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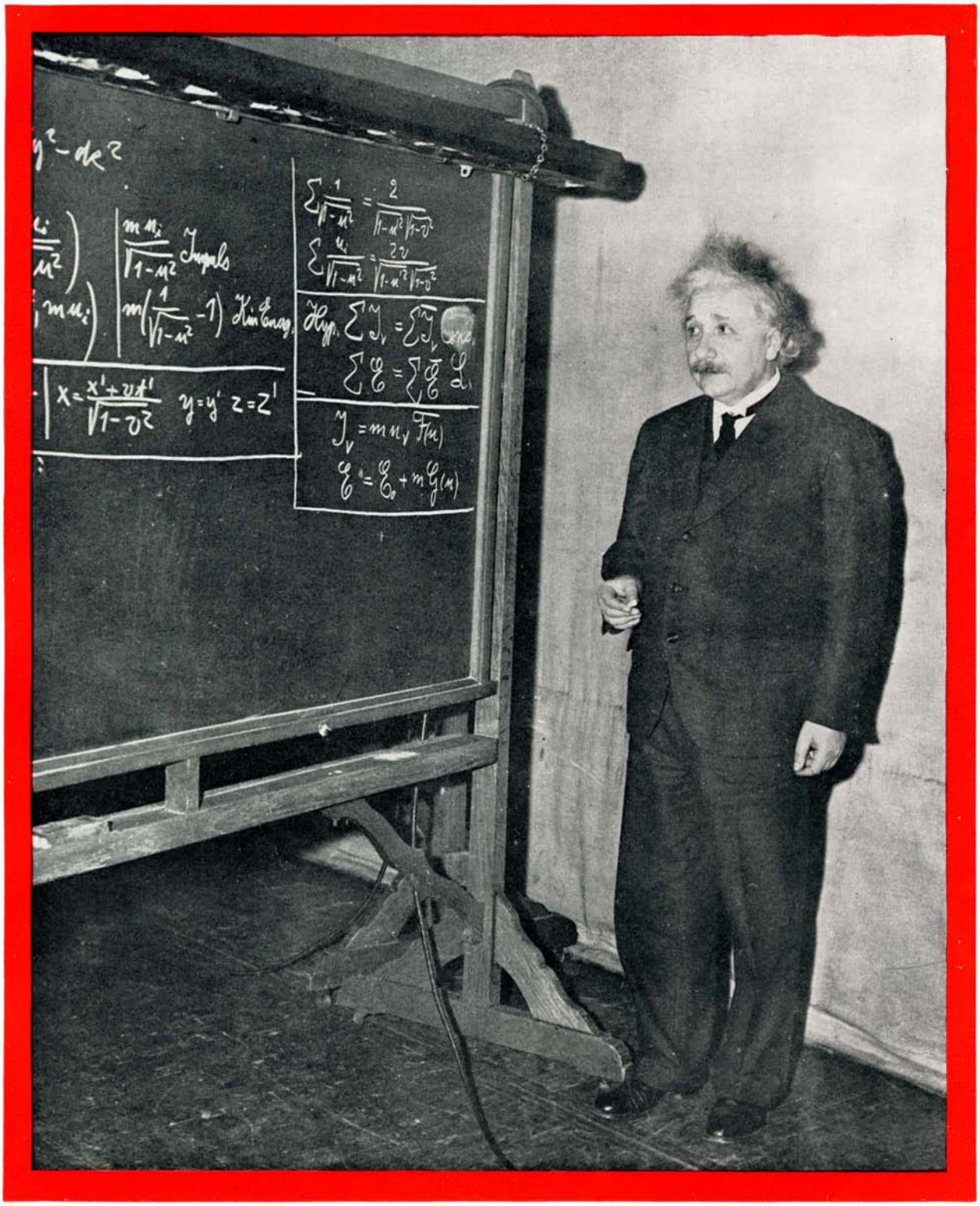

Einstein Proving the Principle of Equivalence (See page 113)

VOLUME 152
NUMBER 3

THE ODDEST THING ABOUT THE JEWS

MARCH 1935
35c A COPY

Dear Editor—I Want to Know—

A COMPOSITE OF SUBSCRIBERS' LETTERS

EVERY business day the postman brings letters in large numbers to the desks of the Editors of SCIENTIFIC AMERICAN. The range and diversity of the inquiries on every phase and subject of Science and Invention is a revelation of far-reaching influence and a startling testimonial of the confidence of the readers in the Research and Service facilities of SCIENTIFIC AMERICAN.

IN HARMONY with the new American spirit SCIENTIFIC AMERICAN is marching steadily forward, enriching the lives of an ever-increasing number of worthwhile people in their vocations and avocations.

DEAR EDITOR: Referring to 99.92 percent pure iron mentioned in January 1935 issue, put us in touch with the makers.—R. H. C., Chicago. . . . Your article on plastics encourages me to attempt a development I've had in mind for a very long period. Will you give me the following additional information?—E.H.R., Lake Bluff, Ill. . . . In my work as a sculptor I use a great many moulds, etc., what I want is a plastic material, etc.—C.A.S., Pasadena, Calif. . . . Can you supply me with information on the making of telescopes from an amateur's point of view?—J.W.L., Columbus, Ohio. . . . Can you give me any information on how to take pictures through a microscope?—T.P.H. Jr., Syracuse, N. Y. . . . Please give me whatever information you can on Kitteridge and his associates, authors of the "New Metal Worker Pattern Book,"—R.R.K., West Point, Neb. . . . Once more I call for your help, etc., please mail me address of the "Weston Exposure Meter" described in the March, 1934 issue.—M.A.L., Singosari, Netherlands East Indies. . . . Please let us know the address of the manufacturers of Bath Room Equipment described on page 213, October issue.—V.R.C.G.C.&Co., Madras, India. . . . Please advise if the Great Chalice of Antioch, exhibited at the Century of Progress in Chicago, has been pronounced by best authorities to be the real Holy Grail.—H.M.J., Central City, Neb.

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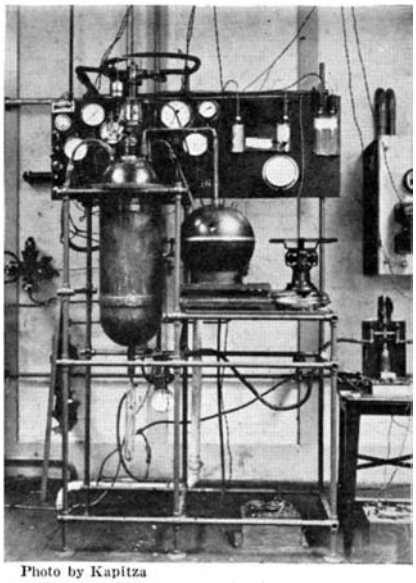
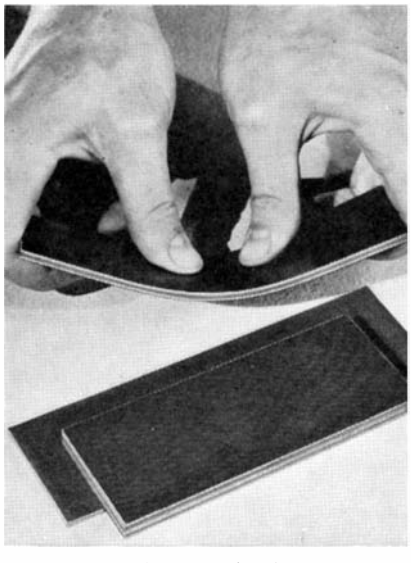
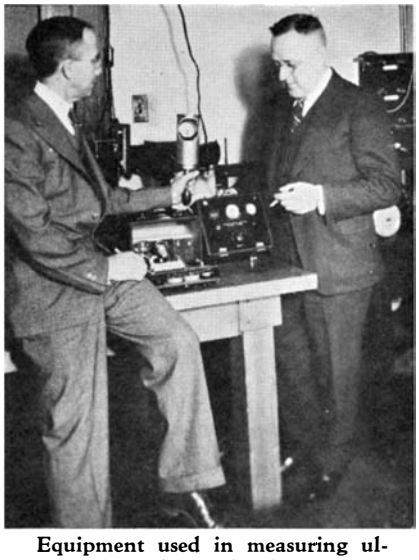


Photo by Kapitza

The apparatus which Professor Kapitza uses for liquefying helium



Bakelite "sandwiches"



Equipment used in measuring ultra-violet radiation by the "cupful"

SCIENTIFIC AMERICAN

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NINETY-FIRST YEAR • ORSON D. MUNN, Editor

The SCIENTIFIC AMERICAN DIGEST

CONTENTS · MARCH · 1935

COVER

BEFORE the American Mathematical Society and the American Association for the Advancement of Science, in a meeting at Pittsburgh, Professor Einstein recently attempted to prove a problem which has occupied his part-time thoughts since it arose in 1905, as a result of his special theory of relativity—that of the equivalence of energy and inertial mass. This problem throws light on the physics of atomic nuclei and provides a useful tool of research.

SCIENTIFIC AMERICAN, March, 1935. Vol. No. 152, No. 3, entered at the New York, N. Y. Post Office as second class matter June 28, 1879, under the act of March 3rd. 1879; additional entry at Greenwich, Conn. Published monthly by Munn & Company, Inc., 24 West 40th Street, New York City.

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ACROSS THE EDITOR'S DESK

THE fact that railroad transportation equipment is at the present moment in a state of flux is obvious even to the most casual observer. Will railroad motive power of the future be steam, electric, or Diesel-electric? In order to present to our readers these three sides of this intriguing question, we have made arrangements for the publication of three articles, the first of which will appear in the April issue. William C. Dickerman, President of the American Locomotive Company, who prepared this article, says: "We have long been equipped, not only on the manufacturing but also on the research and designing sides, to supply all the power needs of our customers, whether they be for steam, electric, or Diesel-electric units. Therefore . . . possibly I can be objective in discussing railroad power problems." The information given in these coming articles will furnish a source of data which will permit the reader to view the problems of the railroad from an unbiased standpoint.

●

"STRANGE as it may seem, the insane, of all people, are sane . . ." says Professor G. H. Estabrooks, of Colgate University, writing for the April issue under the title "The Sanity of Insanity, or the Insanity of Sanity." Just what constitutes sanity and what constitutes insanity? The minds of the insane work the same as our own, only more so—or less so. Again to quote Professor Estabrooks: "In the following pages you will see yourself in one of those funny circus mirrors. It may distort or exaggerate but through it all you will recognize the original of the caricature. There, but for the grace of God, go I . . ."

●

PAINT—and this word covers a multitude of products which are used for an equally large number of purposes—is undergoing a tremendous development which will have a direct bearing on the lives of everyone. A broad yet comprehensive article on the subject of paint, written by Philip H. Smith, who has prepared many of the fine industrial articles which have appeared in these pages during the past few months, will be the next in our series dealing with general housing conditions, the first of which appears on page 140 of this issue. Mr. Smith has made a careful and intensive study of paints, their compositions, their uses, and the many improvements which science has made in paints recently. Out of the wealth of material so obtained he has built an article to be published next month which will carry home to every reader the vital necessity for the proper use of the proper paint in the proper place.

COMING

¶ "There's Life in the Old Iron Horse," by William C. Dickerman, President of the American Locomotive Company.

¶ "The Sanity of Insanity, or the Insanity of Sanity," by G. H. Estabrooks, Professor of Psychology at Colgate University.

¶ Paint: An up-to-the-minute survey of paint and its uses, by Philip H. Smith.

¶ The construction of the Grand Coulee Dam in the state of Washington.

¶ A glimpse behind the scenes with the "ad" photographer, by Jacob Deschin.

¶ "Flying High for Comfort," by Reginald M. Cleveland.

●

CENTURIES ago there was a huge dam on the same spot where engineers are now working on the construction of the Grand Coulee Dam, 92 miles west of Spokane, Washington. The original dam, however, was not an engineer's product. A huge glacier descending from the north reached the bed of the Columbia River and dammed it. The result was the formation of an extensive valley which by the hand of man will soon become a vast reservoir in which will be stored the impounded waters of the Columbia River. The new dam which will do this work will be constructed in two units—high and low dams—and will be described in an article to appear next month.

●

"BORROWING a trick or two from the movies and adding a few of their own, modern commercial photographers are daily turning out pictorial miracles undreamed of a few years ago. These arresting advertising illustrations . . . bring these magicians of the sensitized celluloid or glass as much as 500 or 1000 dollars for a single picture. . . ." Thus is introduced an article by Jacob Deschin, which in an early issue will take the reader behind the scenes with the "ad" photographers and tell him something of the ingenious development work which has been done to bring the art of commercial photography to its present stage. Those who have followed our articles on photography for the advanced amateur will find here many hints that can be applied to their own work.

●

MUCH has been written about the possibilities of flight in the stratosphere and of the increased efficiency which may be expected when this stage has been reached in the development of aviation. As yet, however, the true stratosphere plane for transport work has not been developed; nevertheless, airline operators are sending their huge planes into altitudes often as great as 20,000 feet. Only a year or two ago such altitudes would have been considered as no place for a passenger plane except when necessary to hurdle a mountain range. Just why this important change in flying operations has taken place and what technical developments have made it possible is told in an article entitled "Flying High for Comfort," by Reginald M. Cleveland—coming soon.

Orson D. Munn

Editor and Publisher

Books SELECTED BY THE EDITORS

LAST OF THE WIND SHIPS

By Alan J. Villiers

THE romance of the square-rigged ship will undoubtedly persist long after the last of them has passed from active duty, and that period of time will probably not be in the far distant future; although in 1921 there were 304 sailing ships officially listed as visiting Australia, the number dropped to 138 in 1922. At the present time it has decreased to 21. Because of the rapidly dwindling numbers of these picturesque vessels, the present book, "the swan song of sail," stands as a memento of the days when sailing ships carried the commerce of the world. The present book deals almost exclusively with the voyage of the *Parma* from Australia to England with a cargo of grain. The first part of the book is devoted to the story of the voyage and to it are appended several tables giving the records of sailing ships in and out of active service. The last part of the book is by far the most interesting, consisting of a series of 208 photographs taken during the voyage and beautifully reproduced on heavy coated stock. These photographs with their short captions tell a running story that will capture the reader completely. The tang of salt air hovers over the entire volume.—$4.25 postpaid.—*A. P. P.*

GENERAL SHORT-WAVE AND PUBLIC ADDRESS MANUAL

By Sydney Bass and Herman Cosman

A COMPILATION of short articles, together with numerous tables and charts, makes this book of great value to short-wave radio experimenters. The articles deal with definite design and construction of all types of short-wave radio receivers and both simple and complex transmitters. Public address systems—high-powered amplifiers and loud speakers—are also dealt with, making a well-rounded presentation. In the front of the book are tube charts and base diagrams as well as listings of short-wave stations throughout the world.—50 cents postpaid.—*A. P. P.*

WEBSTER'S NEW INTERNATIONAL DICTIONARY (*Second Edition*)

HERE is a book so monumental in size and scope that it is impossible for the reviewer to do much more than quote statistics. The publishers of this revised unabridged dictionary call it the greatest single volume ever published and it certainly appears to warrant that description. In the regular edition it is 9¾ by 12¼ by 5 inches thick. It contains 600,000 entries, with 12,000 of the terms illustrated. There are 3300 pages, many in colors and half-tone. The cost of this volume is estimated to have been one million three hundred thousand dollars. A corps of experts drawn from various fields constituted the editorial staff. Incidentally, one of the illustrators is J. F. Odenbach, whose work has appeared from time to time in SCIENTIFIC AMERICAN. Regular style, in buff buckram binding, indexed.—$21.00 postpaid.—*A. P. P.*

FISHING A TROUT STREAM

By Eugene V. Connett

A NOVEL approach to the esoteric art of luring the wily trout with a fly has been worked out by this author. Mr. Connett, a trout fisherman of no ordinary ability, spent considerable time with a photographer along one of his favorite streams, and the result is a collection of 94 beautiful illustrations which practically take the reader by the hand and show him exactly where to lay his fly with the greatest expectation of results. The photographs are accompanied by short paragraphs giving necessary explanatory notes. The library of a dyed-in-the-wool trout fisherman will forever be incomplete if it does not include a copy of this book. —$7.70 postpaid.—*A. P. P.*

BIRTH CONTROL—ITS USE AND MISUSE

By Dorothy Dunbar Bromley

THE introduction to this book is contributed by the widely known gynecologist Dr. Robert Laton Dickinson who characterizes it as the first volume to cover the whole subject of birth control for the general public. "I know of no other volume," he writes, "available to the general public and couched in terms it can understand, which covers anything like as much ground as this." Various chapters treat the spacing of children, abstinence, the "safe period," popular fallacies, dangerous drugs and devices, advertised methods, selected methods, sterilization, clinics, sterility, and so on. "The purpose of this book," says the author, "is to summarize and interpret for the lay reader the authoritative medical findings regarding contraception and its allied problems." After reading this volume we consider that it accomplishes that purpose and is an excellent scientific book.—$2.70 postpaid.—*A. G. I.*

AUDELS MATHEMATICS AND CALCULATIONS FOR MECHANICS

By Frank D. Graham, M. E., E. E.

THIS is a 245 page pocket reference book for intelligent workmen and others who wish to learn arithmetic, plane, solid and descriptive geometry, algebra, trigonometry, and the calculus. The book claims to render these subjects "easy"; doubtless meaning relatively easy, since mathematics is not easy but requires hard labor. The second half of the book is devoted to electrical and mechanical calculations and from end to end it is a *practical* book, for the practical man.—$2.00 postpaid.—*A. G. I.*

THE ODYSSEY OF HOMER

Translated by T. E. Shaw (Lawrence of Arabia)

THE translator modestly says: "The 28th English rendering of the Odyssey can hardly be a literary event, especially when it aims to be essentially a straightforward translation." We disagree. Its straightforwardness should make it the more acceptable to those who see therein both the honesty and genius which we saw in our first delighted reading. Dr. Henry S. Canby has said of this fascinating "oldest book out of Europe worth reading for its story": "I recommend for everybody over 12 Lawrence's Odyssey." This translation was widely acclaimed when first published in 1932, and it is expected that this new popular edition will achieve a wide renown.—$1.90 postpaid.—*F. D. M.*

THE COSMIC CYCLE

By Max Waldemar Kurniker

THOSE who rebel against what they call "orthodox" science should procure this book, which is stuffed with unorthodox hypotheses about the origin of the sun and planets and the behavior of the moon, together with a whole bandwagon load of other things. It is said to be the presentation in English of a hypothesis known in Germany as "Hoer-

(*Please turn to page* 167)

HARVESTING AMERICAN-GROWN RUBBER IN CALIFORNIA

GUAYULE, a domesticated wild desert shrub which yields 15 to 19 percent rubber, is harvested at Salinas, California, by a subsidiary of the Intercontinental Rubber Company, which employs tractors for drawing diggers that uproot the plants. After drying in the sun these plants are picked up by another tractor-drawn machine (shown above) which feeds them into a cutter, chops them into pieces and blows these pieces through the arched conduit shown, into a trailing truck. At the mill the chopped plants are fed through rotating tube mills containing flint pebbles. This releases the rubber.

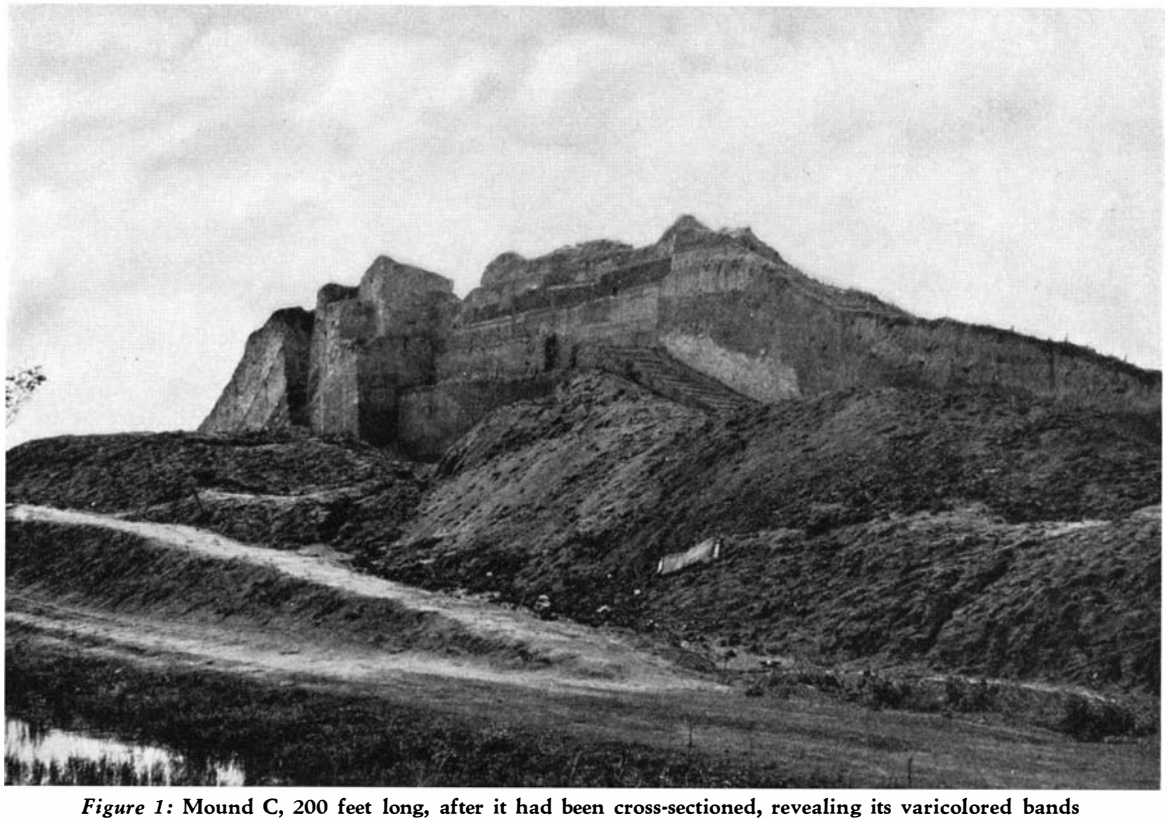


Figure 1: **Mound C, 200 feet long, after it had been cross-sectioned, revealing its varicolored bands**

EXPLORING PREHISTORIC GEORGIA

The Largest Archeological Expedition Yet Undertaken In America Has Yielded Remarkable Results on a Site Later to be Opened To Visitors as a National Monument

By A. R. KELLY, A.M., Ph.D.

(*Part 1*)

IN December, 1933, many different types of work projects were undertaken under the auspices of the CWA to provide jobs for the millions of unemployed men in the United States. The national economic crisis created a situation and set up the machinery by which it was possible to carry on large-scale archeological explorations hitherto beyond the means of even the most heavily endowed scientific institutions.

The Smithsonian Institution at Washington sponsored five expeditions to do archeological exploration under CWA auspices. With one exception all of the projects were located in the southeastern United States, an area known to be rich in archeological sites and remains, comparatively unexplored, and unknown to students of American prehistory.

In central Georgia, near the city of Macon, east of the Ocmulgee River (map, page 121) and continuing southward downstream, were located several large Indian mounds and numerous indications, in exposed surface deposits of midden materials and pottery, that the region had once been densely populated by aboriginal Americans.

EARLY history yielded excellent documentary evidence to the effect that "Old Ocmulgee Fields," as the location was called by 18th Century commentators, had been the site of an important Creek Indian settlement, the probable center or capital of the famous Creek Confederacy. The epic recital of tribal beginnings and migrations, as given in the origin myths obtained from Indian informants living within the period of white contact, implied that here had been the land of Canaan to the ancestors of the Creeks after they had completed their long trek from some obscure quarter "to the west." In the fertile plains of the Ocmulgee, close to the point where the river broke through the foothills of the piedmont belt to continue eastward to the coast, the ancestral tribesmen "sat down," dispossessing and partially absorbing an earlier Indian population already settled upon the land.

Ethnological reconstruction from Indian lore and the testimony of early European observers serve to give only a vague perception of the tribes found by the first comers among the Creeks

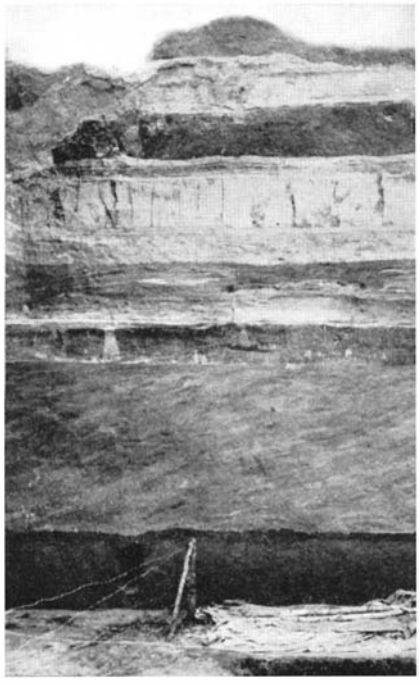


Figure 2: **A closer view of the several bands shown in Figure 1. These were deposited by Indians**

of the Ocmulgee-Oconee River basin.

No very definite idea of time intervals can be ascribed to the events recorded in folk memory. It is enough at present to indicate that the waves of tribal migration resulting in the ultimate preempting of the Ocmulgee territory by the Creeks took place some time before the coming of the white colonists.

The first European settlers found two dominant tribal groups peopling what is now the southeastern United States: to the north of the area were the Cherokees; to the south were the various tribes bound together in a loose political confederation to form the Creek Nation.

THESE two groups held the territory and barred the western passage to the encroachments of the white colonists. They held the piedmont region beyond the coast, and for over a century were the real balance of power in the struggles of the English, the Spanish, and the French to gain possession of the land.

Scientific examination of the existing data led to the conclusion that neither the Cherokees nor the Creeks were the autochthonous population in the area. Language and certain vital elements in the culture of the Cherokees are derived from the parent Iroquoian branch in the northeastern woodland region; the Cherokees are an isolated offshoot who migrated to the south, and were later separated from their Iroquoian kinsmen by the surrounding wall of unrelated tribes.

The Creeks were combined with many other tribes in the southeast, grouped on the basis of linguistic relationships under a large parent family language known to us as the Muskogean. There are indications that culturally the various tribes were most dissimilar. Perhaps some of the more divergent peoples were completely alien elements, absorbed and adopted into the growing nation, as the Creeks grew in numbers with each succeeding wave of migration.

The crux of the archeological question presented to the expedition directors sent to explore the mounds and village sites near Macon revolved about the identification of the historic remains, and the relation of these settlements to possibly older occupation levels belonging to an earlier people present on the Ocmulgee before the coming of the Creeks.

Hypothetically, these older inhabitants might have been the little known Hichiti, some remnants of whom had remained on the Ocmulgee site until 1715 when the removal necessitated by the encroachments of white colonists led to a general hegira to the Chattahoochee and the swamps to the south.

On the other hand it was conceivable that the various tribes had converged upon the Oconee and Ocmulgee rivers over a longer period of time; that the migration was more a slow process of infiltration of numerous populations dislocated to the west and northwest, and pressed south in scattered bands upon one another. Cultural and linguistic integration proceeded slowly. The Creeks emerged in historic times as the dominant group, after a long proto-historic, possibly quite prehistoric, interval in which the diverse tribal cultures went through a "melting pot" process. In other words, older stratigraphic levels of occupation, if present, might belong to ancestral stems of historic surviving tribes. The term, "proto-Muskogean," serves in a rough way to indicate the potentialities involved in this assumption.

Figure 3: **The 14-step, clay-moulded stairway at Mound C**

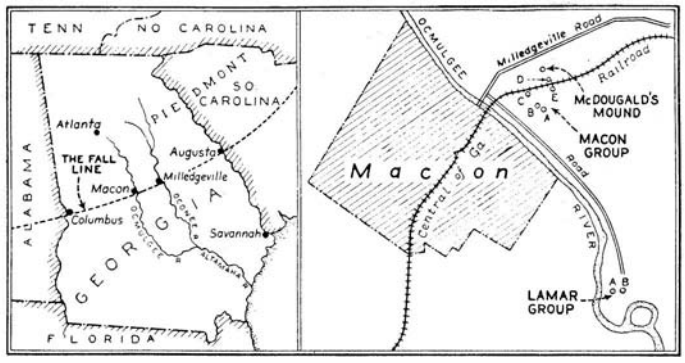
THE geographic setting of the Macon site is important in understanding the implications of discoveries made during the last seven months of archeological exploration. Briefly, it will suffice to indicate that the Oconee and Ocmulgee rivers are twin tributaries or forks of the Altamaha, which carries on to the Georgia coast. Both rivers rise in the highland interior of central Georgia and break through the hilly frontier of the piedmont within 35 miles of each other. Milledgeville, on the Oconee, has Old Oconee Town and Rock Landing as surviving landmarks, reminiscent of the time when this site served as an important transhipment and portage point in the coast hinterland traffic of aboriginal days. Columbus, on the Chattahoochee, and Augusta on the Savannah River to the east, complete the circuit of strategic points in Georgia located on the fall line dividing the piedmont from the coastal plain. It is significant that each was an important center of population and trade in historic Indian times. It would seem that the same geographic factors which have led to the development of thriving industrial and commercial centers today operated in the flux of moving tribes and primitive barter 200 years or so ago.

A series of bluffs, flat and extensive on top to give a plateau character, encircle the meandering course of the Ocmulgee River east of Macon. Approximately one square mile of territory is covered by the habitable area on top of the bluffs. This plateau has been cut into three segments by two railroad excavations of the Central of Georgia railroad. The underlying geological formation shows strikingly in the cuts and deeply eroded sides as a dark, reddish-brown clay loam, hardening to a stony consistency under weathering.

Upon the table land expanse of these bluffs are located five mounds, three of which have been at least partially explored by the present field party operating at Macon. Reference will be made to discoveries at Mound A (see map), a huge pyramid with a flat, truncated summit, extending 45 feet above the natural terrain. Mound B, immediately adjacent to the large pyramid, is much

smaller, only 12 feet above the plateau floor and almost completely destroyed by one of the railroad excavations through the plateau. Mound D, at the northern end of the escarpment, had produced perhaps the most interesting developments on the bluffs east of Macon.

On the east side of the river, between the plateau and the Ocmulgee river, located on a smaller rise or secondary terrace not topographically related to the plateau, is the site of Mound C, the most unusual mound structure in the Macon mound group.



An orientation map showing entities named in the text. Readers may visit the site now, although its formal opening will not take place for several years

SOUTH and east, following the winding course of the Ocmulgee, at a distance of two and a half miles from Macon, the river plain broadens to a span of five miles or more. The terraces and hills no longer overhang the margins of the stream. The area is subject to periodic overflow. Reeds and swamp growth impede the movement of the turgid waters over low-lying flat river bottom. Here is the site of the Lamar mounds (map) and the extensive village remains with numerous house rings extending between the two higher mounds. These people were swamp dwellers, their houses built upon artificially constructed hillocks to escape the inundation of a swollen river. It would be difficult to imagine a more different environment, a more contrasting mode of life, than that which confronted the respective villagers of swamp and plateau.

For seven months, first under CWA auspices, then under a reorganized FERA authority, the field expedition has proceeded with the archeological exploration of the mounds and village site mantling the east plateau; also with Mound C, almost within the suburbs of Macon, and the Lamar village site in the swamps southeast along the Ocmulgee. Three hundred and sixty men were engaged in the work at the peak of activity. A specially trained corps of 45 CWA workmen, selected from the higher professional groups, were trained for three months in an archeological night school to fit them for supervisory duties as trowelmen, engineering assistants, laboratory technicians, and foremen of excavations.

Sight of such a large force of men was rather dismaying to the scientific directors of the project. Ordinarily, archeological field parties, even when rather large and well appointed, do not run over 30 men, including supervisory staff. That is, of course, in the mound areas of the United States; in Mexico or the Near East, larger crews of native laborers might be employed. However, the archeological school proved effective beyond the hopes of the directors. The men, nearly all formerly high-salaried executives in business or the professions, were intensely interested in the work. The writer of this article, who conducted the class, has never seen such diligent application to study, such earnest effort to learn, in any university student body. They became so proficient in their special tasks that they might now serve as trained artisans without further instruction on any normally constituted archeological field party.

Work began with two full-fledged field parties in action at two main sites, the Lamar mounds and village, and Mound C. Archeological discoveries of primary importance came thick and fast.

Mound C (Figure 1, Figure 2) of the Macon mound group had been partially destroyed, about three fifths of the north section having been cut away in 1843 when the Central of Georgia railroad cut a right of way through the plateau. A remnant structure stood as a shell towering above the terrace, the stratified clays and basket-laid sand of the mound defying the ravages of time and the elements. Slump earth in the old railway cut had formed a mound talus mantling the north side of the mound. Human bones, beads, pottery, copper and stone artifacts, invited the pothunters and relic collectors to surreptitious digging into the exposed face.

Figure 4: **A skeleton (bottom, center) left in place with the surrounding earth cut away, leaving it on a raised platform**

In three weeks workmen had cleared the talus slope of all slump material and had cut a scarred cross-section through the longitudinal axis of the mound. Archeological trenching, with straight, vertical profiles neatly dressed, brought out in sharp relief the remarkable schematic arrangement of multicolored sands and stratified clay bands which marked the complex composition of Mound C.

Mound C was found to be unique. A large, conical, truncate structure, 30 feet high, over 200 feet long, the mound in cross-section showed four series of banded clays, each of different color, consistency, and thickness and each marking the summit of an earlier unit of mound construction. In short, there were really four, possibly five, mounds to be made out in the cross-section through Mound C. Each mound was finally determined to be conical in shape, with a flat, truncated summit, mantled with clay 12 to 14 inches in thickness. The lowest clay summit band was slate blue in color, the second and third were yellowish in tinge, the fourth was a brilliant red three feet in thickness, the topmost mantle was an orange red varying several shades from the bright crimson of the underlying band. Four to nine feet of basket-laid mound earth and various-colored sands, constituted the body of the mounds beneath the clay caps.

Between the second and third mound summits a uniform stratum of water-laid sand a foot in thickness confronted the archeologists with an unusual situa-

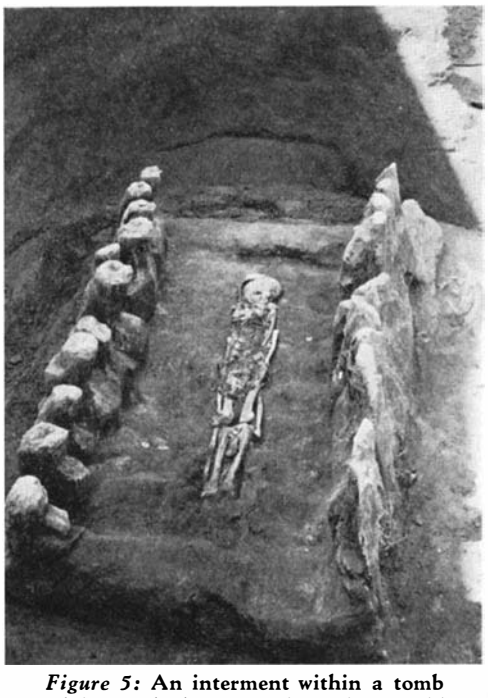


Figure 5: **An interment within a tomb of logs, which exist only as log-mould**

tion, a problem in primitive engineering. For how could sand have been deposited in running water on the level top of a mound constructed upon a natural terrace which drained sharply downward on all sides toward the river? Water will not run uphill, and not in any recent geological time had the land been high enough around Mound C terrace to allow for sandy depositions on mound tops.

THE tentative suggestion made at the time the water-laid sand on top of Mound C was discovered was that the Indian architects had carried considerable quantities of river sand in baskets to the summit of the mound where it was dumped irregularly over the clay mantle. A raised lip or flange of basket-laid clay projected above the shoulders of the mound, forming a round dike on the summit in which to impound rain waters. Heavy rain fell. The sand was gathered up in rapidly developing freshets, the water seeking lower levels where the summit construction was uneven. As the running water found a natural level the sand was deposited. Gradually the smooth, level floor grew over the surface of the mound within the dike construction. Then another clay band was built over the water-laid sand.

Mounds of multiple or composite construction are not unknown, but a mound composed of four or five unit structures contained within is something new in archeology. In Mound C, the marked selection of different colored sands and clays, schematically arranged in serial bands, mantling summit and slopes of the conical truncate mounds, implies a deliberate plan on the part of the mound architects. Color symbolism, however difficult or impossible it may be to identify in its exact ethnological meaning, is quite evident.

So intricate was the internal structure of Mound C—so striking the arrangement of colors—that the archeologists in charge of explorations decided that simple engineering records of levels, profile readings and draughtings, were wholly inadequate to do justice to the creation of the prehistoric architects. A competent artist, Mrs. Carolyn S. Meriweather, was commissioned to make an oil painting of the north profile of the mound, showing essential structural features and color contrasts as they were uncovered and dressed by the trowel and spade of the workers. To archeologist and layman alike it may appear impossible that the mound mosaic should have been so brilliant as the painting indicates. Yet many visitors were privileged to be present during the course of excavations at Mound C, and can testify that the artist has painted a realistic canvas. Her picture is both a scientific and an artistic record.

One additional discovery at Mound C is of special interest. Within the west shoulder of the mound a flight of clay-moulded stairs (Figure 3) was found, 14 distinct steps ascending from ground level to the top of the first unit of mound construction. The steps were about six feet in width, six to eight inches high.

Mound C appeared to be a burial mound. Interments were made underneath the base of the mound, within the body of the mound and covered by the clay bands or summits, and later, intrusively into the slopes of the final complete Mound C, this representing the most recent and modern level of occupation. All these burials were made in pits, and many of them had burial furniture associated with the skeletal remains.

Three levels of occupation are indicated. The topmost intrusive burial pits were of historical date, glass trade beads and iron objects having been found definitely associated with flexed or contracted skeletons. The pits within the mound represented predominantly secondary burials—that is, the bodies had been exposed on platforms or secondarily reburied in the mound pits, only the long bones, skull and jaws being moved in the final reburial. No objects of historic connection were found with these burials made within the body of Mound C. They fix the chronology of Mound C as definitely prehistoric. The burials with iron and glass outside the mound are historic and intrusive.

The oldest burials and occupation level indicated by the chronological series of pit burials at Mound C were found underneath the base of the mound (Figure 4).

IN one instance a tomb of logs encysted what appeared to be the interment of a person of more than ordinary importance (Figure 5), and in another interment (Figure 6) thousands of bone and shell beads, strung into necklaces, arm bands, anklets, probably woven into a mantle, covered the mouldering bones from head to foot. Strangely enough, pottery and other prized objects often found with Indian burials were not found in this grave. The tomb explored beneath the core mound at Mound C required the most expert art of the trowelmen to reproduce the details of the timbered walls, preserved only as log-mould uprights, with the sleepers or cross pieces clearly indicated on the floor of the grave beneath the bundled bones of the single burial.

(*To be continued*)

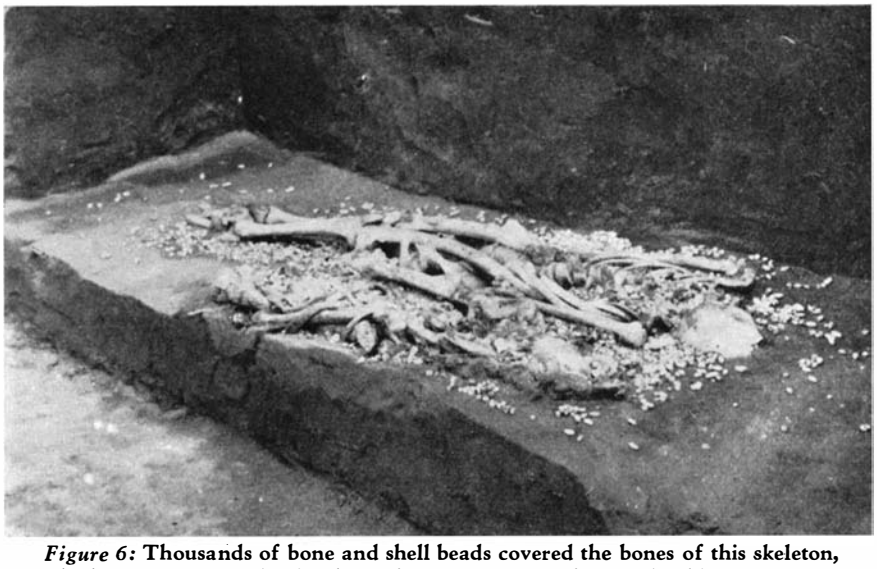


Figure 6: **Thousands of bone and shell beads covered the bones of this skeleton, which was quite evidently that of some person of considerable importance**

OUR POINT OF VIEW

Naval Competition

AFTER abrogation of the Washington Treaty—what? This is the question on the lips of Admirals as well as of the public generally, of statesmen anxious to maintain peace and security for their several nations as well as of devotees to the creed of disarmament by example. Hailed upon its signing as one of the greatest instruments for forwarding the cause of international peace and co-operation, this document, setting up the famous 5-5-3 formula for war vessels of Great Britain, the United States, and Japan, respectively, has been doomed since Japanese militarists began their triumphant march into Manchuria, since this powerful clique began scrapping treaties and making our friends, the Japanese people, like it. Or was it doomed even from the start?

Abrogation comes as no surprise; fair warning had been given. The hope that springs eternal—and often causes insensate delays in preparation against the inevitable—did, however, lead statesmen to do their utmost to prevent it. And now that it is a fact, no one knows just what comes next. Certainly, so far as national emotions go, there is reason to feel that an era of competitive naval building is in the offing. Hard facts, however, make this look extremely doubtful. This country has no wish to build against either Britain or Japan. That we should covet anything of theirs is unthinkable; that we should be jealous of either, unconscionable.

The treaty still has two years to run. And while statesmen talk of the possibility of arriving at some agreement, they are not really optimistic. The nations, therefore, are taking stock of their naval establishments. France and Italy will have a free hand and will, no doubt, take up where they left off in 1922. Already, our Navy plans to build five against Japan's three, to maintain the treaty status regardless. And that's a large order, for with completion of our present program, we shall still be shy 70-odd ships. Perhaps our construction won't be necessary for we may now achieve a happier relationship with England than we have had heretofore. This possibility—nay, probability—is of Japan's making. In trying to widen the gulf between England and America, her engineering went awry and she built a bridge instead.

To the Japanese people, we repeat that we haven't the slightest desire to hurt them. But let us warn them that their military leaders are giving Japan the name of being the world's bad boy. These militarists are indeed Japan's own greatest enemies.

To Combat Crime

"THAT a national scientific and educational center be established in Washington for the better training of police." Thus reads number one of an eight-point plan to wipe out crime, advanced by Attorney General Cummings at the Conference on Crime called by him in Washington recently. Other points were concerned with state and federal co-ordination of control; youthful delinquency; violence in strikes, industrial conflicts, and racial antagonisms; abuses of the parole system, of bail, and criminal procedure; "lawyer-criminals" and "political protection"; and glorification of criminals by the press. The program is indeed a practical one and should go far toward wiping out what has become our national disgrace; but it is not comprehensive enough.

Except by inference, organized crime was not considered in the eight-point plan. It is all very well to fight the "accidental" offenders, the petty racketeers, and the blood-thirsty rats who, with machine-gun in hand, flash across front pages, meteor-like, and are gone. Horrendous though the sporadic crimes of these may be, and are at times, they do not compare with those of the so-called "big shots" and their "business" organizations that exact a toll of billions of dollars annually from the country. Lurid notoriety, built for the cheap thugs and hoodlums by sensation-mongering newspaper editors who pander to the morbid emotionalism of moronic masses, tends to make us forget the wolf tearing at our vitals.

Splendid it is when federal agents track down and kill the meteoric ones but let's glorify none by calling him bandit or public enemy No. 1; let's heap well-deserved abuse upon them all, call them cowardly rats (since their courage lies solely in the tommy-guns they use), give them a few public, and therefore degrading—to them—floggings. This done, let us go after the one who does his work in less spectacular fashion, quietly but efficiently, through bribery and corruption of public officials, and through the trickery of clever shysters. Legal loopholes made use of by these leeches who hold themselves above the law must be stopped, payment of further tribute to them must cease, and a concerted effort must be made by state and federal forces to put them where we all know they belong. Public opinion, aroused and co-operating fearlessly with peace officers, will aid tremendously in stemming the advancing tide of crime, but it *must* be aroused to fighting pitch.

If the police "West Point" can be established, a splendid beginning will have been made. There, police of all ranks will not only be schooled in the use of guns and crime detection instruments but will also be given sufficient legal knowledge to aid them in carrying on a crime war and to combat political influence. Needless to say, powerful "interests" will fight establishment of such a scientific school, but it is to be hoped that here public opinion, seeing the light, will prevail. It is time to lift ourselves out of the mud!

Naughty Babies

IN this world there are people—many of them, we fear—who actually do not want to know the truth if it runs contrary to their pet emotions. "So much the worse, then, for the fact," said someone whose belief was shown to be contrary to fact.

Such a mentality have those at present in power in Germany, with their Aryan superiority dogma, a political faith disguised as a scientific theory. Here is the latest bit of "plastic surgery" on a mere fact which has emanated from that land: As ethnographers know, the predominant head shape in Germany is broad and flat. But the Nordic origin of German nationality calls for a Nordic head—long, narrow. What to do?

The Nazis are equal to it. It is now argued that the broad heads come merely from the habit of placing babies on their backs; as if the children of German-Americans, who sleep in American posture—that is, where they wish—were not also broad-headed to the same extent as in Germany.

Here is a suggestion for the Nazi regime: Make it *verboten* for any German baby to sleep on its back. Throw naughty German babies caught sleeping non-Nordic into concentration camps. In one generation, on the theory mentioned, the German nation would then become truly Nordic, a great victory of politics over science.

What the German leaders and their pseudo-scientist supporters most need at present is a simple sense of humor.

RADIO FACSIMILE

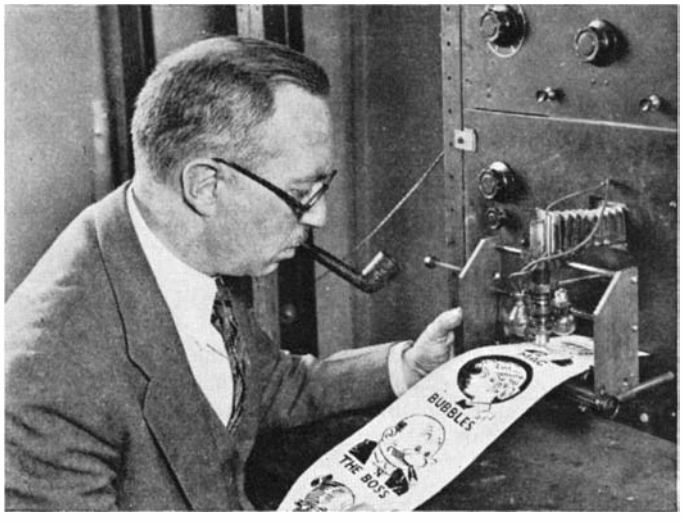
May Add Sight to Sound Broadcasting

By C. W. PAGE

IN the radio broadcast studio of the near future the operator will place a picture and a piece of printed matter in the rack of a machine. On this will be focused a tiny light beam, which will be reflected to a photo-electric cell or "eye." The "eye" and the light beam will start to move, and in thousands of home radio sets a "radio-pen" will glide back and forth in unison with the beam of light at the transmitter.

Out of the home set will slide a strip of paper similar to ticker tape, but much wider. It will contain, let us say, a news bulletin on the result of a final international yacht race, with a cleancut picture of the winning yacht crossing the finish line. In other words, the home radio set will produce a copy of the printed material that was fed into the broadcasting machine, with picture and text reproduced in facsimile by the tracery of the automatic pen.

That is what facsimile radio has in store. Authorities declare that facsimile transmission is no longer in the experimental stage, but is a proved practical success that only awaits commercial development to place the "home radio printing press," as it has been called, in homes throughout the country.



John V. L. Hogan, inventor of the "radio-pen," examining a strip of drawings to be transmitted. Note the scanner

THE creators of facsimile radio believe it will prove invaluable as an adjunct of sound broadcasting, by supplementing the audible program with illustrations and written notes, or making permanent records of useful data. Facsimile reproduces drawn illustrations, any type matter or lettering, newspaper articles, music manuscript, maps, diagrams, and so on. Program records for preservation would take such shape as illustrations to clarify oral statements, or printed notes on a musical performance. Recipes could be printed in connection with a food manufacturer's broadcast and save listeners the trouble of finding pencil and paper and writing from the speaker's dictation. Reply coupons would be printed for writing to broadcasters or for voting on program popularity, thus indicating station coverage. Programs of future broadcasts would be presented, together with printed quotations, weather reports, and so forth, which are easily confused if only spoken.

Sounds uncanny, this visual reproduction job of the newly invented radio facsimile, but it is only one of the latest trends of radio science as developed by John V. L. Hogan. Mr. Hogan indicates that the high price bugbear, one of the factors to delay the arrival of television, will not hinder facsimile. He estimates that facsimile reproducers can be manufactured to retail for 50 dollars or less. These will be in the shape of a compact cabinet, about the size of a portable typewriter, to be coupled with the ordinary home radio receiver so that reception can be switched from loudspeaker to facsimile and back again as desired. On the other hand, the reproducing device, which is described roughly as the equivalent of a loudspeaker unit and auxiliary connecting mechanism, can be incorporated in new radio sets at the factory. Facsimile is said to be perfectly simple to operate and to require a minimum of attention.

Under present conditions, sound and facsimile cannot be received at the same time through a set, but this is said to be a temporary situation, due to the fact that, as yet, few exclusive air channels have been allocated to facsimile. As soon as more channels are opened up, simultaneous synchronized broadcasts and reception of sound and facsimile will become possible. It might be said here, in passing, that experiments now being made in the 1500 to 1600 kilocycle wave band may lead to the assignment of this division to facsimile exclusively.

The broadcasting station's installation for facsimile transmission need not be very costly. A regular sound transmitter is used, a scanning device employing a moving spot of light and a photocell being substituted for the microphone. The original pictures and text matter on a strip of white paper are fed under the scanner. The electric controlling "eye," moving from side to side, scans the copy as it passes slowly beneath.

THE receiving set has, instead of a scanning disc, a sliding arm, which carries an electro-magnetic stylus. Each time the "eye" of the transmitter passes a black spot in the copy it releases a signal, which causes the stylus of the receiver to drop to the paper and make a mark, and to be lifted when the "eye" passes over a white space. Recent experiments have been along the lines of chemically treated paper which changes color when acted upon by the "radio-pen." Synchronized motor mechanisms move the transmitter eye and receiver stylus across the paper, and, at the end of each line, advance the paper to the next line of scanning.

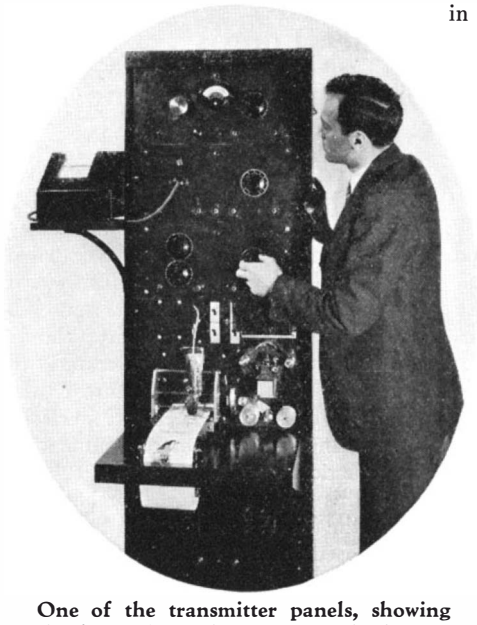
The printing paper strip of the present type of experimental receiver is seven inches wide, in roll form, and feeds into the receiver in adding machine style. It threads upward under the tracing mechanism and then out of the machine like ticker tape. The machine's reproduction of picture and text is performed in full view.

The facsimile broadcast transmitter

The Radio "Printing Press" . . . Only Awaits Commercial Development . . . Transmits Anything Written or Drawn . . . Will it Replace Newspapers?

does not require as wide an air channel as sound. A six-kilocycle band is sufficient. At present stations W2XAR, Long Island City, and WTMJ, Milwaukee, are sending out facsimile, and have been doing so, experimentally, for almost a year. It seems very likely that other stations will soon qualify and the combination of sound and sight broadcasting is expected to develop into radio's peak achievement to date.

Having presented some of the things which facsimile may be expected to do,



One of the transmitter panels, showing the facsimile mechanism near the bottom

let's consider what it will *not* do. This seems to center mainly around its speed limitations. The seven-inch printing paper moves at a speed of 1¾ linear inches per minute, resulting in a text word speed of from 30 to 60 words, with an average of about 40 words per minute. Transmission is faster when the material is limited to printed text than when illustrations are included. A sound program can carry four or more times as much information in the same time, but on a synchronized broadcast, facsimile can keep up by being confined to essential notes, memoranda, and pictures. It is thought that its value in explaining the sound program will prove one of its strongest features.

It has been stated that facsimile might go so far as to print a complete newspaper. If this should become possible, radio owners would switch to facsimile on retiring and find in the morning a complete, home printed newspaper with last-minute news flashes as late as they cared to continue operation.

In support of the idea, it might be cited that, so far as late flashes are concerned, this might be a valuable service. Morning papers go to press for the first time anywhere from 7:30 P.M. of the night before to midnight. By shortly after 1 A.M. the newspaper is set. That is to say, changes after that time are chiefly mechanical, a matter of polishing and improving the product. It would take a news story of considerable importance to make any radical change in the paper after that time.

Most newspapers, however, keep their front pages open until three or four o'clock in the morning for last-minute news. The final edition is then distributed mainly in the downtown districts of large cities. The suburban, rural, and mail readers get much earlier editions. Thus facsimile, flashing late developments on happenings between midnight and seven or eight o'clock in the morning, could supply a valuable service, at least to these last-mentioned groups.

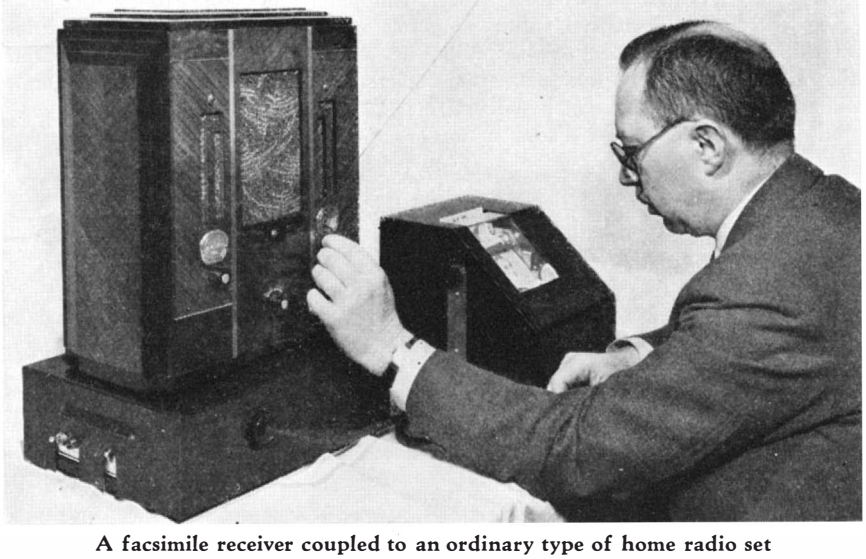
On the opposite side of the ledger are both the slowness of the facsimile method—it would take a minimum of three hours to reproduce a single newspaper page of normal size—and the form in which it would come into the home. The facsimile receiving set prints its text matter in type a quarter-inch high in columns five inches wide on a seven-inch strip of paper. This means that three lines of words, with the spaces between, would fill about a lineal inch of the paper. Thus the news would be presented on an endless roll of paper, folded bulkily in a basket or other receptacle. Because the presentation of the news must be chronological, it would not be possible to sort items of interest as on the regular newspaper page. One would have to read through the entire scroll to get a digest of the night's happenings.

Finally, operation of the machine would cost at the rate of about one cent an hour for electric current, plus the cost of the printing paper, and it would still be necessary to invest in the regular morning paper to get a complete news report.

IT is not possible to forecast what the future may bring in increased printing speed, size, and presentation of the printed sheet, but for the present, it seems safe to regard facsimile as a possible supplement of the daily newspaper for presenting flashes, spot items, and highlights of the day's happenings, referring readers to their daily papers for full particulars.

This is just about the news job that sound radio is doing now, but there would be this difference: Facsimile would "work while you sleep," or while you were occupied with other matters, and still deliver the high spots of the news. Besides, it would give a printed record and not leave you dependent on memory of what was heard.

Whether or not one believes in facsimile as an agency for news dissemination, there seems no doubt that it is soon to be very much with us for a considerable stay. Its rating for service to the public and commercial value to broadcaster and advertiser will depend upon its development and acceptance by those most vitally concerned.



A facsimile receiver coupled to an ordinary type of home radio set

Building the World's

DEEPEST-WATER BRIDGE

By WALTER G. SWANSON
Administrative Assistant, San Francisco-Oakland Bay Bridge

Double-Decked . . . 8¼ Miles Long . . . In Two Sections . . . Twin Suspension Spans In One Section . . . Will Serve Huge Industrial Centers

LARGER than any like construction project ever undertaken by man, the San Francisco-Oakland Bay bridge is being speeded to completion. When at last the 45,000,000 persons and 5,000,000 automobiles transported each year by ferries between San Francisco and Alameda counties begin to move across the structure they will enjoy the distinction of riding over the world's longest and highest above-water bridge, supported by piers sunk deeper than any heretofore poured under water.

The bridge primarily will connect San Francisco, where six square miles at the northerly tip of a peninsula support a population of 635,000 people, and the "East Bay" district, comprised of Oakland, Alameda, and Berkeley, totaling in population 393,000. Each day 50,000 commuters cross from these communities to San Francisco.

When completed, the bridge will supplant the present system of ferries and measurably speed up traffic. It is being constructed by the California Toll Bridge Authority as a state enterprise at a cost of 77,200,000 dollars, after a commission appointed in 1929 reported its economic feasibility and recommended the design which, with modifications, is now being followed. Construction started July 9, 1933, when President Roosevelt touched off by telegraph a blast which broke ground for the Yerba Buena island section of the work. The bridge will be completed by August, 1936, when the State of California expects to open the structure to the public.

Of particular interest physically, the bridge will be double-decked, with roadways 58 feet wide. Its length will total 8¼ miles, including approaches. From Rincon Hill, San Francisco, it will extend in a northeasterly direction to Yerba Buena island, bridging a 10,450-foot expanse with twin suspension spans. This island is an irregular outcropping of sandstone midway between San Francisco and Oakland and rises 340 feet above the water. It is 3000 feet wide and is occupied jointly by the Army, Navy, and lighthouse services.

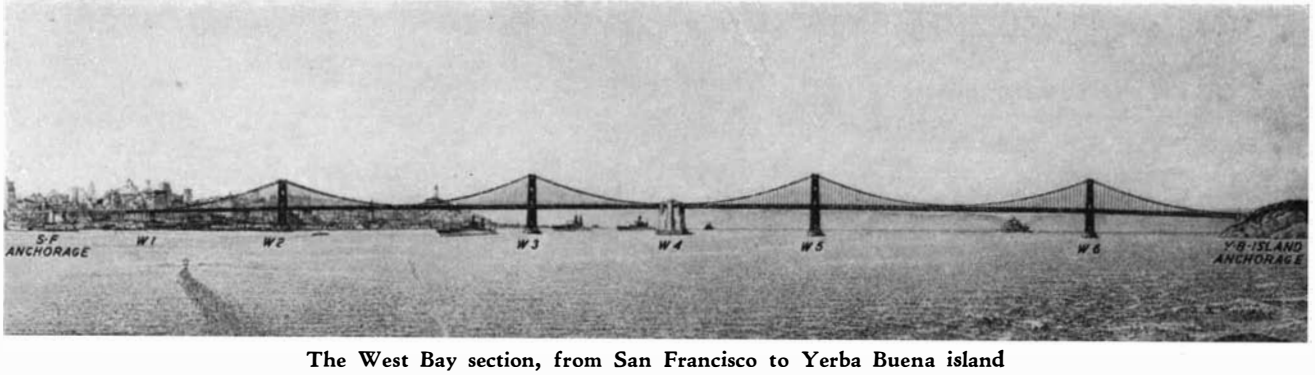
EACH of the twin suspension bridges comprising the West Bay section will consist of a main span of 2310 feet with side spans of 1160 feet. These suspension bridges will clear the water by 180 to 214 feet, more than adequate to permit passage of the largest vessels. Traffic will cross Yerba Buena island through a steel- and concrete-lined tunnel. From Yerba Buena the bridge curves to the right, then follows a line almost due east to Alameda county. The cantilever-type span over the shipping lane is 1400 feet long, clears the water by 185 feet, and is exceeded in length only by the Firth of Forth and Quebec bridges.*

The underwater portion of the bridge, a feat which has attracted international engineering attention, has now been completed, and another of the "big jobs" has passed into history. That part which lies underwater consists of 51 concrete piers. Of these, 8 are ordinary concrete columns built on land; 17 are ordinary concrete rectangular and cylindrical structures set over fir piles which brought the bridge down to a sand fill in the tidelands northeast of Oakland; the remaining 26 concrete piers are all major units in the substructure of the bridge. Of these, eight break previous records for depth of concrete submarine construction.

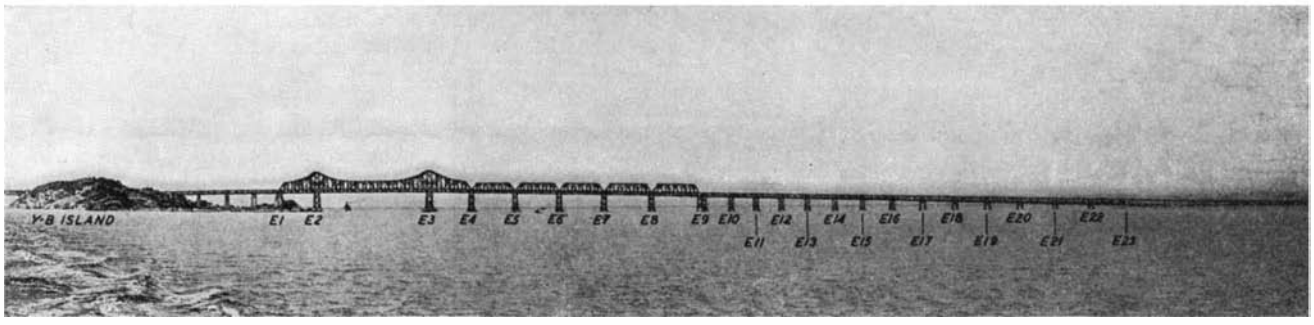
At this writing, after 17 months of work, the bridge construction has metamorphosed from the substructure to the superstructure stage, with all its concrete underwater jobs completed, and six of the 288-foot double deck truss spans, at the east end of the bridge, erected. Three of the four 500-foot structural steel suspension towers, which will support the two 28¾-inch parallel steel wire cables over the West Bay crossing, have been erected, and the fourth tower will soon be on its way to completion.

The superstructure does not set any bridge building records except that it is an 8¼-mile bridge, 4½ miles of which is over water, and will bear the huge weight of two decks of automobile, heavy truck and electric railway traffic, with complicated tentacle-like ramps curving off the 185-foot elevation of the decks to the street levels at the west end, and an equally complicated and carefully engineered elevated structure sending traf-

*For a comparison of "largest" bridges, see page 141, March 1934, *Scientific American.*



The West Bay section, from San Francisco to Yerba Buena island

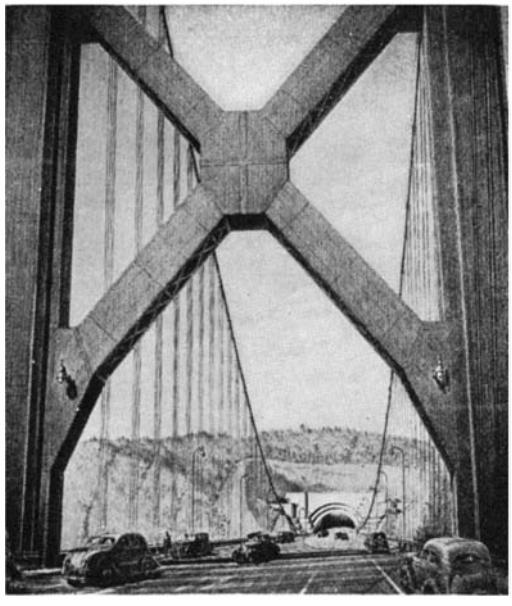


The section of the bridge from Yerba Buena to the "East Bay" district

fic in three directions at the eastern end.

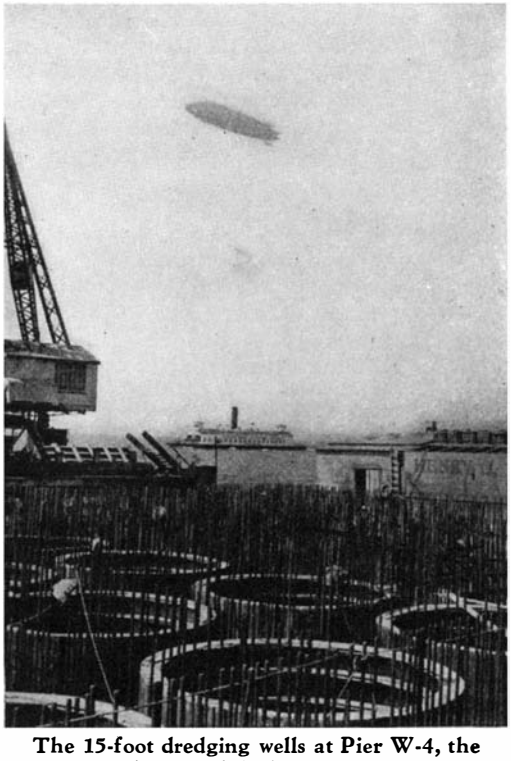
The superstructure involves the construction of concrete arch trestles and a set of twin suspension bridges over the two-mile West Bay channel, with a common concrete monument for a central anchorage in the middle of this two-mile crossing, which is new to bridge building. Also, the East Bay has a variety of bridge types embracing the 1400-foot double-deck cantilever span, five 500-foot through truss (railroad type) bridge spans, and fourteen 288-foot deck truss spans which come to a fork at the east end of the bridge where the lower deck divides to permit the upper deck to go down between the two forks of the lower deck.

The deep-water piers, like underwater buildings of concrete and steel erected upside down in floating caissons by the same highly successful gamblers of construction who are building Boulder Dam, lend something more than mere bigness to the job. Piers W-3, W-4, W-5, and W-6 of the deep water of the West Bay channel, which support the towers and center anchorage of the twin suspension bridges, were constructed within open-dredging-well caissons, modified to permit flotation by compressed air. The resulting caisson, designed by Daniel E. Moran and Chief Engineer Purcell and his staff, is an important addition to subaqueous engineering. The largest caisson of this type is that of Pier W-4, the concrete center anchorage.



A drawing, looking from one of the suspension towers to the tunnel portal on the island

THE completed concrete pier will be a rectangular structure 220 feet high from bedrock to water surface and, roughly, 200 feet wide by 100 feet thick. This concrete structure is cellular, or honeycombed. Piercing the concrete block are 55 vertical holes, each 15 feet in diameter—the size of a large circular room. The walls around these 15-foot vertical cores are of concrete, reinforced with a network of steel. The cores are hollow and the pier is open at the sides to permit sea water to flow into the 15-foot wells.



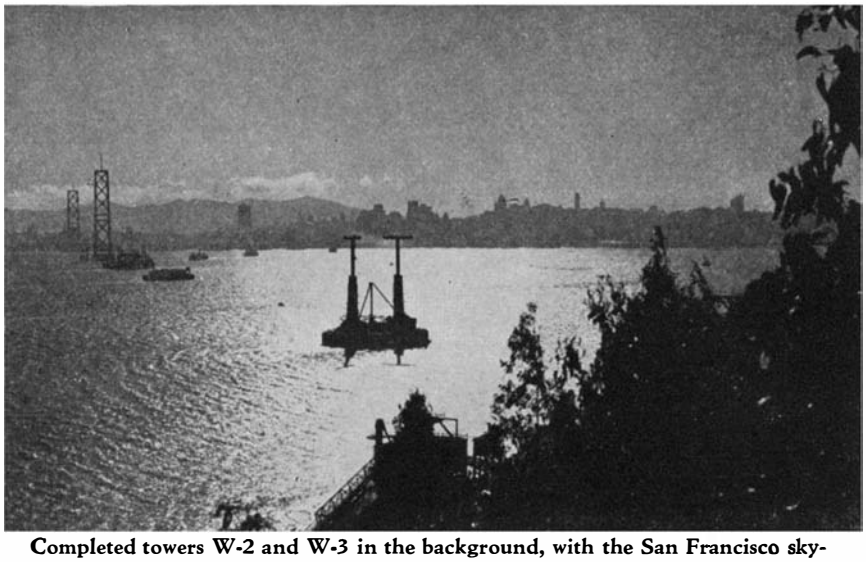
The 15-foot dredging wells at Pier W-4, the center anchorage of the long suspension spans

In all other piers, save this anchorage pier, all cores are hollow, but in Pier W-4 three of the 15-foot wells at each corner, or a total of 12, were filled with concrete from bottom to top as the structure was being completed. For the first 40 feet of this pier at bedrock the structure is solid concrete, a seal of concrete having been poured upon the rock 10 feet below the bottom of the caisson and up each well 30 feet. Like a non-tipping smokers' stand, the pier is weighted solid at the bottom.

To build this structure in water 80 feet deep, with a six-mile-an-hour tide, the novel compressed-air flotation caisson was designed. The outer walls of this caisson are of plate steel for some 17 feet up from the bottom or cutting edge which is beveled on the inside to facilitate sinking through mud. Above the plate steel the walls are of timber caulked water tight. Inside this rectangular floating structure, box girders divide the first 17 feet at the bottom into 55 square cells. Over these square cells are transition cones, or adaptor sections, like steel collars, to which are welded 15-foot steel pipes. At the tops of these pipes, plate steel hemispheroid domes are welded. On each dome is a pressure gage and a valve for compressed air hoses. Thus the caisson consists of an outer wall around a cluster of 55 vertical tubes, domed at the top (during the floating stage), and open to the sea water at the bottom.

HELD at the site by concrete anchors on four sides, this caisson was sunk by the simple process of pouring concrete into it around the 55 steel tubes. When concrete had been poured almost to the top of the tubes, a portion of them were heightened by cutting off the dome and welding on a 20-foot section of pipe, and then re-welding on the dome while other pipes were being similarly treated until the height of the outer walls and the steel tubes within were all increased so that another pour of concrete could be placed within the structure to sink it still farther into the water.

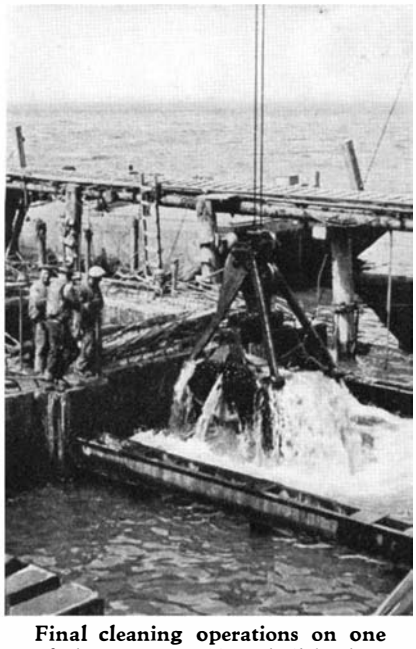
When the caisson's cutting edge lay



Completed towers W-2 and W-3 in the background, with the San Francisco skyline. View from Yerba Buena, with partially completed Pier W-6 near the center

within two or three feet of the mud, the air was reduced within all the tubes and the caisson dropped suddenly into the mud. When solid, the domes were removed. Then clam-shell buckets were lowered down the open wells to the mud beneath the caisson. These buckets undermined the mud beneath the rectangular structure, permitting it to sink by its own weight to within 10 feet of bedrock, where it was stopped and the bedrock cleaned off for the concrete seal floor laid on the rock beneath the caisson.

No men worked under air pressure below water on any of the piers on this bridge. Sand-hogs were eliminated by the clam-shell buckets. Pier W-4 cost approximately 3,000,000 dollars and contains 200,000 cubic yards of concrete, which is more than enough to complete the construction of an Empire State building.



Final cleaning operations on one of the caissons. Clam-shell buckets replaced "sand-hogs" on this job

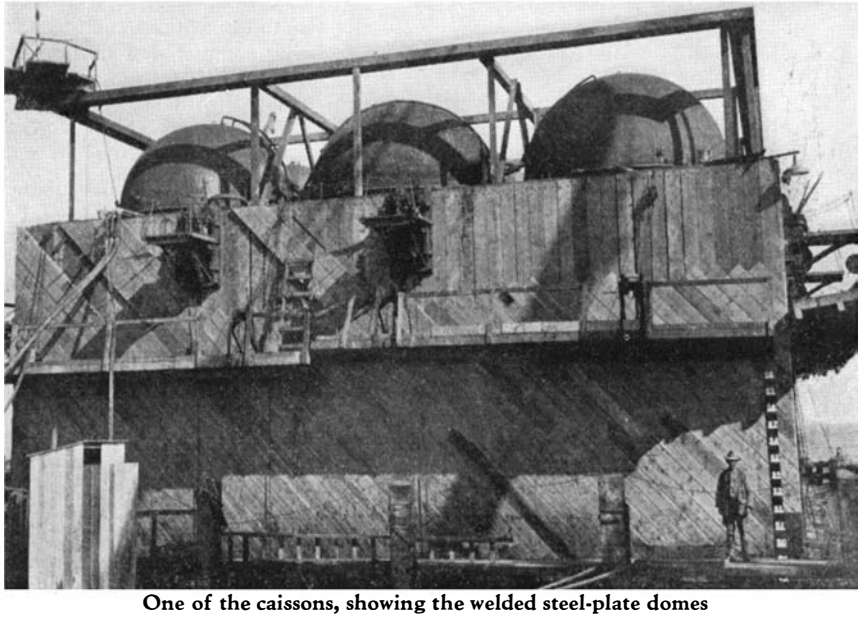
THE false-bottom open-dredging-well caissons are similar except that the cells are square rather than circular, and flotation during the first stage was obtained by timbering over the square wells at the bottom of the caisson to keep the water out and maintain buoyancy. When these caissons landed on the mud, the timbers were jerked out of each of the wells, which produced the same result as cutting off the domes at the top of the compressed-air-flotation caissons.

Other underwater concrete piers of the bridge were built within steel sheet piling cofferdams, like stockades, or plate steel tongue-and-groove pilings. These piles were driven deep into the mud and the mud excavated from the rectangular space within. On most of the piers built by this method some 300 timber piles were driven into the sand-clay strata, and the concrete pier built within the cofferdam and on top of the butts of these piles. This was used where rock in the East Bay tidelands was beyond reach of practicable engineering construction (some 500 feet below sea level).

The superstructure involved a 20,000,000-dollar United States Steel Company order, said to be the largest ever placed. This order involves the entire steel work on the bridge—the spans, the steel towers, the suspension cables, suspender ropes, the cantilever steel, the other truss spans, and the deck truss spans, six of which have already been erected at the time of writing.

By January 1, 1935, all the substructure contractors, many of whom are involved in Boulder Dam construction through the Six Companies, had sold their 1,500,000 dollars' worth of equipment and moved away from the job. Superstructure work has overlapped during the last half of 1934 and will be in full possession of the field in 1935 and to the date of completion. Spinning of the 17,464 parallel-wire cables of the twin suspension bridges between San Francisco and Yerba Buena island will be started by the time this article is in print. The East Bay spans are well under way and will be half completed by the middle of 1935. The huge vehicular tunnel, 76 by 58 feet, through Yerba Buena island, is now half completed by hard rock miners drilling and blasting. This tunnel, which is claimed to be the world's largest bore, would permit a four-story building to be towed through it upright, were it not for the double-deck construction.

AS pointed out earlier, the bridge will link two important communities. Economically it will do more, for it will bring closer together in time and cost San Francisco's financial, business, industrial, and shipping centers; the East Bay's ship yards, rail and water facilities, and factories; and the people and products of the hinterlands.



One of the caissons, showing the welded steel-plate domes

'CANNED' ROSES

By HERBERT O. WARREN

Cutting rose bush stems to the proper length for waxing

WHEN Mrs. Jones shops in the Main Street Department Store, an array of packaged goods greets her eyes. Packaged shirts and hosiery, Cellophane-enclosed commodities in great number—and now, "canned" roses. She also has her choice of variety, size, color, and fragrance, for packaged roses are making their way into every city and hamlet in the United States. A large California nursery, the Leonard Coates Company, located close to San Jose, is growing, processing, and shipping rose bushes, which, attractively packaged, are finding good demand throughout the country.

Other nurseries are contemplating entering this lucrative field with large-scale production and distribution, as a result of the development of special processes for preserving rose bushes. Dozens of varieties of roses are being marketed by the San Jose nursery, all of which can be purchased over the counters of eastern stores. And this is the direct result of observation on the part of some enterprising nurseryman, who remembered his childhood days when he watched his mother pour hot wax over fruit in glass preserving jars.

The full-fledged idea was not born overnight, however, for growers had long experimented in the endeavor to find some method of preserving plants.

In the new process, the rose bush is first pruned to the proper size to fit a standard container. That portion of the box which is to contain the roots is coated with tar, so that moisture can be retained. Applied at a temperature of from 165 to 180 degrees, and with a sufficiently thin coating, ordinary paraffin can preserve an entire season's growth of choice roses. Much experimentation was required to find the proper temperature. When too hot, the melted wax burned the tissues, and curtailed the plant's growth after planting. If the wax was not sufficiently hot, the coat cooled and flaked off in large bits. In order to keep the paraffin at a constant temperature, a double boiler-type vat, electrically heated, has been devised, in which an automatic thermostat controls the temperature. The plants are dipped quickly into the melted paraffin and as the cutting is withdrawn, the excess wax is shaken off. The hot paraffin does not come in contact with the roots, which are wrapped in wet peat moss.

Left: Dipping the stems of rose bushes in wax that has been melted in a special electrically heated tank. *Below:* Placing the processed bushes in boxes

Below: The roots of the bushes are wrapped in moss

Right: The bushes as they are delivered to the buyer. The wax on the stems falls off after bushes are planted

Below: If the processed bushes are properly planted, and given reasonable care, they will produce roses rivaling those grown in their native soil

ATTRACTIVE boxes have greatly assisted the sale of "canned" roses. Each bears a colorful reproduction of the plant it contains.

The amazing growth of the "canned" rose business is but the forerunner of an industry that promises to expand in the near future and include scores of rare and delicate flowers, not possible to ship long distances today. When that day comes, plants and flowers will be available for transplanting in localities far removed from their native soil.

A Star Swells Up

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

THE closing weeks of 1934 were the most interesting of the year to astronomers, for they were marked by the appearance of a conspicuous nova, or temporary star. This was first seen as an object of the third magnitude on December 14th, by an English amateur astronomer, Mr. Prentice, a lawyer.

His discovery, communicated to the Greenwich Observatory, was broadcast by the daily press, as well as by the usual astronomical cable service, and observers everywhere have been busy since. The nova is in the northeastern part of the constellation Hercules, about 10 degrees northwest of the bright star Vega, between it and the head of Draco. Within a few days after discovery it was in conjunction with the sun but, being about 68 degrees north of the ecliptic, it was easily visible, both in the evening after sunset and again before sunrise. For observers in northern Europe it is circumpolar and can be seen all night, though too low near midnight to be profitably observed.

It has varied in brightness more slowly, up to the date of writing (January 5), than typical stars like Nova Persei or Nova Aquilae. For about a week after its discovery it rose gradually and at maximum, shortly before Christmas, it was of magnitude 1.5, equal to Alpha Cygni—though not to Vega—and one of the most conspicuous stars in the heavens. Since then it has declined, but this evening it was still only a little fainter than the second magnitude. Like other bright novae it has fluctuated by more than a magnitude, but the general downward trend has been very gradual, resembling Nova Pictoris rather than the stars more familiar to northern observers. Its present position in the sky is favorable for the study of these changes for, combining evening and morning observation in Europe and in America, there would be no interval of more than four hours length when—weather permitting—the star cannot be followed.

IT was far west at the time of the outburst and outside the part of the sky habitually covered by the nightly "Harvard patrol" with wide angle cameras. The latest photographic record of the region so far reported was on October 4th, and showed the nova as a star of magnitude 14.5. On November 14th it was fainter than $13^{m}.8$. It increased by 13 magnitudes, or to 160,000 times its original brightness, within a month and probably in much less time.

Like the other bright novae of this century it was not discovered by a professional astronomer but by an amateur. The reason is fairly obvious. The professional observer is usually busy with some definite program. He must set his telescope and study some particular object, whether he be observing double stars or measuring some variable with the photometer, or photographing spectra or perhaps fields rich in nebulae. He is not likely to spend much time in gazing about the heavens at large. The amateur, especially if he is not too much encumbered with a telescope, has time to watch the skies. If he has a good enough memory to remember the constellations, and takes the trouble to become familiar with them, and if he has the patience to go over the sky night after night despite the monotony of seeing the very same stars over and over a thousand times, he may some day put his name permanently with the record, and what is more, enrich science with an opportunity which would otherwise be irrevocably lost.

SINCE the 20th Century began, five prominent novae have been seen. Nova Persei in 1901 reached the magnitude 0.1; Nova Aquilae (1918) $-1^{m}.1$; Nova Cygni (1920) $1^{m}.8$; Nova Pictoris (1925) $1^{m}.2$; and now Nova Herculis, $1^{m}.5$. Nova Geminorum (1912) reached $3^{m}.7$ and Nova Lacertae (1910) rose to $5^{m}.0$ (as shown by photographs taken before its discovery).

The last two would probably have been missed by the casual observer, but the five others were conspicuous at a glance to anyone familiar with the constellations.

Only three bright novae were recorded in the second half of the 19th Century, and none in the first half. It may be that we have been favored during the last generation by an accidental accumulation of these outbursts, but to get five in less than 40 years by mere luck seems very improbable. The amateur astronomers of the last century were less numerous, not so well informed and, above all, not at all organized—few of them knowing where the announcement of a discovery might be sent—and this may account for a large part of the difficulty.

There is no such effective watch kept upon the fainter stars, and a great many novae which do not rise to naked eye visibility are doubtless missed. The late Professor Bailey of Harvard concluded that at least ten such objects brighter than the ninth magnitude at maximum must appear every year. Those which are near the sun in the sky when they flare up are naturally lost, and the watch on the southern heavens is much less vigilant than on the northern. But, after full allowance for this, it is probable that three or four novae could be caught each year if the cost could be met for a careful examination of the sky patrol plates as soon as they are made. There are, however, so many more urgent problems awaiting study that this can hardly be done at present.

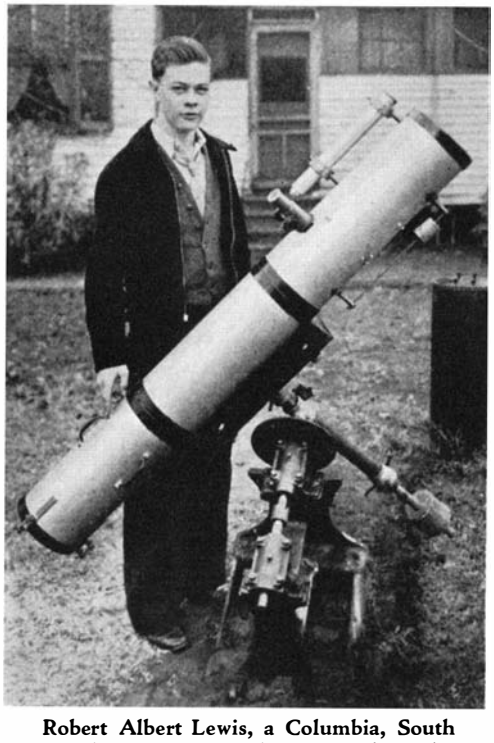
THE present nova was naturally the object of much discussion at the recent meeting of the American Astronomical Society. Observations of its spectrum were reported from the Harvard, Michigan, Yerkes, Lowell, and Mount Wilson Observatories. It resembles other novae in showing wide, bright lines flanked with narrower dark components on the violet side, but the width of these broad emissions is much less than in Nova Persei or Nova Aquilae. Near the maxima of its subsidiary fluctuations in brightness the bright lines almost fade out, leaving a dark-line spectrum. Shortly after the discovery this spectrum closely resembled that of Alpha Cygni—a hot star of class A2. Later on, the metallic lines strengthened at the expense of the hydrogen lines and it was more like Gamma Cygni (Class F8). Both of these stars are well known "super-giants," very remote and of enormous luminosity. Comparisons of an ephemeral object like the nova with these unchanging stars are risky, but it is probable that the former, too, was of great real brightness when the light by which we now see it left its surface.

At the minima of the light fluctuations the bright bands were relatively stronger, but the dark absorption lines were still present.

AND BURSTS

Nova Herculis, the Recent New Star . . . 20,000 Times as Bright as the Sun . . . An Opportunity for Amateur Astronomers to Add to the Scientific Record

It is clear that this nova differs from its predecessors in details rather than in its general nature. The explanation which has now been generally accepted for the others accounts for it too. In the epigrammatic phrase of a German astronomer, "A star swells up and bursts." More precisely, it appears that suddenly an enormous liberation of energy takes place within the surface of a star. Its immediate effect is to drive the upper layers of the mass radially outward in all directions, so that the previously quiescent body is replaced by one which is expanding at a very rapid rate. At first this expanding shell of gas is thick enough and dense enough to be opaque. It is exposed on its inner side to powerful short-wave radiation from the intensely heated core of the star. This is absorbed in the shell, and heats it so that its outer surface maintains roughly the same temperature despite its rapid expansion. The amount of light which escapes from it into space therefore increases nearly in proportion to its area. When it has become 100 times as large as it was originally, it will be 10,000 times as bright when seen from interstellar distances, even though the light emitted per square mile has not changed.



Robert Albert Lewis, a Columbia, South Carolina, amateur telescope maker who discovered Nova Herculis independently

BUT as the expanding shell spreads out laterally it must grow thinner—not necessarily or probably in miles, but in the quantity of material per square mile. The gas of which it is composed will become more and more rarefied, and sooner or later it will begin to become transparent. After this has happened the ultra-violet radiation from the hot core will escape directly into space.

An observer unhampered by air above him, and with a recording instrument which was equally sensitive to all wavelengths, will probably find the star brighter than ever. But to us behind the ozone in the stratosphere, which cuts off all the shorter waves, the brightness would appear to decline. The expanding shell, though transparent in general, would still absorb all the kinds of light characteristic of its own composition, just as any stellar atmosphere does, and scatter the absorbed light in all directions in a bright line spectrum, like the flash spectrum seen at a total solar eclipse. The part of it which lies in front of the core will therefore absorb from its continuous spectrum a set of characteristic dark lines, but all these lines will be shifted toward the violet, since this part of the shell is approaching us. For the rest of the shell, which is moving sidewise, backward, or more slowly toward us, the bright lines emitted by the gas will be unshifted, displaced toward the red or a little to the violet. They will escape absorption and appear in our spectrograms as a broad, bright band, centered on the usual position of the line, extending both to the red and the violet but cut off on the violet side of the band by the absorption line already mentioned.

This is the stage in which Nova Herculis is at present, or was at least when its spectrum was recently photographed. The earlier stage, in which no bright lines appear, but only a dark-line spectrum shifted toward the violet by the approach of the expanding surface of the opaque shell, was observed in Nova Geminorum, but must have been missed in the present case.

The transition from opacity to transparency of the shell is of course not instantaneous, and various phases omitted here for the sake of simplicity may be recognized when the changes in the spectrum have been thoroughly studied. As the shell expands still farther, and the gas becomes still more rarefied, it passes gradually from the physical state of a stellar atmosphere into that of a nebula.

THE energy to keep it shining comes from the core of the star—which evidently still contains most of the original mass. This survives the outburst, but settles into a very hot body possessing a spectrum of the Wolf-Rayet type, with bright bands which suggest that it is still expelling atoms from its surface, though with less violence.

At last the shell expands so much, and becomes so thin, that its light fades away and the drama is at an end. The difference between Nova Herculis and such characteristic objects as Nova Persei or Nova Aquilae appears to be mainly that the velocity of expansion is much slower—something like 200 kilometers per second as against 1700 for Nova Aquilae.

The slow rise to maximum is easy to understand. If the gaseous shell itself is comparable with that in the other novae, it ought to take six or eight times longer to reach any given stage of its history. This is of course but the roughest of estimates; nevertheless it seems probable that Nova Herculis will remain bright for a relatively long time and afford an unequalled opportunity for study.

How far off it is, and how bright, we do not yet know. When and if the expanding shell gets large enough to be seen as a small nebula with powerful telescopes we should obtain a very good estimate of its distance, such as we have for Nova Aquilae and Nova Persei. Meanwhile Dr. Struve has made a rough estimate of its distance from the intensity of the K line of calcium (which, in this as in many other cases, appears to be produced by scattered atoms in interstellar space), and concludes that it is of the order of 1500 light-years. This would make its maximum brightness 20,000 times that of the sun. But we must wait for future data before we can be sure.—*Princeton University Observatory.*

PACKAGING IN INDUSTRY

How Is It Wrapped?

Packaging Now an Industry . . . Amazing Growth . . . Follows Trend Toward Color, Originality, Modernity . . . Employs Much Talent . . . Enhances Quality or Appearance . . . Phenomenal Profit Increases

By PHILIP H. SMITH

INDUSTRY is making huge outlays to promote the art of packaging. And for very good reasons. Skilful packaging has been found to quicken the sale of products to a phenomenal degree; it opens the way to substantial economies in the shipment of goods; and it is instrumental in reducing losses incurred by deterioration and spoilage of consumer articles.

Packaging is a bewildering business. It involves an array of materials such as wood, paper and paper products, metals, glass, rubber, plastics and other synthetic materials. It utilizes the skill of sales promoters, industrial designers, draftsmen, research chemists, machinery manufacturers, not to mention all the allied workers such as the producers of inks, adhesives, and the materials from which packaging materials are made. And just to add to the bewilderment: every product packaged raises its own individual problem of design, material, and technique.

Here is an industrial enterprise without the status of an industry, yet within a very few years it has come to have an individuality of its own. Packaging once meant little more than wrapping products because they had to be wrapped to be moved, or at best, to carry the trade-mark of brand quality; today that is a very small though fundamental part of it. The cardboard, paper, and string stage is outgrown, and major credit for it must go to Cellophane, for it was this transparent material which made the consuming public "package conscious" in a new sense and gave impetus to the whole packaging idea.

IS it any wonder that business turns its attention to packaging when, for example, a group of grocery stores can increase the sale of dried beans 29 percent, or noodles 80 percent, by the simple process of placing them in transparent bags? These are common examples of the benefits of packaging, but they tell only part of the story. To understand the significance of present-day packaging and to grasp the direction of its triumphant sweep, one must first become familiar with current practice in all its phases for it is the things being done right now which explain "why" and give an inkling of what is in store as this new industry progresses.

Practically all packaging aims to enhance quality or appearance, either of the package or the contents. This is true no matter what other purpose may be sought. Under this spur almost all household goods have passed or are passing through a re-juvenating process. Form, material, color, and treatment of packages have been altered to attract attention, to make them stand forth and encourage the consumer to say "Give me that." Indicative of the wide variety of packaging for appearance are: bags of kraft paper simulating leather, for carrying whiskey bottles; transparent wraps for coffee cans; bottles made to look like a honey comb, for strained honey; glass milk bottles with colored imprint; plastic boxes for a variety of goods; wood-grain paper coverings for cosmetic boxes. Packaged rugs and shirts, sheets and blankets

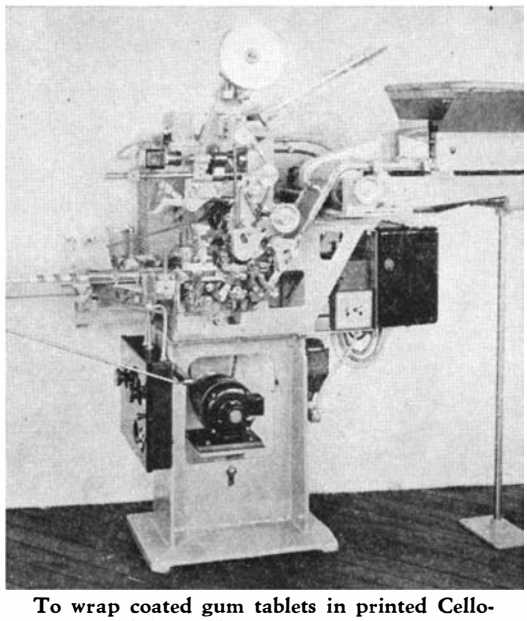
in cellulose wrappings express the aim of better appearance with the added purpose of keeping the articles clean.

Accompanying efforts to make packages more attractive have been those of making them more convenient. A tack manufacturer, for example, has redesigned his package to permit picking out a tack without pricking the finger or tipping the box over; ink makers have been widening bottle-mouths for easier filling of pens; while a pencil company puts its lead re-fills in a paper pack like matches. And products theretofore not packaged are now being placed in containers to facilitate the use and handling of the product. One coal company offers cannel and stoker nut coal in 50-pound corrugated boxes; another puts anthracite in 18-, 25-, and 50-pound bags. Packaged lumber is on the market, so is beer—in cans with keg lining. Even lubricating grease has been packaged in cartridge form with special equipment for use. Such examples can be multiplied indefinitely, but there is still another type of packaging which is more striking. This is the type which features use of the package itself when the contents have been consumed. It is another twig of the vast packaging tree, but perhaps the fastest growing.

RE-USABLE containers have made great strides since pottery ginger jars from the Orient served as flower pots. Malted milk comes in colored glass jars with screw tops, handy in a number of ways; tea, cheese, and jams are packed in thin-blown tumblers, suitable for the table; a pair of garters and suspenders come in a leather container which becomes a book cover; while a belt in a plastic box provides a humidor when the belt is removed. As evidence of ingenuity, witness the container for a belt which makes a cocktail shaker when placed over a drinking glass, or the variety of re-usables launched by a west coast company. This particular concern packaged vinegar in a bottle which was suitable for ice water and when the market seemed well sold, it switched to a bottle that would make an attractive lamp base, to be colored if desired. Then, sales soon doubling with this practice, table syrup was offered in a would-be candlestick jug.

Pioneer suspender box and re-use container. The molded plastic box becomes a humidor

The foregoing examples of packaging represent the most obvious and the best understood. There is still another type, and it is a highly significant one—packaging to prevent or retard spoilage of food products. It has been given comprehensive study but as a research matter it is still in its infancy. It ties in closely with the transparent cellulose development and for that reason we must discuss it first.



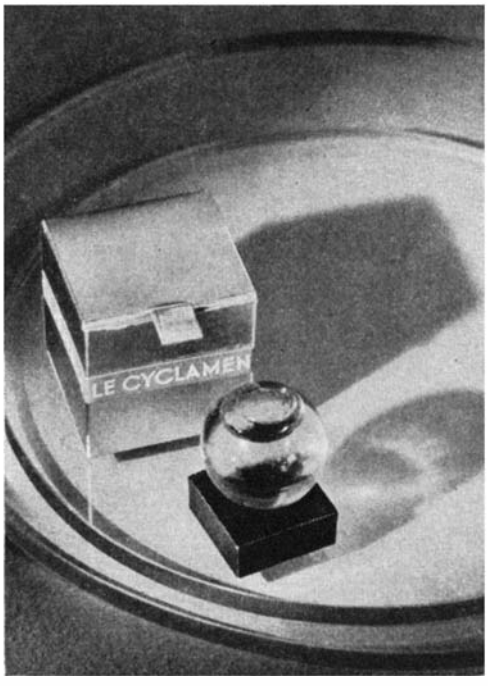
To wrap coated gum tablets in printed Cellophane, while a photo-electric cell supervises

Cellophane was a laboratory product and the self-starter of the packaging engine. Its first large scale application—to cigarette packages—is familiar to all. And the reason for this was its moisture-retaining quality, as well as its neat appearance. Cellophane raised many problems. It wouldn't stick, it wouldn't take printing, and it didn't lend itself to existing wrapping machinery. So technicians had to take hold, develop adhesives and new printing processes, and redesign machinery. And while they were doing this, competing products came on the market—Sylphrap; Protectoid and Kodapak, both cellulose acetate products; and, more recently, Pliofilm, a synthetic rubber. All of these products have their peculiar qualities; some are more moisture proof than others; and they vary in tensile strength and other characteristics. Sylphrap, for example, has one type for which is claimed practical impermeability to invisible ultra-violet rays without sacrifice of transparency, while Pliofilm claims, among other qualities, resistance to oils, greases, and many chemicals.

The transparent cellulose films have stimulated many other developments and we find in the packaging world such accomplishments as cellulose acetate containers, made like cans, with transparent sides and metal top and bottom, rugged and capable of re-use. We also find a product which when applied wet to the tops of bottles, shrinks and forms a tight seal. All these developments stemming from the application of cellulose to packaging, represent laborious research, but they by no means circumscribe the contribution of research as we can demonstrate by reference to actual cases, having the development of transparent cellulose in the background.

If many of us have heard of frozen foods—perishables frozen at sub-zero temperatures and shipped in this state to retailers for distribution—few have heard of the problems of packaging involved. Success of this enterprise hinged largely on proper containers without which there could be no wide distribution. What was needed was a container that would withstand conditions incidental to the freezing process and remain unaffected by the liquid or moisture within the package prior to freezing. It had to be essentially airtight. The problem was answered by a paperboard carton with a fixed inner lining of transparent, waterproof cellulose. Then for shipping these cartons with maximum protection there was developed a corrugated board container with a layer of asphalt barrier board, the corrugations giving strength and insulation, while the asphalt protects against the moisture of condensation.

THERE are vast possibilities in the shipping of chilled foods, and packaging developments have gone a long way toward making them a reality. It is now possible to ship foods using solid carbon dioxide—dry ice—as a refrigerant and exercise a high degree of control over temperature. It is done by using a paperboard box having a corrugated liner with imbedded aluminum or copper wires. One surface of the



"Upside-down" spherical perfume bottle on a plastic base—attractive packaging

refrigerant is exposed to this wire conductor liner which quickly spreads the cold to all parts of the container, while incoming heat is carried by the wires to the refrigerant. Further control is exercised by inserting corrugated resistance pads between the refrigerant and the liner.

In packing plants, in can and glass factories, in fact wherever food packaging is studied, technicians have made their contribution. So today we have dates pasteurized in the package to make them a year-around rather than a seasonal food. We have cans which allow cheese to be packed before ripening—a vent valve allows gases to escape while excluding entrance of air. And we have foods protected from bacterial growth by the process of packing in inert gasses.

FOR a long time it has been suspected that light rays had more to do with the deterioration of certain food products than was generally credited. The use of colored glass bottles in years past represents a rather unscientific attempt at meeting just this problem. Quite recently experiments conducted at the Department of Agriculture proved that light rays caused rancidity of butter; that grass-green is the best protective color and blue and violet the least. Even though this work is still in its preliminary stages it has begun to change packaging practice, and the upshot may be the saving of many millions in losses now incurred from rancidity. As a rancidity retardent metal foils have proved effective and the packaging of such products as potato chips in foil bags illustrates practice which is growing in favor.

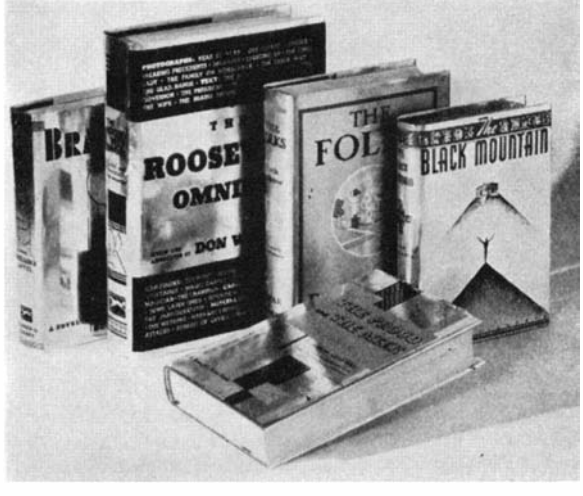
Another manner in which research has played a rôle in packaging has been in lowering costs —reducing the mechanical costs of wrapping, lowering shipping weights by redesigning containers, and cutting container costs by designing ones that can be used over and over again. The most striking cost reductions have been accomplished by package machinery manufacturers and the most dramatic example is the application of the photo-electric cell. The "electric eye," as it is frequently called, is being used where printed wrappings are such that the printing must be located accurately upon the wrapped object as opposed to the wrapper that can be placed in any position. Packages of gum with printed panels on four sides provide a good example.

The job of the "electric eye" is to control the cut-off on the individual wrappers as they are fed from a roll on the machine. The roll is generally arranged to feed about $^1/_{64}$ or $^1/_{32}$ of an inch more than the actual spacing of the printing on the web. Then, when the printing design creeps ahead, allowing the light to fall on the cell, the cell operates to shorten the cut-off of the wrapper, usually by twice the planned over-feed. In this manner accurate register is obtained within fine tolerances. There are variations in the use of the "electric eye" for packaging but the purpose is always to shorten the cut-off if the machine is set to over-feed, or to increase the cut-off if set to under-feed. In either case, correction of the register is made intermittently.

Packaging machines in use today accomplish unbelievable things and at speeds unthinkable in years past. Wrapping close to 100 cigarette packs a minute; opening cellulose bags, and filling, closing, and sealing them at the rate of one a second; hooding milk bottles at more than 100 a minute; and banding cigars and putting them in cellulose tubes at the rate of 40,000 a day, are some striking performances. There are machines which take a strip of transparent cellulose, draw it over a milk bottle and band the cap so formed; there is another which will take a sheet of transparent wrapping, fringe it on two edges, wrap it around a piece of candy, and twist the fringed ends. All manner of odd shaped objects are now being wrapped successfully by such rapid mechanical processes. Each application of the machine to wrapping is unique, worked out laboriously to the end that wrapping can be improved without an exorbitant increase in cost.

THE development of packaging to reduce costs is quite in keeping with the times. It is perhaps best exemplified in the move to make containers lighter, more compact, and re-usable. Quite recently a box was placed on the market which is collapsible, requires no nails, has no center partition, and is materially lighter than its orthodox predecessors. It is claimed that it saves one third in packing costs and 10 percent in freight charges. Another development is a bag for perishable foods which contains pockets for dry ice. When the contents have been removed, the bag can be folded, bundled, and returned for use again.

One may conclude from the foregoing survey of packaging practice that there is much in it that smacks of fad. And this raises the question whether the packaging boom will last. Looking at the most obvious examples—the redesigning of packages to enhance appearance and the wrapping of articles heretofore sold in volume without wrapping—people wonder what will be left of competitive advantage when every package is redesigned. The answer is that packaging is not static and there is no reason for believing that the last word has been spoken. There are fads in packaging and fads change, but packaging goes on. Competition forces improvement in containers, and compe-



Strictly modern: Aluminum foil jackets, carrying printed designs in the modern manner —the sort of packaging originality that compels attention and thus increases sales and profits

tition is unceasing. The battle which goes on behind the scenes between the makers of wood, paper, glass, foils and all the other packaging materials is a reflection of the movement toward better packaging, because, although each purveyor wants to play a larger rôle, his ultimate status hinges on the suitability of his product for specific jobs commensurate with costs.

When a meat packer reports a sales increase of 20 to 100 percent in a few months following the re-packaging of his product, when a department store, through tests, discovers wrapped hosiery outselling unwrapped 12 times, though displayed at adjoining counters with prices higher on the former, packaging has validity. The staunchest concerns see merit in it; witness Montgomery Ward. This company thought packaging so important that it established a Bureau of Design and out of it has come a broad plan involving simplification of packages and even a re-designing of contents. With many thousand items carried, Montgomery Ward's re-packaging moves slowly, but already sales have increased in every department where action has been taken. General Foods, mammoth of the food industry, has a Carton Committee. On this committee there is a representative from each of the research, sales, advertising, legal, and production departments. It is the duty of this group to study packaging thoroughly and advise on matters of appearance, utility, style, and the development of new package types. Ford Motor is another convert to the packaging idea. Ford has divided parts into six groups with special color designation, and the gains reported are better merchandising and instant, accurate inventory.

Ubiquitous Cellophane protects while permitting display of foods

INDEED, packaging is here to stay and destined to become more highly specialized. The competition which forces it, also forces a high degree of consideration to every phase, for costs cannot get out of bounds or ends are defeated. It has been said, and it is significant, that manufacturers are much more interested in improvements in production convenience and economies in packaging than they are in attractiveness of design. We may anticipate, therefore, more and more thought being given to packaging in relation to the product, carrying back to consideration of the product itself, to the use of cheaper materials, and to a higher degree of mechanization in production processes.

That costs have risen out of proportion in certain instances is a fact. And there is a reaction to it, manifesting itself in a search for substitute materials. Over-packaging may be a nuisance and may even lead the consumer to question the value of the contents. Poor laundry work, for example, cannot be offset very long by putting the shirt in a paper, cardboard, metal straight-jacket. Producers are not slow to sense this possible reaction to paying for the wrapper and the re-usable container is one answer. We may expect to see much more development of this type of packaging wherein the dual value creates double purpose buying.

If for one moment anybody thinks all packaging problems have been solved, the example of milk distribution will disabuse him. For quite a while milk distributors have been testing out and pioneering the use of fiber containers. Hence, the time may come when a container will be perfected allowing sight of the cream even as we now have tin cans with glass tops. But whatever it may be like, its cost must be below that of the orthodox glass bottle.

When a concern adopts a new form of package and it gets all the advantage of the innovation, costs don't have to be studied very closely. When competitors adopt a similar package, the advantages may slip away, even to nothing, and leave behind principally high packaging costs. Something of this kind happened in the packaging of oil in cans. It was a big jump from bulk oil to canned oil, involving new problems of distribution, and oil companies would now like to lower their costs. They cannot return to the old methods if they would for the public has been taught to demand sealed cans, so they look for a savior in the form of a cheaper container.

WHERE packaging promises to make its most lasting contribution to this age is in the handling of articles which deteriorate between the time of production and consumption. It has accomplished, a great deal already in solving the problem of moisture retention and protection from moisture. It has demonstrated effectiveness in aiding the shipment of perishable foods by facilitating the maintenance of proper temperatures. It has been instrumental in controlling bacterial action and safeguarding products from light rays. From the Pacific Coast come reports that transparent cellulose wrappings will keep the saw-tooth beetle from foods and no less a person than Mayne R. Coe, U. S. Department of Agriculture expert, declares that millions can be saved by the food industry by protecting products from destructive light rays.

All these developments hint at accomplishments to come, and delineate one of the broadest channels for packaging progress. When they materialize, the advantages will accrue not only to the individual consumer, but to the nation.

Photos courtesy of:
Du Pont Cellophane Co.
Reynolds Metal Co.
Toledo Synthetic Products
Continental Can Co.
The Glass Packer
Package Machinery Co.

SUNDIALS AND THEIR CONSTRUCTION

Part IX—The Principle and Construction of the Armillary Sphere

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THE Chaldean astronomer, Berosus, who lived about 370 B.C., is generally acknowledged the inventor of the hemicyclium, which was a crude time-telling device hollowed out of a block of stone. This instrument was used for many centuries and, according to the writings of the Arabian astronomer Albategni, was in use as late as 900 A.D.

At the time of Berosus, the picture of our universe was that of a hollow sphere with the earth at its center. About 255

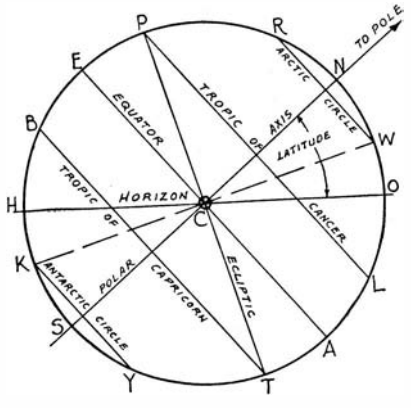


Figure 1: **Principle of armillary**

B.C., Eratosthenes, an astronomer and mathematician of Alexandria, devised an instrument to represent the system of the universe. This instrument consisted of many rings put together in the form of a hollow sphere with a globe suspended in the center, which portrayed the heavens encircling the earth.

Usually ten rings were employed, denoting the ten major circles of the sphere placed in proper relation to each other. They were the (1) meridian, (2) horizon, (3) equator, (4) ecliptic, (5) Tropic of Cancer, (6) Tropic of Capricorn, (7) North Polar or Arctic Circle, (8) South Polar or Antarctic Circle, (9) equinoctial colure, and (10) solstitial colure.

Such was the armillary or armillary sphere.

FIGURE 1 shows the construction of the armillary, in diagrammatic form.

In the figure the circle *HENAS* represents the meridian, and the line *SN* the polar axis of the sphere, with its poles at *N* and *S*. When properly set up, *NS* lies parallel to the axis of the earth.

A globe is suspended at the center *C*.

The line *HO*, drawn through *C*, lies parallel to the plane of the horizon.

The equator *EA* is perpendicular to the polar axis *NS*, at *C*.

The ecliptic *PT* is drawn through *C*, making an angle with the equator of 23°27′, and it cuts the sphere at *P* and *T*. The points *P* and *T* represent the greatest northern and southern declination of the sun.

The Tropic of Cancer is represented by *PL*, and it is drawn through *P* parallel to the equator, because it is a circle of latitude.

For the same reason the Tropic of Capricorn, *TB*, is drawn through *T* parallel to *EA*.

In like manner the polar circles are drawn. The dotted line *KCW* is perpendicular to the ecliptic at *C*, and cuts the sphere at *W* and *K*. These two points are called the north and south poles of the ecliptic. The north and south polar circles are noted by the lines *WR* and *KY*, drawn through *W* and *K*, parallel to the equator.

The equinoctial colure is indicated by the line *SCN*. It passes through the points where the equator crosses the ecliptic, and the north and south poles of the sphere. When the armillary is used as a sundial, it is generally a stationary sphere, in which case the equator will cross the ecliptic at the east and west points of the horizon, with the vernal equinox or sign of Aries at the west. (See page 139, September, 1934, number.)

In the diagram, the solstitial colure coincides with the meridian, shown by the circle *SENA*. This circle passes through the poles of the sphere, the zenith, and nadir. Its plane is perpendicular to the plane of the equinoctial colure.

THE armillary sphere in Figure 2 is so constructed that it shows the apparent motion of the heavens and the real motion of the earth. Suspended within the rings is a small sun, which moves about in the path of the ecliptic; and a small moon is so inserted that its motion is portrayed. The globe at the center turns upon its axis. The horizon may be elevated or depressed at will, and the rings may be turned about their common axis. The whole instrument may be adjusted in any latitude by means of the quadrant directly above the base.

The armillary was used by ancient astronomers for observational purposes. Although the hemicyclium and its successor, the conical dial, were in use at the same time, no mention is made in early Latin, Greek, and Arabian manuscripts, of the armillary as a sundial. Vitruvius, a Roman architect of the 1st Century B.C., listed all dials known in his time, but he does not refer to the armillary as such; Albategni, who showed the construction of horizontal dials as early as 900 A.D., does not mention it as a timekeeper.

From the abundant material to be found in early English and European treatises on gnomonics, as well as the more modern works on the subject, the authors have endeavored to place the appearance of the armillary as a sundial. Even as late as the 17th and 18th Centuries, when all dialists were fa-

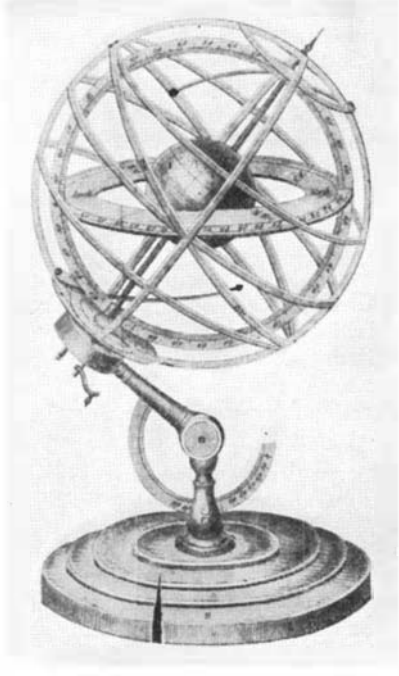


Figure 2: **An 18th Century armillary sphere, reproduced from Ferguson's Lectures. Described in text**

miliar with the functions of this instrument, it was used to solve problems of the sphere, and, peculiarly, to lay out sundials.

Ferguson, a prolific writer and astronomer of the 18th Century, describes the armillary, and clearly defines its use as "an instrument with which easy calculations can be made." He also describes one of glass, invented by Dr. Long, which depicted the position of celestial bodies and their relation to the circles of the sphere, and the motion of the planets—all operated by machinery.

That the armillary sphere may be used as a sundial is evident; it seems improbable that the ancients did not use it as such. Today it is common, and one of its simplest forms would be that of a hoop elevated above the horizon, so that it lies parallel to the plane of the equator. The inner surface, divided into 24 equal parts, would give the hours of the day. A rod suspended in the center, perpendicular to the plane of the hoop, would lie parallel to the axis of the earth and point to the pole, thus serving as a gnomon.

FIGURE 3 shows a sphere constructed with three hoops, or iron bands. The band *HO* lies parallel to the horizon; the meridian circle is represented by the band *NMOSE;* the equator is shown by the band *EM* (lying parallel to the plane of the equator), on whose inner surface is inscribed the hours. The gnomon *NS*, perpendicular to *EM* and pointing to the pole, completes this instrument.

The elements of the armillary have been described and are illustrated in Figure 1. It is not necessary to use all of the circles when the instrument is to be a sundial, but it must be remembered that the hours are inscribed on the equator and the signs of the zodiac on the ecliptic.

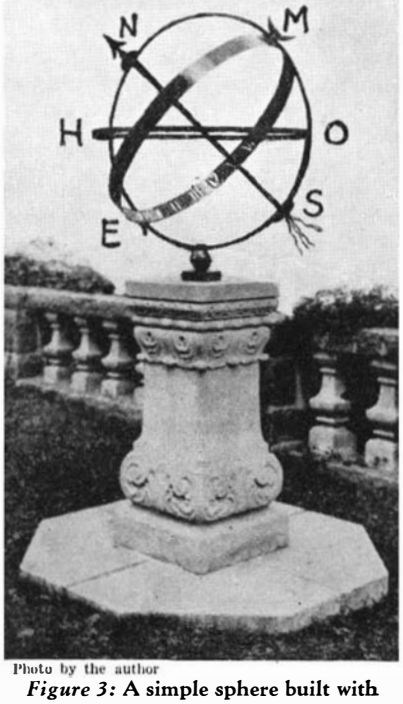


Photo by the author

Figure 3: **A simple sphere built with three hoops of metal, and not at all difficult to construct of metal bands**

One of the finest armillary spheres in this country (Figure 4) is situated on the campus of Phillips Academy in Andover, Massachusetts. The authors are indebted to Dr. Claude M. Fuess, Headmaster of the Academy, who kindly furnished the accompanying photograph and the following description, written by Mr. Paul Manship, the designer and sculptor of this unique sundial.

"The path of the sun is shown by the Ecliptic and the Signs of the Zodiac are portrayed in high relief on the band of the equator. The shaft, representing the axis of the earth, points to the North Star; and its shadow on the belt of the equator indicates the hour. The four Elements, as well as Dawn and Evening, figure in the decorative scheme: Water in the wave motif, with the Earth motif growing out of it; Air is represented by the ribbon, and Fire on the flaming meridian. The whole is supported by turtles, emblems of eternity. Man, Woman, and Child make up the Cycle of Life, as the sphere itself symbolizes the Cycle of Eternity."

This sphere with its pedestal and base, as a unit, might well be symbolical of character, strength, and dignity, thus being an ever-present reminder of the responsibility of all such institutions to men in the making.

Figure 4: **One of the finest armillary spheres in this country is on the campus at Phillips Academy (Andover, Mass.)**

Figure 5: **A south declining dial**

From the designer's point of view the armillary sphere is probably the most flexible type of sundial. It may be easily molded to suit one's fancies or interpretations.

BOOKPLATES often reflect the owner's interests by means of symbols. The sundial may be similarly designed, or it may serve in a descriptive capacity. This is exemplified in Figure 5, which shows a south declining dial designed by Mr. A. G. Ingalls, an enthusiastic amateur worker in stone masonry. "This dial," he says, "is to be made of sandstone and set into the wall of a rock cabin which I am building as a sort of 'island' just off the shore cliffs of Seneca Lake with its foundations resting solidly on a submerged stratum of Devonian rock. Because of the high cliffs immediately to the westward, the sun sets here at noon and the dial is therefore provided with morning hours alone." The hearty welcome "Good Morning" doubtless alludes to cheeriness within despite the presence of the sinister spider, while the biblical quotation in the panel below the dial refers to the situation of the cabin among the waves and on a solid rock foundation.

The earmarks of a good sundial are accuracy, craftsmanship, and design.

Accuracy in laying out the elemental lines on the dial plate is of prime importance, and good craftsmanship speaks for itself.

The dial with its support may be treated as a structure and, as such, it should be sincere in design; that is, be concordant with its surroundings or blend harmoniously with other structures in its vicinity.

THE ODDEST THING ABOUT THE JEWS

By VICTOR W. EISENSTEIN, M.D.

THE essential difference between Jew and non-Jew has been often sensed, less often clearly discerned. Physically, there has been enough distinction in the Semitic physiognomy to prompt that common remark, "He looks Jewish," even though the object of that expression was an Italian or a Syrian. Yet neither the beard, nor a hooked nose, nor curly hair are exclusively Jewish adornments. Psychologically, a curious obsequiousness of behavior and clannishness of relationship have been thought to be distinguishing features of the Jew. Yet all these are relatively inaccurate impressions by comparison with a truly irrefutable distinction in *vital* makeup which exists and which really characterizes him. Rarely has the contrary nature of the Jew in a basic and organic sense been suspected, let alone proved, until the comparatively modern science of vital statistics forced the truth of this disparity upon us.

Even the modern Jewish youth in college would be most reluctant to admit the existence of any such gross physical dissimilarity between himself and his Gentile schoolmate. He might, indeed, resent such implication with the echo of Shylock's protest:

> "Hath not a Jew eyes? hath not a Jew hands, organs, dimensions, affections, passions? fed with the same food; *subject to the same diseases, healed by the same means . . . as a Christian is?*"

NEVERTHELESS, medical science does not regard Shylock's question as being merely rhetorical. That the Jew is not "subject to the same diseases as a Christian is" becomes increasingly apparent with every contribution to racial demography; in fact, the vital statistics show the Jew to be so peculiar in expectation of life, and in both the diseases to which he is susceptible and the immunities which he enjoys, that he presents a unique risk, and might almost be entitled to a separate schedule of premium rates.

The distinctive health record of the Jew of today is largely but a fragment of his biologic record. Like the story of the evolution of an animal species, which is revealed by the imprint on rock or by the growth of an embryo, the history of a race is often disclosed by characteristics embodied in its members; and, in the case of the Jew, these traits reflect the unmistakable traces of an age-long persecution. The small stature, the slight physique, and the proverbial excitability of the Jewish race eloquently tell the tale of the past 2000 years. Certain health hazards which are incident to being a Jew are likewise the results of that peculiar racial experience, and though these are less obvious than his bodily characteristics, they are nevertheless more definite than the alleged curl of his nose.

Diabetes, for example, is notoriously a Jewish disease, approximately one fourth of the members of the facetiously termed "Diabetic Club of America" being Jews. Accurate records gathered the world over, from Leningrad to New York, thrust upon the Jews the unenviable distinction of having two to six times as many diabetics as any other race on the face of the earth. Obese individuals are the usual candidates for this affection, and obesity is far from rare among Jews.

NERVOUS ailments have also been found to rank high among the afflictions of the Jews, and these, to some extent, account for many of the aberrations of behavior which non-Jews so quickly perceive about them. That the Jews are the most nervous of all civilized peoples has been established as almost axiomatic in the medical profession. It has been observed, for example, that the condition known as hysteria, which is but an unbalanced emotional state, presents its protean form more frequently in the Jewish element than anywhere else in the population, while a host of related functional derangements of the nervous system are met with two to three times as often among Jews as among any other group. In this light it is not surprising to note, as did a leading insurance company, that the suicide rate among the Jews of Prussia (even before the Hitler régime) was equal to the combined rate for the other two religious confessions in that region.

Not only in nervous diseases, but wherever nerve influence is a factor in disease, the Jew bears the brunt of the attack. Physicians know, for example, that Buerger's disease, which causes cramps of the legs, and angina pectoris, which causes excruciating pains over the heart, are both diseases which are more frequent among Jews than non-Jews. They know, too, that near-sightedness is more common in Jewish children, as is hardening of the eyeball (glaucoma) among Jewish adults; and that a certain rare form of idiocy with blindness is exclusive to Jewish infants. Recently they have found that a certain facially coarsening and disfiguring glandular disease known as acromegaly affects Jews inordinately, as does a certain enlargement of the spleen known as Gaucher's disease.

JUST why the Jews are most susceptible to these diseases will become apparent further on. Suffice it to say here that their diabetic and nervous heritage dates back almost to the exile of the Hebrews from their ancient Homeland (70 A.D.).

Just as there are conditions to which the Jew is definitely predisposed, there are many against which he is as definitely protected. In former years the infectious diseases were the prime causes of death, and it was in relation to these that the Jew enjoyed his greatest immunity. Today the cardinal causes of death are: heart disease, Bright's disease (nephritis), pneumonia, cancer, and tuberculosis; and these, to various degrees, are the chief causes of death in all civilized communities. In localities where comparative statistics for religious faiths are collected, the data indicate that the Jews apparently have a somewhat lower mortality from the dread heart and kidney diseases than the general population in the same localities. In Budapest, for example, the Jewish mortality rate from the degenerative heart and kidney affections has been reported as two thirds and four fifths, respectively, that of the rest of the population. Somewhat similar figures obtain in Russia and other European localities, where such records are available, although such data are as yet too scant to be entirely reliable.

But it is in the realm of the infectious

diseases that the Jewish mortality experience is really outstanding. Measles, smallpox, diphtheria, cholera, and the like claim only half the toll of lives from among the Jews as from an equal number in the general population affected. In the history of the world there have occurred repeatedly widespread epidemics, which seem to have swept through the land with the severity of the memorable plague of the Egyptians, and which likewise "slew very many of the first-born in the Kingdom of Pharaoh, yet spared the children of Israel." Typical was the cholera epidemic of Russia, in the late war, when the relative death rates from this disease were 29 for non-Jews; 6 for Jews. Recent European statistics accredit the Jews with only one tenth of the smallpox mortality, three fourths of the scarlet fever and diphtheria mortality, and less than half of the measles mortality observed among the other peoples in the same communities. Noteworthy in this connection, too, is the fact that venereal blood infection is said to occur in Jews about one fourth as often as in Gentiles.

PNEUMONIA is the most dreaded and fatal of all acute infectious diseases, ranking third among the chief causes of death in the American experience, being outranked only by heart disease and cancer. Yet pneumonia, often regarded as "captain of the men of death," orders Jews to the grave only half as often as it does their neighbors. Perhaps it is in the deliverance from the dreaded toll of the infectious diseases that the Jews still merit some claim to their ancient title, "The Chosen People."

While the infectious diseases are becoming less prominent among the causes of death, cancer is becoming more and more conspicuous. Cancerous conditions rank today as the second leading cause of death among women of middle age in this country. Most frequently the site of such growths in women is in the pelvic organs, such tumors constituting 15 percent of all cancers in this sex. When comparative racial experiences with cancer were recently compared the amazing discovery was made that fatal cancer of the uterus is less than one fourth as frequent among Jewish females as among the general population. The lessened susceptibility of the Jewish women to these relatively common malignant growths makes quite a favorable showing in the general mortality experience of the race.

Among the "Big Five" of the fatal powers which stalk among the American people, tuberculosis is still present and potent. Public health measures have done much to lessen the ravages of the white plague in this country; still, this malady is of great importance, and takes off a disproportionate number of

Why Jews Have Some Diseases More and Others Less than Gentiles . . . First Class Insurance Risk . . . Most Nervous People on Earth . . . An Effect of Inbreeding, Either Very Good or Very Bad

the population. Yet, in this country, as in the world over, the ranks of the Jews are decimated less often by the ravages of tuberculosis than those of their neighbors. It is curious that from the earliest times the Jews were never too gravely affected by this malady. There are no ancient Hebrew words for "cough" or for "tuberculosis." Today the consumptive death rate among the Jews throughout the world is about half that among their neighbors, while in the city of New York the Jewish population has only about one fourth the tuberculous mortality observed among the Italians

Painting by Betty Byrne, courtesy of *Asia*

A Chinese Jew. Contrary to common belief, Jews mix with all races

and Irish. The fact that the Jews less frequently die from these most formidable and fatal diseases, notably the dread infectious diseases, makes the usually cited freedom of the Jew from the pork-tapeworm infestation pale into puny insignificance.

Just why is the Jew so peculiarly predisposed to certain diseases? Why for instance does he bear the brunt of diabetic and nervous affliction? The answer lies chiefly in his racial history, and partly in his mode of living. That the Jew is the most nervous of civilized races is probably a legacy from his days of persecution. For centuries he had known the lot of inquisitions, pogroms, and discriminations. For generations, too, his people had been forced to herd together, to live and work within the confines of the crowded Jewish quarter —the "ghetto"—and in this herding process family ties were not merely preserved, but intimately welded. Marriage was virtually limited to members within the small group, both by the restrictions of Hebrew law and by the compulsion of the anti-Jewish oppression. In the space of a few generations quite a large number of the Jews in any given community became related to each other through more or less consanguineous marriage.

It is this close mating, technically "inbreeding," that developed the biological type known as the "pure-bred Jew." That this racial type is occasionally a high grade product is a fact frequently cited in favor of inbreeding. But there are terrible compensations for such superiority—for close blood marriages, while they intensify the desirable qualities, likewise exaggerate the defects in the offspring. The factors of inheritance add up both ways to increase the power of whatever traits exist in a family. Should a superior intelligence exist, that would tend to be transmitted to the child of such consanguineous marriage. On the other hand, if there were a tendency to nervousness or to insanity, that tendency might bloom too often as a glaring certainty in such offspring. Whether the "ace" or the "joker" will be dealt out of such family shuffles is a circumstance beyond certain prediction. The effect of this uncertainty is apparent in the Jewish race, into which many great characters have been born among a goodly sprinkling of unstable and neurotic individuals.

THERE are other effects of this herding process. Jews have developed in the course of centuries a defensive group-consciousness and a keen sense of family devotion. To this day the unique family relationships of the Jew shape his mind, his way of thinking, and even his mental aberrations. Dr. Brill, the psychiatrist, has pointed out the effect of an excessive "familialism" in the Jew. He observed that the tendency of the Jew to be overattached to his own particular group is a force which often contributes to his mental maladjustment. Because of such deep-rooted family loyalties the adolescent Jew often fails to make a proper social adjustment when he takes his place in the larger adult world. Failing to find the accustomed profusion of solicitude in his new environment, he retreats into himself and becomes an introvert. Thus he be-

comes a candidate for a neurosis or a frank psychosis. Apparently these factors have not been properly appreciated by those who perceived only the obvious clannishness exhibited by Jews as a race.

Often the tendency to nervous affliction which exists in the Jews is activated by the occupations which they follow. They have not, in the main, engaged in agricultural or other manual pursuits. Their choice of occupations in the past was conditioned both by their slight physical endowments and by the insecurity of life in a hostile community. The constant danger of expulsion precluded the possibility of any great attachment to the soil. For these reasons they have since earliest times engaged in pursuits demanding somewhat more of brain than brawn. They have always pursued business with a characteristic zeal, and this fact has probably played some part in weighting their mental burdens. The likelihood of mental breakdown under competitive economic stress is rendered all the more probable among offspring of a long line of consanguineous ancestors who were for the most part endowed with delicate mental mechanisms. Krafft-Ebing noted long ago that the nervous vitality of the Jewish race has therefore apparently diminished and that they may, therefore, expect an increasing share of the mental diseases, which run side by side with the advance of civilization.

IN explanation of the Jewish predisposition to diabetes, several factors contribute. The chief factors in the production of the diabetic state are obesity and sedentary occupations. The Jews are committed to both. Because worry and anxiety play predisposing rôles in this disease, it is readily understood why a train of diabetes has in the past followed in the wake of every business depression. This fact has been aptly expressed by the Jewish adage: "On Broadway, when business takes a fall, diabetes takes a rise."

The immunities to disease, like the predispositions exhibited by the Jewish people, are likewise not mere chance phenomena but have been developed through a most ruthless process of natural selection in past centuries. The armor against infection which the Jew has acquired has been strengthened by the hygienic mode of life which is his ancient heritage and, paradoxically, by life in crowded cities.

The infectious diseases, particularly tuberculosis, take their greatest toll among rural inhabitants who are exposed for the first time to urban conditions. This fact was well demonstrated during the World War, when almost as many deaths resulted in American training camps, where the boys from the country were brought together with those from the city, as upon the European battlefields where they met the enemy. Epidemics of influenza, measles, mumps, scarlet fever, meningitis, and the like swept the camps like wildfire, and those affected with greatest severity were those who had not been exposed to these diseases during childhood.

The Jews, however, who are the children and grandchildren of town dwellers, have already built up an effective immunity to these infections. For 200 years they lived almost exclusively in cities, often packed into ghettos, under which conditions those who were predisposed to tuberculosis, and the like, succumbed; the many who survived left a progeny likewise refractory to the disease. "The American Jew's advantage in respect to the contagious diseases lies in the fact that his ancestors have already been exposed to infections, not only in past centuries but even in comparatively recent-day Europe; for the Jewish immigrant," as Dr. Fishberg observed, "does not make any material change in his milieu by changing his abode from eastern Europe to America. He lived there in a city, and settles here again in a city. He worked there at an indoor occupation and does the same here. He lived there in overcrowded quarters, and moves here into a 'double-decker' tenement."

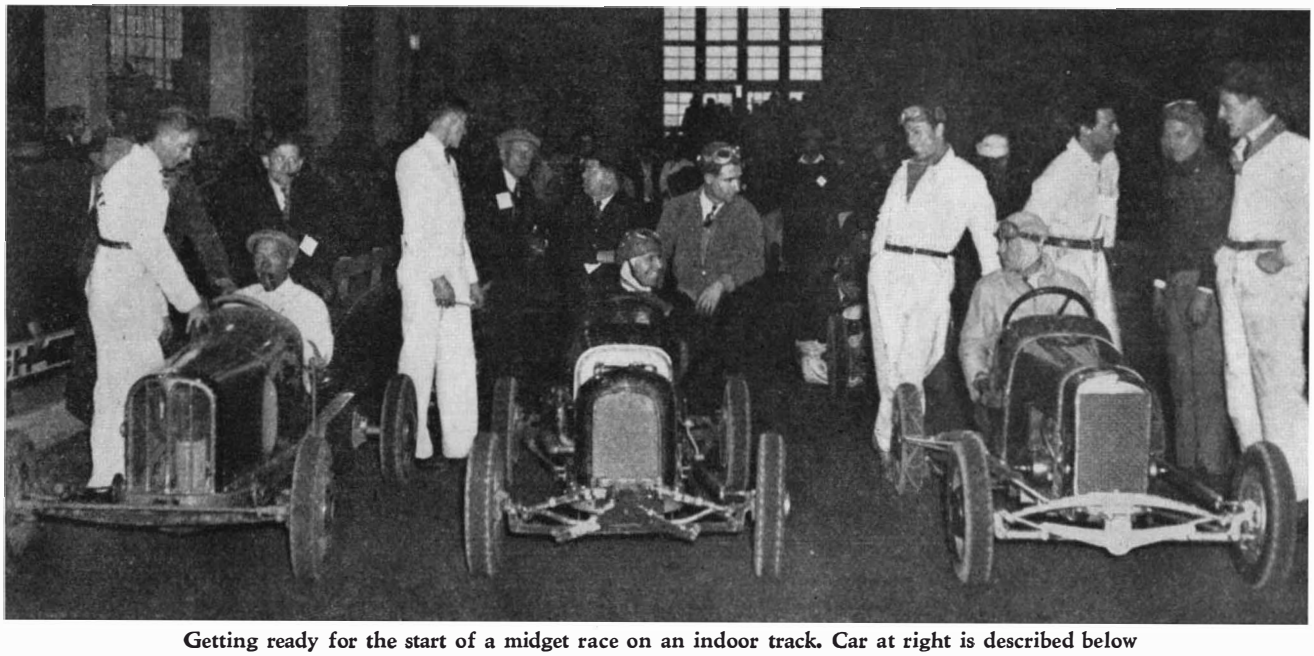
THE relation of city life to active immunity against the infectious diseases was strikingly demonstrated in Palestine after the late war, when for the first time the city-bred Jews of Europe began commingling with their hitherto rural brethren, the Jews of Yemen. Tuberculosis at once ran rampant among the previously unexposed Yemenites, at the same time sparing the European group. A more diabolical experiment could hardly be contrived to prove that not race, but city life confers the peculiar kind of immunity which the Jews enjoy in relation to tuberculosis.

Undoubtedly there are other factors which play a part in this immunity, such as the mode of living and the habits of eating and drinking. As a rule the Jew has subsisted on inspected "Kosher" foods, has been always temperate in regard to drink, has avoided outdoor occupations in rigorous climates, and has always sped to the doctor with every slight (and even imaginary) ill—with the consequence that he has altogether avoided many struggles with serious acute illness. That the Jewish resistance is not entirely inherent becomes evident when one notes the effect of social conditions upon the so-called "racial" immunity. Intermarriage, for example, does not seem to increase the Jewish susceptibility to the "white plague."

After observing the conditions which add to or detract from the chances of life afforded to the Jew, it is natural to inquire: "In whose favor does the balance lie?" "How does the expectation of life among the Jews differ from that among the other people?" In so far as vital statistics can give an answer, the advantage is distinctly on the side of the Jew. The chief causes of death molest the children of Israel but little as they cross the bridge of life. The mortality rates of the Jews, *at all ages*, are relatively and absolutely lower than those of the people among whom they live. Owing chiefly to their immunity from the infectious diseases, the Jews lose relatively fewer children and bring more to maturity than their neighbors. Dr. Billings, one time Surgeon General of the United States, pointed out that "The average annual death rate (7.1 per thousand) among Jews is little more than *half* of the annual death rate among other persons of the same social class and conditions of living in this country," and that "*the Jewish expectation of life at each age is markedly greater than that of the class of people who insure their lives; the average excess being a little over 20 percent.*"

IT is only because of this remarkable tenacity of life that the Jew has survived the 2000 years of persecution which he has encountered. He has, in fact, emerged from his buffets and his wanderings, a first class insurance risk!

Whether the balance of life will remain in favor of the Jew is problematical. To the extent that his immunities are inherent in the race, they will be handed down into his children's children. Intermarriage alone can diminish the extent of purely *racial* protection, and intermarriage is already far from a rarity. Perhaps it is a wise plan of Nature that the Jew, as his life becomes easier and free from oppression and as he therefore needs no additional biological defenses to survive, should turn to assimilation, and so lose this type of protective armor. As we follow the gradation from the purebred or "inbred" Jew of Russia to such "interbred" varieties as are found in Germany, England, and the United States, we perceive that the tenacity of life of the Jew and his resistance to certain diseases gradually diminish as we proceed from east to west. To the extent also that the Jew adopts the mode of life of his Gentile neighbors, follows similar occupations, eats and drinks to the same quality and extent, and even develops the same psychology—to that extent does he likewise approach their vital capacities. Wherever the Jew is thus commingling with the people among whom he lives, he gradually loses his hygienic "racial characteristics" and his comparative demography presents no peculiarities. He is then hardly a "preferred risk."

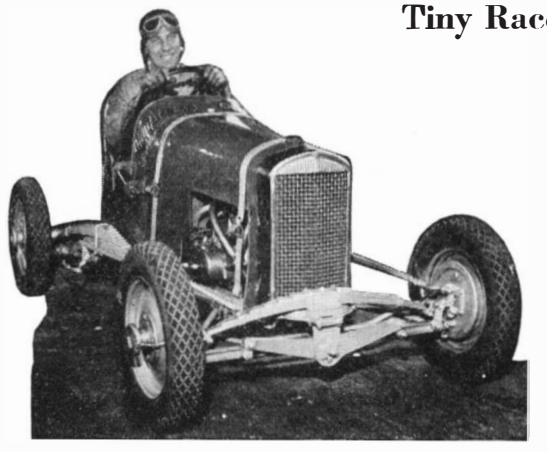


Getting ready for the start of a midget race on an indoor track. Car at right is described below

Roaring Midgets

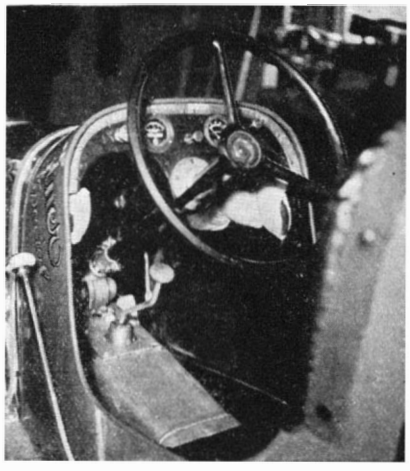
Tiny Race Cars Are Developing a New High-Speed Sport

By A. P. PECK



A midget race car powered with a four-cylinder outboard motor developing 65 horsepower

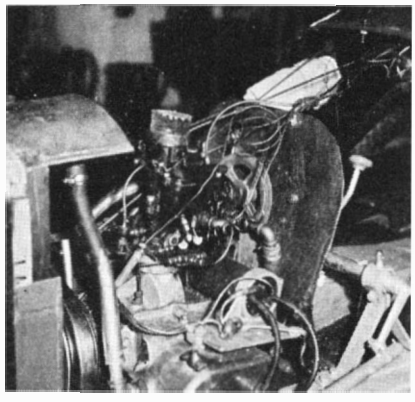
MOTORS screaming, tires squealing, drivers grimly intent on getting ahead or keeping there, midget race cars are setting new records on equally midget tracks. This new sport is attracting thousands of devotees among the spectators, many of whom have never before been interested in racing, but who are fascinated by the tremendous speed developed by these tiny cars. An indoor track, one fifth of a mile in circumference, is drawing large crowds in New York City, and the next summer will probably find many similar ovals throughout the country.



Looking into the "cockpit." The gear-shift lever is in the center

One of the most consistent performers at the New York track is the little car illustrated here. Designed by Edward Hauptner of City Island, New York, this midget cost well over 1000 dollars and is an excellent example of intelligent design. The power plant is a 4-60 outboard engine especially adapted for the job. The motor is placed on its back and securely mounted in a sturdy frame. A water pump, belt driven from the drive shaft, keeps the motor cool even at high speeds.

The normal rating of the motor used is 60 horsepower at 5800 r.p.m. It has been "pepped up" to a point where, turning over 6600 r.p.m., it delivers 65 horsepower.



Under the hood. The motor is equipped with a down-draft carbureter

The wheel-base is 70 inches and the tread 43 inches. Tires 20 by 4 inches are mounted on disk wheels.

Because of the short straight-aways on a fifth-mile track, the best average speed of this car is about 48 miles per hour for several laps. At times, however, it travels at a speed of 75 for short distances. The theoretical top speed, calculated from engine speed and gear ratios, is around 128 miles per hour.

1

2

THE HOUSES WE LIVE IN

By DR. HAVEN EMERSON

President of The American Public Health Association
Professor of Public Health at the College of Physicians and Surgeons of Columbia University

As long as man was nomadic, wandering over desert and through forest, making his home wherever he pleased, the problem of health was one which gave him little concern. But as soon as he congregated by an oasis, or at the fork of a river, or in a well-situated harbor, then began the necessity for healthful living. Without science it would have been impossible for man to develop the great cities of today. The problems of healthful housing, adequate water supplies, effective sewage systems, protection against fire and plague —all these must be answered before man can proceed to the more esthetic things in life.

If the tendency of the succeeding waves of civilization to be of longer duration, and of the intervals of barbarism to be briefer, is to continue, it can only come about through increasing wisdom in the control and processes of human life and a wise use of the agencies of wealth and power over material things.

Public health is founded upon scientific discoveries which are comparatively recent. There is an inevitable cultural lag between the acquisition of knowledge and its application to a community, and unless man is directly touched by imperfections in civilization he is inclined to ignore them. Although the desire for life and health is a basic human emotion, the absence of disease, the prevention of an epidemic or a city-wide fire, and the elimination of food shortages are all negative accomplishments which are not dramatized in the public consciousness. We do not realize that unless scientific housing and health continue, man may easily slip back to the days of plagues or even to barbarism.

Housing conditions in the United States today are alarmingly backward. We are, in housing, at least a century behind our achievements in transportation and communication and yet science has perfected many improvements which our public inertia has kept us from ultilizing. The National Housing Act is beginning to awaken people to the fact that we are desperately in need of improvements and that these improvements lie within our grasp.

Just what are housing conditions in this country? The statistics are appalling. Even in the colder sections of the country a bare 33⅓ per cent of residential buildings, including apartments and tenements, have central heating systems. In the rural areas, which include towns of less than 10,000 population, only about one sixth have plumbing in the house. Homes with running water are less than one fourth of the nation's total, while homes with electricity are less than one half.

MANY American homes are actually nothing short of fire traps, despite the fact that there are many fireproof building materials on the market today. Twenty-three percent of all fires start on the roof and in rural sections as much as 75 percent begin there. Many home-owners are beginning to eliminate this danger by covering their roofs with fireproof shingles. Composed of materials that can stand the flame of a blow-torch (often of Portland cement and asbestos fibers), they are recommended in many communities where inflammable roofing materials are prohibited by law.

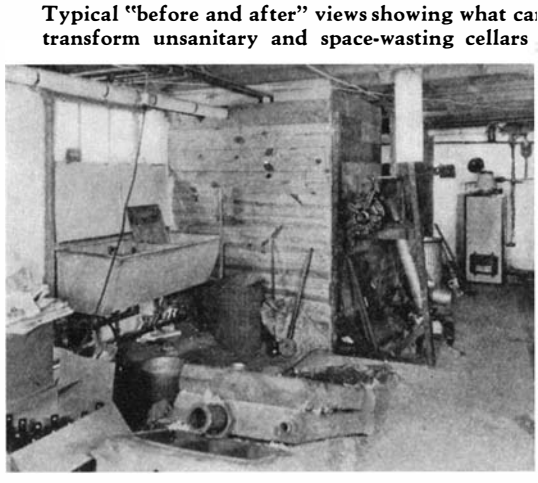
The average American home is wasteful of heat in winter, because it is not properly insulated, and uncomfortable in summer for the same reason. It has been estimated from responsible data that if all the residential buildings in the United States were properly insulated, there would be an annual saving of 100,000,000 dollars in fuel bills. When such an insulating material as rock wool is blown into the hollow wall space of homes, it not only reduces fuel costs anywhere from 25 to 40 percent, but also constitutes great protection against fire. Being factory made of molten rock blown into fine shreds by jets of steam it will not burn and effectively keeps fires from spreading from floor to floor.

Kitchens and bathrooms are too often finished in wood and hard to keep clean. Not only are there many homes lacking running water for bath, kitchen, and toilet but there are hundreds of thousands of homes where there is no privy of any kind indoors or out. In the southeastern portion of the United States there are thousands of schools which lack this elementary convenience so essential for health and the prevention of communicable diseases.

Homes hardly more than shacks or shelters throughout the malarial sections of the South lack screens for doors and windows upon which prevention of mosquito-borne infection depends. In many of our wealthiest cities, the priceless privilege of direct, and even indirect, sunlight is denied to homes in the shadow of tall buildings. Without light the human being, particularly the young and growing child, suffers as definitely as he does with an infectious disease.

How true are the words of Dr. Ray Lyman Wilbur in reference to present conditions: "The housing conditions of the wage-earning population of American cities and industrial villages, with surprisingly few exceptions, are characterized by ugliness, poor sanitation, overcrowding of buildings on land or of people within the dwelling or bedrooms. The number of wage-earning families affected by such unwholesome, drab,

Typical "before and after" views showing what ca transform unsanitary and space-wasting cellars



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From left to right: **1, dilapidated and abandoned; 2, the same house after remodelling; 3, an unkempt and unhealthful farmhouse; 4, a section in Chicago soon to be replaced by modern apartments; 5, New Jersey house with new insulated wing (old section wastes heat as shown by the fact that all snow has been melted from the main roof); 6, Chicago's Ghetto**

OUR announcement last month of a coming series of articles on various phases of housing stressed many pertinent, but general, facts indicating the colossal nature of the housing problem. Dr. Emerson is specific; his subject covers perhaps the most vital problem now facing us in housing: Human Health and Sanitation. Indeed, the future growth of the country hinges upon the working out of a solution to this particular problem, even as our future prosperity will be influenced largely by the extent of our present housing activities. We, therefore, commend those agencies—federal, corporate, and private—that are now so intensively promoting a consciousness of better housing.—*The Editor*.

and uninspiring conditions runs into millions. The slums of our cities, and blighted areas—whether in cities, towns, or villages—are an economic and social liability and disgrace. No nation can afford to permit such conditions. They are too closely linked, not only with industrial inefficiency and economic incompetence on the part of their victims, but also with colossal annual expenditures on the part of public and private agencies for poor relief and social service which alleviate *after* the needless damage has been done. Where prevention is possible, cure is a costly experiment."

There are, fortunately, building improvements which can remedy these evils once public sentiment has been aroused. The National Housing Act is the finest piece of legislation passed in many decades and at the present time it looks as though it might accomplish the desired result. The main function of the Federal Housing Administration in my mind lies in its power to prevent conditions in neighborhoods which could eventually turn them into slums.

There will always be slums as long as a certain percentage of mankind persists in slovenly, unhealthy habits. The finest dwelling place in the world can become a pig-sty if the essential health laws are flouted. It is through education of the people and by instilling in them a pride in their community that bad housing will be eliminated.

Until man has so emerged from the level of the beast that he has learned not to make his own shelter, his garden patch, his dooryard, the pathway to and from his work, a source of continuous pollution of his and his family's food, feet, and water, he cannot be considered to have started on the climb to social security. The transfer of feces to food is a particularly insidious result of the lack of proper sanitation.

THERE are a number of diseases, true scourges of man, which today are major problems of preventive medicine chiefly because of man's congregate existence in houses and in crowded sections. Tuberculosis, rickets, diseases due to vermin infection, and enteric diseases are all traced in a large part to bad housing conditions.

The cause of rickets in its full complexity is not yet known but it appears that the growing child from before birth to the age of two or three years cannot accomplish sound development of bone unless the body metabolism has the benefit of the stimulation which sunlight gives to the cells of the skin. Rickets contributes heavily to sickness and death from bronchitis and pneumonia in little children, and to lowered resistance to measles, whooping cough, and tuberculosis.

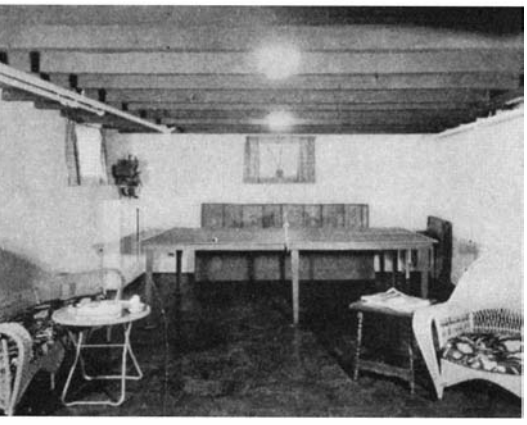
Bad housing is one component of a vicious circle of disease, others of which are drink, poverty, vice, carelessness, and ignorance. The evidence is abundant that the general death rate is low where the number of rooms per house is adequate for the inhabitants. Crowding to the extent of having more than one occupant per room is a factor in raising death rates.

In Detroit, New York, Glasgow, and Edinburgh, studies have been made showing that increased prevalence of cases of and deaths from pulmonary and other forms of tuberculosis is related directly to houses overcrowded and poorly constructed. Jewish dwellers in dark, crowded, and otherwise undesirable tenements in Manhattan who moved in large numbers into much better spaced and arranged homes in Brownsville, Brooklyn, exhibited notable reduction of their tuberculosis mortality as compared with that of their fellows who continued to dwell in the old style tenements in Manhattan. Among industrial workers in Cincinnati, the United States Public Health Service found that bad housing had a marked influence on the tuberculosis rate.

Studies on infant and maternal mortality rates show a close correlation between loss of life from childbirth and in the first year of infant life, and the number of persons per room in tenement housing and particularly with the number sleeping in the same room with the infant. Darkness and crowding in rooms where home deliveries are the custom, and where the economic level of the family makes of the mother the sole house worker—and often also a wage-earner—are directly related to high maternal and infant death rates.

Thus we see conclusively how important to our health as well as to our comfort is the need for good housing conditions. The conditions which should be laid down for every house in America include the following points: first, a building weatherproofed and insulated; dry and easily cleanable interior surfaces; size proportionate to use, not less than one room per person; a great deal of sunlight; ventilation that assures cross air movement by windows opening directly to outdoors; water supply and efficient sewerage system; and, lastly, fireproof construction.

ne—and what *is* being done by many people—to omfortable and healthful living or play rooms



CREATIVE ENLARGEMENT

Advanced Amateur Photographers Will Often Find it Possible to "Retake" Scenes in the Dark Room . . . Some of the Tricks of the Trade

By JACOB DESCHIN

OFFERING almost the equivalent of "retaking" a picture in the leisure of the dark room, the enlarging process in photographic work makes a special appeal to the creative sense of the serious cameraman. Its growing popularity, particularly among users of miniature cameras, is based on the opportunities it affords for altering the "framing" of the original negative, for recomposing the picture by deleting what is unwanted, for emphasizing the main point of the picture, and for enhancing the beauty inherent in the negative but unperceived and therefore unappreciated in the contact print made from the whole negative.

Like the journalistic photographer, the advanced amateur takes everything in his stride that seems to offer good "human interest" as well as pictorial material. Like his news contemporary, therefore, the independent worker finds that many of the most attractive pictures snapped in the streets or elsewhere are taken without full opportunity for properly composing the picture. He also finds that many pictures are taken from a point of view that does not permit correct lighting, or that does not limit the field of view strictly to the subject matter. On viewing the finished negative in the dark room for the first time, therefore, the worker discovers that, in a great many cases, better composition may be had by using only a certain portion instead of the entire area of the negative.

The great variety of so-called "fine grain" films now available makes it possible for even the miniature camera devotee, using a film the size of a postage stamp, to enlarge only a small portion of it up to as much as 8 by 10 inches or larger without appreciable loss of definition. Even where there is a lack of sharpness in the enlargement, this feature is even found desirable because of the pleasing diffusion which it gives.

ENLARGING cameras are divided into two general classes—the autofocusing type, which brings the lens into correct focus at whatever point from the paper it is fixed, and the type requiring manual focusing. In the latter case, it is necessary for the operator to focus the image until it appears sharp on the paper. While the baseboard of the enlarger, or the table on which the enlarger rests is used by some as the "easel" on which the paper is placed, the paper being held by push pins, photographic tape, or other means, it is more satisfactory to use one of the many inexpensive easels on the market. These are adjustable to the size picture desired and give clean-cut margins, while holding the paper absolutely flat during the exposure.

The variety of bromide papers on the market may well bewilder the beginner in enlarging but since no reputable manufacturer can afford to turn out inferior material it is generally safe to pick one of the well-known brands and see what it will do. After having become thoroughly familiar with it, switch, if you wish, to some other brand, and later, perhaps, to still another brand. Eventually, however, choose one paper that peculiarly fits your style of working and stick to it. There is nothing like simplification of the printing process. After all, the big thing is the subject matter.

The brand of paper having been chosen, there is the matter of surfaces of the paper to be considered. Generally speaking, these include glossy, mat, semi-mat, and rough. While glossy prints are necessary in some instances, as when made for newspaper reproduction, the other surfaces will usually be found more pleasing. As a rule, rough papers are used for portraits and certain pictorial subjects, as landscapes and cloud effects, while the smooth papers are more desirable where rich detail and delicacy are wanted. Glossy papers, because they are offered in different grades of contrast, ranging from "soft" or "normal" for "contrasty" negatives to "extra hard" for flat negatives having little or no contrast, are useful in cases where a variety of contrasts is necessary, as in newspaper work. Bromide glossy paper comes in four different grades and chloride glossy in six. Since the "normal" papers retain every detail in the negative, including the most delicate gradations of tone, the clear, crisp, "transparent" negative should be the photographer's constant goal—and that means correct exposure.

The general procedure in enlarging

Improving the interest in a scene by cropping incidental material and strengthening (dodging) highlights

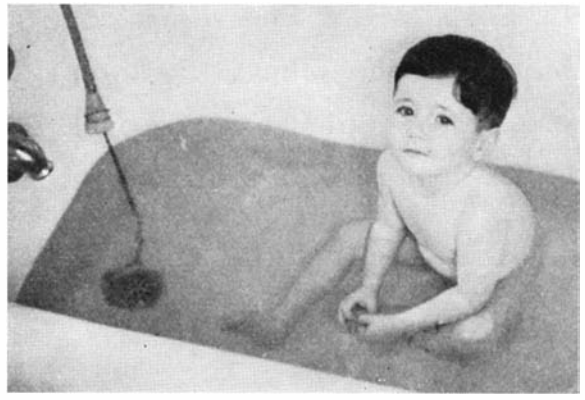
is the same as that for the making of contact prints, except that in enlarging the print is made by projecting the negative image to paper on an easel some distance away. As in contact printing, the dull side of the negative should face the paper.

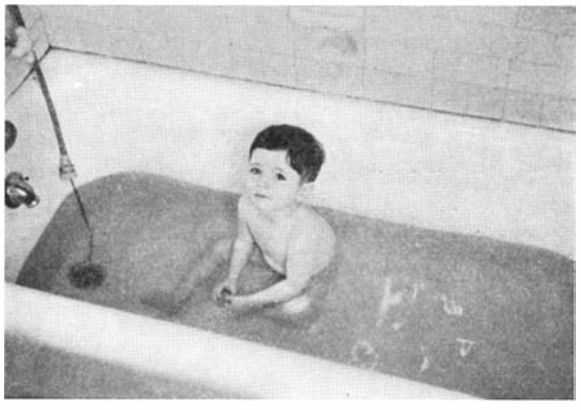
"Test strips" should be made until the operator has become accustomed to the speed of the paper. These are made by cutting a strip about an inch wide from the kind of paper you are going to print on and focusing on it the principal object in the picture. Then, after covering with a cardboard or other opaque material all but a portion of the strip, turn on the white light and give a 10-second exposure or less. Then pull the card down to expose the first and another section of the strip for the same length of time (do not move the test strip itself); proceed thus until you have made a half dozen or so exposures. Each one will be 10 seconds less than the one preceding. Develop and fix this strip in the ordinary way and then view it in a bright light. When you have determined by careful study which section does the negative the most justice, insert a full sheet of the same paper and give it the exposure which was right for the correctly exposed section of the "test strip."

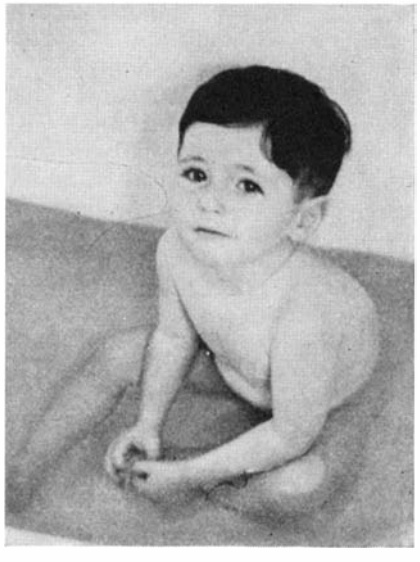
ASIDE from the mere limitation of the area of the negative to be enlarged—though this often calls for a real artistic sense, a lively imagination, and an understanding of the principles of composition—the worker's scope is greatly widened by the use of "dodging" methods and the various means of diffusion.

Diffusion, or the softening of definition of the image, is resorted to in photographic printing and enlarging in the production of pictorial and portrait work and in other cases where sharpness, a quality much desired in commercial photography and newspaper work, actually is a detriment.

Diffusion may be realized by any one of a variety of means. There are available diffusing lenses or screens for the regular enlarger lens. Where the enlarger lens may be adjusted to different stops, as on the regular camera lens, the worker may diffuse by starting the exposure at the full opening, after focusing on the center of the picture, and then stopping the lens down for over-all sharpness. A piece of black chiffon placed over the lens during all or part of the exposure will often produce pleasing diffusion. Another favorite method is to use an embroidery hoop and fasten in it a piece of silk, cheese cloth, or bolting cloth. The hoop is kept in motion between lens and paper during all or part of the exposure, depending on the amount of diffusion desired. In using any of these methods, the exposure time must be increased.







Four enlargements (reduced for reproduction) from the same negative. *Above:* The entire area of the negative is used. *Left:* Composition improved by using only part. *Below:* Just the figure. *Extreme left:* The head of the subject vignetted

"Dodging," or the practice of using the hand, a cardboard, or some other opaque material to shade the more transparent parts of a negative while allowing more exposure time for the denser parts, is a very valuable and useful art which requires only a little practice to learn. "Dodging" is resorted to in cases where, if the entire negative or that part of it which is being enlarged were given the same exposure all over, either the highlights would get insufficient exposure or the shadows would receive too much. The procedure is to use the hand where suitable, or a piece of cotton or black paper at the end of a wire or long piece of glass, to shade the shadows after sufficient exposure has been given to show full detail, thus giving further exposure to the denser parts. Landscapes with clouds, and most negatives with strong contrasts are greatly improved by "dodging."

"Vignetting" or the process of printing only a certain portion of the picture, usually a head, while shading off all the rest, leaving the shaded part white, is liked by many for portrait work. A hole the size of the image to be printed is cut in a piece of cardboard somewhat larger than the area of the printing paper. This cardboard is interposed between lens and paper, and is constantly moved up and down during the entire exposure, the amount of motion determining the diffusion of the vignetted edges. In all "dodging" and "vignetting" the shading medium must be kept in continual motion or lines projected by the "dodging" medium will show in the final print.

The possibilities in enlarging are without limit. A search through your collection of negatives, even the ones which you have thought worthless, may reveal marvelous opportunities for producing beautiful enlargements from what are apparently trite negatives.

POPLARS OF PROMISE

Rapid-Growing Hybrids . . . 10 to 14 Times Faster Than Natural . . . 80-Cord "Crop" Per Acre in 12 Years . . . More Profitable Than Wheat . . . Boon to Farmers, Paper Makers, Lumbermen . . . Cut Importations . . . An Important Achievement

By R. G. SKERRETT

WHAT does paper mean to the average person, and in how many ways does he utilize so-called paper products? The facts are of great economic significance.

Seventy-five years ago, the per capita consumption of paper annually in this country did not exceed eight pounds. Today, it is close to 225 pounds! The term "paper" includes "boards" and other wood-pulp commodities, for the outstanding fact is that each and all of these products require pulp wood as a basic raw material.

There was a time—and that not so many years ago—when our forests furnished all of this essential wood; but we have used up most of those stands of timber far faster than nature could possibly replace them by normal processes. Wood-pulp and paper mills that used to stand close to virgin forests have, in most cases, stripped virtually bare those nearby areas and have had to go to distant points for their logs—thus adding each year to harvesting and haulage costs. Moreover, the dependence of American wood-pulp and paper plants upon foreign sources of essential raw materials has grown at a disquieting rate in latter years. That is to say, just as our uses of paper and paper products have approached their present volume we have had to rely increasingly upon other countries for the basic stock; and the price has mounted accordingly.

Systematic reforestation might, in the course of generations, place our domestic paper mills in their erstwhile favorable situation—always assuming that reforesting were done on a scale in keeping with the cutting of the mature trees. Even so, nature would not hasten the process of replenishment. A natural-growth poplar tree is not a size suitable for pulp wood until it has been growing from 45 to 55 years, and is then eight inches in diameter at breast level of an average man. A pine tree, to attain the same diameter, would require a growing period of 70 years; a spruce tree would take 90 years.

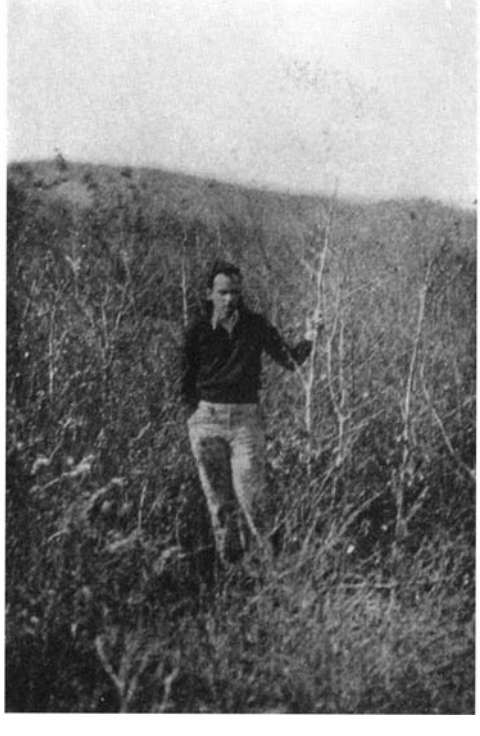
On the face of it, most farmers and other owners of cut-over timberlands would not be inclined to look so far ahead, especially as they would not, in all likelihood, live long enough to reap the benefit of their planting. It was just this discouraging drawback to reforestation that inspired Dr. Ralph H. McKee, of Columbia University, about 18 years ago, to study the raw-material problem of our paper industry.

AS Dr. McKee explains: "After considerable research, my technical associates and I were convinced that from the 25 or 30 varieties of poplars obtainable in this country and elsewhere we could deliberately produce crosses that would be radically different from any of those poplars and perhaps give us a new source of wood for paper-making. Any hybrid, to be acceptable, would have to have a wood of good color and of fairly long fiber, and grow a straight and long trunk to a considerable height before developing branches. Branches, at their junctures with the trunk, form discoloring knots; and the papermaker needs logs that are very light or white for most of his products—otherwise the knots must be removed before the wood is pulped, and that operation adds to the cost of production and reduces the amount of paper or pulp that can be manufactured from each cord of wood."

The poplars that were obtained by Doctor McKee and his associates through crossing are, so far as knowledge goes, unlike any others in existence. To be exact, they are freaks that are the outcome of definite acts on the part of man combined with utterly mysterious actions on the part of nature.

DESIRABLE and different varieties of poplars were found in the United States among collections in certain botanical gardens and also in several commercial nurseries on Long Island. Poplars, unlike many other familiar trees, are not bisexual but grow separately as male and female trees. This simplified the hybridizer's work. The flowers of the chosen female trees were safeguarded from normal pollination by bees and other insects by covering the unopened buds with paper bags. When the flowers opened, pollen was taken from the chosen male flowers and dusted on the selected female flowers—the protecting bags being momentarily removed for that purpose. The sheltered seeds ripened in six weeks and were then planted in a mineral soil favorable to germination. Doctor McKee's efforts were well rewarded, and again we shall quote him.

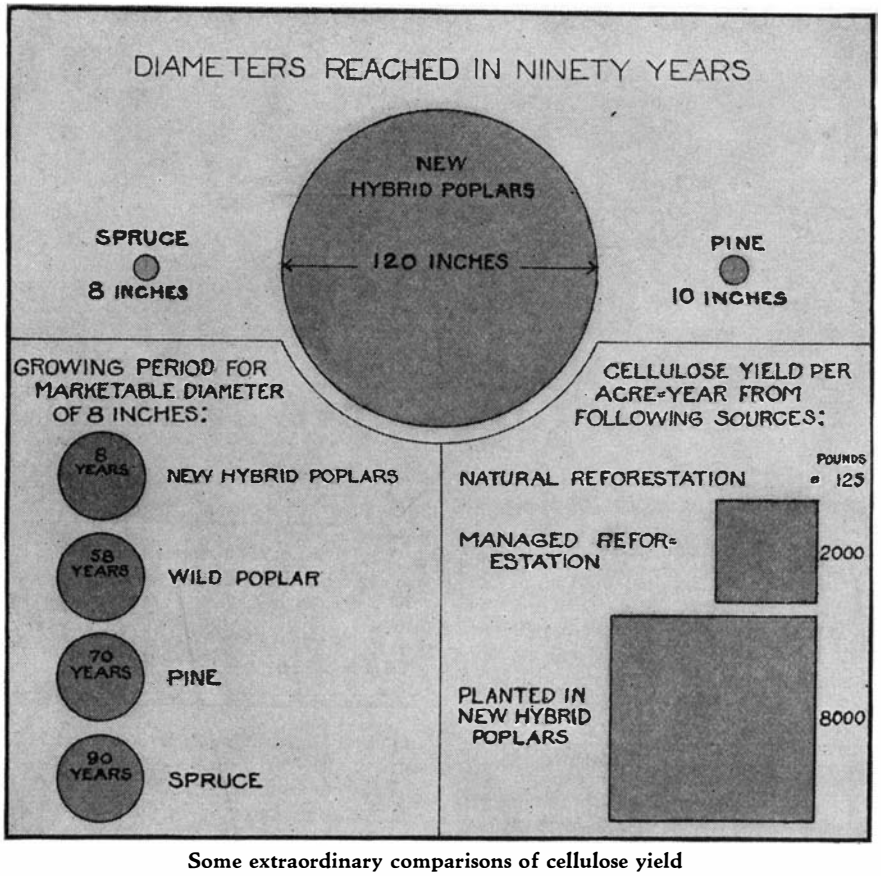
"By our cross breeding we obtained, all told, substantially 100 different cross combinations. During the years that the experiments have been carried on, we have grown well-nigh 16,000 seedlings; and out of these, virtually 100 of the best hybrids were retained for further study and for propagation by



cuttings. We thus ascertained that 25 types of trees were deserving of intensive cultivation. Eventually we shall probably find six or eight of these hybrids to be best suited for commercial planting on an extensive scale. Today, we have these poplars flourishing in Maine, New York, Florida, Wisconsin, and North Carolina—on a total of substantially 300 acres. In this way we are learning how these poplars adapt themselves to a considerable climatic range, and how they grow vigorously on wind-swept hilltops, on mountain slopes, and in the moist soils of bottom lands.

"INSTEAD of waiting 45 or 50 years, as is the case with the ordinary wild poplar, certain of our new hybrids can be cut profitably at the end of eight or ten years following planting. These trees increase in diameter at the rate of an inch annually. At the end of 12 years, an acre of these poplars should yield 80 cords of timber that can be used either for lumber or for pulp wood. They *grow from 10 to 14 times as fast* as the wild poplars that are now used in large quantities for pulp wood in the manufacture of what is known as 'book paper.' When nature unassisted retimbers a cut-over area, the yield per acre of pulp wood from poplars averages six cords, and it commonly takes about 60 years to attain marketable size.

"Our calculations make it reasonably certain that more dollars per acre-year of wood can be grown than can be realized per acre-year in wheat or other farm crops. Cellulose plays an important part, and a steadily increasing one, in modern life. It is the raw material in the making of paper, textiles, explosives, and numerous other commodities that serve our needs in various ways. Cellulose will, undoubtedly, have wider applications in the years to come; and sources of cellulose may, therefore, be reckoned as potential wealth. In this particular, let us see how the new hybrid poplars measure in comparison with other sources of cellulose:



Some extraordinary comparisons of cellulose yield

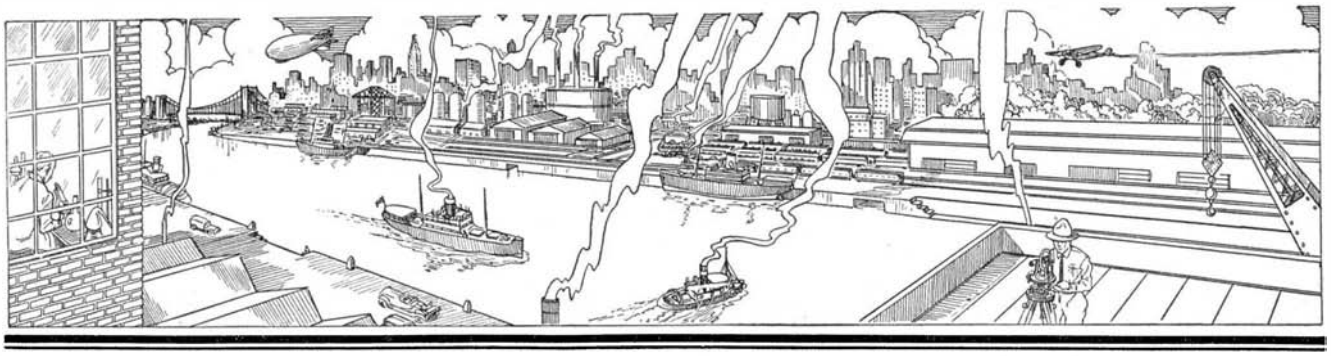
	Per acre-year
Flaxstraw	100 pounds
Cotton	150 "
Cornstalks	500 "
Reforestation—Natural, best	125 "
Reforestation—Managed, pure species	2000 "
Reforestation—New hybrid poplars	8000 "

"Thirty years ago, pulp wood in America cost five dollars a cord delivered to our paper mills; and within the succeeding 13 years the price mounted to ten dollars a cord. During the past decade, pulp wood averaged 25 dollars a cord by the time it was at the mills. Undoubtedly, this raw material will fetch more as years go on. The new hybrid poplars thus offer prospectively a substantial source of relief, especially when used in making book paper, which is extensively employed in the publication of magazines. At the present time, our mills are working into paper about a million cords of poplar yearly, together with other suitable hard woods; and we obtain from Canada annually approximately 200,000 cords of poplar. Think what this would mean to our farmers in a few years if they could grow hybrid poplars for this purpose."

At left are natural-growth poplars five years old. *Above*: New hybrid poplars of the same age. The difference is striking

DOCTOR McKEE and his associates can now produce in four years a volume of nursery stock that would require a period of six years if generally accepted nursery practices were followed. The McKee poplars, as they are called, will make it surely profitable to plant what are commonly considered unpromising or waste areas; and these poplars need be harvested only when there is a market for them. The trees can be planted where they will greatly help to arrest soil erosion, which annually takes from farmers a toll of fully 200,000,000 dollars; while saving against loss through erosion, the hybrids will be gathering value from the very soil that they protect.

It is inevitable that these hybrid poplars will take their place in any broad plan of reforestation—something that must be adopted in this country. In these promising and extraordinary trees we have one more example of the rich rewards that can be realized through scientific research.



THE SCIENTIFIC AMERICAN DIGEST

Conducted by F. D. McHUGH

Contributing Editors

ALEXANDER KLEMIN

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

A. E. BUCHANAN, Jr.

Lehigh University

Ejector Ice Cube Tray

ICE cubes that pop out of the tray as if propelled by some magical force are featured in the new Westinghouse refrigerators. The Eject-o-cube ice tray is one of many exclusive contributions incorporated in the new line of refrigerators designed to reflect the spirit of the present streamline age. Due to increased efficiency, a supply of cubes can be frozen in an hour's time.

Moving two levers ejects the ice cubes from this new type of tray

This new tray eliminates the necessity of pouring water over the tray to loosen the cubes, or following any other of the present tedious methods employed to secure the desired cubes. It also eliminates the waste in temperature and size brought about when the conventional method of securing cubes is followed.

By simply moving two levers upward and outward the entire supply of cubes is available, or as many as desired may be removed. The cubes are full sized, and the person wanting them suffers no annoyance in getting them out dry.

Other features of the new refrigerator are: a revolving shelf that permits greater accessibility to the stored foods and makes additional tall bottle space possible; an easy action "button touch" door latch; oversize froster with chromium plated door; triple storage compartment with separate drawers for salads, perishable foods, dairy supplies, and fruit; a seven-point dial temperature selector; and a handy tray that folds back on the inside of the door.

All models have the hermetically sealed unit that carries a five year protection plan.

Wheeled Centipede in Africa

UPON the recommendations of the British Colonial Office, the Leyland Motors, Ltd., of Leyland, Lancashire, England, designed and built a new type of motor vehicle to solve the various problems involved in the transportation of heavy loads over the primitive roads and trails of Darkest Africa. This unit consists of a tractor and two trailers, each hauling a part of the maximum useful load of 15 tons. After being tried out over 5500 miles of unimproved roads in England, it was shipped to the African Gold Coast and in six months of 1933 covered 8050 miles with practically no trouble.

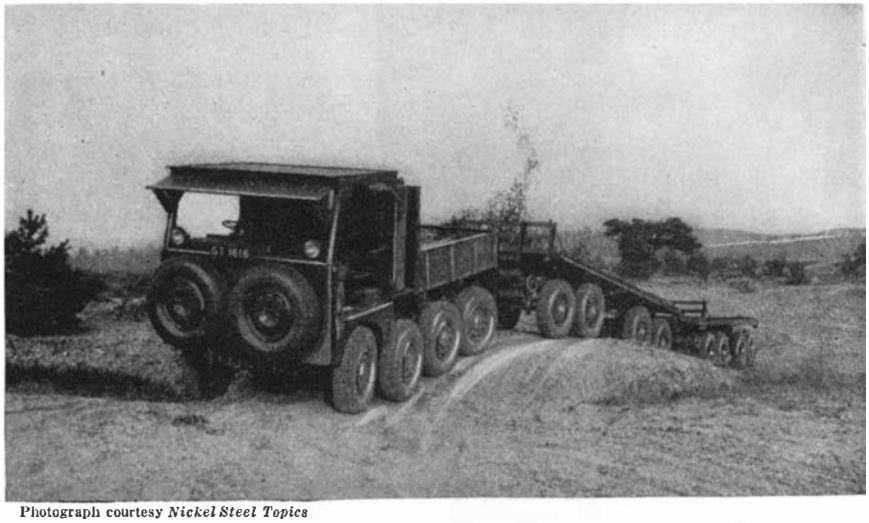
Each of the three components is mounted on eight wheels, all articulated, and all of the tractor wheels are driven, steered, and braked. This arrangement gives thorough steering control, as was demonstrated on a four-mile ascent in Africa with an average gradient of 1 in 20, the route having a continuous succession of hairpin curves. Both going up and coming down, even in the rainy season and under full load, this route was negotiated with ease and complete safety.

This tractor-trailer unit has been used to carry barrels of cement, concrete culvert pipes, timber, native products, and live stock. Its service was so satisfactory that the Leyland plant was called upon early last year to manufacture another one exactly similar except for the substitution of a Diesel oil engine for the Leyland six-cylinder gasoline motor. The net transport cost with the original unit was less than sixpence per ton-mile, and with the Diesel engine this is reduced about 20 percent. The Diesel-powered unit has recently successfully crossed Australia fully loaded.

In the performance of these vehicles, the use of nickel alloy steels plays an important part.

Oxalic Acid from Corn-Cobs

THE lowly corn-cob, heretofore useful for nothing much but pipes, is a potential source of oxalic acid, according to Dr. H. A. Webber, of the Engineering Experiment Station of Iowa State College. Between 6,000,000 and 8,000,000 pounds of oxalic acid are used annually in the United States, according to Dr. Webber. It is used in laundries, in the production of Celluloid



Photograph courtesy *Nickel Steel Topics*

An articulated 24-wheeled vehicle made for use in the wilds of Africa

and rayon, in the purification of glycerol and stearin, in leather manufacture, in tanning, in calico printing, in bleaching straw and wax, and in the manufacture of ink and dyes.—*A. E. B.*

RAT LEPROSY

MAN has nothing to fear from rats as carriers of leprosy, since the rodent disease is not true leprosy and is caused by a germ to which humans are apparently immune, according to Dr. Malcolm H. Soule, professor of bacteriology in the University of Michigan.

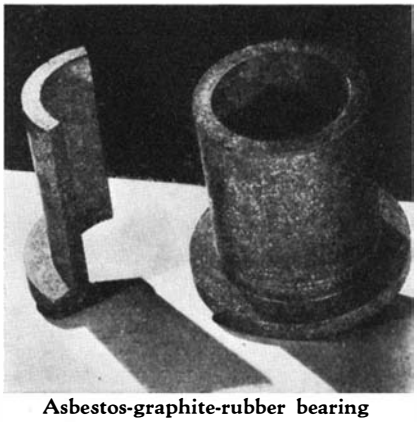
Asbestos in Bearings

A NEW bearing material which solves the problem of under-water operation, has just been announced by Johns-Manville.

A compound of asbestos, graphite, and rubber developed after several years of laboratory research and field tests, this material (slippery as its name implies) is a tough but readily-machined product which has a low coefficient of friction, even though unlubricated. Water is its best lubricant.

"Eel-Slip" material fills a long-felt need in industry for a bearing material which does not require use of the commonly employed lubricants and for numerous other uses where its mechanical strength, low coefficient of friction, increased efficiency in the presence of moisture and long wearing qualities make it unique.

In the paper industry, aside from bearings which run in water or under intermittent dry and wet service, Eel-Slip material



Asbestos-graphite-rubber bearing

is used for increased efficiency and economy on the wet end of Fourdrinier paper machines as shakers or flat screen blocks, water tables or forming boards, suction box covers, steam joints, suction couch and press rolls, and deflector strips and doctor blades.

Rickets Fought for the Eskimos

THE New World, discovered and colonized by Europe 500 years before Columbus, was lost again because of rickets, modern archeological excavations in Greenland suggest. At Herjolfsnes, on the lonely Greenland coast, several skeletons of Viking women, disinterred and studied by Prof. F. C. C. Hansen of Copenhagen, exhibit severe pelvic deformations. The abnormalities are due to osteomalacia (rickets in its severe form), according to Dr. J. Preston Maxwell, British physician and professor of gynecology at the Union Medical College at Peiping, China. By inhibiting reproduction among the settlers, this disease changed the course of history, Dr. Maxwell suggests.

The Greenland colony was founded in 985 A.D., by Eric the Red. It was Eric's son, Leif the Lucky, who discovered "Vinland," thought to have been perhaps Massachusetts. The Greenland settlements lasted five centuries. An independent state at first, they finally became a Norse colony. Scandinavian ships maintained a busy commerce there, trading European wares for New World walrus ivory. Great stone churches were erected; cattle were imported; and new local industry began.

Clothing styles dug up by archeologists in Herjolfsnes show how close and continuous the European contact was for a while. Then, at last, for some mysterious cause, decline set in. The population died. Houses fell into ruin. Grass and willow grew over them. Finally Eskimos settled on the sites. The Norse ships stopped coming, no one knows when, or why.

The ruins and the buried objects tell their strange and tragic story, and the deformed bones, perhaps the reason for it. Did the even-then-proud Nordics refuse to take the native cod-liver oil which has enabled their despised Eskimo neighbors to survive to the present day?—*Science Service.*

The "Crown Jewel" of the Aluminum Industry

THE cap of the Washington monument was examined with great interest by scientists when repairs to the famous landmark made it possible to inspect the aluminum pyramid. After 50 years service as a lightning rod, 550 feet above the ground, the metal that cost 12 dollars a pound when the monument was built showed no signs of deterioration. In fact, the engraved inscriptions on the sides of the pyramid were perfectly legible. Today aluminum sells for 21 cents a pound, but when this cap was made, the metal was such a curiosity

PROGRESS In This Age Of Science

As Told to SCIENTIFIC AMERICAN

By FREDERICK H. ECKER
President, Metropolitan Life Insurance Company

LIFE insurance is based on actuarial science, which combines the mathematics of interest with the mathematics of mortality. It may seem strange to the layman to talk about mathematics of mortality, but mortality tables are developed by mathematical formulas.

As is well known, the probability of a person dying increases with age after infancy. However, it is desirable, in most cases, that the policy-holder pay the same amount of premium each year instead of an increasing amount. Hence a part of premiums collected in the early years must be set aside in a reserve fund which, with its interest earnings, will supplement the premiums received in later years to pay the claims which will then be incurred. The determination of the amount of yearly premiums to be collected, the part to set aside the reserve fund, and the amount of the necessary reserve at any given date is a definite function of applied actuarial science.

As is well known, compound interest is a powerful factor in the accumulation of reserve funds and the mathematics of interest is applied in various ways. To illustrate: it is an algebraic operation to determine the actual yield to maturity of bonds purchased either above or below par.

The mathematics of mortality includes the analysis of the number of persons living or dying during a past period in such manner that the future mortality among a large number of humans can be determined with a workable degree of exactitude. No man knows whether he will be alive a year hence—or ten years hence. But when humanity is considered in the thousands, the percentage of each thousand that will live or die each year can be computed by the mathematics of mortality.

It is highly desirable that larger numbers of our population become insurance conscious. When this becomes more general, a person will not insure himself primarily with the thought of a lump sum in mind for the replacement of his economic loss to his family and to his dependents. He will insure himself with more consideration toward the thought of replacing his income with an income from the amount of insurance he carries. He will make such arrangements with the insurance company that this income will continue to be paid his beneficiaries over a number of years. When the great percentage of insurance is carried on this basis, the public will derive the greatest benefit from insurance and will have a truer concept of the science of insurance.

that the cap was exhibited in the window of Tiffany's and people shook their heads dubiously at the new-fangled metal and doubted whether it would stand up under the severe conditions of weathering to which it would be exposed.—*A. E. B.*

The Wingless Autogiro

THE wingless Autogiro, originated some time ago by LaCierva himself at his British factory, has recently made its appearance in the United States in two machines, one built by the Autogiro Company of America, and the other by the Kellett Autogiro Corporation. Previously, the Autogiro carried a fixed wing at the ends of which were placed conventional ailerons. Rudder and elevators were also employed,

Upper end of the rotor support pyramid in the new wingless Autogiro

and the controls followed those of a conventional airplane. The rotor system was four-bladed.

In the new wingless Autogiro, direct control is obtained by inclination of the entire rotor system, which is so mounted as to pivot on a species of universal joint, and which can be tilted either fore-and-aft or laterally. As a result, the fixed wing has been eliminated, and neither ailerons, elevators, nor rudder are employed.

A remarkable improvement in performance has derived from the invention of the direct control. Previously there were two lifting systems—the freely rotating or "autorotating" rotor and the fixed wing. These two lifting systems carried varying proportions of the load but always involved aerodynamic resistance. Now but one lifting system, the rotor, is there to create air drag and hence the aerodynamic efficiency has

The wingless Autogiro in flight over Mt. Vernon

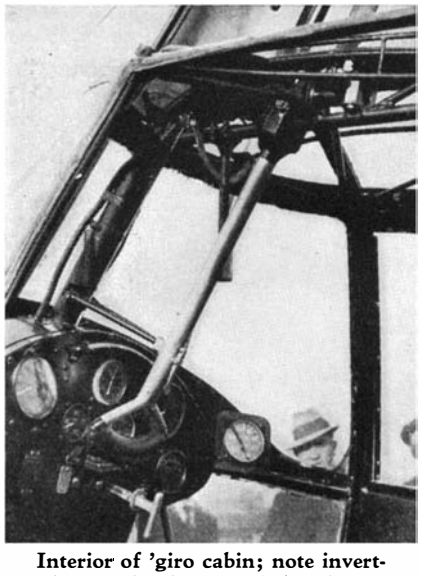
been greatly improved. This improvement in aerodynamic efficiency is further enhanced by the substitution of three blades for the four of earlier practice. (The dynamic balance with three blades is, incidentally, just as good as with four blades.) The elimination of the fixed wing has reduced the structural weight, and structural weight, as we know, is the constant concern of the aircraft designer. The Autogiro has always had remarkable landing characteristics and a low take-off speed. It was not so satisfactory in top speed except with excessive application of power. Now an extraordinary speed range (that is, ratio of top speed to minimum speed) of approximately 6 to 1 has become available.

The specifications of the wingless Autogiro built by the Autogiro Company of America illustrate this improvement in performance:

Engine 80 horsepower Pobjoy, five cylinder radial.
Top speed 100-105 m.p.h. (approximate).
Cruising speed 90 m.p.h.
Take-off speed 25 m.p.h.
Minimum speed 17 m.p.h.
Weight empty 600 pounds.
Gross weight with pilot, passenger, and fuel and oil, 1140 pounds.
Fuel 17 gallons.
Range 350 miles.
Rotor diameter 32 feet.
Over-all length (blades folded) 20 feet 10½ inches.
Over-all height 8 feet 3½ inches.
Landing gear tread 6 feet 5 inches.

It will be noted that this machine, with a slightly more powerful engine, would have successfully met the requirements of the recent Department of Commerce competition for low power planes, and shown itself well adapted to the needs of the private owner and amateur pilot.

The machine features a comfortable two place, side-by-side enclosed cabin which is entirely suitable for private ownership. Another practical advantage from an owner's point of view lies in the ability to fold the wings. The over-all length of less than 21



Interior of 'giro cabin; note inverted control column with hand grip

feet is then quite moderate, and the width of the storage space is no longer determined by the span of the fixed wing or rotor diameter, but by the span of the tail surfaces which is only eight feet.

The perfect control available under all circumstances by the introduction of the tiltable rotor is perhaps even more important than the improvement in performance. Direct control being achieved by the tilting of the rotor, and the 'giro lifting system

Rear view of wingless Autogiro, showing steerable tail wheel

Piled in front of this Eastern Air Lines plane are emergency repair parts which were recently rushed from Newark, New Jersey, to an oil refinery on the island of Arubia, Dutch West Indies, a distance of 3000 miles. Three weeks were saved by sending these parts by air, and the 808 pounds which this shipment weighed made it the largest single international air-transport express shipment to date

being utterly immune to side-slips or possible spins, it is sufficient to push the stick in the direction in which one wishes to go and the 'giro follows. While the American wingless has a rudder, we are informed that the use of the rudder may be dispensed with in all normal flying. There is no coordination of aileron and rudder to be acquired, and turns, climbs, and other normal maneuvers can be readily acquired by the novice.

Since control is not dependent on the forward speed but on the manipulation of the main lifting element itself, the 'giro can land substantially vertically or at least with a forward velocity of only 10 or 15 miles per hour and still be under full control. Take-off is simplicity itself. With elimination of the fixed wing it is not necessary to get the tail up to gain speed. In a normal take-off for the wingless ship, the tail remains on the ground until 25 m.p.h. is reached. To take off it is not necessary to change the attitude of the fuselage, but merely to increase the incidence of the rotor by tilting it back. On landing, in the words of "Pontius," writing in the London *Flight:* "Get over a point just short of the petrol (gasoline) pump or hangar door, and come straight down, nose well up, and in absolute control, to, say, 150 feet. Then gain a trifle of speed by easing the nose down, and when you are there, pull the stick back, when you will sink a few feet and stop in your own length." There are still certain rules to observe as in revving up on the ground, waiting till the rotor has reached the right speed, and so on, but these are simple and easy to learn.

The general appearance of the wingless Autogiro is well illustrated by the photographs. The cabin has windows at front, sides, top, and rear; with no fixed wing the vision is well nigh perfect. The construction of fuselage and landing gear follows that of the conventional airplane. The landing gear tread is somewhat less than that of previous Autogiros; the lateral control is so perfect that very wide tread is not essential even at very low speeds. The rear view shows a steerable rear wheel, a stabilizer, and no elevator, and fins without rudder. The stabilizer has on the right side a positive camber and on the left a negative camber. This to take up the engine torque, which formerly was taken up by suitably rigging the fixed wing.

We cannot conclude this note without mentioning one experiment which has been successfully made with the 'giro in England, and is about to be tried in the United States—an absolutely vertical initial climb of some 75 feet or so. This is achieved by the use of controllable pitch blades. The pitch is at first made quite small or flat and the blades are turned up to their highest speed by the starter system. Then the clutch is disengaged and at the same time the blades are moved to their highest pitch. They are therefore rotating with the very high speed of low pitch, and meeting the air at a high lift angle. Naturally the lift of the rotor becomes very high, and the craft rises vertically in the air.—*A. K.*

Clipper "No. 7"

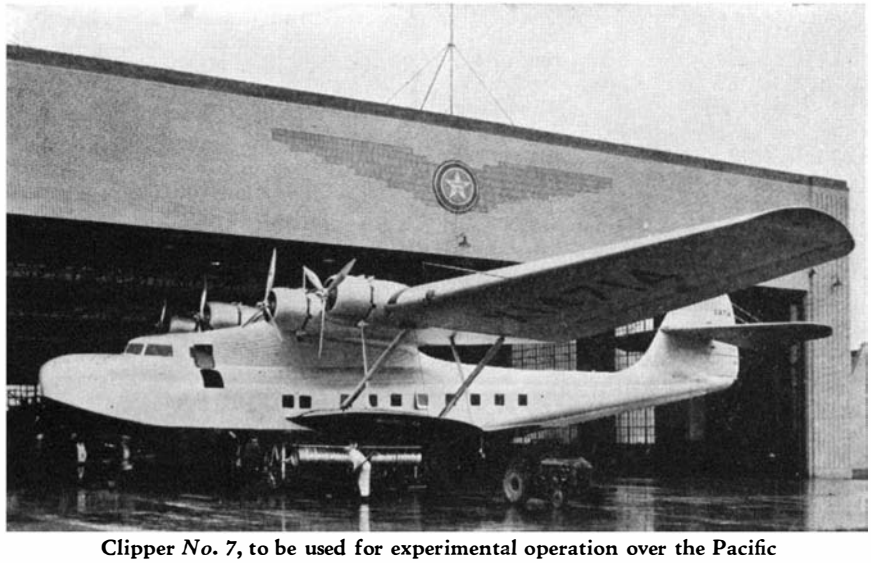
WHILE the Sikorsky *S-42* already in service on Pan American Airlines is adding to its reputation, and the second of the Sikorsky Clippers is nearing delivery, Pan American Airways are accepting another huge ship, Clipper *No. 7*, from the Glenn L. Martin Company.

Clipper *No. 7* is specifically intended for experimental operation in the Pacific, is the largest American airliner ever built, and is of tremendous significance from the point of view of over-ocean operation. Like the *S-42*, which we have described fully in these columns, the Martin Clipper was designed and built in the greatest secrecy. Successful acceptance flights have lifted the veil of secrecy somewhat, although many of the characteristics of the new flying boat are still being withheld.

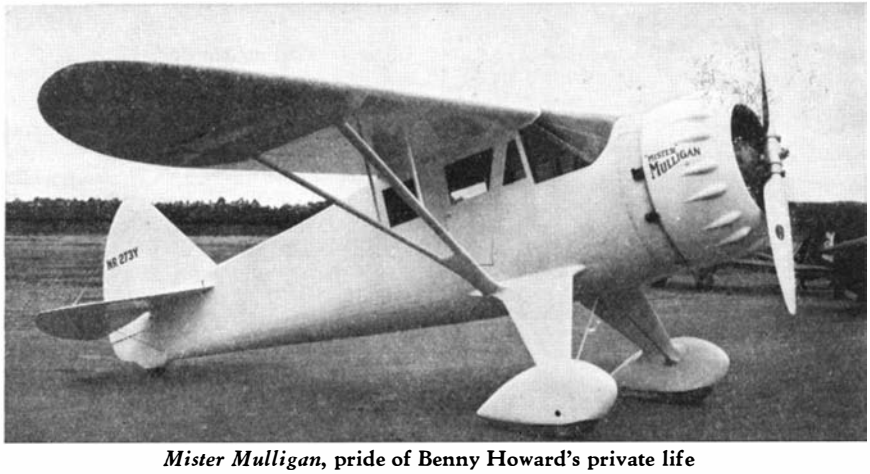
Nevertheless it is possible to draw some comparisons regarding the efforts of the two design groups. The Martin Clipper is somewhat larger and heavier than the *S-42*. The span is longer and the wing chord is wider, reaching 20½ feet at the root of the wing. The engines employed are double row Wasps developing 800 horsepower, while in the Sikorsky four single-row Hornets of over 700 horsepower each are employed. The Sikorsky engineers, making skilled use of rear flaps for lift increase, loaded their ship up to 28 pounds per square foot, and were fully justified in so doing. The Martin group was more conservative, and only used a loading of 22 pounds per square foot. After the results of the Sikorsky tests there is no doubt that the higher loadings will now be quite acceptable for large flying boat practice.

In the Sikorsky, twin rudders are employed, disposed towards the end of the stabilizer. This means that the rudders are always under the influence of the propeller stream. The Martin engineers disregarded the slip-stream effect, and used a single huge rudder at the end of the hull. Such a rudder arrangement probably means saving in weight and head resistance. The Sikorsky design provided for strut bracing carried out quite far on the wing, to secure lightness of wing structure. In the Martin, the top ends of the bracing struts are not so far out.

The most striking difference lies in the flotation system. In the Sikorsky Clipper, wing tip floats are braced from the wing and disposed towards the tips. In the Martin boat, wing tip floats are dispensed with and sponsons or water wings projecting from the sides of the hull are counted upon to give lateral stability when in con-



Clipper *No. 7*, to be used for experimental operation over the Pacific



Mister Mulligan, pride of Benny Howard's private life

tact with the water. Tip floats probably give more head resistance, but many authorities believe that they give better water stability characteristics and that sponsons cause difficulties in turning the boat while in the water.

Comparisons aside, the Martin design is a splendid one, from every point of view. The use of 24 ST—the strongest modern aluminum alloy—is a step forward. Metal covering is used practically throughout. The arrangements for passengers, crew, and the equipment are complete and carefully thought out. Oil driven turbine pumps are used to transfer the fuel from the hull to the engines. The landing speed is low in spite of the absence of floats, as the wing loading is less than in the Sikorsky boat. While actual performance figures are still not available we are informed that they will closely approximate the following:

Gross weight, 51,000 pounds; weight empty, 23,100 pounds; wing span, 130 feet; chord, 20½ feet at strut point; over-all length, 89 feet 6 inches; over-all height, 24 feet; wing area, 2170 square feet; Power plant, four double row Wasps geared down and supercharged, developing 800 horsepower each and driving three blade, automatic controllable pitch propellers; top speed about 180 miles per hour, cruising speed 163 miles per hour.

The Martin Clipper will be able to carry 14 passengers and 2000 pounds of mail for 3000 miles non-stop. With its full passenger complement of 53 it will have a non-stop range of 1200 miles. With mail load only, the range will be 4000 miles.

Great attention has been paid to sound proofing. With geared down and rubber mounted engines, with sound proofed cabin, and exhausts carried back above the thick wing, the decibel noise level in the cabin will be only 72—the level of a Pullman compartment on a straight railroad track.

The Glenn L. Martin engineers and the Pan American authorities are to be congratulated on the co-operation and skill which have given this admirable addition to American aviation achievement.—*A. K.*

The Private Life of Benny Howard

WHAT is the private life of a transport pilot who, like "Benny" Howard, flies the huge airliners of United between New York and Cleveland with perfect regularity and freedom from accident? Mr. Howard's private life consists in spending all he can save from his generous pay in constructing racing planes which lead in this field. One of our photos shows *Mister Mulligan*, the latest product of this practical flyer, original constructor and serious student.

Mister Mulligan was intended for the Trans-Continental Bendix Trophy dash. A flight at 20,000 feet without oxygen led to grogginess, a forced landing, and an unpleasant mishap, which prevented the participation of *Mister Mulligan* in this trans-continental dash. The fact remains, however, that this new ship, fully equipped for private flying, with dual controls and four occupants, powered with a supercharged Hornet engine, has a top speed of 290 miles an hour, and is probably the fastest cabin plane the world has ever seen.

What we admire in this beautiful ship is the logical idea of streamlining, carried to the extreme of the art. The huge cowl blends into the fuselage, the fuselage flows with perfect smoothness into the wing, fittings and struts are all hidden. Even though plenty of power is available for *Mister Mulligan* and the wings are small in area, this ship still remains a fine example of applied aerodynamics.—*A. K.*

NIGHT FLIGHTS

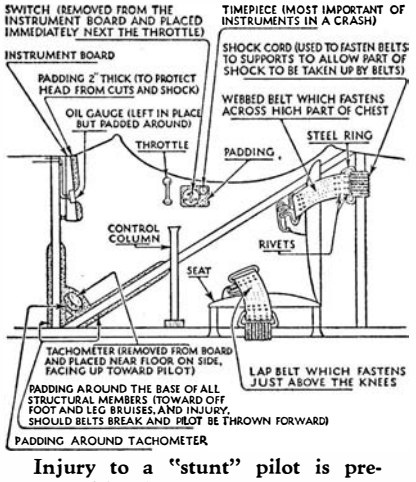
SIXTY percent of Eastern Air Line's flying is now done at night. Two daily round-trip eight-hour passenger, mail, and express schedules are flown between New York and Miami and an eight-hour 50-minute schedule between Chicago and Miami on the first direct transportation route between these two areas.

"I Am Still Alive"

THE book with this intriguing title, by Dick Grace, is a thoroughly well written and exciting account of the experiences of a man whose hazardous profession is crashing airplanes for movie "thrillers." The adventures of Mr. Grace make exciting reading, but the book also carries serious lessons for the aviation constructors.

In preparing for crashes Mr. Grace soon decided that to use a steel suit of armor was wrong in principle. A severe blow from a flying propeller might cause the plates to squeeze together with danger of piercing the body and retarding rescue. Besides, an armor-plated suit would be intolerably clumsy and heavy. He came to the conclusion that a better plan was to design the cock-pit in such fashion that the entire airplane might be wrecked and still leave one section of the fuselage, that in which he sat, intact. Mr. Grace has been able to do just that. The pilot's motor has broken through the gas tank in front of him and the controls have been broken and destroyed in back, the wings and landing gear have been scattered, but he has been able to keep most of the débris from striking him and to have a cock-pit around him when he finished!

The diagram, reproduced by courtesy of Rand, McNally Company, illustrates the final design of the cock-pit. An arrangement



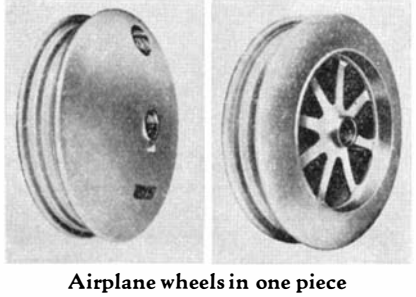
Injury to a "stunt" pilot is prevented by this cockpit arrangement

of webbing is fitted high under the pilot's armpits; when the central safety clasp is locked it pins the pilot to the very back of the seat so that only the slightest movement is possible and it is difficult to take a deep breath. A lap belt fastened just above the knees adds to the voluntary imprisonment. All instruments are either removed out of harm's way, or are carefully padded. There is padding around the base of all structural members. Even though the daredevil has broken his neck on one occasion, such an arrangement of cock-pit may have suggestions for our designers.

Equally interesting is the deliberate and careful way in which the precise method and location of crashes are worked out.—*A. K.*

A Single Piece Airplane Wheel

THE Palmer Monodisk Wheel, a British invention, attracted favorable attention at the recent Paris Aero Show. The structure of the wheel consists of a single casting of magnesium alloy. Because the wheel is produced in one casting, no bolts, rivets, or nuts are used. The sides of the disk are fashioned with integral webs, and are thus



Airplane wheels in one piece

load carrying members. The benefits of the design from a maintenance point of view are evident. For the same strength the monodisk wheel showed a weight reduction of 28 percent compared with conventional built up wheels. The use of the casting also enables the wheel to be given a fine streamline form, important from an airplane performance point of view.—*A. K.*

EXPANDING AIRLINES

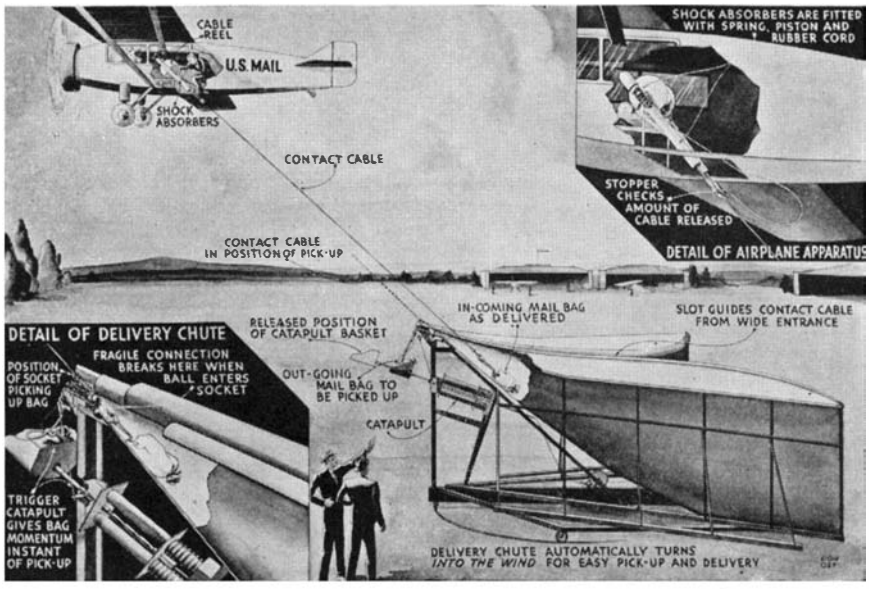
PERHAPS the greatest benefit of an expanding airline program during the past year has accrued to American business groups interested in developing Central and South American markets. New fast daily schedules from New York and Chicago to Florida make direct connections with planes to all South American points.

Airmail Pick-Up

SEVERAL years ago we described the Lytle S. Adams system of airmail pick-up and delivery. Since then Dr. Adams has made important improvements and installation of the system is under favorable consideration for the huge new Chicago post office at Van Buren and Canal Streets, which fortunately has a vast flat roof. The plans call for an airplane shuttle service between the Chicago Municipal Airport and the new post office, which will reduce the time of delivery of letters between these two points to six minutes. There is no doubt that the incorporation of such shuttles in our transport systems would speed up service and increase the popularity of the airmail.

The main element of the Adams' device is a huge metal chute with a wide entrance narrowing down to a small slot. The chute is so mounted, either on a flotation system on water, or on rollers running on a track, that it always heads into the wind. Since airplanes when landing or taking-off head into the wind, this weathercock feature of the apparatus is essential.

The incoming mail bag, suspended from the airplane at the end of a cable, enters the wide mouth of the chute. The contact cable is guided to the narrow slot at the end. The mail bag makes contact with a smooth slide. When a ball enters the socket at the extreme end of the chute, a fragile connection is broken and the mail bag is released and slides downwards to the floor of the chamber. At the same instant a spring trigger actuated catapult shoots another mail bag outward in a species of bucket or basket. The end of the suspended cable makes instantaneous connection with the hook connected to the outgoing mail, and in an instant mail has been delivered and picked up. The catapult which brings the outgoing mail up to speed lessens the shock on the airplane cable, but a shock absorbing system is nevertheless provided at the point where the cable is attached to the airplane.—*A. K.*



Details of the airmail pick-up described on this page

Carbureter Ice Formation

COLD weather flying is becoming much more popular. In the early years of air transport, the volume of passenger traffic used to fall off abruptly as soon as cold weather set in. Nowadays there is scarcely a drop in the curve when winter comes.

But cold weather flying brings to the fore a most difficult problem, that of ice formation in the carbureter. When there is enough moisture in the cold air, ice may be readily formed in the fuel induction system and all the passages may be clogged up. The most effective cure is to preheat the air entering the manifold system. The Phillips Petroleum Company is undertaking the study of the problem in the most scientific fashion.

A Lockheed Orion has been completely equipped for the research. Systematic temperature measurements will be made with small iron and constantan wire thermocouples. Three thermocouples are installed at various points of the carbureter Venturi. Others are located in the carbureter bowl, and before and after the supercharger. At the same time various types of air preheaters can be investigated.

The purposes of the research will be two fold. One will be to determine the atmospheric conditions under which ice formation is to be most feared. The other aim will be to determine the best preheater and the amount of preheating required. To raise the temperature of preheating too much will, of course, mean a loss in volumetric efficiency and power of the engine.

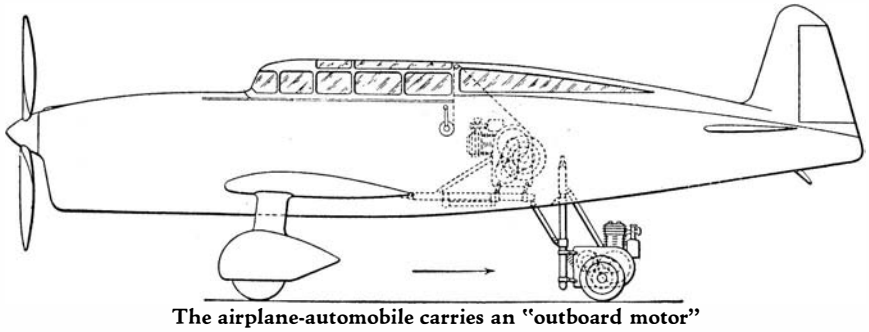
The experiment will be very valuable for general aviation operation and will also help engine and carbureter designers.—*A. K.*

An Airplane-Automobile

PARISIANS like to loaf on the streets of their beloved city, and, when seated at sidewalk cafés are often rewarded by curious sights. Certainly the appearance in the streets of Paris of the Caudron airplane-automobile must have attracted considerable attention. The airplane is entirely conventional in character, and the wings are made to fold back along the side of the fuselage after a manner which is well known in the United States.

The novel feature of the "Aviocar," as the strange vehicle is called, lies in a small air-cooled engine mounted in the rear on a third wheel. This little motor is provided with a change-speed gear and one or two other items which we generally associate with a motor car. With the aid of a retracting mechanism, cable operated, and not different from an ordinary amphibian gear, the small auxiliary motor and the third wheel disappear in the bottom of the fuselage. The wings are unfolded, and behold, the automobile-airplane is ready for flight!

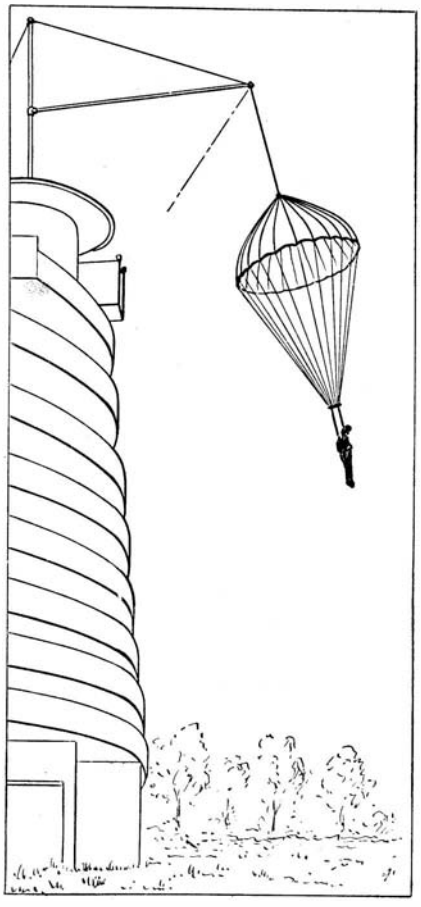
Granted that the additional mechanism can be kept within a reasonable weight, and that certain obvious mechanical difficulties are overcome, we see no reason why some day such a combination should not be practicable for general use. Of course, to develop such a "gadget" until it is entirely satisfactory will mean a good deal of patient mechanical work.—*A. K.*



The airplane-automobile carries an "outboard motor"

Teaching Parachute Jumping Safely

THE first parachute jump that a man makes is apt to test the strongest nerves, and it is on the very first jump that a student is most likely to make a fatal mis-



A safe method of parachute jumping instruction developed in Russia

take of some kind or another, particularly in pulling the rip cord.

The Soviet aviation authorities have introduced a new wrinkle in this exciting art. A special device mounted at the top of a tall building holds the parachute open and only releases it when the student is ready for the drop. In this manner he at least becomes accustomed to the sensation of the jump.—*A. K.*

Stout Announces New Type Automobile

AN entirely new type of automobile which discards all previous traditions and conceptions generally used as the basis of car design, is announced by William B. Stout, President of the Stout Engineering Laboratories. This new car has been under development by Mr. Stout for several years and preliminary models have been undergoing actual road tests for the past two years.

According to the designer this new car marks the first real departure of the automobile from its classification as a development of the "horseless carriage" which initiated the present type of automobile design. The new vehicle is no longer in overall length than the present type of car and yet incorporates a tremendous gain in interior roominess and, in addition, is also claimed to have added superiority in riding comfort and performance.

Because of its general shape the car has been tentatively named the Stout Scarab because of its resemblance in form to the classic Egyptian beetle. It is not streamlined in the sense usually used as a means of reducing drag at high speeds; but is shaped to facilitate easier steering in all directions of wind. It has been found by careful investigation that this is a far more important factor in roadability than generally realized, while gains in speed or fuel mileage as a result of streamlining in an automobile are negligible at usual road speeds.

The engine in this car is at the rear. It takes up no more than the space of the usual trunk rack. Since the engine is housed away in the tail of the beetle shape, the usual hood space up front—all the way to the point corresponding to the radiator ornament of the ordinary type of car—is available for passenger room.

Controls are all conventional as to gear shift, pedal location, steering gear, and so on, although a power-brake is standard equipment, eliminating most of the work necessary in applying the brakes on the usual car. To the engineer it will be illuminating to state that the support for the body is materially above its center of gravity. Since this is the case the car tends to pendulum and "bank" on the turns. This method of support eliminates all tendency of the car to roll even on sharp corners.

This peculiar side stability plus the use of a very sensitive spring suspension eliminates all quick road shocks. The spring suspension itself consists of an airplane landing gear on all four wheels including coil springs with large oil cylinders to absorb shocks.

The manner of weight distribution is based on the idea of providing easier steering by removing some of the weight from the front axle. Also to improve the ride, additional weight is placed over the rear axle. Both of these have been accomplished by placing the engine in the rear. This also results in greater traction. It is, furthermore, of marked assistance in braking because of the reduction in the amount of weight transferred to the front wheels in stopping at high speed. This greatly reduces the tendency to skid and for the car to "dive" as is so often the case where the load is concentrated heavily over the front axle. Other advantages claimed for the rear location of the engine are the elimination of engine noise and odor.

The engine is a standard V-8 of 100 horsepower driving through a selective gear mechanism to the rear axle. Because of the lightness of the car the axle ratio is more nearly direct than usual, contributing toward smoothness, speed, and economy.

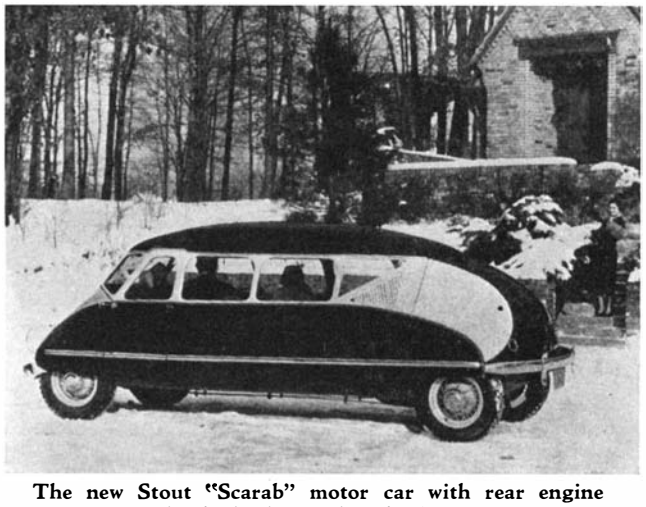
It is the plan of the Stout company to build one hundred of these cars during the coming season. The production is to be limited to this figure and the cars are to be placed in the hands of selected representative owners in various parts of the country.

HIGH OCEAN BED

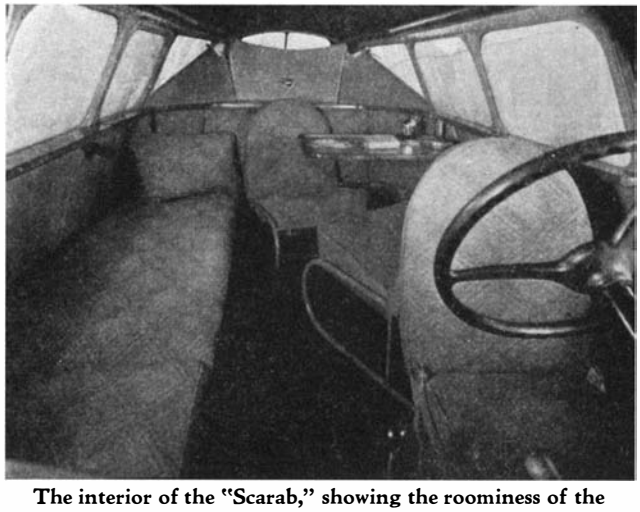
THE deepest hole in the ocean, Emden Deep near the Philippines, is very little closer to the earth's core than is the top of high Mt. McKinley in Alaska. This seeming paradox is due to the well-known fact that the earth is not a true sphere but bulges somewhat at the equator and is flattened at the poles.

Silver as Material of Construction

SOLID silver apparatus in the chemical plant has progressed far beyond the stage of a novelty. At first thought, it seems hard to believe that the large vats and tanks in acid, perfume, photographic film, and dye plants are lined with sheet silver of a high degree of purity but when it is realized that the cost of silver is comparatively low these days and that the metal has ideal properties for certain uses, we begin to understand that the precious metal has



The new Stout "Scarab" motor car with rear engine mounting and a body designed to facilitate easy steering



The interior of the "Scarab," showing the roominess of the body. The gear shift and other controls are conventional

grown into many utilitarian applications.

Silver may be used in most industries where corrosion takes place owing to attack on base metals by the acids involved. Silver is attacked by nitric and hot sulfuric acids, but its resistance to the organic acids makes it especially suitable for food manufacture where corrosion has the additional effect of food contamination. Among the food products for which silver is advantageous are jams, pickles, vinegar, essences and cider. Other plants for which silver is in demand includes those used for acetic acid, scent, photographic emulsions, aniline dyes, general chemical production, and ink.

In vinegar and acetic acid plants, condensing coils and stills are made of silver, this metal being especially recommended for use in the distillation of white vinegar, where copper has been found to cause discoloration.

Plants making scents, essences, photographic emulsions, aniline dyes, and general chemicals find that pure silver apparatus is usually best adapted to their requirements, but occasionally copper and nickel pans or troughs are lined with the metal. Ordinary ink has a very corrosive action on base metal with which it comes in contact, and silver has been found to give good results when used to line many of the essential parts of machines for filling ink-bottles.—*A. E. B.*

WHAT—ANOTHER?

A NEW "ology" has made its appearance. "Phenology" has been coined to indicate the study of flower-blooming time and fruit-ripening time. The study appears to be quite important, especially in the rehabilitation of depleted grasslands for grazing.

Self-Sealing Wrapping Paper

THE tremendous vogue of Cellophane has focused interest on wrapping materials that make an attractive appearance, and, at the same time, protect the contents of the package from moisture and contamination. There has now appeared on the market a new wrapping material known as "Parafilm," which is flexible, elastic, waterproof, and self-sealing. Being opaque, it does not compete directly with Cellophane, but opens a new field where a bright, glossy, and rugged wrapping is desirable. [Another new type of flexible wrapping material was described on page 32, January, 1935.—*Editor.*]

This new product is made in sheet form, cut to various widths, and marketed in rolls. According to Arthur D. Little's *Industrial Bulletin*, it has remarkable resistance to both water and water vapor from high-humidity atmospheric conditions, making it suitable for protective coverings of materials to be stored in a moist atmosphere. The sheet is thermoplastic, sealing to itself or to other surfaces with the application of a low degree of heat and pressure, giving a good bond. It comes in many attractive colors, and can be stretched to a considerable degree.

One of the first extensive uses to be made of this unique material is in the florist business, where it is admirably adapted for wrapping wreaths, flower stems, potted

plants, and so on. The attractive color combinations available, the ease of shaping, and the glossy surface appearance make it suited for the manufacture of artificial flowers. —*A. E. B.*

Improved Transmission of Photos by Wire

ALTHOUGH the actual transmission of photographs by wire is not at all new, recent developments have brought the subject very much to public notice. The Associated Press has inaugurated a system for the transmission and reception of photographs for newspaper reproduction. The technical advances which have made possible astonishingly good results are given in the following paragraphs. Those readers who have seen wired photographs reproduced in the past have undoubtedly noticed the complete lack of detail. Under the present system this tremendous handicap has been overcome and even portraits transmitted by the Wirephoto process, as it is called, are, when reproduced in newspapers, practically as clear as a reproduction made from an ordinary photograph.

In the Wirephoto system, a positive print wrapped around the sending machine cylinder is scanned in strips 1/100 of an inch wide by means of a light beam focused first on a light valve aperture similar in all respects to the light valves used in sound picture work. The light valve chops the beam at a frequency of 2400 cycles, passing a pulsating beam which is turned through ninety degrees to focus sharply on the surface of the picture.

Wirephoto transmitter: A picture is in place on the scanning drum

The light beam travels horizontally at an inch a minute. The cylinder, rotating at 100 revolutions a minute, is approximately 12 inches in diameter, thus giving a scanning area speed of more than eleven square inches a minute.

Since the light reflected from the picture surface is proportional to the tone density of the surface, the pulsating beam is thereby modulated with the tone values of the picture before reflection to a photocell of the gas-filled cesium-oxide-on-silver type.

The optical system is made up of a condenser lens to focus the beam on the light valve aperture and an objective for focusing the pulsating beam onto the picture surface. Turning through 90 degrees is accomplished with a small stainless steel mirror, and parabolic surfaces, also of stainless steel, gather reflected light from the picture for passage to the photocell.

The light valve itself is an aperture 0.01 of an inch square with two parallel duralumin ribbons, 0.006 of an inch wide and 0.0005 of an inch thick, partially covering it and connected at one end to form a loop. A magnetic field at right angles to the plane of the ribbons, furnished by two permanent magnets, and a 2400-cycle current through the ribbons furnish the shutter action. As the ribbons vibrate on their inward swing the aperture is closed, and on their outward swing the aperture is opened.

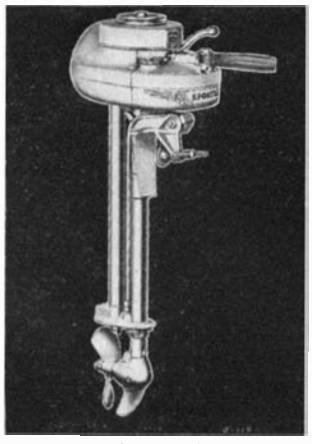
The principle of operation of the receiving light valve is similar to that of the sending light valve except that only one ribbon is used. It is caused to move by the varying direct current representing the tone variations in the picture, and not by a constant frequency. This ribbon is tuned to the rather high natural frequency of 1200 cycles, and suitably damped so that all movement of it is forced vibration caused by the incoming picture signal. In this ribbon circuit is a tuned equalizer which prevents unwanted or transient vibrations.

By varying the side motion of the receiving light valve ribbon, the opening through which the light reaches the film is varied proportionately, thus obtaining film exposure in exact proportion to the original tone values of the print on the sending machine. This light beam is adjustable in width, so that the exposure lines may be made to merge and be practically invisible on the finished print.

The scanning of the negative is exactly at the same rate as the scanning of the print by the sending machine, the cylinders rotating at the same speed and the beam moving horizontally at the same rate. After the negative is completely scanned it is removed to the dark room for developing and printing.

New Light Outboard Motor

A NEW outboard motor that develops 1½ brake horsepower at 3500 r.p.m., ample to drive commonly used rowboats, fishing boats, and so on, at speeds of five to seven miles an hour maximum, has just been announced under the name of the Sportsman Single. The motor weighs only 24½ pounds, which is just about ⅓ the weight of Ole Evinrude's first outboard, which developed only about 1 horsepower. Thus this new model symbolizes the tremendous development that has taken place in outboards since their inception 26 years ago, as well as marking the 26th birthday of the institution which carries forward the Evinrude as well as the Elto name.



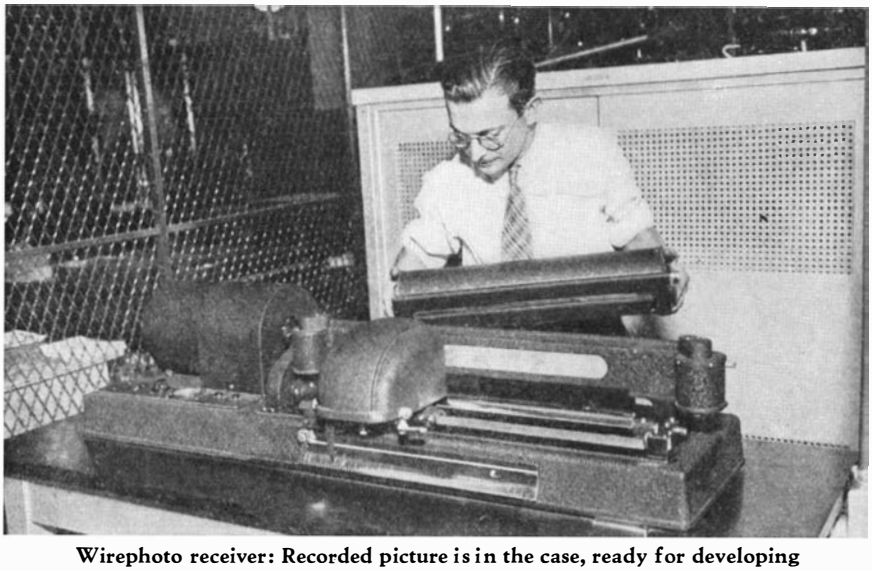
24½ pounds; 1½ horsepower

The new Sportsman is not only the lightest of the new outboards, but it excels in practicability, for parts have been eliminated and simplified so as to procure utmost compactness. It is capable of extremely slow trolling speeds, and the flexo-rubber steering handle increases steering ease. Fuel consumption is trivial; the magneto gives a hot spark that assures quick starting. Tilt-up and stern angle adjustment features are standard.

Filter Removes Tooth-Mottling Fluorine

AN aluminum and sand filter that removes fluorine from water has been devised by Dr. S. P. Kramer of Ft. Thomas, Kentucky.

Fluorine in drinking water is the cause of a dental disease known as mottled enamel. The condition has become so serious in the southwest, where fluorine is frequently found in the water, that at least



Wirephoto receiver: Recorded picture is in the case, ready for developing

one town has changed its water supply and now obtains its drinking water from another source in order to protect the teeth of its inhabitants. At one time it was feared that the water impounded by Boulder Dam would prove useless because of reports of the high fluorine content of the Colorado River tributaries.

Dr. Kramer made a contact filter of river sand to which he added 2 percent by weight of powdered aluminum. He reports to the journal, *Science*, that this filter removes fluoride from a solution containing 30 parts per million of sodium fluoride.—*Science Service.*

A VITAL INDUSTRY

ONE SIXTH of all persons engaged in wholesale, retail, and service trades depend upon the gasoline and automotive industries for their employment and wages, says the United States Census Bureau.

Service for Photography Fans

THE Photographic Society of America, which is the recent expansion program of the Associated Camera Clubs to extend service to those interested in photography whether they be members of clubs or not, will begin its second year by publishing its bulletin in printed form with a few excellent illustrations. The society is also planning a national meeting in April, at the time of, and in conjunction with, the Pittsburgh Salon of Photography at Pittsburgh. Those interested in the work of this organization may address its secretary, B. H. Chatto, 1300 Milton Avenue, Pittsburgh, Pennsylvania.

Sulfur as a Lubricant

SULFUR has been found to make an ideal lubricant for metal cutting and machining operations. The machineability of a metal is more affected by the cutting lubricant than by the material of the cutting tool. Hence, it is obviously important to use an efficient lubricant. At the temperatures usually prevalent in modern machine-tool practice, oil is not a lubricant, although it is useful for its cooling effect on the metal work.

Probably the best machining lubricant which could be used is molten sulfur because it is a viscous fluid at temperatures which destroy the lubricating properties of lubricating oils. The use of molten sulfur for such a purpose is obviously impractical, but the Thomas and Hochwalt Laboratories, Inc., of Dayton, Ohio, have developed a material which accomplishes the same result. They call this cutting fluid "Sulflo," and it consists of the stable suspension of finely divided sulfur in petroleum oil. Sulflo is a moderately thin oily yellow fluid in which the sulfur particles are large enough to be seen with the naked eye. The use of this sulfur lubricant permits metal cutting machines to be operated at higher speeds, greatly increases the life of tools, and gives better finish to the product.

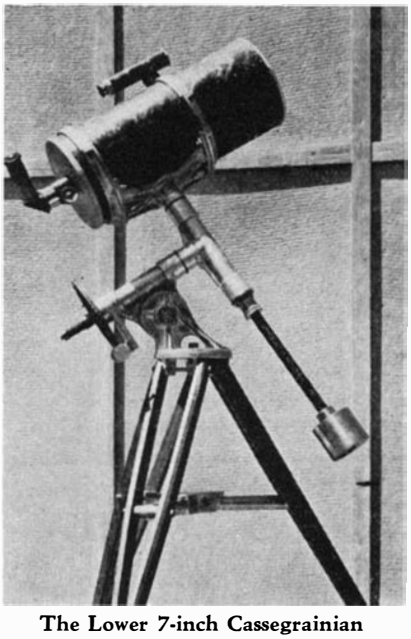
The action of Sulflo as a cutting fluid depends upon a peculiar property of sulfur not possessed by oils—namely, an increase of viscosity with a rise in temperature from

(*Please turn to page* 159)

THE AMATEUR ASTRONOMER

Conducted by ALBERT G. INGALLS

THE average amateur telescope maker finds the common Newtonian type of instrument satisfactory but, as a number wanted to make Cassegrainian telescopes, Russell W. Porter accordingly wrote, for the instruction book "Amateur Telescope Making," a chapter entitled "How to Make a Cassegrainian." He stated, however, that



The Lower 7-inch Cassegrainian

he had found the Newtonian the better performer of the two, and so, he added the subtitle, "And Why Not To," beneath the title named above. As he anticipated, this bit of discouragement has had the effect of causing many workers to tackle the job, after spitting on their hands and sticking out their chins, and with widely varying results.

One such job was done by Harold A. Lower, co-author of "Amateur Telescope Making," and his father, Charles A. Lower. Both are skilful old hands at the amateur telescope making art. Lower, junior, writes from 1032 Pennsylvania Street, San Diego, California: "I enclose a photo of the latest member of the Lower family, a seven-inch portable Cass. This little instrument is shielded for daylight use, and performs in daylight just like a refractor. While the optical surfaces are not perfect, I believe the errors do not exceed the theoretical limit for good results. At least, the performance is quite good, as it will stand up well with a one fifth inch ocular and will resolve doubles as close as one second of arc. The grinding, polishing, and figuring of this scope were done on a machine. We just wanted to see whether we could make it without any hand work on the mirrors, and we did. I rather believe that the difficulty of figuring short focus mirrors has been exaggerated, as we had no trouble with this one, although the primary mirror is *f*/2.7."

We asked the Lowers to send us a drawing of the layout and this is also reproduced on this page. As they state, the shade tubes, shown in heavy line, are the main feature. The primary mirror is held in place by a collar on a short tube which extends through the perforation in it, and the shade tube screws fast to this.

We also show a photograph of the twin Lower telescope, a 12-inch Cassegrainian of *f*/18 and a 12-inch Newtonian of *f*/4.5, mounted on the same axis. A little coop mounted on wheels rolls forward and covers the two tubes and their mounting when they are not in actual use.

"When we mounted the new instrument," Harold Lower writes, "we compared the new and the old silver coats, and found that the Cass, which had been silvered 10 months, was almost as bright as the new one. That proves that the can of caustic soda which we place in the telescope on closing it up has really helped to prevent tarnishing of the silver. Before we started using the caustic soda, the mirror would be badly tarnished in six months."

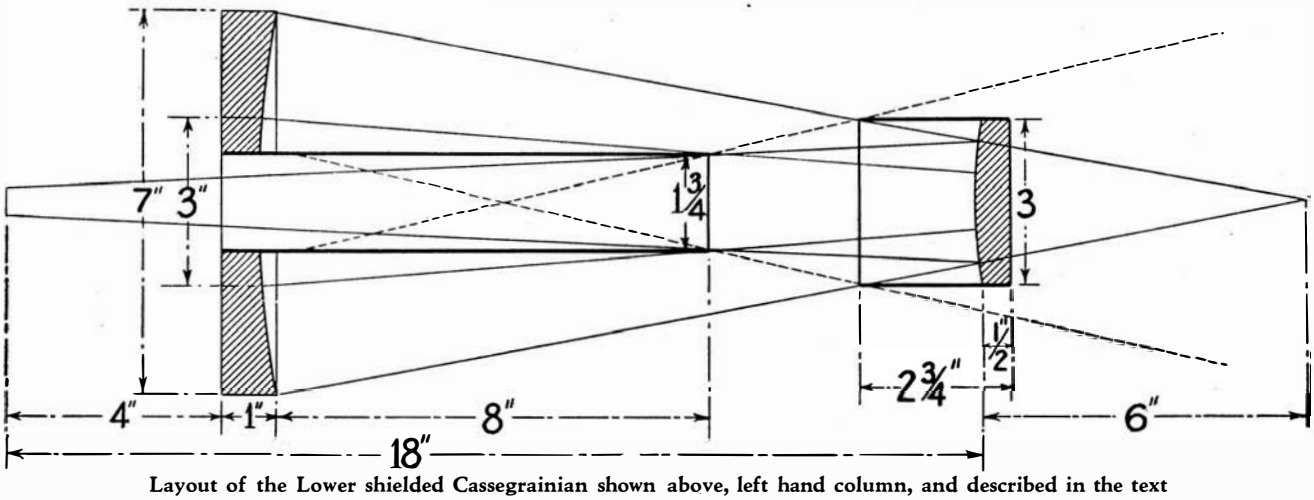
A COUPLE of years ago Lincoln K. Davis, 1351 Main Street, Brockton, Massachusetts, made one of the smoothest non-professional telescopes we have ever laid eyes on—in fact it was smoother than many a professional job, and so when we heard that he had more recently completed a vest-pocket Cassegrainian we asked him to describe it. Here is his letter:

"Your threat to run a photo of my Cass beside Lower's gives me cold feet, because I wrote you this was not a particularly smooth outfit. It was made to be readily portable, which it is, and it has been thrown around all summer, in the car and on a boat. While I can resolve Epsilon Lyrae plainly, there is too much scattered light in the field. At first I suspected a turned edge, but Everest pointed out what is probably the real reason—zonal irregularities. He said that he always smooths the surface

"Dad" Lower and Newt-Cass twins

of his mirrors with a very soft lap and short strokes, after figuring, with an invariable improvement.

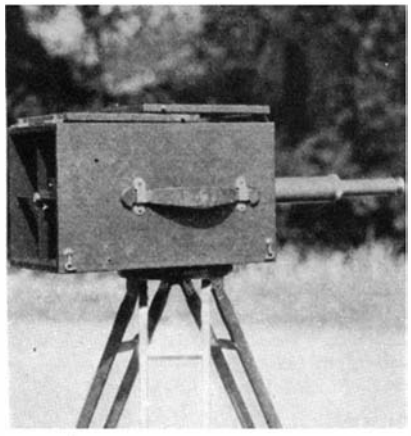
"My primary is a good one, but the secondary was whacked into passable shape just about as my patience was running out, so this fall it will be overhauled and trued up. I cannot agree with Lower that



Layout of the Lower shielded Cassegrainian shown above, left hand column, and described in the text

the difficulty in figuring short focus mirrors has been overemphasized, as I had one devil of a time with mine.

"The photograph shows the telescope set up for terrestrial use with an erecting eyepiece, but minus the equatorial mount, which I carried away from a junk yard for a quarter (old movie camera tripod head, having a geared friction panoram motion,



The Davis portable Cassegrain

which makes a fine slow motion in right ascension).

"The primary is of Pyrex, 6″ diameter, 13⅛″ focus, giving a relative aperture of *f*/2.2. Primary has a 1½″ hole through it. Secondary is of ⅜″ plate, 2″ diameter, 10½″ radius of curvature, and is placed 9 3/16″ in front of primary. Amplification is approximately 4×, so that overall focal length is about 52½″, and effective aperture *f*/9. Box is of plywood, cloth covered, and is 7¼″ square and 13″ long. Weight of telescope proper is 7 pounds; the eyepiece and tripod shown add about 5 pounds to this.

"The mirrors were silvered by the dunking method, which is to say, face down. This eliminated all my previous troubles with pinholes, poor coats, and so on. The primary mirror is a fine one, if I do say so (ask Everest), and is within one percent of a parabola, but the secondary is fair only, with the result that the performance is not up to that of my 6″ Newt, although in daytime use with a power of about 75× it works well.

"I spent 11 hours in grinding and polishing, and then 10 more figuring to a 60 percent correction, when I succeeded in knocking a big, flat chip out of the surface, and after a brief rest and cuss period, sadly went back to No. 60. In the meantime I built a machine, so the second attempt was made with this, and the total time ran into something like 45 hours, as the machine proved to be much slower than hand work. Final figuring was done by hand, and testing done by the Ronchi test and my modification of it. For obtaining parallel light I set up my Newt with a pinhole at infinity focus, and found this to work very well.

"For daytime use I made stops the size of the exit pupil for each eyepiece, and found this successfully cut out unwanted light, as Hindle says, so that the Cass gives as brilliant an image as the Newt in daylight.

"The hole in the primary was cut within an eighth of an inch of through before fine grinding, and then carried all the way

(*Next page, please*)

THE AMATEUR ASTRONOMER

(*Continued from preceding page*)

after figuring. This, on a drill press, was the easiest part of the whole job."

A TRIM Newt-Greg combination made by Dr. S. H. Sheib, a chemist and testing engineer, Box 737, Richmond, Virginia, is shown in the photograph below. Sheib says he had lots of fun making this telescope, but prefers his old Newtonians when it comes to actual use.

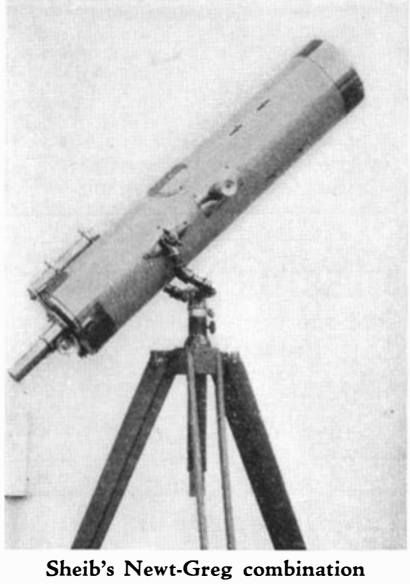
So, there you are: To make compound telescopes or not to—that is the question.

BY now the reader may have noticed that an extra page is given to this department. This addition, we hope, will be permanent, and is a reflection of the fact that the amateur telescope making hobby is still on the make.

TO continue, Mr. Davis mentioned above that he had a modification of the Ronchi test and we therefore asked him to tell the world about it. Here is what he says:

"I ran across the fact that the Ronchi may be conducted in broad daylight, or with any ordinary unshielded lamp. I placed a piece of ruled celluloid over a white card having a hole in it, to look through. Then I held the card at the center of curvature of the mirror under test, with the ruling facing the mirror, and a light source arranged to illuminate it rather brightly. By looking at the mirror through the hole in the card the Ronchi bands may be seen.

"As I figure it, light is reflected from the white card between the lines of the ruled screen, thus forming a multiplicity



Sheib's Newt-Greg combination

of slits or slit sources, and the returning rays are examined through the grating in the usual manner.

"I made another grating which works somewhat better by following Kirkham's suggestion ("A.T.M.," 266, Fig. 4) and threading a piece of brass having a hole in it, winding some fine wire around it, soldering the edges, and then cutting away the wires on one side. The wires facing the mirror were polished, with the side to face the eye blackened. In this case the polished wires act as very bright sources, with the added advantage that these sources and the point of observation are practically coincident, eliminating parallax effects, which with short focus mirrors are to be reckoned with."

There is some difference of opinion whether this method will give as good contrast as the single slit, also whether it will give periods of confusion ("A.T.M.," page 270, line 2). Try it and see what you think of it.

THE use of small or sub-diameter tools for amateurs is a heresy but amateurs, ever since this hobby took hold of them, have been dealing in heresies and the result has been an advance in the art of telescope making. So, avast with dogmas: Here is what two amateurs have written about small tools, at our suggestion. Believe it or not, a thing that works, works, even if it is all wrong. First, testimony from Harold A. Lower, who writes:

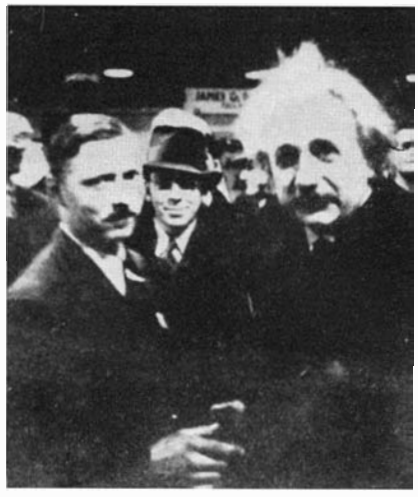
SPECIAL NOTICE TO AMATEUR TELESCOPE MAKERS: Be sure to see the supplementary item at the top of opposite page.—*The Editorial Staff*

"Ellison mentions that it is easy to grind and polish with small tools, but does not say how to do it. The 12-inch Pyrex mentioned above was rough ground face down for nine hours over a nine-inch tool. At the end of that time the curve had reached full depth at the center, as determined by measuring the sagitta, but lacked about an inch and a half of reaching the edge of the disk. (This first grinding face down leaves the edge of the mirror untouched—not even scratched.) When the curve had reached full depth in the center, the mirror was turned face up and the same tool used on top. One simply makes large epicycles all around the mirror, working mainly on the edge of the hollow, until the curve reaches the edge, at which time the curve should have become spherical. This grinding with the mirror face up also required nine hours, but did not deepen the center the slightest bit, so it is important to go to full depth in the first grinding while the mirror is face down.

"The fine grinding is all done with the mirror face up. The strokes used are large epicycles around the mirror, alternated with a zigzag stroke across the mirror. Do not permit the edge of the tool to overhang the edge of the mirror more than an inch or so, or a turned edge may result. One can tell when the surface is spherical, as the tool will slide freely in all directions. If it binds at any point, the surface is not spherical, and must be made so by working on the zone that binds until the tool will slide easily.

"Polishing was done with a 9-inch tool, with the mirror face up. The strokes used were large epicycles, alternated with the zigzag stroke. No difficulties with turned edge or zones were encountered, but it should be understood that good contact is just as important when using small tools as with full size. The handle of the small tool *must* be low and well centered. Never apply any pressure on the *edge* of the tool. Pressure may be applied to the center of the tool, and will merely hasten polishing.

"Figuring was done with a 6-inch tool, working with a variety of strokes, mainly over the center. The figure is easily controlled, as one simply applies more abrasion at the points that seem to need it. I would not recommend this small tool method for any except short focus mirrors. For *f*/6 or shorter, it works fine."



At the Pittsburgh meeting of the American Assn. for the Advancement of Science, Prof. Einstein made a special trip to see the exhibit of the amateur telescope makers and Leo J. Scanlon (left)

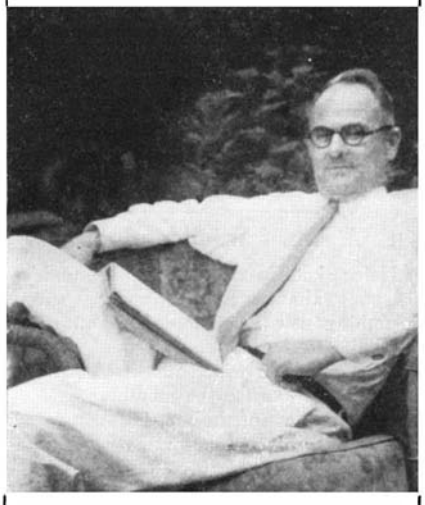
Paul Linde (see "A.T.M.," 138, 228) of Crossville, Tenn., submitted a 12-inch mirror to us for test and its figure proved up beautifully. On inquiring we found out he had figured it with small tools, so we asked him also to write a word about that method. This is what he says:

"The first time I tried a smaller-than-mirror tool was on a 12-inch of *f*/4.5. I used a 7-inch tool merely because it was one I happened to have. The facets were graduated to fine points at the outer edge. The strokes should be of about the same length and of an elliptical or circular nature while making one round around the pedestal, and should be changed with every round to prevent formation of zones. As a general rule the center of the tool should travel more often over that zone or diameter of the mirror which needs deepening most. Starting with short, circular strokes close to the edge of the mirror and keeping away from the center, the strokes should be lengthened with every other round until they are quite long, after which they can be gradually shortened.

"If there is a hill in the center it can easily be reduced by going with the tool across the mirror with slightly elliptical strokes, beginning with short ones and gradually increasing them with every second round. Turned up edge can be gotten rid of easily by pulling the tool farther over the edge of the mirror.

"Of course, there can be no fixed rules for using the small polisher and one simply has to experiment and test often to see the results. Any mistakes made by the small tool can be corrected in comparatively short time by the use of the full-sized tool to bring the figure back to flat. I find the small polisher method by far the easiest way to get all the zones right, especially with mirrors of short focal length. One word of warning: The mirror, when face up, is much more likely to be scratched."

THE MENTOR OF AMATEUR TELESCOPE MAKERS



Many readers have requested that a photograph of the conductor of The Amateur Astronomer department (see opposite page) be published, but the innate modesty of the gentleman has always stood in the way of granting these requests. Finally, the rest of the editorial staff connived to this end, and the above photo of "Doc" Ingalls is the result. By means of various dodges this has been kept from "Doc's" knowledge, and he will not see it until the magazine is published. Thus, if the newspapers, about the 15th of February, carry stories of wholesale mayhem on 40th Street, New York, you will know the reason

THE SCIENTIFIC AMERICAN DIGEST

(*Continued from page* 155)

its melting point of 235 degrees, Fahrenheit, almost up to its boiling point of 832 degrees. This high viscosity sulfur is carried by its suspending oil vehicle between the tool and the work in such a way that at temperatures and pressures at which the oil thins and ceases to act as a lubricant, the viscous molten sulfur supplies a high degree of true fluid film lubricant. The manufacturers claim that Sulflo is particularly efficacious for machining difficult metals such as chrome-vanadium steels, chrome nickel steels, Monel metal, and so on.—*A. E. B.*

Champagne or Bubbly Hard Cider?

PEOPLE with champagne thirsts had better watch the labels when buying their champagne, for deceptive bubbles have been found on the market in Washington and may be found elsewhere. This is on the authority of J. W. Sale, in charge of the Beverage Laboratory of the Food and Drug Administration, who found that bottles of a certain beverage from 13 retail places about the District had tricky labels, bubbles, impressive corks and wire ties, just what the consumer associates with champagne—and they contained nothing but bubbly hard cider.

The label on this bottle does not carry the word "champagne," the labels of genuine champagne seldom do; but it does carry the word "champyne." Three stores in the District carried the sign "Like Champagne." . . . One dealer gave a receipt for "champagne" when he had sold some of this "Champyne." Each bottle has on it a very small back label which carries the statement that the beverage is fermented apple juice, but this label is stuck on only at one end.

Beer Fattens Because . . . .

IF you are undernourished and feel that beer will build you up, medical science is prepared to recommend that you add the beverage to your usual diet. You can silence your critics by the scientifically attested statement that it is not only the alcohol in the beer that is building up your weight. The *Journal of the American Medical Association* says that only half of the calories in German beer are derived from alcohol; the rest come from "dextrin and protein-like extractives" in the beer. Here is food material "whose fattening properties may be very highly considered," according to one medical authority cited.—*Science Service.*

Preserving Paper Records with Cellophane

CELLOPHANE, of the acetate variety, provides a convenient and efficient means of preserving valuable written or printed records, says the United States Bureau of Standards, which has conducted experiments on this subject. The high degree of transparency, tensile strength, and smoothness of cellulose sheetings are attractive features for this use. The cellulose acetate sheeting appears to be particularly well adapted since it is apparently very stable if made from high-grade cellulose, can be secured in sheets only one thousandth of an inch thick, and is thermoplastic, that is, can be applied by combined heat and pressure.

The paper bearing the record is placed between two slightly larger sheets of the cellulose sheeting, and the combination is pressed between heated platens in a hydraulic press. This forms a smooth, firmly bound unit, with edges sealed by the overlapping edges of the cellulose sheeting. The last feature is important because it makes the combination quite impervious to air. —*A. E. B.*

Disease Defense a Normal Function

ONE of the most influential factors in the evolution of animals and man, probably one of the chief reasons we are alive today, is that our bodies have developed an ability to defend themselves against disease-producing bacteria. This capacity for defense is now considered a "normal and natural" physiological function comparable to digestion or respiration.

This defensive function the body applies not only to disease-producing bacteria, but to proteins and other normally harmless substances.

Medical knowledge in the past has regarded the phagocytes, or soldier cells in the blood and certain "antibodies" in the body fluids, as the forces which destroyed invading bacteria, and hence were alone responsible for immunity. The fixed tissues, such as the skin and muscle, were regarded as being hypersensitive. This meant that an individual might be both immune and hypersusceptible to the same germ at the same time.

According to Dr. Kahn's views, an immunized person, in accordance with the law of self preservation, is in a defensive state only. All the tissues of the body carry in common the burden of defense, whether fixed tissues, fluids, or phagocytes. In fact, the fixed tissues, such as skin and mucous membranes, carry a special load of defense because through the evolutionary ages they have been the first to come in contact with disease-producing bacteria.

DEADLIER

BACILLUS botulinus, long considered the most deadly poison, is actually less poisonous than a substance found during certain seasons in a sea mussel. However, the term "ptomaine poisoning" should never be applied to the effect of these substances.

Better Lubricating Oils

"VISCOSITY" is a chemist's word that has lately come out of the laboratory into public parlance. Roughly, the viscosity of a liquid is its consistency, or a measure of the ease with which it flows or pours. As everyone who reads the ads must know, the viscosity of the oil in an automobile engine is of prime importance to the oil's lubricating efficacy. Heretofore, the viscosity of the oil has depended pretty largely on the quality of petroleum from which the oil was extracted. Recently, however, chemists of the Standard Oil Development Company have discovered a substance that, when added in proper proportions to a lubricating oil, affects its viscosity to a remarkable extent without changing its other properties.

Exanol is the name given to this substance, although the name is understood to refer to a class of compounds rather than one specific material. Exanol is made from the "light ends" of refinery gasoline, by polymerization—a process by which the Exanol can be made in any form, from a light fluid oil to a thick, paraffin-like solid.

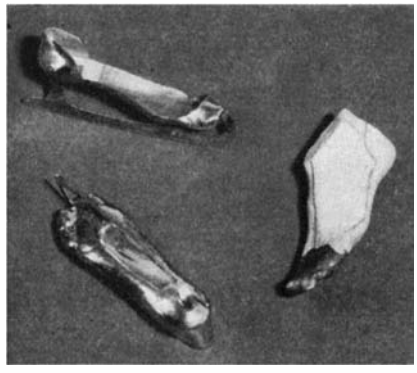
A large number of experiments and motor tests have been carried out to determine the operating characteristics of oils containing Exanol and the advantages gained in their use. They included ease of starting, consumption, pumping, and engine-sludging experiments. The results of this work have confirmed predictions based on the physical characteristics of Exanol blended oils, in that they have shown that these oils, in comparison with normal oils, give (1) lower consumption for comparable ease of starting; (2) lower carbon and sludge-forming tendencies; (3) excellent piston seal and lubrication.

This has led to commercial production of motor oils by this process. It is believed that Exanol will be a valuable tool for both the petroleum and the automotive industry, in that it provides a means of economically obtaining oils of better temperature-viscosity characteristics than can be manufactured solely by refining methods. Better low-temperature starting is obtained without loss of protection to other parts of the engine by excessive thinning out or loss of "body."—*A. E. B.*

A New "Winged Foot"

AN ice skate is merely a knife on which one skims over a slippery surface. Something new is a method of attaching this knife to the foot. The method employs a metallic slipper which fits the foot much as a dental plate fits the mouth.

A special cast of the foot is taken which gives a natural contour of the sole, surgically exact. This cast is marked for bearing center of the body weight; and for retention points of the foot. Both slipper and skate are fabricated from this basis. The metal used is a strong alloy of cobalt-chromium.



Mold from which "winged feet" are made, and two views of the skates

This new type of skate is the invention of Alan E. Murray, a professional skater, who describes the skate as follows:

"This skate is intended for use with a jacket which is a sort of leather stocking or Greek shoe which covers the metallic 'slipper' and laces down the front. However, with the Slipper Skate, skating of the most difficult sort may be accomplished with the slipper alone.

"All skating factors are improved in this skate: There is greater ice clearance; the weight is considerably lowered; the foot temperature is absolutely under control by means of the jacket. But the greatest virtue lies in the orthopedic principles which strengthen the foot. It is a positive corrective device. One feels better in street shoes after skating in it.

"The Mercury Slipper Skate will allow the ladies to have uppers to match each costume. Then for cold days there can be lamb's wool uppers. There can be different weight uppers for different activities. Thus one pair of skates provides the service of a number of outfits."

New Forest Films

THE service rendered mankind by the forest is discussed in a new one-reel talking picture, "The Forest Serves Man,"

recently released by the Division of Motion Pictures, United States Department of Agriculture, for the Forest Service.

Scenes illustrating the importance of the forest to mankind in the production of timber, the prevention of erosion, and as a haven to both man and beast form the background for the lecture delivered by H. N. Wheeler of the Forest Service, who explains how proper treatment and care of the forest may insure its perpetuation.

Another new film (silent) sponsored by the Forest Service deals with the regulation of surplus deer in the Pisgah National Game Preserve to prevent destruction of future timber supply through over-grazing. Regulated Deer Hunting includes scenes showing fawns being reared by artificial means before transfer to understocked areas, older deer being trapped for transfer, and a sequence showing in detail a regulated deer hunt held for the removal of deer from congested areas.

Copies of these films can be obtained in both 16- and 35-millimeter size upon application to the Division of Motion Pictures, United States Department of Agriculture, Washington, D. C. No rental charge is made but the borrower must be responsible for transportation charges.

Personal Radio Phone

THE "personal radio-telephone," long envisioned by writers of pseudo-scientific fiction, is almost an accomplished fact. Intensive research on the ultra-short waves, in the vicinity of five meters, has brought about the development of combined receivers and transmitters, known as "transceivers," of exceedingly small dimensions.

Typical of this progress is the compact Insuline five-meter transceiver which measures only 6¼ by 5 by 4 inches overall—hardly larger than a cigar box—and uses only two battery operated tubes which serve for both receiving and transmitting. With a four-foot length of brass or aluminum tubing acting as the antenna, this remarkable little outfit is capable of direct communication over distances as great as ten or fifteen miles. Even longer jumps have been made under good topographical conditions.

The required filament and plate batteries can be carried in coat pockets or in another small box tied to the transceiver itself. For automobile service the regular car storage battery is employed.

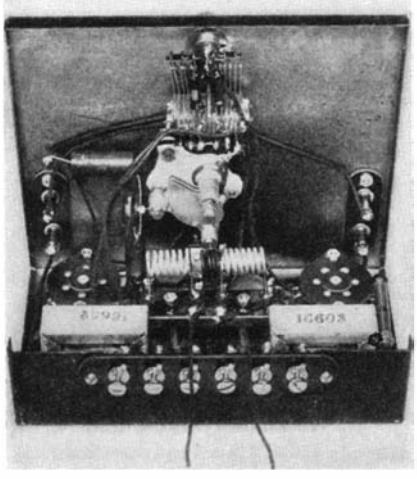
This transceiver is finding widespread use by radio amateurs and experimenters for many interesting field applications. It is available in kit form for easy assembly at home, the only tools required for the work being a screwdriver, a pair of pliers, and a soldering iron.

Oiticica

ONE of the activities of the National Paint, Varnish, and Lacquer Association has been to search the world for raw materials that can be used in varnish making. Dr. H. A. Gardner, of the Association, went to Brazil recently, and brought back reports of a natural oil which seems to hold great promise. If the oil is as tricky as its name, it ought to be good—the name is Oiticica.

Says Dr. Gardner, "The oiticica trees grow profusely in Brazil and produce in the fall a fruit in the form of a nut, containing a very large percentage of oil. Some of the trees produce two tons of fruit, an extraordinary quantity. The fruit contains about 60 percent of this oil which is very similar to china wood oil.

"The crude method of paint manufacture in Brazil has precluded its use there. Experiments with it have yielded poor results because of the fact that the crude or raw oil wrinkles very badly and forms a film. We have found, however, that if the oil is cooked with a resin, natural or synthetic, all wrinkle phenomena are overcome.



Left: **A five-meter transceiver in use. The long tubing is the antenna.** *Above:* **The interior of the unit, showing its extreme compactness**

"This oil is a varnish oil that can be used to take the place of china wood or be used with china wood oil in the production of quick drying oil. The amount available in South America will be very large. This year's crop is probably the largest they have ever had. Production this year amounted to something like one hundred million barrels of oil."—*A. E. B.*

Powdered Skim Milk in Small Packages

POWDERED skim milk, a nutritious by-product of creameries, which in the past has been kept off the retail market because of the difficulty of marketing it in small quantities, is now available for distribution in small packages.

A new type of bag container for the

product has been tested by the Bureau of Dairy Industry of the Department of Agriculture and found suitable for general use. It keeps the powdered skim milk dry and eliminates the danger of spoilage.

Powdered skim milk has been used chiefly by ice-cream manufacturers, commercial bakers, and other large manufacturers of food products. Since it is a cheap means of obtaining many of the valuable nutrients in milk, the Department recommends its purchase by families trying to economize on their food budgets.

Food experts say that one pound of skim milk is equivalent in food value to 4¾ quarts of fresh skim milk. If the powdered skim milk is made available at food stores at 15 cents a pound, when mixed with water it would provide fluid skim milk at three cents or less a quart, according to the Department.

Almost everything which is contained in whole milk, except the fat, is contained in skim milk. It has calcium, phosphorus—is high in protein and rich in vitamin G.

The Department nutritionists point out that dry skim milk has these same values and may be used in the same ways as fresh skim milk.

Nutritionists recommend that children be given dry skim milk in their cereals, milk soups, gravies, or in cocoa made with milk powder.

One warning is offered. The skim milk should be used to supplement the whole milk in the diet of children and not to take its place.

One way in which powdered skim milk can be used is in baking bread. Information on this use may be obtained by writing to the Bureau of Home Economics, Department of Agriculture.—*The United States News.*

WATT A METAL!

To make one pound of aluminum requires about 3¾ pounds of ore, one pound of carbon, and 12,000 watt-hours of electricity. This is enough electricity to burn a 40-watt lamp continuously for more than 12 days.

An Old Hobby Revived

METEOROLOGY as a hobby for the people of the United States is in high favor with the Weather Bureau. Simple weather observations by 4500 co-operators, who receive no pay but use Government-owned instruments, have long added materially to the great mass of meteorological data on file in Washington. Additional records from dependable sources would be most useful in drawing a true picture of the climate of this continent.

Meteorology is a common hobby among private citizens abroad, Weather Bureau officials say. At one time it was a common hobby among American citizens also, but with the establishment of a professional forecasting service in 1870 interest in it waned, not to be revived until the last few years. The Weather Bureau ascribes this reawakened interest, in part at least, to the unusual weather features of recent times —the Mississippi flood of 1927, the abnormal winter weather over most of the country of 1933-34, and the drought of 1934; to advances in aviation, calling for more weather-wise pilots; and to the newly recognized relation between weather and forest fires, which has converted many foresters and lumbermen into lay students of meteorology.

In meteorology, Weather Bureau officials hold, people of many temperaments and different callings can find a satisfactory hobby. Merely keeping a diary of the weather will interest many, and such records have provided supplementary information of great value to official climatologists. Setting up meteorological instruments—simple sets as well as elaborate ones—and recording the readings will satisfy hobby seekers of a more scientific turn of mind. An intensive study of the clouds, accompanied by picture-taking, both still and moving, is suggested for others. Such photographs, the weather men say, may supply an important link in solving some weather mystery. Both statisticians and people concerned with human activities can take meteorology as a hobby, each group using a different angle of approach. Meteorological physics, air-mass analysis, and forecasting are among the many phases of meteorology that make worth-while hobbies, in the opinion of Weather Bureau officials.

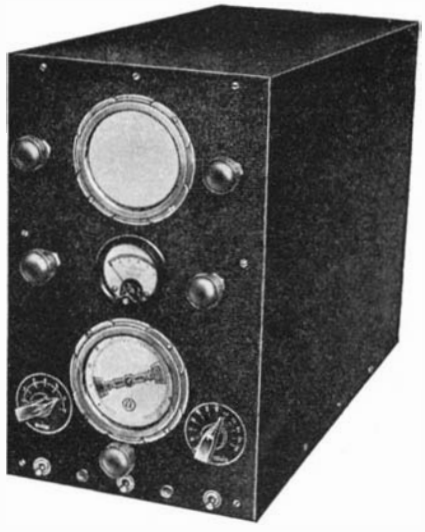
Oscilloscope for Industrial Applications

REMARKABLE strides have recently been made in the design of cathode-ray oscilloscopes with the result that the improved instruments may be conveniently used in the research laboratory, the industrial plant, or any place where the precise visual indication of electrical or mechanical functions is a necessity.

The advantages of the newly designed cathode-ray oscilloscopes for industrial applications are many. For example, the instrument illustrated is completely self-contained, is conveniently carried about and may be operated directly from any 110-120 volt alternating-current light line.

The pattern of the mechanical or electrical function under study appears directly on the screen of the tube at the upper part of the panel. Means are provided on the panel for adjusting the focus and controlling intensity.

The unit also contains an oscillator covering frequencies from 100 kilocycles to 22,000 kilocycles, the desired frequency



An industrial oscilloscope

The sub-stage lamp for microscope use, made by Spencer Lens Company, has been improved by the use of a molded Bakelite case. The housing is in two parts, one of them providing a base for the lamp socket

being selected by a dial on the front panel which may be read to an absolute value of 0.1 percent of the frequency desired. The device likewise contains a frequency-modulated oscillator and buffer amplifier which, used separately or in conjunction with the radio-frequency oscillator, permits the study of many electro-mechanical functions that would ordinarily require additional equipment to obtain a pattern. The sweep frequency is also provided by instruments included in the case.

The cathode-ray oscilloscope is gaining favor as a means of studying vibration in machinery, relative mechanical pressures, intermittent electrical functions, and so on. It has even been used for testing the muzzle velocity of projectiles.

Imports of Crime

THE major contribution to American crime, from the point of view of quantity of offenders, comes from those of foreign descent or foreign immigration. This has been shown heretofore by statistics, chiefly those compiled by Dr. H. H. Laughlin of the Carnegie Institution of Washington.

When it is figured out just how many of each nationality might be expected to appear in prison, on the basis of the numbers there are in the population, these "quotas" do not agree with the actual numbers present in the institutions. Some nationalities give more and others less than their quota to crime, just as some individuals give more than their quota to the community chest.

In general, the southern Europeans give more than those from the north of Europe. Those from the West Indies, Greece, Balkan States, and Asia have many more representatives in American prisons than the population justifies. Those from Switzerland, Ireland, and Germany have proportionally few representatives.

But lest those tracing descent from northern European families feel too superior, the other side of the picture is presented by the experience of the Department of Justice. The criminals who have lately been giving the most trouble—the "public enemy number one" class—have been almost exclusively of the northern European stock. They have been good Americans, with good old names easily pronounced, easily recognized as coming from the "best" part of Europe. There are Kelly, Nelson, Floyd, Dillinger, Hamilton, and many others.

And guilty or not guilty as he may be of murder, a man who has already cost the state a considerable sum because of his possession of "hot money" is from the proud stock of Germany—Bruno Richard Hauptmann.—*Science Service.*

Low Water Alarm

AMONG new electrical devices recently introduced is one for controlling or indicating conductive liquid levels without recourse to floats. There are several distinct applications of the principle.

The two most common uses are: as a means for disconnecting the power supply to an oil burner or stoker in case of water failure in the boiler, and as a means for controlling pumps of all descriptions from sewage disposal to boiler feeders. Other uses include a low water alarm for domestic boilers, in which case the device serves directly as a buzzer or alarm bell, instead of as a relay.

The device depends for its action on the presence of an alternating magnetic flux generated by a small coil, consuming about the same energy as a door bell transformer. This flux has a choice of two magnetic paths, one thru an iron shunt integral with the laminated structure and another thru a relay armature of sufficient iron section.

A second or control coil is wound on the shunt. As long as the terminals of the control coil are open, the flux passes across the shunt, neglecting the armature path. If, however, this circuit be closed by means of electrodes in water, or other conductive agency, the current induced in the control coil sets up a reactive effect to the passage of flux across the shunt with the result that the flow of flux across the armature path is increased to a sufficient amount to actuate the armature. This armature movement is in turn utilized to open or close auxiliary circuits or by action with suitable vibrator contacts to sound an alarm.

Smooth Finish Lacquers

STUDIES into the fundamental character of lacquer films have apparently revealed facts that will eliminate the necessity of sanding a lacquered surface in order to obtain a high finish. The studies were undertaken by the Thomas and Hochwalt Laboratories of Dayton, Ohio, in behalf of the Sharpless Solvents Corporation, because somebody stopped to think that it is a rather foolish procedure to apply a lacquer, let it dry, and then laboriously sandpaper off 20 or 30 percent of the coating in order to get a smooth surface.

Two fundamental discoveries were made in the course of this investigation: First, that the presence of even minute quantities of water in the lacquer film was responsible for the roughness of surface that made sanding necessary; second, that the presence of medium- or low-boiling solvents in the lacquer is definitely conducive to a rough surface. Water finds its way into lacquer formulas in devious ways. Some creeps in with the nitro-cellulose that is the basis of lacquer; some is carried in by the

solvents, plasticizers, and thinners which although supposedly free from water, often absorb it from the atmosphere; frequently, moisture gets into the lacquer by way of the compressed air line and, finally, moisture may be absorbed from the air after the lacquer has been applied.

By very carefully drying the nitro-cellulose used in lacquer manufacture, the resultant film shows practically no tendency to blister or peel and requires no sanding. The drying of the nitro-cellulose is accomplished by washing it in alcohol. By especially careful procedure, the other sources of water contamination may be eliminated. —*A. E. B.*

ANCIENT EGG

AN age of 225,000,000 years is estimated for a fossil egg recently discovered in north central Texas. Three inches long and rusty in coloring, it is more than twice the age of the Gobi Desert eggs found several years ago. The monster which laid it has not been identified.

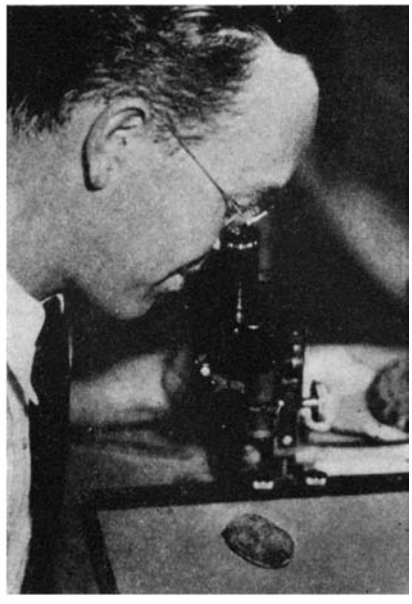
Better All-Wave Radio Reception

A FURTHER refinement in noiseless antenna systems for all-wave reception is offered in the variable impedance matching of downlead to receiver. For the first time this feature is made possible by a simple accessory applicable to any doublet antenna and receiver. The knob adjustment brings about precision balance between antenna system and receiver for greatest sensitivity and loudest signals, while reducing still further any remaining noises.

Known as the TACO Noise Rejector, the variable impedance matching unit is a development of Technical Appliance Corporation. Compact and handy, the unit is mounted alongside antenna and ground binding posts of the receiver by means of base lugs. Two short leads connect with receiver. Two screw terminals take the twisted-pair downlead cable of the usual doublet antenna. With the set in operation, the noise rejector knob is adjusted for maximum transfer of signal energy from downlead to set, as well as for minimum background noise. An intricate coupling coil with a plurality of parallel windings, in combination with a variable component, following a carefully worked out engineering formula, forms the basis of this aid to modern reception.

Mind, Brain, and Survival

DR. WILLIAM BROWN, lecturing on "Modern Science and the Possibility of Survival," at the Survival League, discussed the various theories of relation of mind to brain, and expressed the view that nothing firmly established in modern science makes personal survival after bodily death intellectually inconceivable. But the task of obtaining reliable evidence is beset with enormous difficulties. The results and messages in mediumistic trance should be closely scrutinized in the light of modern knowledge of the psychology of the unconscious, and sifted with due regard to the statistical laws of chance coincidence. Spontaneous psychic experiences on the part of private individuals, though more



Examining the ancient egg described in paragraph at the immediate left

reliable in other respects, are specially difficult to assess statistically. There is little doubt that a large proportion of the apparent evidence for survival has to be rejected by strict science; but when all the sifting has been done there remains a small residuum very difficult to explain. Phenomena can only be fitted into a scientific system if their conditions of causation are known, and this is far from being the case with psychic phenomena, although some of the more general conditions are being gradually revealed. Very thoroughgoing psychological analysis of selected mediums will advance our knowledge considerably in this dim borderland of science, and may indicate further lines of investigation.—*Nature* (London).

Chemical Safety

CHEMICAL manufacturers must be constantly on guard against possible harmful effects on employees of materials handled. The DuPont company is erecting a medical research laboratory to cost 100,000 dollars, the purpose of which is to study the possible effect of the company's new chemical products upon the health of employees during steps of manufacture and to study all possible effects of the new products on public health before the products are marketed.—*A. E. B.*

Artificial Lightning More Powerful Than Nature's

MAN-MADE lightning rivaling nature's own thunderbolts, with electrical current of 250,000 amperes, was put on display in Pittsfield, Massachusetts, recently in a crashing, flaming exhibition by engineers of the General Electric Company's high-voltage laboratory.

Measurements of current surges in power lines have indicated that a direct hit by a natural stroke of lightning causes the current to mount to only 150,000 amperes. The current in the demonstration was discharged at 150,000 volts potential.

The electrical power expended during the eight one-millionths of a second of the flashing "bolt" was 30,000,000,000 watts.

This is 30 times the electrical power developed by the hydro-electric plants at Niagara Falls and as much as the combined electrical output of all the electrical plants in the United States.

Ordinary copper wires for handling heavy currents were blown apart and vaporized in a few millionths of a second during the demonstration. A section of reenforced concrete was shattered by the impact of the artificial lightning bolt just as a concrete structure is sometimes wrecked by natural lightning.

A metallic conductor large enough to carry the tremendous current without fusing is subjected to powerful mechanical forces during its transmission of the current. A flat strip of copper shows the "pinch effect" which changes it from a ribbon to a nearly round cross section.

The new high-current apparatus is a companion instrument for the 10,000,000-volt artificial lightning generator already in use at General Electric's high-voltage laboratory. Both instruments are used in the research which the company is, and has been, making to study the effect of natural lightning on long distance transmission lines.

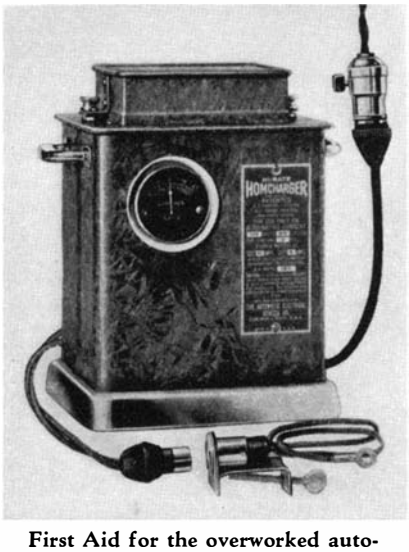
Already many protectives have been devised to improve the service to distant places which formerly was interrupted by lightning strikes.—Copyright, *Science Service*.

Home Battery Charger

THE use of larger and higher compression engines, dual electric horns, more powerful lights, auto radios and the like, has imposed such a drain upon car batteries that some car owners find it necessary to recharge the battery quite often. The rate of recharging by operation of the car is too slow to keep the battery fully charged.

To meet this need, the Automatic Electrical Devices Company has developed a new "Homcharger" which they claim will charge the automobile battery overnight for a nickel. They claim that this new equipment will charge a battery faster and cheaper than chargers now commonly used.

The Hi-Rate Homcharger is for use only on alternating current, 115 volts, 60 cycles, for charging a three cell storage battery at 10 amperes at the beginning and tapering off to six amperes at the finish. Connection is made to the battery through a clamp-on receptacle which requires no tools and needs but a single connection to the ammeter terminal in the rear of the dash.



First Aid for the overworked automobile battery, in the shape of a high-rate charger for use at home

35-Ton Propellers Revolve at the Touch of a Finger

SO perfectly balanced are the huge propellers of the Cunard White Star superliner, *Queen Mary*, now being "fitted out" in Scotland, that even the touch of a finger on the giant blades is enough to set them in motion.

Each of the four propellers weighs 35 tons, being the largest manganese bronze units ever cast. The total weight of each casting in the rough state was about 55 tons, of which 48 tons was in the main pour, from two ladles, the balance being added as feeding metal at intervals, over a period of 4½ hours, to make good the liquid shrinkage and to ensure soundness in the propeller itself.

This mass of propeller metal required 14 days to cool down to a temperature at which the casting could be safely removed from the mold. The construction and assembly of the molds called for the highest degree of accuracy by the skilled craftsmen employed on this work, and eight weeks were required for preparing and drying each mold. The melting, casting, and handling also required infinite foresight, and care, after which the propellers were machined, dressed, polished, and statically balanced.

Vitamin D A Dental Aid

THAT vitamin D helps to protect teeth from decay is borne out by studies recently completed by Dr. E. C. McBeath, of Columbia University. Child-feeding experiments were carried on for six months, and it was found that the carious surfaces of the teeth of the children on a regular diet had increased from 55 to 84 percent, while those who had taken 300 units of vitamin D daily had an increase of 10 to 18 percent.—*A. E. B.*

Vegetable Vitamin D

USING a highly refined vegetable oil as a base, and dissolving in it a pro-vitamin from a vegetable source, Lancaster, Inc., produces "Astra-D," a vitamin-D concentrate. The pro-vitamin used is highly activated by natural solar irradiation. The manufacturer reports that this concentrate is being used in bakery products, mayonnaise, cottage cheese, salad dressing, peanut butter, candy, macaroni products, jams, and jellies.—*A. E. B.*

Insect Racketeering

PARASITIC ants of a new species, recently discovered in southern Germany by Dr. Karl Gösswald of the Institute for Applied Zoology, Munich, set a new record for insect racketeering. If Solomon could have seen these insects, he might have hesitated about making a blanket commendation of ants in general as models of industry and thrift.

This ant's career of wickedness begins when a fertile queen intrudes herself into the nest of another species of ant—the normal, hardworking kind that inspired

Solomon's praise. Ordinarily the workers in the nest would make short work of any stranger, but she somehow manages to flatter herself into their good graces.

Proceeding thus unmolested to the chamber of the rightful queen, the intruder springs upon her back and fastens her strong jaws into the body of the much larger insect. The home queen does nothing to defend herself, and the workers still pay no attention.

After the rightful queen is dead, the invading queen is accepted by the duped workers as their own. She proceeds to lay eggs of her own parasitic species, which are cared for by the workers.

These eggs produce "neuters" or undeveloped females, which in a normal ant species constitute the worker caste. But in this parasitic species they are as useless as their mother, living lives of complete idleness, accepting the food the active workers bring them and giving no thanks for it—as typical a lot of alien aristocrats as ever afflicted a community, whether ant or human.

It might be expected that when the last of the workers had died off, the helpless parasites would perish. But here the nature of the "host" ant workers intervenes to play a mean trick on them and perpetuate their slavery.

Normally, when an ant colony loses its queen, some of the usually "sexless" workers lay unfertilized eggs, just as worker bees do under similar circumstances. These eggs develop only male or drone insects, useless as workers. But with these poor afflicted ants, the eggs laid by the workers produce new workers, so that the "aristocratic" idle parasites always have a full population of exploitable "proletariat" workers to take care of them.—*Science Service.*

CURRENT BULLETIN BRIEFS

Hydro-Electric Progress in Canada During 1934. Bulletin No. 1784. An annual review of hydro-electric and water-power development during 1934 which gives a brief description of those undertakings which were begun or which reached the developed stage during the period. *Director of the Dominion Water Power and Hydrometric Bureau, Ottawa, Canada.—Gratis.*

Better Tenant Farming, by Cornelius J. Claassen, is written for all farm owners, especially those who lease their farms to tenants. Many helpful suggestions are offered as to how you can improve your land and increase your profits without incurring great expenditures. *Farmers National Company, Omaha, Nebraska.—Gratis.*

General Short-Wave and Public Address Manual, by Sydney Bass and Herman Cosman, is a series of articles on the construction of radio equipment, supplemented by valuable charts and tables. *Bulletin 335B, Scientific American, 24 West 40th Street, New York City.—50 cents postpaid.*

The Thirty-Hour Week, by H. G. Moulton and Maurice Leven. A 20-page essay weighing carefully the advisability of a 30-hour work week. Such questions as "How would the 30-hour week affect wealth production?", "Is a shortened working week a satisfactory means of relief?", and "Would the 30-hour week generate recovery?", are discussed and answered and a startling conclusion is drawn. *The Brookings Institution, Washington, D. C.—Gratis.*

Novel Short Wave Dial Log. With a single setting of the rotating arm, the days of the week, hours of broadcasting, call letters, kilocycles, city, and country in which station is located, all appear in a straight line and can be read at a glance. *Bulletin 335A, Scientific American, 24 West 40th Street, New York City.—3 cent stamp.*

Water as an Engineering and Industrial Material concerns itself with industrial applications, power plants, water analysis, and detection of impurities. Comprising 45 pages with illustrations, it treats of the removal of suspended solids from water, detrimental effect and removal of manganese, and the effect of color on industrial water supplies. *American Society for Testing Materials, 260 South Broad St., Philadelphia, Pennsylvania.—50c.*

Electrical Capacitors is a remarkable little booklet telling the story of the construction of condensers for various electrical purposes. An unusual series of photographs presented in a modernistic manner carries the reader from raw material to finished units. *Bulletin 335C, Scientific American, 24 West 40th Street, New York City.—3 cent stamp.*

Sixty Ways To Prepare Cheaper Cuts of Meat. Of interest to those who must stretch their "meat dollars" is the new circular of 60 tested recipes for meat dishes at low cost. Ten years of research by the Bureau of Home Economics has brought to light much material about the science of meat cookery, all of which is contained in the circular. *Superintendent of Documents, Government Printing Office, Washington, D. C.—5c.*

Peak Efficiency Design on the Short Waves, by James Millen, M. E., describes the engineering of a universal AC-DC receiver especially designed for amateur band reception. Circuit diagrams and data are given. *Bulletin 335D, Scientific American, 24 West 40th Street, New York City.—10 cents.*

Statistics of Waterways. Based upon official reports and records available up to December 1, 1934, this bulletin is designed as a convenient reference for statistics of waterways and waterway operations in the United States. *Bureau of Railway Economics of the Association of American Railroads, Washington, D. C.—Gratis.*

World-Wide Short-Wave Reception, by James Millen, M. E., tells in particular of interesting experimental work to be found in the short-wave bands. Receivers and antenna systems are described and illustrated. *Bulletin 335E, Scientific American, 24 West 40th Street, New York City.—10 cents.*

Books SELECTED BY THE EDITORS

(*Continued from page* 115)

biger's hypothesis" and the publishers assert that many astronomers have adopted it, a statement concerning which this reviewer is from the well-known state of Missouri. For readers who prefer their science wild this book is recommended—with the warning that they may accept its contents as science only at their own risk.—$3.15 postpaid.—*A. G. I.*

THE STARS FOR CHILDREN

By Gaylord Johnson

THIS book is a "sugar-coated pill" by means of which youngsters may be encouraged to learn a lot about astronomy without realizing it. The text is in story form but from end to end it is packed with solid facts. The illustrations are copious and attractive, as well as ingenious. Before passing this book to that boy or girl of 10 to 14, you will no doubt secretly read it yourself, and will pick up more practical elementary astronomy from it than you could learn from a textbook. We did.—$1.65 postpaid.—*A. G. I.*

THE POETRY OF MATHEMATICS, AND OTHER ESSAYS

By David Eugene Smith, Professor of Mathematics, Columbia University

THIS little book contains five essays which will interest those who are in love with mathematics, yet they are not themselves mathematical. Besides the essay which gives the book its title, the others are: The Call of Mathematics; Religio Mathematici; Thomas Jefferson and Mathematics; Gaspard Monge, Politician. On reading the one entitled Religio Mathematici, the reason why mathematical enthusiasts are mathematical enthusiasts will appear: mathematics is a religion and its pursuit is a worship, and at long last we understand the hold it has on its disciples. A readable little book.—85 cents postpaid.—*A. G. I.*

APPLIED ACOUSTICS

By Harry F. Olson, E.E., Ph.D. and Frank Massa, B.S., M.Sc.

RADIO broadcasting and sound motion pictures have resulted in a vast increase in knowledge in the science of acoustics. Fundamental principles of acoustics have been known and understood for years, but the applications of these principles to broadcasting and motion pictures have necessitated a vast amount of research work in order to couple theory and practice satisfactorily. The present book is an excellent attempt to gather all of the data which have been built up in the last few years and to present them in a form which makes possible ready reference. Since much of the science of acoustics depends upon mathematics, this text can be followed intelligently only by those who have the required background.—$4.70 postpaid.—*A. P. P.*

HOW TO IDENTIFY THE STARS

By Willis I. Milham, Ph.D.

THIS little book gives practical instructions for learning the constellations. The method is the same as that used in the course in descriptive astronomy at Williams College, where the author is professor of astronomy. It contains 24 black charts of the principal constellations.—$1.65 postpaid.

—*A. G. I.*

HEREDITY AND DISEASE

By Otto L. Mohr, M. D.

THIS is an elementary presentation of what science knows today about the actual physical or physiological mechanism of inheritance, the genes of the heredity cells. This new science is not based on elusive guesswork or psychology but on actual, tangible, observable cells studied under the microscope. In this book we learn the definite principles of inheritance—genetics, in other words. A final chapter takes up the bearing of the new genetic science on human affairs, such as intermarriage, heredity and disease, and human breeding. Genetics is fast becoming one of the exact sciences.—$3.70 postpaid.—*A. G. I.*

GENERAL ASTRONOMY

By H. Spencer Jones, Sc.D., F.R.S.

THIS is the second edition of a standard astronomy which appeared in 1922 but it has been almost entirely rewritten. The author is the Astronomer Royal at Greenwich. The many amateur astronomers who are known to be "collecting textbooks" in order to have the last word on this and that at their fingertips will do well to obtain this one. It has 426 pages and many illustrations, and is almost wholly non-mathematical.—$3.95 postpaid.—*A. G. I.*

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