SCIENTIFIC AMERICAN

September
1933

35c
a Copy

Sexual Abstinence

A Reply to a Former Article; The Other Side of the Question

By Ignatius W. Cox, S.J., Ph.D.

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50,000,000 MILES OF FLYING

By Robert Johnson

•

CHECKING UP ON THE SILKWORM

By Grace Lockhart

•

WELDING WITHOUT FLAME OR ARC

Volume
149

•

Number
3

Number, the Language of Science

By Tobias Dantzig, Ph.D., Prof. Univ. of Md.

Extremely few popular scientific books "make" a second edition but this one which was first published three years ago has met with an unexpected reception. The reason for this evidently lies in the fact that the content is unusual, peculiar, sometimes bizarre. It is the antithesis of the commonplace. If a reader has had high school mathematics he will be able to grasp its contents, and whether he likes or dislikes mathematics proper, the pure philosophical interest of the book will hold his attention and cause him to exclaim at least once per page, "Well, I never thought of that before."—$2.65 postpaid.

Modern Physics

By G. E. M. Jauncey, Prof. Phys., Wash. Univ.

This is a new textbook of modern (i.e., mainly atomic) physics by a former editor of the *Physical Review* and it presupposes full completion of a first course in college physics—also a knowledge of algebra, geometry, trigonometry and calculus. (It is true, this book also contains a special chapter on calculus, intended to bring those who lack it up to the required level, but only a reader with a tough will can expect to whip calculus when working alone.) The text space is about one third mathematical, is compact and concise, wastes no words, and covers a great deal of territory in that manner. It *is* as "modern" as its title suggests.—$4.20 postpaid.

The Expanding Universe

By Sir Arthur Eddington, Prof. Astron., Cambridge Univ.

Now comes another brilliant popular book by the noted author of "The Nature of the Physical World," himself one of the world's greatest scientists, covering all the most recent theories of the universe. Most persons of scientific turn of mind are keenly interested in keeping track of the current discussions of these great minds, and here is a real chance to "sit in," as it were, on the argument. What Eddington offers us is a chatty, intimate picture of developing cosmological theory. We actually see and follow the great thinkers feeling about in the dim light of present ignorance, hitting on this or that, rejecting it, searching further, testing, debating, wondering. It is not at all too heavy for the average intelligent lay reader, and will be sure of a wide and well-deserved distribution.—$2.15 postpaid.

The Principles of Optics

By Arthur C. Hardy, Assoc. Prof. Optics, M.I.T. *and* Fred H. Perrin, Dept. Physics, M.I.T.

Here *is* a book! Amateur telescope makers who aspire to know the general background in all-around optics will find it all, or very largely, right here in the 618 text pages of good solid meat of this remarkable treatise. In it there are 29 chapters, which we may divide into two groups. The first group of six chapters deals with optical theory and these will provide good hard plugging through 120 solid pages of basic stuff, but the worker who really whips them will then really "know something" about optics. This textbook is used by the authors in teaching optical engineering at the Massachusetts Institute of Technology and it contains a whole world of fact. It is not very mathematical—perhaps 25 percent so—and the mathematics used are only algebra, with a little "trig" and a very little calculus. $6.20 postpaid.

Hewitt's Handbook of Fly Fishing

By Edward R. Hewitt

One hundred and sixteen pages of trout fishing lore by an American past-master of the art. Clothing, wading equipment, rods, reels, lines, leaders, flies, all are described and their good and bad points detailed. Prices are quoted, and in some cases the reader is told where to buy. How to fish and what to do after you hook one is explained clearly—something that most fishing books overlook.—$1.40 postpaid.

Earth Oil

By Gustav Egloff, Ph.D., Dir. of Research, Universal Oil Prod. Co.

This is still another of the little Century of Progress books and it tells in most interesting fashion the fundamental facts about petroleum—how it is found, drilled for, stored, transported, refined and used; also the geology and theories of its origin.—$1.15 postpaid.

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EIGHTY-NINTH YEAR • ORSON D. MUNN, Editor

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SCIENTIFIC AMERICAN DIGEST

Of General Interest

Aviation

Chemistry in Industry

Health Science

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

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ACROSS THE EDITOR'S DESK

THE close alliance between aviation and SCIENTIFIC AMERICAN covers a period of almost a century. During that time we have reported and interpreted the significant events in the progress of man's conquest of the air, and in a small way have frequently contributed incentives for still further progress. In the Scientific American Digest, this issue, are announced the details of two recent model airplane meets at which SCIENTIFIC AMERICAN awards were presented; also, a trophy which will be awarded shortly to an airplane sports pilot who has shown the greatest ingenuity in improving his or her plane since it was purchased. Here is an opportunity for private plane owners to show that they are more than just pilots—to show that they are interested in furthering the science of flight—and at the same time to compete for worthwhile prizes. More details next month, together with a survey of SCIENTIFIC AMERICAN'S intimate contact with aviation since long before the historic flight of the Wrights at Kitty Hawk.

●

A practical question, which in one way or another touches the lives of perhaps the majority of us, concerns the inheritance of diseases. Take cancer, for example: If your mother or your father died of cancer, what are the chances that you will have it? Or tuberculosis, or goiter? How about syphilis? One often hears snap opinions on these matters, delivered by acquaintances and occasionally, too, by physicians who entertain ideas which are not altogether scientific. We have asked a leading man of science, working in this field of research—incidentally the leader in this particular field—to write an article answering these questions and this will appear next month. Readers of scientific turn of mind doubtless would like clearer ideas about these questions than the average layman possesses. This article gives them.

●

"Which eye do you use?" This question starts the fourth of our articles on amateur microscopy, to appear next month. Actually, this article is a continuation of the one appearing on pages 110-111 of this issue, and the two together form a part of a series, started in July, which will take the interested hobbyist through the entire range of microscope work, from simple fundamentals to the more advanced but also more absorbing operation of the instrument for various purposes. From the response which we have had to these articles to date, it is apparent that the microscope affords to many of our readers a pleasant and at the same time instructive way to pass leisure hours. If you have not been following our series, now is a good time to start. The articles have been written especially for the tyro, yet are sufficiently instructive and "meaty" to be worth perusal by anyone who has already started on the hobby.

●

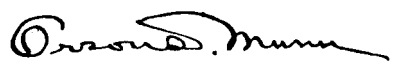
Of all the extraordinary powers granted to President Roosevelt by last spring's special session of Congress, the Tennessee Valley Authority Act of 1933 was the only one not largely attributable to prevailing world economic conditions. Under this Act, the President has exercised his authority to appoint a body of three members to develop the natural resources of the Tennessee River basin, including completion and operation of the Muscle Shoals Project. The ramifications of this body's proposed work are so varied and confusing, however, that it is felt that the details should be clarified. We have accordingly obtained from an engineer who is an authority on Muscle Shoals an article which outlines the history of the entire project and gives the details of proposed work. See next month's issue.

●

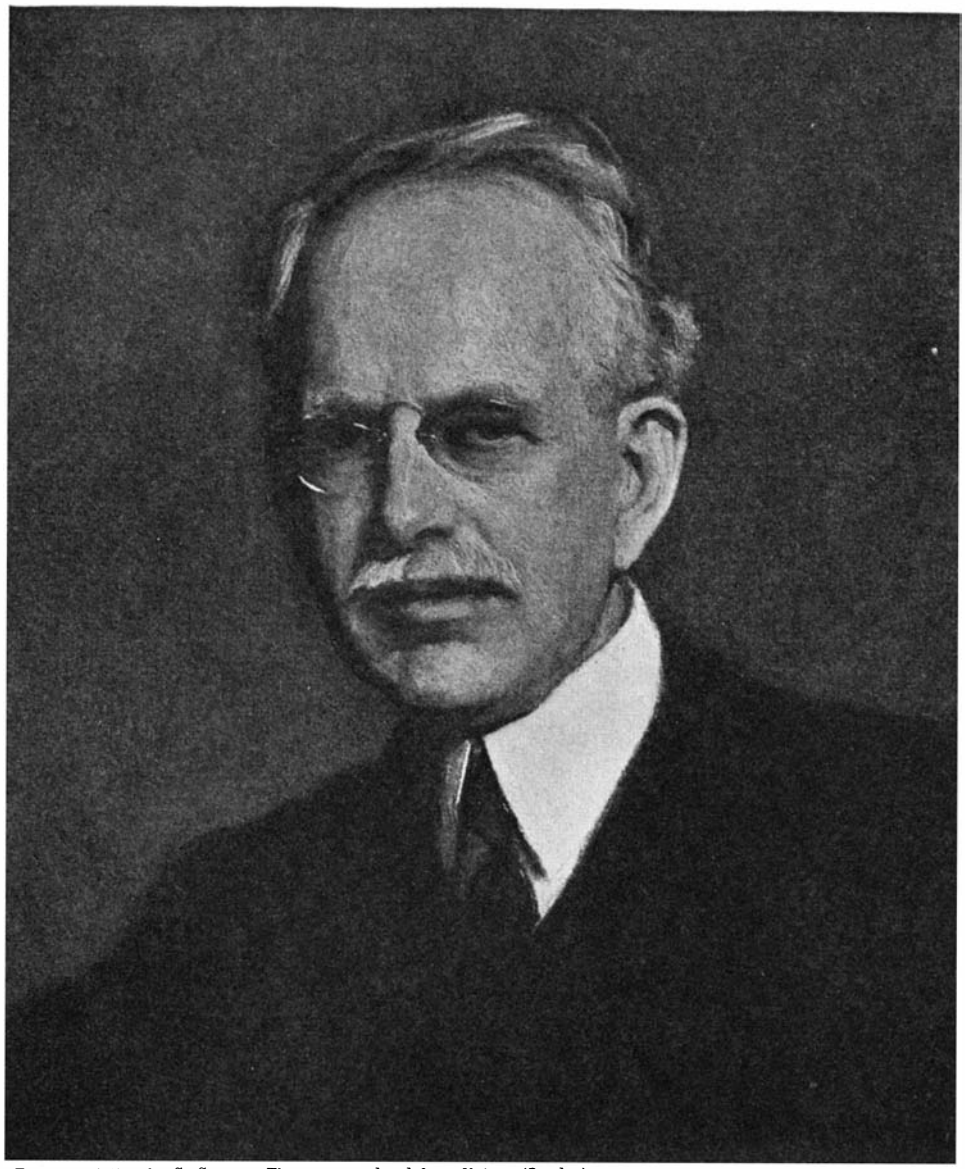
Those brilliant advertising displays collectively known to the general public as neon signs—have you ever given a thought to how they are made? There is a real story behind the glowing tubes and one of our editors has been delving into the subject and gathering the material upon which to base it. He has gone to the factories where these tubes are made and the signs fabricated, and has had taken a series of special photographs illustrating the more interesting phases of the work. Since an article of this kind requires much time for its preparation—checking and rechecking details, and getting every last fact correct—we cannot promise the article for next month, but it will be presented as soon as it is ready.

●

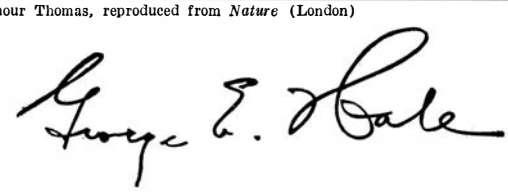
Reports on our second test of telepathy, details of which were published in June, are still coming in, but in many cases there appears to have been a misunderstanding or misinterpretation of the method by which the test is to be conducted. We are therefore publishing, on page 108, a short article which clarifies the seemingly obscure points, and are extending the time for completion of the work. We are desirous of obtaining, from this test, as wide a variety of data as possible, and take this opportunity to urge those of our readers who have not already done so to consult the June issue again, make the test, and forward the results to us.



Editor and Publisher



From a painting by S. Seymour Thomas, reproduced from *Nature* (London)

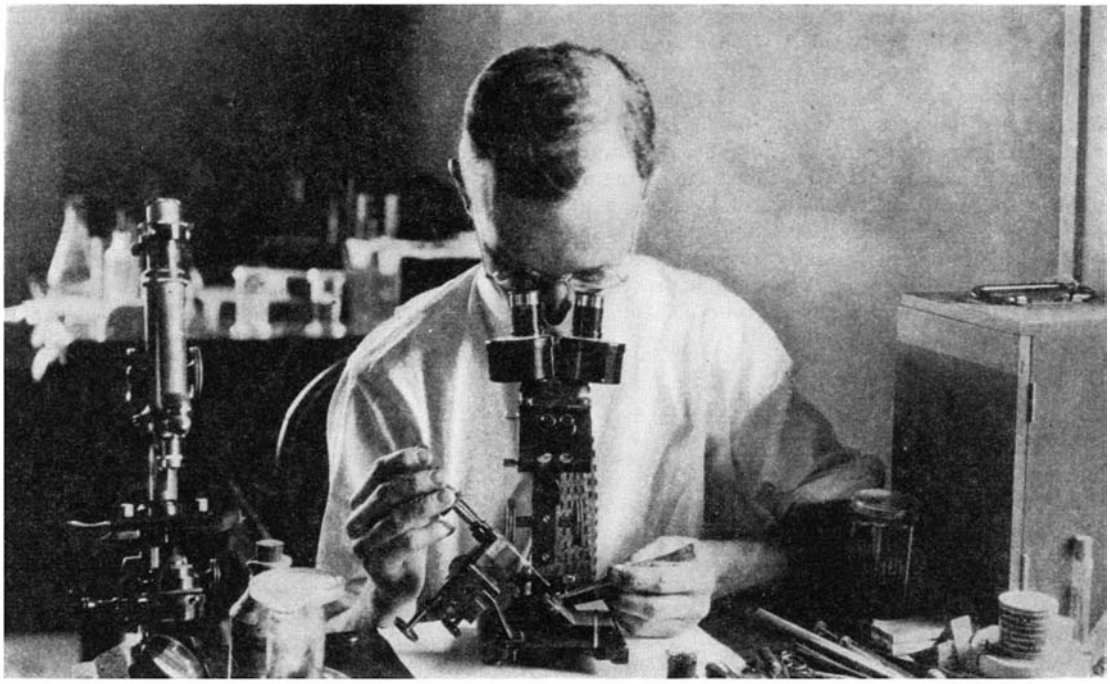


DR. GEORGE ELLERY HALE, Honorary Director of the Mount Wilson Observatory, near Pasadena, California, has done more to make astronomy the most rapidly advancing science of our times than any other man—not only as an astronomer in his own right but even more as a far-seeing organizer of large undertakings. Three great observatories—the Yerkes Observatory, the Mount Wilson Observatory, and the unnamed observatory which will center around the 200-inch telescope—are his creations. His special flair is for administration, combined with a first-hand, intimate knowledge of the research tools and activities administered—administration and coordination of the rare kind which makes possible the best, wholehearted efforts of others. At Mount Wilson he gathered around him the pick of the world's astronomers and kept them working together happily.

All through the years during which he was organizing and developing large astronomical observatories he was doing astronomical research of his own. If he never had headed an institution his position in science still would rest easily secure on his research on the sun. He proved that the sun is a magnet, and proved the existence of magnetic fields around the vortices in sunspots. Literature on solar research bears Hale's name in some connection on every page. Few major projects in astronomical research or institution planning fail to reach Dr. Hale for the last word.

GIANT SCULPTURES OF ANCIENT PERSIA

THE illustration above shows a pair of gigantic mutilated statues at the head of the grand staircase of the palace of Darius at Persepolis in Persia. It was up this staircase that the barbaric emperors, Darius and Xerxes, made their dramatic entrance to their palaces. Much interest was aroused by the recent discoveries at this ancient city, particularly as regards the fine sculpture. Dr. James H. Breasted has recently returned to Chicago after an airplane trip to the various sites which are being excavated by the Oriental Institute. Other photos on page 104.



W. J. Nolan at work in the Government's laboratory at Sunset, Maryland. Queen bee is bound to an operating block and inseminated from a fixed glass syringe of semen from *selected* drones. The syringe is accurately manipulated by slow motion screws. The right hand is operating the plunger

AFTER 10,000 YEARS—A NEW BEE!

By RUBY M. STRICKLAND

HAVE you ever stopped to think that the fine large domestic animals—horses, cattle, hogs, chickens and so on—with which we are all familiar are essentially not Nature's work but man's? Like our fruits and vegetables, our domestic stock was developed comparatively recently from what we should call today, if we could see them, only scrubs and runts. Breeders have accomplished this by artificial selection —controlled mating. But it never has been possible to control the mating of the honeybee, hence bees have remained bees until now.

What the breeder of domestic animals has dreamed of is a better bee—one, for example, with a longer tongue so that it might obtain nectar now unobtainable from deep flowers; a stronger bee that could carry heavier loads of honey and fly farther for them; a bee that was more disease-resistant and gentle. These qualities would have great economic value, for our honey crop is about 80,000,000 pounds per year.

A method doubtless destined to produce these qualities, the artificial insemination of the queens from man-selected drones by means of delicate instruments, has at last been found, and bees are already being inseminated by a few advanced breeders. Credit for making this advance practical goes mainly to Dr. Lloyd R. Watson, Director of Research at Alfred University. The Watson technique is described minutely in Technical Bulletin 326 of the United States Department of Agriculture, by W. J. Nolan of the Bureau of Entomology.

IN this day of constant mechanical change, the story of biological evolution becomes increasingly easy to understand. Yet there is one animal in which for 10,000 years there has been so little change either in physical characteristics or in habits as to be almost imperceptible. Thousands of years before the Great Pyramid was built beekeeping was an established occupation of man and the honeybee of those days was essentially the same bee as the Golden Italian, the German Brown, or the common Black bee of today. While the human race was still in its infancy the bee race had reached that same state of democratic, organized efficiency that it now enjoys.

But the principle of modern progress will not tolerate such a situation, and science has turned its attention to the static bee. To appreciate fully the difficulties encountered in a quest for a new and better bee, it might be well to look into a typical apiary, and observe the natural habits of the members of the insect commonwealth.

Here is a colony in which it has become apparent to the population that the queen is nearing the end of her usefulness as the mother of the race. But a motherless colony is a colony doomed! So, with that mysterious foresight characteristic of honeybees, the workers (who are also the rulers, constituting a "government of the people") have, through special feeding and care, raised up a princess. She is a superb specimen with all her rightful physical heritage, but lacking that mentality which the workers have won through forfeiting their motherhood. For three days since her release from the cell the new princess has wandered about the hive neglected and apparently unnoticed. Now, at last, she has heard a mysterious call and she soars out into the light.

For this very moment there have been tolerated about the hive some few hundred drones. They have been loitering about, too lazy even to feed themselves, but sallying forth into the heavens each noon in search of a bride. They have perhaps shared the same comb with the new princess, but not until she presses out into flight does it occur to them that she is the bride whom they seek. They give chase.

At the same time in neighboring bee cities other drones

are instantly aware that a young princess is seeking a mate and they too take to wing. Soon a veritable grey cloud of suitors stream after the fleeing princess. Human eyesight can follow that far, but no one has fathomed the secret of the mating itself, which takes place in flight. To the strongest and fleetest drone comes the prize. With him the princess weds and his reward is instant death.

We can witness the hesitating departure of the bride-elect and the tumultuous departure of her many suitors. We can see the dejected return of the disappointed lovers. But the return of the bridegroom is not ours to see, for he has met death and only in the triumphant return of the bride have we evidence of what has transpired.

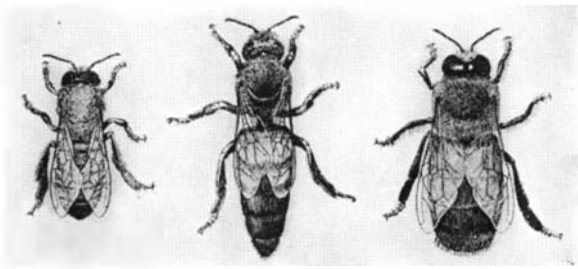
The wedding, which is also a coronation, is over. Back to the hive comes a sobered queen—already a widow, but a potential nation, for of this union will be born to her a million—perhaps two million daughters. Her few thousand sons will be the off-spring of mother alone.

These sons or drone bees are by far the minority citizens of the bee colony. At the same time, it is their numbers, rather than their lack of numbers, that has caused the problem resulting in this story. For every lone princess in the hive there are hundreds of drones desiring a mate. Because the princesses of their own colony are so scarce and so difficult of conquest these drones do a little courting in the vicinity of neighboring colonies. Neighboring drones are quite certain to invade *their* territory and the result is that no one knows just which colony in the neighborhood provides the mate for a certain queen. Not only may there be hundreds of colonies near by, but there may be half a dozen distinct races within the flight range of drone and queen. Therefore, pure breeding by natural means is just about impossible.

THE only redeeming feature is the fact that it is the swiftest and strongest drone who makes the conquest. Thus nature has, unaided, carried on for centuries a kind of selective breeding that has kept the honeybee on at least a level plane.

Man has not been satisfied with this method, however. Why should a beautiful Italian princess of pure strain mate with a drone of another race or perhaps with a hybrid, just because he happened to be the swiftest and strongest drone abroad on the eventful day of her wedding flight? In her own race there are drones who are strong and swift. Why should she not mate with one of them or at least with a selected drone of another race?

In other animal and plant life controlled mating has long been practiced and has resulted in such improved varieties as the hardy and productive Rhode Island Red hen, the seedless orange, the gorgeous chrysanthemum—once so scraggly and unattractive—not to mention the blight-resistant potato, rust-resistant wheat, and disease-resistant plants by the hundreds. Not only improved varieties have resulted from controlled mating but varieties



Left: **A worker honeybee.** ***Center:*** **A queen—mother of the race.** ***Right:*** **A drone—solely for mating**

so different from the original animal or plant that they might be mistaken for distinct species.

If this progress is possible in plant life and in other forms of animal life, why should not also the honeybee receive the helping hand of applied science? It would be poor judgment to belittle the prowess of the bee, but the room for improvement, even so, is vast. Although the bee accomplishes miracles of flight and labor, it is at best a tiny, frail creature. In a life-time one bee produces not more than one fourth of a teaspoonful of honey. Therefore, think what even the slightest increase in wing power and in carrying capacity would mean in the total volume of honey produced!

There is more nectar available every year than the present bees could gather in ten. In each section of the country this abundant flow of nectar is concentrated within a short period of time. Other nectars are available throughout the season, but only in sufficient quantities to feed the bees. In the tulip-tree or tulip-poplar section, for example, there is no other large source of nectar, and yet tons of potential tulip-tree honey are never gathered. The tulip-tree flow lasts only about two weeks. Local bees will not work in bad weather or even cloudy weather. If dark days and the tulip-tree flow coincide, there is no honey crop.

Now, from a study of bees of different races it seems that some races rise earlier than others and work faster and under more adverse conditions. This superiority, however, may be offset by some bad habits. Think what it would mean in increased crops from the tulip-tree section alone if the desirable characteristics could be bred into the local bee!

Even that gain would be insignificant, however, compared with the economic advantage of a superior bee for pollination purposes.

Agriculturists realize that the honeybee is the most valuable pollinating agent existent and that a good pollinating agent is the most important factor in insuring good crops where cross fertilization is necessary, particularly in orchard and seed crops. A good example of what the honeybee can do for the orchardist is found in the recent experience of Albert McClay, a commercial orchardist of Illinois. McClay has 1700 acres in apples. By distributing 450 colonies of bees through his orchard during blossoming time, McClay doubled his crop of apples over the preceding year, even though it was a poor year for apples and his two neighbors had only half a crop.

Another experiment with bees as an aid to fruit growers was conducted by the New Jersey Agricultural Experiment Station, with really startling results. They enclosed in a wire cage a Jonathan and a Wealthy apple tree and a hive of bees. In another cage a Jonathan and a Wealthy tree were enclosed without any bees. The result showed that in the cage with the honeybees there developed 40½ times as many Jonathan apples and 55 times as many Wealthy apples as developed in the second cage without benefit of honeybees.

These are only two examples from recent literature, which is replete with similar instances.

But the present honeybee is not plentiful enough or well enough distributed at pollination time to handle the job thoroughly. In northern climates the cold winters deplete the membership of a colony. In all climates disease plays havoc with their numbers. The swarming fever causes bees to divide and subdivide their ranks precisely when strength of numbers is most needed, and this habit is so strong in all races of bees that only watchful and intelligent management will curb it. Also, the bee has an eye to the weather at pollination time as well as at any other.

IT may be that all these weaknesses and many others could be remedied through controlled mating. For many years man has bent his best efforts to accomplish that, but the very nature of the honeybee's mating has made success only a gamble.

One method most persistently experimented with has been the use of mating tents or enclosures within which the desired queen and drone have been permitted to fly. Larger and still larger enclosures have been constructed, but

they have never been large enough and the experiments have failed.

Finally bee breeders have fallen back upon the plan of raising an excess of drones of the desired stock, trusting that their very superiority of numbers will make pure matings probable. Others have established isolated mating stations from the vicinity of which all bees other than those of the desired race are banished. The queen-breeding business is based on these two methods, and it has become a business of proportions.

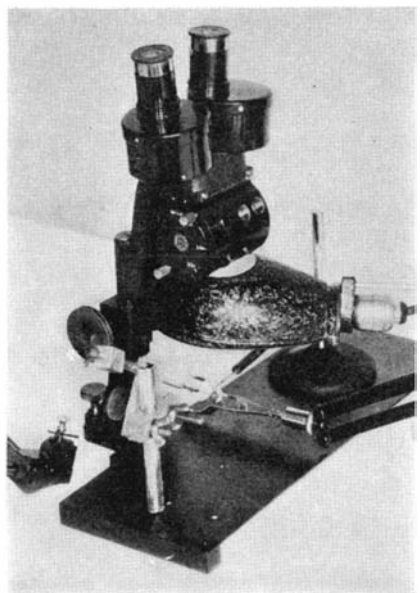
Always there is present, however, that element of doubt. Did this queen who has returned to the hive, ready for her task of raising up a nation, mate with a drone from the mating station, or, in spite of precautions, did a strange drone cross over into that territory?

Of course there is a limit to the distance a bee can fly. It would seem that success would be absolutely certain if mating stations were located well beyond the flight range of outside bees, but workers have been known to make a round trip of 20 miles for nectar. A 10-mile radius means over 300 square miles of countryside. Who can say for a certainty that there are no stray bees within a particular territory of that size? One single swarm hidden away in a giant oak could supply enough drones to make every mating a matter of conjecture.

In some European countries, where mating stations have become a part of beekeeping practice, success has probably been above average. There, queen-breeders have been able to find isolated spots well fortified on all sides by barriers insurmountable to the honeybee. In those spots, to which outside bees cannot penetrate and which inside bees cannot leave, breeding experiments have been practiced. Switzerland, whose high mountain barriers create numerous secluded localities, has perhaps achieved the greatest success with this method.

BUT even in Switzerland it has not been possible to mate queens with individual selected drones. To accomplish that, drones and queens would have to be kept caged and only one drone and one queen released at a time. With all the hazards that accompany the mating flight—sudden storms, the presence of birds and insects that prey upon bees, not to mention the mere disinclination of a certain drone to pursue a particular queen or his physical inability to overtake her—it is doubtful whether one mating would be accomplished out of a thousand attempts. With tens of thousands of colonies needing requeening every year, the expense alone of this method would make it prohibitive.

In America, with its wide spaces, the situation is even more difficult. One attempt after another has been abandoned because of failure or expense. In 1883, D. A. Jones, a well-known beekeeper of Beeton, Ontario, established three distinct apiaries on three different islands in Georgian Bay. On these islands he placed, respectively, Cyprian, Syrian, and Palestine bees, his aim being to raise each variety as pure as possible. He even named the islands after their bee inhabitants, but the venture failed because of the expense.



Nolan's multiple set-up for operating on six queen bees at one time

However, the research worker never gives up. He attempts what appears to be impossible, and eventually succeeds. After perhaps a hundred years of experimentation in various parts of the world there has issued from the laboratory a method of artificially mating queen bees. Dr. L. R. Watson was the first to demonstrate the practicability of using instruments for artificially mating queen bees. He demonstrated the method publicly for the first time before a special committee at Cornell University, in October, 1926. Today it is being carefully tested by scientists in the United States Department of Agriculture. At the same time Government scientists are also testing a hand method which has been in the process of development for some years by Quinn and Laidlaw. The objectives of both methods are identical. Also, for either method the work is accomplished entirely within the laboratory walls. All the romance of the mating flight is lost.

A virgin queen and a sturdy drone who fulfill certain requirements as to size and temperament are selected to mate. If the hand-method is used, the scientist-operator brings into play only a delicate skill and a watchful eye unsurpassed in almost any other laboratory operation. If the instrumental method is employed, the scientist becomes a surgeon and the spotless laboratory takes on the appearance of an operating room. There on a miniature operating table under a binocular microscope the queen is gently fastened by means of tiny equipment designed especially for that purpose. Under the glow of the microscope lamp the drone forfeits his life and the queen is inseminated by means of a micro-syringe, a micro-manipulator, and other especially constructed scientific equipment.

And the few scattered scientists who are working on the method, perfecting and simplifying it, are aware of the trust that has been imposed in them. Whatever the technique they follow, to them their work is a ritual and they are confident of only one result. After Nature has failed for thousands of years, the laboratory with its delicately tuned scientific instruments will produce a superior bee.

WHAT that superior bee may eventually mean to the world is certainly worthy of contemplation.

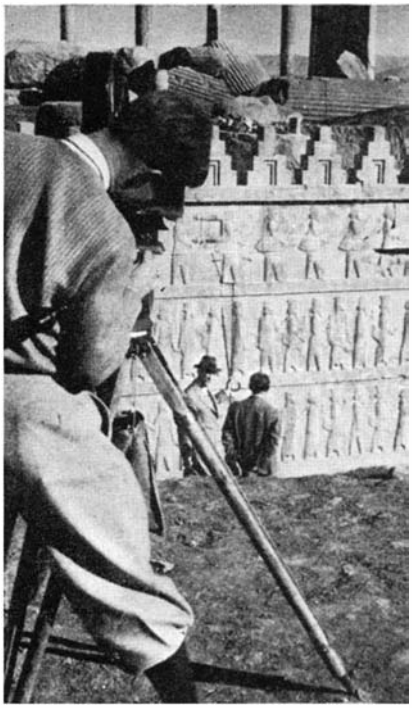
Think what it would mean to the comfort of beekeepers (and their neighbors) if the gentleness of Carniolans could, for example, be bred in the Cyprians, who are good honey gatherers and vigorous defenders.

Think what it would mean to our desert country if the Saharan bee, which has good strength of wing and sense of smell and can stand extremes of temperature, could be introduced and its tendency to be fidgety bred out through uniting it with a more dependable though less hardy race, such as the Brown European. Perhaps there are desert flowers and crops which could grow in abundance if there were available honeybees that could pollinate them, but what American beekeeper would want to bother with the present Saharan race, whose queen is always hard to find and whose workers will join every passing swarm?

Perhaps a bee hardy enough to survive the most severe winter in sufficient numbers to take full advantage of the first honey flow is possible. Of a certainty more and cheaper honey would result, making the most healthful sweet known available to all.

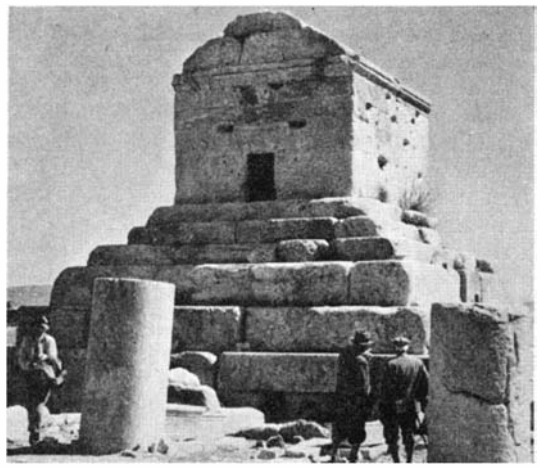
Not only should it be possible to have bees on hand in ample numbers and of the proper temperaments to do a thorough job of pollinating, but it is entirely likely that a honeybee with a longer tongue can be produced to save the red clover crop now threatened with extinction because of the diminishing of its bumblebee pollinators.

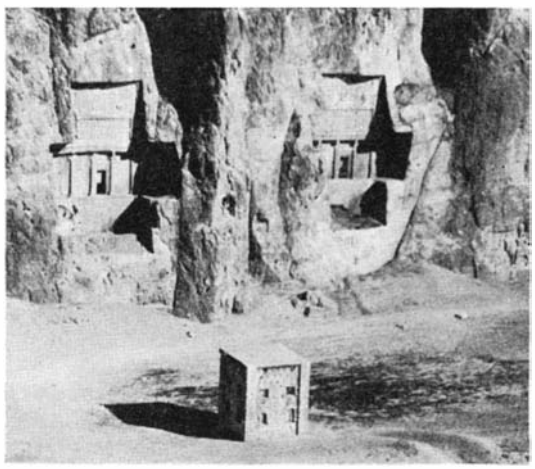
In short, as honey and clover are alike dependent upon the industry of this tireless little insect, the new bee, which is to come from the coordination of laboratory and nature, may result in a land flowing with honey.



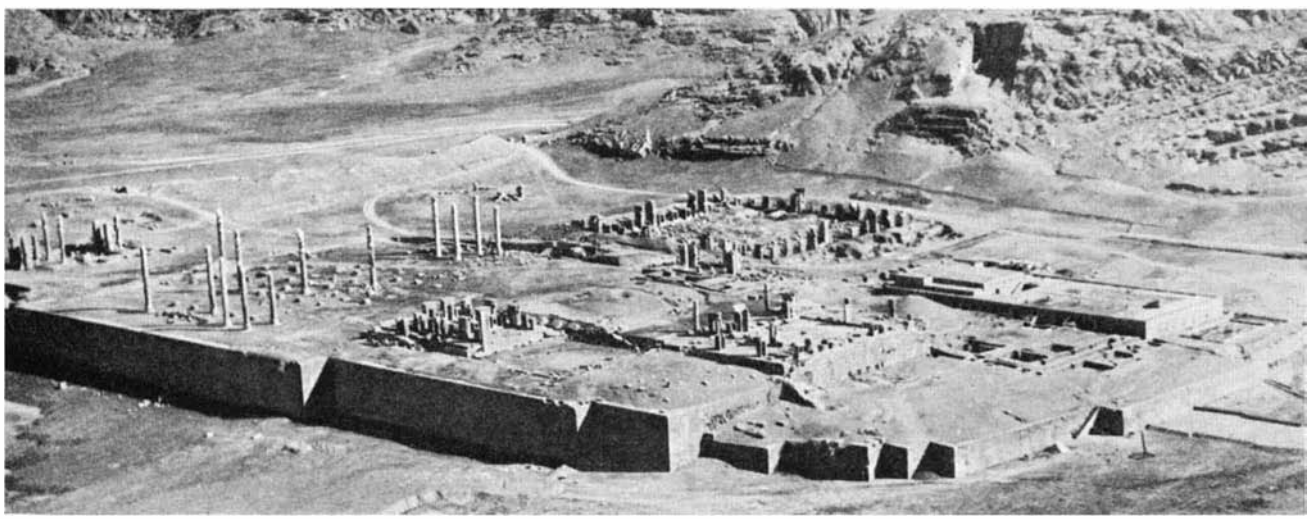
The Oriental Institute cinematographer making a motion picture record of the Persian Expedition's recent discovery of the sculptured wall reliefs which were laid bare when a trench was dug back of the terrace of the royal audience hall

Right: Tomb of Cyrus the Great, founder of the Persian Empire, is very well preserved. He fell in battle in 528 B. C. and was buried in this magnificent tomb at Pasargadae, not far from Persepolis. Dr. Breasted, with cane, is on the right, with Professor Ernst E. Herzfeld, Field Director of the Persian expedition's work





Left: Tombs of Darius II and Artaxerxes are in the rock; in the foreground is a tomb of unknown origin, but attributed by local legend to Zoroaster who lived as early as 1000 B. C. These royal tombs are about six miles from Persepolis and were cut out of the mountain overlooking a plain which is more than a mile above sea level. This picture was taken from the Oriental Institute's specially chartered airplane



In this air photo can be seen almost the entire terrace of Persepolis, located high on a plateau among the Persian mountains

Latest Photographs from Persepolis

WITH the aid of the airplane, Dr. James H. Breasted, Director of the Oriental Institute, has secured a series of remarkable pictures at Persepolis which give some idea of the imposing nature of the structures erected on a terrace which measures 1000 by 1600 feet. The terrace is often 50 feet high and is built of blocks of stone which frequently weigh 40 tons or more. The cluster of columns in the center, in the large photo directly above, is nearly 70 feet high and supported the roof of the *apadana* or royal audience hall. In the foreground, adjacent to the audience hall, is the winter palace of Darius the Great, and the remnant of the palace of Xerxes; at the extreme right is the harem building of both emperors. Further information as to the work of the Oriental Institute, at this and other sites, will be found in SCIENTIFIC AMERICAN for October, 1932, and April, 1933. The beauty of the scene can be realized when it is stated that the site of Persepolis is on a lofty plateau high among the Persian mountains, commanding an extensive view. Persepolis early passed into oblivion from which it is only now emerging, thanks to up-to-date methods of transportation.

OUR POINT OF VIEW

Who Can Say?

TELEVISION is not the only thing which may profit by the new Zworykin-R. C. A.-Victor discovery described on page 117 of the present number. It may also affect telescopes and astronomy.

All along, as optical telescopes of greater and greater size have been built for astronomers, a few dreamers have harbored in the back of their mind the idea and hope that they would some day find a practical way to amplify an optical image—say of a star or a planet—much as we now amplify radio signals. It will be recalled that we take exceedingly faint electrical pulses that come down our radio aerial and, by means of the magic vacuum tube, we cause them to release much stronger currents from our own local supplies, in such a way that the new and stronger current reproduces all the characteristics—tiny variations—of the incoming current, but "writ large." We again amplify the end-product in the same way, and the end-product of that—all in a chain that amplifies millions of times overall, giving us finally a current strong enough to affect mechanical apparatus—a loud-speaker.

Now, the dreamers have said, why not find a way to do much the same thing with light? Take the faint image of a star, add to it some stronger light of our own, controlled faithfully of course by the star's light, amplify it enough times to illuminate the image very strongly and then you can magnify it—a thing you can't do very well by existing optical methods because there isn't enough light to see it by when you do.

"The plan is fine," answers the astronomer, "and the only thing you dreamers appear to lack for its success is the way to do it!"

The dreamer sets to work, digs into optics, studies the theory of resolving power (a fool if he thinks he can hope to get by without this) and pretty soon finds that he is also studying the principles of television; that is, he finds that the facts which underlie television are the same facts which underlie the amplification of an optical image. To approach the one he must study the other. He learns that he must find some kind of screen, or mosaic, broken up into units or elements about 1/100,000-inch square—about the fineness of the pattern given by light waves—or 10,000,000,000 units per square inch. Only then can he guarantee the integrity of an optical image according to the astronomer's exacting criteria and positive requirements.

Well, there you have it: The dreamer, previous to the Zworykin advance, found his inspiration in the existing state of television and he discovered that the only tool then available had about 2500 picture elements to the square inch. Zworykin now puts 62,000 elements on a square inch for television; while the astronomers need 10,000,000,000. The second is about 50 times better than the first, but the third is 100,000 times better than the second.

Still, we are on the way. Who knows? Some day we may get there. When we do, our best and biggest telescopes will be junk—just junk.

But they are pretty safe at present, we suspect!

Streamlined Automobiles

REPORTS from the automobile industry are most optimistic. Sales are mounting and production can hardly keep pace with the demand, due not to the manufacturers' inability to produce cars fast enough but to the difficulty of obtaining raw materials in sufficient quantities. The stepped-up demand for cars is putting thousands of people to work in the industry and in other lines that supply its needs. Such activity portends a bright future for the country, as it is believed that millions of cars now rattling over our roads will soon be junked and new ones will take their places.

What are the manufacturers doing about it? Their research staffs have been badly cut for the sake of economy during the depression. Have these smaller staffs been able to produce any radical new developments for cars for 1934? Have they made any real progress or will they be able to do so, before those new cars are announced, by speedily augmenting their forces? Car users in recent years have become accustomed to rapid automotive advances and will be dissatisfied if they are not forthcoming in the new cars. Higher speeds, more efficient engines, improved brakes and transmissions and tires, better starting and acceleration—these are the achievements that have made America a nation of car owners. The advance in fuel economy has not, however, kept the pace.

Streamlining of car bodies seems now to be the one remaining important step that must inevitably be taken in car design. This is so because, in the words of Professor W. E. Lay, of the University of Michigan, ". . . we are now driving motor vehicles at a speed at which most of the engine power is used to overcome air resistance, the greater part of which is unnecessary and can be eliminated by correct shaping of the vehicle body to this end." This is according to the simple law that to move an object slowly through the air requires little effort while to move it swiftly may require great power. It appears that we pay dearly for the higher speeds of our cars; the enormous power required to overcome air resistance alone comes directly from the gasoline tank.

Professor Lay, among others, has made an intensive study of the aerodynamics of the motor car and has discovered some amazing things. He found that the air resistance of some older touring cars was about equal to that of a flat plate of the same cross-sectional area pushed broadside against the air stream. (Some of the newer models have been streamlined sufficiently to decrease this resistance slightly.) He found that smoothing of the under surface of the car (experimentally by means of canvas stretched tightly from front to rear bumpers) increased the speed of the car to an extent that indicated a decrease in air resistance of 5.8 percent. Building models with various front and rear streamlined profiles, he concluded that the following things should be done:

(1) Remove all barnacles or windclaws from the car. If they can not be removed, build the body out to enclose them. (2) Replace all sharp edges and corners with round edges and corners of generous radii. (3) Build the front of the vehicle to bore a hole through the air with the least possible disturbance of the surrounding air. (4) Build the rear of the body to lay the air back in place without eddies or turbulence.

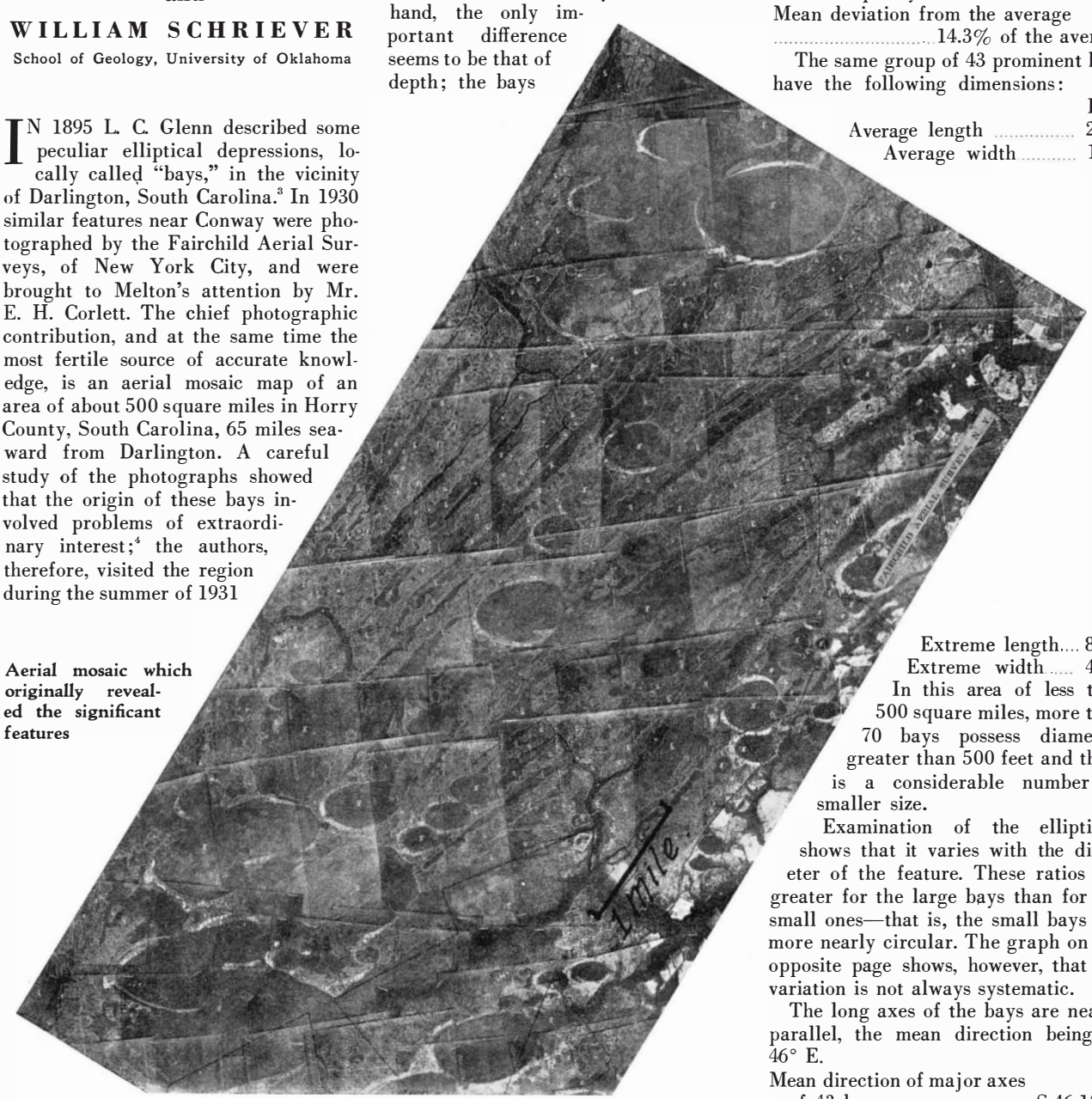
He states further: "The shape of the ideal streamline form naturally provides space for housing the engine at the rear. The public is becoming streamline conscious and will welcome these changes at a more rapid rate than ever before. At this time it is particularly keen to accept changes which reduce operating costs."

It is to be hoped that automobile manufacturers have already studied the data that have been accumulated and will earnestly consider Professor Lay's conclusions. It may mean their salvation; it certainly will help the country.

The Carolina Bays—Are They Meteor Craters?—I[1]

By
F. A. MELTON
and
WILLIAM SCHRIEVER
School of Geology, University of Oklahoma

IN 1895 L. C. Glenn described some peculiar elliptical depressions, locally called "bays," in the vicinity of Darlington, South Carolina.[3] In 1930 similar features near Conway were photographed by the Fairchild Aerial Surveys, of New York City, and were brought to Melton's attention by Mr. E. H. Corlett. The chief photographic contribution, and at the same time the most fertile source of accurate knowledge, is an aerial mosaic map of an area of about 500 square miles in Horry County, South Carolina, 65 miles seaward from Darlington. A careful study of the photographs showed that the origin of these bays involved problems of extraordinary interest;[4] the authors, therefore, visited the region during the summer of 1931 in order to confirm their deductions and to make additional observations beyond the area of the mosaic.



Aerial mosaic which originally revealed the significant features

It was discovered that the typical bays near Conway differ somewhat from those described by Glenn, but apparently only in non-essentials. In most respects they are identical. The conspicuous similarities include such features as the elliptical plan and a peculiar elevated rim of light, sandy soil which is almost invariably present at the southeastern end of each bay. On the other hand, the only important difference seems to be that of depth; the bays frequently occur near Darlington as pronounced topographic basins, while nearer the ocean the depressions have been filled largely by the development of peat bogs.

The ellipticity[5] of each of 43 conspicuous bays near Conway was determined by careful measurement of the photographs. The range of values is given in the tabulation below:

Average ellipticity	0.336
Greatest ellipticity	0.454
Least ellipticity	0.174
Mean deviation from the average	14.3% of the average

The same group of 43 prominent bays have the following dimensions:

	Feet
Average length	2210
Average width	1430
Extreme length	8090
Extreme width	4410

In this area of less than 500 square miles, more than 70 bays possess diameters greater than 500 feet and there is a considerable number of smaller size.

Examination of the ellipticity shows that it varies with the diameter of the feature. These ratios are greater for the large bays than for the small ones—that is, the small bays are more nearly circular. The graph on the opposite page shows, however, that the variation is not always systematic.

The long axes of the bays are nearly parallel, the mean direction being S. 46° E.

Mean direction of major axes of 43 bays	S.46.1° E.
Modal direction of major axes of 43 bays	S.45.0° E.
Median direction of major axes of 43 bays	S.47.0° E.

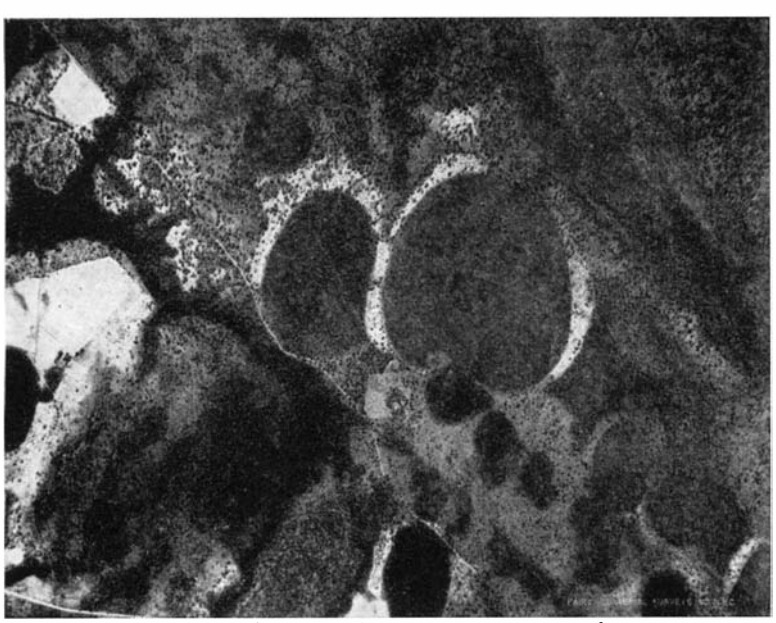
The average of the deviations from the mean direction is 3.08 degrees. Since the allowable error in determining the long axis of a bay is greater than this amount it is apparent that the degree

LAST winter the two authors presented at the meeting of the American Association for the Advancement of Science evidence for regarding certain large earth scars in South Carolina as meteor craters, and later published the same evidence in the *Journal of Geology*, a special periodical for the professional geologist. We intended then to reprint the same article but certain attacks on the meteoric origin theory caused us to delay. (Better delayed than sorry.) Subsequently other geologists, notably Longwell of Yale, have sided with the authors and their theory has now survived very healthily, though the matter cannot even yet be regarded as finally settled.

The astronomer Olivier, a noted authority on meteors, says that if the craters are meteoric in origin they must have been made by a vastly larger comet than the one which made the Meteor Crater in Arizona. —*The Editor.*

of parallelism exhibited is striking.

The elevated rim of light-colored soil is an almost universal feature. Its absence in certain places can easily be explained. While it is usually present only at the southeastern end, there are a few instances in which a bay is completely



Two intersecting bays, signifying non-simultaneous formation

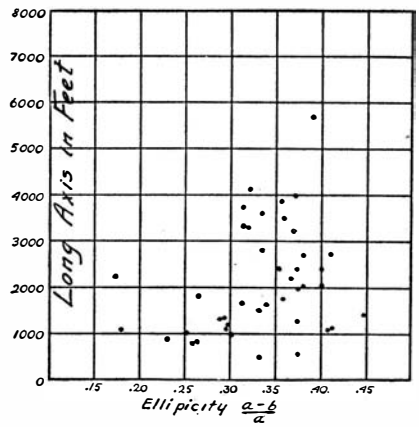
encircled by it. In such cases, however, the elevation is invariably larger at the southeast than elsewhere. Double and triple rims are not uncommon. They are arranged concentrically about the central depression and conform to the systematic relationship just stated; that is, they predominate at the southeastern end.

The rims possess very gentle slopes. A typical one near Conway, rising five feet above the surrounding surface, has a width of 250 feet at the base.

In the region shown in the mosaic, and at many other places near the ocean, the bays are being filled slowly with decayed vegetation and peat. It seems probable, in view of the antiquity of these features, that prior to the development of the peat bogs the bays already had been filled to a considerable extent by the deposition of sand and silt, a process which doubtless occurred while the region was covered by the sea during the terrace-forming marine invasion of the Pleistocene period. This aggradation, also, may have been accomplished in part by subaerial forces operating on the coastal plain prior to the invasion.

Glenn[6] has presented data regarding the depth at which sand was encountered in wells drilled near the center of some of the depressions. He discovered that clean, white sand and water existed beneath some 20 feet of dark, clay soil. Though comparable data for the area photographed are not yet available, Glenn's information is not discordant with results the authors obtained by using a soil auger. It is estimated that depressions which are between one-quarter and one-half mile in diameter, after removal of the peat and carbonaceous soil, would be 25 to 50 feet in depth.

The mutual intersection of some of the bays implies that their origins were not simultaneous. Where the interference is of such a nature that one is somewhat obscured by another, the bay preserving its entire elliptical outline may be of either large or small size. Examples of both relationships may be seen. Though it is not a common occurrence, small depressions are occasionally found within larger ones; between



Graph of the various ellipticities plotted as a function of lengths

them, however, the small features occur in considerable numbers. These relationships are to be expected if the depressions, once deeper than they are at present, have been partially filled by sediment. In this way small features within the large bays may have been totally covered and obscured. Regardless of the origin of the depressions, such conditions, having been observed on the mosaic and verified in the field, may be considered as evidence that the process of filling has taken place.

IN the area covered by the photographs the bays were once beneath the sea. Proof of this statement is found in the fact that beach ridges of an old shore intersect and obscure several of the depressions. These ridges mark the successive positions of a beach which, according to Mr. W. C. Cooke,[7] of the United States Geological Survey, belongs to the Pamlico or Satilla terrace and is probably late Wisconsin in age. Not only have the depressions been obscured and their rims partially removed by wave and current action, but there are a few features visible on the mosaic to be explained only as basins which have been completely filled and buried by the beach material along this old shore. In the entire region the number of bays which have thus been buried probably is to be counted in hundreds.

(*To Be Concluded*)

Reprinted by courtesy of the *Journal of Geology*, the University of Chicago Press, and the authors.

[2]The authors are grateful to the Myrtle Beach Estates and to the Fairchild Aerial Surveys for the privilege of reproducing the photographs used as illustrations in this paper; they are indebted to the "Research" Committee of the University of Oklahoma for financial assistance.

[3]L. C. Glenn, "Some Darlington, South Carolina, Bays," *Science*, Vol. XI, pp. 472-75.

[4]Any undrained depression which contains water throughout most of the year is locally designated by the term "bay." In view, however, of the unusual nature of the hypothesis herein presented, the authors prefer to use this word temporarily for the type of basin under discussion in spite of the ambiguity involved. At some future time, if it seems desirable, the more logical appellation "scar" may be applied, or another name may be assigned *de novo* to these unique features.

[5]Ellipticity: The ratio $\frac{\text{long axis minus short axis}}{\text{long axis}}$

[6]*Op. cit.*, p. 473.

[7]Personal communication.

A Request for Data on Apparitions

READERS of the *Scientific American* who have been present while dying persons, otherwise seeming to be sane and rational, have by speech or other tokens given evidence of seeing apparitions, and readers who know persons who have been present at such scenes, will confer a great favor on the undersigned by writing out in full detail and sending him accounts of the incidents, or persuading others to do the same. These are wanted for comparative study. State clearly whether the apparitions were or were not recognized, and, if they were, whether they were of the living or of the dead, and how related to the dying person.

Also, it is desired to obtain accounts of such experiences of dying persons by other tests judged to have been in a state of delirium, as by being unable to hold rational conversation or to recognize their relatives present. It now appears that there is a radical difference between the apparitional experiences of rational and delirious persons *in extremis,* but the matter has not been sufficiently tested.

Whatever may be printed as a result of the returns, in the *Scientific American* or elsewhere, will contain no names or identifying particulars, unless there is express permission given.

The subject is of much more scientific interest and importance than appears on the surface.

Walter Franklin Prince, Research Officer,
Boston Society for Psychic Research,
719 Boylston Street, Boston, Mass.

Further Details Concerning

Our Second Test of Telepathy

MANY of our readers who have cooperated with us in our second telepathy test appear to have missed one of the main points in conducting the experiment, and therefore vitiated to a great extent the value of their results. In the complete instructions for the conduct of this test, published in our June issue, we stressed the following point: "(5) The agent writes on his sheet the name of some familiar object which he can clearly visualize in his attempt to send his thought to the percipient. . . ."

This part of the instructions was carefully worked out in order to provide simple, straightforward material with which to work, and to avoid complications which would have arisen if, for example, the test were conducted by writing *any word* that happened to come to the agent's mind. By using familiar objects, the agent has in mind not only the word which he has written, but also a vivid mental picture of the object named, and, in this manner, the "power of telepathy," if such there be, is given ample opportunity to function.

WHEN conducting this test, the agent greatly handicaps not only himself and the percipient, but also renders his work less valuable to the research in telepathy if he writes such a word as "eagle" and attempts to send the thought. He is visualizing a bird, and the test might be considered as partially successful if the percipient wrote "bird" as the result of the transmission. But if in the first place the agent had written "bird" and visualized an eagle, the chances for success would probably have been greater. We can not see how the percipient could receive the mental picture of "bootlegger," "your life's ambition," "pain," and some of the other words and phrases that have been used.

In order that the best interests of psychology may be served, it is necessary that telepathy tests be conducted on a large scale and that the data amassed cover a wide area. It was with this thought in mind that SCIENTIFIC AMERICAN began its investigation of the subject. If a great number of our readers will conduct the experiments and submit their results for analysis it will mean that another chapter in the study of telepathy may be written.

If you have not already done so, look up the June number and read carefully the article that appears on page 324. Then, together with another person who is seriously interested in science, try the experiment outlined there. Send your results, regardless of how successful they may appear to you, to the Editor, and you will have done your share to extend the sum total of knowledge of telepathic communication.

Can YOU Prepare a Telepathy Test?

IN the near future we expect to publish a third test for telepathy, to continue with the series started in our March and June issues. In searching for what appeared to be the best and most all-inclusive test it occurred to us that our readers might be willing to help with their ideas. We are therefore inviting you to plan a test for telepathy that will meet the requirements of this particular type of research. There is no award offered, other than that we will pay our regular space rates for any manuscript that we publish. If you want your test plan returned after we have made our selection, be sure to inclose postage.

Here are the points that must be kept in mind when planning a test for telepathy to be published in a periodical: The rules must be relatively few and simple. Little or no equipment should be required; that which is necessary must be of the sort that would be found around the home. Recording of results must be simple, speedy, and offer no temptation to alteration. No test should be planned that will require too much time at any one sitting, or that will impose a mental or physical strain on the participants.

With these points in mind, reread at least the telepathy test articles in March and June, and preferably the articles on telepathy in every issue since March, 1933 and in March, 1932. Then go to work. When you have finished your plan, mail it to the Editor, *Scientific American,* 24 West 40th Street, New York City.

Is Sexual Abstinence Harmful?

By IGNATIUS W. COX, S.J., Ph.D.
Professor of Ethics at Fordham University

A Reply to An Article in the May Number

I PROMISED to answer in the columns of Scientific American H. M. Parshley's article on "Sexual Abstinence as a Biological Question." In it he claims that it is a deliverance of science that, "With the exception of a few abnormal individuals, all men and women require expression of the sex impulse as a physiological necessity"; and again, "its complete repression is impossible and any prolonged effort to repress it results in physiological injury and psychological disturbance." On this basis he attacks the current and accepted morality of sex as founded on "the purely social forces of tradition" and closes his article with a principle which basically leads to free love: "Sexual intercourse between people who love each other is necessary for physical and mental health. This alone can fully satisfy at once the biological demands of our primate bodies and the psychological requirements of our human minds."

This thesis Professor Parshley tries to sustain, first by an attempt to establish a complete similitude between the sex life of man and that "of other mammals"; secondly, by an appeal to authority. In order to gain scientific light on this dual approach of Professor Parshley to his thesis, I sent out, or had sent out, inquiries to medical doctors, psychiatrists, specialists in mental hygiene, and biologists. Besides I have had the books of authoritative writers combed for any matter that might throw light on this question. Though I have not yet received complete returns from all my lines of search, still I have collected an ample amount of material to show that, whatever may be the subjective "beliefs" of Professor Parshley, they are not founded on science, and that his attempt to identify such beliefs with science is naïve but unscientific.

FIRST, with regard to the basic similitude which Professor Parshley traces between the sex life of man and that of other mammals, with the drawn conclusion that man ought to model his own sex life on what he observes in the sex life of exclusively irrational mammals: There is a book, published by the Williams and Wilkins Co., entitled, "Sex and Internal Secretions." This book, edited by Edgar Allen of the University of Missouri, and published in 1932, is the result of ten years of research work on the subjects contained. Chapter VI, on "Sexual Drive," was written by Calvin P. Stone. Here is the way he demolishes the similitude that Professor Parshley tries to establish between the sex life of man and animals. "As a rule experimenters have been slow to apply to man the data on sexual drive obtained from lower animals. *For that they are to be commended,* [italics by Stone]. Only rigidly controlled experiments reveal the limits of applicability of data from animals to man (or vice versa), in view of many *constitutional* [italics mine] and cultural factors by which they are separated. Standing in the way of such experiments at the present time is the paucity of *factual* data [italics mine] concerning sexual activity in man."

EXAMINATION of Professor Parshley's attempt to establish this similitude between the sex life of man and animals further reveals, not only a most astonishing and unscientific failure to include all the elements that have a bearing on this problem, but actual self-contradiction. Whatever may be the likeness between the sex life of other mammals and that of man, there is a natural and thought-provoking difference. The sex life of brute mammals is not under the control of free will; the sex life of man is subject to that control. Even Professor Parshley does not deny that *expression* of sex in sexual intercourse is subject to the control of will; he only asserts that such complete control over sex, if exercised by free will, brings harmful physiological and psychological effects. Now nature does nothing in vain. She does not subject the circulation of the blood, the action of the heart, to man's free will. If she subjects the expression of sex in sexual intercourse to that free will, it is evident that she intends the exercise of sex to be directed by free will under the light of reason. And here is where Professor Parshley falls into a contradiction. At one moment he tells us, "We are unquestionably peculiar among mammals in lacking all instincts (or inborn, hereditary patterns) except the few shown in infancy—we are peculiar in having to develop individually the intelligence that depends on learning, in being surrounded and moulded by cultural influences as we grow up"; in the next moment Professor Parshley is telling us that we must discard the light of reason and model our sex life on the patterns supplied by unreasoning animals.

The real purpose of nature in subjecting sex urge to free will is that man might use free will to discipline sex and, through that discipline, integrate conflicting interests. As W. S. Taylor says in the monograph quoted by Parshley—"A Critique of Sublimation in Males"—"Human nature is not set forth fully by psychoanalysis, nor by this or that extreme school of psychology; and the findings of general psychology run in no way contrary to the conclusions of the Ethicists that life is a complexity of interests, and that living involves the *integration* [italics mine] of interests, not the satisfaction of some through the destruction of others." On page 100 Taylor quotes W. G. Everett as saying: "It is also to be remembered that the deliberate choice not to have a given experience is in itself an experience, which for the total meaning of life, may be one of the best and the richest." This failure of Professor Parshley to consider the intention of nature in placing the complete expression of sex under the control of human free will, in contrast with the physical necessity to which the brute is subjected in the question of sex, absolutely destroys the validity of the similitude he so laboriously constructs.

NOW the truth is that the light of reason and not the purely social forces of tradition is the basis and guarantee of the accepted ideas on morality and sex life which Professor Parshley so lightly discards. Even "the purely social forces of tradition" are far better guides for human conduct and happiness than the animal patterns which Professor Parshley would have us adopt. The accepted ideas on morality and sex are the only scientific ones, according to Dr. Logan Clendenning. The author of "The Human Body" is an authority. This book was listed amongst 40 "Notable Books published in the United States in 1927" which were recommended by the League of Nations International Institute on Intellectual Coopera-

(*Please turn to page* 135)

THE AMATEUR AND HIS MICROSCOPE—III

LEARNING TO USE THE INSTRUMENT

By FRANK CHALLIS and JOHN F. BRANDT
Bausch and Lomb Optical Co.

FOLLOWING out Mr. Foster's suggestions in his article last month we now have before us our microscope, some slides and cover glasses. With these materials to unlock the door let us take our first step into the microcosmos.

The microscope is not as difficult to use as tradition would make it out to be. True it is that, even among experts, there are different degrees of skill in procuring the best possible image of a specimen. However, we must remember that the expert is usually working with a highly complicated instrument, with very small and almost colorless specimens, and with involved apparatus, in order to secure just the right amount and right kind of illumination. But we do not have to bother with these details now, since it will be a long time before we are interested in specimens that require such delicate technique.

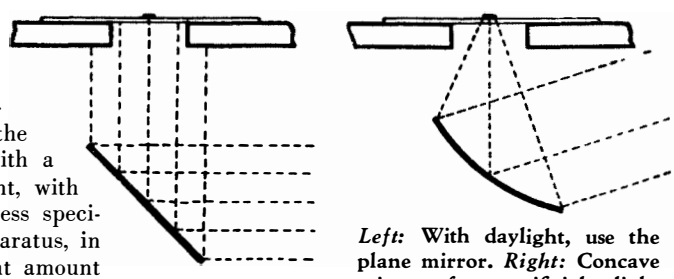
Let us assume that your microscope is one of the standard types with a 5× and 10× eyepiece, a 10× and 43× objective, and having a condenser under the stage. If your microscope happens to be one of the less complicated ones the following instructions will serve you just as well; merely ignore references to the fine adjustment and condenser.

Most of us are interested in living, moving things, so let us choose for our first specimen an insect, one that is close at hand at this time (too close at hand for most of us)—the common house fly. Swat a few of these until you find one on which a wing is in fairly good condition.

Take one of the plain glass slides and a cover glass, clean and dry them thoroughly with lens paper or Kleenex, making sure that no lint is left on either of them. Take care not to touch the surfaces of the glass with your fingers, as even such a tiny smudge will blur the image under the microscope. It is best to prop the cover glass against something, so that it can be picked up between the thumb and forefinger by the edges when you are ready for it.

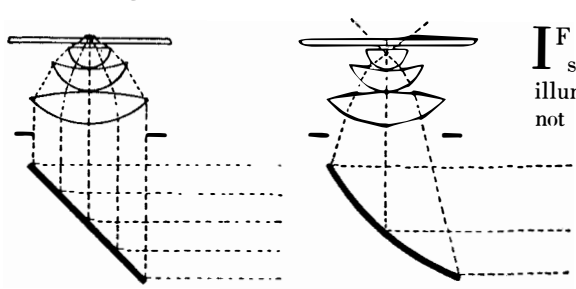
With a tweezers disconnect the wing from the fly and lay it in the center of your slide. Cover it with a cover glass by resting one edge of the cover glass on the slide right next to the specimen and letting it fall so that it completely covers it. With a handkerchief or a piece of lens paper press on the cover glass until the wing lies flat and even.

The stage of your microscope has a hole in the center and two clips. Place the slide under the clips so that the wing comes immediately over the center of the opening.



Left: With daylight, use the plane mirror. *Right:* Concave mirror—for artificial light

Now we are ready to consider the manipulation of the microscope itself. There is a certain procedure which is followed almost universally by amateur and professional microscopists alike. At first this procedure may seem unduly complicated, but after a while it will become natural and as you go further and further into microscopy you will understand the importance of each move.



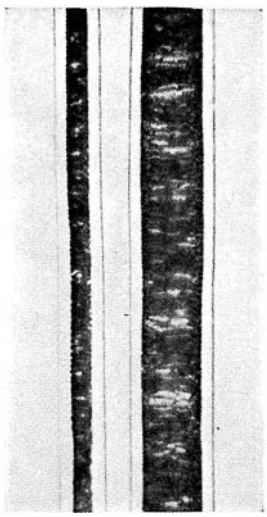
Left: Illuminating object with a condenser and plane mirror—right. *Right:* Wrong—wrong mirror

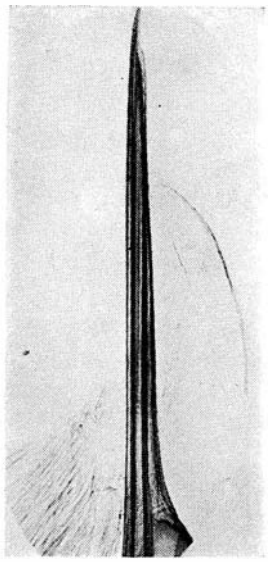
With the specimen on your stage, turn the revolving nosepiece so that your lowest power objective, the 10× in the case of the microscope we are considering, is in position at the end of the body tube. Notice the numeral that is engraved on the top of the eyepiece and see that the one marked 5 (5×) is in place. Always use your low power to "find" your specimen and then change to a higher power if necessary. Now, not looking down the microscope, but at the side, so that you can observe the distance between the specimen and the end of the objective, turn the upper, or coarse, adjustment until the objective almost touches the slide.

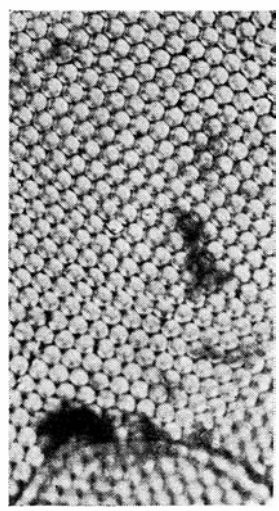
The mirror should now be adjusted. The mirror is usually double—plane on one side and concave on the other. In using skylight as a source it is immaterial whether the plane or the concave mirror is used, so far as brightness of illumination is concerned. It will be easier to rid the field of objectionable window-bar images, and so on, when the plane mirror is used. When using small artificial light sources, on the other hand, the concave mirror permits much more intense illumination. If there is a condenser on your microscope the flat side will be used almost always. So turn your mirror so that the proper side is up and reflecting the light from the light source up through the specimen and into the objective of the microscope.

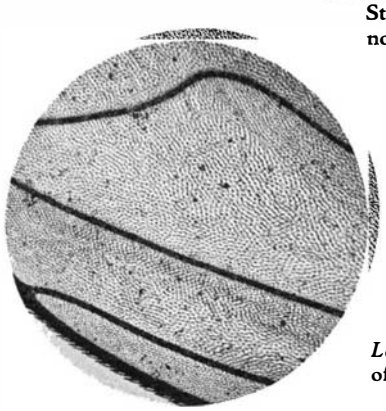
IF we now look down into the microscope there will be a round evenly illuminated field, but our specimen will not be in view. To bring the specimen into focus rack the body tube up (remember, *always focus upward*, to avoid the danger of breaking the cover glass with the objective, which would both ruin the specimen and perhaps injure the objective) until you have secured as clear an image as possible in this manner. The fine adjustment (on the smaller microscope this adjustment is sometimes made with a thumb screw on the stage) should now be used to bring the specimen into exact focus.

It is now a good idea to test the adjustment of your mirror. Change the focus just a little. If the lines on the specimen remain in the same spot and just become blurred, your mirror is correctly adjusted. However, if the lines in the specimen seem to move sideways









Studying out the utmost comfortable position possible is not mere laziness; it results in increased observing ability

Upper right: **Stinger of bee, magnified to correspond with the impression made on the recipient thereof**

Right: **Multiple eye of a fly. Flies do not, however, see multiple images of things because of such eyes**

Upper left: **Hairs from a cat, very greatly magnified. The study of hair, human and animal, is a specialty**

Left: **Photomicrograph (note: not a "microphotograph") of a small portion of the wing of a common house fly**

or toward the top or bottom, your mirror needs to be tilted at a slightly different angle.

In comparison with many specimens a fly's wing is quite thick. Most specimens under the microscope are almost transparent, and strong illumination will so flood them with light that they will be invisible. Direct sunlight should never be used, both because it would harm your eyes and because it is too strong for properly viewing specimens. There are no set rules which can be given for illumination; you will simply have to experiment around a bit with each specimen. Try propping a small square of ground glass in front of the mirror.

And so there you are. Thus easily you have learned the fundamentals of the manipulation of that awe-inspiring instrument, the microscope. There are some fine points which you can find out by experiment alone, and details which are not of much use to the beginner, but which will be explained in future articles when the need arises. For example, oblique illumination is usually accomplished by decentering the iris diaphragm below the condenser. You can see the effect of this by tilting your mirror to a point where the field suddenly becomes dark and the objects stand out in white relief. In this case the light, instead of passing through the specimens, is being reflected from them and up into the microscope. This technique is useful in locating specimens that are too small or so transparent that they are not easily detected in a brilliantly lighted field. If there is a condenser on your microscope you can best determine its proper position for yourself by focusing it up and down until the object is seen most clearly.

ON the microscope that we have been considering there is a diaphragm just underneath the stage. This diaphragm should never be used for cutting down the amount of illumination. With the diaphragm we change the angle of the cone of light, which results in giving the specimen better contrast with its surroundings. Here again only experience can tell you the proper adjustment of the substage diaphragm.

With regard to your position at the microscope, the only thing to be considered is your comfort. If your neck or back is bent too much there will naturally be a strain on the muscles and you will tire quickly. So see that the table is low enough or your chair high enough so that you are in an easy, natural and comfortable position. When the neck is strained, or the chest compressed because a constrained position has been taken up, the visual acuity of the observer is reduced. It is not the eye alone which "observes". Astronomers who sit under muscle tension at the eyepiece of a telescope often experience similar disabilities. Discomfort in one part of the body reacts on the nervous system and its control of the perceptions. Being spartan and attempting to ignore the discomfort will prove self-deceptive. Standard microscopes have an inclination joint which allows you to tip the microscope back while its base remains on the table. With specimens in liquid, however, this is not very feasible, as your liquid would run from under the cover glass. It is best, therefore, to arrange things so that you will not have to tilt the microscope.

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This article will be continued next month.

WHERE ASTRONOMERS (

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

IT has been known for about 70 years that the sun, and the stars also, contain substances, or at least atoms, of the same kinds as are found upon the earth, for these atoms absorb or, in rarer cases, emit light of exactly the same kind as terrestrial atoms. But are there other substances in the stars, or perhaps the nebulae, unknown here? And why do we find no evidence of some familiar ones?

These questions have taken much longer to answer. Our spectroscopes reveal multitudes of lines in the spectra of the various celestial bodies. Many, indeed most, of these could be identified without much trouble as produced by known atoms. But others remained uninterpreted. When the writer first studied the subject 40 years ago the list of these unknown lines was long and important. Now it has shrunk to almost nothing.

Various causes have contributed to this success. First may be mentioned the discovery of new elements—or at least of helium. Recognized first in the spectrum of the sun's atmosphere and of the whitest stars, its lines were found years afterward to be emitted by the gases evolved from certain minerals. The new gas was purified and studied and received the name already assigned to it by astrophysicists.

Next comes the study of the spectra of molecules—of chemical compounds—which exhibit bands composed of a bewildering assemblage of lines. When the patient labor of exact measurement was completed great numbers of these "band lines" were found to coincide perfectly with lines of the solar spectrum, or of that of sunspots. Some of the compounds appear only in the latter, being decomposed at the higher temperature of the solar disk. Others persist even then. Many hundreds of solar lines have thus been identified, and it is probable that a large proportion of the thousands of very faint lines not yet interpreted arise from compounds whose spectra have not yet been adequately studied.

The great bands which almost cut in pieces the spectra of the redder stars are due to molecules—compounds of carbon or oxides of titanium, zirconium, scandium and other metals.

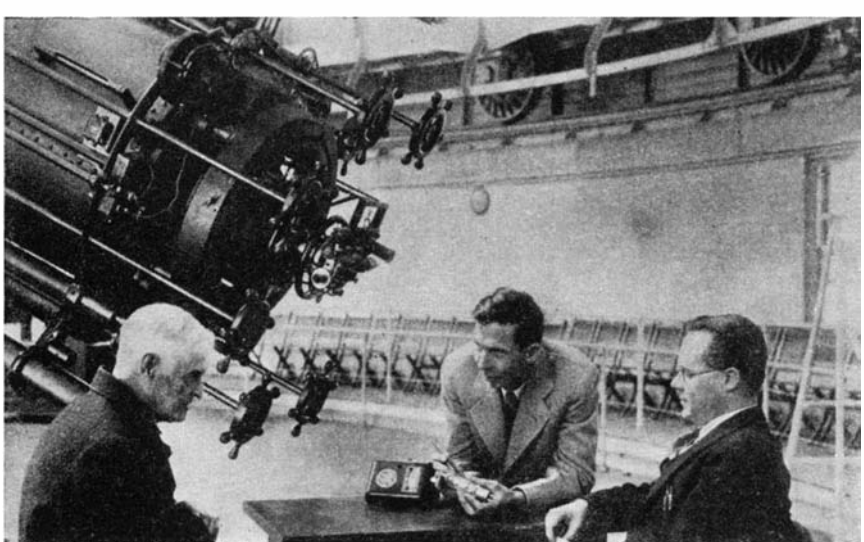
Again, known atoms, when excited to shine by new methods, may produce "new" spectral lines—that is, not previously recorded. In most cases these lines come, not from the neutral atoms, but from those which have been deprived of one or more electrons.

Adequate spectroscopic study of the more highly ionized atoms is a recent development. With its advance has come the identification of almost all the outstanding lines in the spectra of the hottest stars, which are found to come mainly from the familiar lighter atoms—carbon, oxygen and nitrogen—stripped of one, two, three, or sometimes even four electrons. The peculiar Wolf-Rayet stars (so-called from their discoverers), which show spectra composed mainly of wide bright lines, have thus been thoroughly interpreted. In some of them Miss Cecelia Payne has found absorption lines of nitrogen four times ionized. To strip so many electrons off these atoms the temperature must be of the order of 80,000 degrees, Centigrade.

YET another type of lines includes those whose positions can be predicted from present theoretical knowledge, even though we cannot produce them at will in the laboratory. There belong the "forbidden" lines which appear only in gases of excessively low density, and are so prominent in the gaseous nebulae. Oxygen, nitrogen, and sulfur have thus been detected, and very recently Boyce, Menzel, and Miss Payne have shown that the two strongest of the still unidentified nebular lines are due to neon (forbidden lines of Ne^{III}) which is thus added to the list of elements found in celestial bodies. Further work by these investigators shows that almost all the unknown lines in the nebulae and in new stars are certainly or probably of this sort.

Over the whole wide range of astrophysical spectra, the task of identification is thus practically completed, with one great exception: not one of the bright lines of the solar corona has yielded, so that one great unsolved problem remains.

Even here, however, there can no longer be any question of the hypothetical existence of unknown kinds of atoms. We know enough of the structure of atoms now to be certain that all the lighter and simpler kinds have



Courtesy General Electric Company

A group of astronomers near the 40-inch refractor at the Yerkes Observatory. *Left:* Dr. Edwin B. Frost, Director Emeritus. *Center:* Dr. C. T. Elvey. *Right:* Dr. Otto Struve, the new Director. Dr. Elvey holds in his hands a photoelectric cell used nightly for opening the Century of Progress Fair at Chicago. The light of Arcturus, gathered by the telescope, is focused on the cell and there it generates a tiny current, working a relay. This sends an impulse over the telegraph wires to Chicago, where the Western Union amplifies the impulse. The amplified current turns on a powerful search light whose beam, from a tower, reaches photoelectric cells on various buildings as it sweeps around, and turns on the lights of each. As this service has tied up the much-used 40-inch telescope, a 20½-inch reflector made by the amateur telescope maker Arthur Howe Carpenter is now being used in its stead, at the Elgin Observatory at Elgin

WHEN THEY DIE

already been discovered. The few possible atoms which have not yet been separated and adequately studied are heavy, would certainly have complex spectra, and are not to be anticipated in the corona. The enigmatic lines must come from known atoms of some sort, likely enough from very familiar atoms, but we do not know yet how to set these atoms on the job. With the one exception the great problem of the identification of the spectral lines of the heavenly bodies may be regarded as substantially solved.

The next question is, why do the lines of some elements appear strongly and others faintly or not at all? The simplest answer would be that the first set of elements was abundant in the given body, the second rare or absent. But this is too simple to be true. The spectrum of a metal such as iron contains thousands of lines. If an iron atom could give out all these kinds of light at once, or absorb them, it would indeed be an extraordinary mechanism. But there is convincing evidence that this is not so. A given atom is at work only on one line at a time but, since there are uncounted millions of atoms in the smallest visible light source, some at least of the millions will be at work in each of the thousands of possible ways, and so we get the rich spectrum. If a large number of atoms are engaged in the transition which produces a line it will be strong. If only a few, it will be weak.

WITHIN the last 10 years we have found out (well enough for the present purpose) just what most atoms are doing when they absorb (or emit) their spectral lines. Some of these are absorbed by atoms in their normal state, others only by excited atoms which have been loaded with a considerable store of energy.

At low temperatures practically all the atoms are in the normal state. At high temperature small but definite fractions get into the various excited states—the fewer the greater the excitation. Even in the latter case the lines absorbed by the unexcited atoms will be far the strongest.

Now, for almost all the metals, these lines are in the visible or near ultra-violet region and accessible to observation, hence our test for metals in the stars is a delicate one. But, for the lighter non-metallic atoms, these strong lines lie far out in the ultra-violet.

Here we come to the most tantalizing thing imaginable, at least to the astrophysicist. The earth's atmosphere which, barring clouds, haze, and smoke, is sometimes at least fairly transparent to visible light and to a smallish region in the ultra-violet adjacent to the visible, is as opaque as a stone wall for the shorter waves. The visible limit is near 4000 Angstrom units (in the violet). Just beyond 3000 A. the opacity begins, and continues without recovery. At first the culprit is ozone, present in rather small but all too-sufficient proportions in the upper atmosphere, too high to hope to get through with even a pilot balloon. For shorter waves, beyond 2000 A., even a few feet of air become opaque, and the observer has to put his whole spectroscope, photographic plate and all, in a vacuum-tight case and pump out all the air.

Come back now to the stars and to the non-metallic elements. Their strong lines lie far in the ultra-violet and are hopelessly inaccessible. The few observable lines are absorbed only by highly excited atoms. Even at the high temperature of the sun's surface only one atom in a hundred thousand, or even a million, will be in these excited states. Elements such as oxygen, nitrogen, and carbon are therefore at a tremendous disadvantage in the solar spectrum and the wonder is, not that their lines are faint, but that they appear at all.

In the hotter stars the metals become ionized, and the lines of the neutral atoms fade out. Their singly ionized atoms, either in the normal state or in moderately excited states, have usually good lines in the accessible part of the spectrum, which remain visible in stars of fairly high temperature—up to 12,000 degrees or so. But when two or more electrons have been removed, practically all the lines lie in the concealed region and, so far as our observations go, we lose the metals altogether.

The lighter atoms, even though two or three times ionized, have still some lines in the observable region, and these are found in the hotter stars. These lines, however, are absorbed only by very highly excited atomic states. For every atom in such a state there must be many thousands, or tens of thousands in the normal state.

IF only we could observe the far ultra-violet part of the spectra, we would doubtless find these lines enormously stronger than the rather feeble ones which appear on our photographs. Even in the sun, where many strong lines are observable, there must be still stronger ones behind the veil of ozone absorption. The stellar spectra which we photograph, therefore, are mere wraiths of the far more remarkable ones which we could observe if only we could find some way of moving and keeping alive on an airless body like the moon. The good spectroscopist—to parody the old jest—might perhaps be permitted to go, when he died, instruments and all, and set up an observatory on the moon.

—*S. S. American Trader*, at sea, July 1, 1933.

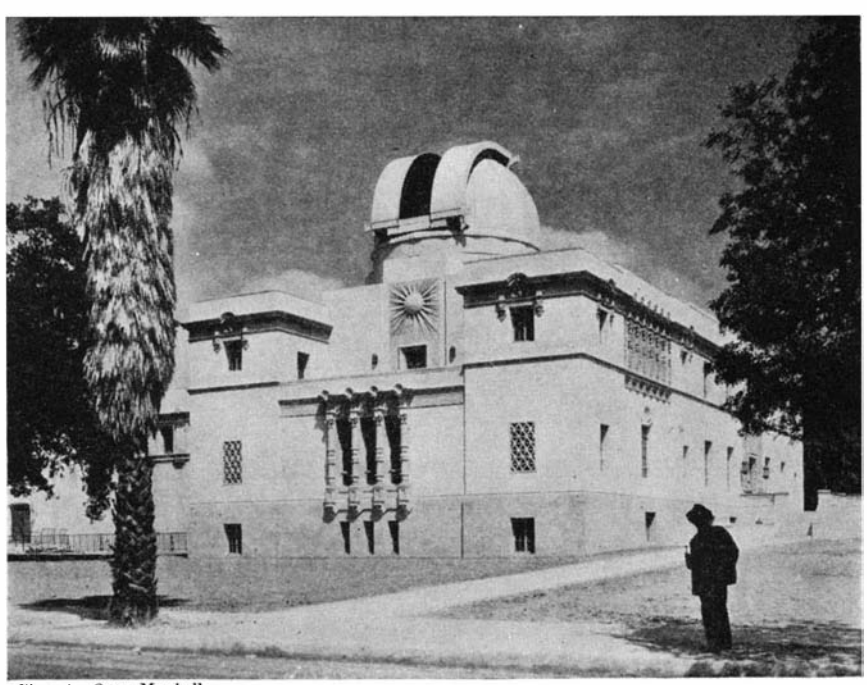
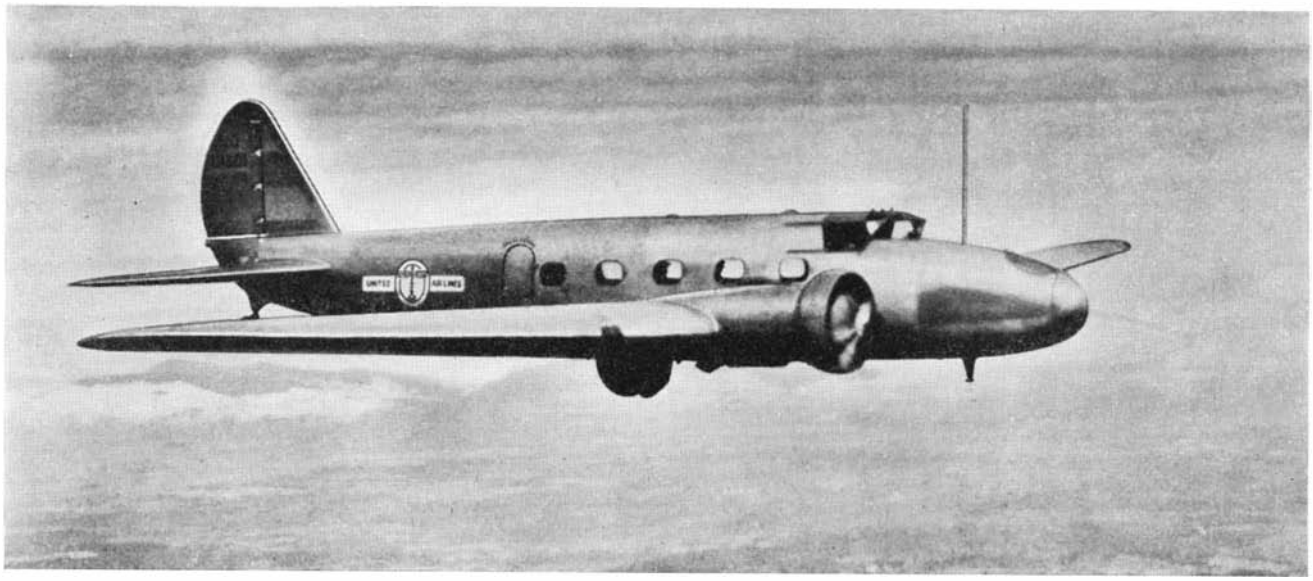


Photo by Oscar Marshall

The new Astrophysical Laboratory at the California Institute of Technology. Beneath the open dome is a concrete tower which does not touch the building, and a well 50 feet belowground. This arrangement is for a vertical solar telescope with a two-mirror coelostat in the dome. This equipment was designed by Russell W. Porter, and is similar in type to the tower solar telescope on Mount Wilson. The 200-inch telescope is being designed in this building



Speed, economy, strength, and safety are salient features of this new 10-passenger and cargo transport plane

The Lessons of

50,000,000 Miles of Flying

By ROBERT JOHNSON

AN aerial armada of 100 transport planes recently completed 50,000,000 miles of flying over a single nation-wide system of airlines, establishing a world's record in commercial aviation. This achievement represents more than six years of operations, some 20,000,000 miles of winter-season flying on regular schedules, 23,000,000 miles of night flying, and over 30,000,000 miles of operations from the Atlantic to the Pacific coast over the mid-continent route.

In a broad sense, completion of this record symbolizes the graduation of air transportation to a position of front-rank importance among established modes of transport, and the acceptance of the airplane by the public as a matter-of-fact agency of travel is a natural result of the progress which has been made during the past decade in placing air transport upon an efficient level.

In popular parlance, the first 50,000,000 miles are the hardest, and United Air Lines, the company which attained this record at the close of the last year, has found them to constitute a beneficial and fruitful experience. On the premise that "50,000,000 miles can scarcely be wrong," a review of some of the lessons which this air-transport company has learned during the past six years should not only prove typical of the developments in air transportation generally, but should also serve to indicate the trend which may be followed in this field of transport.

In 1926, a total of 95 airplanes in scheduled commercial airline service flew 2,026,000 miles and carried 5782 passengers and 433,649 pounds of airmail. In 1930, 637 planes flew 28,833,967 miles and transported 385,910 passengers, 8,513,675 pounds of airmail, and 286,798 pounds of air express. In 1932, 655 planes flew 51,206,000 miles and carried 520,000 passengers, 7,266,000 pounds of airmail, and 1,372,000 pounds of express.

During a period which has been characterized by retrenchment rather than expansion for business in general, air transportation has moved steadily forward in all respects save that of airmail, in which branch there was a decrease in 1932 due to a combination of higher postal rates and a low ebb of business correspondence.

THIS expansion of air transportation is of particular significance; it represents not merely familiarizing the public with airplanes and providing increasingly extensive service, but, more important, the completion of a developmental period of air transportation during which efforts have been effectively directed toward placing scheduled air service on a basis of dependability and efficiency. This vital stage includes constant improvement of airplanes and engines, lighting of the airways to allow night flying, establishment of a comprehensive weather reporting service along the air routes, development of two-way radio telephone communication between planes in flight and ground stations, systematizing methods of maintenance and repair of equipment, invention and improvement of air navigation instruments, installation of the directive radio beacon service, regulation of pilots' physical condition, and many other important features. Until the majority of these developments had been put into practice, effective progress in air transportation was not possible.

With the overcoming of many of the manufacturing and operating problems which loomed large a few years ago, air-transport companies are concentrating more and more on the traffic phase of the business, attacking the problem of acquainting the traveling public not only with the speed and extent of schedules, but also with the numerous factors which contribute to the reliability of scheduled air transportation.

As a result of its 50,000,000 miles of operations, United Air Lines* is placing a greater emphasis than ever upon research and experimentation on a plan of capitalizing on its experience through improvement of present equipment and facilities and invention of new features further to increase efficiency of operations. This company has established an engineering laboratory in the same skyscraper in which the company's general

*United Air Lines operates the following mail-passenger-express airways: New York-Chicago-Pacific coast; Seattle-San Diego; Salt Lake City-Seattle; Chicago-Kansas City-Fort Worth-Dallas; Kansas City-Omaha-Watertown, S. D. These airways total 6500 miles in length and over these airways United flies 14,000,000 miles annually, and last year carried 90,000 passengers, 1,670 tons of mail and a substantial volume of express.

offices are located at Chicago, and already the laboratory personnel has made several significant contributions to air transportation, although thus far these have been confined to the field of communications and radio.

As a matter of fact, radio telephony is an extremely important factor in today's air-transport operations and is the key of the plan of traffic regulation which United has evolved from its experience. Known as the co-ordinated control of operations on a centralized basis, the plan permits of a traffic regulation that is flexible, constant, instantaneous, and far-reaching. The divisions of the company vary in length from 884 miles to 2030 miles, and coast-to-coast service is maintained by two inter-locking divisions operating the mid-continent airway from New York to the Pacific coast, a distance by air of 2760 miles. By means of radio-telephone communication between the various planes in flight, and the ground transmitting and receiving stations established every 200 miles, the operations department can be in constant contact with the crews of the aircraft, and by an organized system of radio telephone dispatching, the positions of all planes are known at all points along the divisions.

Other projects of far-reaching importance scarcely visioned in the early days of air transportation are now being undertaken by United's research department, and during the next few years it is expected some of these will exercise a profound influence upon air-transport operations.

ONE of the biggest lessons learned during the flying of 50,000,000 miles was in regard to flying equipment. Fundamentally, the airplane is the keystone of operations. Upon its combination of performance, economy, load characteristics, safety factors and durability depends the success of an air-transport company. To achieve an effective and desirable combination of these features, United has learned that it is imperative for the transport company to co-operate to the fullest degree with the airplane manufacturer in the matter of designing transport aircraft, even to the extent of laying down general specifications.

The company has learned that the length of the airplane's daily flight can be substantially increased, provided proper maintenance and service methods are employed. A few years ago, for example, the company used five different planes to fly one schedule on its 2030-mile Chicago-San Francisco division of the mid-continent route. Now it uses but two, one from Chicago to Cheyenne and another from Cheyenne to the Pacific coast. The big advantage of this is apparent when one considers that a transport plane becomes obsolete considerably in advance of the completion of its useful life by reason of advances in airplane and aircraft engine development. Properly to absorb the depreciation involved, therefore, a maximum of duty consistent with safety must be obtained from all planes.

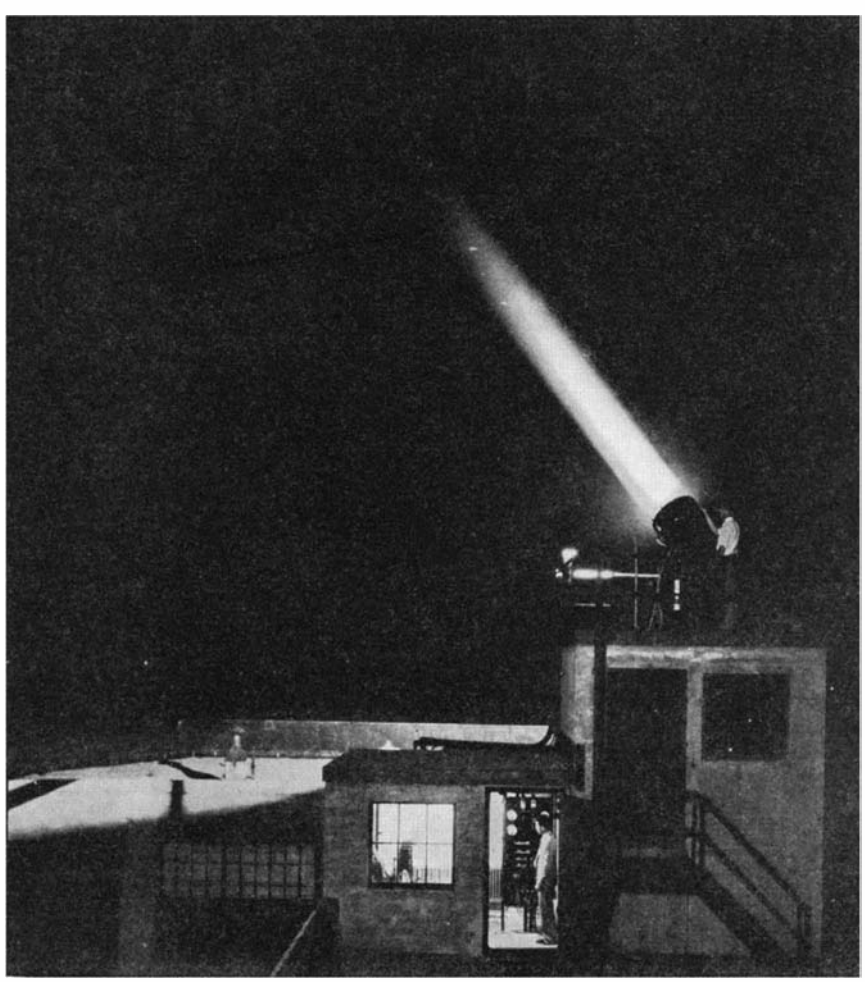
The company has learned, too, that the once generally favored theory that bigger and bigger airplanes would be the order in air transportation, is ill-advised in the light of present needs. For the immediate future, at least, United officials are convinced that the best service is provided by the company which operates medium-sized aircraft on frequent schedules. Speed is naturally the commodity aviation has to sell to the public, and to be properly effective, this speed of service must be correlated with frequency of schedules.

Perhaps the greatest lesson of all has been learned in regard to an airplane's performance. Speed has been a predominating consideration, and the emphasis placed upon this point has tended to becloud the public's mind to other pertinent issues involved. This year sees the major airlines competing for faster and faster services, inspired partly by the growing public appetite for speed which has been whetted by spectacular cross-country speed flights made in planes which could not possibly be adapted to commercial air transport.

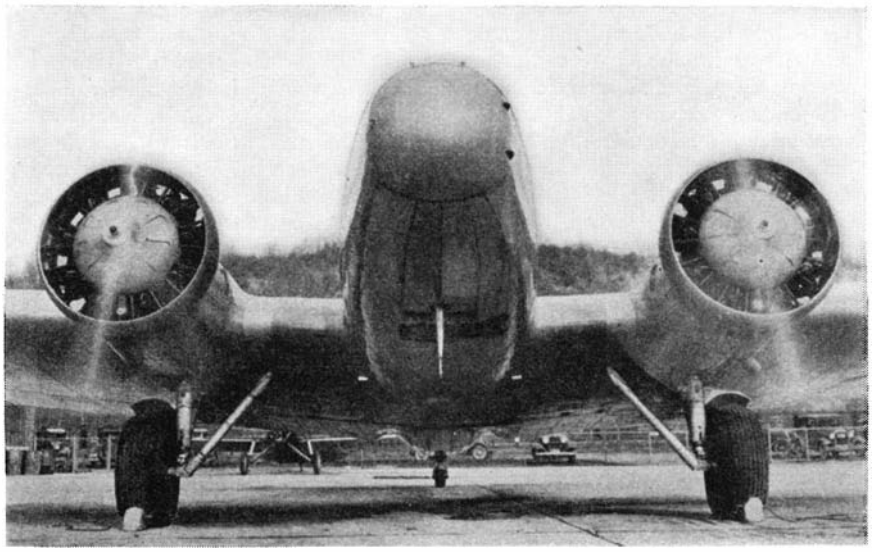
Speed cannot, however, be satisfactorily obtained through the sacrifice of other important features, such as strength, comfort, and loading characteristics. Planes of this company operate from coast to coast over a 2760-mile airway that covers every type of terrain found in the nation, involves all possible climatic variations, and includes airports at sea level and airports as high as 7000 feet above sea level.

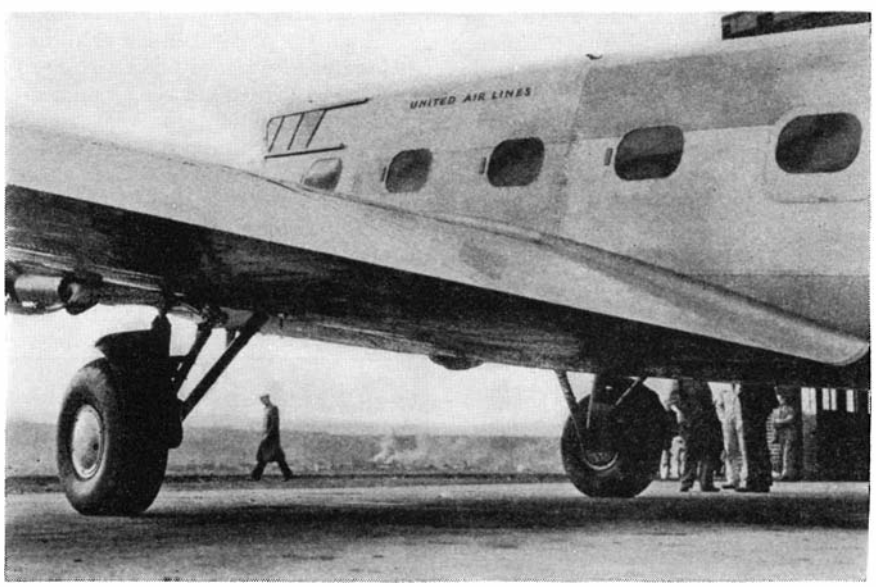
The ideal transport plane for this route must perform as satisfactorily at high altitudes as it does at low elevations, and it must operate as effectively at airports a mile or more above sea level as it does from terminals at sea level. Strength is a point of prime importance, for to it the measure of safety is closely allied. Also, proper accommodations must be provided in order that passengers be comfortable, especially on flights that involve long distances.

With these facts in mind, 60 specially-built airplanes were ordered in 1932 from the Boeing Airplane Company at Seattle. Characteristics of these new type planes reveal that the lessons the air-transport company has learned from 50,000,000 miles of flying with airmail,



The beckoning finger of light from an airway beacon is an important factor in the provisions made for dependable night schedules on our far-flung airlines





Two views of the United Air Lines Boeing-built transport plane showing the two super-charged 550-horsepower Wasp engines, retractible landing gear, and wide tread

passengers, and express, are manifested in the new ship. It is of all-metal construction because of the strength and durability gained.

It is claimed that more than any other aircraft, the new Boeing is particularly adaptable to inspection, maintenance, service and overhaul procedures. This means not only lower operating cost but less time lost in servicing planes at division points. It is fast, having a top speed of 175 miles per hour and a cruising speed of 155 miles per hour with full load.

It is medium in size, accommodating 10 passengers with their baggage, two pilots, and a load of better than a third of a ton of cargo. It is strong, its wing alone having a safety factor of 5.8, considerably in excess of the Department of Commerce requirement of 4.85. It is comfortable, its roomy passenger cabin being equipped with chairs larger than any previously used in commercial transport planes, and spaced 40 inches apart to provide that all-desirable legroom for passengers.

UNITED AIR LINES as the operating company not only laid down the general specifications for the new plane, but also followed through with an effective liaison organization during the construction of the aircraft. After it was decided that the plane would be a low-wing metal monoplane with two Wasp engines supercharged to deliver 550 horsepower each at 5000 feet above sea level to insure proper performance at airports of high elevation, United operating executives inspected and evaluated a full-size wooden mock-up, or wooden replica of the essential sections of the plane to insure that everything be satisfactory.

P. G. Johnson, President of United Air Lines and also of the Boeing Airplane Company, answers the question of what his company believes in regard to the type of aircraft which will be commonly used in American air transportation during the next few years, by pointing to the new Boeing twin-Wasp monoplane.

"In our judgment, this plane embodies the features which we feel essential to aircraft for commercial air-transport purposes during the next few years. There is a distinct trend toward standardization upon all-metal monoplanes of clean, streamlined design. The main difference among transport planes will be in the type and number of aircraft engines employed. This will be an important factor in increasing aircraft speed."

Another lesson which has been learned during the past several years is that proper attention to passenger comfort at terminals and division airports is essential, along with provision for comfortable accommodations in the planes. Hangar-depots with modern passenger waiting rooms and the usual facilities found in other transportation terminal stations have been erected at most airports in the country served by regular airplane schedules.

Still another forceful lesson which United Air Lines has learned is that night flying is not only as practical as day flying but that it is increasingly popular from the standpoint of the traveling public. Approximately 50 percent of the company's annual scheduled mileage of 14,000,000 miles is flown at night, an amount substantially in excess of the night flying of all European companies combined.

Yet another significant lesson concerns the one-time theory that pilots reached an age limit, from 32 to 35 years of age, beyond which their efficiency decreased to a point preventing them from remaining actively in air-transport flying. This theory was exploded by the institution of a policy of examining all members of the pilot personnel by competent flight surgeons every 30 days, which resulted in the findings of the surgeons that in most cases the so-called age limit is considerably higher.

Just as it may be said that the first 50,000,000 miles are the hardest, so are they the slowest. Due to the growing acceptance of air transportation and increased schedules between important cities, United Air Lines will complete the flying of its second 50,000,000 miles in approximately three years, about half the time required for the present record. Five years ago and less, the average speed of airline service was 100 miles an hour. In 1933, the average is around 150 miles per hour. Instead of the 1932 schedule of 27 hours elapsed time from the Pacific to the Atlantic, the 1933 schedule is approximately 20 hours. New York is only five hours from Chicago instead of six and one half. The public wanted speed. In 1933 the operators are giving it.

New Photo-Sensitive Mosaic Makes Possible

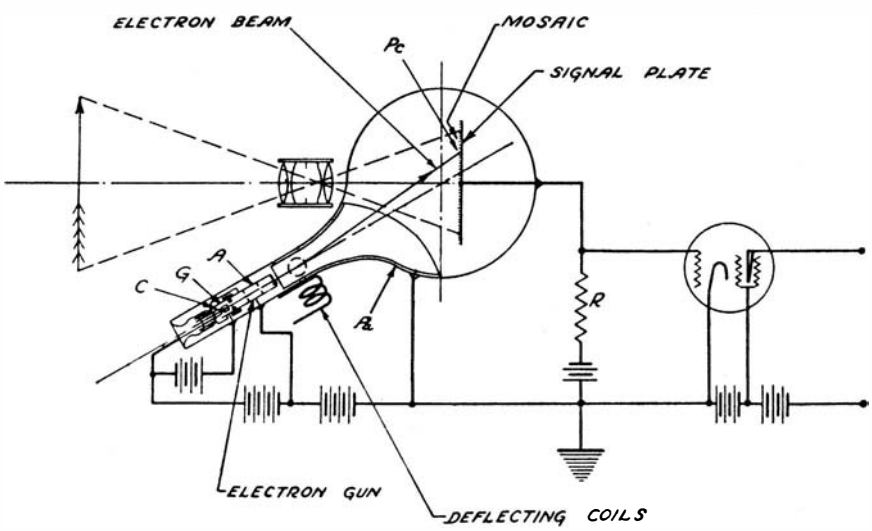
A Real 'Electric Eye'

By A. P. PECK

A SECRET method of depositing 3,000,000 photo-sensitive elements on a four-inch square of mica is the foundation of a new television transmission system recently announced by Dr. Vladimir K. Zworykin of the RCA-Victor research laboratories. Without mechanically moving parts, Dr. Zworykin has succeeded in transmitting images built up of 250 lines to the inch, or 62,500 picture elements to the square inch. The best that can be done with the conventional scanning disk is about 50 lines or 2500 picture elements.

This new system may be closely likened to the human eye. In the eye, speaking generally for purposes of analogy, the image of the object seen is focused through a lens upon the retina, in which are millions of rods and cones, or "photo-sensitive" elements. These rods and cones are connected with the brain by a series of tiny nerves, and in the brain the image is registered and we see. In the Zworykin system, the mica plate with its 3,000,000 photo-sensitive elements corresponds to the retina with its rods and cones. This sensitive surface is swept or scanned with an electron beam that moves at an extremely high velocity. This beam corresponds to the optic nerves and serves to conduct the "vision" from the sensitive surface to the transmitting amplifiers, from which it is sent to the receiver or "brain" and there reproduced.

The modified cathode-ray tube used in the Zworykin transmitting system is called the Iconoscope. As shown in the illustration at the bottom of this page, the mica screen or mosaic is located in the bulbous portion, in such a position that an image may be focused upon it through the glass of the tube. At the base of the tube is the electron-producing "gun." The invisible stream of projectiles from this gun is controlled by four coils mounted on a frame and placed outside the tube. When the proper alternating currents from vacuum tube oscillators are applied to these coils, the beam of electrons may be controlled so that it will sweep back and forth over the surface of the mosaic, covering every portion of it 24 times during each second of operation.



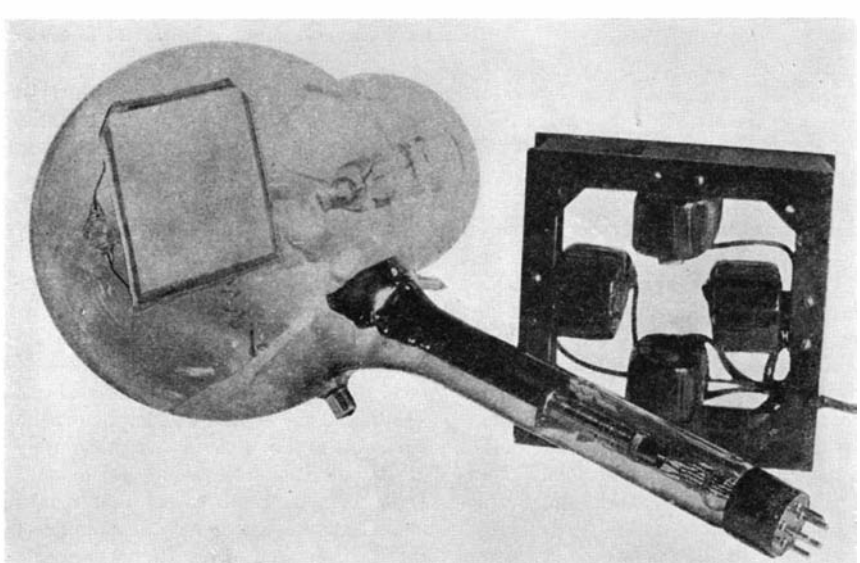
A simplified diagram of the Iconoscope showing how the light rays are focused on the sensitive mosaic, and how the latter is scanned by the electron stream

The mosaic plate, as mentioned, has on one surface 3,000,000 light-sensitive units and on the other surface a plate of silver. Each of the units, together with this plate, forms a tiny condenser that stores up current in exact proportion to the amount of light that reaches the unit. This condenser is discharged as the electron beam sweeps over it, and therefore adds its bit of current to the "picture signal" which is being built up for transmission.

In the present development, the beam of electrons is of such size in cross-section that it touches three of the light-sensitive units at a time; therefore 1,000,000 picture elements are possible on the four-inch square.

DR. ZWORYKIN states that this new system will operate at a speed comparable to that of motion-picture camera film. Thus it is possible to televise objects in ordinary light and to dispense with the intense lighting systems that up to now have been necessary. In addition, detail of picture reproduction is vastly improved, due to the great increase in the number of picture elements over the older systems of television.

At the receiving end, the Zworykin cathode-ray type of reproducer is used, as described in the February, 1930, SCIENTIFIC AMERICAN.

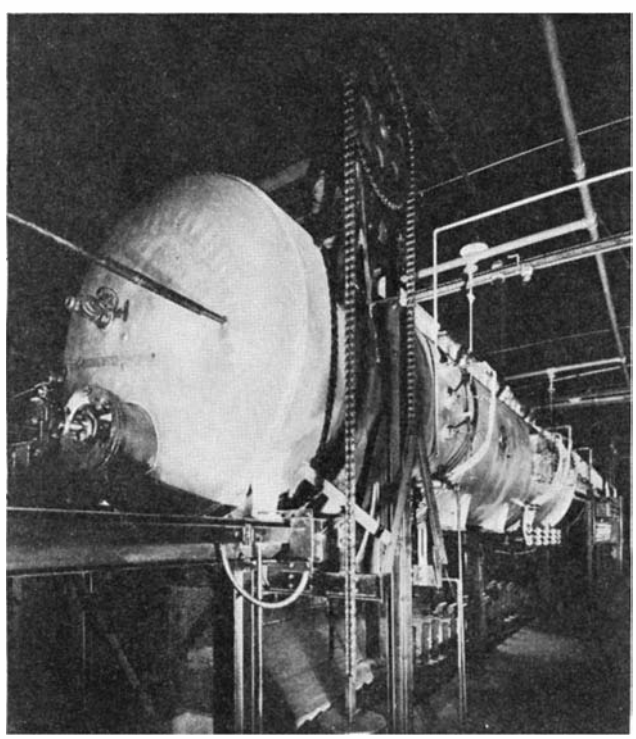


The mosaic plate in its vacuum chamber and, at right, the beam control coils

"Mass Production" Welding

Flameless, Arcless Process Produces Thousands of Welds an Hour Under the Supervision of One Man

SIXTEEN hundred individual welds made by one man in 45 minutes! That sounds like a "Buck Rogers in the 25th Century" story! Yet it is what is happening every day in the huge "Zeppelin" copper - hydrogen - electric furnace in a plant in Detroit. At first thought, it would seem that this kind of wholesale welding would keep one man pretty busy. As a matter of fact, however, he has little to do, except to set the automatic electric controls of the giant furnace to regulate the welding cycle in keeping with the nature of the parts in production. The heavier and more bulky the part, the longer the welding period required. It is also this one man's duty to load and unload the cars on which the parts are automatically carried through the furnace.



The hydrogen-electric welding furnace discharges a car of welded parts every four minutes, 24 hours each day

AND here are still more points in favor of this revolutionary process: The weld itself is accomplished without either flame or arc; without fusing or melting of the integral parts; and without the apparent application of any metal. Yet the welds produced are actually stronger than the steel in the parts they join together! Perhaps the most unbelievable statement of all is that it is entirely possible to make welds which are completely enclosed and out of sight of the operator!

To help visualize the process, consider first the furnace in which it is carried on: The initial impression is of a long steel cylinder six or eight feet in diameter supported above the floor level on structural steel trusses. About half the length of the cylinder is occupied by the electrically heated welding zone; the other half by the water-jacketed cooling chamber. It is one of the major advantages of the process that the parts are gradually cooled to room temperature before leaving the hydrogen-filled atmosphere. This eliminates any possible chance of scale, oxidation, or distortion.

Underneath the large cylinder travel the cars upon which the parts are loaded before entering the furnace. At exactly the right moment an elevator at the "in" end of the furnace is automatically lowered, a car filled with parts is rolled upon it, and it is elevated into the furnace where the welding process begins.

The discharging of the welded parts from the furnace is carried on with exactly "reverse English" at the opposite end of the "Zep." Both entrance and discharge as well as movement through the furnace are completely automatic, being actuated by an intricate system of electro-magnetic contactors.

Once inside the heating zone the process depends upon the curious affinity of steel for copper, and vice versa. At high temperature (2100 degrees, Fahrenheit) molten copper will be drawn by capillary attraction into even the infinitesimal space between two pieces of steel that have been assembled by a press fit. That is, this will happen *if* the surfaces to be welded are absolutely clean and free from scale and oxides! It is this last requirement that makes necessary the hydrogen atmosphere of the furnace and gives the process its name. If the parts to be welded were heated to this high temperature in the open air, the surfaces would become covered with a scaly deposit which would completely prevent the desired action of the copper and steel. So both the heating and cooling chambers of the furnace are filled with Electrolene —a gas composed largely of hydrogen. As this gas can be produced from ordinary illuminating gas by mixing it with steam under high pressure at high temperature, it is far more economical than pure hydrogen would be. This atmosphere reduces all oxides and foreign matter of any kind, and provides a clean, oxide-free surface for the welding action.

It might seem at first that the molten copper would simply solder or "paste" the surfaces together. Actually, however, there is no free copper left in the weld. The best proof of this is that the welded parts may again be passed through the welding furnace with no effect upon the structure of the weld.

THE photomicrograph reproduced here illustrates a section of two pieces of steel which have been welded together by this process. The iron and copper have alloyed together. Some of the copper has gone into solid solution in the steel, and some of the iron has been dissolved by the copper to produce an integral copper-iron alloy bond between the parts (approximately 97 percent iron, 3 percent copper). The alloy so formed is represented in the photomicrograph by the black areas. Note how the alloy has "grown" into the grain structure of the steel and has actually surrounded many of the individual crystals.

Because there is no obvious application of metal to the seam, it is often impossible for a person seeing an assembly to tell just where the welds have been made. To people who ordinarily think of a welded joint as one with a band of metal built up over the seam, this clean-cut appearance sometimes has the effect of bringing up the question of strength.

This question of the strength of hydrogen-welded joints may be answered with one simple, direct statement: They are actually stronger than the steel in the parts they weld together! This fact

is not based upon theory; it has been conclusively proved by exhaustive tests, both in the laboratory and in the severest kind of actual use.

For example, a steel tank assembled from a length of tubing, two stamped end plates, and a screw-machine threaded fitting with all joints hydrogen-welded, burst at 2200 pounds hydraulic pressure, but there was no failure of the hydrogen-welded seams at any point. Two pieces of ⅝-inch bar stock were pieced together with a 45-degree hydrogen weld. Under 66,000 pounds per square inch tensile stress the steel itself failed but the hydrogen-welded joints remained intact!

IN the original design of an automobile spring shackle, threaded bars were inserted in holes drilled in a piece of flat steel, and the ends either peaned or arc welded. Experience proved, however, that when excessive torque was applied to the bar, as might very easily happen in trying to remove a "frozen" nut, the bar had a tendency to turn in the steel strip. In revising this design for hydrogen-welding, the fabrication and assembly are identical with the above. However, in a long series of exhaustive tests, it has been proved that the bar will twist and break before the hydrogen-welded joints are ruptured. These are only a few of the many tests which the process has successfully undergone.

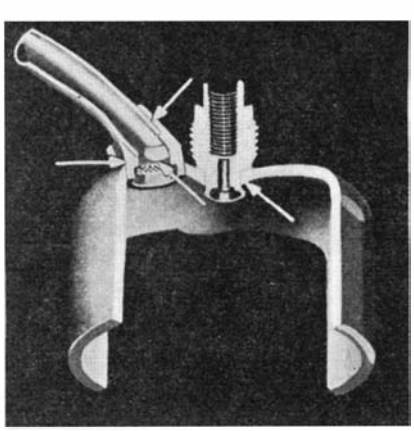
What does this welding process at 2100 degrees Fahrenheit do to the metal? The obvious effect, of course, is a dead anneal, which in most cases is highly desirable as it relieves the parts from any strain which might have been set up by such previous processing as drawing, shearing, machining, and so on. However, the condition may be corrected when desired by any of the usual heat-treating methods, without in any way affecting the weld. As a matter of fact this is one of the best proofs that the bond is considerably more iron than copper; its melting point is practically that of steel.

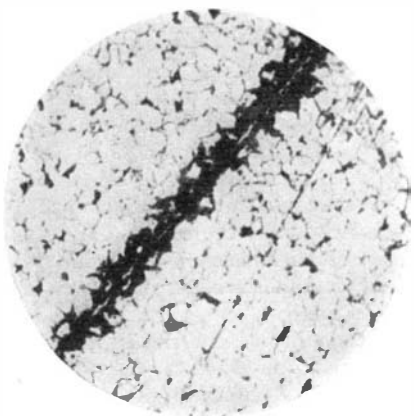
Although hydrogen-electric-welding, developed by the Bundy Tubing Company, has been available to industry in general for only a few short months, it has already had a marked influence upon product design and production methods in many industries. To the designing engineer, hydrogen-welding opens up possibilities for intricate assemblies which could not possibly be produced by any other methods. There is an outstanding advantage in connection with the production of such enclosed parts as tanks, floats, headers, small tubes, and so forth, in which ordinary assembly methods necessitate a difficult and expensive (if not impossible) final cleaning operation. When produced by hydrogen-welding, such parts leave the furnace clean and free from scale both inside and outside. Designers who are compelled by the necessity of absolute economy to shy away from costly integral parts may now revel in the assurance that practically any assembly which their ingenuity can conceive may be produced by welding together such simple and inexpensive units as tubing, stampings, drawn and cut shapes, bar stock, and so on. So, if in examining some iron or steel part of your new 1933 automobile, or airplane, or electric refrigerator, you fail to find any visible means by which it was assembled, and yet find that it is as solid as a single piece, you may safely conclude that the manufacturer utilized this most modern of electricity's contributions to industry—copper-hydrogen-electric-welding.

●

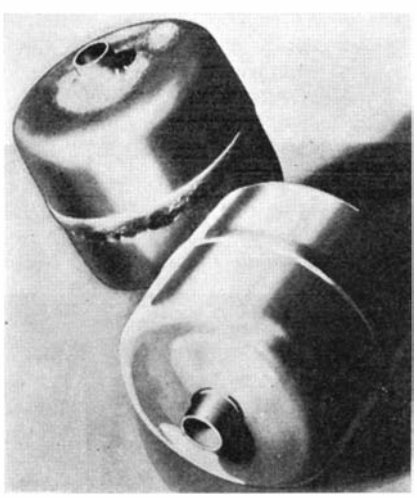
A fascinating way of passing idle hours this summer would be to carry out the telepathy test explained in our June issue.—The Editor.

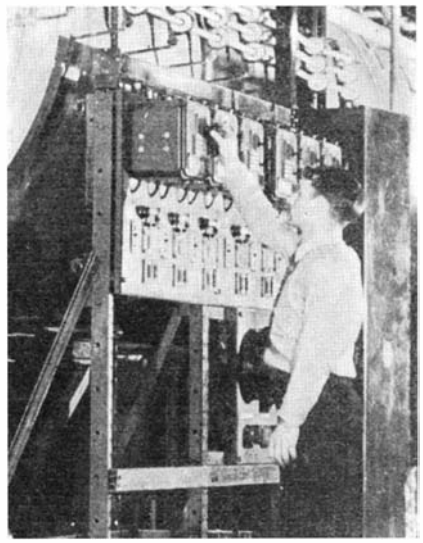
Preparation for welding requires a snug fit of parts and application of copper or copper paste at or near joint. ***Below:*** **A large number of welds may be made at one time**



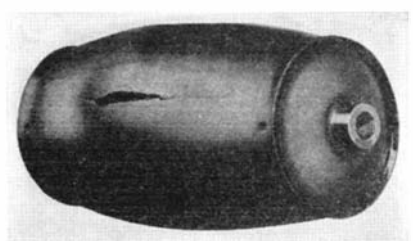


Photomicrograph discussed in text. ***Below:*** **A contrast in welded floats —superfluous metal on oxy-acetylene job, and clean hydrogen weld**



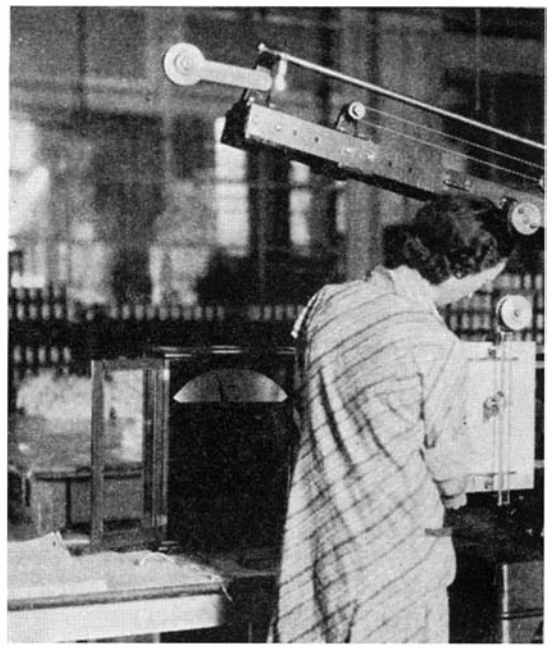


Above: **Finger-tip automatic control of welding furnace.** ***Below:*** **A steel tank, all joints hydrogen welded, which burst at 2200 pounds pressure with no failure of seams**



Checking Up On the Silkworm

By GRACE LOCKHART



The incline plane serigraph, the machine It checks exact strength and elasticity and

IT appears that that small martyr to woman's love of sheer silk hose and gossamer-fine lingerie, the silkworm, is far from being an efficient worker. The strand he weaves is consistent neither in its color nor its diameter. Consequently, there is much more to the manufacture of silken garments than appears on the surface, as was discovered in a chance recent visit to the research laboratory maintained in Brooklyn, New York, by a large silk firm.

In these laboratories, technicians, under the direction of Warren P. Seem, internationally known raw silk authority, test for physical quality, evenness, and cleanness all the silk used in the nine Julius Kayser & Company factories in the United States, Canada, and Australia. Approximately 1500 bales of silk are tested per month in this interesting laboratory.

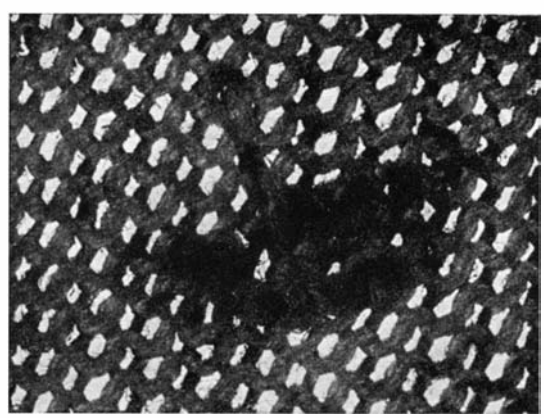
Methods used are regarded by the Raw Silk Committee of the National Association of Hosiery and Underwear Manufacturers as the most conclusive and reliable "measurement" standards of raw silk available. These methods are now being considered as a basis for the establishment of international standards.

Thinking, for a moment, of silk stockings or silk lingerie in-the-making rather than as gifts "sure to please," we hear the roar of mill and factory; we visualize row after row of machines knitting the welt, the leg, the toe, and heel of millions of pairs of silk stockings; we see countless batteries of spools and cones feeding fine silk threads into milanese, tricot, and warp knit machines where they are transformed into millions of yards of exquisite silk fabrics.

Behind all of this—behind the cobweb-fine silk stockings and the filmy heaps of lingerie exhibited in the world's leading shops, is the testing laboratory, where one thing after another is carefully, consistently done to assure quality and perfection in the finished goods.

FIFTY years ago Julius Kayser, maker of silk gloves, or "mitts" as they were then called, developed the double finger tip. As a result, Kayser gloves achieved immediate and widespread fame, and Mr. Kayser was soon faced with the problems of mass production. As quality was the foundation upon which his business success had been built, he determined to maintain it and concluded that, in order to do so, it would be necessary to test all raw material that went into his products. This decision saw the beginning of the Kayser research laboratory which today is of major importance in the silk industry.

The quality of raw silk is determined by what is described as "physical" and "structural" properties. The physical properties are those inherent in the fiber—strength, elasticity and luster. These properties vary in different grades of silk. They are determined by climatic conditions, nature of the soil, and the care and feeding of the silk worm, *Bombyx mori.* Raw silk is stronger than any other usable textile fiber of equal weight, its strength giving to silk fabrics their superior wearing qualities.



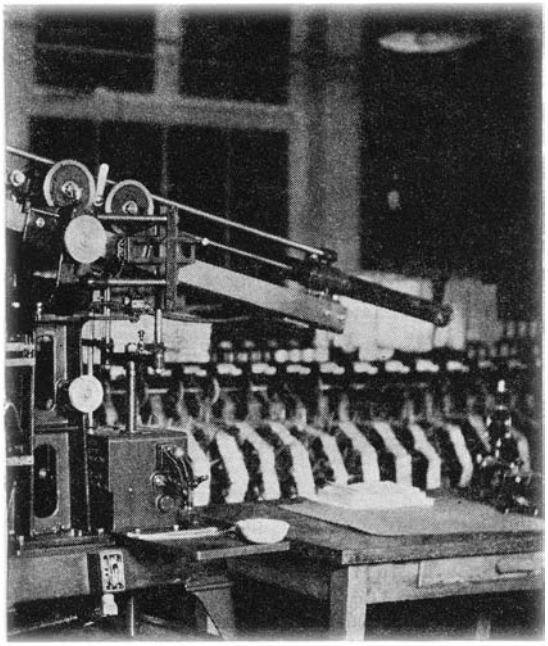
A silhouette and surface projection showing irregular plaiting at the heel of silk hose

Grading hosiery for evenness in a grading cabinet, with measured light and light filters

Upon the elasticity or "liveliness" of the raw silk depends the excellence of fit of fine silk stockings or gloves. Upon the luster or "sheen" depends that luxuriousness and softness of texture or "feel" for which silk garments are so admired.

Years of study by Mr. Seem went into the development of a reliable method by which silk could be tested for these various physical properties. The machine used in the testing laboratory is an Incline Plane Serigraph which not only checks accurately exact strength and elasticity but also makes a chart record of test results.

The structural qualities of raw silk relate to its evenness and cleanness. The silk worm spins a fiber consisting of two filaments from two tiny orifices in its head. In spin-



which tests the physical properties of silk. provides a chart record of the results obtained

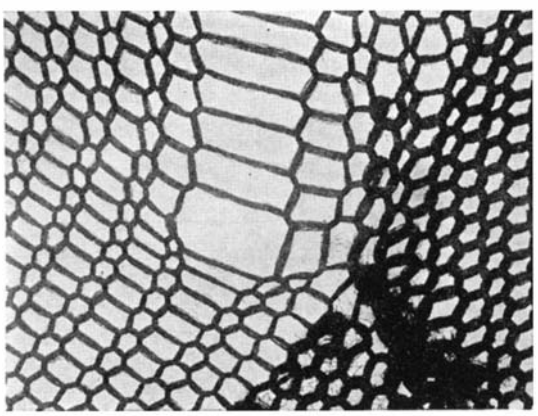
ning, the worm winds itself round with this fiber in a figure 8 to form the cocoon. The fiber measures from 1500 to 2100 feet in length and varies in diameter (the weight determinant) from 3.36 deniers on the outside of the cocoon to 2.11 deniers on the inside.

In the process of reeling or unwinding the cocoons, the reeling girls try to even up the thread, but in spite of the greatest care, a perfectly even thread cannot be reeled. To reduce variation in size, the girl adds and takes off cocoons as the thread size changes. Because the cocoon filament is as fine as a spider web, it is impossible to tie the threads together when adding one cocoon to another. The ends must be cast in on the running thread which adds to the difficulty of producing a uniform thread. In order to obtain a pound of silk thread it is necessary to unwind between 2500 and 3000 cocoons. To produce enough silk for one dozen pairs of stockings takes a reeling girl about 10 hours.

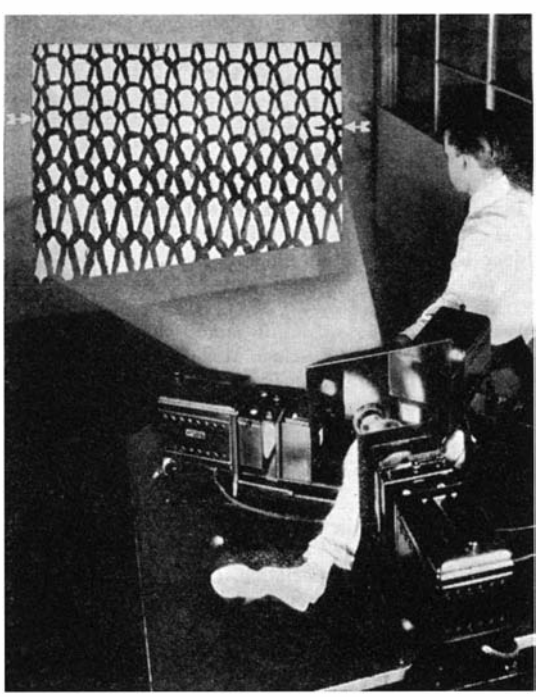
Besides unevenness of the thread there are structural imperfections in raw silk generally called "cleanness defects" such as waste, slugs, nibs, and the like. The number of these defects determines the cleanness grade of the silk, and to measure this, the thread is run through gages set to an accuracy of 1/10,000 of an inch.

Obviously, laboratory tests for evenness and cleanness are of the greatest importance in determining whether the raw silk is of proper quality for high grade merchandise. In the manufacture of hosiery, for example, uneven silk occasions objectionable rings or bands and streaks.

The evenness test perfected by Mr. Seem is known as the "nine meter composite evenness test." The silk to be tested is wound on a seriplane board using a Georgetown attachment. After winding, the threads are parted into groups of nine threads each. These groups are accurately cut into nine one-meter lengths which are then twisted into tiny skeins by an electric motor which revolves a twisting hook. The nine-meter skeins are then weighed, one at a time, on an automatic weighing and recording scale. Threads of larger diameter or denier naturally weigh more than fine denier threads. Thus the milligram weight of each tiny skein may be converted into diameter in microns. Evenness is computed by a mathematical formula based on the theory of least squares.



Silhouette projection showing run in stocking caused by missing a loop when topping



Projection of two kinds of mesh, the ordinary and the new, flexible, Fit-All-Top weave

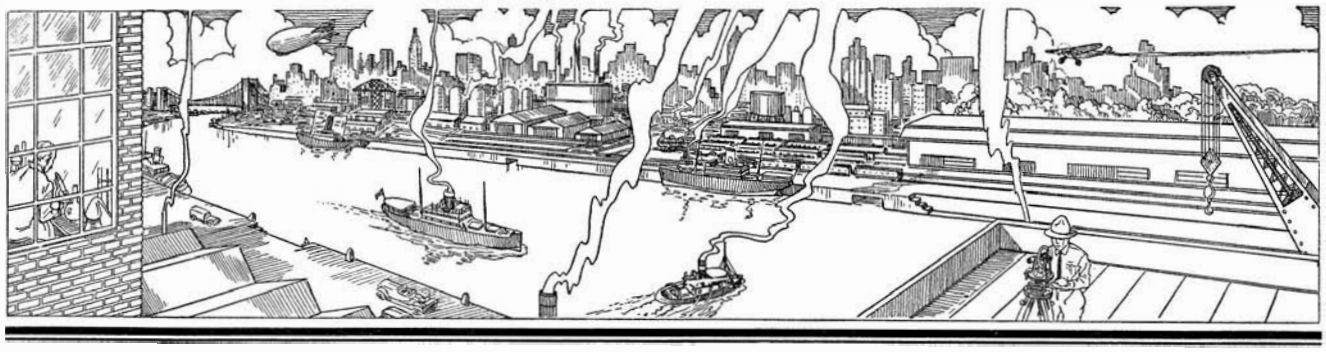
To avoid making thousands of nine-meter skeins to determine the average size of the lot, a number of whole skeins, 2250 meters in length, are reeled, and the deviation in average size calculated by the same method as that used for the nine-meter skein. In testing a 10-bale lot of silk, for example, 40 full-length skeins and 500 nine-meter skeins are weighed. These two results are multiplied together to determine a composite unevenness evaluation (in percentage). The evenness evaluation or final rating of the lot is obtained by deducting the composite unevenness from a theoretical 100 percent.

ONLY silk which has passed rigid laboratory tests is released to mill and factory. In the process of manufacture, the merchandise is inspected all along the line, and sample lots of finished goods regularly returned to the laboratory for check tests where speedy analysis of difficulties is made. Frequently photomicrographs are studied. Often in determining the cause of the defect, a textile projector is used.

This last equipment consists of three lanterns having 500-watt Mazda lamps so arranged as to provide surface and silhouette illumination. Minute details are clearly revealed by a high-powered projection lamp. Colored light filters are used to produce contrast. Projection of the fabric is about 80 inches on the screens, which are made of aluminum curtains or ground glass. By this method of magnification large fabric specimens can be examined, and analysis of imperfections in knitting or weaving is greatly facilitated.

The textile projector is also used for study of new weaves and constructions such as the recently introduced Fit-All-Top stocking. This stocking was designed to provide for elasticity up and down as well as across.

New machinery and equipment are constantly added to achieve greater speed and accuracy in testing, for not only must silk be tested with infinite care but also it is essential that the laboratory be able rapidly to test and grade a tremendous quantity of this valuable raw material. In rating raw silk, even color variation must be taken into consideration, there being some 25 color tones in each of the three major classifications—white, ivory, and cream. These color variations may not seem important to the casual observer but the most minute variance in color is full of meaning to the technician who is always on the alert to detect any lack of uniformity in silk selected for a particular purpose.



THE SCIENTIFIC AMERICAN DIGEST

Conducted by F. D. McHUGH

Contributing Editors

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

A. E. BUCHANAN, Jr.
Lehigh University

Scientific American Prize Awards

UNDER the auspices of the United States Amateur Air Pilots Association, a National Charity Air Pageant will be held at Roosevelt Field, Mineola, New York, on October 7th and 8th, 1933. The meet, which is under the patronage of prominent society women, will feature a number of interesting races with valuable trophies and cash prizes. The proceeds are to go to charity.

One of the events of the Air Pageant will be rather original in character. The

Irving M. Bailey, of Connecticut, winner in airplane model contest

SCIENTIFIC AMERICAN Trophy is to be awarded to the man or woman sports pilot, who, in the opinion of the committee of judges, has made an outstanding improvement to his or her airplane since its purchase. The committee will take the following three features into consideration in selecting the winners: (a) Enhancement of safety; (b) Scientific advancement; (c) Possible improvement over the manufacturer's advertised performance.

The Trophy will be the outright property of the winner. There is to be no entrance fee, and the only restriction is that entrants shall be members of the United States Amateur Air Pilots Association.

The chairman of the SCIENTIFIC AMERICAN Award Committee will be Professor Alexander Klemin of the Daniel Guggenheim School of Aeronautics, New York University. The other members of the committee will be Mr. James B. Taylor, Jr. one of the outstanding pilots of the country, and Mr. Jerome Lederer, Chief Engineer of Aero Insurance Underwriters.

The contest promises to be of considerable interest and of real scientific value.

A YEAR'S subscription to SCIENTIFIC AMERICAN was awarded to each of the winners of the 1933 National Championship Model Airplane Meet, all of whom established outstanding new world's records. They are:

Vernon Boehle, R. R. 1, Box 188, Indianapolis, Ind.

John A. Bartol, 7 Codman Hill St., Roxbury, Mass.

Albert Levy, 1036 Bloor St., W., Toronto, Ontario, Canada.

Boehle established a record of 8 minutes 43 seconds in the Stout Outdoor Fuselage Model Contest for rubber power. This event called for models weighing at least one ounce for each 50 square inches of wing area, with a built up fuselage and landing gear. Boehle also placed second in the Admiral Moffett International Contest, and fifth in the Mulvhill Contest. His outdoor performance was the best average.

Bartol established a new world's record of 17 minutes 47⅗ seconds in the Stout Indoor Duration Contest for stick models. The previous record was 13 minutes .03 seconds.

Levy made a record of 8 minutes 56 seconds in the Indoor Fuselage Model Contest for the Bloomingdale Trophy. In this event the models were required to have a built up covered fuselage with landing gear.

The meet was held June 27th at Roosevelt Field and June 28th at the armory of the 258th Field Artillery Regiment, Bronx, under the sanction and supervision of the National Aeronautic Association. *Universal Model Airplane News* sponsored the meet.

AT the State Model Airplane Meet held in Hartford, Connecticut, Irving Bailey, 621 Elm Street, New Haven, Connecticut, won the prize of a year's subscription to SCIENTIFIC AMERICAN for his model of a Boeing P-26 low-wing Army pursuit plane which was built to a ¾-inch scale and has the following dimensions: Span 21¼ inches; length 17⅞ inches; height 5⅞ inches. The Pratt and Whitney motor was reproduced faithfully as was the complicated nose of the ship.

The control surfaces are movable but not connected with the cockpit. A great deal of detail is incorporated such as many louvres, lights, and so on. The construction is all-balsa, covered with super-fine tissue to cover the grain. Bailey's comment was:

"I received my first issue of SCIENTIFIC AMERICAN today and all I have to say is that it is a mighty fine prize."

Antitoxin and Scarlet Fever

IF scarlet fever antitoxin is given within the first day or two after a person has become sick with scarlet fever, the disease is much less severe and complications are less likely to develop, Dr. Luke W. Hunt of Chicago recently told members of the American Medical Association.

His report was based on a study of more than 2000 cases in nearly 900 of which the antitoxin was given. If enough antitoxin was given early, the rash faded within 24

The trophy to be given at the meet at Roosevelt Field, Mineola, N. Y.

hours and the fever fell several degrees. An important discovery was that the subsiding of these symptoms made it possible to find the complications which are more to be feared than the disease itself, he said.

Mastoiditis, ear abscesses, heart disease, kidney infection, and pneumonia are among the serious complications of scarlet fever. —*Science Service.*

Chemistry of Pretzels

NOW that pretzels have come into their own again, chemists of the United States Department of Agriculture are trying to take some of the guess out of pretzel making. They have found that flours of high protein content have a tendency to produce pretzels of hard and flinty texture; that flours of low protein content cause trouble in the rolling machines and produce a poorer shape and size of product; that clear flours when used alone tend to produce pretzels of poor outside and inside color, of inferior taste and of uncertain keeping quality.

They have learned that "sound flours of both the straight and patent grades, containing from 8 to 10.5 percent of protein and not over 0.50 percent ash, such as those milled from soft red winter wheat, are satisfactory for pretzel making"; that a "satisfactory pretzel flour can be made by blending hard-wheat flours and soft-wheat flours of high and low protein content or by using a patent or straight flour with a small percentage of clear."—*A. E. B.*

New Model Casting Materials

HOW to exhibit 70 realistic models of baked goods at the Century of Progress—that was the problem of Standard Brands, Inc., a problem that was solved by Dr. Poller's moulage process. In the Standard Brands exhibit in the Hall of Science are now on display bread, cakes, rolls, and pies so realistic that they defy the observer to distinguish between the models and the actual product.

In making casts by this process, the mold, or negative, material, Negocoll, is heated slightly. It is then wiped over the object—a loaf of bread, a wound, a man's face, a statuette, or almost any other object of which a model is desired—and it quickly hardens to form the mold. Into this is poured the positive material, Hominit, and reinforced with Celerit. The resulting "casting" faithfully reproduces every detail of the original object.

After the molding material, Hominit, has been poured into the mold: lifting out the cast of a man's face

The first step in the new moulage process: applying the Negocoll to a small statuette by means of a brush

The American distributor of these products was led to them by his own skepticism. A friend of his had told him of a material on the market in Europe called Negocoll with which casts could be made from the human body, or from any object, without the necessity for preparing the surface. Recalling an experience of his university days when he had attempted to make a plaster cast of a man's head and the plaster had stuck to the model's hair, he was very much interested in this material which he was told would not stick to the hair. Going to Europe to investigate, he learned in addition that when Negocoll is used on the living model, the model sits in a natural position and breathes naturally while the material is being applied.

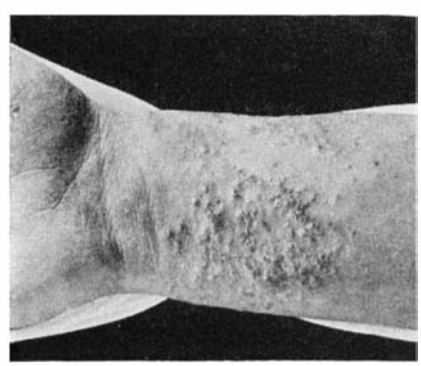
As a result there have been made available for American doctors, in private practice and in hospitals, the ideal products for making casts of anatomical specimens for purposes of study and research, as well as for evidence of a patient's condition before operating, of the progress of a disease, or of the steps in its cure. With these products police departments and bureaus of identification make moulages of victims, of tools used in the performance of a crime, of wounds of living or dead victims to be used as evidence in court, and of the unidentified dead for purposes of identification after interment. Artists, too, are using the materials in the making of face masks, portrait busts, and so on.

Varied as are the uses to which they are already being put, new applications are continually being discovered. The materials are even being used as a hobby by the layman because of the startlingly lifelike results they make possible and because they can be successfully applied even by those with no previous casting experience.

Swimming Pool Risk

SIGNIFICANT light has been thrown on the risk of infection from swimming pools by the findings of research recently performed by Doctors W. L. Mallman and W. Cary of Detroit, and published in the *American Journal of Public Health.* These investigators found that the most widely practiced method of testing the water in swimming pools is untrustworthy and has been giving false data, because it often indicates the absence of disease germs when such germs are actually present. This is how it happens:

The water in swimming pools is usually chlorinated. This will, it is true, kill germs —but how rapidly? The customary method of testing the water is to take samples and send them to a laboratory for examination. Where chlorine has been used in the water such routine tests generally indicate that it is germ-free, and the pool is given an O.K. What the two Detroit physicians found, however, is that several hours usually intervene between the taking of the samples and the actual tests, and this lapse of time, giving the chlorine taken up with the sample full opportunity to work, accounts for the apparent absence of germs. On the other hand, tests made on the spot and at once, in a special laboratory set up at the pool indicated the presence of *Bacillus coli* and streptococcus germs. The more bathers in the pool, the more germs were found in the tests, even in the presence of chlorine. Chlorine will kill germs if given time, but in the meantime many of them remain alive and ready to invade the bodies of swimmers.



A finished model: cast of a man's forearm showing fidelity with which a skin eruption is modeled

In an article published in our October, 1931, issue ("Are Swimming Pools a Health Menace?") we emphasized the feeling, then growing, that swimming pools constitute more of a risk than had previously been thought. The fresh findings mentioned above add one more bit to the growth of that same feeling.

What Happens to the Wheat Crop

GOVERNMENT figures, recently published, indicate an expected 1933 crop of wheat only about 55 percent of that of normal years, the total predicted being about 500,000,000 bushels. Thus it is of interest just now to look into the question of wheat consumption to see where we stand as to the carry-over of surplus wheat from previous years' crops.

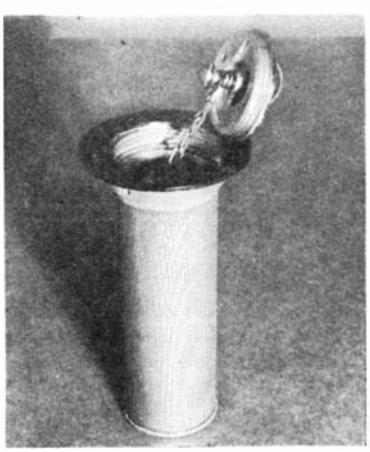
Three things happen to the annual wheat crop in the United States. From 600,000,000 to 700,000,000 bushels go into domestic consumption. Since 1923 this consumption has increased less rapidly than the population. The two other channels into which the supply goes are exports and carry-over. As the exports decline, the carry-over mounts. Records of the United States Department of Agriculture show that in the year ended

June 30, 1923, we exported 205,000,000 bushels and had a carry-over of less than 100,000,000 bushels. In the year ended June 30, 1932, we exported 112,000,000 bushels and had a carry-over of 362,000,000 bushels —three times the normal.

It might be supposed that these declining exports and mounting carry-overs implied a slump in world wheat consumption. As a matter of fact, the world consumption of wheat grew steadily in the last decade. In the 1930-31 season the total apparent disappearance of wheat outside Russia and China was 3,800,000,000 bushels, as compared with only 3,200,000,000 bushels in 1921-22. World wheat consumption in the depression year 1930-31 exceeded that of the preceding year and about equaled that of the highly prosperous season 1928-29. It was not falling consumption that brought about our mounting wheat surplus. It was rising production here and abroad.

Reducing Aircraft Fire Hazards

THE gasoline used in aircraft engines is highly volatile and has a flash point equal to that of ordinary room temperature. Therefore the storing and handling of gasoline always offer a certain hazard, with the tiniest spark sufficient to produce an explosion when airplane tanks are being filled. An interesting device to lessen the hazard of filling airplane fuel tanks is the "Protectoseal."



Built on the principle of the Davy lamp, Protectoseal prevents passage of flame while filling the tanks of airplanes with gasoline

The principle on which this device operates is not new; it is that of the Davy miner's safety lamp. Fundamentally the Protectoseal consists of flame baffles made of non-ferrous perforated metal, arranged in cylindrical form (as shown in the photograph) in order to provide the maximum area of screen openings in relation to the area of the openings to which they are attached. These openings prevent the passage of flame or spark into the vessel where volatile vapors may be lodged and where there may also be enough air to form an explosive mixture. In addition, the filler cap has a spring-loaded poppet valve in the center.

The application of Protectoseal for filling gasoline tanks is obvious. In addition it serves as a safety measure against airplane explosions. If the airplane should catch fire from any source and the gasoline tanks become enveloped in flame, the internal pressure mounts rapidly to the bursting point of the tank. As soon as a dangerous pressure is reached the poppet valve opens, since its release pressure has been previously set, and allows the expanded vapor to escape without the fire coming in contact with the gasoline in the tank. The valve closes again when the pressure is back to normal.—*A. K.*

Balbo's Transatlantic Flight

GENERAL ITALO BALBO, youthful Air Minister of Italy, and his formation of 24 military seaplanes, completed, on July 16, one of the most daring and spectacular flights on record. His landing on that day, at Chicago, marked the completion of a 6100-mile flight from Orbetello, Italy. Starting on July 1, 25 planes flew first to Amsterdam, Holland, where one plane cracked up with the loss of one man. The remaining 24 flew by Londonderry, Northern Ireland; Reykjavik, Iceland; Cartwright, Labrador; Shediac, N. B.; Montreal, Canada; and thence to Chicago without further mishap. At the time of writing, the planes have just started the return flight to Italy.

The Safety Belt as a Warning Signal

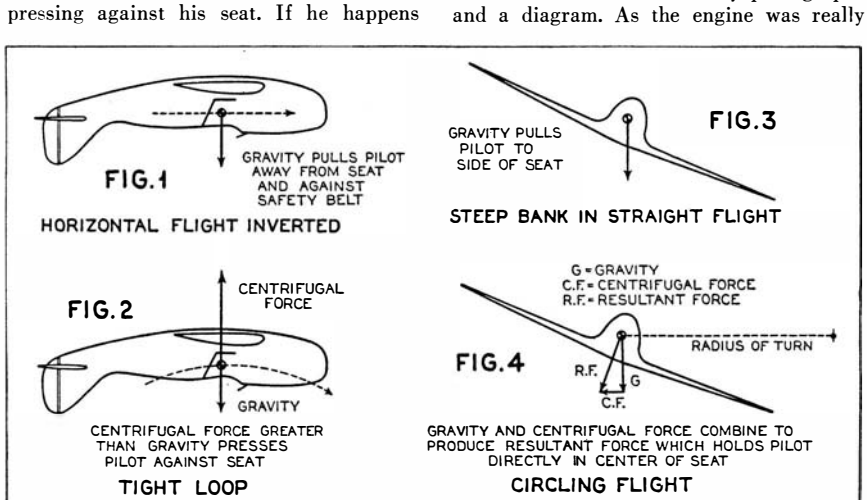
WHEN blind flying is being discussed, the question is often asked as to whether the safety belt will or will not warn the flier of an abnormal attitude of the airplane?

In the classical manner, the answer is "yes" and "no." It depends on the particular maneuver and on the particular combination of gravity and centrifugal force. If when flying blind, the plane is flying upside down and in a horizontal line, then of course the force of gravity will be pulling the pilot downwards, head first, and he will be hanging by the safety belt and feel its restraining pressure accordingly.

Let us now suppose that the pilot is at the top of a very fast and very tight loop, and practically upside down. There will now be two forces at play: gravity acting downward, and centrifugal force acting outwards from the center of the loop and upwards. If the loop is very tight the centrifugal force may be greater than the force of gravity. In this case the pilot will be upside down in space, yet he will be pressing against his seat. If he happens to be flying blind, his safety belt will certainly give no warning of an abnormal attitude in this case.

Again, if he is flying straight ahead, but is sharply banked, gravity will exercise a lateral component on the pilot's body and he will certainly feel its effect. But let us imagine that while flying blind the pilot instead of flying ahead gets himself into circling flight or a spiral. Then the force of gravity and centrifugal force will combine to give a resultant which will pass through the seat. The pilot in this case will feel no abnormal force, but a slightly greater pressure on his seat—which he will scarcely notice.

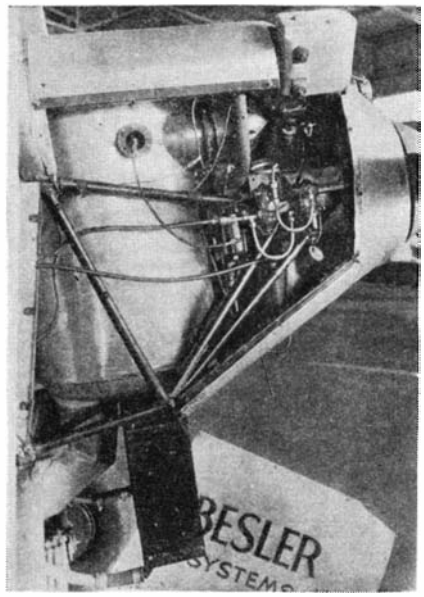
The safety-belt may scarcely be considered a reliable guide.—*A. K.*



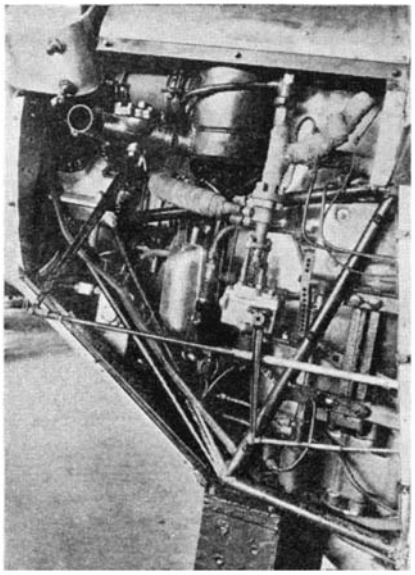
Resultant forces on the safety belt to warn a pilot of unusual attitudes. Figures 1 to 4 show the various positions of airplanes discussed in the column above

A Steam Driven Airplane Engine

TWO brothers, William J. and George Besler recently installed a reciprocating steam engine in a conventional Travel-air biplane, and a number of successful flights have been made at the Oakland, California, airport. The power plant is illustrated in these columns by photographs and a diagram. As the engine was really



Right side of steam airplane power plant, showing fuel and water tanks, spark plug housing, Venturi assembly, flue, and other details



Left side of Besler plant, showing low pressure cylinder, feed water heater, boiler, throttle lever, electric control, and other accessories

an old automobile engine, the airplane came out 300 pounds over weight, but it is expected that savings in weight will be readily made later.

The Besler brothers' steam engine is a two-cylinder double-acting, compound 90-degree V engine, with a cut off at about 50 percent of the stroke. The high pressure cylinder has a bore of 4¼ inches and a stroke of 3 inches. The low pressure cylinder has the same stroke, but a 5 inch bore. The ordinary working pressure is 950 pounds per square inch, and the temperature of the steam is 750 degrees, Fahrenheit. The engine not only drives the propeller but also drives a blower through an over-running clutch. The blower (an electric motor is used when starting) supplies air to a Venturi in which the fuel lines terminate. The Venturi leads the mixture to a fire box, where an ignition plug sets the mixture aflame. Once ignition has been started, the process of combustion is continuous.

The steam generator is of a modified flash type. The tubing is continuous in length, about 500 feet in total length; the coils are covered with metallic wool insulation and sheet aluminum. A pop valve is set to give relief at 1500 pounds pressure. A thermostatic normalizer device injects water into the superheater whenever the temperature goes above 750 degrees, Fahrenheit. From the boiler the steam passes through a throttle to the engine proper, and then to two condensers—one mounted at the top of the fuselage and one below. From the two radiators or condensers, the steam passes into the water tank, which is provided with a steam dome. From the water tank, a pump passes the water through a primary heater and then to a secondary heater. By preheating the water, some of the energy of the exhaust steam is put back into the system, and thus the overall efficiency is improved. After passing through the heaters the water again goes back to the boiler, and the process is repeated over and over again.

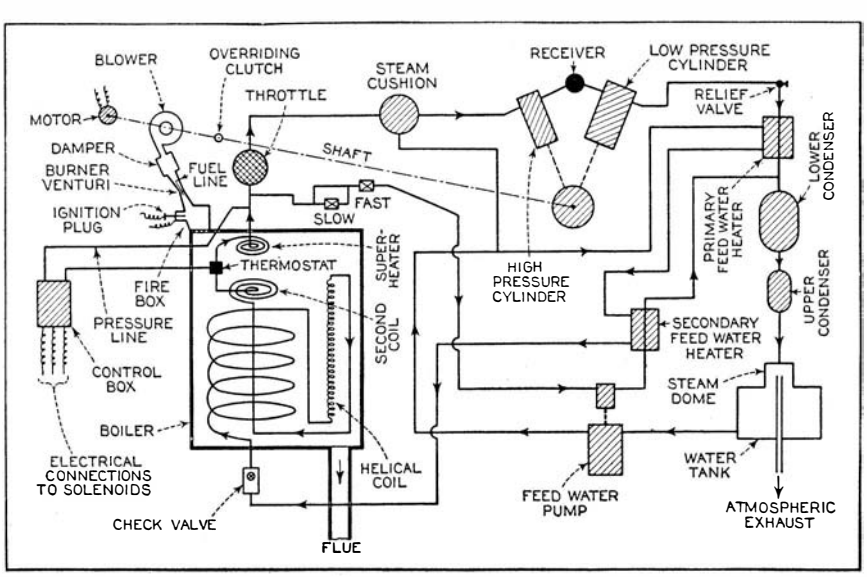
In the tests the rapidity with which the boiler got up steam was remarkable. In five minutes the plane was ready to take the air. In the air, the absence of noise was remarkable. On landing a very interesting possibility of the steam engine was in evidence. As soon as the pilot landed *he reversed the engine* (reversing the engine is a simple matter on a reciprocating steam engine). With the propeller driven in the opposite direction, a powerful braking effect was obtained. Perfect control and smoothness of operation was noted throughout the test flights.

A great deal of the technical work on the Besler steam engine was done at the Boeing School of Aeronautics, and we are indebted to Mr. Welwood W. Beall of this school for a first-hand account of the design.—*A.K.*

1933 Air Traveler Has 107 Pounds of Comforts

TO provide the comforts the modern day air traveler demands, air transport companies have had to allow for approximately 107 pounds over and above the 170 pounds allowed as the average weight of a passenger. Years ago companies had to allow only for the weight of the traveler because comforts were not much in evidence then.

In the new three-mile-a-minute Boeing multi-motored planes on United Air Lines' coast-to-coast route, the following allowances are made per passenger: baggage, 30 pounds; seat and safety belt, 19 pounds; laminated window glass, 4.4 pounds; sound proofing and cabin lining, 16.3 pounds; lavatory, 4.4 pounds; stewardess and her equipment 28.8 pounds; and 22.6 pounds for ash trays, steps, hat and coat racks, visual intercommunication system and other items.



Schematic diagram of the Besler steam power plant for airplanes

Wind Vortex Wrecked Airship "Akron"

NOT structural failure, but a wind vortex, wrecked the airship *Akron*. A reconstruction of the recent disaster made by Prof. T. von Karmán and reported at a California Institute of Technology conference gives a picture that is in striking agreement with known facts.

The *Akron* was caught in a vortex. The wind above the ship was moving more slowly than the wind below the ship. This generated a force which could reach a magnitude of more than 70 tons; as the lift or buoyancy was at most 20 tons, the *Akron* was very suddenly forced down until one end struck the water, which caused shock enough to stop the ship and to tear it apart.

The steam Travelair biplane, formerly powered with an OX-5 engine

The mechanical features and the handling of the ship were not at fault.

The *Graf Zeppelin* once had a quite similar experience when it suddenly lost a thousand feet in altitude and found itself about 200 feet above the ocean, Prof. von Karmán said. It was sheer luck that they came out of it at this height because they had absolutely no control of the situation.

Prof. von Karmán had given this problem of forces due to vortex to his students over a year ago when he did not anticipate that it would have the unhappy application provided by the *Akron* disaster.—*Science Service.*

Air Schedules Give U. S. Edge On Speed

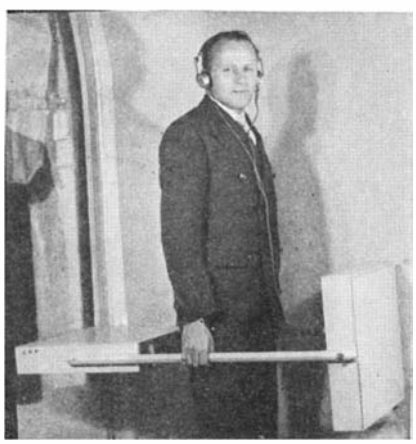
WITH the placing of the new all-metal, low-wing, Boeing Wasp-powered monoplanes in service on United Air Lines' coast-to-coast route, this country possesses not only the fastest multi-motored passenger transport in the world, but one capable of cruising 40 miles an hour faster than the fastest multi-motored transport in service in Europe or Asia, according to figures on

European plane performance, as compiled by the Aeronautical Chamber of Commerce.

Illustrative of the speed of the new three-mile-a-minute 10-passenger transports is their ability to cruise faster than the high speed of practically all tri-motored passenger transports now in service in the United States.

Another "Treasure Finder"

ELECTRICAL apparatus for finding buried gold, silver, iron and so on may now be had in two varieties, the fake and the scientific. For a long time the principles by which really genuine scientific apparatus of this kind could be made have been known but, given these principles, the would-be constructor was still



The new "treasure finder"

a long way from his "buried treasure." He must design and make his apparatus, and only those who have tried this know how many false starts must be made before they get it right—that is, designed right, made right, adjusted right and working right. The fact is that few ever have accomplished this.

One who has thus worked the "bugs" out of the apparatus is Gerhard Fisher, of the Palmer Building in Hollywood, California, a consulting research engineer connected with the widely-known Radiore Corporation which has undertaken and performed much successful geophysical prospecting for mining companies and stands high in the professional field of geophysics. "Metallascope" is operated electrically, weighs 22 pounds, is equipped with dry batteries, vacuum tubes and head phones, and each instrument is self-contained, requiring no external connections. It requires no special training or skill to operate and, as the Director of the Bureau of Standards has recently stated, it is based on sound principles. Briefly, an artificially created magnetic field is distorted by the buried metallic object, and this alters the pitch of the note in the earphones.

The instrument is widely used by public utility companies to locate quickly and accurately old pipe lines, cables, casings, steel rails and other buried structures, the map records of which have become lost. In prospecting, every near-surface vein, ledge or stratum of ore also registers its presence when the device is passed over it.

It is used as a "treasure finder" by persons who believe they know the approximate location of buried wealth; and while we know that many reported cases of buried treasure prove mythical, it is a fact that the Metallascope has located at least three buried caches. It can do this within its range of penetration—10 to 20 feet or more. It is carried over the area in question and when directly above the buried metal or ore body, a definite signal is noted in the head phones.

Mr. Fisher has also prepared blueprints and instructions by means of which the amateur may build his own Metallascope, using standard radio parts.

New Contractor's Cost-Plus Formula

ONLY too often a contractor, after submitting his bid on a job on a cost-plus basis and getting the contract, allows the actual cost to run far in excess of his bid. On his contract, he then gets more for the job than he is really entitled to and the owner pays more than he expected to pay. To obviate this state of affairs and "compel the contractor to pull on the same end of the rope with the owner," Mr. A. L. Williams, of Madison, Wisconsin, has developed a formula which he has copyrighted.

This formula is the essence of simplicity and may be stated in few words. "Pay to the contractor his agreed percentage, not upon cost but upon Double the Estimated Cost Less the Actual Cost." That is all there is to it. The formula becomes:

$$P(2x-y)$$

P is the contractor's percentage; x is the estimated cost; and y is the actual cost.

By the use of this formula, the contractor gets a larger percentage if he saves money for the owner by holding the actual cost below the estimated cost, and forfeits a part of his predicted percentage if he allows the cost to exceed his bid. To prove this, let us assume that P is 10 percent and x is 5,000,000 dollars. When y is 5,000,000 dollars, the contractor's earning is exactly what it would be under ordinary cost-plus practice. Suppose, however, that the actual cost, y, exceeds the estimated cost by a million dollars. This would ordinarily pay the contractor a bonus, but under the new formula he would lose 100,000 dollars. Conversely, if the actual cost turns out to be a million dollars lower than the estimated cost, the contractor will make 100,000 dollars more than he would under the ordinary plan. Work it out by the formula and see.

Antiseptic Soap

A NEW and powerful antiseptic and germicide recently put on the market in London, under the trade name "Abracide," is reported by *Chemical Markets*. It has been found to have a phenol coefficient of 105, using staphylococcus aureus as the test organism at 37 degrees, Centigrade. A 5 percent solution of Abracide in a 10 percent soap solution is antiseptic and germicidal in dilutions of one part in 300, the solution being found effective against the most highly resistant spore-bearing bacilli.

Its stability in soap solutions is a marked advantage over most other germicides. This stability is due to a very weak acid character—insufficient to hydrolyze the soap. The material is not easily soluble in water, and is generally used as a 5 percent soap solution; or it may be dissolved in industrial ethyl alcohol or in isopropyl alcohol. Trials have already shown the value of the new material in preventing the bacterial decomposition of tan liquors in the leather industry; in the production of antiseptic soaps; in preventing the objectionable odor and mold formation which frequently occur on cardboard boxes; and in the preparation of water-miscible disinfectants.—*A. E. B.*

Warm Bath Opens Clams

CLAMS may be opened easily and with no ill effects by a new method announced by the United States Bureau of Fisheries. The opening is effected by immersion in a warm bath of fresh or sea water at a temperature of 105 degrees, Fahrenheit. A temperature fluctuation between 100 and 110 degrees is permissible.

In the Bureau's experiments, 100 percent of the clams opened their shells in from ten to twenty minutes, and when removed from the bath a few minutes later, were completely narcotized. The immersion method causes no shrinkage or apparent loss of tissue fluids, and the meat is in the same condition as when the clams are opened unwarmed.

The process will be tried out on a commercial scale, and further studies are being made to determine if a similar method can be applied to oysters.—*A. E. B.*

Sources of Quick Muscle Energy

TWO methods, hitherto unrecognized, by which the muscles get the energy to do short but violent spells of work, such as running the 100-yard dash, were described at the meeting in Cincinnati of the American Physiological Society by Dr. Jacob Sacks, of the University of Michigan pharmacology department.

Normally the muscles do their work by burning lactic acid with the oxygen in the

Photograph by Max Kettel, Geneva

One of the numerous S.O.S. telephone stations established by the Swiss Automobile Club in several Alpine passes. By means of these, automobilists may quickly summon doctors, a garage, or the police, telephone numbers of which are posted at each of the many booths

circulating blood. Occasionally the body must move very quickly during a short period of time, requiring energy faster than oxygen can be carried to the muscle tissues by the blood. In these cases, Dr. Sacks reported, glycogen, or "animal starch" stored in the muscles, undergoes two quick chemical break-downs.

One of the products of the glycogen is lactic acid in large amounts, another is "hexosephosphate," a glycogen and phosphorus compound, said Dr. Sacks. Energy sufficient for short but violent exertion is the by-product of both these processes, much as electrical energy is a by-product of chemical action in a battery. If the emergency continues, the heart has time to increase its rate of beat and pump enough oxygen-charged blood to the muscles to enable energy production to continue. Thus a policeman, suddenly giving chase to a thief, would call on the newly discovered quick energy processes for a good start, but would gradually change back to the usual oxygen burning method if the chase proved a long one.

Page Mr. Ripley

HERE are a couple of "Believe-it-or-nots" that Mr. Ripley may have missed:

According to *Food Industries*, a German farmer on the Bay of Kiel operates a dairy in which milk is obtained from sea cows.

Experimental installation of new sodium vapor lamps on a highway

It isn't known whether he herds the animals with dog fish, but anyway, he obtains about 75 quarts of milk daily. And this milk has proved excellent for butter and cheese.

Students at Massachusetts Tech have built a rat-trap consisting of a "cannon" and a photoelectric cell rigged up in such a way that Mr. Rat is put on the spot as he ambles down his favorite pathway and intercepts the light beam. For economy's sake, the "cannon ball" is tied to a string. —*A. E. B.*

Man Sees World without Colors

THE discovery of a young man who sees a completely colorless, gray world was revealed to science by Dr. Frank A. Goldard, University of Virginia psychologist, reporting to the meeting of the Southern Society for Philosophy and Psychology.

Only 10 other such cases have hitherto been discovered in America. There are many who cannot tell a green "go" light from a red "stop" light, but inability to see anything but gray color in spring flowers, vivid millinery, or gaily painted pictures is extremely rare.

Mr. J. M., 23-year-old graduate student, as Dr. Goldard identified the unusual individual in reporting him to the scientists, was asked to pick out a card containing red or reddish dots. He picked one with red, green and gray spots. Then the test cards were shuffled and he was asked to pick a card with green or greenish dots. He picked the same red, green, gray dotted card.

Careful study of this interesting case, which was facilitated by the fact that Mr. J. M. is a graduate student and co-operated willingly, showed conclusively that the eyesight defect is caused by failure of the cones of the eye's retina to operate.—*Science Service.*

Sodium Vapor Highway Light

THE sodium vapor lamp has been given its American première at Schenectady, where a half mile of highway has been illuminated, under the joint sponsorship of the General Electric Company and the New York Power and Light Corporation, with the characteristic orange-yellow glow of sodium vapor.

Twenty-two lighting units have been placed by the engineers, but not more than 18 will be lighted at any one time. They have been so installed that they can be shown in spacing combinations of 125, 250, and 500 feet for purposes of comparison.

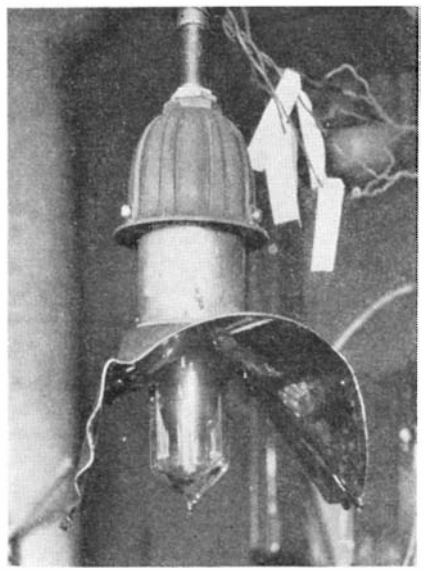
Sodium light is monochromatic, or of one color, whereas daylight is made up of all colors. Monochromatic light is valuable in highway lighting, being especially useful in revealing the details of objects at low levels of illumination, although it has disadvantages in interior lighting where color discrimination is important. The monochromatic light of sodium falls in a region near the maximum sensitivity of the eye. The experimental setup will determine whether this visual sharpness is an important factor in night driving.

The most important advantage of sodium vapor lamps is their comparatively high efficiency. They can be manufactured with two to three times the efficiency of the tungsten filament incandescent lamp, and there are indications that even greater efficiencies will be obtained eventually.

At first glance the light from the new lamps seems markedly dim in comparison with incandescent or arc lamps, but seeing is actually made easier by the reduced glare and the monochromatic quality of the light. Sodium lamps give about 2½ times the light output of the incandescent lamp for the same wattage input.

Gases as Meat Preservatives

IT has been found that the inhibiting effect of carbon dioxide on the growth of molds and bacteria on meat and connective tissue stored at or near freezing point is considerable, even at so low a concentration as 4 percent, according to *Industrial and Engineering Chemistry*. With 20 percent carbon dioxide the inhibition is so marked that, if judged by this criterion alone, the life of meat is at least doubled. This finding may be important, if, in the transportation of chilled beef, it is possible to maintain concentrations of carbon dioxide of this order in the ship's hold.



Close-up of sodium vapor lamp with its curiously designed reflector

With ordinary methods of storage, bacon fat tends to oxidize and become rancid, but it remains free from rancidity when kept in nitrogen. Moreover, the lean of bacon keeps better in nitrogen and carbon dioxide than in air. Pork keeps well in carbon dioxide but not in nitrogen, and it is known that carbon dioxide has a specific effect in delaying the growth of microorganisms which spoil pork. A carcass of pork has been kept for 17 weeks at –17 degrees, Centigrade, in carbon dioxide. The fat was not rancid and the lean was tender. —*A. E. B.*

Blood for Transfusions

DR. JUDINE, head of the surgical service of the Hospital at Moscow, recently lectured before the Academia Medicoquirúrgica of Madrid on his method for the use of blood from cadavers for transfusion. All emergency cases in Moscow, a city of more than 3,000,000 people, are brought to the Surgical Hospital of Moscow. The problem of getting donors for blood transfusion was long a puzzle because of the number of patients in need of transfusion. The experiments performed by Chaumow in 1928 on dogs suggested to Dr. Judine the use of the blood of cadavers for transfusions in man.

The first case in which Judine used the blood from a cadaver was that of a man who attempted suicide by cutting the veins of the forearm with a razor. The patient was in a preagonal condition. Judine took the blood of a man, aged 60, who had been dead six hours from fracture of the skull. He opened the abdomen of the deceased and from the vena cava withdrew 450 cubic centimeters of blood, which he injected immediately into the veins of the suicide. A few minutes later the pulse rate increased and the condition of intense anemia disappeared. Four days later the patient left the hospital cured.

Since that experience, Dr. Judine has used successfully the blood from cadavers in transfusion several times. He first does

a Wassermann test. At the third Congress of Surgery, in Ukraine, Dr. Judine obtained legal authority to continue this work. From a large number of experiments he has learned that the blood of a cadaver keeps its vitality for 12 hours after death. He uses blood only from cadavers of suicides, of persons who died of heart disease or of skull fractures. The cadaver is placed on an inclined plane and with a cannula in the jugular vein the blood is collected in salt solution and then placed in the icebox, where it may remain in good condition for 28 days. Judine prefers to use it after not more than 10 or 12 days. Blood taken from cadavers whose death occurred more than 12 hours before the blood is collected may cause grave poisoning; its use is not advisable.

The method is indicated in all the cases in which transfusion is indicated. After a Wassermann test and the determination of the blood group, the blood is kept in the icebox until a transfusion is necessary. In this way, a man may be useful to his fellow men even after death.—*Journal of the American Medical Association.*

Contrasting Thunderstorms

SOME thunderstorms are wind hatched; others are calm brooded. Humidity of the air decreases during storms of the first type and increases during those of the second type, according to a recent study by Dr. W. J. Humphreys, of the United States Weather Bureau.

Wind-hatched storms, also known as "cold front" and "squall line" thunderstorms, are caused by cooling from above, usually the result of the importation of cold air. Wind is necessary for the creation of such storms.

Calm-brooded, or heat, thunderstorms are caused by warming below from exposure to the sun. These storms grow from small to large circular flows of warm air straight up from the earth's surface. These chimney-like storms arise only when there is no wind.

As the absolute humidity of the air on all sides of a heat thunderstorm is about the same, the evaporation of the falling rain increases the density of the atmospheric vapor, making the humidity greater than it was before the storm.

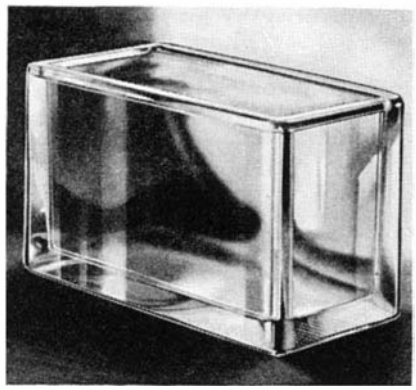
The distribution of the absolute humidity about the cold-front storm, however, is unequal. It is much greater in the warm air in front of the storm than it is in the cold air to the rear. The absolute humidity, therefore, decreases as the storm passes over.

Glass Block—New Building Material

ONE of the most conspicuous sights at the Century of Progress Exposition in Chicago is a building made of glass blocks, erected by the Owens-Illinois Glass Company, Toledo. The glass block represents a new development in building materials which offers new scope to the architectural profession.

The structure at Chicago is 100 feet long and 60 feet wide, surmounted by a colorful tower 50 feet high. Its lines are simple, straight and strong; its dignity impressive. To these satisfying qualities it adds the new note of surface colors covering the whole range of the spectrum, and an interesting three-dimensional pattern effect.

The glass block used in this building is six-sided, hollow centered, about twice the size of an ordinary brick, and so designed that it can be laid by the ordinary mason. It is made by pressing a five-sided unit and adding a separately pressed sixth side, the



One of the glass building blocks

two members being hermetically sealed together to complete the block, leaving an air-tight cavity within. This air-chamber in the center of the block serves as an effective insulator, conserving heat in winter, and providing a cooler interior in summer.

To assure a good bond between the mortar and the glass block, to prevent the mortar from dropping off the block, to give the block some suction while being laid, and to prevent water from penetrating the wall between the block and the mortar, the surfaces which would normally be in contact with the mortar are painted in the factory with a cement paint.

By applying color to four or five of the surfaces, the effect of a block of colored glass is achieved. The translucency of the block admits diffused light to the building's interior without permitting anyone to see through the wall. When the interior of the building is lighted the exterior presents a glowing spectacle of beautifully harmonized color.

While not intended as a load-bearing material, the glass block is a sturdy unit, not easily broken, and is expected to prove highly useful as a curtain wall material in all kinds of commercial and industrial buildings.

Too Much Vitamin D

ALTHOUGH plenty of vitamin D is undoubtedly good, more may not be better. This warning to parents who wish to prevent rickets in their growing children may be deduced from the report made public in *Child Development Abstracts* and abstracted from the *Edinburgh Medical Journal.* Dr. L. Thatcher reported that a child of 18 months was admitted to a hospital in Edinburgh, much under weight and unable to walk alone because of weakness. Doctors at the hospital diagnosed the ailment as a kidney inflammation. The child died.

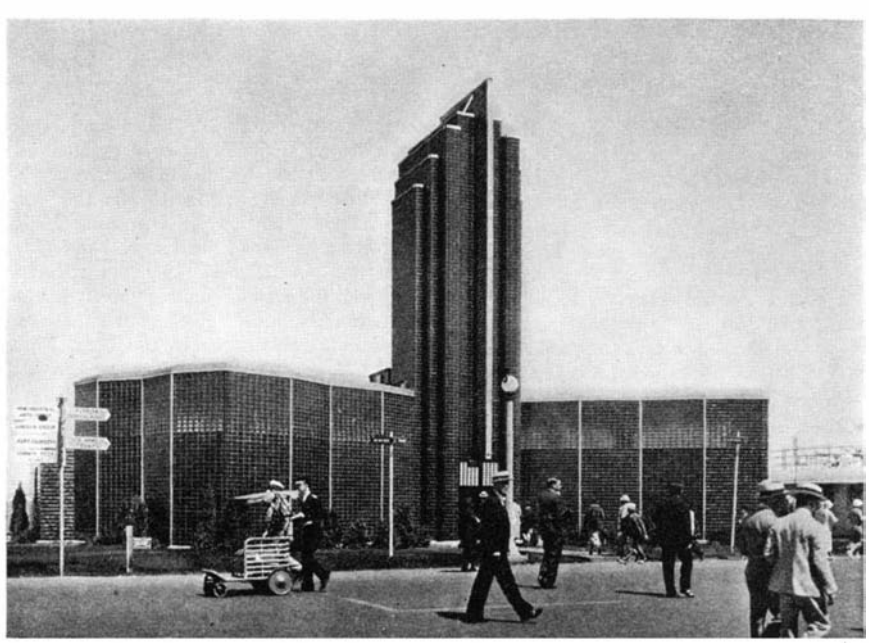
Then it was found that the child had received a daily dose of irradiated ergosterol equal to twice the recommended dose and that this severe dose was continued during the summer despite the fact that he was living an outdoor life at the seashore.

Examination of his kidneys showed large deposits of calcium, a constituent of bones. Vitamin D is supposed to help the body use the calcium from food to make strong bones. But in the case of this child, the double dose of vitamin D resulted in calcium being deposited not only in the bones but in the kidneys, where it does not belong, and where it apparently interfered with the function of these important organs.

Death in this case was caused by too much vitamin D, it was decided.—*Science Service.*

Improved Mercerizing Process

RECENT improvements in the mercerization of cotton depend upon the discovery that certain substances known as "wetting agents" speed up the impregnation of the cotton fibers by the alkali, thus reducing the time required for the process and also eliminating the necessity of pre-



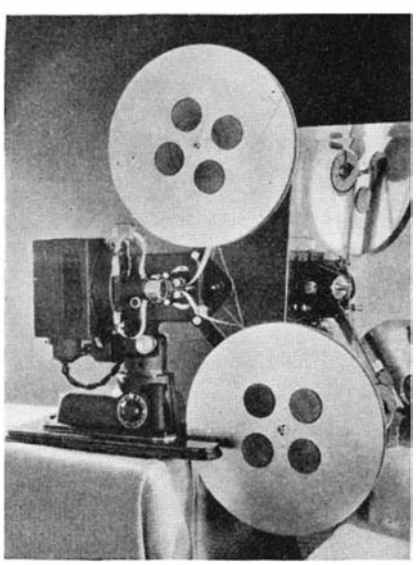
A striking example of modern architecture using the new glass blocks described

liminary boiling of the cotton in water. Cresol, cyclohexanol, sulfonated higher alcohols and sulfonated glycol ethers are used as wetting agents.

It is now reported that even more rapid wetting can be effected with the aid of light wood creosote, by-product of the manufacture of pure creosote for pharmaceutical purposes in the course of wood-tar distillation. According to Dr. W. Pohl, writing in *Chemiker Zeitung*, speed of wetting of dry cotton with 20 percent sodium hydroxide solution employed in mercerization is increased to an extraordinary extent by the addition of 1.5 grams of light creosote to each liter of the bath. Light creosote thus appears to be superior to many of the commercial preparations which require to be added to the mercerization bath in 10 times the above quantity.—*A. E. B.*

1600-Foot 16-mm Projector

THERE has lately been a considerable demand for a 16 millimeter motion picture projector with a film capacity of up to 1600 feet. Although it may sound simple, the designing of such a projector has presented manufacturers with a problem of no mean difficulty—that of equalizing and controlling the film tension to prevent serious damage to the film, particularly when the greater part of the film weight is concentrated on one or the other of the two reels.



The 16-millimeter projector with new large reels. Mirror at right shows other side of the mechanism

Victor Animatograph Corporation, of Davenport, Iowa, have solved this problem with the newly announced 1600-foot Victor, in which the problem of equalized tension has been successfully overcome by an intermediate take-up unit which employs the slip-friction principle to control automatically the tension on any size reel.

The 1600-foot reel arms, with pulleys attached, intermediate take-up unit, cut-out baseboard, and special carrying case may be obtained as attachments and adapted to any Victor 10FH or 10RH now in use without interfering with its use as regular 400-foot equipment. Changing the reel arms and attaching the intermediate take-up unit can be quickly accomplished by simply removing four screws.

Basing the opinion on interest already manifested, the Victor company predicts that this new 1600-foot projector will become popular in the industrial, educational, and religious fields.

Australian Ants Are Formidable Animals

"BESIDES the poisonous snakes, they are really the only formidable 'animals' in the Australian Bush."

Thus Prof. William Morton Wheeler of Harvard University characterizes the Australian "bulldog" ants, in a new book, "Colony-Founding Among Ants." Prof. Wheeler describes these fierce insects as sometimes more than an inch in length, "singularly alert, wasp-like, large-eyed, long-jawed, and fiercely stinging."

The primitive ants of Australia, he states, differ from ants of other continents in their colony-founding methods. The queen ant, at the outset of her career, does not accept the permanent imprisonment which is the fate of her sisters elsewhere, but from time to time breaks through the wall of her cell and goes out to forage for her young. When she returns she seals herself in again, and after the colony has made a good beginning she settles down to being permanently housebound.—*Science Service.*

Poison Gas from Burning Clothes

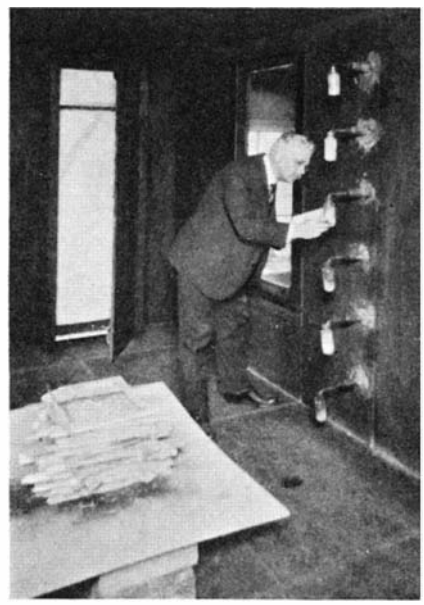
BURNING clothes are revealed as a source of deadly gases which are responsible for a large percentage of the 10,000 lives lost each year in the United States through fire, according to an investigation conducted at the Polytechnic Institute of Brooklyn and reported in *Industrial and Engineering Chemistry*, journal of the American Chemical Society.

Fumes from all types of blazes were investigated in a small building, especially constructed for the purpose, by Prof. John C. Olsen, George E. Ferguson, and Leopold Scheflan, who carried out the research. The structure, consisting of a single room with a capacity of 1104 cubic feet, has three windows and a door and is lined with asbestos.

Fitted with openings for sampling gases at levels of one, two, three, four, and five feet, the room makes possible selective study of distribution of gases from fires kindled on the floor. Combustible materials used for experiment included wood and cellulose products, oils such as gasoline, textiles such as wool and natural silk, and articles containing rubber, such as electrical insulation.

"Persons overcome by the fumes produced by fires," says the report, "can be more intelligently treated by physicians if the latter are familiar with the gases produced by fires."

Cellulose materials burning in the absence of air give off highly toxic concentra-

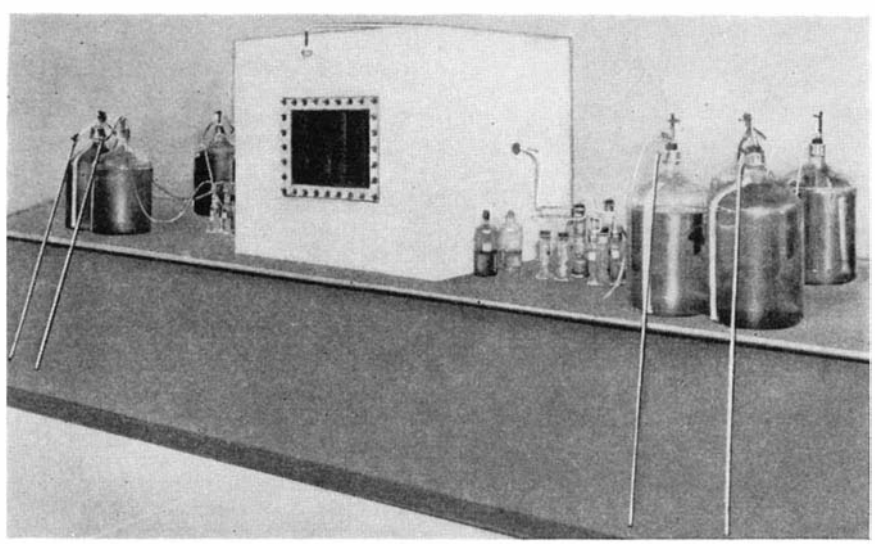


Outside the fire test room, showing connections for sampling the gases

tions of carbon dioxide and monoxide, the investigation shows. Both carbon dioxide and monoxide concentrations are much lower in a gasoline fire, which makes it evident that a person could breathe gases from a gasoline or oil fire much longer than toxic gases from a wood or cellulose fire.

Rubber insulation fires gave "surprising" results. Considerable amounts of saturated and unsaturated hydrocarbons as well as free hydrogen were produced and appreciable quantities of highly toxic hydrogen sulfide were obtained. Large amounts of carbon monoxide and dioxide also were formed.

Decomposition of woolen materials gave



Experimental set-up for determining products of combustion

a much greater number and variety of gases. In addition to carbon monoxide and dioxide, hydrogen sulfide, hydrocyanic acid, ammonia, nitrogen, and hydrogen were evolved in large quantities.

"The most surprising result of these experiments," the report points out, "was the presence of such highly toxic gases as hydrogen sulfide and hydrocyanic acid in high concentrations. As ammonia is toxic, even in low concentrations, the large percentage of ammonia would make these gases dangerous to breathe.

"The combination of these gases with the large content of carbon dioxide and monoxide would make the atmosphere dangerous to breathe for even a very short time."

Natural silk produced carbon dioxide and monoxide, saturated and unsaturated hydrocarbons, free hydrogen, prussic acid and ammonia, free nitrogen and oxygen. Large amounts of prussic acid as well as ammonia and carbon monoxide make this gas "very toxic."

"Boiling" an Egg with a Noise

WHAT kind of a noise annoys an oyster? A noisy noise annoys an oyster! Modern science has gone the old conundrum one better by discovering that a noisy noise will also boil an egg! At least, Dr. E. W. Flosdorf and Dr. L. A. Chambers subjected a raw egg to a sharp sound for a few minutes, before a recent meeting of the American Association for the Advancement of Science, and apparently "soft-boiled" it without raising the temperature.

The secret of the phenomenon seems to be that intense sound will bring about certain chemical reactions. The two noise-making doctors are able to coagulate proteins, convert ethyl acetate to acetic acid, and generate acetylene from vegetable oils by subjecting the substances to the proper sound of sufficient intensity.

Attempting to explain the mechanics of their discovery, the scientists submit the hypothesis that the sound vibrations produce accelerated vibration in the molecules of the substance concerned, this stimulation producing a spontaneous chemical reaction much as heat frequently does.

Most of the sounds used in the experiments were shrill and loud, but some were quite musical.—*A. E. B.*

Tiny Mirrors

MIRRORS only 1/64-inch wide, 1/32-inch long and 5/1000-inch thick are used regularly in the General Engineering Laboratory of the General Electric Company. A single one weighs only about three one-millionths of an ounce.

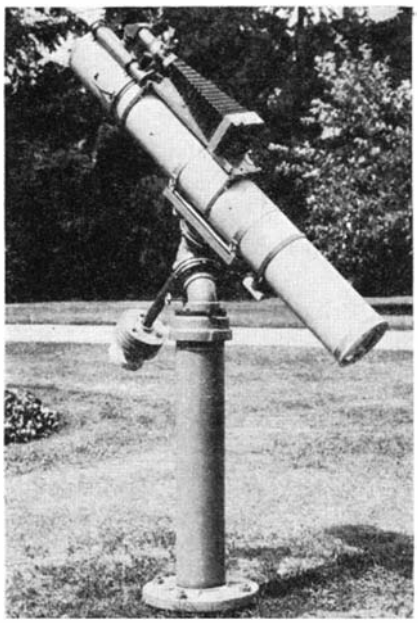
Used in an electromagnetic oscillograph, each mirror is suspended between magnets by two wires, sometimes only three ten-thousands of an inch in diameter. (The human hair is usually more than 10 times that thickness.) The mirror moves with each variation of voltage applied to the wires, and traces these variations by means of a beam of light, necessarily tiny, on a sensitive photographic film.

The mirrors are made in the laboratory by silvering a microscope cover glass, diamond ruling it, and breaking it into 2048 pieces per square inch.

THE AMATEUR ASTRONOMER

Conducted by ALBERT G. INGALLS

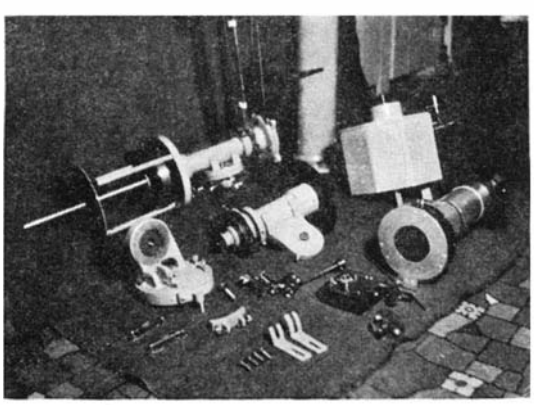
WELL, folks, we've been serving up a steady diet of high-brow stuff—aplanatic telescopes—for the past few months, and summer months at that, so let's pick out something lighter. Here are some descriptions of telescopes—fancy ones—made with the assistance of the amateur's bible, "Amateur Telescope Making." First, however, if you are interested in aplanatics, please hunt up the July number and change FN to VN on page 41, two thirds way down the page. Now let's go.



Davis' telescope, with a special camera with 2-inch lens attached

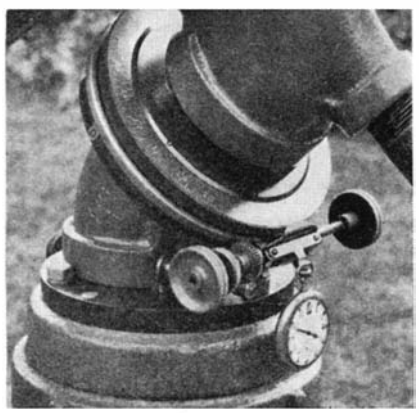
Some builders of telescopes—or of anything—have an innate sense of cleanness in design, and turn out jobs that are as "smooth" as a flapper—well, anyway, some flappers—without gadgets, hickerpickers, excrescences, and what-have-you, stuck on here and there. Their jobs look "finished." One such is the telescope made by Lincoln K. Davis of Campello Station, Brockton, Massachusetts. Look closely at the photographs.

"THE mirror is of 50-inch focal length, fully parabolized," Mr. Davis writes.



The various "makings" of Reynolds' job

"The mount is built around pipe fittings, faced off on the ends, to which are bolted flat iron disks which serve as bearings. The disks are held together by 1¾-inch iron sleeves with ring nuts to adjust the degree of friction, and between them are held six-inch, 192-tooth, steel spur gears, lapped



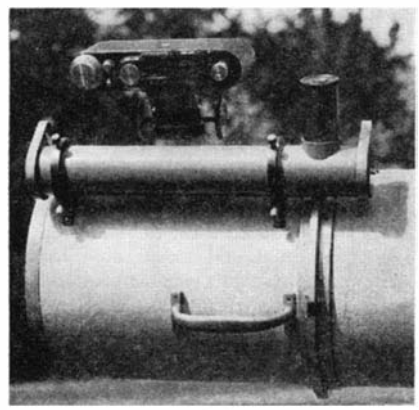
Detail of Davis' mounting. The clock drive is hidden inside tube

to work with hardened worms, to provide slow motion. Between each gear and the disk carrying its corresponding worm are 133 ball bearings running in a groove cut in the disk, to reduce the frictional stress on the worm. The entire mount is very stiff and rigid, but the motions work very easily.

"The pedestal is of five-inch pipe, bolted to an old machine base from the junk yard, which is buried in the ground. The mount is fastened to this by three cap screws with interrupted or breech threads, and may be removed in one minute. Dowels are provided to locate the mount accurately in azimuth each time it is replaced.

"The tube is also detachably fitted to the mount, and the whole outfit can be taken down and carried inside. The end of the tube rotates, so the eyepiece is always accessible. Circles are provided, and that on the polar axis is movable, with two indices, eliminating calculations. I did the graduating on my small screw-cutting lathe, by making a worm to mesh with the large back gear on the spindle and arranging a shaft to carry the worm on one end, and one of the change gears on the other. The indexing was done by counting teeth on the change gear and calculating the resulting motion of the work carried by the spindle. The engraving was done by a sharp tool held in the tool post.

"There is also an electric drive, adapted from a synchronous phonograph motor, which is attached to the bottom flange of the mount, and goes down inside the pedestal. The gears were obtained from the Boston Gear Works from



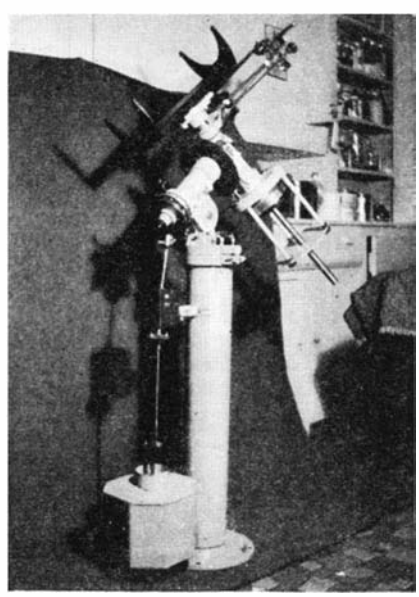
Davis' finder, also eyepiece tube with a Leica camera attached to it

stock, and give sidereal time within .8 second per day. The motor has a 22½:1 gearing built in (giving 80 r.p.m. of the turntable shaft on 60 cycles A.C., so the rotor turns at 1800 r.p.m.). The gears are as follows, including the worm and gear on the polar axis:

1	2	3	4	5
1:22½ x	14:44 x	26:66 x	32:20 x	1:3 x

6	7
1:40 x	1:192

"Nos. 2, 3, and 4 are 48-pitch brass spur



Reynolds' baptismal font, with telescope (minus tube) attached to it

gears; No. 5 is a pair of 48-pitch brass bevels; No. 6 is a 48-pitch bronze gear and steel worm to fit; No. 7 is the gearing on the polar axis, described above. These gears give a reduction of 2,584,878:1, compared with a true ratio of 2,584,902:1. The discrepancy is about one part in 108,000, or .8 second per day. I found the slide rule a great help in selecting ratios, to be checked by dividing out.

"While my instrument is fitted with a finder, I am inclined to agree with Mr. John C. Lee, who favors simple sights, so I have added them, and find them even

more convenient than the finder in picking up visible objects. If the rear sight has a relatively small hole, it increases the depth of focus of the eye, so that the forward sight is sharper when looking at a distant object or star."

ANOTHER trim, neat job is that done by Francis H. Reynolds who is an assistant professor at Clarkson College of Technology, Potsdam, New York. He says: "My first mounting was more sensitive to slight tremors than the most sensitive seismograph. When the Japanese were bombing Shanghai I had to quit observing." To replace this shimmying "seismo-scope" he decided to turn out a real job, and the photographs show what this looked like

Made in Cuba, by Paul Ricelli

when finished. It has a five-inch cast-iron pedestal which surely will not shimmy. The polar axis shaft is turned down from a chunk of 2⅛-inch cold rolled steel shafting, and that won't shimmy either. "The main brain-storm," according to the owner, "is the design of the rat trap on the nether end of the declination axis." This supports an adjustable declination axis counterweight for eliminating flexure from that axis. "I purloined the idea," says Reynolds, "from Zeiss."

"The baptismal font you see at the base of the pier," continues this builder, "is the drive, consisting of a G.E. phonograph motor." He goes on to describe in detail the various parts—too much detail to reproduce here. This 'scope evidently is a "swell" job, adjustable everywhere and embodies real machine design.

PAUL RICELLI, Pasaje Praga 31, Jacomino, Habana, Cuba, has this to say concerning the instrument mounted on a tripod, which is shown in one of the illustrations:

Mirror: 6″ diameter, 54″ focus, parabolized.

Cell: Of cast bronze with screwed ring. Wall of cell and the bottom of mirror are lined with cork. An inside tripod with three coil springs pushes mirror against front ring. A second tripod with central sockets and ball attachment adjusts mirror in all positions.

Tube: 56 inches long, seamless aluminum, granulated finish, Duco, gray, sprayed, with polished German silver bands.

Equatorial mounting: On ball bearings. All in cast bronze.

CURRENT BULLETIN BRIEFS

THE VISUAL FATIGUE OF MOTION PICTURES —A WORLD-WIDE SUMMARY AND SURVEY was compiled and edited by Aaron E. Singer. The bibliography is very extensive. *Amusement Age, 24 West 40th Street, New York City.—$1.00.*

BELMONT ROLLED STRUCTURAL STEEL INTERLOCKING CHANNEL FLOOR describes an assembly of rolled structural steel channels or other shapes ranged with flanges alternately up and down, with the flanges interlocking and securely arc welded. Thus is produced a continuous symmetrical section of light weight and great strength. The pamphlet gives many illustrations and specifications. *Belmont Iron Works, Philadelphia, Pa.—Free to interested parties.*

THE INSULATION OF NEW AND OLD HOUSES (Dominion Fuel Board, Pamphlet No. 15), by G. D. Mallory, is brimful of useful hints gathered from both Canada and the United States. There are many illustrations covering the most recent development of heat insulation in relation to the building industry. *National Development Bureau, Development of the Interior, Ottawa, Canada.—15 cents, no stamps.*

INSULATION ON THE FARM (U. S. Department of Commerce, National Committee on Wood Utilization) describes an important factor in economical housing and also in maintaining the proper temperatures for storage houses, such as barns, milk houses, brooder houses, and houses for the storage of foods. *Superintendent of Documents, Washington, D. C.—Ten cents (coin).*

A METHOD OF DETERMINING VALUES OF DIFFERENT FUELS FOR POWER PLANT USE (The Ohio State University Studies, Engineering Series Volume 11, No. 3, Part 11, May, 1933), by H. M. Faust, describes studies which will assist boiler plant owners and operators. *Engineering Experiment Station, The Ohio State University, Columbus, Ohio.—Gratis.*

THE PERFORMANCE OF PROPELLER FANS (The Ohio University Studies, Engineering Series Vol. 11, No. 3, Part 1, May, 1933), by A. I. Brown, describes the application of the airplane propeller to a ventilating fan and its development as a commercial product for a variety of ventilating purposes. *Engineering Experiment Station, The Ohio State University, Columbus, Ohio.—25 cents.*

TOBACCO AMONG THE KARUK INDIANS OF CALIFORNIA (Bureau of American Ethnology, Smithsonian Institution, Bulletin 94), by John P. Harrington, is a specialized study of great interest to ethnologists. The linguistic method traces the use of tobacco through the psychology and mythology behind it. *Superintendent of Documents, Washington, D. C.—80 cents (M. O.)*

TRAILSIDE INTERDEPENDENCE, by Wm. H. Carr, describes the building of a trailside museum intended to show the public that all the diverse and separate phases of nature are truly a part of one harmonious whole. *American Museum of Natural History, 77th Street and Central Park West.—15 cents.*

THE ARMSTRONG STEAM TRAP BOOK. When saturated steam gives up heat, it changes back to its original form—water. Water condensing in steam heating units must be discharged so that live steam can continue to enter the apparatus. In order to remove condensate without loss of live steam, automatic valves called "steam traps" are employed. The present catalogue is really a treatise on the use of traps. *Armstrong Machine Works, Three Rivers, Michigan.—Gratis.*

THE HOUSE OF THE PEOPLE, an account of Mexico's new schools of action, written by Katherine M. Cook, describes an educational experiment in progress in Mexico. In that country where some 90 percent of the people are either Indian or of Indian origin, education is a serious problem and it remained for Dr. Moisés Sáenz to really find a type of education which would suit these people. *Superintendent of Documents, Washington, D. C.—10 cents (coin).*

RAILROADING AFTER A CENTURY OF PROGRESS is the result of several years of collaboration by Mr. F. X. Milholland, Assistant to the Senior Vice-President of the Baltimore and Ohio Railroad and Mr. A. A. Hopkins, Associate Editor, SCIENTIFIC AMERICAN. There has never been a more informative railroad folder ever presented. It is one of the best pieces of literature distributed at the Century of Progress Exposition at Chicago. *Baltimore and Ohio Railroad Company, Baltimore, Maryland.—Gratis.*

IS SEXUAL ABSTINENCE HARMFUL?

(*Continued from page* 109)

tion. This is indeed high approbation.

In a subsequent work, "The Care and Feeding of Adults", Dr. Clendenning has a stimulating chapter entitled, "Doubts about Sex". This is what he says concerning modern doctrines promoting exactly what Professor Parshley is contending for. "And this is the second most serious criticism that I find concerning modern social doctrines. They are not scientific at all: They are the opposite of science—they are merely vague speculation. The method of science is experimentation, trial and error, and the code of sexual morality under which most people in the world operate, the customs of marriage, of child education, of female chastity, of social ostracism for infringements, has been tried out through many thousands of years of human history. It continues in force because it is the plan which is 'scientific'. Its fitness is indicated by its survival. All the plans of the modern social reformers were squeezed out of it, I suspect, before the dawn of history.

Its rules were laid down not because they were pronouncements from heaven but because they were the shrewd wisdom of earth. They have survived because as a result of a long process of trial and error they were found to make for the greatest happiness of the largest number of people taking a long view of life from infancy to old age."

It is just the attempt to distinguish between the mere sex impulse and the mating impulse made by Professor Parshley, that brings on sexual perversions, according to Professor Wechsler of Columbia University: "Perversions represent regressions to infantile levels, to the stage of partial impulses without the production of conflict and the need of repression. Some tendencies to erotic expression in ways other than normal sexual intercourse to a slight extent characterize all normal love life, but when those and other tendencies *are not definitely directed to, and solely in the interest of, the procreative act* and *become ends in themselves*, [italics mine] they constitute perversions. Essentially, they represent primitive sex impulses unbridled by repression and unfettered by social morality." ("A Text-Book of Clinical Neurology," 2nd Edition, 1932, edited by Sanders.) Hence, according to Wechsler, making sex pleasure an end in itself leads to perversions.

So much for the so-called biological similitude between sex in man and sex in brute mammals. It is unwarranted on scientific grounds in the present state of science to make the leap from one to the other, and the control possible by free will over sex expression is an important differentiating element between the sex life of man and the sex life of brute mammals which is unscientifically ignored by Professor Parshley.

But if this similitude will not scientifically bear the conclusions which Parshley rests upon it, perhaps his appeal to physiology and psychology will do the trick. Professor Parshley says explicitly, "the sex urge through natural selection is so deeply implanted in living beings, so involved with the *physiology* and the *psychology* of the individual as a whole, that its complete repression is impossible and any prolonged effort to repress it results in physiological injury and psychological disturbance."

The proof of this proposition must now be the scientific basis of all Professor Parshley's propositions on sex and the vindication of his emotional onslaught on "that senseless and oppressive structure called morality". Without scientific proof of this proposition Professor Parshley will find it hard to defend himself from the charge of ignorance which he so unscientifically levels at those who disagree with him. For he says: "As this view gains ascendency, we may look for an ethics of freedom, responsibility, and *knowledge* to replace the morality of repression, dependence, and *ignorance*." [italics mine]

Now no scientific *proof* is given for this proposition in Professor Parshley's article. Instead we are treated with this paragraph: "I am aware that this assertion will be questioned and challenged, that it is not the statement which we are accustomed to hear from professional moralists; but I believe it to be the truth—

the truth not only of modern scientific research but also of well-nigh universal experience. The purely biological considerations that we have advanced constitute an almost irresistibly strong presumption in its favor; the vast and varied machinery of repression which has long been in action and is today beginning to break down, bears witness to the living strength of the deep-rooted urge that it would eradicate from humanity; and finally the views currently expressed in public or privately by, so far as I know, all competent and disinterested students of psychiatry and psychology of sex, are overwhelmingly in agreement with the statement I have made."

LET us analyze this paragraph which is the so-called scientific basis of the most astonishing conclusions. First, these conclusions are merely the belief of Professor Parshley. "But I *believe* it to be truth—the truth not only of modern scientific research but also of well-nigh universal experience." Secondly, Professor Parshley's biological considerations are not *scientific* proof but only constitute a presumption in favor of his views: "The purely biological considerations that we have advanced constitute an almost irresistibly strong presumption in its favor." Third: "The views currently expressed in public or privately—by, so far as I know, all competent and disinterested students of psychiatry and the psychology of sex, are overwhelmingly in agreement with the statement I have made." With regard to the first point, the scientific authorities and arguments already given truly relegate Professor Parshley's views to the realm of his subjective beliefs. With regard to the second point; we have already shown that Professor Parshley's biological considerations do not even constitute a scientific presumption in favor of his views. So the whole force of Professor Parshley's scientific argument must rest on the third point.

And here we arrive at a most interesting phenomenon; no proof is given except a sweeping statement that "all competent and disinterested students of psychiatry and the psychology of sex are overwhelmingly in agreement with the statement I have made." Besides this there is a footnote with regard to the exact nature and extent of injury from repression, and four names are given—Nacke, Schufeldt, Robinson, Ellis. Nowhere are references cited. We must take Professor Parshley's word that the unnamed and the named support his view, that their statements bear the interpretation he puts upon them and that their proof is scientific and not pure conjecture. All this is most amazing in a scientific article by one who condemns the thunderings "by arbitrary authority." In other words, when we look for proof of Professor Parshley's conclusions we find only his thunderous assertion that they are true and that all competent people agree with him. I could rest my case against the professor here and simply say "not proved." However I will not do so. There is a mass of reliable scientific testimony that sexual abstinence involves neither physiological nor psychological injury.

In answer to a letter Dr. Arthur C. Jacobson, M. D., the scholarly editor of the *Medical Times* writes: "I am sure that the leading experts in this field would

hesitate to speak dogmatically on the proposition 'Is sexual abstinence harmful;' that is, harmful *per se.* For proof of this, see pages 137 and 138 of Millais Culpin's book, 'Recent Advances in the Study of Psychoneuroses,' 1931, published by Blakiston. Culpin teaches in the London Hospital Medical College. Please note what he says about the teaching of Freud in this matter. Scientifically we have to be sure that a neurosis supposed to depend upon a sexual deprivation is uncomplicated, that is, that it has so arisen independently of other factors beyond the individual's constitutional equipment . . . Stekel, a great authority, declares that neuroses are never uncomplicated."

Professor Thomas Bryant, the great English surgeon, says in his book, "Surgery": "The student should remember that the functions of the testicle, like those of the mammary gland and uterus, may be suspended for a long time, possibly for life, and yet its structure may be sound and capable of being roused into activity on any healthy stimulation. Unlike other glands it does not waste or atrophy for want of use." As Doctor Max Huhner says in "Disorders of the Sexual Function," (F. A. Davis Co., 1931), page 262, wherein he has a whole chapter on continence to prove "that continence is not detrimental to health, considered either from a *physiological* or *psychological* stand-point," "the sexual organs are constructed upon entirely different lines than most of the other organs of the body. They are constructed for intermittent action and their functions may be suspended *indefinitely* [italics mine] without harm to either their anatomy or physiology."

James Fisher Scott, the great authority, in his book "Sexual Instinct," page 39, says: "If the penalties meted out to the impure are so many, there is yet comfort for the unmarried man in those pages which show that perfect continence is quite compatible with perfect health and thus a great load is at once lifted from the mind of him who wishes to be conscientious as well as virile and in health with the organs of the body performing their proper functions." Again on page 95, he says: "There is an *erroneous* and widely spread belief that the exercise of the sexual functions is necessary to maintain health . . . ," and on page 99: "It is a *pernicious* and *pseudo-physiology* which teaches that the exercise of the generative functions is necessary in order to maintain one's physical and mental vigor of manhood."

THE very opposite seems to be true. Ask any trainer of football players or of pugilists. They know by experience that continence is a guarantee of physical health. It is hard to prove scientifically, but there are indications that the reabsorption of seminal secretions in the male makes for health of body. This elemental fact of human experience was known to the Romans. For Horace writes in the "Ars Poetica": "He whose ambition it is to reach the wished-for goal of the race-course has borne much and done much in his boyhood, has sweated and shivered, has denied himself love and wine."

William Acton, in the "Functions and Disorders of the Reproductive Organs," fourth edition, page 97, says: "One argument in favor of incontinence deserves

special notice as it *purports* [italics mine] to be founded on physiology. . . . No continent man need be deterred by this apocryphal fear of atrophy of the testes from living a chaste life." Lionel S. Beale, Professor at King's College, London, "Our Morality and the Moral Question," "chiefly from the medical side," says: "The argument that if marriage cannot for various reasons be carried out, it is nevertheless necessary, upon *physiological* grounds that a substitute of some kind be found, is altogether erroneous and without foundation. It cannot be too distinctly stated that the strictest temperance and purity is as much in accordance with physiological as with moral law, and that the yielding to desire, appetite, and passion is no more to be justified upon physiological or physical grounds than upon moral or religious grounds." On page 64, in a chapter on "Question of Physiological Necessity-Sexual Hypochondriasis," Sir James Paget, the eminent English surgeon, says: "Chastity does no harm to mind or body; its discipline is excellent; marriage can safely be waited for."

Let us now examine the proposition from the standpoint of psychology and neurology. W. R. Gowers, one of the great neurologists, in his "Lectures on Syphilis and the Nervous System," says: "With all the force that any knowledge I possess can give, and with any authority I may have, I assert, as the result of long observation and consideration of facts of every kind, that *no man ever yet was in the slightest degree or way the better for incontinence*, [italics mine] and I am sure, further, that no man was ever yet anything but better for *perfect* continence." [Italics mine.] Commenting on this passage Dr. Max Huhner, already cited, from whose work many of my quotations are drawn, says: "The lectures from which the above quotation was taken were delivered by Gowers in 1889. In order to determine if modern neurological research work might possibly alter this opinion I sent a circular letter in 1910 to many of the most prominent neurologists in the United States, asking them if they had ever seen cases of nervous disease which could be attributed to continence. In practically every case I received the answer that not only they considered continence physiological but that they did not believe, from their experience, that continence ever leads to nervous disease."

IN the bibliography of his recently published book, from which parts of the SCIENTIFIC AMERICAN article are transcripts, Professor Parshley lists one of the works of Paul Popenoe. It is too bad that he did not also list "The Conservation of the Family" (Williams and Wilkens Co., Baltimore, 1926) by the same author. In this volume is a chapter on "Premarital Incontinence," which is a devastating refutation of the conclusions of Professor Parshley in the article under consideration. On page 64 Popenoe says: "In spite of this it is sometimes asserted that premarital continence is a mere puritan dogma, that is contrary to the facts and implications of science, and that it must be discarded. Those who hold this idea (which is most often, no doubt, merely a rationalization of their own overstimulated sex impulses) usually take their stand on a half-digested

reading at third hand of the doctrines to which the Jewish neurologist, Sigmund Freud, has given currency. . . . Those who hold any such idea as the foregoing have overlooked some essential facts, which J. A. Hadfield summarizes effectively." Again, on page 66, the same author states: "To put the matter more simply, mental and nervous disturbances, due to a lack of normal sexual life cannot be cured by mere physical intercourse, for they are due primarily to mental, not physical, factors . . . ; and these mental factors are not eliminated, but rather aggravated, by mere physical satisfaction of the sexual instincts."

I looked in vain in the bibliography of Professor Parshley's book for a listing of the profound work of F. W. Foerster, Special Lecturer in Ethics and Psychology at the University of Zurich, entitled, "Marriage and the Sex Problem," Frederick A. Stokes Co., New York. Dr. Foerster closes his chapter on "Sex and Health" with these significant words, page 126: "All these hygienic and scientific fears as to the danger of manly self-discipline often seem to us no more than an 'academic hypochondria,' divorced from healthy instincts, and in fact itself a sign of nervous degeneration. This may sound hard but in truth there are a number of modern reformers who make one despair of the spiritual sanity of the human race. It is essential for our safety that a clear distinction should be made between such tendencies as these and really sound and fruitful criticism."

IF any further scientific testimony were required against the conclusions of Professor Parshley it may be found in Dr. Prince A. Morrow, "Science and Health," and in the conclusions of the "Congrès international de prophylaxie sanitaire et morale," Brussels, 1902, in which 159 prominent medical men from various countries declared: "Young persons of the male sex must be taught that not only are chastity and continence not detrimental, but the practice of these virtues is the best safeguard of health and physical hygiene." Charles Féré, in "L'Instinct Sexuel," and E. Régis and A. Hesnard in "La Psychoanalyse des Neuroses," Paris, 1914, also bear witness against Professor Parshley.

In the light of all this one wonders how Professor Parshley can say: "and finally the views currently expressed in public or privately by, so far as I know, all competent and disinterested students of psychiatry and the psychology of sex, are overwhelmingly in agreement with the statement I have made."

I am not interested in what Professor Parshley has to say about sublimation. He quotes a recent monograph by Professor W. S. Taylor. I have before me a letter from one highly connected with a well-known institution for mental hygiene. This is what he says: "I have read the recent study by Professor W. S. Taylor, but do not feel that it justifies the generalization which the author of the article (Professor Parshley) seems to make." I myself bought a copy of Professor Taylor's monograph. In this is a most interesting personal communication (page 99) to Professor Taylor from Professor David Camp Rogers, who as a psychologist has been consulted by

persons of various ages about emotional and social adjustments. "I have personally deplored the part that psychologists and sociologists have played, in reviving as features of an avowedly scientific point of view *though it is unsupported by new evidence,* [italics mine] the to me fallacious sophistries of Greek thinkers. . . . I have also regretted the part these same groups have taken in contributing to the more specific popular idea that sex restrictions are mostly unreasoned taboos which should not be allowed by intelligent people to interfere with gratification for strong sex impulses. To me the experiment in assuming freedom for sex gratifications apart from attachments intended as permanent, which many in the present generation are carrying on, seems on the whole an extravagant and foolish one. . . . It is my strong conviction that a considerable number of those who have taken this new liberty have gotten into more emotional difficulties than they have escaped, and that there has been already a large loss for social motivation and general happiness resulting from this change in customs." M. J. Exner, "The Sexual Side of Marriage," is quoted in a similar sense.

And Professor Taylor himself explicitly declares (page 98): "Emphatically, the findings of the present study provide no apology for license. . . . People who feel 'emancipated' enough to enter freely upon sex experimentation, with the result that they find themselves ensnared in various sorts of dissatisfaction, are significant cases of failure to organize life."

IN this answer to Professor Parshley I have met him on the ground chosen by himself in advance. I have not referred the question to rational ethics, which is as old as Aristotle but which Professor Parshley erroneously seems to identify with "arbitrary authority," "the purely social forces of tradition," and "a cultural lag." Nor have I attacked Professor Parshley on his unjustifiable assumption of materialism as a proper philosophy of life, which has been rejected within the past few years by so many prominent scientists, as exposed in a book, "The Religion of Scientists," by C. L. Drawbridge (The Macmillan Co., 1932). Nor yet did I call attention to the implicit denial of Christianity and the teachings of its Great Master contained in the article of Professor Parshley. But an examination of Professor Parshley from this triple standpoint would make interesting reading. I have confined myself to meeting the conclusions of Professor Parshley on the very basis on which he chose to advance them. Nôt one of the authorities whom I have cited, as far as I know, is a Catholic or particularly interested in the religious aspects of the matter examined.

The conclusions advanced by Professor Parshley are being reduced to their logical sequence by many young men today to their irreparable physical and emotional harm. If the labor of research, inquiry and writing, involved in the preparation of this article will prove helpful in the guidance of even one of our youth, I will consider myself amply repaid. It is to the cause of the education and guidance of American youth that I have dedicated my life. To be free from all entanglements I have consecrated myself in the pursuit of this purpose by a vow of continence and celibacy.

Books SELECTED BY THE EDITORS

MAJOR MYSTERIES OF SCIENCE

By H. Gordon Garbedian

THE author of this new book takes up a central position, as it were, in the immense field of science and its applications and, as with a panoramic camera, swings clear 'round the circle through every one of the most important and most significant advances in electricity, chemistry, biology, earth science, physics, astronomy, and cosmology. This is an unusual book. It is eminently readable; the author senses the desire of his reader not to be bored, and the latter will be held by this book without a struggle. It does not attempt to explain every detail profoundly and is therefore suited to the tastes of the average human being, rather than the few. It leans toward newspaper writing (of the high grade kind), being somewhat dramatic in style, but never objectionably so.

What science is doing *now*—today—what problems it is most vigorously attacking on the fighting front—is the central motive of this attempt at exposition. It contains a vast amount of material. Perhaps only one who is in a position to know how much looking up, working up and checking up even a one-paragraph "story" in science can entail if a true picture of facts is to be presented, will fully appreciate how much labor it represents. The author has fairly ransacked the whole scientific field for interest and his book will be received as a "major" success. It has 27 chapters, 348 text pages and 64 illustrations, large clear type and an attractive binding.—$3.90 postpaid.—*A. G. I.*

PRINCIPLES OF GENERAL CHEMISTRY

By Stuart R. Brinkley, Asso. Prof. Chemistry, Yale

A REVISED text designed especially as a general college course for students who have had a preparatory course and, therefore, particularly adapted to the reference library. Throughout, fundamental principles are developed as logical consequences of descriptive facts derived from experimental observations, and these are illustrated by industrial applications. Particular mention should be made of the index for its inclusiveness and clarity. Few realize what a job it is to compile a good index and what an enhancement it is to even a good text. The moderate price will also attract.—$3.65 postpaid.

EARTH-LORE—GEOLOGY WITHOUT JARGON

By Prof. S. J. Shand, Univ. Stellenbosch, S. Africa

IN this 134-page illustrated book Professor Shand has found a way to embody the essential parts of earth science, as well as the parts most likely to interest the average lay reader—prominent theories and so on—without use of the sesquipedalian polysyllabics which have long been responsible for scaring most readers away from the true fascinations of geology. This does not mean that his book is "written down." Quite the reverse—it is a book for the mature adult. The author evidently recognizes, however, that persons not intending to become professional geologists do not care to master a lot of terminological jargon in order to understand geology *well enough.* He also explains things clearly, evidently having none of the urge, often suspected of scholars, to "mystify" his readers.—$1.75 postpaid, imported.—*A. G. I.*

MILK—THE INDISPENSABLE FOOD

By James A. Tobey

ALL persons who are interested in or concerned with human nutrition, whether as consumers, producers, teachers, or investigators will find material of much value in this series of essays which laud milk as an incomparable food. One would scarcely believe there are so many interesting phases of this subject, which the author emphasizes in his most readable style, addressed to the layman entirely.—$2.40 postpaid.

THE MEANING OF ANIMAL COLOR AND ADORNMENT

By R. W. G. Hingston

"A NEW explanation of the colors, adornments, and courtships of animals, their songs, moults, extravagant weapons, the difference between the sexes, the manner of formation of their geographical varieties, etc."—so runs the sub-title. Frankly an exposition of the author's theory that the color of an animal is conditioned by a conflict or compromise between two fundamental emotions or attitudes to environment, fear and threat as represented by outward appearance. The discussion is carried to considerable length with much repetition to stress the points, yet withal a most entertaining and instructive account of the habits and manners of wild life by one especially familiar with that of India, Burma, and Ceylon. Many years of observation and close study give the author an unusual advantage to correlate the wild life of the various continents. The layman will be edified and the biologist will have a chance to match the author's observations with accepted Darwinian theory. A book that will be much discussed.—$6.20 postpaid.

THE APE AND THE CHILD

By W. N. Kellogg, Assoc. Prof. Psych., Univ. Ind., and L. A. Kellogg

A CHIMPANZEE aged 7½ months and a human infant aged 10 months were reared together for 9 months and intensively studied by a psychologist and his wife, the authors. They were given exactly the same environment, eating together, playing continually together, being bathed alike, dressed alike even to diapers and shoes, and using the same nursery chair, toys and all. In short, the ape might have been a second baby in the family. The two became fast friends.

The experiment was to study the effect of such environmental advantages on one of the higher anthropoids, to measure at all stages the relative intellectual abilities of the two, and to see to what extent the ape was humanized. No attempt was made to teach it tricks. The results are scientifically treated, yet the book is almost wholly narrative mixed with discussion, and is lucidly written. Some may find the account rather fulsome but the authors surely missed nothing observable. 336 pages, illustrated.—$3.20 postpaid.—*A. G. I.*

COMMERCIAL PROPERTY NEWS

Conducted by SYLVESTER J. LIDDY

Member of the New York Bar

Beer and Liquor Trademarks

ORDINARILY no trademark can live in the eyes of the law beyond the period of its use. But when the National Prohibition Act became effective many trademark owners were *unable* to continue longer the *use* of their respective marks. And yet the owners of beer, whiskey, and other liquor brands were bound to attempt to preserve their marketing rights "against encroachments, should the public policy ever change."

What, then, has happened? Are these pre-prohibition passport ties, these commercial coats of arms, these former passwords to customer and prospect, still valid and subsisting, or have they been lost and destroyed as matter of law by mere lapse of time and disuse?

In 1927 Mr. Justice Holmes said:

"A trademark is not only a symbol of an *existing* good will, although it commonly is thought of only as that" (Beech-Nut Packing Co. v. P. Lorillard Co., 273 U. S., 629).

In the foregoing case the Supreme Court did not feel that the trademark owner had lost any rights by abandonment, in spite of the mark having been left dormant for about five years. *For nothing had happened in the meantime to lessen the original proprietor's preferential right to try (i. e., use) its mark again upon goods of the same general class.* "Beechnut was *still* its business badge and autograph so far that the public, seeing the mark on any package of tobacco, believed it of their make."

"To constitute an abandonment there must not only be *non-user*, but an intent to abandon" (Rockowitz Corset Co. v. Madame X Co., Inc., 248 N. Y., 272).

Likewise, neither registration nor renewal of registration in the United States Patent Office or elsewhere is necessary to *continuous* ownership of a trademark (16 U. S. Pat. Q., 383, February 7, 1933). But though not necessary *in this country*, there is respectable authority for the opinion that "to register a trademark the world round is true economy. This means an average yearly expense of about five dollars a country, for the 125 or so countries. * * * Though half a generation of discouragement has intervened, the owners of beer, whiskey and other liquor trademarks *have helped* to keep alive their marketing rights throughout the world by registration and re-registration" (U. S. Trade Mark Bulletin, November, 1932, February, 1933).

To-day indications are far from lacking that we are in for a period of bootlegging of trademarks owned by our nationally known soft and hard drink manufacturers. It should therefore be of interest to learn of the current experiences of such corporations as Anheuser-Busch and Bass' Ale in their recent laying of their grievances before our state and federal courts.

In December one of our United States District Courts in Chicago found that Bass' Ale had been continuously sold here until 1919, so that the name had become well known; that notwithstanding the fact that the owner of this mark had not been able to *sell* its ale in the United States since 1919, the date of the adoption of the National Prohibition Act, the trademark "Bass" and the owner's distinctive label were *still* well known and had an existing good reputation; that it was the owner's intention to resume the sale of its ale in the United States as soon as permitted by law. Hence a decree was entered providing in part as follows:

1. The plaintiff's trademarks have not been abandoned.

2. The registrations of plaintiff's trademarks are valid and subsisting, unrevoked and uncanceled.

3. That defendant, by the use of the words Bass's Amber Ale on a hop-flavored, bitter carbonated beverage, has infringed plaintiff's trademarks and has competed unfairly with the plaintiff.

4. That the plaintiff is entitled to a decree against the defendant for a perpetual injunction and to damages and profits (Bass, Ratcliff & Gretton, Lim., v. Windsor Ale Co., U. S. Trade Mark Rep., February, 1933).

Anheuser-Busch's experience, less recent (1930) but equally important and instructive as a precedent, concerned another's use of the name "Budd-Wise" in simulation and in fraud of the Anheuser company's trademark, "Budweiser," known to us all. The infringer's argument was that since the Anheuser company's mark had only been used on intoxicating lager beer, hop-flavored barley malt syrup and barley malt syrup, they had a perfect right to use *their* mark on a different product, that is, malt sugar syrup. The court answered this contention by declaring that the name "Budd-Wise" suggested that all three products came from the same source. —JOHN C. PEMBERTON, in the *New York Law Journal.*

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

Trademark Cancelled

IN the case of Quaker State Oil Refining Co. v. Quaker Oil Company, Inc., First Assistant Commissioner Kinnan held that Quaker Oil Company, Inc. is not entitled to register, as trademarks for motor lubricating oil, the notation "Quaker" with the letter "A" therebeneath, a mark consisting of the representation of a barrel surrounded by two concentric circles having therebetween the words "Quaker Oil Co." and "Plainfield, Ind.", the latter words being disclaimed, and the words "Quaker Premium," the latter word being disclaimed. It was also held that the registration which the Quaker Oil Company, Inc. had obtained for the latter mark should be cancelled.

The ground of the decision is that these marks are confusingly similar to the notation "Quaker State" used as a trademark for lubricating oils by the opposer and petitioner for cancellation, Quaker State Oil Refining Co., and that the applicant and registrant had established no date of use of its mark prior to the date established by the opposer.

Device Tests "Feel" of Flexible Material

A MECHANICAL "hand" which determines quality in textiles, paper, and similar materials usually described as "feel" or "drape," or "handle," has been devised by the Federal Bureau of Standards. The flexural attributes of cloth, paper, sheet rubber and similar materials, says the Bureau's announcement, can be evaluated with the new "flexometer," according to a predetermined standard.

Roofing Trademark Not Registrable

UNDER a recent decision by First Assistant Commissioner Kinnan, The Barrett Company, of New York, New York, is not entitled to register, under the Act of 1905, as a trademark for roofing comprising a fabric of fibrous base treated with waterproofing material, the notation, "Ever-Fast." The ground of the decision is that the notation is merely descriptive of the goods.

In his decision, after noting the statement in applicant's brief that the roofing material is a bitumen-saturated felt base having the side which is exposed to the weather coated with crushed rock or slate which may be of different colors and stating that the term is not deemed to be merely descriptive as indicating that when the roofing is in place it will not curl up and will make a water-tight roof, the First Assistant Commissioner said:

"The roofing material, especially when it is in the form of shingles, is given the colors as above noted. It is also stated that 'in some cases the material is treated to alter the shade thereof' while the applicant contends, and an affidavit is submitted in support of such view, that the word 'fast' has not been used in the trade in connection with the color of the goods yet it is believed the applicant's notation would mean that these colors of the goods are permanent and will not fade unduly under weather conditions. The word 'fast' is widely used in connection with materials that are colored to indicate the permanency of the color."

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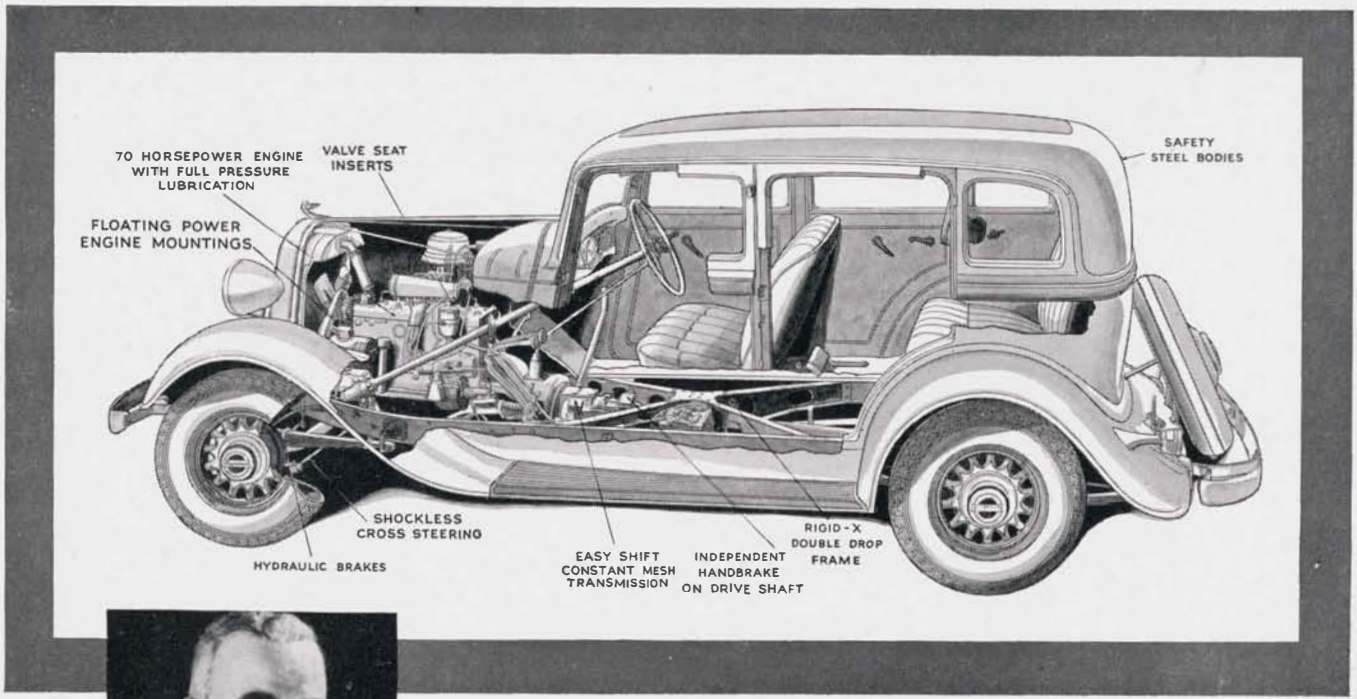

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