrigeration units, about six kilowatts of electric power are required for cooling an entire dwelling. To produce cooling by means of heat directly, as in the case of the steam jet or absorption systems, more heat is usually required than is necessary to heat the same dwelling in winter.

People often wonder why heating a certain residence to 70 degrees, Fahrenheit, with an outdoor temperature of 0 degrees, Fahrenheit, requires only 100,000 B.t.u. heating per hour, while to cool it a mere 10 degrees, Fahrenheit, below the outside temperature, 50,000 B.t.u. of heat per hour must be removed. The extra heat consists of that required to remove water vapor from the air, that caused by the sun shining on the walls and windows, and that generated inside the dwelling, as from people.



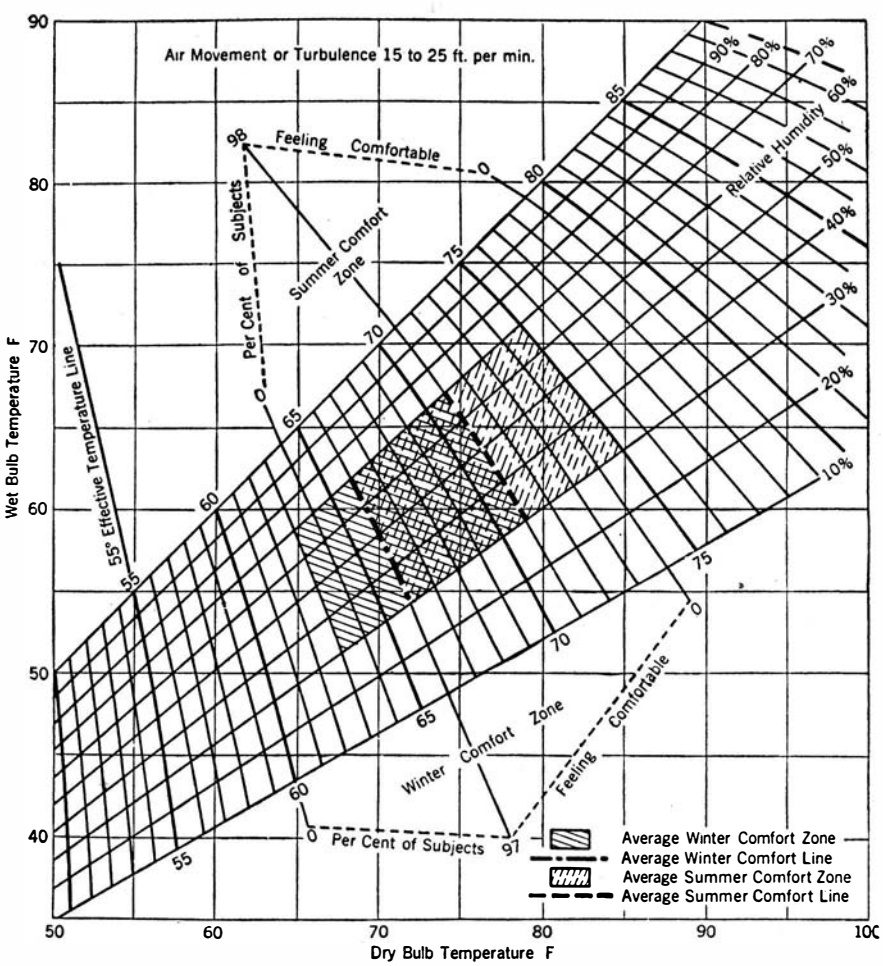
A self-contained and portable air-conditioning and condensing unit in a single small cabinet

Some "air conditioners" are represented on the basis that by the addition of a small amount of equipment, cooling can be obtained. Upon inquiry, it develops that one of the most expensive parts of the complete system has been omitted. Many think that by simply placing a cooling coil in a hot-air heating system, with equipment to provide the cooling, the resultant air circulation will be completely satisfactory. Such happy circumstance is rare, because of the tendency of cool air to fall instead of rise as in the case of hot air. A proper air conditioning system has to be designed to give good air distribution for both heating and cooling.

THERE is the impression that air cannot be given a velocity greater than about 300 feet per minute without noise. Specifications for air-distribution systems in public and private buildings often require that the velocity at which air is delivered to a room must not exceed this value. The real criterion is the actual noise produced.

Other phases of air conditioning such as odor elimination and "vitalization," whatever that is found to be, are rapidly gaining public attention. When it is found possible greatly to reduce air infiltration or fresh air brought in, a material saving in operating costs of air conditioning may be accomplished. The air from outside must be partially conditioned by regulating its cleanliness, its temperature, and its humidity, in order that it may give to the air inside, a "something" which "manufactured air" has so far failed to supply.

Air conditioning will progress faster with a proper public appreciation of each of its phases. It is not a fad to be built solely on the hope of immediate sales, but a new industry which, if built on solid ground, will grow rapidly and will surely endure.



A composite comfort curve, based on conditions in an average home, but subject to the varying limitations discussed in the text of the accompanying article

INDUSTRIAL CORN

By PHILIP H. SMITH

CORN, our major agricultural crop, moves steadily toward industrialization. Ever since chemists found the way to break down the kernel into its components, the golden grain has been playing an increasingly important rôle away from the farm. Today, about two million tons undergo factory treatment. The products derived from it are used in more than thirty industries and further penetration is by no means remote.

The refining of corn yields both edible and industrial products, all rather closely allied. The public knows only a few—corn starch, table syrup and cooking oil—but inedible products figure just as prominently in everyday use. The dextrins and starches, of which there are a great variety, permeate industry more thoroughly than the edible products, though they account for a smaller tonnage.

New avenues of use for corn products are being opened up by systematic research in more than thirty industries

THE process used in refining corn is largely mechanical, but surprisingly complete. The complexities are principally in the matter of controls to insure a maximum yield of desired products. If the meat packer can claim distinction for utilizing everything but the squeal in the processing of a pig, the corn refiner, too, has his claim, for when he has put corn through its paces he returns 26 percent of the original grain to the farmer to provide a supplementary feed for his livestock.

The corn kernel has three main parts, the endosperm containing starch, gluten, and solubles; the hull which is chiefly cellulose; and the germ which yields oil and fibrous material. The refiner begins by softening the grain in water and pulling it apart. The hull is shredded, the endosperm broken up, and the germ left intact to float off. From this germ comes an oil used by soap manufacturers, producers of artificial leather, makers of lacquers, varnishes, and photographic film. Refining the oil makes it edible and it reaches the market as a cooking and salad oil.

With the germ removed and some of the solubles recovered from the water of separation, the refining process treats the disintegrated kernel to free it of all substances and leave starch and gluten. These are separated by means of a settling process. Gluten so obtained is used to provide the protein element in stock feed while the starch is held for further treatment.

Starch is the "Mother Lode" of the grain. It gave rise to the refining industry and still remains the principal product in the sense that it is the base component. From raw starch are derived the food starches, the pearl, thin-boiling, crystal, powdered, and lump starches; the gums and dextrins; and finally the sugars and syrups. Gums and dextrins are products of conversion. They are made by treating starch with dilute acid and then neutralizing the acid when the chemical change has progressed to a specified point. The time factor in conversion determines the type of dextrin produced and there are many types, each developed for a specified use in industry.

AS a food, corn starch is too well known to need comment. The other starches, together with the dextrins and gums, play an essential but less well-known part in modern life. When they are shipped from the refiners they may turn up as a constituent of adhesives, explosives, foundry cores, asbestos products, cordage, cosmetics, colors, fireworks, or oil cloth. Starch makes an excellent "finisher," hence it goes to laundries, to the makers of textiles who use it to give the proper texture to their goods, and to the producers of paper who use it for sizing.

To convert starch into sugars and syrups the refiner uses hydrochloric acid just as the human body does. He heats starch in the presence of this acid and by varying the time, pressure, and temperature controls he can produce any of several sugars and syrups. Completely converted starch makes dextrose or "grape sugar," so-called because it occurs normally in fruits and vegetables. This sugar is identical in chemical nature with the sugar found in the human system and is unique in that it can be assimilated by the body without change, whereas ordinary sugars (sucrose) must be converted into dextrose before assimilation. Crude corn sugar has several industrial uses. The most striking one is in the manufacture of rayon, where it improves the quality of the textile. Refined dextrose and syrups are used in foods, principally as a sweetening agent in ice cream, candy, and bakery products.

AFTER noting the array of derivatives and their wide application in industry it seems justifiable to term corn an industrial product. On the other hand, relating the volume of corn refined to the volume of corn grown makes the word "industrial" almost a misnomer. The corn crop of the United States averages about 2,700,000,000 bushels and of this huge volume only 75,000,000 bushels, or a little less than 3 percent is refined. Such figures as these prove that corn is still overwhelmingly a food crop almost untouched by industry. The real significance—that corn now sides with industry—comes from interpretation of other figures.

If farm consumption and direct food uses of corn were on the increase, it would be far-fetched to stress the importance of industrial use (employing the word industrial to embrace food use after factory treatment). But the corn crop has long held at 2,700,000,000 bushels and consumption on a per capita basis has been declining for 30 years. It is a fact that the crop volume of 1902 would be adequate for today's population. Added to this decline in direct use there is a falling off in potential demand because our people have

changed their dietary habits. The public has been cutting down on meat eating and this presages a stationary if not reduced demand for corn-fed hogs and cattle which now consume 50 percent of all corn raised. Corn has failed utterly to keep pace with population growth and the slowing down of this growth, already manifested, holds no promise for an expanding market.

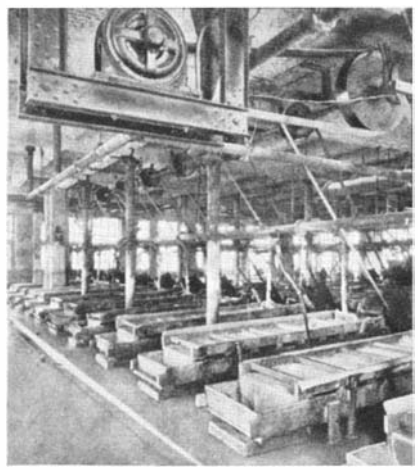
THIS situation places the industrial use of corn in a new light. It focuses attention upon corn derivatives even though an increase in their use may be slow or slight. This is so because corn used for refining is bought for cash and at present represents one third of the entire cash market. Economists may disagree as to the measure of influence on corn prices wielded by this cash market, since the price of corn-fed livestock bears heavily upon it, but they all agree that it is a factor with which to reckon. An active industrial market, they hold, is desirable for the maintenance of equilibrium between supply and demand. If industrial use expands it may prove a boon all around and there are potentialities for doubling, if not tripling present consumption.

There are possibilities that the chemist will find new uses for starch but the future of corn derivatives in industry does not hinge on remote contingencies. It bases upon a more widespread use of corn sugar or dextrose. The potentialities of this market have grown ever since the chemist found a way to make dextrose pure, and it was given a boost recently by a Federal ruling which permits the use of dextrose in certain foods without so labeling.

This lifting of the ban on dextrose opened a new market but it did not mean an overnight penetration of that market, for dextrose cannot in all instances replace ordinary sugar, pound for pound. Dextrose is only three fourths as sweet as ordinary cane or beet sugar, a quality which limits its use in some directions and enhances its value in others. When used in the canning of fruit, for example, exact formulas must be developed to make the product superior and that takes both time and experience. This brings the technician to the fore, but it doesn't replace the chemist. The food chemist is working upon matters more fundamental upon which to raise the structure of a larger market. He is delving into the nature of dextrose.

Dextrose may have very definite nutritional and physiological advantages in the general diet. A hint of this is given in the recommended feeding of syrups to infants in the scientific belief that the dextrose and edible dextrine content has merit. But more needs to be known about dextrose and its place in the human diet and this unknown is now being investigated in several of the large universities where manufacturer sponsored researches are being conducted under the broad direction of the Corn Industries Research Foundation.

THE expansion of the use of corn derivatives, however, does not wait wholly on research. Experience in the handling of dextrose in several industries has been of sufficient duration to prove practicability and to warrant broader use immediately. Candy manufacturers have discovered that ordinary sugar can be replaced with dextrose to the extent of 40 percent with improvement in the consistency and flavor of the product. Bakers now use dextrose and could use more generally; makers of jams, jellies, and canned fruit can work out formulas combining dextrose with cane sugar in varying amounts to get maximum benefit. In the production of ice cream about 20 percent of sugar



Corn starch and gluten are here passed through fine mesh silk to remove fiber and other particles

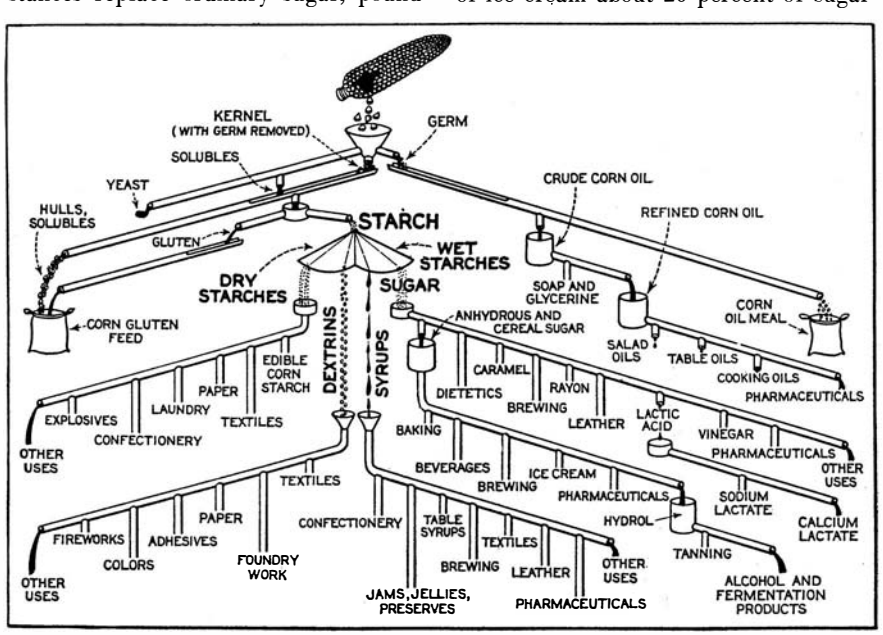
requirements can be met advantageously with dextrose, while a 50-50 blend of cane sugar and dextrose is considered meritorious in condensed milk.

Certain types of foods can be prepared with corn syrups even better than with dextrose. This syrup contains carbohydrates, dextrose, maltose, and dextrine and has a decided place in food preparation, as it prevents crystallization which occurs with cane sugar.

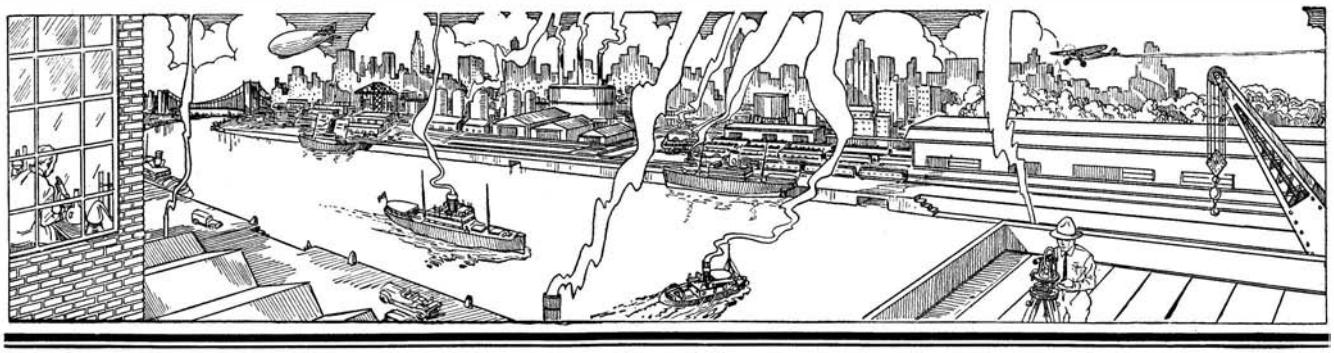
If it is the food industries which offer the greatest possibilities for the immediate growth in use of corn, it is food again which gives promise for the future. Ultimately dextrose may have a large household use. While it is less sweet than ordinary sugar it has its place, and household economists are busy finding it. And there is an almost untouched market in the manufacture of soft drinks, now opened with the discovery that carbonated beverages can be given a better body and more natural flavor when dextrose is used.

NO statement of the industrialization of corn would be complete without mention of commercial alcohol. At present only about 27,000,000 bushels are used for alcohol manufacture since imported blackstrap molasses is now the main source and a cheaper one.

But "ifs" and "whens" have little place in discussing the probabilities of further industrialization of corn. There is future enough without figuring what might take place if tariffs were wholly favorable or the petroleum industry opened its arms to corn-made alcohol. If corn dextrose should be used by the food industries only to the extent that it would make superior foods in the light of existing knowledge, some 75,000,000 more bushels, some 2,000,000 more tons of corn, would flow to factories for refining. This in itself is a goal of no mean proportion and sufficient to keep activities at a high pitch for many years to come.



Flow sheet showing some of the varying uses to which corn products are put



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Conducted by F. D. McHUGH

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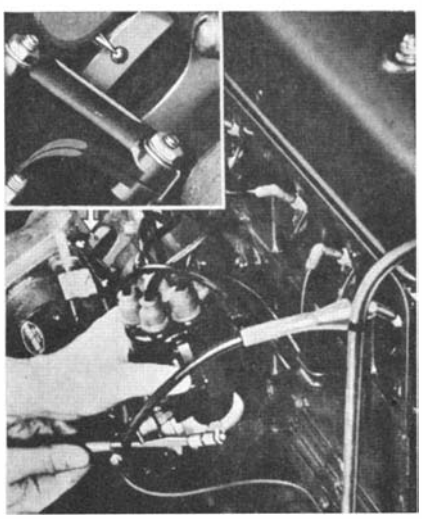
Timing Ignition While Engine is Idling

A SMALL neon lamp, flashing each time the spark plug of number one cylinder fires, and illuminating a polished steel ball set in the rim of the flywheel, facilitates the timing of the 1934 Chevrolet engine. The flashing of the lamp makes the ball



A neon tube flashes every time No. 1 cylinder fires, illuminating steel ball (inset) and facilitating timing

appear to stand still. By rotating the distributor until the ball appears directly in line with a pointer, the timing can be set to an accuracy of one half of one degree. The entire job can be performed in less than five minutes.

Radio Does Not Cause Drought

WHAT is the effect of radio broadcasting upon weather and its responsibility for drought conditions? None, positively none whatever, in the opinion of Charles D. Reed, Director of the State Weather and Crop Bureau of Iowa.

Someone conceived the notion that broadcasting is to blame for the recent drought and resulting dust storms in that section of the Western agricultural area. The notion spread and became popularized, so that the state weather bureau became the target for many letters asking the scientific details on the supposed phenomenon.

Nearly 20 years before radio was thought of, in 1886, occurred in Iowa the driest summer of 61 years with an average rainfall in June, July, and August of only 4.25 inches. Crop failure was almost complete in Iowa in 1894, when only 4.88 inches of rain fell; the corn yield was only 12 bushels to the acre.—*The United States News.*

Waterproof Non-Glossy Wallpaper

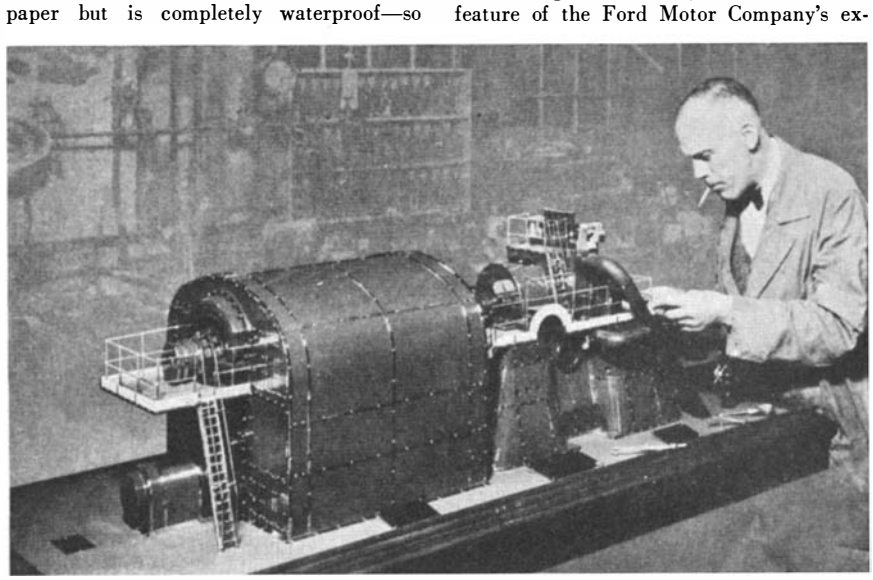
MANUFACTURERS of wallpaper have for many years worked on the idea of developing a wallpaper which would have the softness of ordinary wallpaper and yet would be sufficiently waterproof as to be washable. Some papers have been rendered waterproof by the addition of various kinds of varnish coatings but these are too glossy to be desirable. By the use of well-known chemicals and by a process which has long been available and needed but slight development in order to adapt it to the manufacture of waterproof wallpaper, the Imperial Paper and Color Corporation has now solved this problem satisfactorily. This company produces a paper which does not differ in appearance from the ordinary paper but is completely waterproof—so much so that test samples have been washed as many as 300 times without appreciable damage to the surface or colors.

In the manufacture of this new paper a sizing material such as casein, animal glue, or albumin is incorporated in the material with which the web of paper or similar material is coated. After the application of such coating material to the web, an agent such as formaldehyde or metallic salts or a mixture of such metallic salts, capable of converting the sizing material into a form substantially insoluble in water, is applied to the coating.

In practicing the process, the web of paper is first coated on one side with clay and a solubilized casein. If a colored or tinted coating is desired, a suitable pigment may be added to the coating material. The coating is then dried and the desired figures or designs are printed with a composition comprising the solubilized casein, pigments, clay, and the like. After the printing has been done, but before it is dried, the formaldehyde solution is sprayed on the surface and the coating and printing are dried.

Working Model of Turbine

A WORKING model of the largest industrial turbine-generator ever built, which has been presented to Henry Ford by the General Electric Company, builder of the original machine, will constitute a feature of the Ford Motor Company's ex-



Working model of the world's largest turbine

hibit at A Century of Progress this summer.

The model is 1/16th the linear size of the 110,000-kilowatt vertical compound turbine generator built at Schenectady in 1930 and now installed at the Ford Rouge plant, Detroit. It is complete in every detail, even to the turbine blades, and a cutaway section shows how it operates. The model is the work of H. E. Chesbro, whose scaled-down reproduction of an electric ship was on display at A Century of Progress last year.

Plastic Cream

THICK cream made from milk—this is the latest development of the dairy industry, "plastic cream." It is made by whizzing the very "daylights" out of surplus milk in a very high-speed centrifugal machine at a higher temperature than customary in the ordinary cream separator, according to M. J. Mack and C. R. Foskett in a recent issue of *Food Industries*. The high centrifugal force thus applied produces a cream testing as much as 80 percent fat.

The milk or cream is pasteurized at 145 degrees, Fahrenheit, with a 30-minute holding period before separation. The cream flows from the separator as a viscous fluid. In a few seconds it is cooled, commercially, to 50 degrees, Fahrenheit, over especially constructed drum coolers. The product, when cooled to this low temperature, becomes plastic and is carried away by a sterilized belt to be packaged. At the present time plain plastic cream generally is packed in 60-pound butter tubs lined with sterilized parchment-paper liners. The cream is removed from the tub as easily as butter and without loss.

Since the introduction of plastic cream, it has been sold chiefly to dairy and ice-cream companies in New York, Philadelphia, Chicago, and throughout New England. It has been used commercially in butter, dairy spreads and ice cream, and has been separated from surplus milk on the farm for home or local consumption. When plastic cream is made into butter, the cost of manufacture is reduced because the churning process is unnecessary. After the fat is solidified by cooling, the plastic cream resembles an unfinished butter. Only working is necessary to convert the solidified cream into butter.

Although plastic cream has been available for only a few months, it is already used regularly by many ice-cream plants to good advantage as a source of butter fat. Plastic cream also makes a very desirable spread, either alone or combined with honey or some similar food product, but at present has a limited use for this purpose. Bakers, confectioners, and other food manufacturers who now use butter might well experiment with plastic cream.—*A. E. B.*

C. Francis Jenkins

ON June 6, 1934, there passed away an inventor whose name is indelibly inscribed in the history of radio and motion pictures. At the age of 66, C. Francis Jenkins died at his home in Washington, D. C. Dr. Jenkins had been in ill health for more than

C. Francis Jenkins

three years but had nevertheless carried on experimental work in his laboratories throughout his illness. The last work which he was attempting to complete had to do with a home movie and sound-recording camera.

Among the honors which had been showered upon Dr. Jenkins in the last few years of his life were the John Scott and Elliott Cresson gold medals of the Franklin Institute.

Dr. Jenkins was one of the pioneers in motion picture work, having projected such a picture before an audience of friends in 1892. He was widely known for his development work in television and facsimile, many records of his progress being published in past issues of SCIENTIFIC AMERICAN. More than 400 inventions are credited to the ingenuity of Dr. Jenkins. His work also touched on the field of aviation in which he developed a sonic altimeter and a control board instrument used in connection with the aviation radio beacon.

Readers who desire to refresh their memories regarding the work of Dr. Jenkins will find interesting material in the following issues of SCIENTIFIC AMERICAN: June 1927, August 1927, August 1928, June 1929, December 1929, and July 1931.

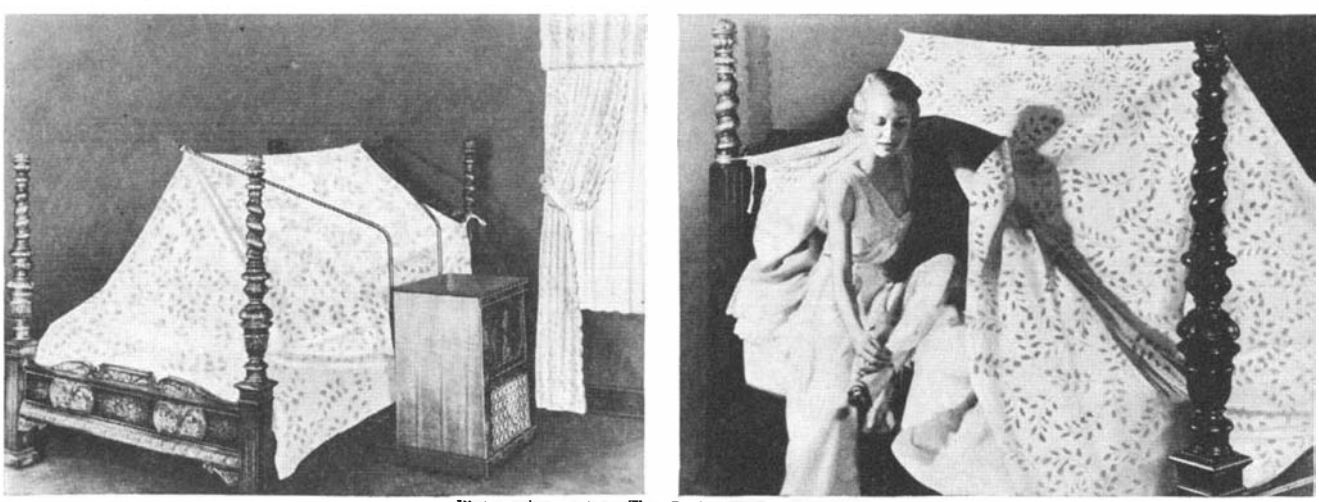
Chemistry Glorifies The Pumpkin

JACK-o'-Lantern is becoming a more useful citizen, according to Dr. Erich Tschermak, of Austria, who has developed the culture of a creeping, rindless pumpkin, containing a nutritious, palatable oil. Whereas we usually regard the lowly pumpkin as raw material for Thanksgiving pies, the chemist is attempting to use it as the basis of a number of useful products, each part of the gourd serving a distinct purpose. The oil from the new type pumpkin may possibly be used in part as a substitute for olive oil in canning sardines and in conserves. The seeds may be utilized in place of almonds. The oil cake serves as a feedstuff for cattle.—*A. E. B.*

New Electric Pyrographic Pen

ONE of the most interesting attractions at fairs used to be the booth of the man who burned designs or your name on leather goods and novelties to be used as souvenirs. The sort of work he did may now be done at home by the use of a new electrical pyrographic pen, neatly made and well-balanced to allow free movement of the hand in burning designs or drawings on such articles as cigarette boxes, waste baskets, and the like.

This new device, called the Pyrolectric Pen, has a highly polished point containing a heating element, a flexible wire for making connection with any lamp socket or



Photographs courtesy The Crosley Radio Corporation

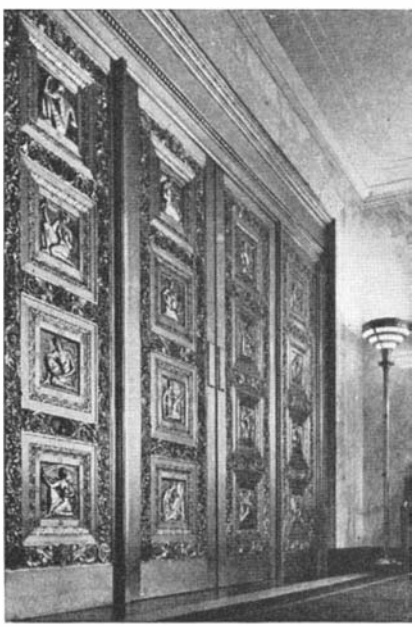
A new angle on air conditioning, which gives promise of great possibilities for future development, is illustrated above. Here the advantages of air conditioning are brought to a localized spot—to the bed, instead of cooling a whole bedroom, which is expensive. The Coolrest cools and dehumidifies a sleeping compartment to be used with any bed

outlet in the house circuit, and a self-contained screw socket for inserting a light bulb in series with the heating element in order to protect the latter.

More Aluminum Uses

THE accompanying photographs illustrate three interesting new uses of aluminum.

An effective example of modern metal work is seen in the ornamental aluminum



doors shown here which were cast at the Fairfield, Connecticut, works of Aluminum Company of America. Each of the four sections contains four figured panels surrounded by intricately interlaced ornaments. After casting, the ornamentation was hand chased, following which the doors were polished to a fine satin finish and high-lights were buffed to a brilliant luster.

Aluminum closures are finding many uses in the recently revived wine and liquor industry. The bottle in the foreground in one of our photographs is capped with a "pilfer-proof" aluminum seal. The bottle at the left illustrates how the upper portion of this closure breaks away from the lower locking ring when the cap is removed, forming an effective safeguard against tampering. The tall wine bottle at the right is capped with an "Aluvin" capsule made of aluminum foil. The capsule, which is available in a variety of colors, is crimped tightly over the top of the bottle by machine. The use of a special adhesive makes possible a firm bond between the foil and bottle, making it practically impossible to remove the capsule without leaving evidence.

The nails are aluminum markers used on poles. The fact that aluminum does not rust and the characters on the markers retain their legibility, makes the metal particularly well suited for this use.

Cheap Aniline by Catalysis

WHILE the modern organic chemist seems to be able to start with almost any compound and juggle it around through a series of chemical changes until he finishes up with what he wants, there is always the question of whether or not the process will pay commercially. Thus, the announcement that aniline can be made from phenol is not news, for chemists have done it in laboratories for years. But the announcement from Germany that a process of converting phenol to aniline by a simple catalytic synthesis in one step is significant because it indicates that a commercially feasible and economical process of producing cheap aniline is "just around the corner."

Professor Franz Fischer is the chemist who has worked out the process, reported in a recent issue of *Chemical and Metallurgical Engineering*. He has condensed phenol and ammonia directly to aniline, at a pressure of 10 atmospheres, with a yield of 10 percent in the presence of catalysts which split off the water, particularly aluminum oxide. The reaction takes place in the vapor phase at 450 to 480 degrees, Centigrade.

Of the catalysts examined aluminum oxide has the best effect. The catalyst lost its action comparatively rapidly, but could

Three new uses for aluminum. *Upper left:* Ornamental doors of intricately ornamented metal. *Above:* Bottle closures. *Right:* Non-rusting markers used on telephone poles

be regenerated by oxidation in air of 450 to 500 degrees, Centigrade. By the use of low pressures, from 5 to 10 atmospheres, the resulting yield was considerably increased. A pressure of about 10 atmospheres (the vapor pressure of ammonia at room temperature) is the most favorable working pressure.—*A. E. B.*

Mother's Milk Still Best

MOTHER'S milk is the means to further reduction of the death rate among American babies, Drs. Clifford Grulee, Hayworth N. Sanford, and Paul H. Herron of Chicago recently told members of the American Medical Association. They based this opinion on a study of 20,000 Chicago babies.

The mortality for these infants was ten times higher among those artificially fed than among those fed by their mothers in the natural manner, the baby specialists found.

The success of artificial feeding of infants during the past few years has made it seem that the prepared baby foods can safely replace mother's milk, but there is no scientific proof of this, Dr. Grulee and associates declared.

Natural feeding by the mother gave greater resistance to infection than artificial feeding, the records of the 20,000 babies showed. Even partial breast feeding gave considerable protection against disease which the completely artificially fed babies did not enjoy.—*Science Service.*

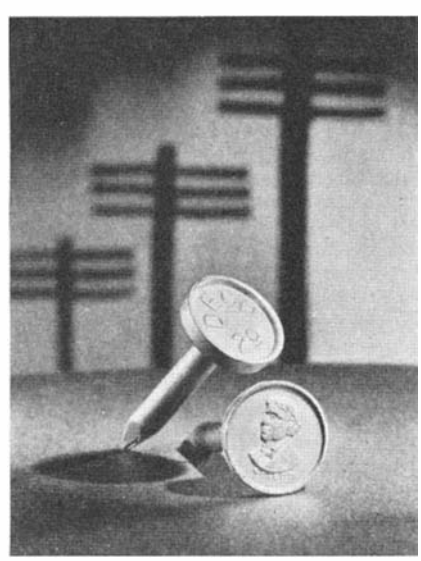
It is not as widely known as it should be that, despite the well recognized value of artificial feeding for babies, mother's milk is incomparably superior. Statistics prove this.—EDITOR.

Rain Will Interfere with Ultra-Short-Wave Radio

FOG and rain will prevent man from developing a reliable wartime or commercial radio communication system with ultra-short waves less than ten centimeters long, Prof. Gennady W. Potapenko, California Institute of Technology physicist, predicts.

Short waves of this length or less can be transmitted in clear weather, he said. However, their absorption during inclement weather makes them unreliable for commercial purposes. Based on data compiled on charts, Prof. Potapenko made the forecast that rain and fog would absorb all waves from ten centimeters to the infra-red waves of about 100 microns in length.

"Therefore," he said, "in order to avoid



atmosphere absorption by fog and rain, one must use waves either longer than ten centimeters, or shorter than 100 microns." The advantage of ultra-short-wave communications, Prof. Potapenko stated, lies in the fact that messages can be concentrated in a beam.—*Science Service.*

Psychic Medium Fails

IF there is a mysterious "force" which manifests itself when a medium goes into a trance, it has eluded the keen eye of the infra-red camera.

To test the psychic powers of Rudi Schneider, well-known medium, two British investigators have made a series of experiments using an infra-red beam and also a camera with a movie film sensitive to infra-red. The camera thus equipped is capable

of taking pictures in feeble red light or even in the absence of visible light, thus working in conditions of light that mediums usually prefer for their sittings.

Preliminary announcement of their findings is made to the British scientific journal *Nature* by the investigators, Theodore Besterman and Oliver Gatty of the Society for Psychical Research, London.

The infra-red film caught nothing unusual except the moving of a curtain.

When a beam of infra-red light was used in connection with apparatus in the tests, there were frequent announcements by the trance personality that the "force" had entered the ray. Notwithstanding this, the two investigators could obtain no evidence of absorption of the beam of infra-red light.

While in a trance, the medium on several occasions announced that the "force" had gone into one of a pair of cotton-wool lagged boxes and remained there for some 15 minutes, but no change in temperature of the box could be detected.

During half an hour, the "force" could produce no significant difference in rate of growth of two strains of bacilli or of dormant yeast.

The investigators spoke highly of Mr. Schneider's willingness to submit to tests and control.—*Science Service.*

Animal Fat For Feeding Calves

A NEW outlet for animal fat has been developed, which will afford farmers a better way to utilize skim milk on the farm. The idea is to feed the fat to calves as a milk supplement in the form of a homogenized product called "Vita-Fat." Thus the farmer may skim the butter fat from his milk, replace it by other animal fats of cheaper cost and value, and feed it to produce better calves than before. The "Vita-Fat" contains 55 percent of fat and adequate quantities of vitamins A and B. —*A. E. B.*

Transoceanic Plane Refueling Stations

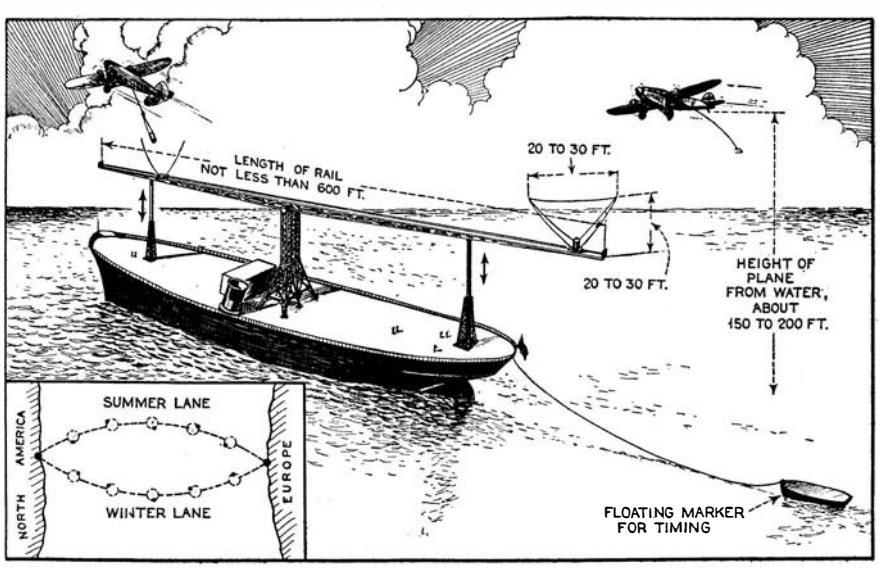
IF we grant that transoceanic airplane service for freight or passengers is desirable—and apparently it is, if the interest in the subject by large transport operators may be taken as a criterion—then the question becomes one of "ground" equipment rather than of planes. Present-day planes and motors have been developed to a point where transatlantic flights in a single hop are entirely possible, but impractical because little or no payload can be carried. The huge amount of fuel and oil required for the long flight prohibits carrying freight or passengers.

The problem, apparently, requires refueling at sea so that planes can carry a minimum of gasoline and a maximum of payload. One highly interesting proposal, which involves refueling in flight at sea without the use of refueling planes, calls for a series of specially equipped liners placed at intervals along a transoceanic air lane.

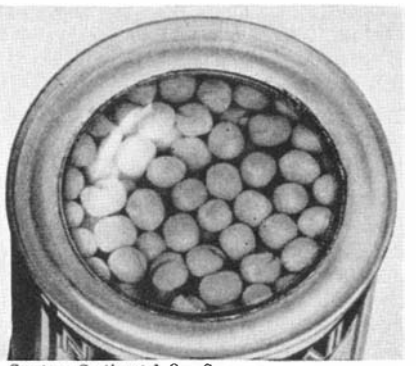
These liners, which will be comparatively low in cost and maintenance because of their specialized work, will be provided with a long catapult running lengthwise of the ship, and pivoted at the center. Cars running on the track of this catapult, as shown in the drawing herewith, will carry tanks of fuel and oil which will be picked up by the planes in flight by means of a trailing cable and hook. Acceleration of the car just prior to picking up the load will reduce to a minimum the strain on the plane. Experiments in the past have proved that picking up weights in this manner is perfectly feasible.

In practice, the system should work as follows: The pivoted beam is provided at or near each end with a hydraulic or other means for keeping the track close to the horizontal regardless of pitching. This will be accomplished by means of automatic mercury or pendulum switches. Heaving of the ship is comparatively slow and it is assumed that it can be allowed for by the pilot.

When a plane approaches to refuel, the liner is headed into the wind. The pilot of the plane maneuvers into position at the lowest practicable flying speed and heads straight along the catapult track. As he passes over a marker towed by the ship, the catapult car is started so that by the time the hook engages with the loop attached to the fuel tank, the car will be going at maximum speed. The plane flies on, the fuel tank being drawn up by a winch, and an empty tank dropped, to be picked up at leisure by the liner.



Drawing of the transoceanic airplane refueling station described above. These stations may be located in positions most advantageous according to weather



Courtesy Continental Can Company

"Window-top" cans permit the purchaser to see the exact condition of contents before buying. The "window" is of heat-resisting Pyrex sealed in before the can is packed

This short description gives a bare outline of an interesting project; mechanical details are many and will require much work, but do not appear to be insurmountable. The system will be perfectly flexible and with an adequate radio communication system should be able to forestall much of the weather delays that must always be considered. The positions of the ships may be changed for winter and summer routes, just as in the case of steamer lines, so that seasonal storm areas may be avoided.

The big feature of this system, from the pilot's point of view, is that it eliminates the necessity of frequent landing and take-off—always the danger points with heavily loaded planes.

Air Trains

THE Russians are intensely interested in gliders and have quite recently made a number of splendid records. One glider pilot at a meet in the Crimea recently achieved the record altitude of 10,827 feet. Another flew 38 miles in a straight line and returned to his starting point. These feats sound a little like perpetual motion, but are evidently feasible by men who know how to take advantage of rising currents, cloud and thermal effects.

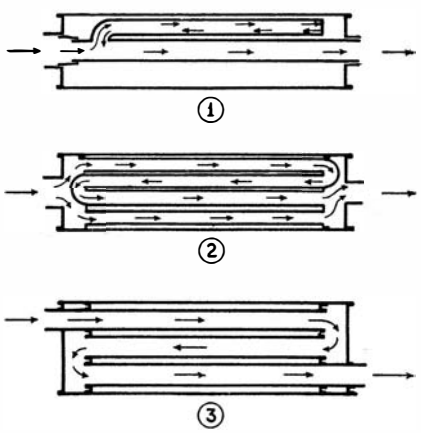
Of course, no one believes, in spite of these remarkable records, that the glider will ever become an instrument of transportation, but the Russians are making experiments which may possibly lead to practical results. Thus for the first time in the history of the art an airplane picked up a glider weighing 625 pounds, at Samara. The glider was picked up by an automatic coupling device by a plane flying at 75 miles per hour and sailed into the air after a run of 60 yards on the ground. Our readers will remember that Captain Frank M. Hawks made a transcontinental flight towing a glider, but the Soviet pilots have gone one step further. One Fedosief actually pulled an "air train" of three gliders for 25 miles, after which the glider pilots disconnected their own crafts and glided safely to the ground.

If picking up and releasing gliders becomes a matter of current practice, then we can see a number of applications in airmail work, possibly in refueling and so on. Of course, the problem of stability and

control in such an air train becomes a matter for intensive study and experiment. Also, no air train is likely to be as efficient as a single airplane, because of interference, drag of cables, and so forth.—*A. K.*

Cancelling Sound Waves

At a recent meeting of the Society of Automotive Engineers, E. G. Gunn discussed the interesting process of cancelling sound waves due to engine exhaust—a process which is equally adaptable to the aircraft and the automobile engine. Physicists have long been familiar with this process of sound cancellation. It is the engineers, however, who are developing mufflers dependent on sound wave interference or cancellation. These mufflers are of three general types.



Three methods of cancelling sound waves in mufflers, described here

Figure 1 shows a Quincke unit. It embodies a closed-in tube of a length equal to one fourth the wavelength to be cancelled. The wave enters the tube, is reflected from the far end, and returns 180 degrees out of phase, thus completely or partially cancelling the incoming sound wave.

A second method incorporates the so-called Herschell tubes. (Figure 2.) Here a divided path is provided for the sound waves. One path is longer than the short path by one half of the wavelength to be cancelled. The waves, on re-uniting at the exit end of the silencer, are one half wavelength out of phase and cancel.

Still another dodge is shown in Figure 3. Here the gas travels through perforated pipes alternately from the one end of the muffler to the other. These are usually made with three pipes, the gas first flowing from the front to the rear through one pipe, then through another pipe to the front, and then to the rear and into the tail pipe. Since at any transverse section of the muffler a wave in one pipe is out of phase with the wave in another pipe, it can short circuit across the surrounding chamber and the waves cancel.

People often inquire why silencers are not more frequently used on the airplane. This is because airplane mufflers have been of the baffle type in which the gas went through holes into an expansion chamber, thence through holes into another chamber. Such restrictions offer more resistance to the flow of exhaust gas than to the passage of sound. Consequently to get a fair degree of silencing, considerable back pressure is developed. The aircraft operator cannot and will not tolerate this back pressure.

With the new type of "sound-wave cancellation" mufflers, which give little or no back pressure, the prospects of silencing the exhaust of an airplane become much more promising.—*A. K.*

Langley Field

THE writer recently had the privilege of attending the annual conference of the National Advisory Committee for Aeronautics at Langley Field, Virginia. The research work of the Committee is both extensive and comprehensive, so that only a very brief review of the Conference is possible in these columns.

It has often been stated that the problem of getting sufficient air to flow past the cylinders would put a limit to the size and power of the air-cooled aircraft engine. Perhaps the introduction of a blower forcing the air into an enclosure completely surrounding the cylinder will put this limit indefinitely far off. At any rate, such experiments have been made, and the cylinders have been kept perfectly cool with only 4 percent of the engine power being used up by the blower.

A new safety fuel, developed by the Standard Oil of New Jersey, attracted considerable attention. This is heavier than gasoline, and has a higher flash point so that fire hazard is diminished. At the same time it has wonderful anti-knock properties and can be employed at a compression ratio of 9½ to 1, instead of the usual 6 to 1 for gasoline, without detonation. Hence the "Safety Fuel" gives at least equal power and economy, and surpasses gasoline in safety. Such a development may have considerable importance in aviation operations.

On the aerodynamic side of things, we were particularly impressed with the small six-inch high-speed wind tunnel, in which small airfoils can be tested at speeds of 400 to 600 miles per hour. At very high speeds, approaching the speed of sound, the ordinary airfoil loses both lift and efficiency. The usual streamline flow ceases and compression waves are set up, just as in the case of a rapidly moving bullet. It has now been definitely shown that in propeller blades (which turn exceedingly fast) this compressibility effect can be diminished by using a sharp entering edge for the blade instead of the conventional rounded edge of the airplane wing. In stratosphere flying at very high speeds (which may come sooner than we now think) the same re-design of the airfoil may be necessary to avoid this detrimental compressibility effect. Hence the new high-speed research has more than academic importance.

Visitors at the Conference were given a ride on the carriage of the huge 2200-foot long towing basin, the largest in the world. Under this carriage the flying boat hull or the seaplane float is attached, and the resistance of the float is automatically measured; at the same time the spray can be observed. Thus many factors entering into the problem of hull and float design are being systematically investigated. The towing carriage is capable of a top speed of 56 miles per hour, but the visitors were only treated to 25 miles an hour. Even with this long channel, it appears that at the high speed the approach of the end wall is so rapid as to be terrifying to the uninitiated!

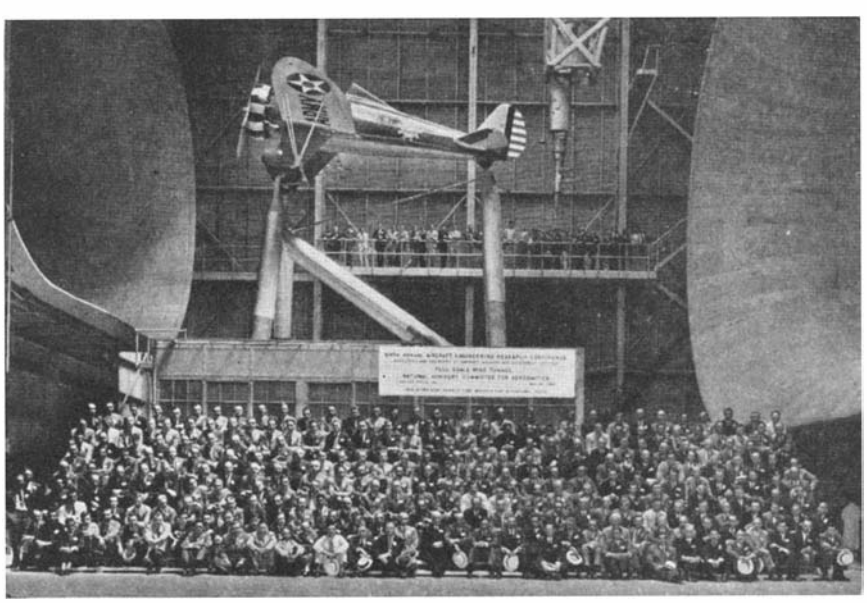
Lift increase devices, and rotary wing airfoils were among other interesting matters exhibited to and discussed by the visiting constructors and engineers.—*A. K.*

Stick—Stuck

THE manufacturers were stuck because the glue did not stick. But they stuck a vacuum tube into the sticking process, and no longer are they stuck by not having the product stick.

All of which is merely introduction to a story of a vacuum-tube application. A company in San Francisco manufactures box ends from scrap lumber. In the process, after the lumber has been grooved, certain pieces are glued and then pressed together. At one time it was practically impossible to detect the absence of glue in the grooves and the company found that box ends made by pressing these grooved pieces together pulled apart through lack of glue. This was both expensive and annoying.

In solving the problem, the company installed a vacuum-tube relay and arranged



Engineers at the Langley Field conference, in front of a huge wind tunnel

steel piano-wire contacts to scrape in the grooves in such a manner that the circuit is completed through the film of glue. This circuit is connected to the grid of an amplifier tube mounted on a panel. This amplifier tube is so connected as to control a sensitive relay. As long as the circuit is closed through the glue, no action occurs, but as soon as the circuit is opened by the absence of glue the relay operates to ring a bell and light a lamp.

A Quick Job with Dynamite

A RATHER unusual use of dynamite as an aid in taking out standing trees is reported from the McComb Subsistence Homestead at McComb, Mississippi, where work is being done under the auspices of the Subsistence Homestead Division of the Department of the Interior. At that place, in order to save time, numbers of rather large standing trees had to be removed. The problem was solved by employing a combination of tractor and dynamite. The smaller growth was pulled out by the tractor. When it came to the larger trees, a long cable was rigged from the tractor to a point as high as possible in the tree to be uprooted. A light charge of dynamite (depending, of course, on the size of the tree) was placed under the roots. When everything was ready, the signal was given, the cable tightened, and the dynamite detonated.

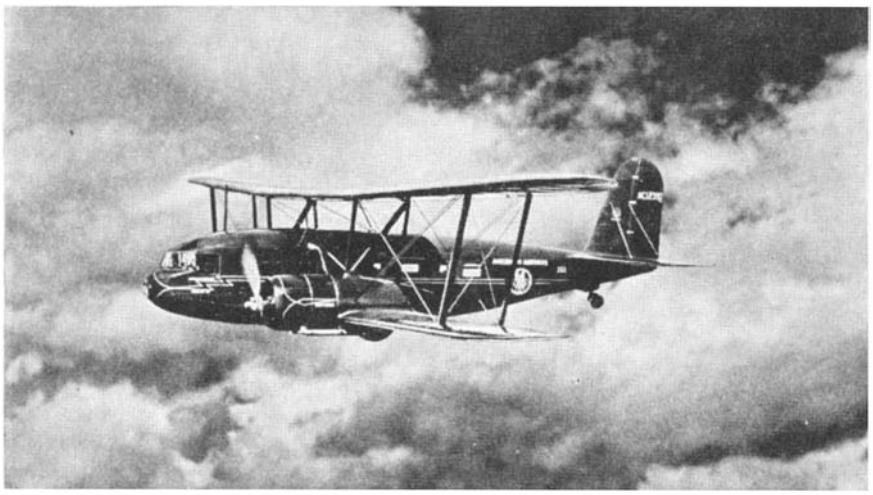
The report indicates that the operation is successful, economical, and time-saving.

Air Sleepers

IT is claimed by American Airways that they are putting into service the world's first sleeper plane in their new Curtiss Condor. This ship has a top speed of 190 miles an hour and a cruising speed of 160 miles an hour. It will carry 12 passengers, two pilots, and a steward. The first sleeper plane has now proved itself entirely satisfactory and five more ships equipped in this fashion will soon be in service on the Dallas, Fort Worth, Los Angeles route.

Photographs reproduced in these columns illustrate the Condor with landing gear retracted, the day accommodations, and the sleeper. The two seats in each compartment are quickly convertible, in flight or on the ground, into spacious lower and upper berths, an inch longer than the standard berths in a Pullman car. Each passenger during the day is provided with an unusually wide lounge-type chair, individual window, reading light, service call button, and so on. Ventilation and noise proofing go without saying. Luggage shelf, clothing net, coat hanger, ash tray, and so forth, are also provided.

This is a commendable advance in the comfort and adaptability of the modern transport. Only one word of warning should be said. In case of a rapid descent or ascent and a consequent change in pressure, the ears are apt to be slightly affected. This is noticeable even in a rapidly moving elevator in a skyscraper. The effect is not serious and passes off in a very few minutes because the human organism is remarkably adaptable. It does not appear certain, however, that the same power of accommodation is present when the occupant is asleep—or so at least a well-informed airplane operator tells us. Therefore, if sleepers are to be used extensively in the airplane, pilots should be instructed neither to make too rapid ascents to high altitude, nor to make too rapid descents when approaching an airport. Or, alternatively, sleeper passengers should be awakened when a rapid change in altitude and pressure is to be expected.—*A. K.*

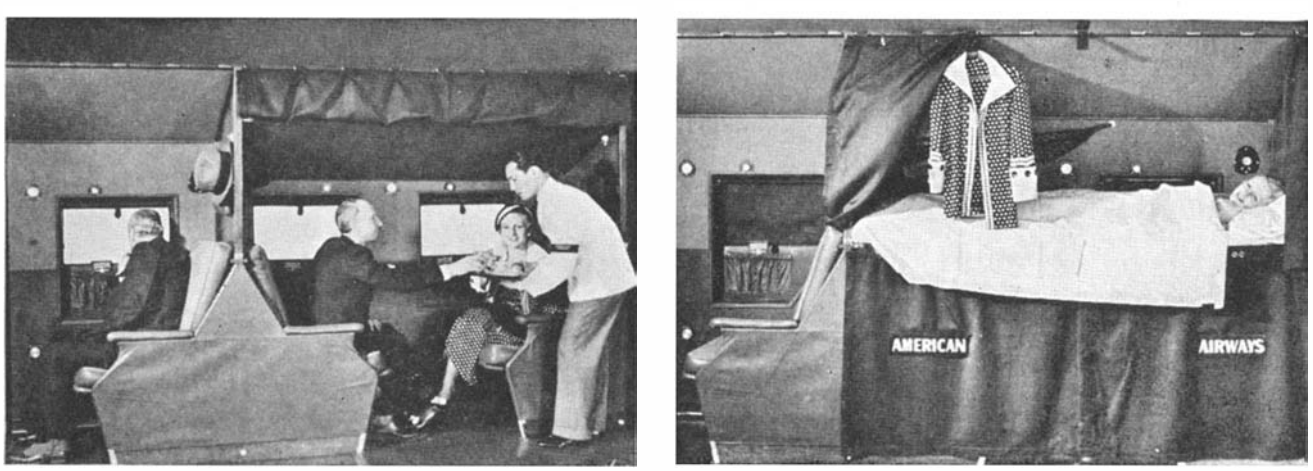


A Curtiss Condor plane with sleeping accommodations

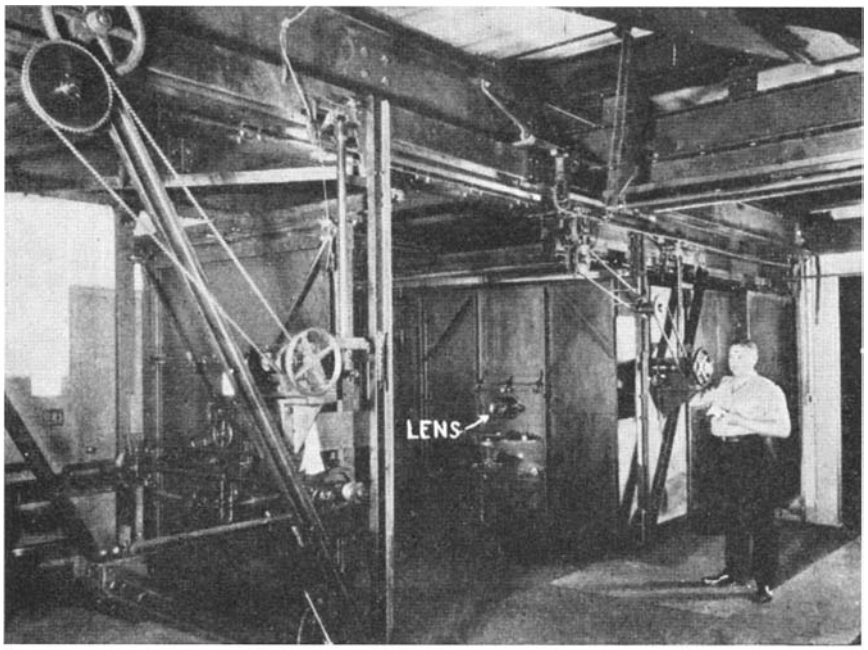
Wm. E. Boeing, awarded the Daniel Guggenheim air pioneering medal

William Edward Boeing

BORN in 1881, educated at Yale, and active at an early age in mining and lumber work, Mr. Boeing learned to fly in 1915. An accident to a seaplane in which he was flying led him to build seaplanes of his own, first in the Pacific Aero Products, and then in the Boeing Airplane Company which has achieved such success in both military and transport aircraft. This year he was awarded the Daniel Guggenheim Medal for successful pioneering in aviation. At the same time, under the new regulations of the Post Office Department, the United Aircraft and Transport has split up into three component parts: Boeing Airplane Company, in the west; United Aircraft in the east; and United Airlines as an independent operating unit. So Mr. Boeing is again left in independent charge of his magnificent plant on the west coast.—*A. K.*



Two views of the new air sleeper, showing day and night arrangements



Looking toward the lens of the giant camera of the Coast and Geodetic Survey

Emotions Cause Physical Disease

AN emotional disturbance may be the cause of such physical diseases as stomach ulcers, goiter, and diabetes. Not merely the symptoms of such ailments, but actual changes in the tissues of various organs and glands may be produced by emotional factors alone.

These facts, showing the close relation between mind and body and personality, were brought out at a meeting of the American Psychiatric Association and were particularly emphasized by the association's presiding officer, Dr. George R. Kirby of New York.

Figures from various big diagnostic clinics show that for about half the patients who come in with complaints of physical disease no sign of such disease can be found by the most careful examination with X rays and all the other aids of modern medical science. Even in animals emotional shock or disturbances can produce physical diseases.

Psychiatrists hope that physicians in the future will not only examine a patient by taking his pulse and blood pressure and by X-ray pictures but will analyze or examine his personality and his emotional make-up as well in order to find the real cause of his ailment and how to treat it. —*Science Service.*

Giant Camera of Coast and Geodetic Survey

THOSE to whom "camera" means a box carried about in the hand may properly be astounded at the mammoth instrument, 31 feet in length and 14 tons in weight, capable of taking a picture 50 by 50 inches in size, now used in reproducing the nation's nautical charts and airway maps. Such a "camera" has just been put to work in the basement of the Commerce Building, Washington, D. C., after two years devoted to its design, construction, adjustment, and calibration, at a total cost of 15,240 dollars.

Captain R. S. Patton, Director of the United States Coast and Geodetic Survey, states that this gigantic instrument will make it possible to photograph a complete chart on one negative—a decided reduction in the cost of chart production.

According to Captain Patton, it represents an increase in the speed and efficiency of chart reproduction, so essential to the safety of navigation. It is capable of reproducing chart drawings with a probable error of only one or two thousandths of an inch —an error so small that the eye can scarcely detect it without a microscope.

The frame of the camera resembles a railroad bridge structure, with its 27-inch "I" beams. It is suspended on three groups of chains, from girders resting directly on the building foundations. These chains permit the camera to swing free from any horizontal building vibrations, while provision has been made for cork pads to damp out vertical vibrations. The three-point support also makes the camera independent of any settling of the foundations.

The plate-holding end is partitioned off to form a darkroom, permitting the massive negatives to be sensitized, exposed, and developed without bothering with plate-holders.

Although each copyboard weighs almost a ton, it can be moved along its track by the pressure of a finger-tip and then set into position to within a thousandth of an inch by a scale fixed to the overhead track, read by an optical vernier in a periscope.

Synthetic Perfumes in United States

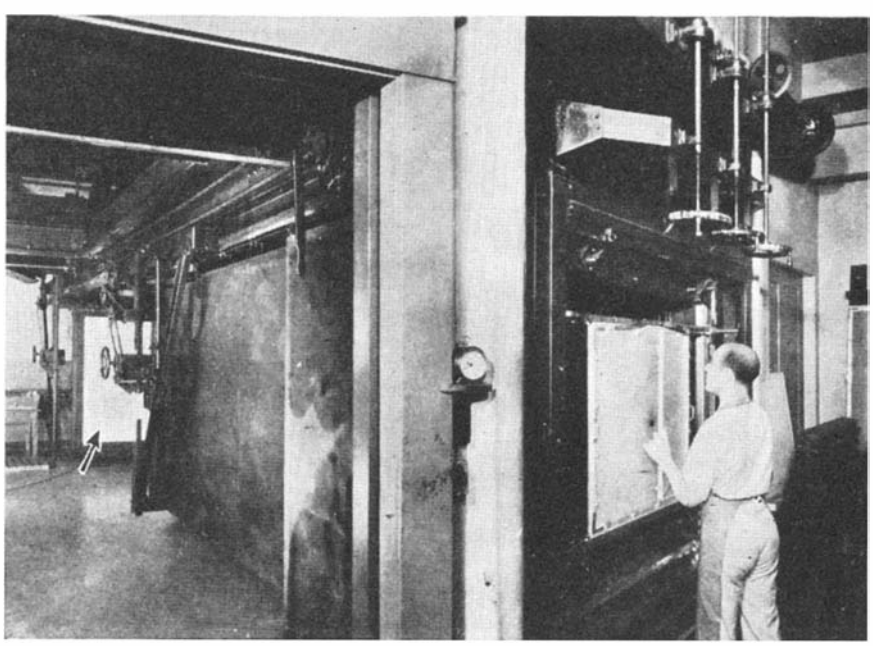
AMERICAN manufacturers continue to make progress in the production of artificial flavors and perfumes, a large proportion of which is composed of synthetic aromatic chemicals produced from coal tar. At the rate progress is being made it may not be long before the United States will be independent of foreign sources for these important commodities, according to the Chemical Division, Bureau of Foreign and Domestic Commerce.

The downward trend in imports of flavors and perfume materials of coal-tar origin, apparent in 1933, is continuing in 1934. During the calendar year 1932 a total of 67,469 pounds was imported; imports declined to 46,000 pounds for 1933. Domestic production of artificial flavor and perfume materials in 1932 totaled 2,300,000 pounds valued at more than 2,625,000 dollars, indicating that less than 3 percent of our needs were obtained abroad.—*A. E. B.*

Pennsylvania Pearls

PERSONS who never have thought of pearls as a Pennsylvania product would have found a pleasant surprise awaiting them in June in the Free Natural History Museum of the Academy of Natural Sciences, in Philadelphia, where a number of such pearls were placed on special exhibition. This collection, the only one of its kind, was made by Frank M. Ebert of Tamaqua, Pennsylvania.

Over a period of 40 years Mr. Ebert carefully fished the small streams near Tamaqua forming the headwaters of the Schuylkill River for the pearl-bearing fresh-water mus-



Arrow points to the copyboard of the giant camera

sel, the scientific name of which is *Margaritana margaritifera*, and this collection represents the fruits of his long search. It contains about 100 specimens, among which are some of choice size, shape, and color, and many seed pearls. Some of the mussel shells are also shown, including one to which a pearl is attached as originally found.

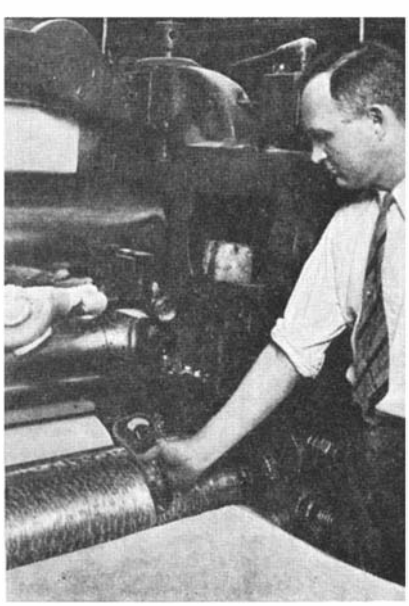
More than a century ago the Moravian settlers in Pennsylvania gathered a few pearls from the Lehigh River near Bethlehem. The year 1857 was the "pearl fever" year. A Paterson, New Jersey, carpenter found a pearl weighing 93 grains in a small tributary of the Passaic River. It was purchased by the Empress Eugenie, and today is known as the "Queen Pearl," though it since has passed into possession of the bejeweled Gaekwar of Baroda. Its value is more than 10,000 dollars.

Moisture and Heat Indicators

TWO highly practical and simple instruments, one for determining moisture in stacks of paper in printing plants and the other for determining the amount of heat accumulating in machine rolls or rolls of materials being produced are shown in use in two accompanying photographs.

The amount of moisture present in paper and the relative humidity conditions of the press-room atmosphere, as well as the relation of one to the other, are important factors in lithography and color printing. The problem of obtaining satisfactory moisture conditions and holding them reasonably uniform has been doubly difficult through lack of a simple, practical means of checking these elusive factors. Thus the Printer's Moisture Indicator has been developed.

This is a small portable instrument designed to measure the moisture content of piled or stacked sheets of paper—also to indicate the moisture in pressroom air. The instrument consists of a light case with a pistol grip, to which is attached a thin hollow blade 1 inch wide by 18 inches long, the extreme end of which is perforated on both sides. Within the perforated section of the blade is located a measuring element, the length of which varies with changes in moisture, and the movement of which causes the indicator pointer to move across the scale. The scale is calibrated in percent relative humidity with a range of 20 to 80 percent.



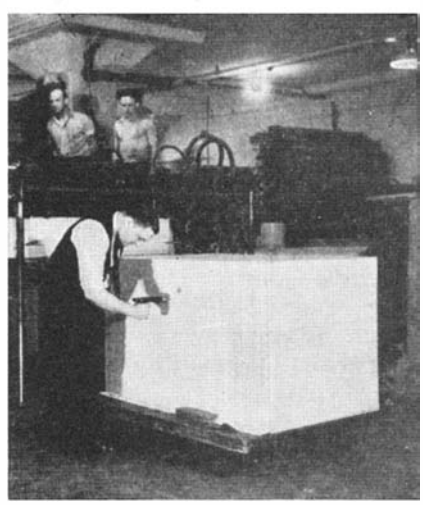
A portable temperature indicator that will work on curved surfaces

Modern industry has long needed an accurate and rapid means for determining the temperature of flat and curved surfaces. These temperature readings must be obtained under working conditions whether the surfaces are stationary or in motion.

By successive improvements in the construction of the thermo-electric pyrometer, the Cambridge Instrument Company has perfected a series of simple, accurate instruments for quickly and easily measuring the temperature of stationary and moving surfaces, one of which is shown here.

The hand model surface pyrometer is a self-contained instrument for use upon readily accessible moving rolls. A sensitive, thin, flat-strip thermo-couple with the junction at its mid-point is stretched across the end of an inverted bow spring. The latter is fixed to the underside of a metal case enclosing a millivoltmeter and also providing a convenient handle.

In use, the pyrometer is pressed into contact with the heated surface, the thermo-couple strip conforms to the shape of the surface and within five seconds a steady reading of the temperature is obtained. The machine need not be stopped while the temperature is being taken, nor is there any danger of scratching the roll. The Indicator has an easily read scale three inches long, calibrated directly in degrees, Fahrenheit.



Using humidity meter to determine moisture content of paper stack

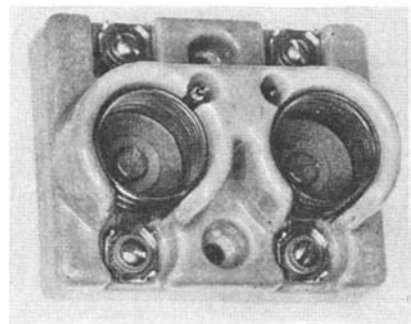
Aluminum Chloride Causes Accident

A SERIOUS accident recently occurred in the laboratory of the Department of Chemistry, St. John's University, Collegeville, Minnesota, upon opening a new package of resublimed aluminum chloride. The product was purchased less than six months ago, and was put up in a glass bottle sealed with a rubber stopper. The stopper had barely been moved when it was blown violently to the ceiling and about one-third of the contents (2500 grams) discharged into the eyes and face of the assistant who was opening the bottle, and into the whole room.

It is suspected that the rubber of the stopper was responsible for the decomposition of the aluminum chloride. It is also suggested that the pressure may have been due to absorption of water by the aluminum chloride previous to packing.—*A. E. B.*

Blown Fuse Indicator

WHEN a fuse blows out in a newly designed fuse block, a tiny neon lamp starts to glow immediately and indicates exactly which fuse on a switchboard has failed. This little neon lamp is an integral part of the fuse bulb and is automatic in operation. It indicates either loose or blown-out fuses and is distinctly visible, giving an indication which cannot be misinterpreted. The neon lamp will show that there is trouble, whether or not there is load on the circuit.



New type of fuse block with "built-in" indicator for blown-out fuses

Fuse blocks with these indicators are available in all standard types and are completely interchangeable with existing equipment.

Birth Control in Tibet

TWO much criticized customs of Tibet, polyandry, or the taking of more than one husband, and the maintenance of a priesthood numbering a third of the male population, are really forms of national birth control, designed to keep the population within the limits of the national food supply, states Dr. Walter N. Koelz, University of Michigan anthropologist, recently returned from a year and a half in that country.

Where the American farmer usually has little more to do than plow and plant a good soil, the Tibetan must start with a poor and stony land, so irregular that he must build terraces and retaining walls to save even that from erosion.

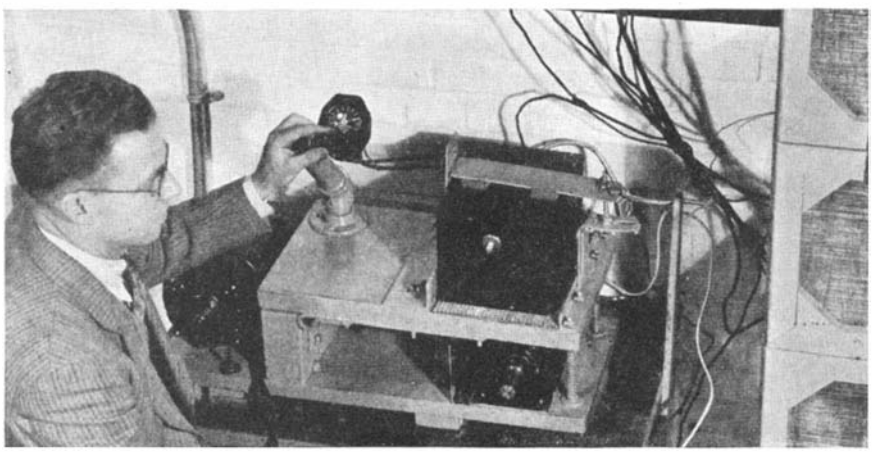
His fields terraced, the Tibetan then faces a very short growing season, liable to late snows and severe early frosts, plus a perpetual summer water shortage. These circumstances have always limited the crops of barley, wheat, buckwheat, and potatoes which may be raised, while lack of good pasturage confines cattle raising to the hardy yak, sheep, and goats which furnish milk, leather, and meat, while the yak also serves as the national draught animal.

"Under these conditions, a normally large or increasing population would be simply a national tragedy," Dr. Koelz states. "Whether polyandry and a large and mainly celibate priesthood were consciously developed as remedies is difficult to say. Nevertheless both customs act as birth controls, since the number of children born is limited practically to the married women, and in turn the number of the latter is limited

by the prestige of religion, which draws a large percentage of the men to the priesthood. As priests, they not only occupy themselves with religious duties, but also govern the country and serve as teachers, scholars, and physicians. There are also large numbers of unmarried women, *jomo* or nuns, in the convents, a fact not so well known.

Radio Sets Jiggled to Death

A DEVICE that "jiggles" automobile radio sets 3425 times a minute with such force that a single vibration would jar a driver's hand loose from the steering wheel, is the radio industry's latest application of automotive "proving ground" methods.



The vibrating table on which auto-radio sets are jiggled to death

With the problem of ignition interference solved, vibration, according to John B. Hawkins, designer of the device, remained the one unpredictable factor in automobile radio practice. And Mr. Hawkins, who is production engineer of the Emerson Radio and Phonograph Corp., was not satisfied to wait two or three years to find out the actual result of repeated vibrations on a car radio of 1934 design.

Drawing, therefore, on automotive experience, he set up the auto-radio "proving ground" pictured in these columns. Test sets are clamped firmly on the upper shelf. A motor then shakes the shelf at varying speeds up to a maximum of 3425 times per minute. The apparatus is so designed that the set is vibrated in varying directions. The force of each vibration is roughly equivalent to driving a car over an 8 inch rut at 40 miles per hour.

Test sets were left on the device until they actually ceased to function. This brought to light the minor structural weaknesses which otherwise could not have been discovered without years of actual driving, and enabled the engineers to eliminate unsuspected sources of interrupted reception, before a single 1934 model was released.

Cider At All Seasons

CARBONATED beverages are now frequently made from fruit juice concentrates and carbonated water, instead of from synthetic flavors. Carpenter and Smith, of the New York State Agriculture Experiment Station, have tried to concentrate apple juice so it can be handled just as the bottler wants to use it; that is, by placing in the bottle a small amount of concentrate or syrup and filling the remainder of the bottle with ordinary carbonated water.

Whether to freeze the water out of the apple juice as ice, or to evaporate it by heating was their problem. Heating would drive off the aroma as a vapor unless it is condensed. As described in *Industrial and Engineering Chemistry*, they ran the juice through a tubular heater to coagulate the colloidal matter and cooled it at the other end of the tube to condense the aromatic vapors. When the concentrate was filtered some of the protein, pectin, and tannin was removed. The flavor was improved. Further concentration was at the risk of getting apple jelly. Russet and Rome Beauty apple juice could be concentrated to 55 percent total solids without jelly formation but Northern Spy went to 71; probably because the acid content is greater. As little as two to three ounces of the concentrate will make an eight ounce bottle of apple juice drink.—*A. E. B.*

World's Largest Photo-Mural

THE artist's drawing reproduced in these columns shows the special enlarging room built in the Kaufmann and Fabry plant, where negatives were printed to an enlargement of 35 diameters on photographic paper 40 inches high for the huge photo-mural in the Ford Building at A Century of Progress. In the lamp house are 7000 watts of brilliant illumination. Most of the printing was done after midnight when steadier electrical current insured greater uniformity of prints. The entire mural required about 12,000 square feet of photographic paper. At the time of the Louisiana Purchase Exposition, in 1904, the largest photograph in existence was ten feet long and two feet high. The Ford mural is 20 feet high and 600 feet long.

Depressed Freezing

FILTERING a melted organic substance through a warm filter of glass wool seems to remove the crystal "germs" or nuclei from it. It is from these centers that crystals grow when the substance is cooled and freezes. Without these germs the filtered liquid cools far below its freezing point without solidifying. German investigators, reporting in *Festschrift für Unorganische Chemie*, are not sure whether the germs are true tiny crystals which survive even after melting seems complete or whether they are particles of foreign matter with which the liquid is "inoculated." At any rate filtering through warm glass wool removes them.

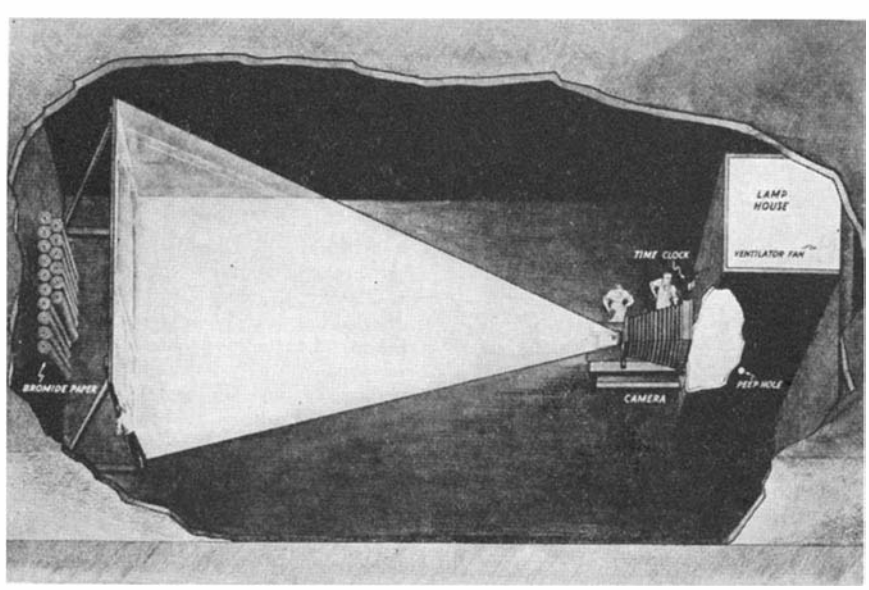
Connected with this discovery may be an explanation of the important refinement in the grain of cast iron when it is heated far above its melting point before pouring into the moulds.—*A. E. B.*

Out-dated School Hygiene Ideas

NOT eating between meals, bathing for health, and many other health and hygiene rules still taught in schools and popularly accepted are definitely out-dated or are now regarded as unimportant by advanced medical science, writes Dr. Warren E. Forsythe, director of the University of Michigan Health Service, in the current Bulletin of the Michigan School of Education. Here is a list of commonly taught ideas which Dr. Forsythe considers either unimportant or actually harmful, from a strict health point of view:

That the evils of poorly ventilated rooms lie in the lack of oxygen and harmful increase in carbon dioxide. There is never a lack of oxygen nor excess of carbon dioxide. The essential problem of ventila-

(*Please turn to page* 102)



Artist's drawing of the enlarging room where huge photo-mural was made

RECENTLY PATENTED INVENTIONS

Conducted by A. P. PECK

Golf Club

Patent Number 1958032, Louis Justin Cocke. It is well known that any golf club shaft, whether made of wood or metal, is likely to become bowed or bent because of readjustment of strains set up in the shaft when it is made, or by a sudden accident. Such bending of a shaft is highly objectionable because it prevents the user from getting the most efficient results from the club. In the majority of golf clubs the shafts have been attached to the heads in a relatively permanent manner so that they are not readily adjustable. Thus after the club becomes bent or bowed it is necessary to discard it or have an expert repair it.

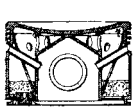
In the present invention means are provided for attaching a shaft to the head of a golf club so that the head can be removed with an ordinary screw driver. Also, the head can be rotated on the shaft and locked in any desired position. Thus it is possible, if the shaft becomes bent, to rotate the head so that the bow may be brought into such a position that it will lie in a vertical plane through the axis of the shaft and the body of the user, in which position the bent shaft will have the least effect on the use of the club. Furthermore if the head of the shaft becomes damaged it is possible to replace it, thus salvaging the undamaged part of the club.

Tourniquet

Patent Number 1953074, Harry Cohen. The main object of the newly invented tourniquet illustrated in the drawing is to provide a device of this nature which is simple in construction, is easily applied to the limb of the patient, and extremely effective. Because of the construction used in this device, it is possible to regulate the pressure exerted on the limb by the gripping members. The parts of the tourniquet which are in contact with the flesh of the patient are so made that there is no tendency to cut or pinch the flesh. The ratchet mechanism which is incorporated in the handle is so arranged as to lock the gripping members in any desired position.

Piston

Patent Number 1953109, Sam D. Heron. In order to cool the pistons of a gasoline engine rapidly, the present invention provides for a cooling medium sealed in a chamber formed as part of the piston. This cooling medium also provides for the transfer of heat from the piston head to the skirt. The inventor states that the cooling medium employed is in liquid form at normal operating temperatures, metallic sodium, potassium, lithium, or other salts being used for the purpose.

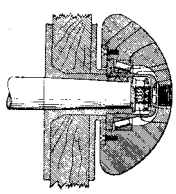


Insulating Material

Patent Number 1957822, Paul S. Denning. The present invention relates to insulation of buildings and so on, and more particularly to that type of insulation wherein the material is prepared in blocks or units. Means are provided for employing insulating material in loose form yet so arranged that it can be used in assembled units. In the conventional use of insulating materials for sound and heat proofing, it has been the practice to place the loose material in position at the building site. Such an arrangement is objectionable because when used in the side walls of buildings, for example, the material will settle due to its own weight and therefore leave considerable vacant space near the top of the wall. By employing this new system, the insulating material is placed in unit containers having cells for containing it, thereby reducing to a minimum the settling of the material when placed in upright walls. These units can be piled up to form continuous surfaces of large areas without affecting in any way the insulating material in each of the individual cells. One type of unit for general construction work, showing the individual cells containing the insulating material, is illustrated in the accompanying drawing.

Safety Hub Cap

Patent Number 1955735, Thomas A. Cheatham. The conventional type of hub cap used on automobiles is the cause of frequent trouble. Coming close to obstructions, it often happens that the hub cap engages with some projecting part of the obstruction and the vehicle cannot be moved until the hub cap is released. Also in traffic hub caps are often hooked into by bumpers of other cars, frequently with disastrous results. The object of the present invention is to provide a hub cap which will eliminate such possibilities. This is arrived at by producing a convex cap which is so mounted on an inner cap that it can freely rotate thereon. As shown in the drawing, the inner cap is fastened rigidly to the wheel while the outer cap with its smooth surface is mounted on roller bearings. Since this outer cap can rotate, it can often be disengaged from an obstruction or from the bumper of another car much more easily than the conventional type of hub cap.

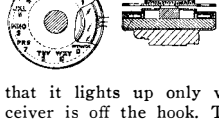


Portable Shower

Patent Number 1957956, Charles Hardy and Louis Bady. Portable showers consisting simply of a small spray head arranged with a flexible tube have been known for years but have proved disadvantageous because the hands of the bather are occupied in holding the shower and also because the spray may be, and frequently is, directed so that it falls outside of the bath tub. The present form of shower has been devised to overcome these and other obvious difficulties and consists of a ring which is supported by the shoulders of the user, thus permitting a shower of water to fall down vertically over the body. Any tendency of the shower ring to tilt away from the horizontal is overcome in the present invention by providing relatively rigid supports at the ends of the ring, which supports can be rested upon the shoulders of the user and also extend far enough below the shoulders to provide sufficient bearing surface to insure against shifting. These supports are made of flexible metal strips covered with soft rubber.

Illuminated Phone Dial

Patent Number 1955972, Melvin Edward Muse. In order to provide for easy operation of telephones of the dial type, the present invention provides a special type of lamp to illuminate the dial under all conditions. This lamp may be so connected with the telephone circuit that it is constantly illuminated, or it may be so connected that it lights up only when the telephone receiver is off the hook. The lamp itself is of a special glow-discharge type designed to operate on a voltage as low as 24 volts, yet capable of withstanding the large increases in line voltage which take place when the dial is being used. In the patent specification dealing with this invention, two methods of mounting the lamp are proposed, one of which is illustrated in the drawing herewith. The lamp itself is, in general, circular in shape but of flat cross section so that it can be mounted beneath the figures on the lower dial, in which case these figures will be cut out so that the light shines through them.

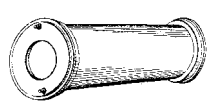


Paste Tube

Patent Number 1956558, Bert C. Berry. This invention is concerned with producing a collapsible tube for paste of various kinds, from which the paste can be removed with the least possible difficulty. The invention provides a specially shaped head, as shown in the accompanying illustration, over which is placed a closely fitting cap held in place by a crimped portion which engages with a depression in the head of the tube. In both the cap and the head of the tube are located holes which can be aligned by turning the cap and thus permit the material within the tube to be squeezed out. Turning the cap so that the holes are not in line seals the tube and preserves the contents. Thus is provided a tube for various materials of a paste-like nature from which the cap cannot be lost and yet which has a closure sufficiently perfect for all ordinary purposes.

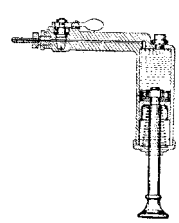
Hollow Concrete Objects

Patent Number 1955760, Clifford R. Nichols. A new method of manufacturing hollow bodies or plastic materials is described in the patent issued to this inventor. Guard rails and fence posts, lighting standards, telephone poles, porch columns, and so on, can readily be manufactured by this new process. A mold is provided and mounted in such a manner that it can be rotated. Into this mold is poured a molten material such as paraffin, the mold being rotated to distribute the molten material evenly over the interior. After the paraffin is hardened, a suitable quantity of the proper mixture of plastic materials is introduced into the mold, the latter being continuously rotated to provide even distribution and at the same time a homogeneous mass. The mold is then removed from the rollers and placed in a kiln for curing and to secure proper hydration. After this has taken place, sufficient heat is applied to melt down the paraffin and thus release the product from the mold.



Marking Implement

Patent Number 1957545, William E. Krueger and Hugh M. Hodge. A marking implement for decorating objects with colored lines and particularly for applying stripes of paint to such objects as automobile bodies is the subject of the present invention. The device is simple and compact in construction and is claimed to be highly efficient in operation. It is provided with a reservoir for paint or other material, the supply compartment being so arranged that the liquid is gradually and evenly delivered to the nozzle. The whole affair is so constructed that it can be manipulated in a manner similar to an ordinary pen or pencil and thus is easy to use. The nozzle is so designed that the flow of paint can be controlled so as to produce lines of any desired thickness and of uniform width. In the illustration reproduced herewith is shown one type of the implement in which the supply reservoir and the delivery nozzle are made in one unit. In another form the reservoir and nozzle are separated but connected together by means of a flexible tube so as to permit unhindered operation.

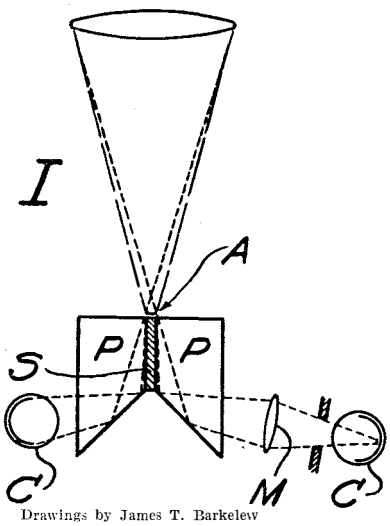


The above information has been taken from copies of patent specifications. No further details are available except as can be obtained from such specifications.

THE AMATEUR ASTRONOMER

Conducted by ALBERT G. INGALLS

HERE is the contribution of James T. Barkelew, an engineer and patent attorney of Los Angeles (Great Republic Life Building), which we promised last month as a continuation of an article on photo-electric guiding of telescopes, written by Wilbur Silvertooth. It indicates how far he has progressed. Other amateurs are invited to take up the same problem and work on it. If a few amateurs will pound it hard enough,



Drawings by James T. Barkelew

amateurdom may as a result have something to contribute to professional astronomy. Sic 'em, Tige.

Mr. Barkelew writes:

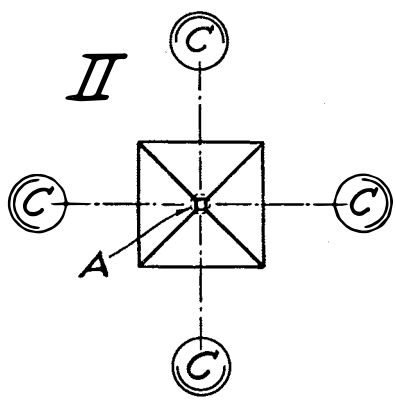
SOME time ago, George Mitchell and I did a little arm-chair work on automatic telescope guiding. George is a telescope nut. In his spare moments he is the guiding genius of the Mitchell Camera Corporation. In the course of evolving several different physical schemes for automatic guiding of telescopes, some shown in the sketches, we have found several difficulties that any successful automatic guide apparently must overcome.

The guiding star image is very small and of very low total illumination. In the form of I the square shim *S* between four totally reflecting prisms *P* (two shown) can be located out of focus, so that the enlarged image *A* will just occupy the shim end or somewhat overlap all of its edges. If the image moves, one or two of the light-sensitive cells receives more light, the opposite one or ones receiving less. A magnifier or condenser at *M* may concentrate the light on the cell.

In II a four-sided pyramidal prism has a small flat on top, and the image lies on or overlaps the flat, the light from the overlapping portions of the image being surface reflected to the four cells *C*. The smaller this point flat can be made, the better, as more light then goes to each cell. A major problem seems to lie in getting as much light as possible to each cell; the average guiding star that one can count on is so faint that the reliable sensitivity limit of the cell is closely approached.

The scheme of III was gotten up to offset small image size and normally to throw half the light into each of two cells. Here *H* is a half-transmissive mirror and *EE* are sharp edges adjusted to pass half images. This form, however, requires duplication for the other two directions. Other physical forms we have worked on involve oscillating edge plates and prisms which will periodically throw light from an image portion on the cells. Those are probably too complicated mechanically, and on the whole the single prism set in out-of-focus arrangement appears best, particularly as the small prism element may be put on a star image in the focal field of the main objective, along with the photographic plate.

One can readily visualize, mounted on the plate holder, a small element including the prism set and the cells. Microscopic observation of the image through the prism would facilitate setting. Russel W. Porter, who has made many suggestions [Nowhere in print, but orally; the two are neighbors.—*Ed.*] has suggested that the prism might be a cone rather than a pyramid, and that the cone, like a pyramid, could be set base-



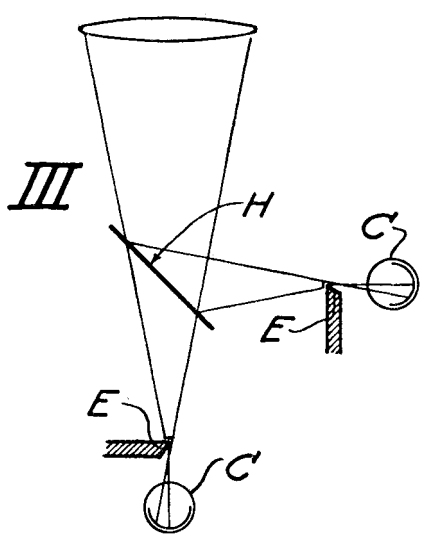
on or point-on to the light. Condensers again could be used to gather the light spread by reflection from the cone's surface. He also suggests additional reflecting surfaces around the prism to reflect the beams up to the cells supported above the prism, in order to minimize the lateral space taken up at the plane of the plate holder.

By mounting the guiding element at the plate holder, and applying the corrective movements directly to the holder, the inertia lag of the whole system may be reduced to a minimum. The plate holder may be made as light as possible, mounted on antifriction bearings; and the final driving motors, utilizing the amplified currents from the cells, connected directly to the plate adjusting screws whose pitch would depend on the load, the requisite acceleration, and the motor characteristics. A motor of small inertia seems indicated.

The inertia lag may thus be cut down to compare favorably with manual guiding. There is left, however, the sensitivity lag which is inherent in any such system and which appears to constitute the major difficulty.

In the sketch IV, lag *a* may represent the distance beyond edge *E*, or beyond normal, which the image must move in order to actuate the cell sufficiently to obtain a corrective result from the system. Suppose that *b* and *c* similarly represent time or inertia lags in the system. These latter may be reduced to much less than the corresponding lags in the average personal element in manual guiding; but the reduction of sensitivity lag *a* seems to present major difficulties.

Assume the simple movement of the image from a normal position, on an excursion out and back. Sensitivity lag not only puts the plate movement behind the image on the way out and back, but, most important, brings the plate back to a stopping position short by an amount primarily equal to the sensitivity lag. Now, if inertia lag is equal to sensitivity lag, then the over-run of the mechanical parts may make up for the sensitivity lag, and finally bring the plate to proper position. That, however, depends on the assumption that the image is going to move back to normal in a straight line—an assumption by no means justified. Furthermore, the simple case of the image having a normal position from which it makes temporary excursions is probably not the fact, although the image undoubtedly does predominantly occupy a definite small circle. The actual fact is probably a constantly moving image; but, whatever the conditions may be, the sensitivity lag has the effect at all times of putting the plate position behind the image position by an

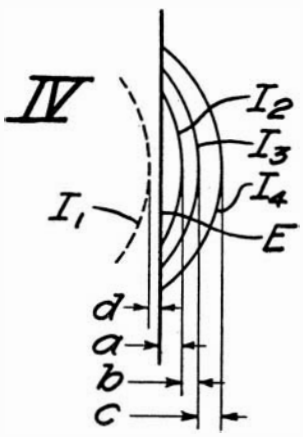


amount dependent on the lag, even though the image may come to a position of effective rest.

Sensitivity lag allows the image to move outwardly a certain distance without any corresponding control movement at all; the image can thus move around in a circle having a radius equal to the image radius plus the lag, without the control operating. And to attempt to correct the sensitivity lag by an equal inertia lag (over-run) thus means that the combined lag would be twice the

sensitivity lag, and the resultant star image very large.

The problem consequently seems to be one of eliminating the inertia lags and reducing the sensitivity lag to a very small amount. If the star image is of the order of 0.0001 of an inch, the *variation* in manual positioning by any one eye, while the image is still, is probably only a fraction of that amount. The sensitivity lag of an automatic control must thus be less than such fraction, to be worth while in improving photography.



Magnification of the image movement might help, but we have to remember that the guiding star image is now viewed through a magnifier, so that the magnified movements are availed of for following. The problem thus seems to resolve itself into one of providing an extremely sensitive system. One thought we have had in that direction is that the star image may be allowed to overlap all four edges in its normal position, thus normally affecting each of the four sensitive cells equally. Approximately one half overlap would give the greatest instant difference between increasing and decreasing overlaps. Then it might be possible to develop a balanced electrical system, such that a very minute unbalance of the opposing light-sensitive elements might result in a relatively very large current unbalance which would then be used for motive control.

Another manner of operating in the same way might be as follows. Instead of having the star image normally overlapping in all directions, let it normally overlap in two directions, say north and east. In other words, the constant tendency of the image could be to over-run in those directions. Then the two sensitive cell controlled currents might be balanced against two constant currents, with unbalance producing a large resultant.

All of this is about as far as we have gotten on the general subject, except to conclude that in any case the automatic system should have some kind of automatic occulter to cover the plate whenever the star image becomes so active as to run away from the control, or expands to a blur, or, what amounts to both those things, shimmers around rapidly.

MR. BARKELEW'S contribution, presented above, ends the discussion of this subject for the time being; the next stage being logically when somebody sends in something indicating results. In the meantime, we sound the last call for the annual convention of telescope nuts, to be held Saturday, July 21, at *Stellafane*, Springfield, Vermont. Everybody come.

THE SCIENTIFIC AMERICAN DIGEST

(*Continued from page* 98)

tion is one of heat regulation. The flow of heat from the human body determines in part its comfort and health.

Deep breathing exercises. Dizziness or actual faint may follow when these are enforced. Such excessive "washing out" of the carbon dioxide in the blood is useless if not harmful. Breathing should be only in response to body activity.

That washing out the interior by encouraging drinking large amounts of water is good for the system. Given a ready supply, normal people will drink what they really need. Related to this is overemphasis on constipation, intestinal regularity, and laxatives. "The troubles attributed to autointoxication are more mythical than real."

Especially when we were children we were told, "Don't eat between meals." However, social custom alone has set the time for eating, and between-meal "piecing" need not be harmful if the total quantity and quality of food are sufficient. Related to this is the taboo against combining sour foods and milk; the normal stomach secretions are always more acid than any food.

"Green apples cause stomach ache." These much maligned fruits, and other foods, have been blamed for many stomach aches which were in reality symptoms of appendicitis or some other serious internal trouble. Taking physics under these circumstances "comes under the heading of suicidal procedures."

"Keep clean to be healthy." Bathing and washing are important "for esthetic and social reasons," but their health virtues are difficult or impossible to prove.

"Kidney disease." The layman's symptoms of pain in the back and urine irregularities are in fact rare in kidney disease and the association should be dropped.

"Take some medicine." Don't, unless the doctor gives it, and do not force him to do so if he apparently does not think it necessary.

"Stand up straight." Personal appearance and self respect should dictate a good posture. It is likely that good posture depends on good health and not vice versa.

"Drink more milk." Usually not bad advice. Milk is a nearly complete food, but many are "sensitized" to it and suffer skin rashes and gastro-intestinal symptoms more serious than the benefits received.

New Farm Tillage Laboratory

A NEW farm tillage laboratory—the only one of its kind in the world—in which studies will be made to find the types of machines best suited economically to the soils of the southeast, will be built by the U. S. Department of Agriculture, at Alabama Polytechnic Institute, Auburn.

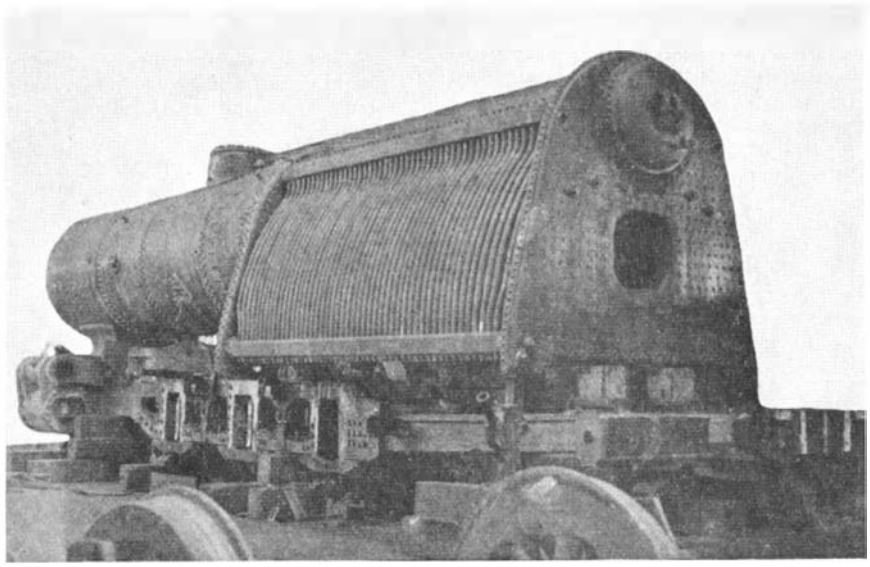
The Federal Bureau of Agricultural Engineering will construct nine shallow pits, each 20 feet wide, 250 feet long, and 2 feet deep. Into each pit will be dumped 10 carloads of topsoil, a sample of one of the agricultural soils of the southeast, ranging from sand to clay. In these parallel pits the bureau can make practical comparative tests of plows and cultivating machinery at one location, working under controlled conditions.

R. B. Gray, chief of the Mechanical Equipment Division of the bureau, will supervise the new laboratory work. John W. Randolph, a bureau engineer, will have charge of experiments and will work in co-operation with M. L. Nichols, head of the Department of Agricultural Engineering of the Alabama Institute.

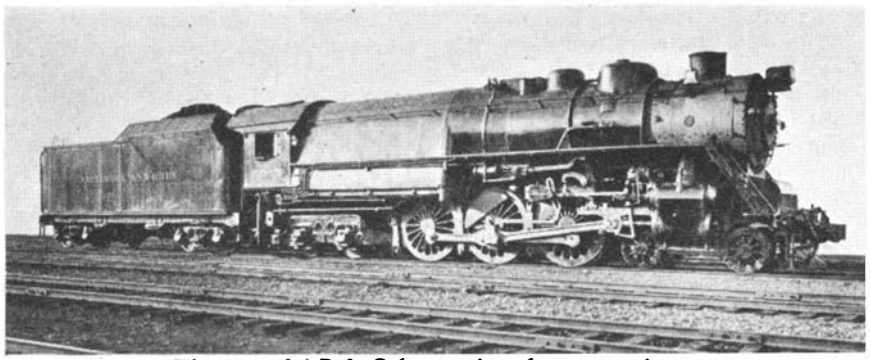
All plots will be adequately drained, and will be separated by concrete walls extending a few inches above the plot levels. The laboratory will be built with funds obtained from the Public Works Administration and will cost about 110,000 dollars. The land upon which it is to be built is the property of the state of Alabama.

Converted Locomotive Is More Powerful

A LOCOMOTIVE which is said to be capable of doing the work of two ordinary engines has just been completed by the Baltimore and Ohio Railroad. Since this 4-6-4 type has been converted from a 4-6-2 and its working pressure greatly increased, some of the details, as passed on to us by



Fire box and boiler of converted locomotive



The powerful B & O locomotive after conversion

Mr. G. H. Emerson, Chief of Motive Power and Equipment, are quoted below:

This locomotive No. 5047, Class V-1, 350 pounds boiler pressure and 74-inch drivers was reconditioned by lengthening frames to replace the two-wheel with four-wheel trailer truck and new boiler at the Mount Clare Shops of the company in Baltimore, Maryland, being designed from designs made in the Mechanical Engineer's office, for hauling 14 car trains, such as compose the Capitol Limited on our lines between New Castle Junction, Pennsylvania, and Chicago, Illinois—a distance of 424 miles.

To supply steam to maintain sustained speed, the Emerson water tube firebox boiler was used in its construction having a boiler capacity of 124.0 percent. (Cole's rating.)

This design of water tube firebox boiler has passed the experimental stage, as this company has been applying them for several years, and consists of a double row of staggered tubes forming the side wall of the firebox, set by rolling into a bottom header connecting the front and back water legs, with the upper ends of the tubes set into the top header, located alongside of a single steam drum forming firebox crown, making a centrally disposed connection with the barrel of the boiler.

The header is connected to the drum by cross circulating tubes of a larger diameter than side tubes, and with wider spacing which checks too rapid circulation.

Washout plugs are located in the top and bottom headers opposite the ends of the rows of tubes for inspection and cleaning purposes. This convenient arrangement avoids the entrance of the workmen into the steam drum for cleaning the tubes, saving considerable time and labor in the operation.

The water tube side walls present per foot of length of firebox a greatly increased heating surface exposed to the action of the radiant heat, and have resulted in much more efficient steam generation.

Mr. Fowler, from experiments reported to the Master Mechanic's Association, at one time stated that the value for heat transfer of firebox heating surface was eight times greater than the boiler tube heating surface.

This design lends itself to being extended forward to increase firebox capacity to take advantage of the higher value of the radiant heat.

The 5047, a 4-6-4 type with tractive power of 52,000 pounds without booster, and 64,000 pounds with booster, will do the work of two of the former P-1c, 4-6-2 type locomotives of 46,000 pounds tractive power formerly used on these runs.

A comparison of the elements shown below of the water tube boiler of the 5047 with the conventional staybolt firebox of the P-1c will give the points contributing to the super performance of the 5047 boiler.

NEW BOILER WITH WATER TUBE FIREBOX

Tubes No. & Diam.	205	2¼"
Flues	40	5½"
Over Tube Sheets		16' 1¼"
Firebox Size		96" x 132"
Grate Area		88 Sq. Ft.
Boiler capacity (Cole's rating)		124.0%

HEATING SURFACES (Sq. Ft.)

Firebox	825
Tubes & Flues	2853
Total	3678
Superheating	1015

EVAPORATION (lbs.)

Firebox	45375
Tubes	19610
Flues	10389
Total	75374

CONVENTIONAL STAYBOLT FIREBOX REMOVED FROM P-1c LOCO.

Tubes No. & Diam.	218	2¼"
Flues	34	5½"
Over Tube Sheets		21' 0"
Firebox Size		84" x 120"
Grate Area		70.0 Sq. Ft.
Boiler Capacity (Cole's rating)		91.0%

HEATING SURFACE (Sq. Ft.)

Firebox	256
Tubes & Flues	3706
Total	3962
Superheating	811

EVAPORATION (lbs.)

Firebox	14080
Tubes	23019
Flues	9975
Total	47074

Bothersome Bacteria Commit Suicide

BEATING bacteria at their own business has made money for the manufacturers of fiber-board. One popular variety of fiber-board is made from the tough fibrous pulp remaining after sugar cane is ground up to extract its sugar. This material, known as "bagasse," piles up around the sugar mills during the three-months' grinding season faster than it can be manufactured into fiber-board. Its storage has long presented a problem, for the bagasse is subject to attack by bacteria, molds, and fungus. Now, however, E. C. Lathrop and T. B. Munroe, two chemists of the Celotex Company, have devised a method which forces the bacteria to commit suicide and to kill off the molds and fungi that formerly ravaged the raw material.

The secret is simple. The scientists found that by merely gathering the bagasse into bales, the bacteria, feeding on the residual sugar in the fiber, would produce heat by fermentation sufficient to raise the temperature at the center of the bale to 142 degrees, Fahrenheit, and keep it there for two or

three months, thus effectively killing off the micro-organisms which cause decay.

The carbon dioxide evolved during this fermentation seems to carry away with it so much water vapor that only 30 percent moisture is left in the bagasse instead of 50 percent as it comes from the mill. In this drought the spores which survive the heat do not develop even after the mass cools. Boric acid is spread over the tops of the bales on the outside of the pile of bales where the temperature is lower and a roof covers the pile to keep off rain.

The money savings in the first year were five times the total research cost.—*A. E. B.*

Simple Fire Alarm

ONE of the simplest fire alarms which has come to our attention recently is in the form of a small fuse that will melt and form an electric contact when heated to 130 degrees, Fahrenheit, with the result that an electric bell will be started ringing. This fuse is mounted in a cartridge housing of the shape and size of an ordinary 15 ampere electric fuse and is held in place on a fuse block. It is called Thermotact.

The wire attached to this fuse is connected to the electric door bell of a residence. When a temperature higher than 130 degrees is reached in the vicinity of the Thermotact, the continued ringing of the bell acts as an alarm. Obviously it is dependable because the door bell is usually kept in working order because of the regular demands made upon it.

A number of these devices scattered about the home—in the attic, the basement, the kitchen, or closets—should serve effectively to protect all parts of the home.

A Less Poisonous Insecticide

THE introduction of barium fluosilicate as an agricultural insecticide some few years ago by one of this country's oldest chemical organizations was styled by an authority as the greatest development in insecticides since the introduction of lead arsenate in the late years of the 19th Century.

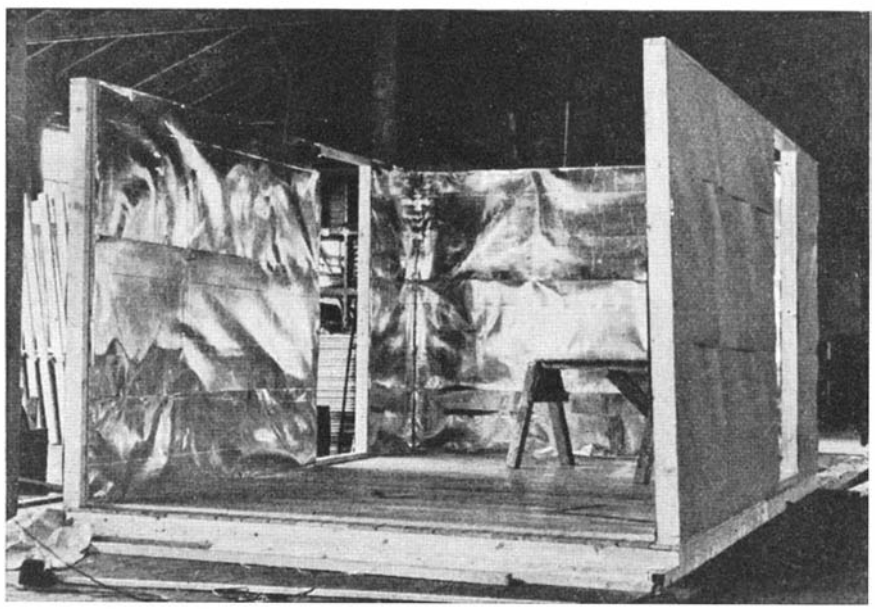
Private research activities on fluorine compounds as agricultural insecticides over a period of years resulted in the ultimate selection of barium fluosilicate as a most practical material. Preliminary trials had indicated this material to be of high killing power to many important chewing insects, and with a high factor of safety to foliage of most plants.

The study of barium fluosilicate then progressed to field trials under commercial conditions, and the material gave indications of being effective on practically all insects which the old materials had controlled, and on many of those important insects which had not been satisfactorily controlled by the old combinations. Freedom from foliage injury in practically all trials, and practically no changes in spraying or dusting equipment or technique of application, were additional factors in favor of this new chemical insecticide. It is not necessary for the insect to feed on a host plant in order to get enough of the material to cause death. The very fact that the insect travels through the material on the plant or on the soil surface around the plant places it in immediate danger of death.

While it is apparent from entomological research that fluorine compounds are more toxic to many insects than lead arsenate, the work of Henry Field Smythe and Henry F. Smythe, Jr., as published in *Industrial and Engineering Chemistry*, indicates that with respect to humans, fluorine compounds leave a much wider margin of safety. Specifically, this work reports that thirteen times as much barium fluosilicate is needed as lead arsenate to give the same chronic toxic effect from repeated doses. It is concluded that the use of fluorine insecticides would leave a much wider margin of safety than do arsenical materials between the weight of spray residue on fruit and the amount toxic to the consumer.

Byrd's Hermit Hut in Antarctica

BETWEEN Admiral Richard E. Byrd and the bleak Antarctic, where the thermometer drops to almost 100 degrees below zero, there are only the slim walls of his hut, a bare four inches in thickness. Within the hut, he has a cook-stove, a small heater and a lighting arrangement—to-



The first assembly of Byrd's south polar hut, showing aluminum foil insulation

gether consuming only four quarts of oil a day. Yet the Admiral reports that his quarters are decidedly livable.

Four quarts of oil . . . four inches of wall . . . on the hem of the South Pole! It doesn't sound possible. And it wouldn't be, except for the intervention of science in the form of two paper-thin layers of aluminum foil or metallation. Embedded in the wall, they throw the heat, generated by the cook-stove, the heater, and the lights, and even from the Admiral's body, back into the room, much in the manner of mirrors. It has been demonstrated that only about 5 percent of radiant heat which strikes aluminum foil goes through—95 percent is reflected back.

This white man's igloo represents so remarkable a feat in the difficult art of keeping warm, that it is being exhibited in replica at A Century of Progress Exposition in Chicago. It occupies the plot facing the Byrd ship, *The City of New York*, which attracted hundreds of thousands of visitors last year.

The hut is 9 feet wide by 13 feet 1 inch long by 7 feet 1 inch high, the size of an automobile crate. Wooden pins are used in many parts after the fashion of old barn builders. A two-way trap door in the roof is security against the Admiral being hopelessly buried beneath the snow. Vents for fresh air and for carrying away cooking fumes are provided, as well as a tunnel and a porch walled in by packing cases containing supplies.

The house was made in panels to facilitate dismantling and assembling. Each panel has on the inside a layer of fireproof canvas which is glued on white pine veneer ⅛ inch in thickness, covered on both sides with tough paper. Next comes a layer of heavy paper on both sides of which were glued the aluminum foil. The metallation, made by the Reynolds Metals Company, was inserted loosely and not glued to the veneer, in order to create air spaces. Back of this and progressing toward the outer wall came a sheet of waterproof paper, wavy of surface and not fitting snugly against the foil.

A half-inch blanket of kapok came next, then another sheet of waterproof paper, then another blanket, another sheet. A layer of heavy paper coated on one side only with metallation facing inwards was next, and finally another panel of paper covered veneer. All of it was held together by a strip of white pine four inches wide and one inch thick.

New Study and Reading Lamp

SEEING conditions in our schools and universities are in line for considerable improvement, following a nation-wide survey of the lighting in the study rooms of dormitories and fraternity houses by the Illuminating Engineering Society.

In its survey, the Society found that the lighting conditions were far below the standard of good practice and are largely responsible for the 40 percent of defective eyesight existing among the student class in this country. In many instances the severe economies, necessarily, but unwisely practiced during the depression, placed restrictions on the amount of light available. Consequently, the level of illumination on the average study desk was usually so low that it seriously impaired the vision of the

The new study lamp, showing direct and indirect lighting features

students while they themselves were unaware of the fact.

As an outgrowth of these disclosures, the Illuminating Engineering Society is recommending a lamp of special design for the study rooms of our college dormitories and fraternity houses. Modelled after an ordinary table lamp, this new design has an inverted bowl of translucent glass, open at the top, and produces a combination of direct and indirect illumination. The standard 100-watt lamp which is specified for the I.E.S. study and reading lamp, is somewhat larger than that generally found in such lighting units. Surface brightness of the light source, however, is kept below three foot-candles per square inch by the translucent glass of the bowl.

The open-top bowl in the I.E.S. study and reading lamp sends considerable light to the ceiling and produces a good level of indirect illumination which lifts the familiar veil of darkness around a study desk and throughout the room. Removing the sharp contrast between the bright spot of illumination on the desk top and dark shadows in the remainder of the room is expected to be an important factor in combating eyestrain. Student's eyes will be spared the continual readjustment which tires the muscles and encourages strain.

With a height of 28 inches, the I.E.S. study and reading lamp is considerably taller than most designs, which usually are so squat as to be of little value except perhaps as a decorative feature. It is this height, however, which is an important factor in the good distribution of direct light on the desk top.

Anxious to remove, once and for all, the evil of improper lighting in study quarters, the Illuminating Engineering Society offers to certify all study lamps which conform to specifications.

Salmon-Liver Oil

PRESUMABLY both the cod fish who supplied the liver and the children who are coaxed to take the oil will be pleased to learn that the salmon threatens to dethrone the cod as a source of vitamins. Two chemists of the United States Bureau of Fisheries, Charles Lee and Chester Tolle, have discovered that oil extracted from the liver of salmon contains more valuable vitamins than cod-liver oil. There are 500 million pounds of salmon caught annually in this country, they state; of this weight 2 percent is liver and 3 percent eggs. The livers are 5 to 8 percent oil, the eggs 10 to 12 percent.

Tests were made on the vitamin A and vitamin D potency of the two kinds of oils by feeding measured doses to rats. The results of tests reported in *Industrial and*

Engineering Chemistry show that salmon-liver oils are approximately 5 to 20 times as potent in vitamin A and twice as potent in vitamin D as is cod-liver oil. The oil from the eggs was in no case superior to cod-liver oil either in A potency or in D potency.—*A. E. B.*

Face Powder from Apricot Seed

FROM apricot seed, Great Britain manufactures face powder, Germany high explosives, and an Australian firm confectionery. The state cannery at Leeton, New South Wales, has discovered the fact and is rejoicing accordingly. They have just disposed of a 50-ton dump of "stones" at 250 dollars a ton.

In Victoria, where most of the apricots are grown, orchardists are much cheered at the thought of being thus able to turn to profit the portion of the fruit that was formerly wasted.

Wines Clarified by Skim Milk

FILTERING a wine may leave it bright but upon standing a short time, it may again throw out a cloud. Many methods using powders such as silica gel, bentonite, or barium sulfate and talc work well in some cases but Blumenthal and Blumenfeld in the June issue of *Food Industries* describe methods which give uniformly good results.

One is to add one ounce of skimmed milk for every 50 gallons of wine and filter it without waiting for it to settle.

Adding 2 ounces of vegetable carbon to 50 gallons of cloudy wine, agitating, settling for 48 hours and filtering through ashes to pulp also gives good results. The bouquet lost by the wine is negligible. The charcoal also causes a young wine to take on age, especially if it is a white wine. —*A. E. B.*

Acetyl-Choline May Prevent Benzene Poisoning

THE many cases of sudden death due to benzene poisoning that occur each year in various industries where benzene is commonly used as a solvent may be prevented by an injection of the drug, acetylcholine. This announcement was made recently before the New Haven Medical Society by Dr. Louis H. Nahum, of the Yale Medical School, who told of his work in this field with Dr. H. E. Hoff, also of the Yale medical faculty.

Benzol vapor, Dr. Nahum explained, produces an abnormal sensitivity of the heart to adrenalin, a common constituent of the blood, bringing about an irregularity in the heart beat which causes death. Adrenalin, incidentally, is sometimes injected into a heart that has stopped beating, in an effort to restore life. Excitement and physical activity predispose to the occurrence of sudden death by benzol vapor. Excitement, moreover, is a condition in which the adrenalin glands pour into the blood large amounts of adrenalin. Animals deprived of adrenalin did not die of ventricular-fibrillation, the fatal irregularity of heart action which appears to be the cause of death in benzene poisoning.

"We found, further, that an injection of acetyl-choline counteracted the action of the adrenalin and protected the animals against this fatal irregularity," Dr. Nahum said.

This finding, while important in itself, opens up a new field of investigation of the causes for death by heart failure. Adrenalin under abnormal conditions, one of them being exposure to benzol vapors, produces ventricular-fibrillation.

Whether other conditions, heretofore overlooked by physicians, predispose the heart to the lethal action of the adrenalin, remains to be investigated.—*Science Service.*

CURRENT BULLETIN BRIEFS

THE CARRIER WEATHERMAKER—MANUFACTURED WEATHER FOR THE HOME, describes the Carrier Air Conditioning System which is used in industry and the home. This is one of a number of pamphlets on allied subjects: The others are entitled "Why Fight The Weather?", "Carrier-Brunswick Refrigeration," and "Air-Conditioning Principles and Equipment." *Write Scientific American for Booklets 8A.—Gratis.*

THE OLDER EMPLOYE IN INDUSTRY. This is one of the many publications issued by the Policyholders' Service Bureau in the interest of better management in business. There are many factors involved which are adequately dealt with. *Metropolitan Life Insurance Company, 1 Madison Ave., New York City.—Gratis.*

WORLD UNITY AS RECORDED IN HISTORY. ("International Conciliation," February, 1934, No. 297.) By Elbert D. Thomas, United States Senator from Utah, formerly Professor of History and Political Science at the University of Utah. In his brief treatment of the subject Senator Thomas cites interesting examples in support of his thesis and stresses the necessity of a broader interpretation of historical events if unity of action on present-day problems is to be attained. *Carnegie Endowment for International Peace, 44 Portland St., Worcester, Mass.—5 cents.*

THE GENERAL ELECTRIC INSTITUTE. Now a new and greater Institute unites under one roof the function of three Institutes that were previously separate—the Lighting, Kitchen, and Refrigeration Institutes, with the most modern equipment and much of the best available teaching talent. The new Institute is prepared to give a unique training, intensive and highly practical. Strange to say, it is a training center with no tuition. A beautifully illustrated pamphlet may be obtained by writing to *The General Electric Co., Nela Park, Cleveland, Ohio.—Gratis.*

UNITED STATES EARTHQUAKES IN 1932. By Frank Neumann. *Superintendent of Documents, Washington, D. C.—5 cents coin.*

RAILWAY AND LOCOMOTIVE HISTORICAL SOCIETY, INC.—NEW YORK CHAPTER. Now more than a century after the advent of the railroad an organized effort is being made to bring together all available relics portraying the tremendous growth of this

country's greatest industry. Those who would like further information and literature should address the *New York Chapter, Post Office Box 434, Madison Square Station, New York City.—Gratis.*

BACON'S PUBLICITY MANUAL is a complete and up-to-date directory of 1600 American and Canadian business and trade papers, classified by markets, with an analysis of the types of editorial material used by each publication. There are also many practical suggestions regarding preparation of manuscript and illustrations. *R. H. Bacon & Co., 608 South Dearborn St., Chicago, Ill.—$3.00.*

SCIENCE REPLIES

(*Continued from page* 79)

velopment work, failure is a common thing and, if we gave up the principle every time an experiment failed, we could accomplish nothing. Our civilization as a whole is new. It is in itself an experiment. Just because we have encountered difficulties is no cause for despair. We must find out what is wrong and remedy it, but we must not give up hope of a better and more secure life.

We are being told that if we develop new things we must accept the responsibility of seeing that they are properly used. We believe that many of the principles that have been developed in the physical sciences can be used in the study of the social sciences and we stand ready to contribute in any way that we can to this work.

Most people think that science and industry are interested only in the development of labor-saving machinery. This is entirely a false notion. We must not forget that for the past 50 years when the great building of our railroads, cities and industrial plants was going on, this labor saving was a most important thing because we did not have enough people to do the work. And only five years ago we had a scarcity of labor in this country.

Science is very much more interested in the production of labor-producing projects and inventions, than in labor saving. I cannot help but feel that in a very short time we are going to break loose another great piece of basic information which will keep us industrially busy for a great many years to come.

If you will only recognize how much there is yet to be done that will be of general good to the whole human family, then we need not worry, but we must be bold enough to take those forward steps which will bring back prosperity in any measure that we desire, or in any measure which we have imagination enough to conceive.

From DR. ABBOT:

I HAVE read Secretary Wallace's article with much interest and sympathy. From general principles it seems clear that the more bountiful is Nature and the more clever and informed is man, the greater should be human comfort. If society were as well organized as scientific research must be to attain success, the reduction by means of research of the amount of work required to provide necessities, comforts, and reasonable luxuries for everybody would be no evil to anybody, but a universal blessing. In other words, it is not work but the products of work that people need.

Greed, dishonesty, distrust, and incompetence stand in the way of such a social reorganization. Whether society can function automatically, as heretofore, and accomplish the desirable end of giving everybody reasonable comfort from childhood to old age, is uncertain. Whether general consent and support can be gained for a social organization wherein an intelligent government would cause want and supply to coordinate harmoniously, is doubtful.

Secretary Wallace implies that those whose acute minds and prolonged training fit them for scientific research ought to devote themselves to the improvement of social organization. No doubt he would agree that some kinds of scientific specialists would waste their time if they turned from their present pursuits to these social problems.

Possibly, however, he might approve a plan whereby the National Academy of Sciences, co-operating with other scientific organizations, should appoint a large committee with power to add to its membership, and to solicit moderate financial support, to the end of making recommendations as to practicable improvements in our social organization. Scientific men are accustomed to meet and conquer difficulties of a physical nature in their experiments. Perhaps such a committee might devise ways and means to overcome the four giants named above, which bar the path to happiness.

RESEARCH AND THE MOTOR CAR

(*Continued from page* 63)

tests under conditions representing the severest requirements of actual use. We cannot recall any other engineering laboratory or workshop where this principle has been so fully recognized and applied.

The owner of a modern automobile must have his car start up in the severest of cold weather. Accordingly a huge cold chamber is provided in which an entire car can be submitted to a temperature of —20 degrees Fahrenheit; it is expected to start functioning immediately after the ordeal. A smaller cold chamber is specially directed to the study of low temperature effects on the carbureter.

Some years ago automobile dealers in Belgium found that the roads of that country made of cobble stones with a disconcerting and pronounced rise in the center caused trouble in the sturdiest American cars. From this developed an instrument of torture called the Belgian Roll. In the use of this device, a car, fully equipped and ready for operation, is lashed down at one end and mounted on four double sets of huge rollers. These rollers are revolved at varying speeds, and on their surfaces have projections several inches in height, arranged unsymmetrically. The car is therefore subjected to an agonizing ordeal where high speed is combined with unequal and violent jolts and bumps fore-and-aft, and side to side. The car can be studied from below as well as at the sides while undergoing this test. From an engineer's point of view, the Belgian Roll is

preferable even to repeated road tests in rough territory because the violence of the test can be systematically varied, intensity of test can be crowded into a short space of time, and the possibilities of systematic observation are greater.

In another part of the laboratory we observed an armored chamber of steel and wood, embedded in the floor, where flywheels can be spun up to a speed of ten thousand revolutions per minute or up to bursting speed, to determine their ultimate strength.

Perhaps no element of the car must be so perfectly reliable as the steering gear, and we inspected the steering mechanism testing jig with considerable respect. A rack moving with a rapid reciprocating motion turns a pinion to-and-fro. The pinion in turn oscillates the steering wheel and steering column, whose lower end functions against a heavy load imposed by a hydraulic plunger which resists motion in either direction. A few hours on the steering-wheel jig is equivalent in its destructive effects to several years of heavy driving on the road. The report of the engineer after such a test is the most instructive comment the design office can receive.

Elsewhere a sound-proof door was opened for our benefit and we saw an array of different types of horn. Through an electric make-and-break system these horns were continually sounded, several times a minute for days at a time. Even a Paris taxi driver with his continuous "honk! honk!" could scarcely put an automobile horn through an equal trial.

Interior fabrics have little connection with safety, but ladies dislike faded fabrics. Therefore, an ultra-violet ray test for fabrics has been devised and is constantly employed. Another curious mechanical device pulls, bends, and twists fabrics simultaneously, providing a test of wear and strength under conditions more severe than those of use. These tests are only representative; safety and reliability are not tested only in the laboratory. Records of prolonged road tests are systematically studied and recorded, with the young men of the Chrysler Institute of Engineering receiving practical training in how a beautiful design on paper stands up in actual usage.

NEEDLESS to say, the study of materials is an integral part of automotive engineering. There is always an active exchange of ideas between metallurgists, chemists, and the car builders to the benefit of all concerned. In many instances, the automotive engineers have themselves made advances in the treatment or application of materials. In viewing the metallurgical and chemical laboratories we were particularly impressed with two developments—one the use of powdered metals, the other an intensive use of rubber in car construction.

At first sight it would seem rather a waste of effort to powder pure metal, but engineers have even gone so far as to powder pure metals and then to re-consolidate them in the form of rods, bars, and tubes. The most striking instance of such use in the so-called "oil-less bearings" the trade name of which is Oilite. Several years ago it was found that the so-called "oil-less" bearings were unsatisfactory, the principal deficiencies being lack of lubrication, rapid wear, scoring, and disturbing noises in operation. Accordingly the Detroit metallurgists undertook to develop their own oil-less bearings.

"Oilite" is made of copper, tin, and electric furnace graphite, all carefully powdered so that they will pass through a 150-mesh screen. These are carefully weighted, thoroughly mixed and fed into an automatic briquetting machine. Bearings are formed under very high pressures to any desired form. Subsequent operations are heat treatment and impregnation with oil, and final sizing of the outside and inside diameters. For heavy duty, satisfactory bearings have been made containing 30 to 40 percent by volume of oil.

It was a most interesting sight to see the metallurgist, W. G. Calkins, place one of the bearings in a vise and see the oil form in a heavy film on the outside of the bearing as pressure was applied.

We now turn to another material in one of the applications of which Chrysler engineering has led the way—rubber. We are, of course, not referring to rubber tires, in which the tire manufacturers remain pre-eminent. In 1926 a "rubber research project" was started. At that time about three pounds of rubber was used in every car, aside from tires. Cars now being shipped carry from 50 to 65 pounds of rubber, exclusive of tires, and the use of this material in the 1934 lines represents an increase of as much as 15 percent over 1933. Perhaps the most striking results of this research project were in the development of rubber engine mountings with their anti-vibration qualities, and in the adhesion of rubber and steel—now said to be the biggest advance in the mechanical rubber goods field.

Physics, chemistry, metallurgy, and mechanics were all brought into play in the original research, and now by means of suitable chemical treatment, electro-plating, and pressure application, the adhesion strength of rubber to metal is as great as the strength of the rubber itself! This means that rubber can be used as a connecting unit instead of the customary steel bolts or screws. Since rubber damps vibration, it can be seen at once what a wide scope of use is opened up.

PERHAPS one of the most significant elements in modern American industry is in the constant seeking after beauty. Nowhere is this more true than in the automobile. The modern American motor car is perhaps the most beautiful product of the machine age. Until recently this evolution toward beauty has been unconscious; now it is conscious and directed. Let us see what activities H. V. Henderson, a genial giant of six and a half feet in height, and head of the Chrysler art department, has brought into being.

An architectural engineer of French training, Mr. Henderson has sought and obtained the atmosphere of a Paris atelier coupled with the utilization of modern applied science. Thus, while he and his able assistants are as alive to the beauties of color as an artist, they use the most modern applications of photo-electric cells in matching and combining colors. With 15 basic colors to start from they have developed a new and scientific form of color nomenclature embracing perhaps 1500 shades and combinations.

No manufacturer, engineer, or draftsman, or for that matter scarcely anyone, can

fully visualize true appearance and beauty of an object from cold blue prints. A model is infinitely better. Mr. Henderson has his artistic draftsmen draw up templates and build large numbers of tenth scale models—weighing perhaps 35 pounds. A preliminary selection results in the construction of plaster of Paris models, less flexible but more permanent than clay. These small plaster of Paris models are painted and finished for future reference. When the small models have served their purpose, full-size clay models weighing perhaps three tons are constructed and serve as nothing else possibly could, as a basis for judgment by executives, designers, and sales managers.

Similar principles apply in the artistic design of car interiors, where perspective drawings are used to better purpose than actual models. The industrial artists do not stop at work on the car as a whole, however. They work up by similar meticulous methods such minor objects as hub caps, door handles, and so on. Here are apparently minor but really very important points. Women will not buy cars if the door handles tend to cut their gloves. Models of door handles are cut out of wood, glued together, smoothed down, and tested for appearance and feel until every practical and esthetic requirement has been met. Similar care is lavished on curtains, moldings, instrument panels, and the hundred and one other visible parts of the modern car. Art magazines, European and American, are fully and widely used for suggestions and ideas, and the "art" discussions at the noon lunch hour are singularly akin to the talk of a modern studio.

THE continued success of an industrial research laboratory depends on the ability of newly admitted personnel, as well as on the growth in knowledge of the veterans. It was interesting to see how the Chrysler Institute of Engineering functions with these two ends in view. Established three years ago, the Institute is incorporated under charter of the State of Michigan with authority to confer degrees in engineering and to issue credits in preparatory school work. To secure admission to the Graduate School of Engineering, a Bachelor of Science degree in engineering is required. Selection by a special committee entails careful examination of the man's scholastic record, other activities, and a number of personal interviews.

The Board of Governors of the Institute has been successful in recruiting really outstanding men from such schools as the University of Michigan, Massachusetts Institute of Technology, Cornell, Iowa State, Harvard, Princeton, and so on. The two-year course leading to the degree of Master of Mechanical Engineering involves nine hours a week of class and lecture work combined with regular related employment as junior engineers in various departments of the laboratories in the first year. Only on completion of this course is the junior engineer definitely assigned to one department for which he has shown special aptitude.

With a distinguished engineer and teacher, Professor John J. Caton, in charge, the faculty (serving voluntarily) is drawn from the leading engineers of the organization. Automotive engineering, thermodynamics, metallurgy, machine design, mathematics, and a number of cultural subjects such as economics and commercial law constitute the curriculum.

Any friction or jealousy which might possibly be aroused among the non-college personnel by the introduction of technical school graduates is forestalled by a five-year undergraduate evening course offered by the Institute. Some of the young college men are themselves instructors in the undergraduate classes.

The plan is admirable in conception and equally well executed. Besides its educational advantages, and its advantages in personnel selection, we see in it possibilities of democratic influence. College men learn from draftsmen and shopmen. The draftsmen and mechanics learn from the graduates of our greatest universities. An industry permeated with such contacts is likely to be harmonious and friendly.

WE do not know what plans for future progress these automotive executives and engineers have, but they surely would not maintain these splendid laboratories and seek out more young men through their Institute of Engineering unless they had constant advances in view. Let us merely guess at some of the things they may be doing in the future.

First of all we may expect further developments in streamlining. The Airflow cars already show marked superiority over the conventional sedan of a year or two ago, but a great deal remains to be done. Minor obstructions such as exposed door hinges cause a great deal more air resistance than is at first apparent. An exposed spare tire at the rear may ruin all the careful design of tail lines. Perhaps a way may be found of actually giving the car a fish-like tail without lengthening the car excessively. It is possible also that even more radical changes may be made with the ultimate in streamlining as the objective: thus we can conceive of engineers taking even the more radical step of placing the engine in the rear, the passengers still farther forward, and giving the car a true airship bow. The flat V windshield may, with progress in glass technology, become curved.

The arched truss of the Airflow cars, entirely of steel, has not only given us a stronger and safer body but has actually served to reinforce the chassis. The arched truss consists of welded steel sections. Since the tube is intrinsically stronger than a channel in compression, we may see the day when, following the lead of the airplane, the truss may become tubular.

The full effects of streamlining on car economy only become available when there is complete coordination between engine and driving wheels. As streamlining progresses further, we may see more speed changes added to the car or even a universal change speed device—automatic in character.

Airplane engines are still far superior to automobile engines in efficiency and lightness. We may see such laboratories as we have described introduce much higher compression ratios with greater efficiency and power as the result.

These are only a few problems suggested at random. Each and all will call for exhaustive study in the laboratory. The young men privileged to enter the Chrysler Institute of Engineering will never cease to find fresh fields to conquer!

Books SELECTED BY THE EDITORS

HIGH COMMAND IN THE WORLD WAR

By William Dilworth Puleston, Captain, U. S. Navy

THIS author needs no introduction to our readers since he is on our editorial staff and has contributed numerous studies and discussions of military questions to our pages during recent years. Many of our readers know him also through his earlier book, "The Dardanelles Expedition," which is a standard work on the Gallipoli campaign.

Regarding the present work, we might lay ourselves open to accusations of bias were we to express ourselves fully. Suffice it to say, therefore, that in these 317 pages Captain Puleston has so correlated and compared facts—beginning with the basic causes of the war, the diplomacy leading up to it, European preparations and mobilization, and carrying through the many harrowing phases in both major and minor theaters to the armistice and a long final chapter "Conclusions and Reflections"—that we get a well-rounded picture of the war as a whole, especial attention being paid throughout to personalities and their influence on the course of the war. It abounds in studies of motives and impulses.

We endorse Colonel P. P. Bishop's comments: ". . . no one better able to present the lessons of the World War to the general reading public. . . . This book will be of exceptional interest to the military man . . . entertaining and enlightening to the civilian really interested in evaluating the accomplishments as well as the mistakes of the leaders, both civilian and military, in the World War."—$3.20 postpaid—*F. D. McH.*

SEEING AND HUMAN WELFARE

By Matthew Luckiesh, D. Sc.

IN this, the latest of 17 books written by the Director of the Lighting Research Laboratory of the General Electric Company, we are told about the new science of seeing, the main theme being that we do not even yet provide nearly enough illumination for reading, studying, working, and even ordinary living. It is a book written especially for oculists, optometrists, lighting specialists, architects, decorators, and the producers of eye-glasses, lighting equipment, paint, paper, and printing; also for the average man who may wish to keep up with the advances of science.—$2.65 postpaid.—*A. G. I.*

AMERICAN INVENTORS

By C. J. Hylander

A SMALL book of inventors is highly desirable. The present volume deals with 19 inventors of greater or lesser caliber, including Benjamin Franklin, John Fitch, John and Robert Stevens, Robert Fulton, and Cyrus McCormick, and ends with C. Francis Jenkins and Lee de Forest. The drawings are perfectly clear and the number of titles is quite considerable.—$2.20 postpaid.—*A. A. H.*

HISTORY OF THE BREWING INDUSTRY AND BREWING SCIENCE IN AMERICA

Begun by the late John P. Arnold. Completed by Frank Penman.

AFTER the hiatus in the literature of the brewing and distilling industry for so many years, it is interesting to note that the pioneers of American brewing science, John E. Siebel and Anton Schwarz, were given a memorial in the Hall of Science of the Century of Progress International Exposition on the 28th day of September, 1933. The brewing trade has been resurrected and this book gives the best history of brewing from 1630 on.—$3.25 postpaid.—*A. A. H.*

THE ANCESTRY OF THE LONG-LIVED

By Raymond and Ruth De Witt Pearl

WHY do some of us live to be old, while others die younger? Has science an answer? Once people said that it was simply because of the way we live, but this explanation bears investigation poorly. Some scientists have said guardedly (and some popular writers too positively) that longevity was a true Mendelian inherited character, passed to us before birth. The Pearls, of Johns Hopkins University, noted scientific investigators, have studied the question analytically, and the answer comes out in their book that heredity is an important factor but that, in final analysis, science does not yet know why we are or are not long-lived. This book is recommended to the serious student of biology and statistical analysis. As the authors state, it will be slow reading, because it is a serious study. Anyway, it avoids the kind of unscientific assumptions, guesses, and mere "opinions" which have heretofore bedeviled this problem.—$3.15 postpaid. —*A. G. I.*

THE MYSTERIES OF THE ATOM

By H. A. Wilson, Prof. Physics, Rice Institute

THIS is an elementary textbook of modern atomic physics—not a lengthy one but compact (111 pages) and meaty. It is not light because elementary but is full of solid substance for study rather than amusement. It contains a little high school mathematics.—$2.70 postpaid.—*A. G. I.*

ATTENDING MARVELS, A PATAGONIAN JOURNAL

By George Gaylord Simpson

THE author of this narrative is a paleontologist on the staff of the American Museum of Natural History and his book takes the reader with him on a fossil-hunting trip in Patagonia. It is a popular narrative, the purely technical and paleontological parts being published elsewhere. The author banged and bumped around in roughneck Patagonia with an old truck and with a tent, for seven months, taking whatever came, and evidently he could take it. We didn't intend to read all of this book but it read itself, for the vertebrate paleontologist who wrote it is no fossil; he can write a better, more readable, rattling good narrative than most professional writers, and he has a fine sense of humor to boot. If you want a glimpse into the adventurous life of the average flea-bitten fossil hunter in the field, here it is. Fossil hunting in Patagonia is no sinecure for molly-coddles.—$3.20 postpaid.—*A. G. I.*

COMMERCIAL PROPERTY NEWS

Conducted by SYLVESTER J. LIDDY

De Forest Wins "Feed-Back" Patent Suit

AFTER years of litigation in various courts, Dr. Lee de Forest's claim to the invention of the "feed-back" and oscillating vacuum tube circuits has been upheld by the Supreme Court of the United States. This decision reverses that of the Circuit Court of Appeals and affirms that of the District Court in which the matter had previously been argued.

The suit in the Supreme Court was brought by Radio Corporation of America, American Telephone and Telegraph Company, and De Forest Radio Company, petitioners, against Radio Engineering Laboratories, Inc., respondent. The petitioners are assignees of patents 1507016 and 1507017, issued to de Forest in 1924; the respondent of patent 1113149.

The suit was brought for infringement of the de Forest patents, the respondent, defendant in the trial court, admitting infringement if the validity of the patents could be sustained, but maintaining that these patents are void in that they were issued to a patentee who was not the first inventor.

In the decision upholding the de Forest patents, adjudging Lee de Forest to be the first in this important vacuum tube work, the Supreme Court, after mentioning the development of the vacuum by Fleming and de Forest, made the following statements:

"Many experiments were made with a view to exploring its capacities and developing them. Among those interested and curious was Armstrong, then a very young man, a student in the school of electrical engineering at Columbia University. He conceived the idea about January, 1913, that through a hook-up or coupling of the output and the input circuit there would be a feed-back or regeneration of energy whereby the plate in the audion would become an independent generator of continuous oscillations. . . .

"It was a brilliant conception, but another creative mind, working independently, had developed it before in designs and apparatus till then unknown to the art. De Forest with his assistant Van Etten had been working during the summer of 1912 along two lines of thought. One was the use of the audion as a telephone repeater to amplify weak telephone currents and thus facilitate the transmission of long distance messages. The other was its development as a generator of alternating currents for any and all uses, some perhaps indefinite, that were capable of being served by oscillations thus produced. On August 6, 1912, a diagram showing a feed-back hook up of the input and output circuits is recorded in Van Etten's note book with a note that by the use of the coupling 'a beautiful clear tone' had been developed, which means that oscillations had been produced and that the oscillations were sustained. . . .

"Armstrong does not deny that all this was done just as stated by de Forest. Indeed the authenticity of the note book entries has never been disputed through the many phases of the controversy. What Armstrong does deny is that anything done or recorded in August, 1912, is an anticipation of his own invention. He says that the sustained oscillations generated at that time were of audio and not of radio frequency, and this, it seems, is admitted. He says there was then no perception or thought that the audion plate could be made to oscillate at radio as well as audible frequencies through a coupling of the circuits. This de Forest denies. He maintains, with the backing of other witnesses, that upon discovering the effect of the feed-back in generating sustained oscillations of the plate, he understood at once that by controlling the inductance or capacity in the oscillating circuit he could also control the frequency."

A petition for a rehearing of this case has been filed.

Corn Cure Trade Mark

IN *ex parte* Hygiene Products Corporation, First Assistant Commissioner Spencer held that the company, of Union City, New Jersey, is not entitled to register, under the Act of 1905, as a trade mark for corn, bunion, and callous plasters, the word "Relief."

The ground of the decision is that the mark is merely descriptive of the goods.

In his decision, after referring to the prohibition in section 5 of the 1905 Act against the registration of descriptive words, the First Assistant Commissioner said:

"In the case at bar, the term 'Relief,' although it may not be descriptive of the goods themselves, is believed to be clearly descriptive of the 'character or quality' of such goods. As pointed out by the Examiner: 'One suffering from corns seeks earnestly for relief. When he sees the hopeful word written across the face of applicant's bottle his only fear is that it *may not* be truly descriptive of the goods.' "

NRA and Monopolies

"PRICE fixing is, however, not the only evidence or weapon of monopoly. Control of natural resources, control of patents, control of credits—are examples of economic powers that may be exerted to crush small enterprises and subject the consumer to unreasonable prices. It should not be assumed that the NRA has a mandate or has the power to destroy monopolies and all monopolistic practices. It is our obligation not to permit or to foster monopolies by provisions written into Codes. But the NRA cannot rewrite the patent laws, or transfer control of natural resources, or direct the operations of the banks—in order to curtail the economic powers of big business institutions. Nor should we be expected to decline to consider codes presented by those truly representative of an industry because they possess economic powers which have been, or may be abused. If these are sanctioned by law, we cannot annul them. If they are held or used in violation of the anti-trust laws, their possessors obtain no immunity from prosecution merely by joining in a Code."—*From an address by Donald R. Richberg, General Counsel, NRA.*

Government Wins Case on Fruit-Washing Patent

A DECISION of great economic importance to fruit and vegetable growers of the United States was made recently by the United States Court of Customs and Patent Appeals when it awarded priority to Arthur M. Henry of the United States Department of Agriculture on a public service patent covering a process for removal of poisonous spray residues from fruits and vegetables. The decision comes after nearly seven years of litigation in which Ernest M. Brogden and Miles L. Trowbridge of California claimed prior invention of the process.

The process covered by the Henry patent consists essentially in the removal of spray residues containing such poisons as arsenic and lead by washing the fruit or vegetables with dilute alkali and acid solutions, followed by rinsing and drying. It takes the place of the old wiping methods.

Can Opener Misrepresented

EXAGGERATED sales representations are charged by the Federal Trade Commission in a complaint just issued against Scientific Products, Inc., of St. Louis, manufacturer of the "Nu-Way Magnetic Can Opener."

Using a purported picture of other companies' can openers in operation, this company, according to the complaint, advertised that "it has now been proved that ordinary can openers shave off sharp, jagged metal slivers that drop into the food contents." The picture also contained a magnifying glass showing what appeared to be particles of metal from cans opened with other companies' can openers. Under this picture appeared the statement "Actual unretouched microscopic photograph showing the many metal slivers shaved off by many ordinary can openers."

The Commission said the company's product does not prevent the falling of metal particles, "if any there be, into the food content of cans opened with said device." Representations of the alleged danger that may result from use of other can openers are "exaggerated in respect to the alleged danger or hazard. . . ."

Certain can openers made by the respondent's competitors are said to deposit smaller amounts of metal particles in the can than the "Nu-Way" itself.

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