SCIENTIFIC AMERICAN

August
1933
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a Copy

Self Conquest Through Self Analysis

By Alfred J. Fox, M. D.

Psychoanalysis Without A Psychoanalyst

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AMERICAN-JAPANESE RELATIONS

By T. S. Miyakawa

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PHOTOGRAPHY WORKS FOR INDUSTRY

By Franklin Courtney Ellis

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WHAT OUR READERS SAY OF TELEPATHY

Volume
149
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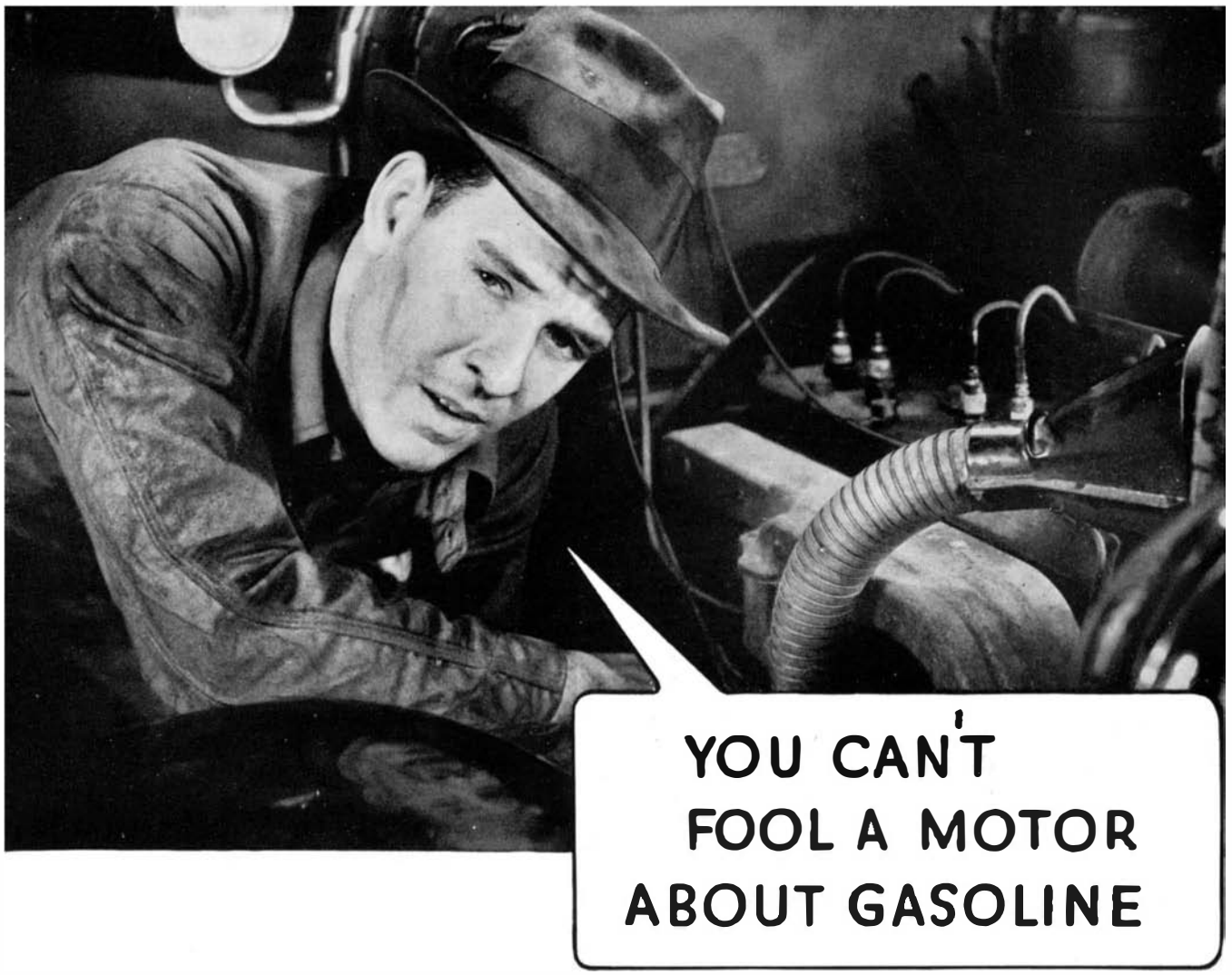
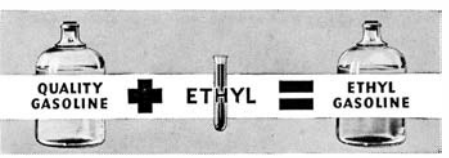
Number
2



"YOU TAKE the best car made and pour in cheap gasoline and what have you got? A half-hearted car, nine chances out of ten. No motor can be any better than the gasoline you feed it. That's why Ethyl makes *any* engine run better.

"I know what I'm talking about. A car doesn't know what you pay for gasoline and doesn't care. It just takes whatever kind of power you give it and hands you back that same kind of performance.

"My advice is, take care of your car—use good oil—and Ethyl Gasoline! The Ethyl will give you all the pleasure and performance your car's got in it and save a lot of motor trouble and unnecessary repair bills." Remember: *The world's highest quality motor fuel is the cheapest gasoline you can buy in the long run.* Ethyl Gasoline Corporation, New York City.



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NEXT TIME STOP AT THE ETHYL PUMP

SCIENTIFIC AMERICAN

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EIGHTY-NINTH YEAR • ORSON D. MUNN, Editor

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"It's Good to Hear Your VOICE"

THIS very day the telephone will touch the lives of millions of people. To a modest home in the suburbs, it will carry words of love and comfort and the assurance that all is well. In another home, a housewife, busy with her work, will pause a little while to place her daily orders or answer a welcome call from a friend. To some one else, the ring of the telephone may mean good news about a position or a business transaction.

To have a telephone in your home is to hold your place in the world of people—to keep unbroken your contact with those whose help and friendship are so essential.

Individuals employ the telephone in many different ways. The busy, to save time. The friendly, to win more friendship. The lonely, to make contacts. The troubled, to find comfort and reassurance. The frightened, to call for aid. The gay, to share their gayety. It is through the medium of the telephone that thoughts become words and words become messengers between one human mind and another, defying space and time and all the elements that would interpose delays and doubts.

The value of the telephone can be measured only by measuring the activity of the people who use it and the diversity of life itself.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY

You are cordially invited to visit the Bell System Exhibit in the Communication Building, Century of Progress Exposition, Chicago

ACROSS THE EDITOR'S DESK

A Statement of Editorial Policy

NEITHER favorable nor adverse comment on an article or on articles that have been published should set the editorial policy of a magazine. A preponderance of either may, of course, influence the Editor to a degree that depends upon circumstances—but not inevitably. Expressions of approval naturally please, but these are sometimes flattering, while criticisms may as often be prompted by bias. Ordinarily one will balance the other. When, however, an Editor publishes a controversial article, he expects to receive comments and arguments from proponents of both sides of the question. If those who write, in both groups, are proclaimed by the evidence as being cultured, thinking people, the vital importance of the subject and the necessity for presenting both sides is more fully realized.

Such was the case in connection with the article on sexual abstinence which we published in our May issue. We have been highly praised for publishing it—and as roundly taken to task. Some seemed to feel that we had accidentally discovered a timely and extremely important subject that needed discussion just now. Others said that we had some dastardly design in using it. Neither is right. We deliberately sought out an author, qualified by his scientific standing, to write this article for us, because it is a biological question and as truly scientific as, for example, a study of the functions of the mind or of the circulation of the blood. A properly qualified author must be given latitude to express his views without undue restraint, so we expected many comments on this article and expected sooner or later to obtain one which we could publish in answer to it. And this brings us to the point of the present discussion: a declaration of our editorial policy which, apparently, is not clear to all of our readers.

FOR over 88 years, SCIENTIFIC AMERICAN has portrayed the scientific progress of the world, has written a complete and understandable record, we might say, of the rise of the present great industrial era. Science, industry, and engineering progress news has been broadcast to our readers throughout the world in a semi-popular style that has made possible an understanding of the aims of science, has helped hundreds of thousands to solve many practical problems in their daily lives, and has even suggested to scientists, far removed from the locale of one piece of research, ideas for parallel research.

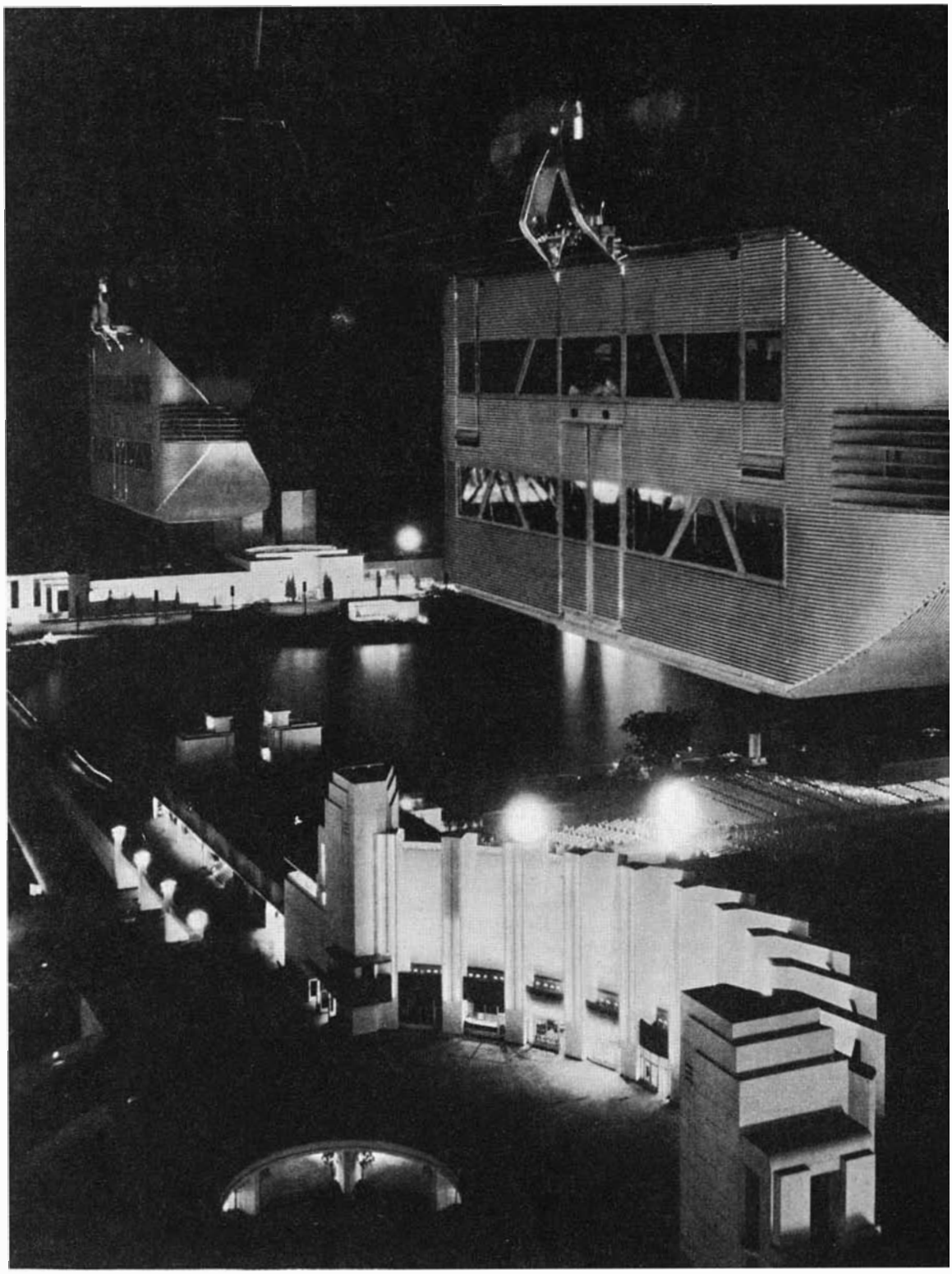
During the first decades of its existence, SCIENTIFIC AMERICAN was the sole semi-popular disseminator of such news, consisting, in those early days, principally of data on mechanics and invention. Latterly, other magazines have sprung up, some being vastly more technical in style of presentation and some touching only the spectacular fringe of science. In this enlarged group, SCIENTIFIC AMERICAN still stands alone, the only magazine of its class in the world—in the class, that is, that aims to present in readable style for the thinking layman a graphic and strictly reliable account of man's conquest of the secrets of the universe. It makes no pretense of appealing to the masses; it does not "write down" to any group but rather aims at a high standard which will appeal to the scientist, the technician, the professional man, and (we repeat ourselves) "the thinking layman" adult.

FAVORABLE and adverse comment notwithstanding, we expect to continue publication of such articles as may, in the judgment of the editorial staff, be considered timely and of importance to science, whether they pertain to objective or subjective studies. When the articles are controversial, we may deem it advisable to present both sides of the question. At all times we shall, of course, attempt to present to our readers the kind of material which careful studies of our adult thinking-reader type indicate are most desirable. We can not hope to please everyone. To those who desire information principally on mechanics or a large volume of invention news, we suggest the other magazines which admirably report such features. SCIENTIFIC AMERICAN is not and never has been a magazine to tell the home mechanic how to repair the kitchen sink or to tell the younger generation how to make toys or bird houses or mechanical gadgets.

Getting the proper perspective on scientific progress is SCIENTIFIC AMERICAN'S purpose in life; to dramatize for the busy man's interest and profit the story of the dynamic drive of progress is its goal. While following legitimate scientific advances rather than predicting imaginative future developments, it still will lead, as always, in accuracy and reliability.

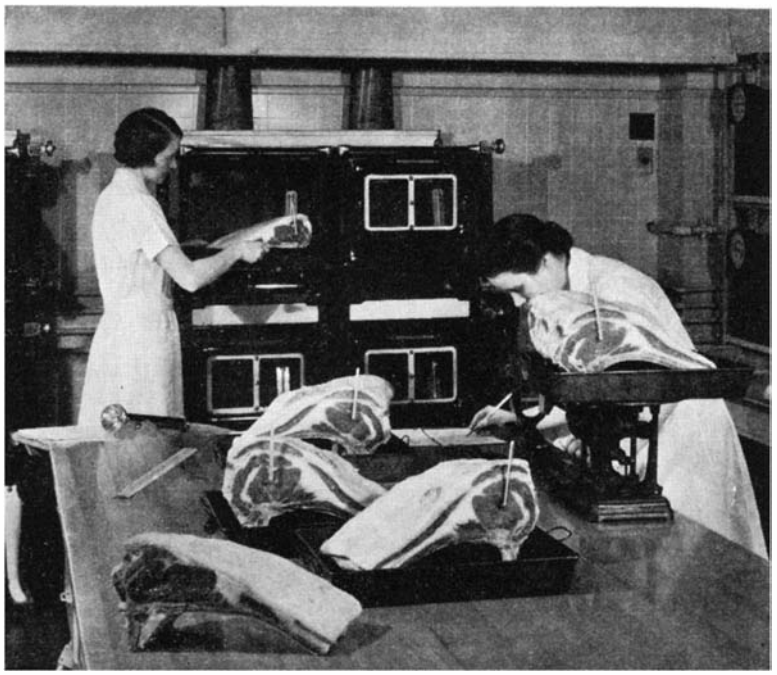
Editor and Publisher

June 28, 1933



'A CENTURY OF PROGRESS' AFTER DARK

SUSPENDED from slender steel cables 219 feet above the ground, the aluminum and glass cars of the Sky Ride at the Chicago Century of Progress are daily giving thousands of visitors a bird's-eye view of the exposition grounds. In this view, taken from one of the supporting towers, may be seen, in the foreground, the brilliantly lighted north entrance to the Hall of Science and, across the lagoon, the buildings of the Electrical Group. The mechanical features of this now famous aerial attraction were described in our January, 1933, issue.



Tests on cooking and the nutritive value of meats, made in the laboratories of the Bureau of Home Economics, save the consumer money

Physical tests of textiles make it possible for the consumer to purchase to advantage

How to Fritter Away Your Money

Government Bureau Expenses Are Criticized, Yet Private Business Losses Go On Unhindered

By T. SWANN HARDING

ALONG with certain other publications, a prominent weekly in the advertising field has been greatly agitated because the Federal Bureau of Home Economics boasts an astounding budget of 217,000 dollars annually. Much valuable space in such journals has been devoted to protest because "an expenditure of 200,000 dollars or more to cover activities such as the proper spacing of buttons on a little boy's trousers is a rather sizable speck (in the budget) at that." We are told that many income taxes must be paid to accumulate that "pot" for the Bureau and that thoughtful taxpayers are having their hearts eaten out now because this, their money, is frittered away to keep people in jobs doing useless and often foolish things.

I am an income taxpayer also and I have a heartache. But I am not worried so much about the social service the Federal Government cares to provide in return for the taxes I pay as I am about the very distressing way in which the investments I have shrink to painful emaciation. That is a heartache. It is a very real loss that I suffer when a bank blows up in my face, when stock of the steel corporation hovers around 35, and when I am inveigled, by the manufacturer's million-dollar a year radio program, into buying some high-priced household equipment later discovered to be worthless. These losses are tremendously real to me and I owe them to private enterprise, to business, and to advertising, not to the Government.

CONSIDER a typical piece of railroad financing, for example. I take it from Judge Anderson's article in the December, 1932, *Atlantic Monthly*. There was the Pennroad Corporation. This was a holding company organized and controlled by the officials of the Pennsylvania Railroad as a device of doubtful legality in its career of joyful expansion—at the expense of ordinary people like you and me. Pennsylvania railroad stockholders were offered shares in Pennroad at 15 dollars each. This brought in about 150,000,000 dollars from the investing public. The holding company exultantly paid a trifle of 5,000,000 dollars to its bankers for their services (roughly 25 times the annual cost of the Bureau of Home Economics) and then invested the balance in the stock of other railroads. This was done when Boston and Maine stock stood around 120 dollars. It goes back into ancient history.

In brief this means that the soundest judges of railroad securities we had in the East bought with other people's money railroad stock right then soaring at boom prices. I do not remember the Bureau of Home Economics doing anything like that. You might heave the Federal Farm Board at me but even the experience of its losses was worth more to the public, to you and me, than this Pennroad joyride. Ultimately, Pennroad stock sold as low as one dollar a share and the 150,000,000 dollars of other people's money it handled is now possibly lost. Meanwhile, as late as March 27, 1933, the conservative financial journal *Barron's* declared that 400,000,000 dollars annually could be saved by partial reorganization of the railroads generally, under Federal supervision. Is that Government extravagance?

Of course, this is a great country for individualism and you can have it your way while I take it mine. Personally it somehow doesn't hearten me when I invest in guaranteed stock that goes blooey as this stock did. What I have left behind is a sense of very real loss incurred at the behest of bankers and

big business men who posed as sound judges of securities. This induces in me a very real heartache which occasionally spreads to my head and makes it almost impossible for my wife to live with me. I resent that loss of 150,000,000 dollars. I resent the quarter of a billion each that Insull and Kreuger poured down the sewers—securities recommended by our best financial minds. I even resent the fact that in 1930 nearly 1000 American banks failed, with liabilities of over 900,000,000 dollars.

If any business or advertising publication would just set up a section sacred to resentment over the terrible biffs in the face the American people take, and the disheartening losses of billions of their capital caused by the lords of private enterprise, I might join them in their crusade to have a few tears wept weekly over the extravagance of Government. But these journals will not do that. They are all steamed up over the deficit of the Federal Government, a deficit that experts in the Brookings Institution tell us would be an actual surplus if the Federal Government made its fiduciary calculations as do private businesses; that is, making due allowance for value of plant and capital investments.

WHEN it comes to the boy and the buttons on his trousers, that is quite an operation. As a matter of fact, in spite of all that private enterprise could do, or because it was so busy devising ways of sending investors' money down the sewer, the boys of this country wore suits that were poorly designed, that were made out of poor fabrics, and that fastened up in the most astonishingly intricate ways, until the Bureau of Home Economics decided to do something about it. In the first place, it is true, the Bureau was not out to design boys' clothes; it wanted to boost cotton consumption and help the farmers, but it all came around to the fact that mothers were loath to buy the very poor cotton suits then offered for boys.

Now it somehow seems quite all right to an advertising journal when the manufacturer of a famous toothpaste, which, scientifically speaking, is quite ordinary and in no way distinguished in merit, spends a million dollars annually to have two black-face white men describe the taxi-cab business over the radio for my edification. But when it comes to having a Government bureau spend a fifth that sum annually on valuable scientific studies in textiles and nutrition, that is frittering away money. This looks ridiculous to me, but perhaps I am standing in my own light.

Anyway, the Bureau did not hash together a hundred thousand boys' suits and flood the market with them. It didn't need to. That had already been done by private enterprise. It studied

Although widely criticized, this pamphlet, published by a Government bureau, has had a circulation of 174,525 copies

cotton fabrics and decided upon the ones best for this purpose. It adapted its ideas of clothing design to the health and education of the child (and a young boy can have a most arduous time with an assortment of buttons and buttonholes) with economy of time and energy of his mother in mind. It produced patterns that were easy to follow and make up into the finished product. Thus, as thousands of letters attested, it was a great boon to mothers. Incidentally the entire project increased cotton consumption, which was very desirable and ought to please even a business journal.

Now it was a fact that neither the suits in question nor the patterns from which they were made were obtainable before the Bureau got to work. The little detail of manufacturing well-designed suits of proper fabrics for little boys had been entirely neglected by astute private enterprise. But since the Bureau of Home Economics did its work and published its findings, its designs have been adopted widely by commercial pattern manufacturers and can be bought in the stores. In fact a total of 29 of the Bureau's designs have been put on the market by eight manufacturers of patterns, which shows a degree of consideration on the part of business and the public that you would never guess existed when reading the business journals.

It occurs to me, now that I think of it, that the very fugitive nature of my fiscal intellect, which appears to take random flight every time some notable banker recommends a bad investment to me, may be rooted in the sublime perplexity I evinced when, as a small boy, I had to get myself into and out of a suit with a superfluity of buttons and a scarcity of buttonholes. I may be altogether wrong but, as far as I am concerned, the Government is welcome to take a few cents from my income tax for the Bureau of Home Economics, just so long as some new agency will preserve me from losing hundreds of dollars of my salary in bad investments backed by individuals that the advertising and business journals regard as the personified light of the world.

IT would make us all gasp if I were to quote the hundreds of millions regularly spent in this country on advertising products that are as poorly fabricated as were the little boys' suits of commerce before the Bureau of Home Economics got busy. Just why we should, therefore, become insanely agitated because a couple of hundred thousand dollars annually are spent on a Bureau which does consumer research and fosters business at the same time, I am at a loss to imagine. Thus, the Bureau got out a bulletin which told ladies how to set sleeves in their gowns; 750,000 ladies wrote in for it since they had never found this particular and, I am told, quite difficult operation in dress architecture well explained and illustrated in the blue prints devised and sold by private enterprise.

The Bureau also got out a bulletin on window curtaining and has been spanked more for that than for almost anything else it ever did, I believe. Well, in 1929 it seems that 226,671,163

square yards of cotton materials, valued at over 39,000,000 dollars, were manufactured into draperies in this country. Also, difficult as it may appear to believe, there are really millions of housewives who can not afford the services of either an interior decorator or a private drapery designer. They can not even afford the costly and over-elaborate draperies recommended by commercial houses in the women's magazines they read. It is said, doubtless with no little accuracy, that they have small incomes.

So a popular bulletin was prepared describing and illustrating the use of inexpensive fabrics in curtains suitable for the less pretentious home. The subject tied in with the textile utilization work carried on by the Bureau—work intended to find the best textile for the specific purpose, to discover how it wears, how it launders, how it starches, and to increase the consumption of American fiber crops. All this, one would say, was very laudable. Over 150,000 housewives found in the bulletin something very near their hearts' desire and I assure them that it puts no ache into mine to contribute what I did to the publication of that pamphlet.

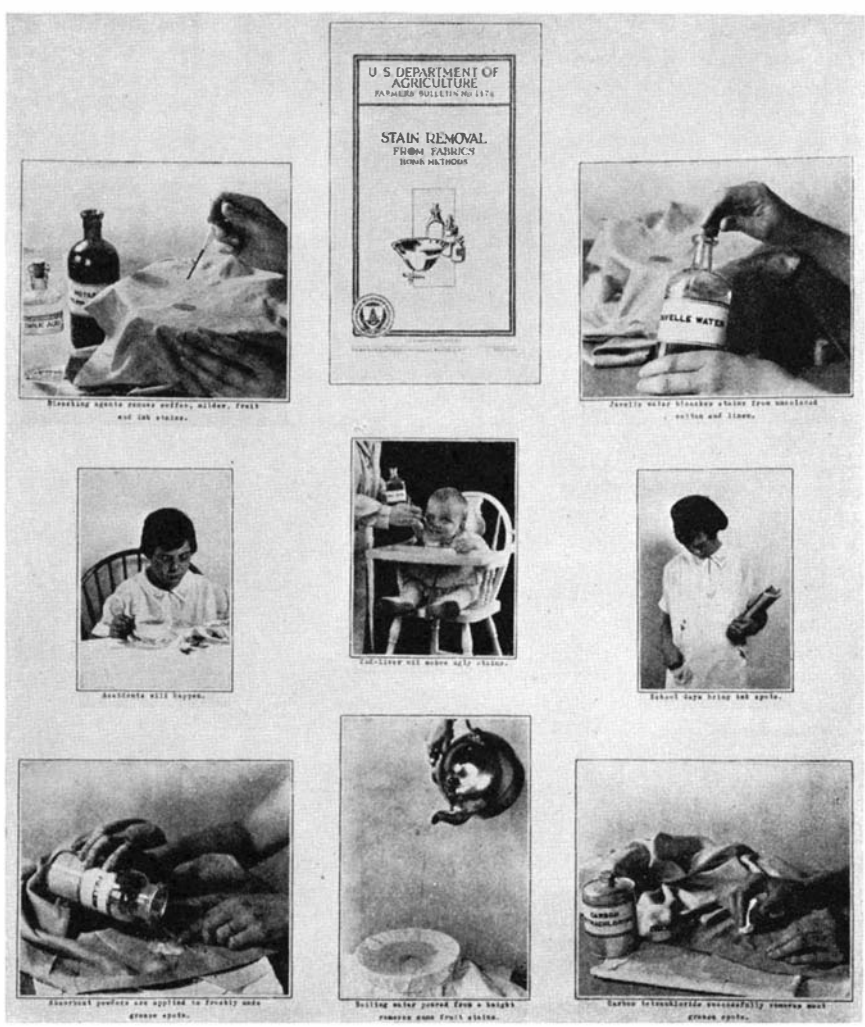
AWHILE ago editorial writers got quite a laugh out of the Bureau's study on where sheets wear out. Some of them referred to it as "why" sheets wear out and, naturally, it makes a bigger laugh that way. Yet it was a matter of record that conferences of sheeting manufacturers and textile experts were constantly cursed with discussion about something everybody thought was settled for years; that is, precisely where and how do sheets wear out? Nobody knew. So the Bureau studied several hundred hotel sheets in their peregrinations from manufacturer to dust rag and came forth with the first systematic information ever made available on the subject. This formed part of a larger investigation on the influence of the grade of cotton fibers on the wearing quality of fabrics, another little detail private enterprise utterly neglected in its passion to make money.

This is valuable consumer service. The Bureau carries on quite as admirably in the matter of nutrition. We talk about standards of living, but what are they? They are based on family expenditures; families spend their money in a competitive market wherein advertising constantly urges them to waste it on this or that, while other advertising, at a different level, advises them how to lose the part they elect to "save" by expending it for worthless securities. Such standards mean little or nothing in ordinary times; they mean less than nothing now when so many families have no income to expend anyway.

To arrive at a rational standard of living one would have first to know the relative value of different foods and fabrics for different purposes. That is fundamental. It is superfluous and uneconomical to use satin for kitchen drapes or for small boys' suits if cotton looks almost as well and wears far better. But you could never expect a competitive satin manufacturer to tell you that. He wants to sell you satin. Whether the boy bursts out of his suit or the drapes look absurd in a kitchen he wants to sell satin. We must look to a Government agency, then, to study the situation and give us the actual, unbiased facts.

THE same thing holds for nutrition. The market is full of foods of sorts. There are all sorts of special health foods advertised in such a way as to make us believe we simply can not live without them. There are vegetables in wide variety and meats in abundance, and advertising, or cleverly camouflaged commercial boosts, appearing in the press urge us to buy this or that, without reference to our actual consumer needs in terms of diminished revenues. The important question we ask is: Now that my income is down to this trifle monthly, what fabrics and what food combinations is it best for me to buy? What shall I buy and what shall I eat and wear in order to maintain health, look halfway decent, and stay within the margin of my shrinking income?

The Bureau of Home Economics was founded to give a dispassionate, objective, thoroughly scientific answer to these questions. If that takes 217,000 dollars a year it comes remarkably cheap according to my notion. The consumer is served because the most authentic information about food and fabric values and standards is given out freely in popular publications. The producer and the manufacturer are served because the use of various foods and fabrics is stimulated and their consumption puts dollars into the pockets of farmers and manufacturers. Precisely what is wrong about such expenditure of public funds, when people so willingly and so freely thrust forward their millions for bankers to lose forever and forever, I can not see. If that is frittering money away, then the business journals and I simply do not speak the same language.



Stain-removal information from a disinterested source that has no "patent" method for sale. Since 1926, 1,161,366 copies of this pamphlet have been sold

SELF-CONQUEST THROUGH SELF-ANALYSIS

A Resume of the Evolution of Psychoanalysis; and an Outline of a System with which a Searching Self-Analysis May be Made

By ALFRED J. FOX, M.D.

THE theory and practice of psychoanalysis originated by Dr. Sigmund Freud more than 30 years ago and proposed as a new psychological cure for many nervous disorders has failed to measure up to the expectations of competent scientific critics and is now in grave danger of being discarded and condemned as an unscientific and unsound theoretical supposition. The critics of the theory maintain that at its best it is a dangerous experiment, that cures reported to have resulted from treatment by psychoanalysis have not been verified by statistical data or even ordinary clinical evidence.

Graduates of the Freud school of psychoanalysis, duly authorized as qualified psychoanalysts, lack the medical education and training to understand, much less diagnose and treat nervous and other disorders. The practice of permitting non-medical men to undertake the cure of physical and mental ailments lends itself to serious abuses that are a menace to public health. Many physicians who have investigated and tested the merits of psychoanalysis are of the opinion that the claims for it are grossly exaggerated. Be this as it may, psychoanalysis has been instrumental in revolutionizing modern psychology, and has turned the spotlight on an entirely new perspective as regards human personality, behavior, and the origin of many psychic disorders.

THE keynote of the Freudian theory is that emotional and mental, as well as physical disorders arise frequently as a result of psychic and not physical causes. Freud discovered, while experimenting with hypnotism at Dr. Charcot's clinic at Paris, that patients afflicted with hysteria, when asleep under hypnotic influence, sometimes spontaneously reveal and explain the nature and cause of their affliction. The onset of the emotional flood is ushered in with a crisis in the form of a more or less violent emotional outburst. The patient awakes after it subsides with a sense of gratifying mental relief and a vivid recollection of the forgotten incident or incidents that were the cause of the trouble.

Since Freud himself was not an adept hypnotist, he set about to discover other ways and means to probe the subconscious mind. He believed that a cure can be effected by transferring some forgotten psychic thorn from the unconscious to the conscious; the conscious realization of the nature and cause of the disorder relieved the fear, anxiety, and agitation of the patient, terminating the conflict between the conscious and unconscious, and the patient was relieved. He termed the unconscious association of ideas that formed the root of the trouble the complex.

AFTER further experimentation with high-strung hysterical patients, he announced that all complexes were the result of repressed inarticulate and immature sexual cravings that had detached themselves from the main stream of consciousness, constituting an independent split personality in a state of rebellion and conflict with the victim's normal self. (Freud lays great stress on and claims that the basis of all human aspirations and activity is the sex instinct. He terms the sex motive the *libido.*) This condition he alleged could be cured by re-attaching the rebellious fractional ego to the main body and then satisfying the patient's unconscious craving by transferring it to a new object of affection, usually the person of the analyst. This process is referred to in psychoanalytic terminology as the transference. Where the transference runs up against a snag through the inability of the analyst to attract, the analyst designates the block as the resistance to be overcome by tact and perseverance on the part of both the subject and the analyst.

Psychoanalysis opens up two avenues of approach to the subconscious; namely, the free association of ideas and the interpretation of dreams. Relief of the patient's pent-up emotions through the free association of ideas is referred to as "catharsis."

Just what Freud, as well as most other psychoanalysts mean to convey by the term "free association" is rather misleading and unintelligible to students unfamiliar with elementary psychology. The facts, simply stated, are as follows: Ordinary association of ideas is the active exercise of the faculty of memory. It is impossible to remember anything without comparing and associating it with some other known object. The total or absolute knowledge of any individual embraces all the facts that he can remember plus the knowledge he has forgotten. In conscious and purposeful association of ideas one endeavors to recall some remembered fact by association with some other remembered fact. In this process of thinking, the direction of thoughts are purposely and consciously willed, and controlled.

It will be found that ideas, mental images, and day dreams sometimes rise to the surface of consciousness, independently of any conscious effort. If we now arrest such fugitive thoughts and feelings for a moment, we discover that every spontaneous involuntary idea is a pathway to some hidden recess of the subconscious mind, and illuminates some dark region of mental activity, formerly completely detached from the memory and unknown to the individual's conscious personality. This is what is meant by free association. Its purpose is to explore the subconscious by means of the links existing between spontaneous involuntary idea images and their associations with the unconscious mind.

SELF analysis does not have to be learned. It is a natural mental process. One sets out to explore himself by easy stages; he records and interprets and joins together the information so compiled into a composite coherent entity unfolding his emotional genesis and history. Involuntary ideas, mental images, and day dreams are related to dreaming and, like dreams, are the outpourings of the unconscious mind that express some unconscious desire, feeling, or disturbance. As in dreams, every mental image involuntarily projected is a part of the symbolic language of the subconscious. This language is the reverse of the language of the conscious mind. As an illustration, if we feel cold, the feeling immediately awakens thoughts associated with the sensation such as the season of the year, clothing, locality,

(*Please turn to page* 89)

OUR POINT OF VIEW

Soviet Russia

AGITATION for recognition of the Soviet government of Russia has taken on a more deadly, insidious tone in recent months—that is since the inauguration of Mr. Roosevelt. Converts to this cause are now numbered among our most influential men. Even Alfred E. Smith, former Presidential candidate, says that he believes "we ought to recognize Russia."

Why the sudden clamor? We want their trade; we need their trade—that is the theme of all the arguments put forward so far. It has been said also that there would be less friction between ourselves and Russia if we should recognize the present Russian régime.

It has been pointed out that our exports to Russia in 1931 totalled 103,000,000 dollars, while in 1932 they amounted to only 12,500,000 dollars. The argument is that this drop was due to our non-recognition. But was it? The Soviet régime had been in power over a decade when we sold the hundred and three million dollars' worth of goods in 1931. Russia had over 10 years to divert her business elsewhere—because we wouldn't recognize her government—but instead, her orders from us had steadily mounted. Naturally. She is modeling her industry on American lines; has employed many thousands of American experts, engineers, and technicians; and wanted all we could give her. The drop in exports to her is therefore due to other causes—the principal one of which may be the depression. Then, too, it may be that the Soviet resents our attitude of horror against a country that builds on conscription and death penalties, our lack of faith in her promises to pay, and our enactment of embargoes against her convict labor. As for friction between us, scan the record and then consider the experience of those countries that have recognized Russia. No American has yet felt the fury of the O.G.P.U. as have several Englishmen recently. It has been reasonably argued that, since the Soviet courts American recognition, she is the more careful to avoid friction in her dealings with us.

There is no reason to get excited about Communist activities in this country; real Americans are too stable and intelligent to be influenced by Communistic beliefs. Nevertheless, we want no traffic with a country that openly declares its aim to overthrow the governments of foreign countries by blood and fire. American principles are at stake in this question. We, therefore, agree with the late Calvin Coolidge when he said: "I do not propose to barter away for the privilege of trade any of the cherished rights of humanity; I do not propose to make merchandise of American principles. These rights and principles must go wherever the sanctions of our government go." And, after all, 100,000,000 dollars is mere pocket change compared with our total export business.

Not Nature, but Human Nature

OUT of years of sad experience with two kinds of destructive natural phenomena—earthquakes and hurricanes—and years of study of their forces and effects by scientists and builders, one elementary fact is beginning, rather late it might seem to some, to emerge and stand sharply silhouetted in the clear—one that might have been a most obvious conclusion to arrive at long ago. This is that man has little actual need to be in terror of these angrier moods of nature if only he will provide good, substantial buildings. Good buildings will ride safely through earthquakes of major force and will outlast a heavy hurricane. It is only bad buildings that go down before these forces. So we need not abandon California and Florida, and we need not even fear to move to them—provided we move into well-built structures when we get there.

News reports and press photographs have always given the public a most distorted concept of the amount of damage done during earthquake and hurricane disasters—"the small average proportion of damage in relation to the sound value of the property, found within the areas of greatest earthquake intensity," as the engineer John Ripley Freeman puts it in his great book "Earthquake Damage and Earthquake Insurance." Reporters do not ordinarily describe, and press photographers do not photograph, buildings which stand relatively undamaged. These are ignored, yet they are always in the majority. In the San Francisco disaster the loss by earthquake was only five percent. The same was true of the Tokyo disaster. Even in earthquakes of major force, heavy damage is done only to badly built structures.

A building in a region which is free from earthquakes is subject to few forces other than that of gravity; in large measure it is held together by gravity. On the other hand, designing a building for an earthquake area is or should be more like designing a ship. The parts of a ship are subject not only to the downward force of gravity but to rolling forces, pitching forces, and twisting forces. Freeman built two dwelling houses which he states are as quake-worthy as a ship is seaworthy, and for the same reasons. He started with a foundation mat of reinforced concrete four inches thick. The cellar walls of reinforced concrete were built on this mat and not merely around it. The first story floor was of reinforced concrete. The house was of wood, boarded diagonally. The exterior finish was of wood, but may be of stucco on expanded metal lath. "Such a dwelling," Freeman adds, "would ride out the worst earthquake nearly as successfully as the ordinary ship rides out the hundred-fold greater wave motion of a storm at sea." It will roll, pitch, and twist as a whole, not in segments, and therefore it will not fall to pieces.

The extra cost of building such a residence should be charged frankly against the advantages of living in the Californian paradise, and not regarded in the light of a net loss.

Returning now to hurricane damage, it appears that here too, good buildings are the simple remedy rather than something complicated. In a study of Florida hurricanes made by Richard W. Gray of Miami and published in the *Monthly Weather Review* of the United States Weather Bureau, the following conclusion is reached: "If a building is properly constructed, including the proper type of roof and roofing material, and is securely anchored to the proper kind of foundation, it will not sustain serious structural damage in a hurricane of major intensity. If, in addition to the proper construction, all windows, doors and vents are protected by storm shutters, the building should withstand strong hurricane winds with practically no damage. Such a building can be constructed at only a moderate increase of cost above that for the usual type of construction, and the saving in storm insurance will repay the extra cost in a few years time." Safety in another paradise is thus provided for.

Some might say that the "trouble" with earthquakes in California and hurricanes in Florida is mainly if not almost wholly a certain trouble closely connected with human nature. That trouble is inertia.

The Amateur and His Microscope—II

By
L. V. FOSTER
and
J. F. BRANDT
Bausch and Lomb Optical Co.

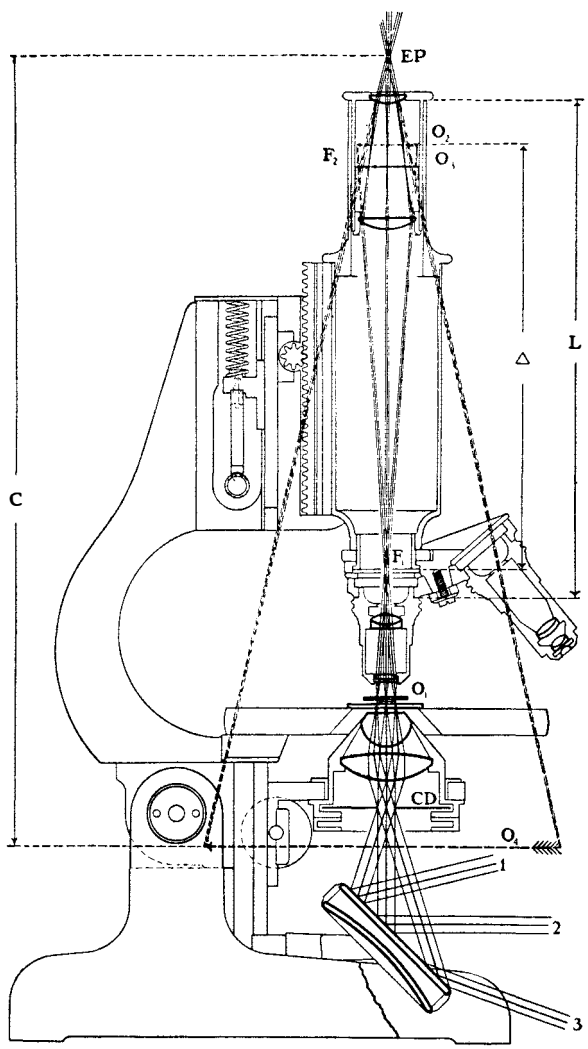
MOST of us have a magnifying glass somewhere around the house or in the office. Have you ever considered, when you pick up this lens and focus it on some interesting detail, just how it was that that detail suddenly became large and quite distinct to your eye?

A lens has only one purpose—to bend light rays. You know how a prism bends light to form a spectrum. Notice in the drawing on the opposite page the similarity of a lens to two prisms placed base to base. Each prism bends the light rays passing through it down or up toward its base, so that eventually they will all meet at a point beyond the lens. The rays of light come to this point at a greater angle than they would if they came from the object alone. That is the crux of the whole matter.

The magnifying power of the lens is dependent upon its curvature. The greater the curvature, the more the light is bent. When light comes from the sun, or any other "infinite" point, all the rays are in lines parallel to each other. These rays entering a lens come together, or to a "focus," at a definite point for each lens and a definite distance away from the principal plane of the lens. Therefore, the index or the magnifying power of a lens is its "focal distance."

OUR magnifying glass will serve to explain two terms which are necessary to the explanation of the compound microscope. These are the real image and the virtual image. We can demonstrate the real image by a very simple experiment. Hold your magnifying glass about a foot from the wall on the opposite side of a room from an ordinary floor lamp which is lighted, or a window. Now if you move the magnifying glass slowly toward the wall, you will come to a point where an inverted image of the lamp or the window suddenly appears. This image is the real image. The virtual image, on the other hand, cannot be focused on a surface, but it is the one the eyes see when looking through any kind of magnifying glass or a microscope.

The magnifying parts of a microscope consist of two series of lenses, the objective, which is nearest the object, and the eyepiece, which is nearest the eye. The objective forms a real image of the object in the body tube of the microscope. The eyepiece then picks up this real image, magnifies it, and transmits a virtual image to the eye. The magnified image which the objective has made is multiplied when it is again magnified by the eyepiece. Thus you can see why it is possible to get such very high magnifications with a compound microscope.



Microscope optics. 1, 2, and 3 represent typical pencils of light which are reflected upward and through condenser diaphragm *CD*, through the condenser above to the object O_3, and then through the lens system of the microscope proper. The effect of such a system is to bend or refract the rays from the object, so that they come to the eye at a wide angle. What we get is the virtual image shown by the arrow O_4. It is just as if the tiny object were as large as O_4 suggests, and were seen from distance *C* with the unaided eye

The primary purpose of the microscope is not simply to magnify an object. When magnified the image must be free from unnatural colors, highly resolved, distinct and carefully focused. High magnification alone is easily obtained merely by projecting the image on a surface far away from the lens. But if the details of the image are hazy, and if two lines in it which should appear quite separate actually appear as one line, and if the lens has broken the light into the spectrum and given the image color that should not be there, the gain caused by the high magnification is illusory.

The most important characteristic of a microscope is its resolving power. Resolving power is the index of the ability of a microscope to separate two details lying close together in an object, so that they appear separate and distinct. It is resolving power, more than anything else, which limits the extension of the magnification of the microscope. It has to date limited useful magnification of microscopes to around 9000 diameters.

ORDINARILY in using a microscope we use light made up of a number of colors. It has been found that if the colors with a shorter wavelength are separated out and used alone a higher resolution is obtained. In fact, research workers are now using a light wave that is so short that it is invisible to the eye—the ultra-violet, which, of course, must be photographed.

You will notice engraved on the objectives of the microscope you buy "N.A." and then a number, such as .85. This is the numerical aperture of the objective and is the index of its resolving power. The larger the numerical aperture, the greater will be the resolving power.

Chromatic aberration gave a great deal of trouble in the

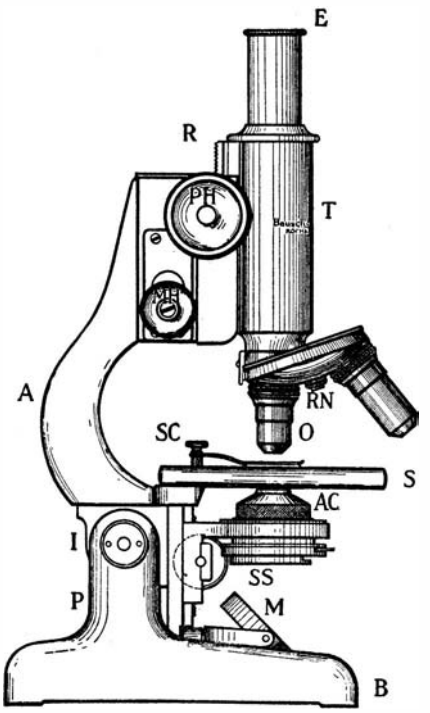
early days of telescope and microscope making. A lens which has not been corrected for its chromatic aberration gives an image that has color fringes around the edge of each detail. As is indicated in one of our drawings, a lens is somewhat like two prisms placed base to base, and will ordinarily act like two prisms, breaking the light passing through them into the colors of the spectrum. White light is made up of the colors of the rainbow; that is, of a number of rays each having a different wavelength. The different wavelengths cause the light to be bent at different angles, so that they focus at different points along the optical axis of the lens. It was found, however, that if two kinds of glass, crown and flint, were used together in making a lens the chromatic aberration, or the dispersion, of one would offset the chromatic aberration of the other.

SPHERICAL aberration, which causes a milky image, known in photography as "poor definition," is corrected in the same way. Here again the cause is the light being focused at different points along the optical axis, but it is caused this time by the curvature of the lens. The farther away from the center of the lens the light passes, the sharper the angle at which it is bent. By combining a dispersing lens of flint glass, which bends light at a relatively sharp angle, with a converging lens of crown glass, which does not bend light at such a great angle, to make a single lens, spherical aberration is corrected.

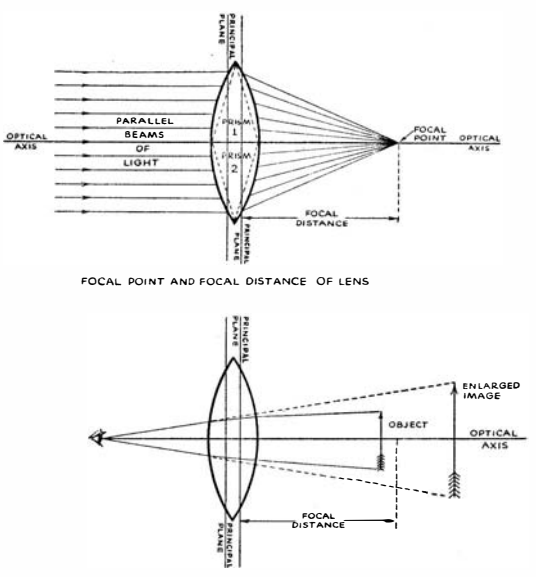
One mistake many beginners make is to think that the higher the magnification the more interesting the work will be. This is not true, since the high magnifications have the fault of not allowing us to see the forest for the trees. For example, with the high magnifications correctly focused on a fly's wing you will see perhaps a large sharp black thorn sticking up under the lens. With the low magnification you would see that this thorn is merely one of many hairs which cover a fly's wings and most of its body. Unless we knew this, the single hair would never be of interest, and might not be then, unless we could dissect it. For quite a long time the beginner will work with magnifications below 400, but it is wise to obtain, if you can afford it, a microscope which will give higher powers for your advanced work later on.

This brings us to the question of what equipment the amateur will need. It is not very expensive in comparison with many other hobbies, since the first purchases are the only important ones.

First of all, the microscope. The beginner need be interested in only three general types of microscopes: substandard microscopes, standard microscopes without condenser and standard laboratory microscopes with condenser. For the purposes of this article we shall classify all sub-standard microscopes as those selling at about 20 dollars or less. The standard microscope without condenser is on a regular laboratory microscope stand, but has magnifications from 75x to 322x. These sell for about 70 dollars. Standard laboratory microscopes have a substage with condenser, an oil immersion lens, and give magnifications from 50x to 910x, and are priced at about 120 dollars. Which microscope you obtain depends upon how important your hobby is to you, how far you want to go into it, and what you can afford. Against the cost of the hobby it is fair to charge off other sums which the worker will *not* spend because of its pursuit. For, while he is spending an evening at home having fun with it, he will not be spending several dollars somewhere else. In that way even a fine instrument will soon "buy itself."



A typical microscope. *E*, eyepiece. *AC* is the Abbé condenser and *SS* the substage with diaphragm. *RN* is the revolving nosepiece. *S*, stage



Two simple diagrams which explain the elementary principles by which microscopes magnify

ANOTHER item of equipment recommended for the amateur, who will usually be working at night, is a small microscope lamp. Small compact lamps especially designed for use with the microscope are on the market for 5 dollars. These can be used on 110-volt current, have a 15-watt bulb, and the light passes through both a blue and a ground glass.

The only other things the amateur will need are a dozen or so glass slides upon which the specimens are to be placed, some cover glasses to cover the specimens, some eye droppers, and a few other odds and ends which may easily be found around the house.

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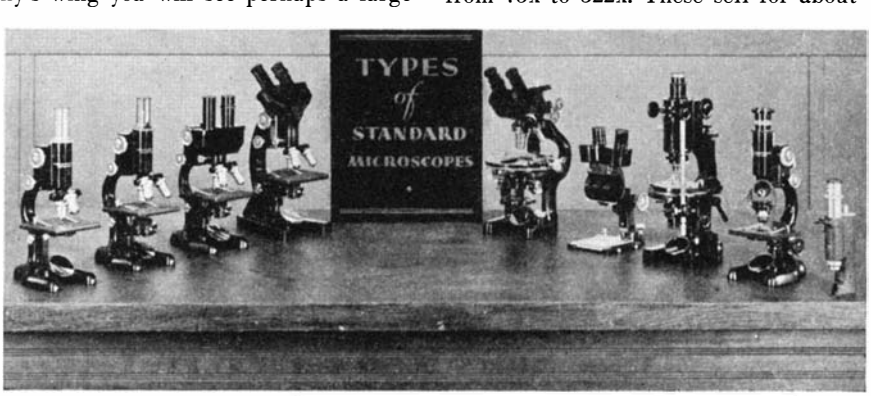
The third article in the present series will deal with the manipulation of the microscope.



Types of standard microscopes. The two on the left are typical instruments for the average worker. The picture also includes four binocular microscopes

SUNSPOTS—

SUNSPOTS are objects of perennial interest to the observer as well as to the public, and year by year we learn more about them. The great work of Hale and his colleagues more than 20 years ago showed conclusively that the spots are essentially cool spots on the hot surface of the sun. Because of their lower temperature they shine less strongly than the rest of the disk, and so appear dark, and their light is redder than that of the photosphere, as is obvious when one can be compared with the black disk of Mercury in transit. The many peculiarities of the spectra of the spots, too, can be fully explained by the effects of diminished temperature and lower ionization.

But *why* should sunspots be cool? A typical one maintains a temperature fully 1000 degrees Centigrade below that of its surroundings, over an area thousands of miles across, and for days or weeks on end. Something is obviously happening to keep it cool, and it has already been told in these columns how there is convincing evidence that the process of expansion in the vast ascending vortex of gases which constitute the spot is the cooling agency. New material is continually being fed into the bottom of the vortex, deep below the surface, and as the gases rise (reversing the familiar motion of water running out of a wash-basin) the forced expansion cools the newly supplied material faster than the influx of heat from the sides can warm it up. Only as the spent gases flow outward close to the surface does the heating process overtake the cooling, and so set an outer boundary to the spot.

COULD we see deep down into these gigantic cyclones the spectacle would indeed be amazing. But the ionized gases of the solar atmosphere are foggy, so that our vision can penetrate at most but a few score miles below the level where the haze begins. This is but a fraction of one percent of the diameter of a fair-sized spot. We cannot, therefore, see the whole affair; we observe only a sort of microtome shaving off the very surface and, unlike the microscopist, we are unable to make further sections at a deeper level and compare them in order to discern the structure of the whole. Even with these limitations we can find out a great deal. A new piece of information derived by a very pretty bit of theory comes from Utrecht, where Dr. Minnaert and his colleague Mr. Wanders, have attacked the problem from a new angle.

There is, of course, no sharply bounded surface of the sun, either in the spots or outside. What we see is a mixture of unobstructed light from the thin outer layers, and light from the hotter and deeper layers more and more obscured by the overlying haze. The final blended result turns out to be much more similar in composition than one would have expected, to the radiation from a hot solid surface of standard "black body" properties and a definite temperature. This is true, at least for the general surface of the sun's disk. Here radiation equilibrium prevails—that is, the temperature of the layer of the atmosphere at any given depth is determined entirely by the process of relaying heat outward from one layer to another. The resulting law of temperature change with depth has been fully worked out, and from it one can find the relative amounts of light of different colors which the sun should emit, and the way in which the brightness, measured with light of any given color, should fall off toward the sun's limb. In both cases there is a very fair agreement with observation.

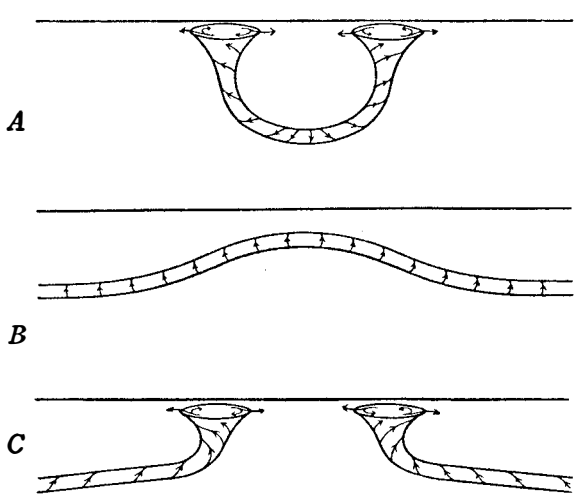
In an ascending column of gas, like that which is believed to occur in the spot vortex, a quite different situation prevails—adiabatic equilibrium, in which the temperature is determined by the expansion, undisturbed by the flow of heat from outside. This ideal condition is of course not fully reached in any spot, but if the stream of gas is wide enough and comes fast enough, the leakage of heat into it from the exterior will be unimportant.

In such a column the temperature gradient—the rate of fall toward higher levels—will for any ordinary gas be greater than in the case of radiative equilibrium. Hence the upflowing stream, starting at the same temperature as other gases at the same depth, will grow gradually cooler than its undisturbed surroundings, and its outcrop on the surface will produce a cool spot.

Suppose now that we had for comparison a cooler star than the sun, with a tranquil atmosphere but a slower flow of heat to the surface—just enough to maintain it at the same temperature in its outer layers as prevails in the outermost layers of the spot vortex. Would the spot look as bright as a piece of the surface of this star, and would it be of the same color? This is the problem which the Dutch physicists set themselves and, after some pages of equations and integrals which would bewilder most of us, they arrive at the conclusion that it would not.

THE reason can be explained without mathematical formulas. In the sunspot the temperature gradient is greater than elsewhere in the sun, and in the cooler star it is smaller. Hence, if we start with the same temperature at the surface of the two, the deeper layers in the spot will be hotter than in the star.

But we see, not the light from any one layer, but a mixture coming from various depths in the atmosphere. The difference in temperature between the upper and lower visible layers will be greater in the spot than in our imaginary star. If we adjust the latter—which, since we



From Russell, Dugan and Stewart's "Astronomy," courtesy Ginn and Co.

Hale's theory of sunspots, which is the one most astronomers accept, is that they are vortices in the sun's outer layers, shaped like the vortex in a discharging wash-basin; except that the gases are not moving downward, but are ascending spirally upward and outward. Sunspots have the appearance of deep pits, down into which we look, but this is an illusion. As Professor Russell points out in the accompanying article, we see down into them scarcely at all. What, then, does go on underneath the surface? One theory is that of Bjerknes: Suppose that a long, rolling vortex, like cut hay driven by a high wind and rolling along a field, exists in the upper layers of the sun's gases (sketch *B*). Some accident causes it to bend up to the surface and it breaks in two, like a broken angleworm. Either end will form a sunspot of its own, as at *C*. Or suppose that a shorter roll bends up toward the surface at either end and something like *A* is obtained. In both cases the surface vortices occur in pairs and rotate in opposite directions, circumstances which check with the observed solar phenomena. These are called "bi-polar groups."

GREATEST EXISTING REFRIGERATORS

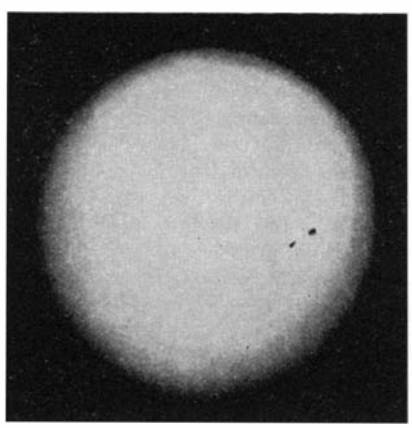
By HENRY NORRIS RUSSELL, Ph. D.
Chairman of the Department of Astronomy and Director of the Observatory at Princeton University
Research Associate of the Mount Wilson Observatory of the Carnegie Institution of Washington

have invented it, we are at liberty to do—so that it gives out just as much light of some given wavelength (say in the red) per square mile as the spot does. this will not be the case for shorter waves in the violet. The hot deeper layers in the spot will send out more violet light than the corresponding but cooler layers in the star. For the upper layers the difference is the other way but smaller; so, all in all, the spot will give out more violet light than an equal area of the star—that is, its light will be bluer.

Now the relative amounts of radiation from sunspots have been measured by Pettit and Nicholson at Mount Wilson, from the ultra-violet far into the infra-red. Comparing these results with their calculations, Mannaert and Wanders find that the light from a spot is of substantially the same color as we would get from a bit of a star cooler than the sun, but is much redder than would be obtained if we were looking into the top of an expanding column of gas with its higher temperature gradient.

THIS looks alarming at first, and bad for the accepted vortex theory, but we must not be too hasty. Suppose that the ascending column of gas slows down and starts moving outward, a little below the visible surface, and that a thin surface layer of nearly if not quite stagnant gas overlies it. In the deeper regions adiabatic relations prevail and the ascending column will be cooled, but in the calm layer at the top there will be no expansion to produce extra cooling and there will be radiation equilibrium. The radiation which reaches the bottom of the layer, however, will come from the broad, deep mass of the vortex, which is cooler than the rest of the sun and far too thick to let light from outside get through it. Hence the stagnant layer will be nearly like a part of the atmosphere of our supposed cooler star, and the light which finally escapes from it will have the appropriate color as well as brightness.

To clinch their point the authors figure out how the brightness, or rather the darkness, of a spot should change as it is carried by the sun's rotation from the center of the disk to the edge. Near the edge the line of sight is oblique and we cannot "see down" as far, either in the spot or elsewhere. The light comes on the average from cooler layers and so is fainter and redder. This actually happens, of course, on the sun. If the upper layers above the spot are stagnant and in radiative equilibrium, this effect will be almost the same in them as elsewhere, and the spot will change very little in brightness *relative* to the disk as it passes from the center to the limb. But if the ascending column reaches to the surface, the uppermost layers will be cooler than before, and



Bi-polar sunspot group, photographed by Gustavus Wynne Cook

in consequence the spot will appear darker compared with the surrounding surface near the sun's limb. Observation shows that this does not happen, but that the relative darkness of the spot is little changed. With this independent test the existence of a stagnant upper layer above the spot vortex appears to be established. How deep this may be we do not know. It is too deep to see through to any extent, but this may mean less than a hundred miles. The turbulent region below, alas, is veiled from our study.

Farther out, near the edge of a spot, the currents of the vortex, now moving almost outward and probably much more slowly, break through to the surface. This was first shown by Evershed, who found small but definite shifts in the positions of the spectral lines for light from the edges of a spot near the sun's limb, of such a nature as to show that there was a horizontal flow outward from the umbra along the sun's surface in all directions. Later observations by St. John showed that this shift was much greater for weak lines than for strong ones. There is good evidence that the weak lines are produced lower down in the solar atmosphere, hence the outward flow is more rapid in the deeper layers of the region to which our vision can penetrate.

The latest word on this subject comes from the Italian astronomer Abetti who, at the observatory of Arcetri, has a tower telescope of the type first constructed at Mount Wilson and peculiarly adapted to detailed studies of the sun.

Numerous plates taken during the last spot maximum, between 1926 and 1930, confirm the differences depending on the intensity of the lines, but show that the phenomenon is more complicated than had previously been realized. The outward motion, even for the same spectral line, is not the same from spot to spot, but is sometimes almost too small to measure, and again rises occasionally to nearly four miles per second, measured along the surface.

IN general, the motion is outward but there is often a thwartwise component which indicates that the flow is spiral and not straight away from the center. Here, it would seem, we learn something of the direction of rotation of the vortex. Comparing his results with the spiral flocculi produced by hydrogen at a far higher level, which are revealed by the spectroheliograph, Professor Abetti finds the curious result that the directions of the whirl are usually opposite. These beautiful photographs must therefore represent a secondary effect of some sort in the topmost regions of the atmosphere, as Hale and St. John long ago suspected.

These results of the Dutch and Italian investigators are evidently in excellent agreement. If the main part of the motion in the spot-vortex is confined to layers below the surface covered by a thin stagnant film of gas—still thick though, however, to hide the rest—it is no wonder that when the motion works up to the surface it is irregular in speed and apparently capricious. Sunspots are very intricate affairs and, despite the conspicuous success of past investigations, there is still a good deal to keep future workers busy.—*Princeton University Observatory*, May 17, 1933.

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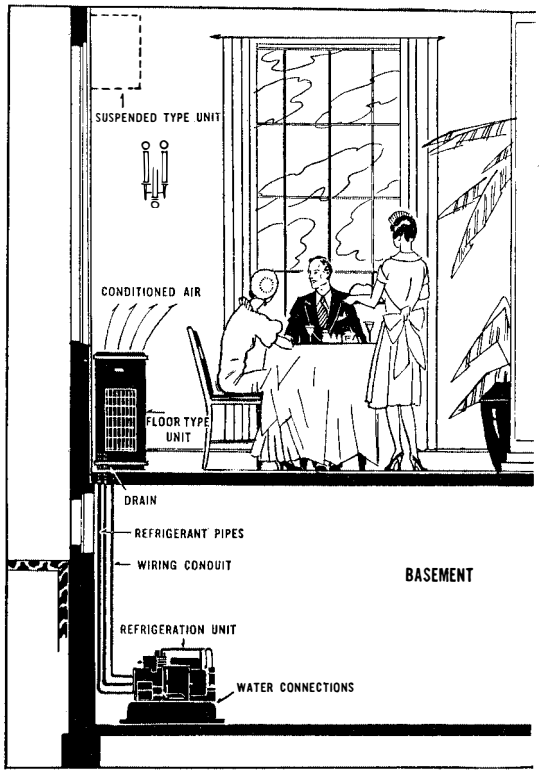
Is the much-discussed increase of cancer and heart disease fact or illusion? Illusion, says the author of an article soon to be presented.

AIR CONDITIONING

What It Is and How It Works



Typical air-conditioning installation with the refrigerating equipment in the basement

By C. D. GRAHAM
Air Conditioning Engineer,
Westinghouse Electric and Manufacturing Company

MAN'S first attempt at air conditioning was the open fire. From this crude beginning, the advance in the art of controlling air temperature was indeed slow, for it was not until late in the 18th Century that Benjamin Franklin gave us the first stove. Then almost another hundred years elapsed before central heating plants began to make their appearance.

Air conditioning may be defined as the science or process of maintaining any desired combination of temperature, purity, moisture content, or air motion within an enclosure. This science is relatively new, but already has made such rapid strides that the public is aware of its presence and it is being looked to as the one means of bringing the urban dweller not only comfort but also freedom (at least within his home) from the foul air which is a by-product of our industrial age.

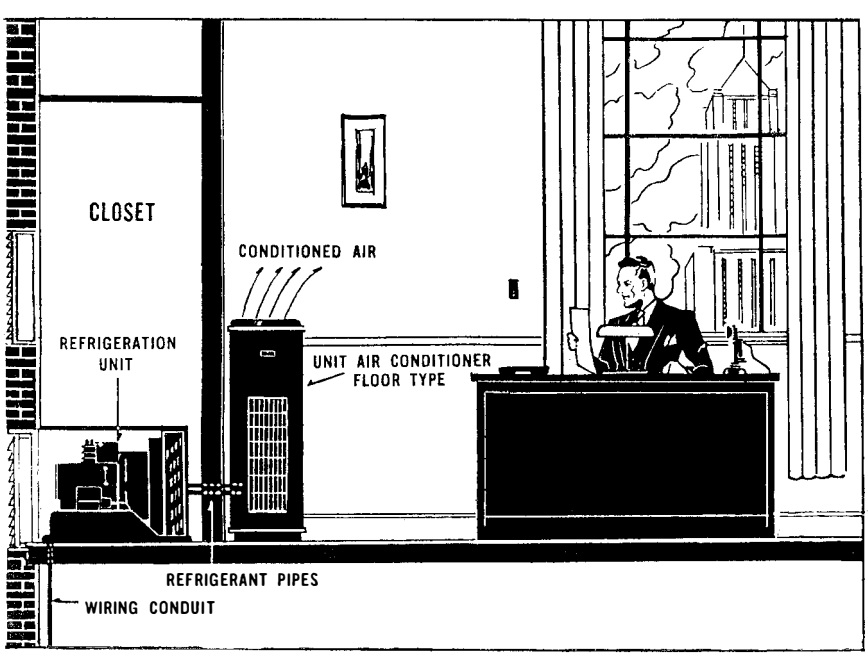
If a sample of air were broken down into its constituent parts, it would be found to contain several gases, chiefly oxygen and nitrogen, but also small portions of carbon dioxide and water vapor.

Although water vapor constitutes only a small portion of air, it is, nevertheless, always present and is essential to both animal and vegetable life. However, the quantity varies, the amount present depending upon proximity to large bodies of water, air currents, topography, and so on.

The effects of air conditioning on man have not been given such careful study as its effects on materials. However, we do know that the feeling of bodily comfort does not depend upon temperature alone. On humid summer days, we feel far less comfortable than on low humidity days of the same temperature. Similarly, on warm days, we feel less comfortable when there is no air movement than when there is a breeze.

Experience and laboratory tests show that the general rules for comfort are: In summer—lower the temperature, lower the absolute humidity, and produce an air movement; in winter—raise the temperature, raise the absolute humidity, and have only slight air movement.

Humidity may mean either absolute humidity or relative humidity. Absolute humidity refers to the weight of water vapor expressed either in grains per pound or grains per cubic foot of air. Relative humidity is expressed as percentage and refers to the percentage of saturation of the amount of water vapor actually in the air relative to the maximum amount it could hold at the same temperature. Our impressions as to whether the air is "moist" or "dry" depend upon relative and not absolute humidity, since all substances which are affected by the presence of water vapor in the air absorb or give off water substantially in proportion to the relative humidity. This form of notation is the one most commonly used and "humidity" is generally understood to mean "relative humidity."

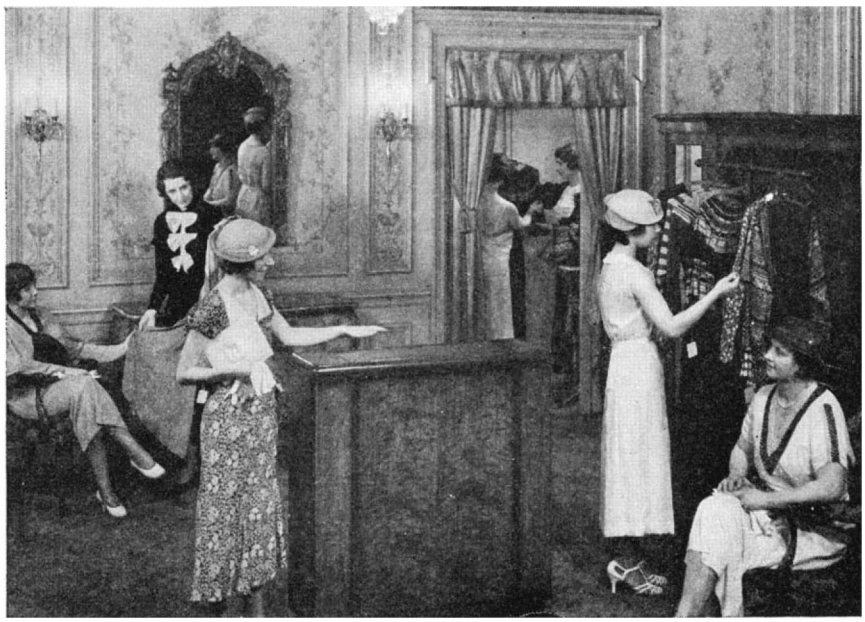


Installation for conditioning the air of upper floors. In such cases the air-cooled type of refrigerating unit is placed in a closet or an adjoining room

THE higher the temperature of the air, the greater is its capacity to hold water. For example, air with a relative humidity of 70 percent at 90 degrees dry bulb temperature contains about seven times as much water per cubic foot as air with a humidity of 70 percent at only 33 degrees dry bulb temperature. (This example also illustrates the distinction between "relative" and "absolute" humidity, for there is a marked difference between the absolute humidity at the two conditions even though the relative humidity is the same.)

The thought in the preceding paragraph may be summarized as follows: When air is heated without the addition of water vapor, the relative humidity

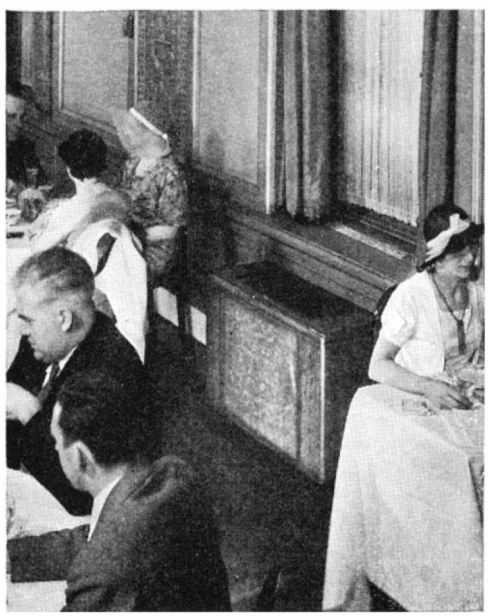
SOME manufacturers, exploiting the public's ignorance of the physics of air conditioning—the scientific principle and the operation—are selling widely with unwarranted claims cheaply made devices that they incorrectly call "air conditioners." To dispel this ignorance and prevent the waste of money on worthless machines, this article explains the various systems, what they do, and how they may be applied. This discussion is in elementary style purposely to acquaint the veriest laymen among prospective users of air conditioning systems with the details that should be most useful in selecting equipment.— ***The Editor.***



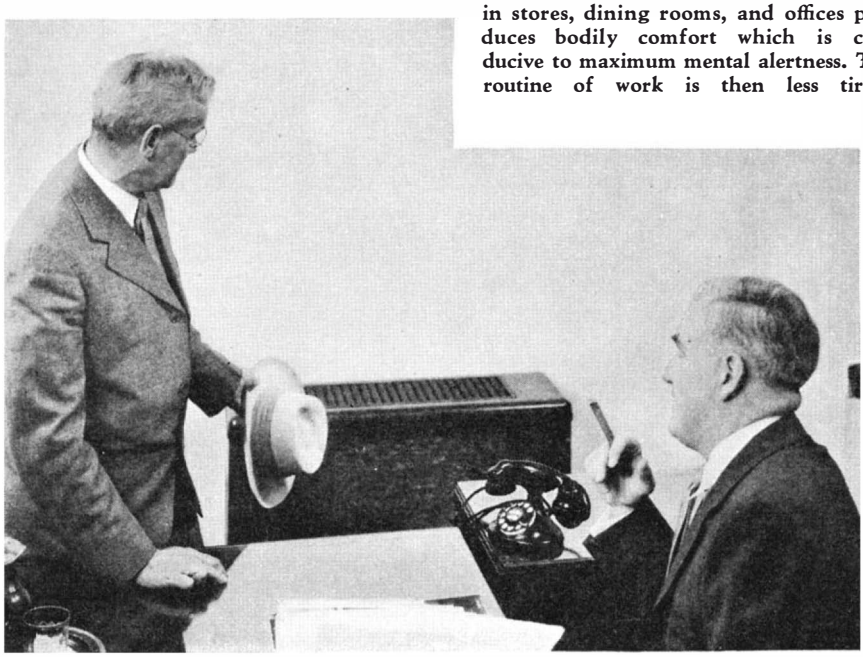
decreases, and conversely, when air is cooled without the extraction of water vapor, its relative humidity increases.

Since the capacity of air to hold moisture decreases with lowering temperature, it is always possible by cooling air to reduce its moisture-holding capacity to the point where the water vapor present exactly equals its maximum holding capacity. The air is then said to be saturated or at its dew point. If cooled below this saturation point, the moisture-holding capacity is still further decreased and the air cannot hold as water vapor all the water present. The excess moisture then condenses into visible form as fog or dew. Air saturated with water vapor at any given temperature is, therefore, at its dew point.

A good example of this action is the "sweating" of a vessel of ice water on a hot day. What really happens is this: A thin film of air surrounding the vessel is cooled below the dew point, and the excess water is deposited as "sweat."



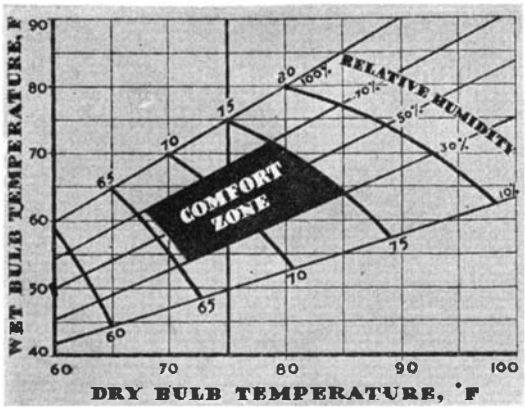
Properly washed, cooled, and dried air in stores, dining rooms, and offices produces bodily comfort which is conducive to maximum mental alertness. The routine of work is then less tiring



To put it in figures: If the air were at 72 degrees with 60 percent relative humidity, it would contain about five grains of water per cubic foot. If the layer of air around the vessel were cooled to 42 degrees, the air at this temperature could hold only three grains per cubic foot when saturated, and the extra two grains per cubic foot would be precipitated or deposited on the vessel as sweat. The same thing happens with the formation of dew out of doors, when the lowering of temperature at night brings the air near the ground below the dew point.

TO evaporate water to steam requires heat. Similarly to change water to vapor requires heat, for water vapor is really steam at low temperature. We use the term "steam" to designate evaporated water at a temperature of 212 degrees or above, and when we speak of "water vapor" we mean evaporated water below 212 degrees.

If the bulb of an ordinary thermometer is covered with a moist, clean soft cloth, and placed where there is a fairly rapid air motion across this covered bulb, a depressed reading will be obtained. This is known as the wet-bulb temperature, and, since the lowered reading is due to the evaporation of the moisture on the wick covering the bulb, it is evident that the wet-bulb temperature is a measure of the moisture in the air, and corresponds to the dry-bulb temperature the air would assume if sufficient moisture were present to bring the air to saturation without any heat being added or subtracted. Hence, wet-bulb temperature is the indication or measure of the total heat of air.



The "comfort zone" indicates zone of most healthful relation between temperature and humidity, particularly during the summer

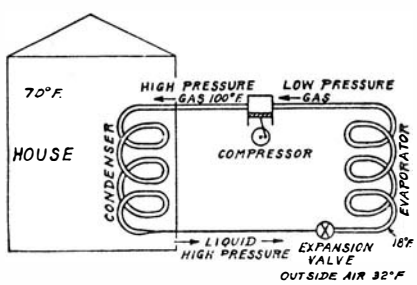
Spray Type Air Conditioning. If we were to pass a stream of air through a sufficient spray of water (which is continually recirculated without any heat being added to the water) we would find that the water temperature would remain substantially at the wet-bulb temperature of the entering air. At the same time, we would find that the wet-bulb temperature of the air leaving the sprays would be the same as the wet-bulb temperature of the entering air. Also, we would find that the leaving dry-bulb temperature and the dew point would be the same as the leaving wet-bulb temperature. In other words, the air leaving the spray chamber would have been adiabatically saturated at the entering wet-bulb temperature. By an adiabatic saturation we mean that the total heat quantity remains constant, there being no heat added to or subtracted from the water spray or air.

THE heat necessary to evaporate the spray water in order to saturate the air comes from the air itself. Its dry-bulb temperature drops to the wet-bulb temperature while passing through the spray. This is known as evaporative cooling. The leaving dew point, however, is higher than the entering dew point. This is to be expected because water vapor has been added to the air.

If the spray water were heated, still more moisture could be added to the air and the leaving wet-bulb temperature would be higher than the entering wet-bulb temperature. On the other hand, if the spray water temperature were cooled, the leaving wet-bulb temperature would be lower than the entering wet-bulb temperature. If the water were sufficiently cooled, the leaving dew point would be lower than the entering dew point, and consequently the air would contain less moisture per cubic foot when leaving than upon entering the spray. Thus controlling the temperature of the spray water controls the amount of moisture added to or extracted from the air.

From the time the air leaves the spray chamber until it is delivered into the room to be air conditioned, there is no moisture added. It follows, therefore, that deciding upon a definite room temperature and humidity fixes the dew point of the air leaving the spray chamber. The air must then pass through a heater coil or else be mixed with warmer recirculated air, so as to raise the temperature to the exact amount necessary to maintain the desired room dry-bulb temperature.

Surface Type Air Conditioning. By surface cooling, we mean that the air to be cooled comes in direct contact with cold metal surfaces. The usual arrangement is to have the cooling surface in coil form (made with either bare or finned pipe) with air passing over the coil, and the cooling medium (which may be either cold water, brine, or direct expanded refrigerant) circulated through the coil. Surface heating is identical in principle with surface cooling. The only difference is that a heating medium instead of a cooling medium is circulated through the coil or radiators.

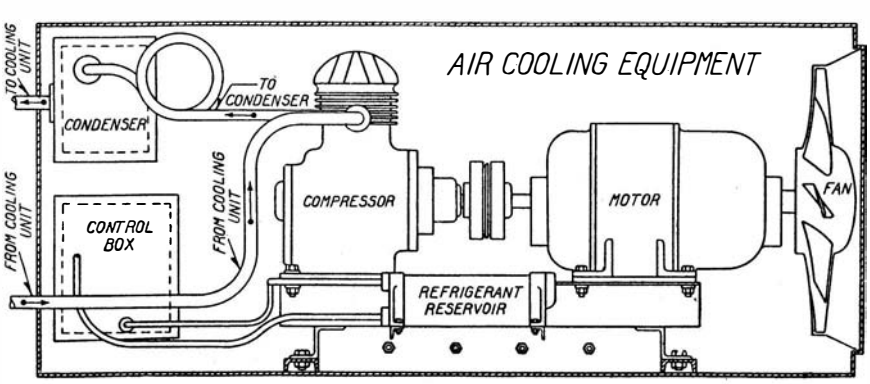


The principle on which engineers hope to heat houses in winter, in which heat is extracted from the compressed gas and used in-doors

This passing of air over a cold surface cools it and also dehumidifies it if the moisture content is high. Thus, the coil in a surface type air conditioner serves exactly the same function as the water spray in the spray type system. The spray equipment has the advantage of giving closer regulation of humidity, and, therefore, is sometimes preferred on industrial applications, particularly where the humidity must be held within close limits. With surface type equipment, a fair regulation of moisture precipitation may be had by controlling the refrigerant temperature. The chief advantages of surface type over spray type conditioners are: lower first cost, lower installation cost, less maintenance, and simplicity.

THE constantly growing demand for comfort air conditioning equipment suitable for homes and small commercial establishments such as restaurants, stores, barber shops, and so on, has forced manufacturers to provide equipment especially suited for these applications. By ingenious design, engineers have produced small compact units which will heat, humidify, ventilate, and clean the air in winter; and cool, dehumidify, ventilate, and clean the air in summer. The heating as well as the cooling and dehumidification are accomplished with compactly designed coils, and the humidification is produced by a needle-like water spray impinging against a target which atomizes the water so it may be easily absorbed by the thirsty air. All the air is passed throught a filter which removes dust.

Today a unit capable of conditioning an average living room or office 20 feet long by 15 feet wide is available which requires a floor space of approximately three feet by one foot and is about two feet high. Such a unit can easily be located in the space formerly occupied by a radiator which produced only heat. For the commercial applications, suspended units of greater capacity are available. The same units may, however, be located in the basement of a home. and connected by ducts to the various rooms so that one unit of larger capacity will condition an entire moderate sized home.



Refrigerator, railway car, or private home—the principle of air cooling is the same. The refrigerant, put under pressure, turns from gas to liquid, the resulting heat being removed by piping the refrigerant through a condenser. In the cooling unit, the refrigerant expands into a gas, which lowers its temperature

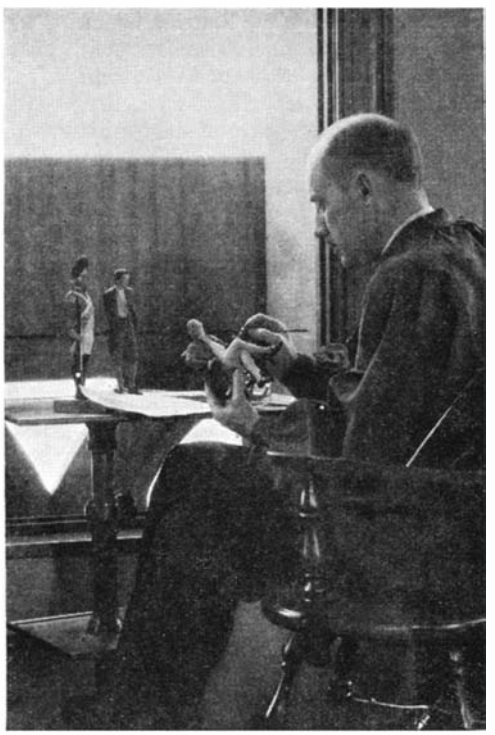
A Third Dimension Illustrator

HIGH in one of the midtown New York skyscrapers is a studio which resembles a cross between a small shop and a pirates' den. All around are little composition figures, costumes, tools, paints, cutlasses, flint-locks, chests and books. Here a one-man trade or art is carried on by Dwight Franklin—artist, technician, student of history, and of course more or less a dreamer, or he could not be a producer. His little groups of figures may be seen in many museums and a number of persons of means enjoy having a colorful little pirate in the house. Long John Silver makes an ideal ornament for an inglenook or for the modern household bar.

Mr. Franklin does not call himself a sculptor. He modestly prefers to be called a "third dimension illustrator." His technique differs from that of model-making where every rope or yard of an old vessel is wrought with meticulous care. He attempts to bring out a dramatic incident or tell a story in miniature. Research plays a large part in this work. There are whole closets filled with actual uniforms which serve as models for the figures; a large frame covered with cutlasses—not theatrical properties but the real thing; chests full of flint-lock pistols, most of which are in perfect firing order; and a rack of various types of rifles. As for books, there is a miscellaneous collection. In the Leonardo da Vinci model group which we illustrate, the various sketches on the wall were made from Leonardo's own drawings as portrayed in costly books.

The "third dimension" illustrator never studied his art in any school except the school of experience. His first job was with the American Museum of Natural History as a preparator. Here he modeled fish and reptiles, inventing new methods as he went along. About 1914 the dynamic John Cotton Dana engaged Mr. Franklin to do some groups for the new Newark Museum. Backgrounds were prepared for figure groups. About this time the "new theater" began to come in and the secrets of stage lighting were pressed into service for the small model groups. Then the Children's Museum in Brooklyn conceived the idea of taking children around the world in 30 minutes; Franklin's groups depicted a costless trip. Other museums followed and success was assured.

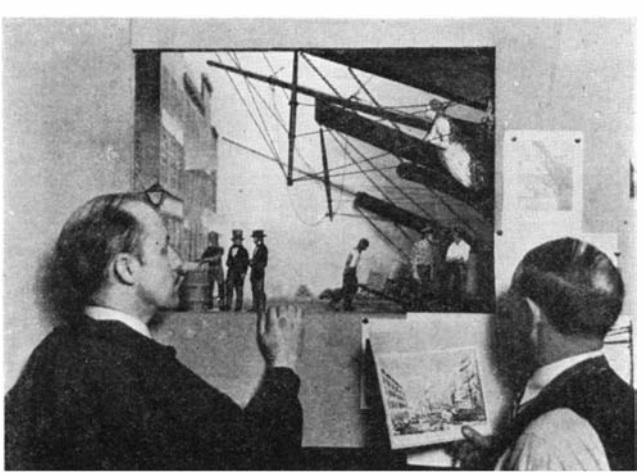
The bases of the groups are composition figures which are cast in molds and then "bent" and posed; uniforms or other clothing are modeled and painted on, and the accessories, background, and lighting are provided.

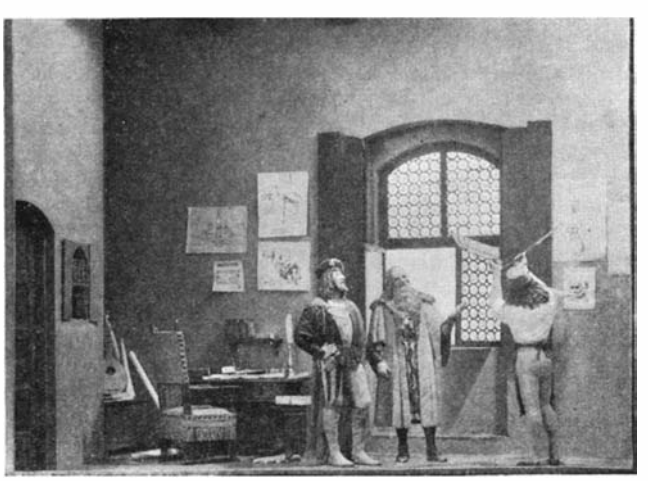


General Howe in process of dressing, while pinioned Nathan Hale looks on

General Howe in miniature is getting his uniform painted on. The artist is working with a Revolutionary coat at the right as an accurate guide

Below: **Making a preliminary study for a group on South Street, New York, in the 1850's. The scene has changed little as regards buildings, but the bowsprits are shorter and fewer in number.** ***Lower right:*** **Leonardo da Vinci, in the center, is showing his conception of a machine that will fly**





SPEAKING OF TELEPATHY—

Our Readers Have Some Interesting Comments to Make in Connection With Our Present Investigation

IN our July issue we sought, by an analysis of the numerous charts that were sent in to us in connection with our first test of telepathy, to show that there is some evidence of telepathic ability in our reader group. This one test could not, of course, be considered sufficient to give the proof necessary for a definite opinion. We are, therefore, carrying our investigation forward and, in addition to the second test which we announced in the June issue, expect to publish the details of further tests in future issues. While awaiting returns from the June test, we believe our readers will be interested in some of the sidelights which have come up in connection with the tests so far. Letters by the hundreds have reached us from all parts of the world commenting on, criticizing, and approving our investigation.

In scanning these letters, one thing is most noticeable and that is the persistence with which many people still connect telepathy with all kinds of cults, metaphysics, the occult, professional clairvoyance, spiritualism, and the like. As we have very clearly pointed out several times, we believe that if telepathy is finally proved it will stand alone as a psychological characteristic of man and cannot be connected with the various kinds of charlatanry one finds on the stage, at street fairs, and at seances.

SOME of these letters are from persons who are obviously paranoiacs —that is, persons who suffer delusions, such as one woman in particular who said that she could never call a thought her own as it immediately became public property. "For instance," she says, "I cannot go to the shop to buy an article but that someone can say aloud the name of my intended purchase without my speaking at all." She seems very much disturbed by what she believes is the domination of her will by that of people around her. This happens to be a common form of paranoia and of course has no possible connection with the study of telepathy. We received one letter from a man in a state hospital for the insane, who said that he had been able for many years to get 100 percent results in his telepathic attempts to discover the thoughts of anyone at any time. Here again we see the workings of delusion.

As might have been expected, there were numbers of letters purporting to show by both specific and general statements that it is a simple matter for sweethearts to communicate with each other though separated by many miles. This brings up the question of the emotional angle which many serious students of telepathy have admitted might be an important factor should telepathy ever be proved to the satisfaction of the average person. One correspondent wrote: "Scientists should realize that only an individual's emotion can be broadcast from one mind to another and emotion cannot be manufactured at will. I believe telepathy can only exist between persons where there is great sympathy and magnetism." It will be noted that this person falls into the common error of mentioning magnetism which is reminiscent of Mesmer's early attempts to explain hypnotism. And while hypnotism is a scientific fact and telepathy has been successful in some cases where the subject has been hypnotized, there are no scientific grounds for believing that man has any "animal magnetism" which will influence others either under hypnosis or while fully conscious.

SEVERAL correspondents bring up the oft-repeated but far from proved argument among those who go in for cults, that the mind sends out vibrations similar to those of a radio station. This theory has been broadcast so positively by those who wish to exploit the gullible that a great many people now believe it. One man writes, "I believe there is in the human body a material that acts as a receiver, something like a radio receiver. There is in the human body a sender of thoughts or impressions both conscious and unconscious." Another man, a doctor, asks: "Is it not true that we are surrounded by a constant stream of radio waves for which the human body is a good conductor and naturally a good receiver? Is it not the same way with thought waves? . . . Now if we get a telepathic message, we may not become aware of it unless it reaches our consciousness; is it not true nevertheless that we may receive messages and not be aware of them because they do not reach our consciousness?" In answer to such questions we can say simply that we do not know, but at the same time it seems that a warning should be given against too-ready belief in such phenomena until scientists have proved or disproved their existence in fact. As hinted above, there are too many charlatans willing to prey upon the gullible in connection with such as yet unfounded beliefs.

A communication from New York City says: "I have never understood why scientists should deny telepathy. I remember the days when they denied hypnotism." In future years this particular linkage of phenomena may have great significance. Hypnotism was denied only until it was proved. Telepathy has been and is still denied by many scientists because they have not seen what they consider to be conclusive proof. As our several articles on telepathy have pointed out, SCIENTIFIC AMERICAN can only hope to add a small measure of proof to that already existing which has convinced some scientists of its existence. Our July report of our first telepathy test showed results which seemed to give evidence of the working of something more than the law of chance. Before the majority of scientists can be convinced, however, a great deal more evidence will have to be adduced.

THIS same writer, after stating that some years ago he became quite an adept at hypnotism, mentions several other experiments which he says he and other young men conducted at parties. One of these may be of interest. "We practiced," he says, "having one person stand in the center of the room with eyes shut, while another concentrated in attempting to make him fall forward, backward, or sideways. At some tests and with some subjects I could almost always make the subject fall in the direction desired . . . At other times I would look at a friend and think of one ear, and will that he should touch the ear. Time after time I would hold that thought and shortly afterward would see my friend's hand wandering to the spot upon which I was concentrating." This experiment whether or not it actually is a "cause and result" phenomenon, savors of the widely known stunt of looking at the back of a person's neck until he turns his head. No one has as yet proved that the turning of the head is the invariable rule for it may be that if a large series of tests were made, utter failure would mark 99 percent of trials while the 1 percent success might be attributed to coincidence. If it could be proved and

ever is proved, this will no doubt be found to consist of "some extraordinary degree of concentration" as this writer comments.

In our first test of telepathy we stated that the percipient should guess the number face up on the die at which the agent was looking. Some criticisms have been sent in to us concerning this use of the word "guess." One serious critic says "If the receiver is to guess the number on the die, will not the tabulation simply express his ability as a guesser without any reference whatever to the fact or power of telepathy? If the percipient has little or no faculty for receiving telepathically, will he necessarily be a poor guesser? If numerous percipients are good guessers will their results be considered as substantiating the claims of the telepathists?"

WE used the word "guess" advisedly since the science of telepathy, if it is a science, is so little known that there is no other word which could reasonably have been used in this connection. There is no way of knowing at this early stage of science's investigation of telepathy just what is the mechanism involved and we have no way of knowing whether that first idea, symbol, or message which pops into the mind of the percipient is a guess or is a true telepathic message. It will be remembered that we did not direct the percipient to juggle in his mind the six numbers which might come up when a die is rolled, but simply to announce the one which seemed to impress itself upon his mind most forcibly. This one number might have been the first that flashed into his mind, as idea-associations are worked out in psychological tests, or it may have been the result of deliberation.

In our report last month one couple was quoted as supplying the three best charts, and the fifth, sixth, seventh, ninth and tenth best. These were all considerably in excess of chance guesses and several of them total over 200 correct calls or "guesses" of the number uppermost on the die. In our opinion it would be as difficult to explain such superior guessing ability as it would be to explain telepathy.

Critics of the study of telepathy may well consider an incident mentioned in the diary of the naturalist, John Muir, appearing in his book "My First Summer in the Sierras." We will not attempt to quote this but will give only an outline of what he says. It seems that one afternoon, high up in the Sierras, Muir was busily sketching and considering the glorious Yosemite landscape. "I was suddenly and without warning possessed with the notion that my friend, Professor J. D. Butler of the State University of Wisconsin, was below me in the valley." As he explains further, he had had no information that Professor Butler was in the Sierras but had simply received a letter from him some time previously in which he said that he might visit California some time that summer. When this thought struck Mr. Muir he immediately jumped up somewhat startled and ran down the western slope of the dome on which he had been sketching and along the brink of the valley wall looking for a way to the bottom. After some time, however, he decided that it would soon be too dark for him to find his way to the hotel so he returned to his own camp determined to go down to see the professor the next morning. His diary for the next day says: "Had a wonderful day. Found Professor Butler as the compass needle finds the pole. So last evening's telepathy, transcendental revelation, or whatever else it may be called was true for, strange to say, he had just entered the valley by way of the Coulterville Trail and was coming up the valley past El Capitan when his presence struck me."

MR. MUIR goes on to say that he considers this to be one of the strangest marvels of his life "of the kind called supernatural, for absorbed in glad nature (as I was), spirit rappings, second sight, ghost stories, etc., have never interested me since boyhood, seeming comparatively useless and infinitely less wonderful than nature's open, harmonious, songful, sunny, everyday beauty."

While having no direct connection with telepathy or any study of it, we believe that one other letter is well worth quoting here due to the writer's high position in the industrial life of the nation. This correspondent is a great financier and also one of the largest industrialists in America, whose family name is well known to all. We quote from his letter:

"Allow me to call your attention to something which may have a marked effect upon your telepathy tests. I am not claiming any discovery, as I read of the matter some years ago, but have been trying some experiments which have had results that surprised me to say the least.

"The experiments I can describe as 'memory' into the future instead of the past. Here is what I have done. Sitting, say in my office, or on a railroad train or somewhere away from home, I picture myself picking up a pack of cards that I know is to be found in a certain place, and cutting the pack at random. In my imagination I turn up the bottom card and look at it and picture whatever my fancy seems to present as the card. This I jot down as 'six of diamonds' or whatever comes into the picture in my imagination as I go over this.

"On coming home that evening I do just what I have done in my imagination and find *the card agrees with what I have jotted down!* This I have done repeatedly. I find that if I put the cards away and do no more until next day, and then try again, I am again right. But if I shuffle and cut repeatedly at one time, I miss not only almost all but *also the first one which I have jotted down.*

"I first discovered this on having the card jotted come fourth or fifth maybe instead of first. But if one card per day is in this way guessed at, I have been right one time in two instead of one time in 52.

"From this I have concluded that we can see in our mind's eye a coming event just as we can see, by memory, a past one.

"In case you can do as I seem to have done (it worked the first time I tried it) you will see that if the subject is about to be told what the thing is he is trying to get by telepathy it may not be by telepathy that he gets his results at all but by this future 'remembering' of being told, after the test, the telepathic message sent.

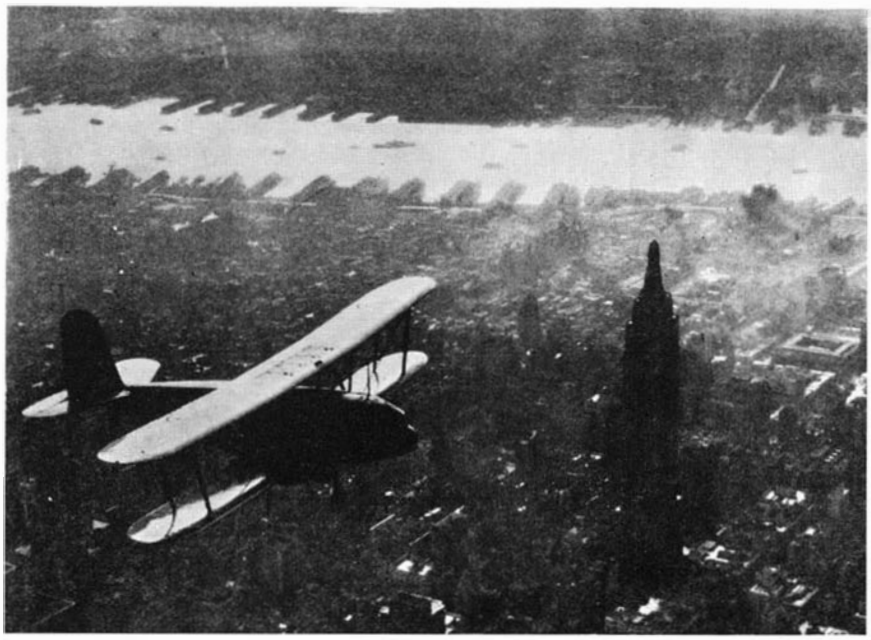
"As I have no theory whatever to explain this strange phenomenon, I will discuss it no further, except to suggest it as a matter for scientific investigation."

It would be difficult to give any reasonable scientific explanation or comment on the phenomenon brought out by this letter; because of the man's stability and level headedness it would not be logical to say that his sub-conscious mind had been playing him tricks. On the other hand, if such is not the case, science might have to admit the possibility of clairvoyance.

THERE were, of course, many letters received suggesting various tests of telepathy which correspondents assured us would definitely and without question settle the problem of telepathy. Most of these were entirely unscientific not only in concept but in method. Others simply outlined tests that have been made by scientists or the basic ideas of tests which we expect to run in future issues.

Perhaps the prize of all letters that have reached us since we began this investigation is that of one man who wrote an intelligent letter with which he sent a test chart showing the result of the test he had conducted. His average of correct guesses was approximately the average due to the operation of chance alone, this, in any case, being very good with only 500 rolls of the die. But this man was *both agent and percipient;* that is, he rolled the die and guessed the number before looking at it. By no interpretation of the rules could this be called anything but guesswork.

FLYING



A 1933 Curtiss Condor transport plane, with cabin insulated against sound, and motors mounted outboard, flying high above the towers of mid-town Manhattan

IT is, of course, trite to point out that the American public is increasingly air-minded. One sees on every hand evidences of the translation of air-mindedness into actual use of the facilities of the air. The air ticket office, the airways bus, the advertising poster that urges the use of the airline in connection with rail travel and bus travel, and proclaims the simplicity of reservation through the services of the telegraph company, all grow more commonplace, more thoroughly a part of the typical American scene. The precise little rows of figures which make up the traffic statistics also tell the story. Not content with being the only means of transport to show gains during 1932, air transport has proceeded, in the first quarter of 1933, to pile new gains upon the old ones. Passenger traffic on the scheduled airlines was up about 18 percent in the period, as compared with the like quarter of last year. Air express showed still larger gains.

The airports of major cities reveal less prosaically this rising tide. At Newark, for example—the busiest airport in all the world, with more traffic per day than Croydon, Le Bourget, and Tempelhof combined—the facilities of the transport lines were taxed to the utmost over the Decoration Day week end, despite bad weather. Every airline operating out of this field, and this means the major units of the domestic system, ran double and triple headers, and many were scouring their shops and terminals for additional equipment.

There is every indication that the air-transport companies are going to prove in this year their contention that, given a reasonable measure of government support, they will be able to meet an orderly and definite annual abatement of that support by replacing the revenue derived from indirect subsidy in the form of airmail contracts with revenue derived from self-originating business. In other words, 1933 seems destined to show that air transport in the United States is definitely on the road to self-support.

Why this betterment of the outlook for air transportation? There are doubtless several factors involved in an answer to this query. Among these, greater speeds, a continuing maintenance of a high safety record, and an intelligent holding down of tariffs to the level, approximately, of railroad fares plus pullman—are important. A factor less frequently stressed, but probably not less important, is that of the growing comfort of air travel.

EACH airplane designer and airline operator has begun to lay new stress on air travel which shall be comfortable as well as fast. Perhaps it would be more correct to say that, having attained a transport cruising speed of from 2½ to 3 miles a minute, each has found it possible to give more attention to the comfort problem which he has realized from the beginning, but put aside to a degree in the struggle for greater performance. Marked success has already rewarded the efforts of the designer and the operator to make it pleasanter to fly. Especially notable instances of this success have marked those cases in which the designer and the operator have co-operated in the production of new planes.

Not long ago I rode high above the towers of Manhattan in one of the new Curtiss Condors which are now carrying capacity loads for Eastern Air Transport down the long coast line to Miami, and for American Airways on its newly forged link from New York to Chicago by way of the city of Buffalo.

Fifteen of us were aloft, besides three in the crew. We swung from Newark over the jagged horseshoe of the bay and up the long spine of Manhattan at 150 miles an hour. It was a day of warm haze, with plenty of thermal currents to bring bumps above the canyons and the thousand-windowed cliffs of the city. But the bumps, somehow, were ironed out in the spread of the great 84-foot wings, and one rode level and at ease. Best of all was the sense of quiet. One could chat easily with his neighbor or the passenger across the aisle in an ordinary conversational tone. and could make himself heard from end to end of the cabin without shouting. It was indeed a different sensation from flight in the winged boiler factories of a few years ago. Engineers aboard who had had a finger in the hushing of this plane explained that audiometers showed the sound level to be that of a Pullman car on a straight piece of track—about 75 decibels. It was not difficult to believe.

A WEEK or two later the first of the new 247's—the twin-engined Boeing monoplanes, sixty of which will thread the far-flung air lanes of United Airlines this year—settled in for inspection at Newark. Here also was a hushed airplane, meticulously sound-proofed, and with strong stress on passenger comfort. Wide, deep seats gave plenty of leg room, and one could tilt them to the desired angle with as little effort and in much the same manner as one adjusts the driving seat of his automobile; a little less effort, perhaps.

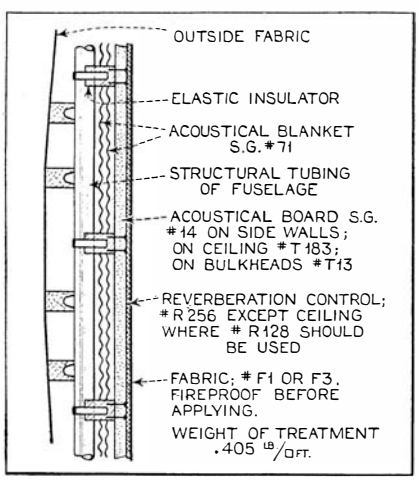
Both these planes are the fruit of thoroughgoing design, aimed not merely at efficient performance, but at the elimination of vibration and noise, and the incorporation of features to accentuate stability.

In this connection both make use of the so-called tabs, or servo devices in connection with the control surfaces. In the trailing edge of aileron, stabilizer, and rudder are inset small moveable sections. When the plane is in flight and these devices are subject to the air stream, the pilot need only to move them, and they in turn move the larger surfaces of which they are a part. The effect is to dampen out the variations in both lateral and longitudinal control, and to make the responses of the plane in the air quicker but less violent. Should the passengers in an old-time transport decide for some reason to crowd up toward the front of the cabin

IN COMFORT

By REGINALD M. CLEVELAND

in flight, the pilot or his co-pilot would have to do some active winding on his crank overhead to correct the nose heaviness, and when they moved backward again, the plane would be tail heavy and the operation would have to be reversed. With the tab on the new Boeing, however, just a touch of a little control in the cockpit trims the ship, and the ridiculously small looking little



Cross-section drawing of the outer "skin" and of typical sound-proofing treatment used on a modern transport. Each sound-proofing installation is a separate problem in itself. Although the fundamental principles are well known, there is no "royal road" to the production of a sound-proofed fuselage

tab moves the whole massive stabilizer unit.

The sound-proofing so successfully demonstrated in the newer planes will doubtless be carried still further. Noise, like vibration, is believed by those who have given close attention to the subject, to play an important part in bringing about air sickness. Aside from the undesirability of the din in an unsilenced ship, it is important therefore to reduce the sound level. This is accomplished by a combination of design and structural factors. Stephen Zandt, an engineer of the Sperry Gyroscope Company, who had much to do with the silencing of the Condors, explains the problem in this way.

"Noise itself must be abated as far as possible, then it must be kept out of the cabin to as great an extent as possible. Finally, that which gets into the cabin must be prevented from reverberating and building up."

In the case of this particular plane, the low decibel count was achieved by reducing the propeller tip noise—one of the most important factors among the sounds of flight—through the use of slower moving, geared propellers. Then the engine exhaust from the two motors —which, themselves, were located with respect to the fuselage from a point of view of sound reduction as well as of aerodynamic efficiency—was carefully muffled and led to the optimum position beneath the wing.

To prevent the entry of noise into the fuselage, the cabin wall consists, first, of the outer duralumin skin, then an air space, then a layer of cellular, felt-like material, applied in corrugated fashion—which was found to be important—then the inner skin, and finally a heavy felted lining material. Also the intake elements of the ventilating system were themselves soundproofed, and the exhaust elements of this system as well, for it was found that to neglect any source of outside sound was to destroy much of the value of the whole effort.

The dampening of reverberation of such noise as could not be eliminated was accomplished by the use of heavy textiles as decoration, the elimination of all hard-surfaced materials for finish, such as leather and plywood, and, oddly enough, by the passengers themselves. They make excellent noise dampeners, it was found.

In the new Boeings, similar careful study of the construction of fuselage walls, with air space and interlining devices, have been utilized. Here too the wall and ceiling finish and the seat upholstery is of heavy, sound deadening fabric.

Analogous careful attention to the detail of noise elimination may be expected in the new Douglas, Northrop, and General Aviation planes soon to be in use by Transcontinental and Western Air, and the Vultee ship being constructed for the lines of American Airways.

The 1933 crop of planes which will carry America's air passengers between the Atlantic and the Pacific, and from Canada to the Gulf at a pace which only a few years ago would have seemed the stuff that dreams are made of, will not only be relatively quiet, and relatively vibrationless, but they will have a lot of little creature comforts to make smooth the road of the air traveler.

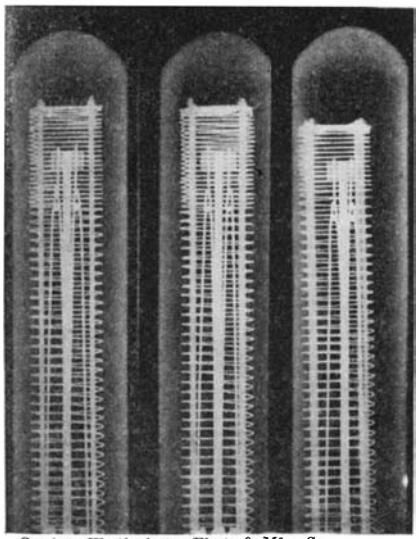
Folding tables are better designed than they used to be, and tables are important because so many people write letters nowadays while flying. You can write much more easily on a modern plane, unless conditions are peculiarly bumpy, than on a railroad train. Individual reading lights are so designed as not only to be ornamental but to keep the glare out of your neighbor's eye should he want to go to sleep. These things are trifling, perhaps, in themselves, but they are important in their larger significance, for they show that the airline operator and the airplane builder are carefully analyzing the wishes of their customers, the flying public.

"WHAT do your passengers do while flying?" I asked the other day of Miss Ida Novelli, senior stewardess for United, who has flown more than 400,000 miles in her 3200 hours in the air.

"They look out a little at points of special scenic beauty," she said, smilingly. "You know my run is between San Francisco and Cheyenne, over the high country; but mostly they read and write, or sleep. Seventy percent of them sleep on the night run."

It's pretty comfortable to fly now, and rapidly becoming more so as the transportation companies learn from experience more and more about comfort.

In the cabin of a Condor, showing the sound-absorbing fabric on the walls and ceiling



Courtesy Westinghouse Elect. & Mfg. Co.

Radiograph of radio transmission tubes to determine spacing between filament and outside metallic sheath

PHOTOGRAPHY WORKS

WHEN Captain Albert W. Stevens of the Army Air Corps photographed Mount Shasta from half way down the state of California—and got it—his lens was 331.2 miles away from his subject.

When, every day many times over, photomicrographers photograph the structure of metals or the condition of textile fibers or the habits of the bourgeois bacterium, the lens is only a fraction of an inch away.

From a fraction of an inch to 331.2 miles delimits the present scope of terrestrial photography. Within that range the camera does an astonishing array of jobs useful to civilization.

The camera as an instrument of pleasure has held attention during the world's busiest 40 years. So quickly does the modern American or Englishman or German think of hobbies and holidays when photography flashes across his mind that he is unlikely to give even an afterthought to photography as the eye of science, photography to keep the wheels of industry turning. Yet photography came into existence principally because there was work to be done and inventive men were in quest of better and less laborious methods of doing it.

Daguerre was a scene painter, a celebrated one. Like many other artists of his day he used a "camera obscura"—a camera that could form a picture before anyone knew how to record pictures photographically—for sketching purposes. He sketched over the lines thrown by the lens on his paper and thus had a picture. But Daguerre was not content to sketch by hand. He wanted a means of recording the scene photographically as it fell on the white surface—and he found it.

DAGUERRE'S partner in photographic discovery, Joseph Nicéphore Niepce, likewise had a practical purpose. He wanted to find a method of automatically copying designs upon lithographic stone.

In other words, photography's inception was in the practical realm. Pleasure followed. Throughout the many years that photography has been supreme as an art of pleasure, its usefulness still dominated the thoughts of many men who worked quietly by themselves. During the Franco-Prussian War, for example, it was grim necessity that dictated the expedient of reducing a message photographically to a tiny pellet that would be unnoticed if the carrier pigeon which bore it were captured.

The industrial 20th Century leaves few possibilities unturned. Photography helps to devise products, photography helps to make products, photography helps to sell products, and photography appears in unexpected places throughout the whole economic and scientific structure.

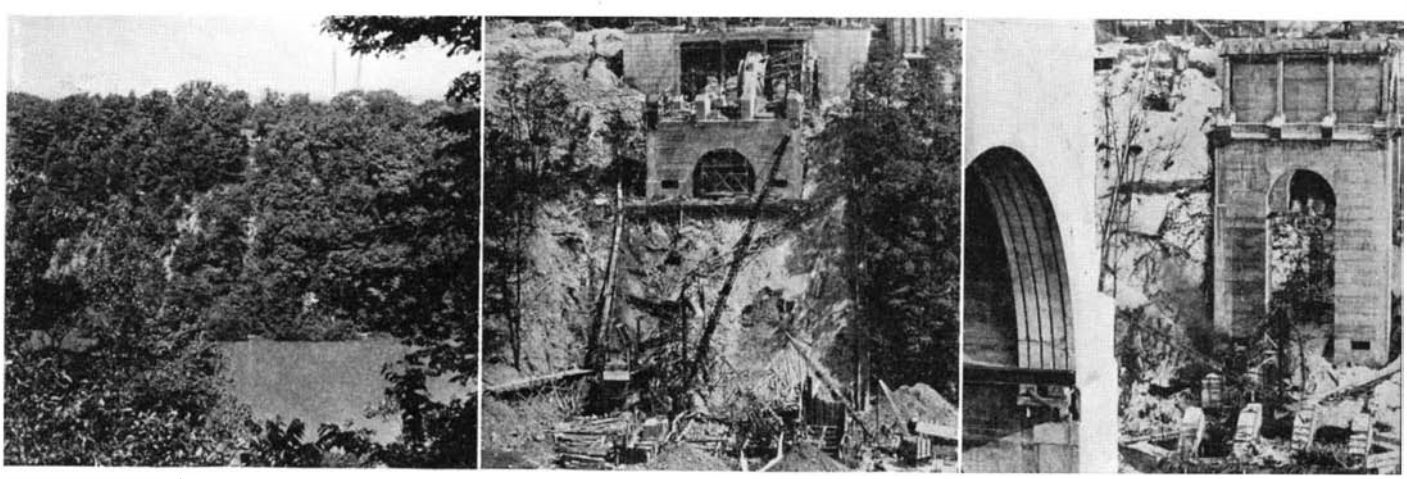
An end to generalization. . . . Let's examine some cases. We can not possibly survey even a fraction of the work that photography does in this industrial age, but we can see some interesting things. What is the favorite topic of economic conversation these days? Taxes? That doesn't seem to have anything to do with photography, but let's see.

Photography is impartial. Big taxpayer, little taxpayer; it's all the same to the camera. A number of towns and small cities have taken that cue and have had tax maps made from the air by photography. With what results? A tax map of a New England manufacturing town, made by photography from an airplane, revealed 1896 buildings, lots, improved pieces of land, and similar taxable properties that had not appeared at all on any previous tax map. Forty-nine of these untaxed properties were on the main street. The camera said so and the fact was incontestable.

IN consequence, the assessment roll of this town of 16,000 population jumped from about 20,000,000 dollars to a figure beyond 30,000,000 dollars, the tax rate was reduced 20 percent, and yet taxes collected were 60,000 dollars higher than before. The tax map made by an aerial camera cost the town 162 dollars a square mile and required two months in the making. A neighboring town's tax map had, at the end of four years' work on the ground, cost 3692 dollars a square mile.

"Certain as death and taxes." Well, photography seems to make taxes more certain, but more equitable.

Aerial photography's great future is in rapid process of becoming a very important present. Photographic mosaic maps are proving essential for city planning and zoning, for traffic control



Photography records permanently the step by step progress of construction on the Veterans' Memorial Bridge, Rochester

OR INDUSTRY

By FRANKLIN COURTNEY ELLIS
Eastman Kodak Company

planning, for routing highways, for exploiting real-estate developments, for geological exploration. Sometimes it is necessary to photograph from the air to understand things right in our midst. Such a case is the aerial photography of cotton fields to indicate definitely the areas infected with root-rot. Fields of cotton infected with this blight appear on a photographic print like a pock-marked face, so clearly do the infected areas show from the air.

AS prosperity gets under way again, construction picks up. Construction methods are becoming increasingly scientific. Already many projects have been built under the eye of a camera so that men concerned in the project, but too far away to examine the progress of construction, may be at no disadvantage. With a constant photographic check-up of construction progress, the president of the construction company may follow the work of his job superintendent a thousand miles away and may intelligently criticize work he has never seen.

Consider, moreover, the contractor's need—in case of excavation and construction in a city—to have proof that his work did no damage to adjacent buildings. Cases are on record of suits successfully defended by photographs showing the contractor's precautions to protect adjoining buildings.

If the project should be a dam or a paper mill or development of a mine property, far from urban civilization, the owner or the contractor in this modern day has an aerial photograph of the site made before any work begins. Surveying from the air is easier and more effective in such cases than surveying from the ground.

Suppose the business that we are getting down to, now that "things are looking brighter," is a metal foundry. The next decade will not be gentle with manufacturers whose products are substandard. Time was when gas cavities or sand and slag inclusions or other defects in metal castings didn't greatly matter, because enough extra metal, beyond the requirements of the job, could be included to compensate for loss of strength through flaws. But modern designs prohibit large excesses of metals. Reliance on such a safety factor is no longer permissible. There must simply be no flaws; and there photography comes in—through the X ray, which is merely photography *through*, instead of photography *of*.

It is usual foundry practice to make pilot castings of new parts. Ordinarily the examination of these preliminary castings is made by cutting them apart; but an X-ray photograph—a "radiograph"—can probe inside a casting as well as a saw can. If the casting is perfect, it is saved for use, since only radiation has gone through it and not a saw. If the casting is imperfect, the X-ray picture will probably reveal defects that the saw cuts would have missed.

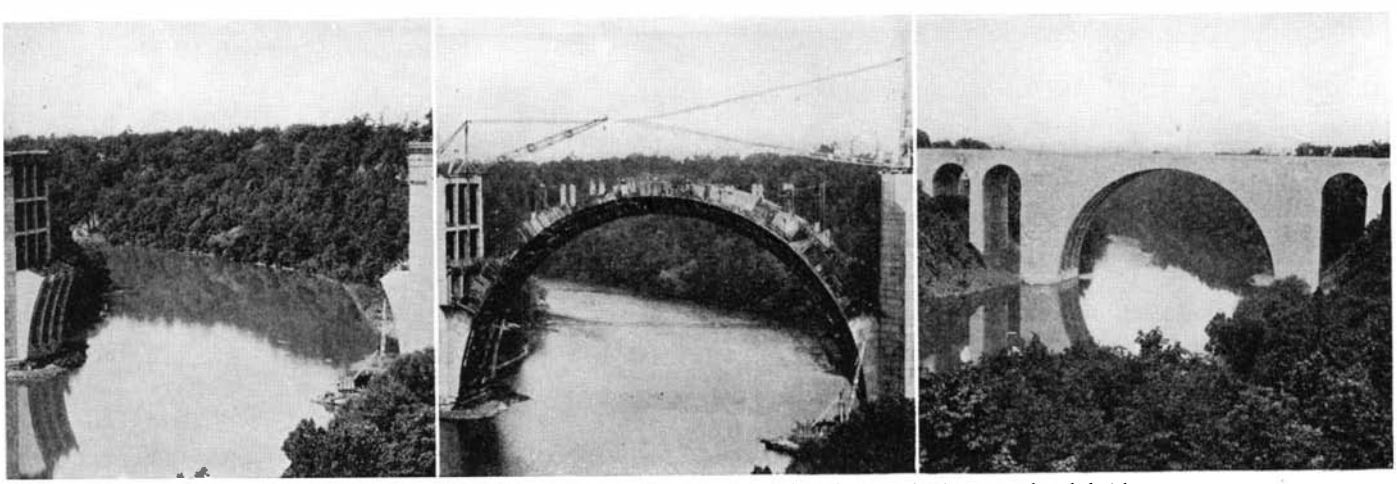
Assured freedom of castings from flaws obviously makes possible the design of lighter castings with safety. The X ray is generally adequate for the job, because it can successfully penetrate four inches of steel under routine operating conditions. Brass to a thickness of three inches, aluminum to a thickness of seven or eight inches, and wood more than a foot thick can thus be examined.

Courtesy the Recordak Corporation

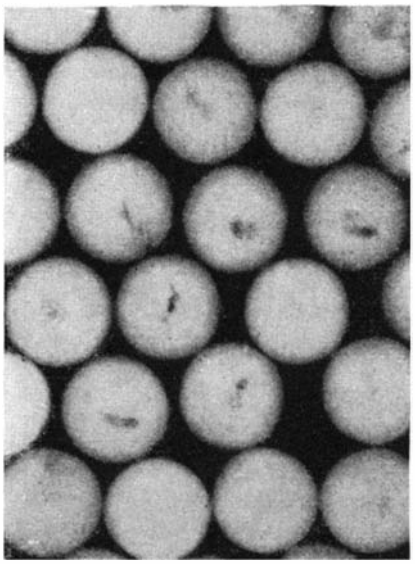
A bookkeeping machine with which checks are photographed for records

A LIST of industrial products that have been submitted to X-ray examination would easily crowd everything else off this page. Not only castings, but also such finished and semi-finished products would appear on the list as airplane parts that might fail in the air, Carborundum wheels that might fly apart if there were defects, golf balls that might have their cores off-center, switchboard panel slate that might contain metallic veins, oysters that might contain pearls—these and many other uses may be found, in addition to the time-honored medical applications of Roentgen rays.

The X ray, junior partner of photography in industry, has had important recognition recently. The American Society of Mechanical Engineers amended its boiler code to permit the use of welded boilers for the generation of steam—provided the welded joints of boilers up to three inches in thickness



[ew York. Six of the many pictures made, beginning with one of the site and ending with the completed bridge



are X rayed. Specifications for the Boulder Dam—the second outstanding recent recognition—called for X-ray examination of 75 miles of steel welds—a job that required at least 159.000 separate X-ray exposures.

Photomicrography, for the fine examination of metals and of many other industrial materials in which the condition of microscopic particles is important, has become routine in the process of turning out better materials.

IT IS nothing, once the photographic experimenter has accomplished it, to produce by photography a diagram of what happens inside the cylinder of a motor when combustion is smooth, when the engine knocks, or when preignition occurs. That is nothing—at least from the viewpoint of public amazement—beside the fact that waves of air have actually been photographed by the Bureau of Mines in the study of mine explosions.

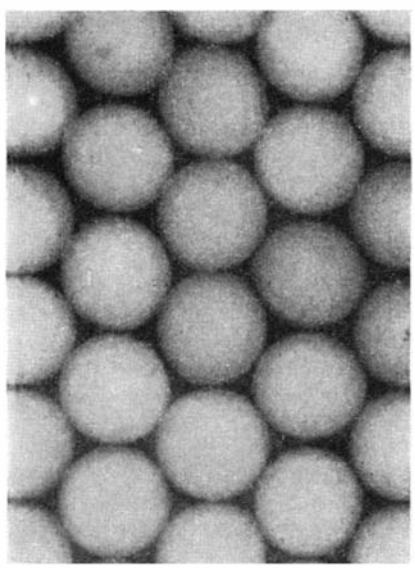
Photographic registering instruments have been put to a very large number of uses that increase the knowledge of conditions under which industrial products must operate. A device used in the Langley Memorial Laboratory at Hampton, Virginia, to record the air pressure exerted on different parts of airplane wings during flight may be cited as one other example. This result is accomplished when holes drilled at various points are connected by rubber tubes with a thin metal diaphragm which bulges in proportion to the pressure exerted. Changes in the pressures are recorded on a moving film by light reflected from mirrors on the diaphragm.

Photography is important to product research in recording occurrences lasting too short a time to be seen. Obviously the ability to examine at leisure the picture of a phenomenon that would otherwise not be observed has been influential in producing products for an exacting age by absolute knowledge rather than by guesswork.

What happens—exactly what—when blasting gelatine explodes? Does the subject of a Photoflash picture wink before the picture has been taken? How does metal flow into a weld from a welding rod? Knowledge of the answers to these questions and to a host of other technical quandaries has been supplied by photography.

A manufacturer of welding rods wished to observe how the flow of metal

Proving that a new manufacturing process gave improved ball bearings. Radiographs of finished balls "before and after" showing defects (dark spots) in the former



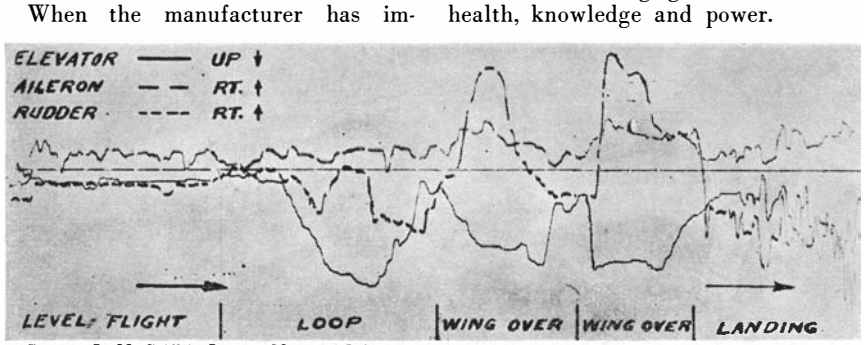
was related to different flux coatings of welding rods. Because of the extreme glare at the point of welding, rather than the speed of the flow, the phenomenon could not be studied effectively, but photography turned the trick again. The welding arc gave out so much more visible light than the flowing metal as to be blinding; but of invisible infra-red radiation the flowing metal gave out, relative to the arc, much more than it gave out of rays visible to the eye. In the medium of infra-red rays, therefore, the difference of intensity on the film was reduced to the point where both could be photographed on the same terms.

When the manufacturer has improved his product the next problem is to sell it. Photography's assistance in that problem is obvious. Advertising photography has reached a high point of development. No longer only the bare product, but even the qualities of the product, the spirit of the organization behind the product, can be put into advertising by 1933's technique of the photographic artists. Salesmen's catalogs are no longer dull tomes. The photography in them puts an actual locomotive or an actual steam shovel, with all the structural details, on the purchasing agent's desk.

When sales are coming in nicely, or before, the business man must look to the smooth functioning of his organization. Again the art by which Daguerre's followers made stilted portraits of our quaint forebears comes to his aid. He finds that his specifications are clearer if photographs supplement or supplant written descriptions. He finds difficulty in instructing his dealers in servicing the product until he sends them a manual photographically illustrated. He finds that his employees have fewer accidents when he posts pictures of accidents that have happened through carelessness. One photographic machine helps him in his bookkeeping, and saves him money besides, by photographically recording outgoing bills and incoming checks. Another machine photographically copies documents or plans that would otherwise occupy his stenographers or his draftsmen for days.

IF his office suffers from a fire, and valuable documents are charred, he may recover their context by putting the burned remains of each in contact with a "fast" photographic film and letting the emanations from the paper fog the film, in the absence of light, until a reproduction of the original document has appeared.

Silver nitrate is believed to have been discovered by medieval alchemists who were trying to transmute baser metals into gold. Those mystic experimenters failed to produce their gold, but they found the substance which later made photography possible. In photography an industrial age has found the missing gold: wealth and health, knowledge and power.



Courtesy L. M. Griffith, Langley Memorial Laboratory

Useful for pilot instruction: Photographic light tracing showing angular positions of parts of an airplane during level flight, acrobatics, and landing

AMERICAN-JAPANESE RELATIONS

By T. S. MIYAKAWA

IN line with our policy of giving an opportunity to the "other side" to present its case in answer to controversial articles which we publish, we asked Mr. Miyakawa, an American-born and American-educated citizen of Japanese parentage, to give some justification for the maritime and territorial plans for Japanese conquest and for Japan's refusal to be guided by the world's moral condemnation of her Manchurian policies, which points were mentioned in our May article on Japan and our Navy. The accompanying article is the result. Publication of it does not necessarily mean that we subscribe to the arguments therein. It is for our readers to consider well both sides and draw their own conclusions.—*The Editor.*

THE American people bear no malice toward the Japanese; the people of Japan want American friendship. The United States desires policies which will lead to security and peace, not to dangers and conflicts. Consequently, this article will consider briefly a few of the factors involved in American relations with Japan, some of which were raised in the May SCIENTIFIC AMERICAN.

At the outset, all of us must realize that Japan has great grievances born of stark realities. Hence, a frank understanding is needed. Let us, therefore, consider first the historical facts. As many know, against wholesale attacks by European powers in the 16th Century, Japan had no alternative save isolation to preserve her national entity. But, as the Western nations seized or gained more and more territories in the Orient, Japan was forced, in 1854, to resume her relations with the outside world. Sensationalists in this country may write about the "yellow peril," but even a casual inspection of the map will reveal the contrary. In the Orient Britain has many colonies, protectorates, and "spheres of influence," among them India, Burma, Malay States, and Hongkong; France has Cochin-China, Annam, Tonkin (French Indo-China), and Kwangchow-wan; Holland holds the East Indies; the United States the Philippines; Portugal has Macao; the vast Amur and Maritime Provinces of Siberia were once under nominal jurisdiction of the Manchus. No Asiatic country holds colonies in the Western world. Perhaps, when the Oriental sensationalists declare that, while "yellow peril" is a mere theory, "white disaster" is a reality, they have a more realistic basis than their co-publicists here.

Not even Japan escaped. When her doors were reopened, America and Europe did not grant her equality but placed stringent restrictions upon her sovereignty, such as extra-territoriality and foreign control of tariff. In spite of the solemn promises for an early revision, not until 1912 was the last restriction upon her sovereignty removed.

IN the meanwhile, Japan had come through the Sino-Japanese War of 1894 with the southern portion of Manchuria in full sovereign control. Thereupon France, Germany, and Russia forced her out. "The preservation of the integrity of China" was the reason given by these nations who immediately proceeded to partition China. France gained coveted concessions in the south where she had already annexed Cochin-China; Germany followed with Shantung; and Imperial Russia, not content with having taken the vast Maritime and Amur Provinces a few years before, now practically annexed all of Manchuria. England herself occupied Wei-hai-wei.

Both Dr. E. J. Dillon, who was the confidential adviser to the Russian Foreign Ministry, and Count Witte, the Foreign and Prime Minister for Russia, years later agreed that the full implication of the Muscovite plans meant not only the exclusive control of Manchuria but also of Korea and the virtual reduction of Japan to a vassal status.

Both of these statesmen frankly say that these plans were actually aided by certain Chinese politicians, such as Viceroy Li, in the Manchu Government, who had practically given Manchuria to Russia in return for a Chino-Russian military alliance against Japan. This diabolical plot, aimed at the annihilation of Japan, now known as the Li-Lobanov Treaty of 1896, was never revealed in full until the Washington Conference of 1922!

So complete was the Russian "conquest" of Manchuria that by 1901, even at the Treaty Port of Newchwang in the southern part, the Russian Comptroller declared that "this port now has reverted to the control of the Imperial Russian Government." Port Arthur was fortified; strategic railways were completed; the "open door" was sealed.

Fearful of this encroachment, Britain and Japan formed an alliance. Japan, says Professor Gowen, made every effort to settle the problem with Russia peacefully. He concludes that the tragic Russo-Japanese War of 1904-05 was born of the unbridled imperialism of Russia.

Much to her own surprise, Japan won that war, but the victory was almost a disaster. The poverty-stricken empire could ill afford the 120,000 dead or the billions of gold yen in expenditures. Russia refused to pay indemnity, but finally, as a partial compensation, she transferred to Japan her rights in south Manchuria, which, as Professor Clyde says, she had stolen from Japan a decade before. These concessions are the bases of the present huge Japanese holdings in Manchuria. Capital, science, and initiative by Japan built great railway systems, cities, and factories; developed mines; and fostered agriculture, attracting a horde of Chinese immigrants. It is not to be wondered that to Japan Manchuria has political, economic, strategic, and emotional importance.

It is also well to consider the words of Dr. J. V. A. MacMurray, a former American Minister to China, when he says: "On the whole, moreover, I think this development of the Japanese interests (in Manchuria) was carried out without deliberate unfairness to the interest of others."

THE permanent bases of Japanese foreign policy, says Viscount Ishii, are two: The search for equality and the search for security. The desire for equality can be understood only in the light of the years of restriction upon the Japanese sovereignty and the discriminatory legislation against her; the search for security only in the light of her near fatal experience with Imperial Russia and her difficult economic position. The prime aim of Japan at Versailles was to have the principles of racial equality recognized in the League Covenants. While Japan had the support of a large majority, America ruled that this required unanimous consent—even though other clauses had been accepted with only a majority—and was one of the minority to vote against the question.

In spite of this, liberalism triumphed in post World-War Japan. The provisions of the Washington Conference were accepted although they seemed to in-

(*Please turn to page* 91)

THE NORDIC— SUPERIOR OR INFERIOR?

By W. P. HARTMAN

AROUND this question discussion has raged for generations. Many books and treatises have been written on both sides of it.

Most of those who do not accept Nordic superiority point to the great civilizations that developed on the shores of the Mediterranean Sea, in Persia and in India during pre-historic and early historic times, and class these as the exclusive copyrighted product of non-Nordic peoples. They assert that, even long after those times, the Nordic was a savage with burrs in his hair.

These critics go astray, in that they classify peoples under racial heads; also by mixing names, as applied to races. Anthropologists agree that there are three distinct branches of the so-called "white" race. These peoples at one time occupied Europe, western Asia and northern Africa, but most of them have become intermingled with other peoples, so that only a few of the pure type remain.

These branches are the Nordic or Aryan, having long, high heads, tall bodies, blue or gray eyes and light-colored hair; the Alpine branch with round heads and brown hair and eyes; and the Mediterranean branch with long, low heads, short slender bodies, black hair, brown or black eyes, and dark or brunette skin.

So far so good, but this is the point where the argument begins.

Before beginning, however, brief reference will be made to the modern Nordic—since the modern Nordic, in the opinion of his critics, is the only one worth considering from the standpoint of racial accomplishment, because, as is asserted, all of his ancestors were savages with burrs in their hair until a comparatively recent date.

WHAT the modern Nordic race and the mixed Nordic have accomplished is too well known to need any mention here. The critics of the Nordic point out, however, that his history is very brief when compared with that of other races, and that his civilization was derived largely from that of the Roman, Greek, and Egyptian peoples. It is true that the Egyptian, Phoenician, and most of the Babylonian civilizations must be credited to the Mediterranean race, but when they try to rob the Nordic of credit for the Greek, Roman, Persian, and Indian or Hindu civilizations it is time to begin to argue.

Even the modern Nordic who has accomplished so much is the descendant of the stay-at-homes (weaklings) of his race who lacked the necessary vigor, initiative, and daring to push out into new lands and find new homes, but were content to remain behind and sit by the fire while their more hardy brothers and sisters (for be it remembered that the women of his race were fit companions to this restless blond giant and trod the long trails with him) pushed out into the Italian Peninsula, into Greece and Asia Minor, into Persia, into India and, if legendary history may be relied upon, into China, Japan, and the islands of the South Seas where they took what they found and built up great civilizations that flourished until the Nordic blood was practically obliterated by wars or absorbed by intermixture with other races.

In later times other generations of adventurous men, springing from those who remained on the shores of the Baltic and North seas, invaded the earth and built the fabric of modern civilization.

THE recent attitude of the German Nazi party toward non-Germans in Germany has aroused fresh discussion of the question of Nordic superiority, always a provocative issue. Some, it would appear, have jumped to the conclusion that the two questions—Nordic and Nazi—are closely linked if not identical, and that the Nazis are trying to establish a Nordic Germany. On the contrary, not all of the Germans are Nordics, the south Germans, including Herr Hitler, being of Alpine stock; and certainly not all of the Nordics are Germans. Therefore the reader must not conclude that the accompanying article implies approval of the present racial policies of the Nazi party, for many regard these as a kind of aberration, temporary it is hoped, of a portion of an otherwise great people. Nor must the reader conclude that its publication implies approval of the well-known Nordic formula in its more extreme forms. It is thought, however, that many, in a sincere effort not to appear narrow and race-conscious and bigoted, have perhaps leaned backward with regard to the Nordic question. The Nordics have truly been a great race.—*The Editor.*

Now, it is asked, if the progeny of those weaklings could do what has been done by the modern Nordic, what *might* have been done by the children of that dominant strain which wasted itself among the sands of numerically superior races?

Where this race of yellow-haired giants came from originally, or from what they sprang, no man knows and very likely ever will know. But it is certain that, ages before the dawn of history, their ancestors lived as a single unit in central or northern Europe and spoke a common language that differed radically from the language of any other racial unit.

ABOUT 2500 B.C. these peoples began looking for homes in more congenial climes and a horde of them pressed through the difficult mountain passes into India, where they became conquerors and rulers of a dark-skinned race. They built up, for its time, a splendid civilization and left an imprint upon the country that is still plainly visible even though little trace of their blood remains. They came among superior numbers and the natural result was that the dark race absorbed them in the course of time, though their language and a truly great literature remain as monuments to commemorate them.

Other swarms from the same hive came into Greece and Asia Minor, where they found a brunette people who possessed the beginnings of culture. Here again they became the ruling class and developed a culture and civilization that was remarkable even when compared with modern civilizations.

But the ancient Greek felt that he must fight, and when no other fight offered he must indulge in fratricidal wars. These depleted his numbers, so that the resurging tide of Mediterranean blood swept over him with unhappy results. (The modern Greek is almost wholly Mediterranean. He is inordinately proud of a history that was written by the yellow- and red-haired Nordic geniuses from whom he claims descent.)

Other Nordic clans came over the Asiatic steppes into the fertile valleys of Persia. They soon surged over the

tottering civilizations of Babylon, Nineveh, Phoenicia, and Egypt, and halted only when they collided with their own kinsmen in Greece. They set up a mighty empire that dominated Asia and northern Africa as long as the Nordic strain was in the ascendency. It declined and crashed with the submergence of the Nordic by other stocks.

Again, in what is now Italy, we see the same story written — the preponderant superiority of the Nordic. Nordic tribes settled there in pre-historic times—the Sabines, the Etruscans, the Latins, the Gauls and others. Native Mediterranean stock remained among them and these made up the plebeian class. These, with the patricians, who were the Nordics, and the slaves, comprised the population.

Rome grew and prospered as long as she was Nordic but, because of the killing of Nordics in external and internal wars, cross-breeding with other races, the increase in numbers of the native Mediterranean stock and its influx from without, she began to decline and eventually she fell, never again to rise in her ancient glory. With her fall a new tide of Nordic blood from the north was injected into her veins. This brought a temporary revival—the Renaissance.

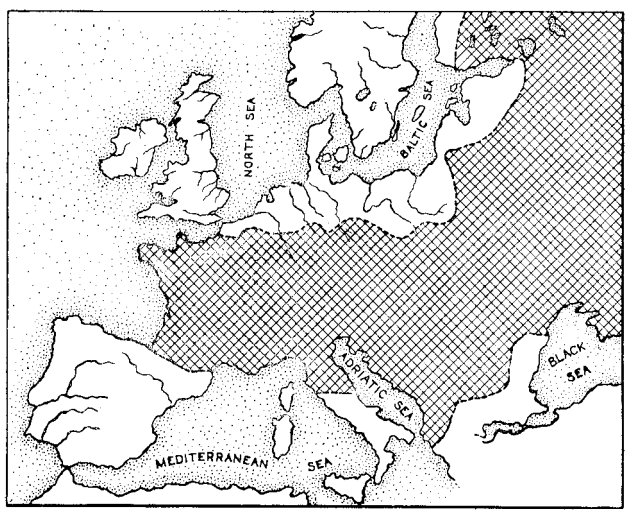
Spain had a Nordic invasion, that of the Visigoths, which made her great. But she too traveled the same road after a few centuries.

The Gauls who settled in France were blond Nordics among native brunettes in greater numbers. Other Nordics came in during Roman rule. The Franks, who were pure Nordics, came in at the fall of Roman power. There were other additions from time to time—for example the Burgundians—and the French people are still perhaps preponderantly Nordic, even though they are largely Mediterranean in appearance. They rightfully belong in the Nordic family of nations.

THE American Indian had occupied what is now the United States for unknown ages and was still a savage when the fair-skinned Nordic arrived; and similarly the black in Australia. Look at those portions of the earth today! Nordics hewed them out of the wilderness.

One notable trait which has been present among all predominantly Nordic peoples is the treatment of women. They have always been on a plane far above that of the fair sex of any other race. Again, the love of liberty is exclusively Nordic. Self government has never been known by any other race in the history of the world. The Nordic will not tamely submit to restraint, either mental or physical. He believes that the course of his destiny runs onward and upward and that only complete freedom will achieve its perfect fruition.

The Nordic has always been a virile and adventurous specimen of the human family. While he may not be superior in general intelligence to other races, he undoubtedly has traits not possessed by other peoples. His far-seeing eyes have always been trained upon the future and on obstacles to be overcome, rather than on the past and the tombs of his ancestors. He built few notable tombs and monuments to the past. His building has been for today and tomorrow.



Approximate extent of the three races of Europe—the Nordic (white, at top), Alpine (checkered, in center) and Mediterranean (white, bottom). These divisions are based on physical characteristics and are much older and more basic than the accidental political groupings

With a few exceptions which will be noted, he unquestionably developed the great civilizations that are known to history. The Mediterranean peoples developed that of Egypt, and this reached a certain point. But it could go no farther, and finally slipped into oblivion. Babylon did the same. What remains of either today? Their powers had a definite limit which they could not surpass.

The Chinese went "just so far," yet could go no farther until the Nordic came to teach him. He lacked the fighting instinct. To protect his home and his over-rated civilization from his enemies he designed and built the great wall to *fence* them out, instead of inventing means to *drive* them out as the Nordic would have done.

Mention often is made of the fine civilization developed in early times by the American Indian in Yucatan and Central America—that of Mayas. Here, again, we find a limit that these races could not pass. They slid back into obscurity, leaving naught but crumbling ruins as mute testimony of their vanished greatness. The Mayas have been back in rude savagery for several centuries and can tell us nothing of their past. We are actually trying to learn their past by studying what their ancestors left behind. They have long gone about among those ruins but have had no curiosity concerning them, or any desire to learn.

The Aztec built up a civilization of a sort in Mexico but when the Spanish came it apparently had run its course and would surely have sunk into oblivion, aided and abetted by revolting practices grafted upon the extant religion by a stupid and bloodthirsty priesthood.

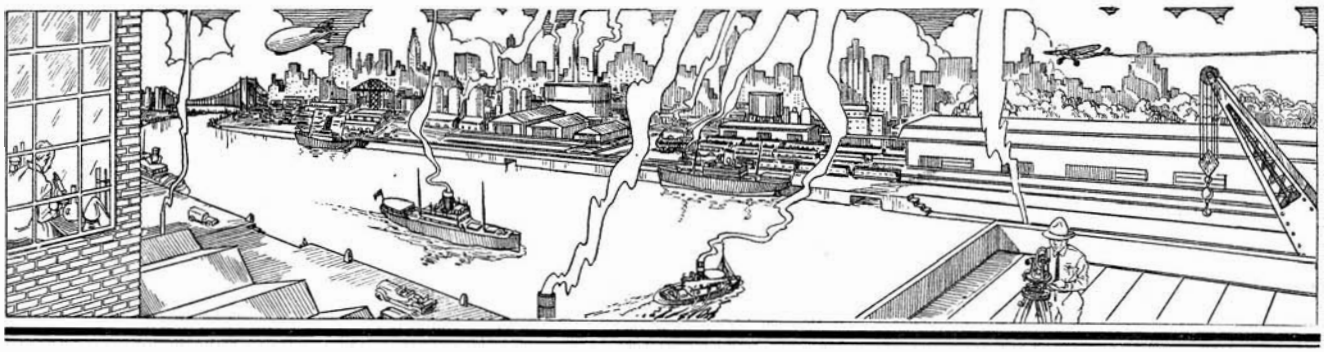
MYSTICISM and meditation upon the past have never had a place in the practical Nordic mentality. Whether those things make for happiness is an open question, but they assuredly are a barrier to progress.

Historians — Bancroft among them—claim that the reason civilization developed first in warm climes is merely that living conditions were easy, thus affording leisure for development. The Nordic in his cold and sterile home-land experienced a bitter struggle to keep alive, while the Egyptian basked in a sunny clime and had an abundance of leisure.

But the blond giant did have an inborn trait which set him apart from other races: he was not content with conditions as he found them. Wave after wave of him spread over the face of the earth, where he found spots to his liking. Promptly he shed his savagery and improved upon everything that he found about him. In every instance he kept right on advancing as long as the Nordic blood remained intact. The Eskimo in hard conditions, and the Negro of Africa in easy ones, did not advance.

The case is plain. Let the critics of the Nordic-with-burrs-in-his-hair peruse the pages of history and get the facts properly assembled—remembering that the Greeks, Romans and a few others were at the time of their greatness true Nordics—and then draw their conclusions from the premises. Some Nordic may at a comparatively late date, historically speaking, have had burrs in his hair, but I submit that he *did* get them out.

The pity is that this great race, through its own folly in indulging in internecine wars and in cross-breeding, is in imminent danger of going the way of its ancient kinsmen.



THE SCIENTIFIC AMERICAN DIGEST

Conducted by F. D. McHUGH

Contributing Editors

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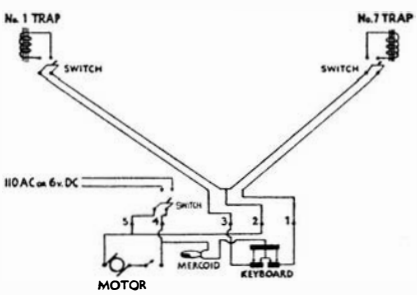
Variable Timer for Skeet

SKEET shooting differs from the old style of trap shooting in that it simulates closely the natural conditions of game bird shooting and allows the sportsman to use his field gun instead of the single barreled trap gun which was developed especially for regular clay-target shooting. In skeet, two trap houses are used facing each other and the firing positions are located in a semi-circle with the exception of No. 8 position which is located at a point exactly between the two trap houses. Furthermore, in skeet shooting the shooter



Circuit diagram of the Joy Ranch Variable Timer for skeet traps

not only has singles but also doubles to fire at during each round of 25.

It was found, as skeet shooting developed, that many of the enthusiasts began to expect the targets to leave the trap houses immediately upon calling "pull" and that some, through inadvertence, would put their guns to their shoulders the moment they called for a target, anticipating immediate flight. To prevent the sport from becoming too mechanical and to compel the enforcement of the rule that the gun of the shooter must show below his elbow up to the time a target leaves the trap house, there have been endeavors to develop some invention whereby the targets would be released from the trap houses automatically any time within a period of three seconds after the shooter called "pull" or "ready."

Mr. Henry B. Joy, of Detroit, has furnished the solution to this problem of automatic release in the form of a variable timer for operating the trap magnets. The Joy Ranch Variable Timer, as the new apparatus is called, prevents the anticipatory lifting of the gun because, after the operating button is pressed, there is a variable time lapse up to the limit of three seconds before the target takes flight.

The new timer is fully portable, being constructed in compact form in a carrying case. It is supplied in both 6-volt and 110-volt types, the former to be operated from the storage battery of an automobile and the latter from a plug connected to the house circuit.

You May Worry More than You Think You Do

AN individual is not a good judge of the extent of his own anxiety. You may be so worried as to be seriously affected physically by the emotional disturbance, but be unaware that you are so affected. Or, on the other hand, you may feel terribly wrought up over some problem while impersonal tests reveal no physical disturbance.

These conclusions were based on tests of the rates at which individuals expended energy while resting without food, under ordinary conditions and then under stress of emotion. They were reported to the Association of Consulting Psychologists by Dr. Charles W. Manzer, of New York University.

Emotions increase the rate sometimes as much as 46 percent. Both pleasant and unpleasant emotions affect it in the same way.—*Science Service.*

Sugar Drives Autos

IF Dr. K. Cuker drives up to your house (which isn't likely, since he lives in Prague, Czechoslovakia), you'll probably listen to his automobile and remark: "What a sweet-running motor!" And you'll be literally correct, for Dr. Cuker has developed a scheme for using sugar instead of gasoline. He pulverizes the sugar, mixes it with air in the proper proportion and produces explosions which propel an internal combustion engine just as does the more familiar fuel.

In order to make sure that the sugar-air mixture explodes when ignited, Dr. Cuker mixes in some nitrated sugar which is extremely explosive. The sugar burns without any ash, thus escaping the biggest drawback of most of the solid motor fuels that have been proposed.

Needless to say, it will probably be a long time before sugar scales displace gasoline pumps along America's highways, but in some countries where gasoline taxes are almost prohibitive and where sugar is, for the moment at least, a drug on the market, this experimental work may easily have more than passing scientific interest.—*A. E. B.*

Cellophane Protects Wet Paint

HUNTING for a method to avoid marring the lacquered surfaces on its small motors, which were piled one upon another in storage, a middle-western motor manufacturing company recently reported that Cellophane sheets placed between the motors completely solved the difficulty. The Cellophane was found to pull free from both paint and lacquer without leaving any imprint or fuzz, says *Chemical and Metallurgical Engineering.*—*A. E. B.*

Mosquito Glands in Treatment of General Paralysis

CUTTING the costs to the government of producing and transporting malaria-infected mosquitoes for treatments of paresis is the latest accomplishment of Dr. Bruce Mayne, United States Public Health Service research worker. Paresis, also known as general paralysis of the insane, is a brain disease resulting from syphilis.

Working in co-operation with the State

The compact Variable Timer case

Hospital for the Insane at Columbia, South Carolina, Dr. Mayne has been in charge of the breeding of special strains of mosquitoes used to give malaria to paresis patients. The mosquitoes are shipped to distant hospitals, out of the malaria belt, for use in treatments. It cost the government 200 dollars per mosquito, Dr. Mayne figured, to get the mosquito bred, infected with malaria, and transported to the paresis patient. Now instead of shipping the mosquito, Dr. Mayne first uses it for patients at the South Carolina Hospital, and then removes its salivary gland, which contains the malaria parasites, and ships this to the distant institutions.

The cost of shipping a package of infected salivary glands to San Francisco by airmail was $5.50. Besides saving on transportation costs, which is considerable, since the San Francisco shipment was the most expensive, there is saving on production costs. Each mosquito can be used to infect several patients at the home institution and the salivary glands might be considered a by-product. Furthermore, 60 percent of the mosquitoes were dead and could not be used when they reached their destination, a loss which is eliminated by the new method of shipping the glands.

The salivary glands are put into a special medium containing blood and the whole mixture is then injected into the patient's vein. The bottles containing serum and infected glands are packed for shipment in a thermos bottle which has been chilled to just the right temperature.—*Science Service.*

Air Steering Control

BECAUSE of a growing tendency to place greater load on the front wheels of the modern motor transport vehicle, proper steering control has become a problem of growing acuteness. Ratios have been increased in an effort to correct existing conditions, but this adjustment falls short of producing the desired results.

Obviously enough, the problem lends itself readily to power control. After a systematic elimination of various methods and combinations, it was found that application of a double-acting cylinder, controlled by a double valve arrangement, was the apparent solution to the problem. Development work culminated in the installation of the first air steering unit on the Bendix-Westinghouse experimental truck in the Pittsburgh laboratories.

The air steering control unit, an aluminum cylinder, under chassis

Among the advantages offered by this modern air steering device, as shown by a nine-month country-wide test, is its ability to reduce steering to a comparatively slight expenditure of effort on the part of the operator. Still further, the operator works with a predetermined resistance or feel exactly proportionate to the angle of turn. This is due to the fact that air steering constitutes a combination of manual effort and power in its operation, and it is this feature which insures positive control at all times, even in the remote event of power failure.

Bendix-Westinghouse Air Steering Control consists primarily of three major parts; a combination of levers mounted directly on a steering shaft, control valves, and a double-acting cylinder.

Are You Losing Your Feet

BABIES and native bare-footed South Africans can "abduct" their great toes, and if you can't "abduct" yours, you are not only in process of losing your feet, but you may soon entertain a painful bunion.

After several thousands of years of "curing" bunions by clipping a piece of bone off the great metatarsal joint, the doctors of orthopedics are now going to the real seat of the trouble—a buckled set of toe joints caused by the pressure of inner or adductor muscles after the abductor muscles had been brought to a condition of desuetude through wearing shoes. In fact, the father of what is now called the base correction method of removing a bunion, Dr. J. M. Hiss, famous American orthopedic surgeon, of Los Angeles, says that "the wearing of shoes is gradually denying us the natural function of our feet."

So, today, instead of cutting the bone that protrudes so painfully from the base of our toe, the doctors simply incise the flesh of the toe and straighten out the tendons that have pulled the toe out of alignment. When given a chance to simulate something like natural conditions, the normal human foot is still so resilient after all the mistreatment of years, that it will return to a healthy condition. Unfortunately, most feet get no opportunity to perform under natural conditions.

Any one, and this includes most of us, who cannot move his great toe out at acute angle to the row of little toes has lost the services of the abductor muscles. These are not the only muscles of the foot which have been lost by civilized man; this latest muscle to suffer, however, generally brings a whole train of distress in the wake of its weakening. When it begins to weaken, the strong adductor muscles on the inside of the great toe pull over the top of the toe, forcing out the great metatarsal bone which forms the base of the toe. This naturally bends the toe out at the center against the side of the shoe, irritation ensues and often pus pockets form. We then say we have a "bunion."

It is a strange commentary on surgical science that it remained for a surgeon now living to get at the real cause of the bunion. Hitherto, it was either believed that the great metatarsal bone had become enlarged or that the joint had swollen. Consequently, surgeons simply clipped a piece of the great metatarsal bone away, bound up the toe and let it heal. Then the ex-bunion sufferer found himself curiously unable to balance himself on that foot thereafter.

The large print—of an African native's foot—shows the well-formed arch of an unshod person. The smaller—archless—is an infant's

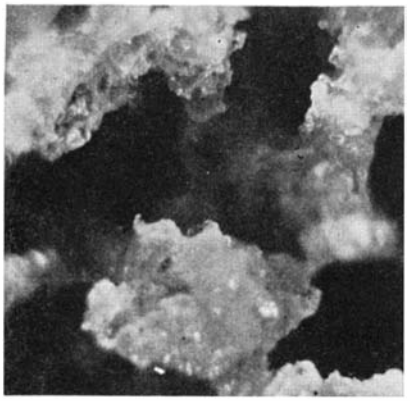
Because it is rather difficult to conjure up any drama about the big toe, the discoveries of Hiss have hitherto been confined, in print, to such professional journals as the *American Journal of Surgery.*

Steam-Pressure Canner Best for Low-Acid Foods

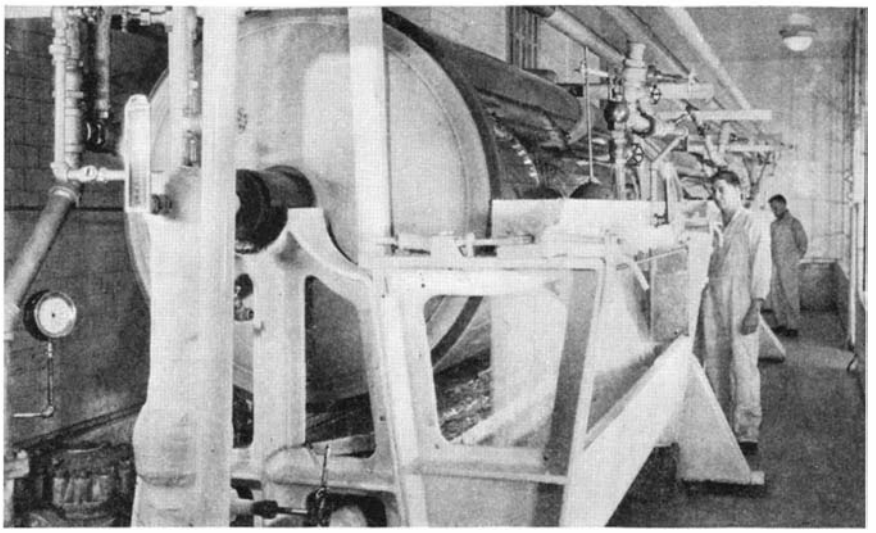
FRESH evidence in favor of the steam pressure canner for foods low in acidity is presented by the Bureau of Home Economics of the United States Department of Agriculture after examining more than 4000 containers of foods canned in its experimental laboratories. These jars and cans included many of the low-acid foods that are commonly canned at home—meats, fish, and vegetables other than tomatoes. They represent 10 years of experimental work in home canning.

Since meats, fish, and corn, beans, peas, and other vegetables, except tomatoes, give most trouble in home canning, the department ran many series of comparative tests with these foods. Repeatedly it tried out the water-bath method with both continuous and intermittent periods of processing, and again and again the high percentage of spoilage showed this method wasteful and dangerous for non-acid foods.

The water-bath method produces a temperature about equal to that of boiling water (around 212 degrees Fahrenheit), but no higher. This is not high enough to kill in a reasonable time the bacteria that



Inside a bakery where the cake-making problem has been to get higher ratios of sugar, eggs, milk, and shortening in machine-mixed batter. At left is an enlarged photograph of home-made cake grains. *Below:* Grains of cake made with Sweetex, the new shortening with which bakery cake is made more like mother's



cause spoilage in these non-acid foods.

The steam-pressure method, however, quickly runs the temperature in the containers up to 240 degrees or 250 degrees, Fahrenheit. These high temperatures destroy the harmful bacteria in a short time. Containers processed in the steam-pressure canner according to directions recommended by the bureau for meats and non-acid vegetables showed only 2 percent spoilage.

As a matter of economy, therefore, as well as a precaution against food spoilage, the bureau recommends using the steam-pressure method when canning meats and non-acid vegetables at home.

Soapless Shampoo

A CHEMICAL firm which has been making for a number of years a special, water-soluble olive oil, used extensively for cleaning and adding luster to silk, has developed a new market for this unusual product by a bit of intelligent research, says C. P. Gulick in *Executives Service Bulletin.* As the oil they made was superior to soap for the purpose, it occurred to one of the chemical staff that this oil might be desirable for use as a shampoo. Research was started on this project, the oil was adapted to the new application and the result was a unique soapless shampoo, which is just beginning to become popular.—*A. E. B.*

Hydrogenated Shortening for Cake Bakers

A NEW discovery in the baking industry which, according to its sponsors, promises greatly increased cake sales and new profits for the baker, has just been announced. This development will permit bakers to compete in cake-making quality with the housewife, it is stated. The new product, a hydrogenated shortening which will permit the baker to make cakes much richer than ever before, comes from the research bakery of The Procter & Gamble Company.

Sweetex has appropriately been chosen as the name for the new product because it can carry higher ratios of sugar (and other rich ingredients) to flour than has heretofore been possible in the bakery-made cake.

Cake making is profitable, as every baker knows. But while the baker is producing 90 percent of the nation's bread he is now baking only 20 percent of the cakes. What is lacking in commercial cakes is a sufficient proportion of enriching ingredients—sugar, eggs, and milk. Why? Solely because old style shortenings, used in the bakers' machine mixers, would not permit them to carry the proportion of sugar, eggs, and milk so necessary for a rich and homelike cake. Sweetex, it is stated, was developed to remove these obstacles that for years have been standing in the way of the baker's cake sales.

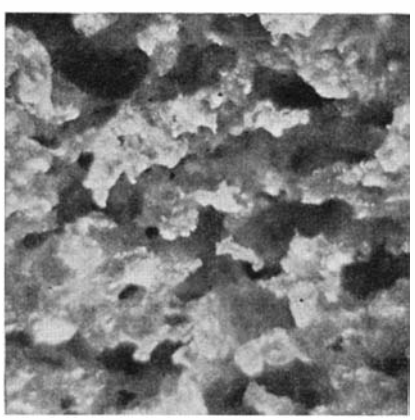
Using Sweetex, the improvement in cake formulas and in cakes is striking. It permits the baker to employ higher ratios of enriching ingredients, in proportion to the flour in the mix, and thus to equal or even go beyond the richness of the housewife's product. The comparison with baker's old style batter is striking too. The usual ratio of 90 pounds of sugar to 100 pounds of flour may be stepped up to 140. Sixty pounds of eggs can be employed (to the 100 pounds of flour), against the baker's former 42. Ninety-five pounds of milk enrich the new batter, as compared with the old style proportion of 58 pounds.

Silver Protecting Cloth

ONE way to counteract the "technological unemployment" which science has imposed upon older industries as it has showered more, better, and less expensive products upon the American people, is to find new "necessities" and new luxuries for the industries and their workmen to produce. From such a situation came the invention and commercial distribution of cloth which will keep tarnish off silverware for at least two years.

One concern with large textile mills in New England found it had much textile machinery of all sorts that could not be kept in profitable operation. Competition had been keen in their regular lines and the profits were squeezed out. So they turned to Dr. Grinnell Jones, professor of chemistry at Harvard University, and asked him to devise some way of treating cloth chemically to adapt it to some new and specialized use. They wanted a process, that could be patented and trademarked, for making cloth to be sold at a profit which would make it worth while to manufacture.

After several months of investigation, it occurred to Dr. Jones that both the housewife and the industry would welcome a cloth treated so that it would protect silverware from tarnish. He and his colleagues began work upon this problem.



Reasoning chemically, Dr. Jones tried impregnating cloth with the hydroxides of the metals which give insoluble sulfides: copper, cadmium, bismuth, lead, antimony, silver, zinc, and others. The idea was that these metals, if placed in the cloth, would catch the hydrogen sulfide and sulfur dioxide which are present in the air as the result of coal-burning and which are the chemical culprits that tarnish the silverware on our tables.

After exhaustive laboratory and field tests, it was found that the only metal that gave perfect protection was silver itself.

The textile mills which had inspired the research therefore decided to put the silver-protecting cloth upon the market. A good grade of cotton canton flannel, tightly woven and heavily napped, is manufactured especially for this purpose. Then the cloth, after suitable scouring processes, is passed into a solution of silver nitrate, the excess is squeezed out by rolling and then it is passed into a hot sodium carbonate solution which precipitates silver oxide on and inside the fibers. After washing and drying, the cloth has a dark brown color, which is the natural color of silver oxide. And it contains about 9 percent by weight of silver.

This cloth is now being made up into bags with draw strings for plates, bowls,

and cups, into rolls with pockets for flat silver and it is also used for linings of silver chests. Patented and trademarked, Dr. Jones' silver-protecting cloth is now turning hitherto idle wheels in the textile mills and a large silverware company is introducing the public to the advantages of the cloth.—All rights reserved by *Science Service*.

Size of Thyroid Gland Varies with Age and Season

THE thyroid gland in your throat, important in the regulation of bodily functions, varies in size according to your age, and also fluctuates in size according to the season of the year.

These observations by Harry von Kolnitz and Dr. Roe E. Remington, of the South Carolina Food Research Commission, were reported in Washington recently before a meeting of the American Chemical Society.

Messrs. von Kolnitz and Remington examined the thyroids of 150 human bodies in Charleston. They found that up to the age of 40, human thyroids increased in size; after that they declined steadily. Women's thyroids averaged larger than men's, but contained a lower percentage of iodine.

Thyroids varied seasonally, increasing in weight from April to a peak in July and then decreasing to a constant level from October on through the winter. This latter result disagrees with findings of earlier investigators.—*Science Service*.

Ships for Our Navy

AS this issue goes to press, newspapers announce that President Roosevelt and Secretary of the Navy Swanson have agreed on a naval building program under which 32 vessels will be built during the next three years. All of these, the reports say, will be laid down this year, thus taxing the facilities of both government and private yards. The most important consideration in taking this initial step toward obtaining a treaty navy is the fact that 85 to 90 percent of the total cost of these vessels, 238,000,000 dollars, will go for labor! It is expected that funds will be allocated by the President from the 3,300,000,000-dollar appropriation for public works under the Industrial Recovery Act.

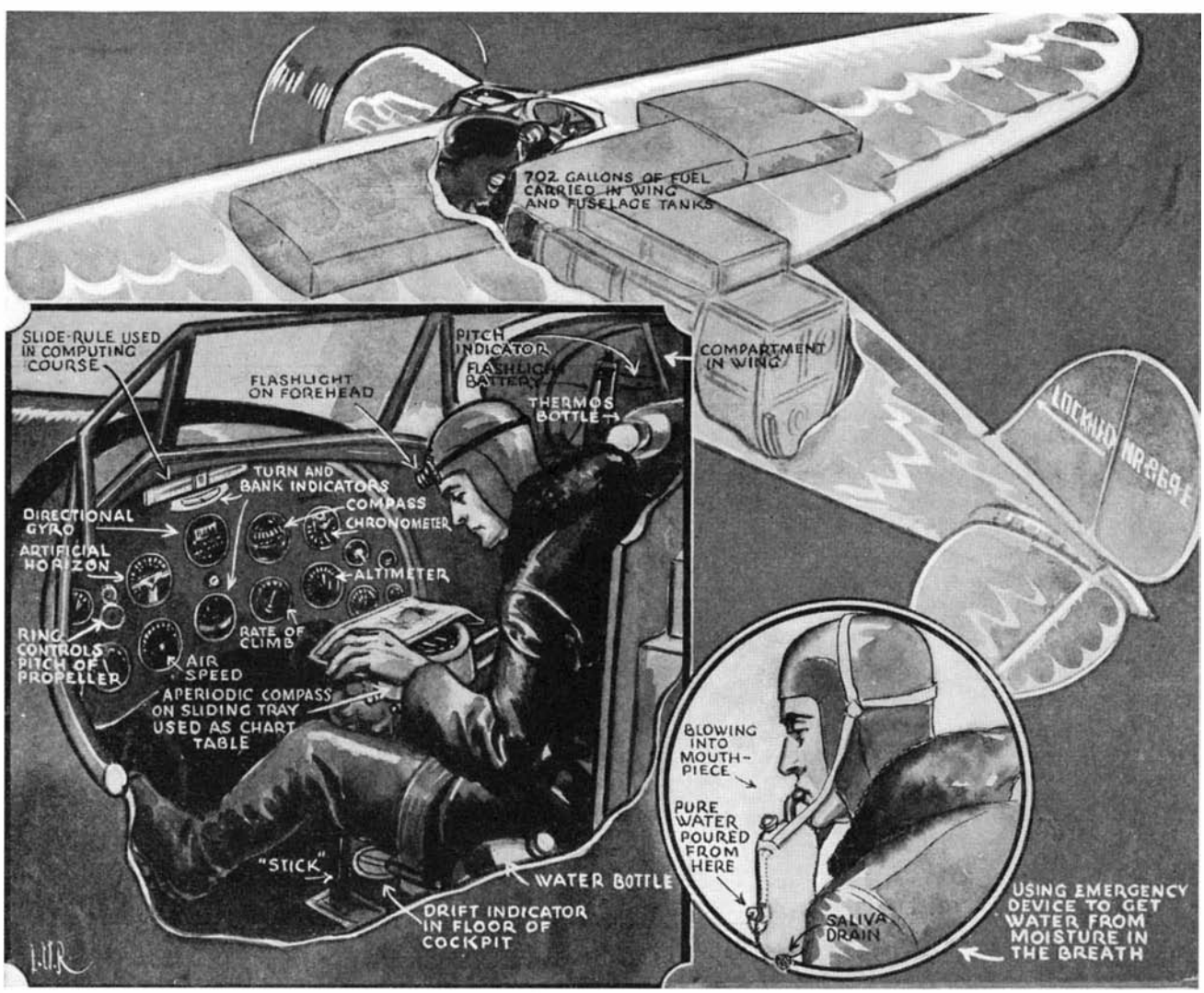
The ships to be built are as follows:

Aircraft carriers	2	each	15,000 tons
Light cruisers	4	"	10,000 "
Destroyers	4	"	1,850 "
Destroyers	16	"	1,250 "
Gun boats	2	"	2,000 "
Submarines	4	"	1,400 "

This amount of construction is moderate and, according to quick calculations, will leave us short of a treaty navy by something like 177,000 tons.

Splash-Proof 'Phones for Aircraft Carrier

A NEW "splash-proof" telephone for use in locations on decks and in other places exposed to driving rain or high waves has recently been developed for the Navy airplane carriers, *Lexington* and *Saratoga*, by engineers of the Bell Tele-



At the time of writing, the veteran aviator James Mattern and his Lockheed-Vega monoplane *Century of Progress* are lost between Siberia and Alaska on the last ocean leg of a spectacular attempt at a solo 'round-the-world flight. When Mattern took off on June 3, 1933, from Floyd Bennett Airport, Brooklyn, New York, he carried an estimated weight in fuel of 4200 pounds. A variable-pitch propeller, controlled from the cockpit, made it possible to take off with this huge load in 23 seconds. The power-plant used was a 550-horsepower Wasp engine. The first leg of the flight ended on Kragero, an island off Norway and 4200 miles from the point of departure. This was accomplished at an average speed of slightly more than 145 miles per hour and required 675 gallons of gasoline. Our artist's drawing reproduced above shows some of the interesting details of Mattern's plane. Two notable safety features are the ability to dump all fuel quickly and so make it possible to keep the plane afloat if forced down on water, and the emergency device for obtaining drinking water from the moisture in the breath, if the pilot should be forced down and lost for any great length of time

phone Laboratories in New York City.

Telephone communication on each ship is supplied by a complete dial system of 400 telephones, over which 80 conversations may be held at one time. The equipment serves the 2000 men living and working in widely separated compartments on the eight decks of each ship. The ships, being without passenger elevator service, require numerous channels for routine telephone calls. The dial system of each ship is similar to the telephone equipment of hundreds of cities, towns, and communities throughout the country. But service conditions on these ships being much more severe than is the case in central offices, it was necessary to make some modification of the standard dial apparatus.

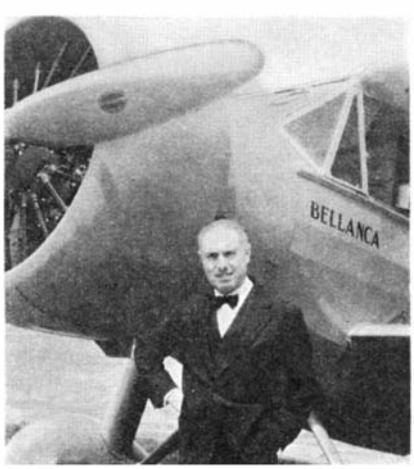
Exposed telephones installed on the decks and in other locations are frequently used in severe weather and the engineers developed a modified standard design telephone which has proved "splash-proof."

In addition to the telephone, loudspeaking amplifiers are a part of each ship's regular equipment. This apparatus is widely used to broadcast everything from fire alarms to "no shore leaves" and from bugle calls to play-by-play accounts of world series ball games.

This telephone equipment, incidentally, was the first ever to be installed aboard ships while at sea. Two engineers from the Laboratories supervised the installation and testing while the ships were taking part in naval maneuvers off the coast of California.

Keeping Awake Aloft

AT the time of writing, General Francesco de Pinedo, famous Italian ace, is preparing for a record non-stop flight, starting from New York. His plane is a Bellanca J3 with a fuel capacity of 1050



General Francesco de Pinedo

gallons of gasoline and a flying range of 7500 miles at 120 miles per hour. The General plans to break the present record of 5400 miles, non-stop, flying from New York to Newfoundland; Cranwell, England; then by a "great circle" to Odessa; and then as far as physical endurance will permit, perhaps going as far as Karachi, India. De Pinedo will thus be in the air for some 50 or 60 hours. He has trained rigorously for three months for this purpose and is a splendid physical specimen, in the prime of life. The General says:

"Two days and a half is a long time for the human machine to keep going and functioning properly, so I have arranged to sleep and allow the plane to fly itself for intervals of 10 or 15 minutes."

The Sperry Automatic Pilot will be employed. We have had occasion to describe this device previously in our columns. It involves two gyroscopes, one for directional and one for lateral and longitudinal control. These gyros can keep a plane almost indefinitely on a perfectly level keel. A siren connected electrically to a timing device is supplemented by a small water tank which hangs just above the pilot's head in the cockpit of his plane, the *Santa Lucia*. The time clock will be set for a 10-minute interval and at the end of that period the siren will howl in the flier's ear and a jet will squirt cold water in his face. Moreover this double alarm system is connected with a bank and turn indicator and a sensitive altimeter. If the *Santa Lucia* turns off its course, the indicator will also actuate the siren and water jet. Likewise, if the plane should lose too much altitude, the altimeter needle will make contact and again resort will be had to the awakening devices. The General has tried the practical working of these devices again and again in his three months' training. He has found them to work perfectly, and what is more has discovered that 15 minutes of sleep will set a man up completely and allow him to wake with all of his faculties alert.

The General's effort may lack the dash of Lindbergh's famous flight, but the scientific interest of his expedition will perhaps be greater.—*A. K.*

Corsets for Aviators

MOVED more by superstitious dread than knowledge, people sometimes say that there must be a limit to the speed at which man can fly, and that we have almost reached this limit. As regards pure speed, a moment's reflection will show the absurdity of this view. Speed is relative. We are being whirled 'round the axis of the earth at 600 miles per hour, and the earth carries us around the sun at something like 60,000 miles per hour. Yet no ill effects are experienced. It is not speed that produces physiological effects on the human body but acceleration or deceleration.

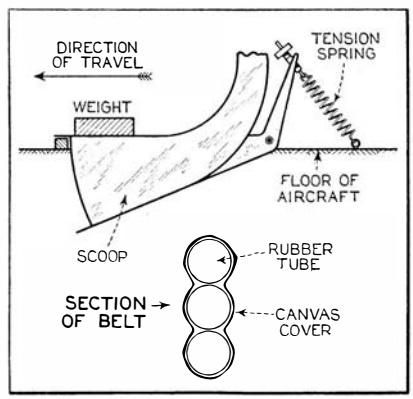
High accelerations are produced in flying when the airplane, in addition to having a high speed, undergoes a sharp turn, or "angular deviation" in highbrow terminology.

When the pilot flattens out his machine from a steep dive, the acceleration produced may reach values as high as eight times the acceleration of gravity. When going around pylons in a race the acceleration may be five or even six times the acceleration of gravity. The pilot is then pressed down on his seat with a force which is a great many times his weight. His bone and muscular structure can withstand this readily enough. Unfortunately the acceleration also acts on the blood in his brain; the blood is driven away from his brain into the relatively unsupported lower abdominal vessels.

This results in "blacking out," or momentary loss of vision. Blacking out is commonly found after about one second of exposure to an acceleration of 3½ to 4½ times *g*, the acceleration of gravity.

Wing-Commander G. S. Marshall, in a paper presented before the Royal Aeronautical Society, suggests a practical biophysical remedy in the form of what might be called an aviator's corset. This is an apparatus which will tighten up on the stomach or support it in moments of emergency.

The aviator's corset is illustrated in the diagram. The apparatus consists of a scoop and a sort of specialized safety belt or cor-



Suggestion for a pilot's belt to neutralize centrifugal force effects

set. The scoop is fitted to the airplane in such a manner that a weight tends to force it out, by turning it about a hinge or pivot mounted on the floor of the aircraft. A spring normally overbalances the weight and keeps the scoop enclosed within the fuselage. When violent accelerations are encountered, the weight is multiplied many times in its intensity and overcomes the action of the spring. The throat of the scoop then receives a violent rush of air owing to the great speed of the aircraft. The throat of the scoop is connected by means of a short, flexible wide-bore tube to the corset. The corset consists of tubes as shown, horizontally quilted to distribute their pressure, when inflated, evenly over the entire abdomen. They are suitably adjusted to the pilot's girth.

The operation of the device is obvious. The pilot flattens out and imposes a heavy acceleration on the plane. The weight drives out the scoop, the scoop fills out the corset, and the blood, unable to flow to the abdomen, stays where it is needed in the brain. The phenomenon of blacking-out no longer occurs! The entire action is automatic, which is as it should be. No pilot while flattening out would have time to attend to any special device.

The suggestion of Wing-Commander Marshall is a very plausible one, and we hope that it will soon be put to a practical test.—*A. K.*

An Energy Analysis

WE are presumably living in an era of efficient utilization of natural resources, but this is only true in a relative sense. Compared with the year 1833 our achievements are remarkable, but when an energy analysis is made of so efficient a mechanism as the airplane, the figures are surprisingly poor.

The airplane engine is supposed to be a marvel of refinement, but when supplied with 100 British thermal units of energy in the form of gasoline or other fuel, it promptly loses 25 units to the cooling system. In other words, to keep our engines operating at

temperatures under which the metals in common use will not melt, we have to throw away one quarter of all the energy available. Of the remaining 75 units, 39 units are lost in the heat of the exhaust gases. This leaves only 36 units for mechanical work, and not all the 36 are delivered to the propeller because work is lost in overcoming the mechanical friction losses in the engine itself. The actual work delivered to the propeller is thus reduced to about 30 units.

The propeller in turn does not deliver to the airplane a thrust energy equal to that which it receives, because it is only 80 percent efficient. So the airplane receives only 24 units of the original 100.

At cruising speed, a fast modern machine loses two thirds of its power in overcoming the parasite resistance—that is, the air resistance of the fuselage, motor, and tail surfaces. One third of the power goes to the lifting wing. The wing therefore receives only one third of 24 thermal units, or only 8 percent of the original energy of the fuel.

The record is not such a brilliant one after all! It is illustrated diagrammatically in the sketch.

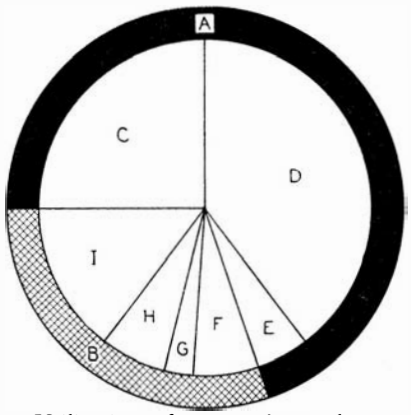
When we started out to make this analysis we did not anticipate arriving at such a low figure. The moral (if moral be needed) is that there is plenty of room left for improvement in both the engine and the plane. Perhaps some day we shall evolve a jet reaction engine in which there will be no cooling losses because the combustion chamber will have no moving parts and will be lined with refractory materials; in which there will be no mechanical losses because the jet alone will exercise the thrust; and in which propeller losses will also disappear. The plane will fly very rapidly in the higher reaches of the atmosphere and therefore meet with little drag resistance. Moreover, it will be reduced to just a flying wing.—*A. K.*

High-Speed Streamlined Train

THE Union Pacific Railroad authorized recently the immediate placing of an order for construction of an entirely new type of passenger train, featuring the high speed of 110 miles per hour, light weight, and full streamlining. This train will be completed in about six months. It will first be operated on special runs between the larger cities on the Union Pacific System, with the purpose of demonstrating its practicability for regular main line through passenger train service, including transcontinental.

Passenger travel on the railroads of the United States has been steadily declining since the peak year of 1920. The executive officers of the Union Pacific several months ago reached the conclusion that to save and restore passenger business to the rails would necessitate the development of a radically different type of passenger equipment.

The new design has been based largely on automotive and aircraft developments, where speed and light weight, combined with strength, have been such a vital necessity. To obtain light weight, with strength, the train will be constructed either of aluminum alloys, or of stainless steel, which has three times the strength of ordinary steel and, therefore, requires but one third of the material to obtain equivalent strength. In place of the conventional underframe now used on passenger cars, which takes all of the shock and carries the superstructure and the load, each car in this new train will be tubular in shape, the entire car body forming a deep, stiff beam, thereby requiring a minimum amount of material for a given strength.



Utilization of energy in a plane. A, total engine losses distributed among C, to cooling system; D, exhaust; and E, engine friction. B is power to propeller. F is propeller loss; G, H, I, are induced, profile, and parasite drag losses

The equipment is designed for a maximum speed of 110 miles an hour, with a sustained speed on straight and level track of 90 miles per hour. The train of three cars will weigh not over 80 tons, which is the present weight of one Pullman sleeping car.

The train will be streamlined to a greater extent than has been attempted to date either in this or any foreign country.

This train will consist of three cars articulated; that is, one truck will be between each two cars and the cars hinged together.

The first car will contain a 600 horsepower internal combustion engine burning distillate (a non-explosive fuel), with direct-connected electric generator and motors on the wheels of the forward truck; it will also contain a 30-foot railway post office and a baggage room. The second car is to be a coach seating 60 passengers and the rear car a coach seating 56 passengers, with a buffet at the rear end to serve light meals to passengers in their seats. This first train will not have any sleeping accommodations, but it is expected that the operation of the train will demonstrate its adaptability for the long transcontinental runs, and a car with sleeping accommodations has been designed.

Aerodynamics of the Streamline Train

IT might not be out of place here to give an idea of the saving in air-resistance which streamlining of the train described in the preceding item might conceivably introduce.

At 40 miles an hour for an ordinary 200-ton train, a total horsepower of 305 is required. Of this, journal and roll friction accounts for 30.6 percent, flange action accounts for 35.7 percent, and air resistance for 33.7 percent, or, roughly, one third of the whole.

At 100 miles an hour, the picture changes considerably. Now 2500 horsepower is required. Of this, 9.3 percent is in journal and roll friction, 27 percent in flange action, and 63.7 percent in air resistance.

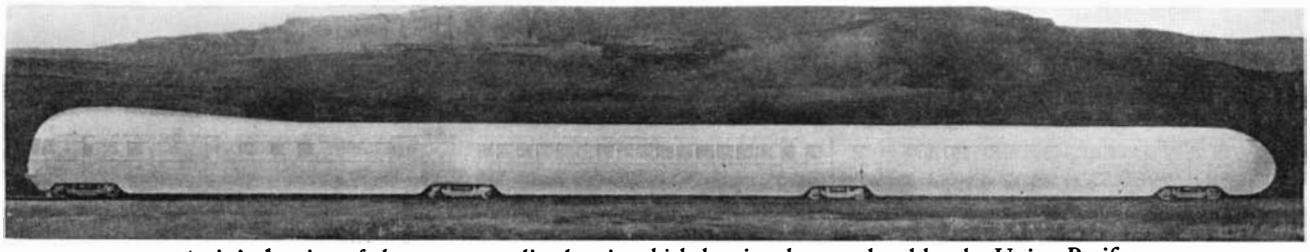
The moral of these two sets of figures is clear. As the speed of the train becomes really high, the air resistance is the predominating factor in the horsepower required.

Another comparison is of interest. The air resistance of this hypothetical 200-ton train of ordinary design is 6000 pounds at 100 miles an hour. Were the train of the shape of a really good airplane fuselage of the same frontal area, the air-resistance would be only 225 pounds. No wonder railroad people have finally turned to the possibilities of streamlining. [SCIENTIFIC AMERICAN has for many years urged investigation of the practicability of train streamlining—*The Editor.*]

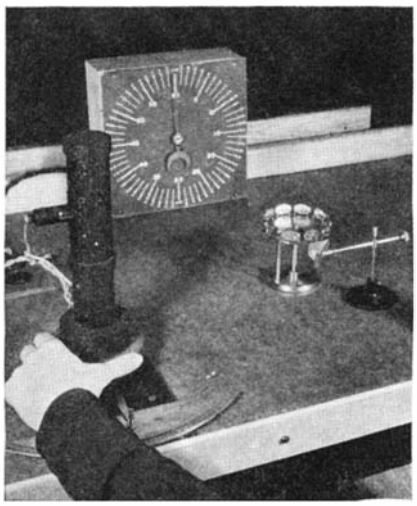
Aircraft operators received the news of the streamline train with mixed feelings. Some saw in it a definite threat to the speed supremacy of the aircraft. We do not think that there is such a threat. On long hauls the airplane, capable of cruising at 200 miles or more per hour, will always be infinitely superior to the fastest train from a time-saving point of view. On shorter hauls the streamline train will redress the balance in favor of the more old-fashioned method of transportation, for in short hauls the airplane is not at its best.—*A. K.*

New Accuracy in Timing Watches

THE Time-Microscope is a recent development by the Research Laboratory of the Hamilton Watch Company, which makes it possible to increase by 1500 times the accuracy in timing watches. It is now possible to observe a change in time of



Artist's drawing of the new streamlined train which has just been ordered by the Union Pacific



The new "Time Microscope"

1/8000 of a second with this apparatus.

Until recently the timing of watches was limited to observing the fastest moving hand on the dial. Under this method the best possible accuracy, in a watch with a second hand, has been 1/5 second a day during a 24-hour observation or 1/5 second an hour during a 1-hour observation. If the watch had no second hand, the best accuracy was six seconds in either an hour or day, depending on the period the watch was under observation.

With the "Time-Microscope" the balance wheel of a watch is observed instead of the dial hands. By means of a stroboscope in this instrument, a succession of momentary light flashes make the balance wheel appear stationary at the fastest point of its five-times-a-second oscillation. The time between light flashes is accurately known and can be adjusted by an ingenious device to indicate the rate of the watch. The light flashes are timed by a constant frequency, 60 cycle, 110 volt alternating current. A weak current generated by a tuning fork controlled by a Riefler observatory clock is amplified by tubes similar to those used in radio, and thus an alternating current is obtained which is timed continuously by and is as accurate as the clock, which does not vary more than a few hundredths of a second a day.

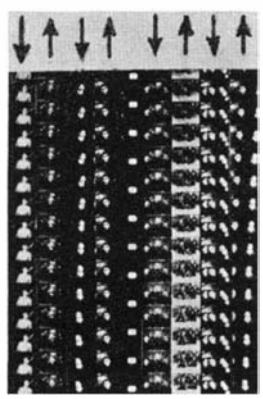
With this device it is possible to obtain the same accuracy by timing a watch for one minute as was previously obtained by timing a watch with a second hand for a 24-hour period and it can be used effectively on even the smallest watches without second hands.

Resonance and Propeller Noises

A THOUGHTFUL note on aircraft propeller noise has been sent to us by Mr. Ray P. Holland, Jr., an aeronautical student at the Massachusetts Institute of Technology. While his views have not as yet been substantiated by scientific experiment, they give a reasonable explanation of the phenomenon.

A high velocity rifle bullet produces a characteristically sharp cracking sound. A very similar sound is produced when a high-amperage spark breaks down the air in passing between two points. A repeated succession of powerful sparks produces a good "sound" imitation of a pursuit plane in a terminal dive of high velocity. The origin of the sound in the case of the bullet is the wave of rarefaction and compression produced by the projectile. The propeller tip passing through the air at a high velocity probably produces a similar sound wave. Such a definite sound wave is formed only when the speed of the projectile or the propeller tip approaches the speed of sound; namely, 1092 feet per second. A slow turning propeller produces only a mild "swish".

In order to get the maximum sensation of propeller noise, the auditor should stand in the plane of the propeller disk, and it is on observations in this plane that Mr. Holland bases his theory. The tip of a 10-foot propeller turning at 2000 revolutions per minute moves at a speed of roughly 1050 feet per second. In flight this figure would be slightly higher because the tip is then moving forward at the same time, following a helical path instead of a circle. In a dive the revolutions might rise to 2400 per minute and the extreme tip speed to 1260 feet per second. Now if we imagine a sound wave being formed under these conditions,



Eight rows of "frames" for the radio-movie synchronization scheme

with the tip moving actually faster than the sound waves, then the tip in a very short space of time would intersect a sound wave and reinforce the pulse in its original direction. This reinforcement would occur at all points round the disk. It is clear also that not only the tip but every point on the blade moving at a speed equal or close to that of sound would contribute to the resonance effect.

Having furnished us with this very interesting viewpoint, Mr. Holland suggests some other important resonance effects which are well worth while investigating. For example, on twin engine aircraft would two propellers turning slowly reinforce each other and cause an objectionable noise? Where is the best location for combinations of airscrews so as to produce a minimum noise? Is it possible to have the two propellers minimize the noise rather than reinforce it? The experimental investigation of aircraft noise has only just begun and inventors and scientists have a fruitful field ahead of them.—*A. K.*

Radio and Movies Synchronized

BY means of an invention recently perfected by Harry H. Golden and Irving Nachumsohn, two Chicago engineers, it may soon be possible to have in the home a motion picture projector used in connection with a radio receiver and so synchronized with it as to project on a screen pictures corresponding to the program being received. The system of doing this is covered by U. S. Patent No. 1,859,665. Essentially the system makes use of a special motion picture film of the type shown in one of our illustrations, running through an electrically controlled projector. On this film, which is of 35 millimeter width but with a single roll of feed holes in the center, are printed eight strips of pictures, and the motion picture projector is so designed as to project these strips in the proper sequence automatically and without attention.

As shown in the drawing, the output of the radio receiver operates a loudspeaker and at the same time is connected through a vacuum-tube circuit to a relay and thence to the motion picture projector. The operation is as follows: The projector is threaded with the prepared film and just before the scheduled time for the synchronized program to start, the operator at the receiver turns on and tunes the set. When the program is to start, the operator at the transmitter closes a switch at the proper moment and a signal is sent out. This signal is above audibility and therefore does not affect the loudspeaker at the receivers but it is passed through the filter system to the relay and serves to start the motion picture projector. It is also possible by means of a refinement of the control system for the operator at the transmitter to stop the projectors on all receivers simultaneously. Furthermore, by means of suitable index marks arranged on the edge of the motion picture film, it is possible to have all projectors stopped at a given point for showing announcements, still pictures, advertisements, and so on. Then as the program continues, all that is necessary is for the operator at the transmitter again to press his button and all of the projectors will start in synchronism.

By means of a system such as this, it is possible to have prepared beforehand a reel of film which will give approximately one hour of operation each night for seven nights. The time allotment could be broken up to extend over various periods during the evening to serve different sponsors.

It is planned to install in the transmitter

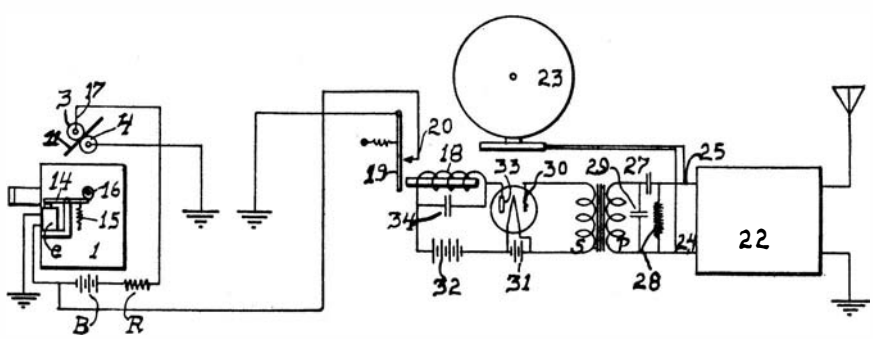


Diagram from patent of radio-movie system

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(Spanish, German or Italian)

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So, whether we like it or not—we've *now* got to know at least *one* neighbor's language, just as our English cousins who are *geographically* close to the European centers, need to know Spanish, French, German or Italian.

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But one must not for an instant consider this necessity of knowing at least one other language an *unpleasant necessity!* It is true that one's chances of advancement, of getting a job, of making money are actually doubled by knowing another language—but so also are one's social pleasure, happiness and appreciation of what other countries and people have to give us.

These things were of course true 51 years ago when the great Edison and Count Cortina worked together to develop the now world-renowned Cortinaphone Method of learning languages, and countless thousands the world over have benefited. But what was true of an isolated America half a century ago, is doubly true NOW of an America which leads the world and has become a neighbor to every nation on earth.

French, the diplomatic language of the world, with your English, will take you anywhere on the globe. *And you learn to speak French at once*—the very day you get your Cortinaphone course.

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A Frenchman speaks to you—you repeat the words, phrases, sentences after him—and that's all there is to it. You speak French as the Frenchman speaks it. It's so easy and simple that a child of 7 grasps and follows the idea instantly.

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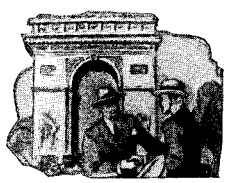
Just listen to this record—made by cultured, clear-voiced natives. Start to speak FRENCH, SPANISH, GERMAN or ITALIAN *at once*—through the famous Cortinaphone Method! You'll be amazed how quickly you pick up your new language. It's actually FUN! Easiest, surest way to learn a language at home.

The NEW Deal



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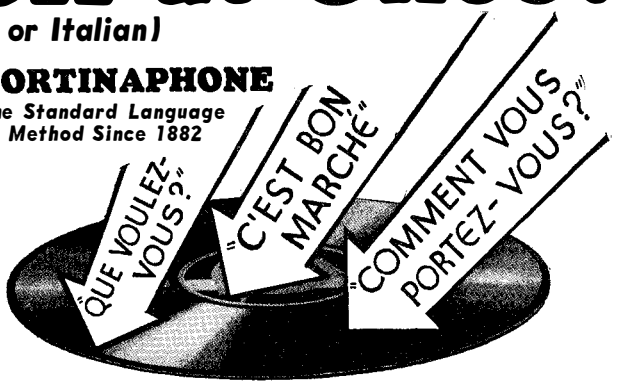

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studio a "master projector" from which the same film is thrown on a screen as is being shown at each subscriber's home. It is then a small matter for the artists who made the films and who have rehearsed their parts beforehand, to go over them again and keep all voice and sound, which is transmitted by radio, in step with the projected picture.

It will be noted that this system may be operated on the standard broadcast wavelengths and without the use of additional channels as is necessary with television.

Music Aids the Anesthetist

MUSIC's power over the emotions, which has been recognized from time immemorial, has again been put to work in the medical profession. Dr. A. F. Erdmann, chief anesthetist in the Brooklyn Eye and Ear Hospital and the Norwegian Hospital of Brooklyn, has for several months been "giving music" to patients on the operating table and has found it of great assistance in his work.

The job of the anesthetist, stated in its simplest terms, is to keep the patient quiet during the operation and to reduce the shock which pain and the operation itself produce on the system. In the modern technique of anesthesia this is done in various ways. The complete anesthetic, such as the familiar gas or ether, renders the patient unconscious. Local anesthetics deaden the area in which the surgery is to be done.

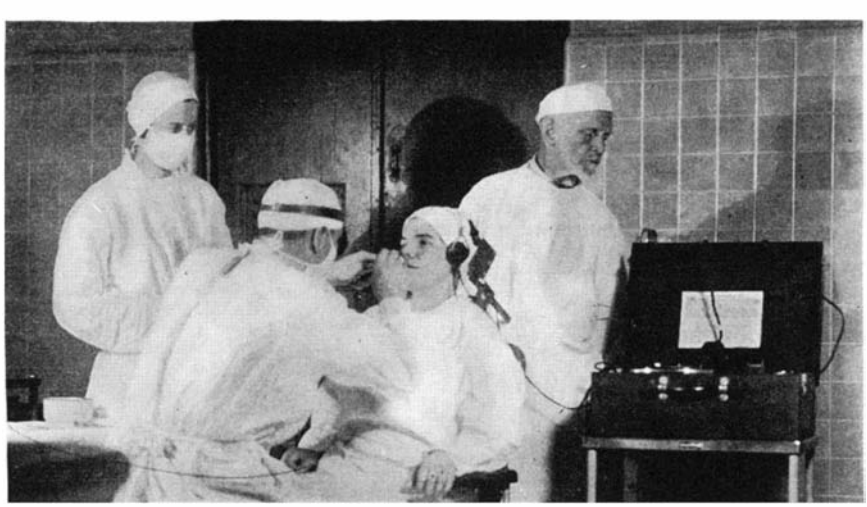
That, it might appear, is enough and is all that the anesthetist can do. But such is not the case. As anesthetists and surgeons very well know, almost every person entering the operating room is in a state of great nervous fear. While this may not interfere at all with the surgeon's procedure, it is nevertheless undesirable if for no other reason than that it taxes the patient's strength and thus may have some effect on his recuperative powers.

So Dr. Erdmann sought some means more dependable than conversation for diverting his patients. From Congreve's famous old quotation he took his cue; "Music hath charms to soothe the savage breast, to soften rocks, or bend a knotted oak."

Radio had been tried. When played openly in the operating room it not only diverted the patient but tended to distract the surgeon. The patient could be furnished with ear-phones but Dr. Erdmann found that he could not always get the type of program which appealed to particular individuals. He decided to try playing music for them.

For the past six months he has been conducting his experiments with a Western Electric music reproducer and a collection of phonograph records. The patient listens through a pair of ear-phones which admit enough outside sound to enable the surgeon or anesthetist to talk to him.

The effects of the "music treatment," says Dr. Erdmann, have been gratifying. The music helps the patient to get away from himself much more so than does conversation. It makes no demands on him as talk does and incidentally also leaves the anesthetist free for the rest of his work.

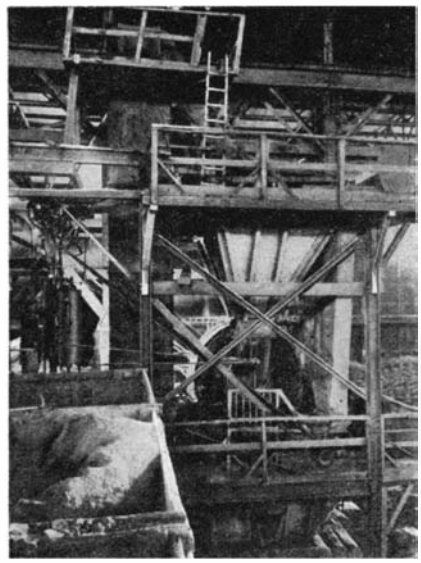


A patient under local anesthetic is calmed by music through ear-phones

A Plant for Making Plant Food

IN the mixer illustrated, the three principal plant foods, nitrogen, phosphoric acid, and potash are combined to produce a "complete" fertilizer. This particular plant, however, is using the newest improvement in fertilizer manufacture—adding the necessary nitrogen in the form of ammonia-urea solution, a recent development by duPont. In the left background can be seen the operator beside the tank in which the solution is measured out prior to mixing. Dry superphosphate is seen in the left foreground.

As soon as the solution is introduced into the mixer, the free or inorganic ammonia reacts with the superphosphate to form ammonium phosphate, ammonium sulfate, dicalcium phosphate and, when large quantities of ammonia are introduced, some tricalcium phosphate. The urea in the solution is precipitated in the fertilizer in such a finely-divided state and is so intimately mixed with the other constituents that its presence cannot be detected microscopically, but can readily be shown by chemical analysis. Experiments have shown that this method of introducing urea and ammonia separately, giving more intimate mixing, prevents segregation and reduces the tendency of the fertilizer to absorb moisture from the air. Since the urea does not react with the superphosphate, the fertilizer manufacturer can add 50 percent more total ammonia by means of this solution than he could with anhydrous ammonia. It has been a common practice to add 30 pounds of anhydrous ammonia to



Interior of plant food plant

make a ton of fertilizer. Using the new solution, the manufacturer will add a total of 45 pounds of ammonia, 30 pounds being inorganic and reacting with the superphosphate in the same manner as anhydrous ammonia. The other 15 pounds in the form of urea will replace some of the more expensive and less available organic sources of nitrogen.

Urea is generally recognized as an excellent source of nitrogen for all crops. Results have shown that urea is superior to other organic sources of ammonia and is an exceptionally good source of nitrogen for tobacco, potatoes, and many truck crops. Urea is not readily leached from the soil by heavy rains; in this respect it is superior to nitrate sources of nitrogen. On being mixed with the soil, the urea soon decomposes to ammonium compounds and these in turn are gradually oxidized by soil bacteria to nitrates. The plant can absorb the urea as such or as the ammonium compound first formed, or it may absorb the nitrogen as the nitrate.—*A. E. B.*

Ammonia Preserves Fruit

APPLES "exhale" a gas (acetaldehyde) which helps preserve the fruit from fungus attack. Recent research by the British Department of Scientific and Industrial Research has shown that the presence of acetaldehyde vapor or ammonia in the air will prevent fungal rotting of certain fruits without damage, provided the concentrations are carefully controlled. A convenient method of supplying ammonia is the presence of dissociating ammonium salts in the cases of fruit.—*A. E. B.*

Patronizing American Ships

DESPITE the great falling off in transatlantic travel this year due to depleted finances, passenger traffic on ships of the United States Lines and American Merchant Lines early this summer showed a large increase over that of last year. This confirms the editorial statement in our July issue, and is a good omen for the future of American ships.

While there is no way of comparing travel on the *Manhattan* and the *Washington* since they are very new, bookings on both

(*Please turn to page* 89)

THE AMATEUR ASTRONOMER

Conducted by ALBERT G. INGALLS

MOST of the available space in the last two numbers was devoted to instructions by means of which the advanced amateur telescope maker may design and make an aplanatic telescope, prepared by Messrs. Carpenter and Kirkham. At our suggestion, Mr. Kirkham has now calculated the zonal radii for three types of aplanatics, in order that those who wish to attempt this advanced type of telescope, yet do not wish to do their own designing, may proceed. "The first of these," he states, "is an *f*/6¼ Richey-Chrétien, this focal ratio being probably the most useful for photography. Primary 42″ focus, secondary (4½″ diameter) is 26⅛″ from primary, and has a radius of 71″. The secondary focus is 2″ back of the primary.

Zone (inches radius)	Radii for R-C.	Radii of paraboloid	difference
0	84.000″	84.000″	.000″
1	84.008	84.006	.002
2	84.033	84.024	.009
3	84.074	84.054	.020
4	84.131	84.095	.036
5	84.206	84.149	.057
6	84.295	84.214	.081

(The radii are the situations of pinhole and knife-edge *together*, hence knife-edge and pinhole must move together, in order to correspond to these figures.)

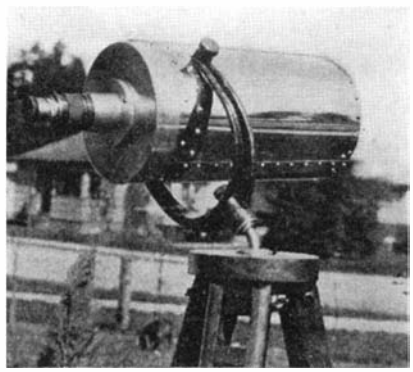
"The second is an *f*/6¼ unity-amplification telescope—primary, 75″ focus, 5″ secondary is a plane mirror 43¾″ from the primary. The secondary focus is 12½″ in front of the primary.

0	150.000	150.000	.000
1	150.008	150.003	.005
2	150.032	150.013	.019
3	150.073	150.030	.043
4	150.129	150.053	.076
5	150.202	150.083	.119
6	150.291	150.120	.171

"The third is an *f*/2 Schwartzschild telescope—primary 60″ focus. The 6″ secondary is 30″ from primary, and has a radius of curvature of 40″. The secondary focus is 12″ from the secondary, which is *concave*.

0	120.000	120.000	.000
1	120.056	120.004	.052
2	120.225	120.017	.208
3	120.509	120.038	.471
4	120.906	120.067	.839
5	121.420	120.104	1.316
6	122.055	120.150	1.905

"The above figures," Mr. Kirkham states, "accept a 12-inch telescope as being the smallest size (possibly) to which R-C or Schwartzschild curves may advantageously be applied. A ten-inch could be made by adhering to specifications, but disregarding the 6-inch zone."



Kirkham's latest adventure

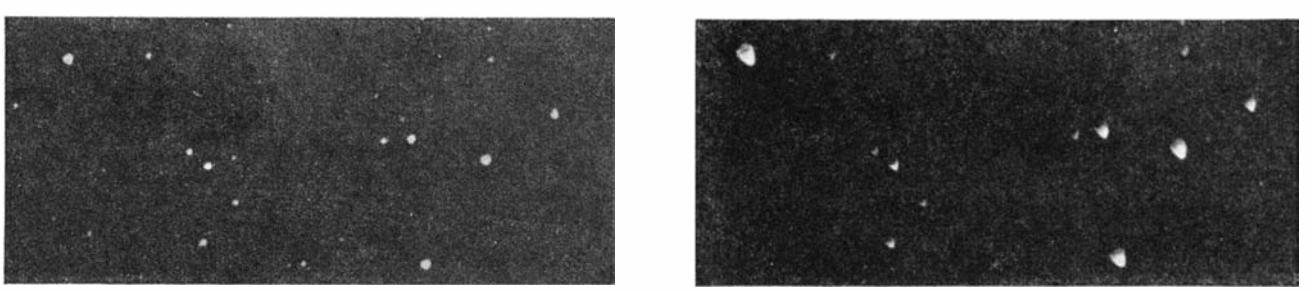
IN the *Astrophysical Journal* for May the astronomer Frank E. Ross of Yerkes describes experiments which have recently been made with a correcting lens inserted in the reflected cone of rays. Its purpose is also to eliminate coma. He prefers this form of correction to the aplanatic types of mirrors. This type of lens has been tried on the 100-inch, the 60-inch, the 40-inch refractor and 24-inch reflector at Yerkes, also on 10-inch and 3-inch telescopes. The correcting lens for the 60-inch is 8 inches in aperture and is placed 15 inches from the Newtonian focus. In two illustrations below, reproduced from the *Astrophysical Journal*, the star images were taken about half a degree off the axis, one without the Ross lens, the other with it. Judging from what has appeared in print and what has been said, the Ross correcting lens is not a suitable job for the tyro. This is putting it mildly.

APLANATIC telescope designer Kirkham, previous to starting an aplanatic, recently completed a stubby Cassegrainian similar in appearance to the one shown on page 451 of "Amateur Telescope Making." "Attached," he writes, "is a pair of photos of my latest, and here's the dirt: Six-inch primary is of 15¾″ focus. Secondary is 2″ diameter and the *e.f.l.* of the combination is *f*/10. It works like any Newt, and has a wide clear field in daytime. One can read signs and billboards five miles away, even with a ⅓″ ocular, which magnifies about 200 times. The tube is spring brass, chrome plated. Fork, cell, and so on, are cast aluminum—everything else brass. The rig weighs about 12 pounds, including tripod. Star images are tiny dots of light, and the diffraction rings are according to Hoyle.

"Coming back to focal lengths of *f*/20, *f*/40 and above," he continues, "that's what's given us the crack about a Cass not being as good as a Newt. One goes to investigate a complaint about Cass and Greg, and finds that the eager fellow has tried to make a perfectly good Newt into a Cass simply by making a secondary. The result is *f*/35 or *f*/40, and no one can get away with that. There's no reason for making a Cass longer in focus than one would a Newt. One must therefore cut the primary to *f*/3 or *f*/4, and design the secondary to give right results with *f*/8 or thereabouts.

"Why, then, bother to make a Cass at all? Here's why. The thing is short and stubby and easily mounted, convenient to use; also, since there are two curves, they can be made aplanatic."

HERE are two amusing sidelights from the earthquake zone—rather late, but these columns have been filled recently with other matter. Dr. C. N. Lord, dentist, 520 Temple Avenue, Long Beach, California, was photographing the moon with his 8-inch reflector and a Brownie camera when the quake hit. The photograph obtained looks decidedly shimmery (too much so to reproduce). This, so far as we know, is the first practical application of an amateur's telescope as a seismoscope. Everything fell about the telescope but did not hit it, and Astronomer Lord heroically stuck to his post. The other incident was reported by Mr. Ferdinand Ellerman of Mt. Wilson Observatory, who wrote: "I had just silvered the 100-inch mirror and had gotten the finest coat ever put on it. While we were at dinner the earthquake occurred, jarred the telescope enough to spill some mercury from the float down on to the mirror and ruined the silver coat." Russell W. Porter describes the same incident at greater length: "Humiston, the astronomer, came down off the mountain today with the strangest tale of what the earthquake did to the 100-inch telescope mirror. It seems that the mirror was resilvered only yester-



Star images before and after taking Ross medicine. Seen best with page on edge

day. This is done twice a year. It has to be removed from its tube and lowered through a manhole in the floor, into the silvering room. Well, Humiston said they put on a beautiful new coat of silver and went to supper. At the first shake they all hurried to the big telescope, to find to their consternation that the new silver coat had disappeared. This is what actually happened: The telescope mounting, weighing some 50 tons, has its polar bearings floating in mercury. The mercury had been forced out of the containers, pouring across the floor to the manhole, and down on the mirror. They are resilvering it again today."

WHEN doesn't a totally reflecting prism totally reflect? When the hypothenuse face is silvered, as occurs in combining the diagonal for a finder with the outer hypothenuse face of the main prism. Experiments described in the *Revue d'Optique*, October, 1932, show that a coat of silver on the outside, especially if thick, actually affects the percentage of inside reflection as much as one half. To test whether the reflection had really been changed to metallic reflection, mercury was placed against the outside, instead of silver. The index of reflectivity was then the same as that of mercury, showing that the reflection was metallic. Just why this change takes place is not stated. Maybe nobody knows.

"THE Bulletin" is the name of a monthly publication of high intrinsic merit, sent out by "The Texas Observers," 312 West Leuda, Fort Worth, Texas. Its emphasis is on observing and it is well worth the dollar a year it costs.

As is now well-known, a 76-inch telescope is soon to be built for the University of Toronto. We learn that its mirror disk is to be of Pyrex and is shortly to be shipped from the Corning Glass Works at Corning, New York, to Sir Howard Grubb, Parsons and Company, at Newcastle-on-Tyne, England, for figuring and mounting.

Can anyone furnish the specifications for designing a telescope rifle sight? We receive occasional requests for these data but have not been able to lay hands on any kind of working specifications.

Here's a note from "Wally" Everest, the HCF man, who lives at 15 Allengate Avenue, Pittsfield, Massachusetts, in which city one of the big General Electric shops and laboratories is located. He says: "Things are moving fast up here. We are forming 'The Berkshire Astronomical Association' which will include some of the best brains in the local branch of the G.E. Co. —about 40 men of more or less important standing here. About 15 are making telescopes. As many more are rarin' to go and the rest are interested in the mathematical or scientific side of it. It's getting terrible —the whole gang is simply going nuts, possibly finding in this game a welcome relief from the mental strain of the depression. You can any time see a couple of birds, high up in the organization, discussing some fool point in connection with astronomy or telescope making."

If the depression has been driving you crazy, don't consult a psychiatrist. Instead, take up the hobby of telescope making and stay crazy about something really worth being crazy about. There are now several thousands of us, some of us harmless, who are crazy over this hobby. Investigate.

CURRENT BULLETIN BRIEFS

THE "AIR ROVER," a two-tube, battery-operated short-wave set, consistently brings in broadcast entertainment from European, South American, and other foreign stations on a loud speaker. These unusual results are possible through the utilization of modern vacuum tubes in an ultra-sensitive circuit. Parts for this set cost less than six dollars, exclusive of accessories. Top and bottom views, list of parts, and additional information from *Allied Engineering Institute, Suite 541, 98 Park Place, New York, N. Y., 10 cents.*

LAUNDRY MACHINERY—CONSTRUCTION AND LUBRICATION (*Lubrication*, Vol. XIX, No. 4, April, 1933) describes the machinery found in laundries and suggests the various greases and oils for lubrication. *The Texas Company, 135 East 42nd Street, New York City.—Gratis.*

AUTOGIRO HIGHLIGHTS FOR 1932 reviews Autogiro development and progress during the past year. There are many excellent pictures. *Autogiro Company of America, Pitcairn Field, Willow Grove, Pa. —Gratis.*

INDUSTRIAL CO-OPERATIVE GARDENING. The B. F. Goodrich Company faced a two-fold problem created by the marked decline in business. Weekly working hours for wage earners in the rubber industry had been reduced so drastically by 1932 that further elimination of workers seemed necessary, unless those employed three days or less could augment their earnings and in this way provide adequate subsistence for their families. Various relief plans were suggested; a co-operative farm operated on mass production principles seemed the most practical solution of the problem. Akron Community Gardens were formed and the rubber workers became gardeners. The story as outlined in the pamphlet is of surpassing interest. *The B. F. Goodrich Company, Akron, Ohio—Gratis.*

CODE FOR PROTECTION AGAINST LIGHTNING (Bureau of Standards Handbook No. 17) supersedes a previous handbook. The protection of persons and property against lightning is a subject of widespread interest and considerable importance. Fire damage from lightning shows losses which aggregate 9,000,000 dollars annually. *Superintendent of Documents, Washington, D. C. —15 cents (coin).*

MANUFACTURING MARKET STATISTICS (Domestic Commerce Series No. 67). This book constitutes a forward step in the assembling of data to assist distributors of goods used by manufacturing industries to locate possible markets and estimate probable demands in different sections of the country. This immense mass of material was collected, arranged, and tabulated by competent employees. *Superintendent of Documents, Washington, D. C.—$1.00 (money order).*

THE SCIENTIFIC AMERICAN DIGEST

(*Continued from page* 84)

of these have been heavy. The four ships of the American Merchant Lines, however, have sailed since mid-April with every cabin booked. The indications are that capacity sailings will be the order for the remainder of the present summer season although, in general, it may be considered the worst travel season since 1913.

Self-Shining Shoe-Leather

BOOTBLACKS are slated as the next victims of technological unemployment, according to glowing announcements from the Mellon Institute of Industrial Research where C. H. Geister claims to have perfected a shoe leather that will "shine itself." The new type of leather is produced by incorporating a combination of filling agents during the tanning operation in such a way that the fibers of leather are both supported and lubricated. This is said to add materially to the life of the shoe and to help it keep its shape while being worn. Having no hard surface, the skins can be worked without the usual danger of factory damage, simplifying handling throughout the process of manufacture.

Shoes fashioned from the new leather are said to require no dressing, and a buffer and friction brush bring out a rich finish of any desired brilliance.

All colors are said to be more permanent because the color is constantly revitalized by the material with which the skin is impregnated. Other advantages are that it is more durable, practically scuff-proof, and is soft and pliable to an unusual degree, yet retains the advantage of kid in permitting the foot to breathe.—*A. E. B.*

SELF-CONQUEST THROUGH SELF-ANALYSIS

(*Continued from page* 56)

and ways and means towards relief. In dreaming while asleep, the dream comes first, the sensation of cold follows. For example: one goes to sleep in a cold room with insufficient bed clothes and dreams that he is marooned on an iceberg. The alarm, from a sense of danger, awakens the sleeper, so that the conscious feeling of cold will compel him to seek relief. Every one possesses his own individual symbolic language. No two are alike. The attempt to interpret the dreams of one in terms of the symbols of another is unsound and leads to error.

It is obvious, therefore, that accurate analysis of one person by another is impossible. The analyst can only instruct and guide; he can no more analyze another than he can digest another's food.

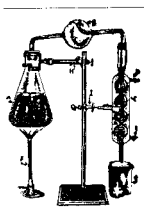
There are almost as many methods of psychoanalysis by free association as there are psychoanalysts. They all lay stress on the necessity of following a routine that begins first with an uncontrolled outpouring of feelings and thought, followed by

the revival and fixation of the subject's sex love and attachment to someone. And this is what is so generally condemned by the clergy and other defenders of common decency and morality, for it is a common practice among analysts to direct the transference of their patients' affections to themselves. It is yet to be made clear by those who profess to cure by means of psychoanalysis whether the "healing balm" is embodied in the exploration of the subconscious or the gratification of one's sex love with the person of the obliging analyst, or both.

IT must be obvious even to the lay reader that these pretensions are not scientific, honest, or even decent. The question naturally arises: "What and how does psychoanalysis cure?" We know that disturbed emotions seriously impair and disturb the functions of body as well as mind and that many if not most instances of these disorders originate in the unconscious mind. The symptoms are vague, unreasonable fears, all sorts of inhibitions, inward conflicts, strange cravings, great irritability, general nervousness, shyness, timidity in social contacts, inability to concentrate. The unfortunate sufferer is constantly subject to unreasonable worry and fretfulness and is unable to endure the shocks, frictions, and general wear and tear of everyday life. He is morose, self-centered, and becomes easily embarrassed. In severe cases, there may be insomnia, loss of appetite, low blood pressure, palpitation of the heart, glandular disorders, hysteria, all forms of hysterical paralyses, impotence, craving for stimulants and narcotics, speech defects and a thousand and one other symptoms following in the wake of a disturbed sympathetic nervous system. The causes of the trouble are repressed and pent-up emotions in the subconscious, causing a constant conflict between two separate parts of one's personality. In other words the subconscious is in a state of rebellion, and disrupts the mechanisms of the entire physical and mental commonwealth.

The cure of this miserable situation is usually found to be a complicated and difficult problem. The problem must be approached cautiously. The objective of any and all treatments should be to end the inner conflict, release pent-up emotions and devise ways and means to still and relieve and divert unsatisfied cravings. As stated before, the "wound" is situated in the subconscious mind. The patient's conscious mind, therefore, must be extended to beyond its ordinary boundaries until that which existed independently in the subconscious is joined to and made part of the conscious. This is the first stepping stone toward a cure and can be accomplished with the aid of a hypnotic suggestion, free association, or solving the code messages to the conscious by way of dreams. The patient's discovery of the fundamental cause and nature of his disorder relieves or at least allays some of the anxiety and fears that torment him. Faith in himself and self-confidence is partly restored. Hope is re-awakened and the natural enthusiasm that follows is a valuable factor in promoting further improvement by becoming a powerful and constant auto-suggestion.

Another element that has to be combated is the fixation of emotional and mental habits. The patient must constantly exer-



cise his will and subject himself to strict discipline and self restraint.

At the commencement of the treatment the patient should be instructed and trained to apply self-analysis by means of free association. The procedure is as follows:

First comes the systematic tabulation of emotions, fears, cravings, inhibitions, repressions, likes and dislikes, subjective feelings, and any other symptom that the patient is aware of. He is instructed to select a quiet room where he is undisturbed, provide himself with a pad and pencil and jot down his symptoms, fears, desires, aspirations, disappointments, weaknesses. Each item is taken up one at a time and subjected to free association. It will be observed that occasionally some word, image, or idea may crop up, that acts as a barrier to further association. When this occurs, the word or sentence should be underlined with red ink as it leads to some repression or inhibition and part of some hidden complex. A separate list of words underlined with red ink is compiled.

The elements of the list are then compared with one another to determine the association relationship that connects them, to form a coherent idea that may restore to the memory some forgotten event that may be an important factor in the formation of the complex. At the termination of each sitting, which should last an hour, another list is compiled, each item underlined with a blue pencil. This list is to record all the facts and remembrances reclaimed and rediscovered and restored from the unconscious to the conscious.

A DAILY application of this routine for two or three weeks will unfold an amazing lot of material from the innermost depths of one's being. The information will be fully understood by the "self-analyst" in revealing the origin, nature, or cause of the trouble. As the analysis progresses, more and more paths will be opened up until the entire panorama of subconscious activity is unfolded. One thus comes face to face with his *other* self. With this realization comes a sense of power over the rebellious second ego. The mentality of the patient is broadened. Mental functions improve, enabling the creative urge to function unopposed.

The patient now discovers that his self confidence and faith in himself have been restored. He has become more receptive to wholesome constructive suggestions. His true character and personality unfolds itself in all its power and glory. The awakening of the new spirit leads to greater efficiency, better health, contentment, and happiness.

AMERICAN-JAPANESE RELATIONS

(*Continued from page* 73)

volve unjust sacrifices. It is well to consider here the words of J. O. P. Bland, that eminent British oracle on things Oriental. It is an anomaly, says he, for America, who had repudiated the League and the Versailles Treaty and had refused to bear the post-war burdens, to sponsor a parley where the United States reached a naval agreement with both Great Britain and Japan,

successfully dissolved the Anglo-Japanese Alliance, and substituted in its place the Nine Powers Treaty wherein American supremacy was tacitly acknowledged. Furthermore, in spite of the revelation of the infamous Li-Lobanov Treaty, Japan, instead of getting further concessions, actually returned Shantung to China.

Not only did Japan accept the results but in addition slashed the army considerably. Military and naval appropriations were curtailed. Yet the Japanese Empire has as neighbors the Soviet Union with its huge army and China in chaos with its 2,600,000 men in the recognized armies—two of the world's supreme enigmas.

These peaceful gestures did not get support from the outside powers. The United States Congress passed the Japanese Exclusion Law in 1924, giving what seemed to Japan a rank insult and which incidentally was a unilateral abrogation of the 1907 agreement. Few acts by foreign powers have hurt as much as this. Japan does not question the American right to restrict immigration. She asks only for equality. The question is not one of economics; on an equality basis, the maximum quota for Japan would have been but 187 per year, the insignificance of this quota removing the issue from such questions as those of labor standards. To the Japanese it is a matter of fundamental principle in the search for equality.

Within a few years, Congress passed the Hawley-Smoot Tariff. To Japan this was an economic blow. If foreign trade is valuable to America, to Japan it is imperative. Unlike this country, she has almost no iron or other necessary minerals. Her food supply is inadequate, since her population density is nearly 2800 per square mile of cultivated land.

TOWARDS China, for many years, says Hallet Abend, the China correspondent of *The New York Times*, the Japanese were patient and forbearing while "every effort was made to find a solution of the differences between the two countries by methods of fair and open negotiations." China itself frustrated these efforts, he concludes, by its disorder and disregard for Japanese rights. In Manchuria, War Lord Chang for years brought pressure to bear in order to "drive Japan to the sea." He was confident in the power of his huge army of 300,000 men. Even the Central Government, declares Dr. MacMurray, "has been refusing to be bound by any treaty that seemed to obstruct what she conceived to be her national destiny . . . and among them she thus denounced, in 1928, the basic treaties of friendship, establishment, and commerce between herself and Japan."

We can see clearly that liberalism, instead of receiving co-operation, was facing extreme difficulties from America due to lack of understanding and from China because of the flagrant treaty violations by the irresponsible Chinese war lords.

A consideration of the American-Japanese trade shows that the annual average between 1927 and 1930 was around 670,000,000 dollars. This is well above a third of the total American trade of 1,800,000,000 dollars with the Orient. America is by far the most valuable customer for Japan. More than 30 percent of the Japanese foreign trade is with this country while between 40 and 45 percent

of the total Japanese exports and about 95 percent of the raw silk exports are sold to the United States. When we remember how imperative foreign trade is to Japan, the extraordinary value of this country's good-will becomes evident. In turn, Japan is third only to Canada and the United Kingdom in commercial importance to this country.

Startling enough, Japan is a far larger American customer than "open door" China. The average American export to China from 1925 to 1930 inclusive was 106,556,000 dollars annually; the American exports to Japan for the same period averaged 243,318,000 dollars annually. In other words, Japan buys about 130 percent more than vast China. Furthermore, a part of the exports credited to China are for the Japanese enterprises in Manchuria. Even in China proper, about 40 percent of the total cotton import is for the Japanese mills in China. Similar statements could be made about many other items.

When these factors are considered, the value of Japanese trade to this country becomes clearer. Facts definitely show that the major items of mutual trade are supplementary. The largest exports of this country to Japan are cotton, iron and steel and sheet metal, machinery, oil, and timber. The main exports of Japan are silk, tea, porcelain, menthol, and camphor.

IT would seem that intelligence and understanding of Japan will be a great factor in assuring world peace. As a well known American writer recently said:

"A study of the American treatment of Japanese news reveals many things. It shows that although many of them are outspoken in their condemnation of Japanese militarism the American people are interested above all else in Japanese military activities. They have only a passing interest in the political, economic, and financial problems of Japan. Of Japanese social and cultural problems, the newspaper readers are permitted to learn nothing whatever."

Peace in the Pacific entails an understanding of the fundamental issues. Only in such an atmosphere of understanding can the Japanese liberals influence the public of that country. Ill-considered policies by America can only mean increased fears by the Japanese and lead them to the determination to assure themselves of positive sources of raw materials.

Since the Americans do not want to destroy Japan but rather want the benefits of the cultural and the commercial relations, common sense and co-operation are greater protection than provocations due to misunderstanding, or a show of force. A single small and frail Dwight Morrow in Mexico created a greater spirit of friendship for America than any show of force ever could have created. So in Japan, Townsend Harris, Guido Verbeck, and others did the most to increase American prestige.

Basically, security can come only when the standards of living of all are raised. This is possible only when the world works together, realizing that, even for their own selfish needs, the powers must help in order to bring the maximum of returns. This co-operation must be more than verbal; it must be economic, political, and cultural. The world looks to America, as the most powerful leader, for guidance and progress.

Books SELECTED BY THE EDITORS

THE SCIENCE OF HUMAN REPRODUCTION

By H. M. Parshley, Sc.D., Prof. Zoology, Smith College

THIS is a rather advanced scientific treatise on the biological aspects of sex, in contradistinction to the nowadays familiar books on the psychological aspects of the same subject. It explains, in more detail than any non-medical book we know of, the physiology of the mechanism of human reproduction: germ cells, sperms, eggs, fertilization, sex chromosome mechanism, the organs of reproduction, pregnancy, the life of the embryo, and so on. On account of the amount and depth of detail regarding the vital points contained in this book, it will appeal especially to mothers and fathers of better than average intelligence, and to others who wish to know quite precisely and seriously the whole physiological process of reproduction and development up to birth. This detail would probably bore readers of tabloid intelligence, who are usually content to acquire a vague superficial idea of the processes and let it go at that, but serious readers who can think and have something to think with will find it the answer to many questions which must have arisen in their minds. It is not, however, pedantic and stuffy. Quite the reverse, for the author has a fine command of good English. Also it is distinctly not one of a number of books, some of them scientific, some a bit silly, on the "art of love" which now fill bookstore windows. It also contains a long chapter on sex glands, a chapter on sex behavior, and a carefully selected bibliography of other books on cognate subjects. It has 305 pages and 66 anatomical drawings, some of which are better and more explanatory than any hitherto published. —$3.65 postpaid.—*A. G. I.*

AN INTRODUCTION TO GEOLOGY

By W. B. Scott, Ph.D., Sc.D., Princeton

FOR the past 36 years Scott's Geology has been a standard elementary textbook of this science and now its famous author has rewritten it throughout. Either as a source of authoritative knowledge of earth science or as a reference book this work is invaluable. It is in two volumes which may, if desired, be purchased separately. Of these the first, of 562 text pages, covers physical geology—minerals, rocks, volcanoes, geysers, earthquakes, rivers, snow and ice, ore deposits and various other geological agencies and phenomena; in short, it gives the groundwork of the science. The second volume of 435 pages covers historical geology from the original earth to our own times, dealing separately with each geologic time period. Both volumes are unusually well illustrated and make good reading. Geology is an easy subject to comprehend.—Volume 1, $3.70, postpaid. —Volume 2, $3.20, postpaid.—*A. G. I.*

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THE former Chief of the U. S. Army Air Corps reviews the whole advance in an interesting, simple, and practical way.—$1.10 postpaid.

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By Maj. General George O. Squier (Ret.)

THIS famous inventor describes how the entire science of communication has been built up on a few fundamental facts. Naturally the Signal Corps in peace and war gets due credit.—$1.10 postpaid.

SPARKS FROM THE ELECTRODE

By C. L. Mantell, Ph. D.

A DESCRIPTION of the growth of the electro-chemical industries, how the metals are refined, how electroplating has assumed such large proportions, how we can make substances harder than nature can make them, and how we prevent corrosion.—$1.10 postpaid.

LIFE-GIVING LIGHT

By Charles Sheard, Prof. Biological Research, Mayo Clinic

LIGHT and life and their intimate relationship from candles to sunlight are entertainingly considered from a scientific background which is most humanistic.—$1.10 postpaid.

THE STORY OF EARTH AND SKY

By Carleton and Heluiz Washburne, with Frederick Reed

IF you have a son or daughter, aged 10 or more, whom you would like to interest in science, we heartily recommend this book for that purpose. It deals with earth history and astronomical science, and is a rare combination of interest, real adaptation to the juvenile mind, and perfectly authentic science. Here are some of its chapter heads: The Earth is Formed; Life; Animals Begin to Live on Land; The Age of Furry Animals; Creeping Ice; A Boy of Long Ago; Hunting the Saber-tooth Tiger; Why No One Lives on Mercury; An Imaginary Trip to Mars; Stories from the Sky. Children would like this book (incidentally, so would you). After devouring its contents, J. V. I., aged 10, wrote: " 'The Story of Earth and Sky' is very interesting. Children can understand the words—they are not ten miles long. The chapters about stars are very interesting. I am sure other people will enjoy this book as much as I did."—$3.70 postpaid.—*A. G. I.*

COMMERCIAL PROPERTY NEWS

Conducted by SYLVESTER J. LIDDY
Member of the New York Bar

Medical Patents Scored

THE possibility of too widespread a use of patents for their products by commercial research laboratories working in the medical field was criticized recently by Sir Henry H. Dale, director of the National Institute of Medical Research in London and secretary of the Royal Society of London, in an address at the opening of the new research laboratories of Merck & Co., manufacturing chemists.

Sir Henry said that too widespread a use of patents by drug concerns supporting laboratories injured the medical tradition whereby new knowledge is placed at the disposal of the profession.

In discussing commercial laboratories, however, he said that biological or natural discoveries, and invention of synthetic substances, should be distinguished one from the other.

"If the industry of any country tells me that it can only promote research, and apply its results in this synthetic field of therapeutic invention, by the use of patents, it is not for me to contest the statement," Sir Henry said. "But I am certain that patents in the medical field will do no service even to industry unless they are so used that they serve also the great medical tradition, so that industry wins and retains the confidence of the academic laboratories and the clinics."

Shirts in Trade

THE Federal Trade Commission has ordered Madison Mills, Inc., New York, dealers in men's shirts and other wearing apparel, to discontinue describing goods made of cotton with rayon stripes or ribs by use of phrases containing the word "Satin" without the proper qualifications.

The company is also to cease using on swatch cards, labels, or in advertising, in connection with the sale of shirts or other wearing apparel composed of cotton, the words "Normandy Flannel" or the word "Flannel." The term "Normandy Flannel," a combination of the name of a wool fabric and the name of a section in France noted for producing such fabric, was held to be misleading and deceptive.

Movie Film Misrepresentation

THE Federal Trade Commission has ordered Congo Pictures, Ltd., Los Angeles, producers of the film called "Ingagi," to cease representation of a motion picture film as a true and authentic record of an expedition in Africa, or any other country, unless all the scenes of such film were actually made in Africa, or such other country.

Advertising erroneously that all scenes incorporated in a motion picture film of travel in Africa, or any other country, are pictures actually taken in Africa, or such other country, or that a film is a true representation of habits and customs of races, tribes or communities of human beings, when in fact such picture is entirely fictional, is also ordered to be discontinued.

An animal proclaimed to be "new to science" and designated in the film as "Tortadillo," because of its resemblance to a tortoise and an armadillo, was a turtle with wings, scales and a long tail glued on to it, while the so-called "pygmies" said to be shown in their native environment were not pygmies at all, but colored children of from five to ten years of age living in Los Angeles.

A lion shown in the film as attacking a camera man and being killed was a trained lion in Hollywood, often used in moving pictures. Many jungle scenes of the film were taken in a Los Angeles zoo.

While the word "Ingagi" was represented as meaning gorilla in the African language, it was found that there was no such word in any written dictionary of any African language, the word for "gorilla" as given in such dictionary being entirely different from the word "Ingagi."

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.

Necktie Producers to Protect Designs

TO discourage the growing practice of imitating the novelties put out by its members and be able to take legal action against manufacturers who appropriate for themselves and exploit the mental property of others, the German Necktie Material Manufacturers Association decided to bring about compulsory legal protection for designs of all its members' products.

All new samples will invariably be introduced by the association, which will, if necessary, legally prosecute claims of its members arising out of violations of the provisions relating to protection of sample designs.

The association also hopes, by means of these measures, to be able effectively to fulfill the desires of its members' customers for protection of the novelties bought by them.—*Department of Commerce.*

Cigar Contents

MISREPRESENTATIONS in descriptions of cigars offered for sale are to be discontinued by Fleck Cigar Company, Reading, Pennsylvania, cigar manufacturers and dealers, according to an order of the Federal Trade Commission which directs that company to cease using the word "Cuba" in the brand name "Rose-O-Cuba" for cigars which do not contain substantial amounts of Cuban tobacco.

Exception is made in instances where the brand name is immediately accompanied by words clearly showing that the cigars do not contain Cuban tobacco, or are composed entirely of tobacco none of which has been grown in Cuba.

Advertising or labeling cigars with the words "Havana" or "Habana" or other words implying that they are composed of Havana or Cuban tobacco, if and when they are not composed wholly of such tobacco, is also prohibited in the Commission's order.

The company is also to cease applying to cigars sold by it any other name or designation which would erroneously imply that they contain Havana or Cuban tobacco.

Olive Oil

UNDER the name of Venice Importing Co., Morris Heller, Brooklyn, distributes olive oil to retail grocery dealers in several states. He has been ordered by the Federal Trade Commission to cease using in connection with the sale of olive oil such statements as "Imported From Lucca, Italy" and "Importato de Lucca, Italia," unless or until his olive oil is in fact imported from Lucca, Italy.

The Commission found Heller's use of the foregoing phrases false and misleading and tending to mislead retail grocery dealers into purchasing his olive oil in the erroneous belief that it was imported from Italy. It was not so imported and had no Italian origin.

Lucca, Italy, is one of the largest olive oil centers in the world. Olive oil produced there has become known for its fine quality and delicate flavor.

Invention

IT is elementary that invention may reside in a combination of elements all of which were theretofore separately old in the art, but, in order to sustain such a combination, it is equally clear that the inventor must have done more than make a judicious selection from the devices of a prior art, each designed and utilized to accomplish its individual purpose at a time and in a place where such function is necessary for the operation of the whole. This is but the exercise of the mechanical ability reasonably to be expected in the development of the art, and has repeatedly been held insufficient to evidence invention, whether such decision be placed upon the ground of aggregation or upon the lack of an exercise of the inventive faculty.—Quoted from Newcomb v. Mahon (C. C. A. 6) 425 O. G. 215, in *Journal of the Patent Office Society.*

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