January 1936

TECHNOLOGY REVIEW

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THE TABULAR VIEW

A HIGHWAY shall be there!" is a slogan of growing power to activate peoples of all parts of the world. The Review presents, on page 138, a comprehensive survey of new lines on the road map of the world, prepared by our Editorial Associate, JOHN ELY BURCHARD, '23. Mr. Burchard is Vice-President of the Housing Company and is well known as an authority in the field of housing. ¶ The discussion, beginning on page 141, of the training of public health administrators is a topic of vital importance not only to workers in this field but to the public at large. Its author, MURRAY P. HORWOOD, '16, is Associate Professor of Biology and Public Health at Technology. Professor Horwood has directed many public health surveys and is the author of a recent book, "The Sanitation of Water Supplies." ¶ A. B. KINZEL, '21, is chief metallurgist of the Union Carbide and Carbon Research Laboratories. ¶ Contributors to the Trend of Affairs section of this issue include AVERY A. ASHDOWN, '24, Assistant Professor of Chemistry at Technology, and FREDERICK G. FASSETT, JR., Assistant Professor of English.

ONE of the questions most frequently asked of the Review Editors is: "Where do you obtain the handsome photographs which are reproduced in The Review?" The answer is literally from all over the world. Our readers send us pictures and tell us about others; both amateur and professional photographers forward to us many prints on approval (during the week before this was written, approximately 100 photographs passed across the Editor's desk, and in selecting the 33 prints in this issue, some 200 were examined); The Review Staff watches photographic exhibitions for appropriate subjects. Many of our most novel and interesting illustrations come from amateurs, and it is in this direction that we look in the future for new material. We solicit suggestions and prints from our readers, feeling that among them are others of the high caliber of W. C. West, '11, the new President of the Chicago Camera Club, Alexander J. Krupy, '24, medalist in salons at home and abroad, Frederick B. Wolf, '28, who has shown us unexpected beauties in Mexico, Alexander Piaget, who has joined Mr. Wolf in his photographic expeditions to Mexico and who has recently, in these pages, given us striking pictures of industrial St. Louis, and of scores of other gifted amateurs whose work has appeared in The Review.

UPON entering 1936, we again salute our family of readers (it is larger by 1,000 than a year ago) and wish them a year fruitful in accomplishment and crowded with pleasures and satisfactions. A magazine is measured by its readers — their responsiveness, discrimination, and interest — and by this rule The Review carries a flag of distinction proudly. To our subscribers, therefore, as we acknowledged a year ago, belongs the final credit for The Review. Its contents have been inspired and improved (*Concluded on page 126*)

THE TABULAR VIEW

(*Concluded from page 125*)

by their understanding and appreciation; their discrimination and interest have drawn to these pages not only able contributors but quality advertisers who have found, because they merited it, ready and profitable response.

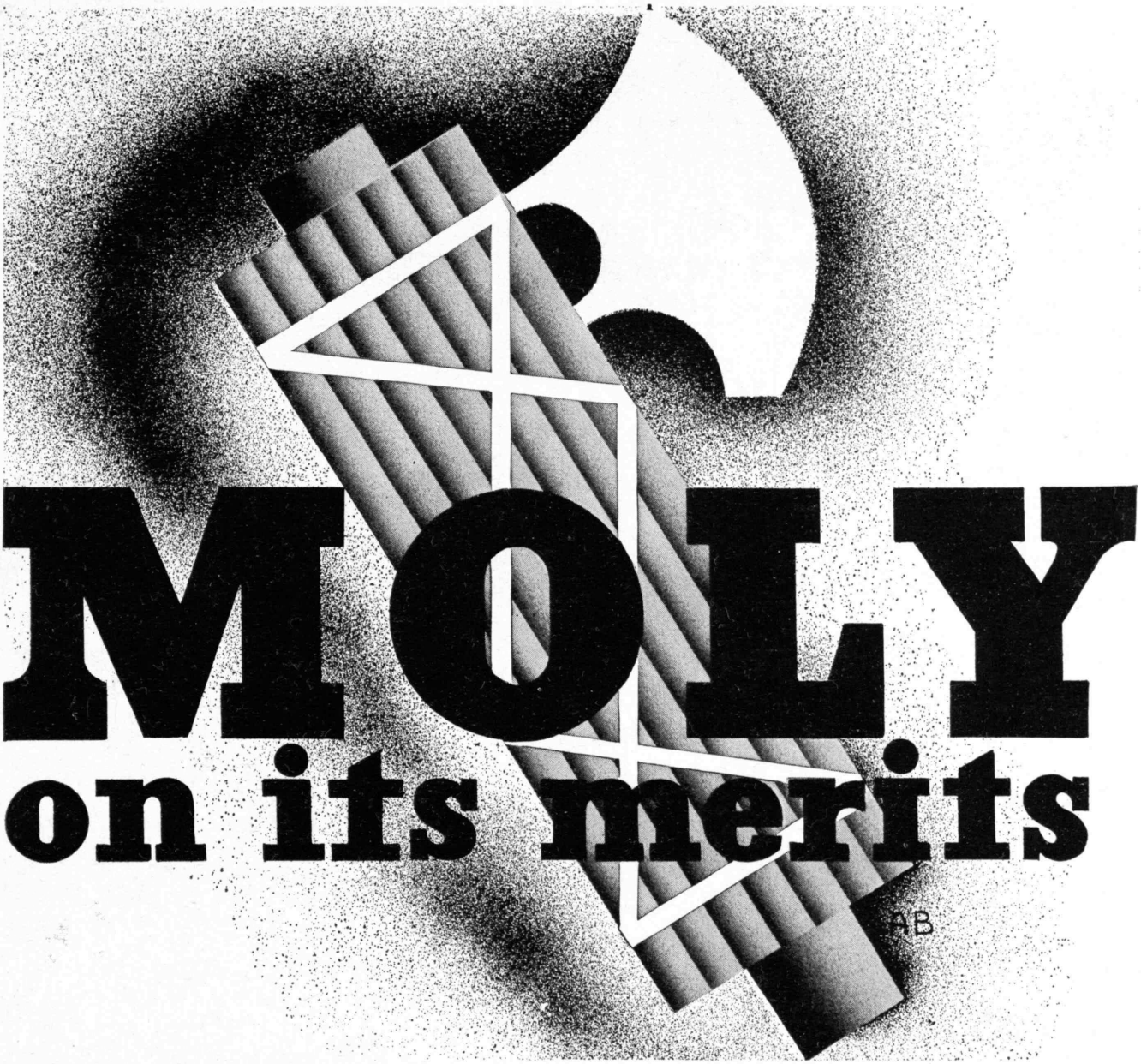
ON the assembly side, a magazine is the product of many hands, and The Review is no exception. Of the many photographers whose pictures lend distinction to these pages we have spoken above; the contributors have their *bona fides* recorded in this column each month; our Editorial Associates are known to you. The Publisher, Editor, and Business Manager present their homage to all of these groups and to another, which we wish our readers to know better — the Review Staff, the roster of which we take pleasure in calling. ¶ Miss Madeline McCormick, mistress of the counting room, authority on Technology alumni affairs. She walks undismayed through the most confusing by-ways of accounting. ¶ Miss Ruth King, curator of advertising, the right hand of the Business Manager. Her typing is a delight, and no part of publishing is beyond her competence. ¶ Miss Irene Lavin, in charge of circulation files, expert in the mysteries of mailing and of circulation statistics. Her wit withstands even a spilled tray of stencils or an unexpected flood of address changes. ¶ Miss Marjorie Fuller, in charge of class and club notes, corrector to the press. The dictionary is her favorite novel, and she delights in the perplexities of manuscript preparation and the arduous chase of elusive facts. ¶ Miss Sylvia Francis, newcomer, who joins Misses King and Fuller in their work and who aspires to their skill in the arts of correspondence, filing, indexing, and preparing manuscript for the press. ¶ To the expertness and loyalty of these various members of the Review Staff it is a pleasure to bear witness.

MAIL RETURNS

From TREADWELL CLEVELAND:

Dr. Lydiard H. W. Horton's article in the December Review (p. 97) must have been interesting to many of your readers, I feel sure. "Historical lag," to use Dr. Horton's own term, does hold back psychology, no doubt, and little wonder. Historical lag is holding back other departments of science, too. It is only in recent years that the extent and importance of this general sluggard's pace in the sciences has been brought to light by the critical efforts of philosophy, the interpreter and organizer of intellectual efforts in all fields.

It was only yesterday that biological evolution began to free itself from the concept of mechanical determinism as taught by the Neo-Darwinians, who construed the process as one of random variations plus environmental selection; that psychology (save for the Die-Hards in America of the extreme Behavioristic school) discarded the old sensationalism and associationism that was part of the same mechanistic dogma; that even mathematical prediction freed itself from the bonds of hard-and-fast determinism and took its stand instead on the ground of statistical probability; that the body-mind (*Concluded on page 159*)



WHEN a user wishes steel for any particular application, he considers the physical properties which the steel must have. He usually has a choice of several steels. The consideration then quite logically narrows down to the *most economical* steel with which to meet the requirements.

For practically every known application, a Molybdenum-containing steel is available which is more economical than any other type of alloy steel. A broad claim? Yes. But a claim that is based, not on laboratory tests alone, not on isolated instances of practice — but invariably on repeated proofs in manufacture and in service . . . *on the merits* and general recognition of Molybdenum's outstanding qualities.

With "Moly" having, in the past few years, so broadly affected costs and service standards, it is a wise move of the manufacturer of alloy-steel products or the user of alloy-steel equipment and tools, to review his requirements; to consult the Climax engineers; and to learn for himself how money can be saved by standardizing on the more economical Molybdenum-containing steel having physical properties at least equal to what he is now using.

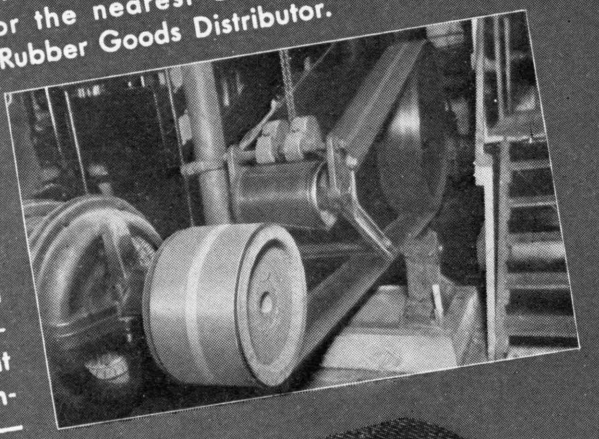
Continual Molybdenum developments have led to the publication of our house organ, "*The Moly Matrix.*" A word from you puts you on our mailing list. A further request brings you these interesting books: "*Molybdenum in* 1934" and "*Molybdenum in Cast Iron* — 1934 *Supplement.*" And for any alloy problem peculiar to your business, the services of our metallurgists and Detroit experimental laboratory are open to you. Climax Molybdenum Company, 500 Fifth Avenue, New York City. (In Canada: Railway & Power Engineering Corp., Ltd.)

CLIMAX Mo-lyb-den-um

THE LONGEST-WEARING BELT EVER BUILT

PROOF—here pictured is a Goodyear COMPASS (Cord) Belt after 4 years' continuous service on the 85 h. p. drive of a variable speed paper machine in an Indiana straw board mill. No other belt ever gave over 18 months' service on this drive! Many failed in two to three months! More than two times longer service than the best—that's typical COMPASS performance on countless belt-killing drives!

REASON—the Goodyear COMPASS Belt is the modern version of the time-proved rope drive. Within a tough protective rubberized fabric envelope, the load is carried by a layer of heavy rope-cord spiralled continuously without a splice—the weak joint in other belts! A patented Goodyear construction, it is the only truly endless belt—and the most nearly stretchless. The G.T.M.—Goodyear Technical Man—will gladly consult with your engineers in selecting the proper type COMPASS for your hardest drives. Just write Goodyear, Akron, Ohio, or Los Angeles, California—or the nearest Goodyear Mechanical Rubber Goods Distributor.



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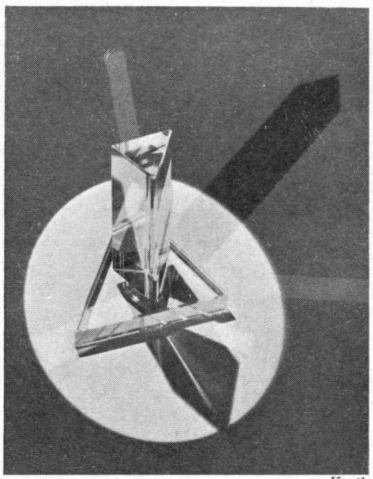

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THE COVER

From a photograph by Gerald Young

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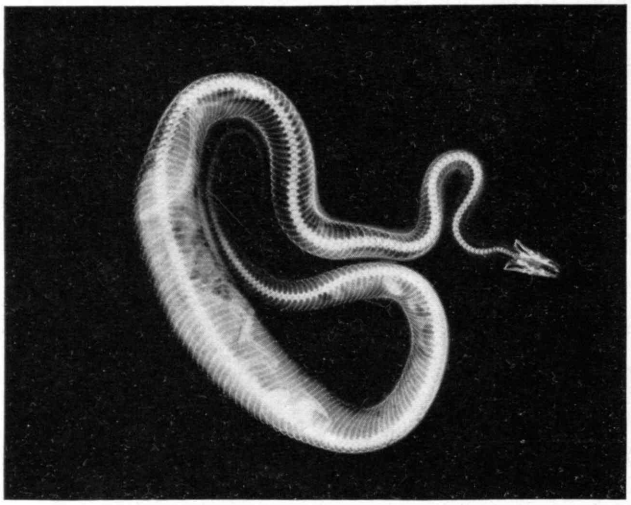
PUBLISHED AT THE RUMFORD PRESS, 10 FERRY STREET, CONCORD, N. H. EDITORIAL OFFICE, ROOM 11-203, MASSACHUSETTS INSTITUTE OF TECHNOLOGY, CAMBRIDGE A, MASS. ENTERED AS SECOND-CLASS MAIL MATTER AT THE POST OFFICE AT CONCORD, N. H. THREE WEEKS MUST BE ALLOWED TO EFFECT CHANGES OF ADDRESS. BOTH OLD AND NEW ADDRESSES SHOULD BE GIVEN.

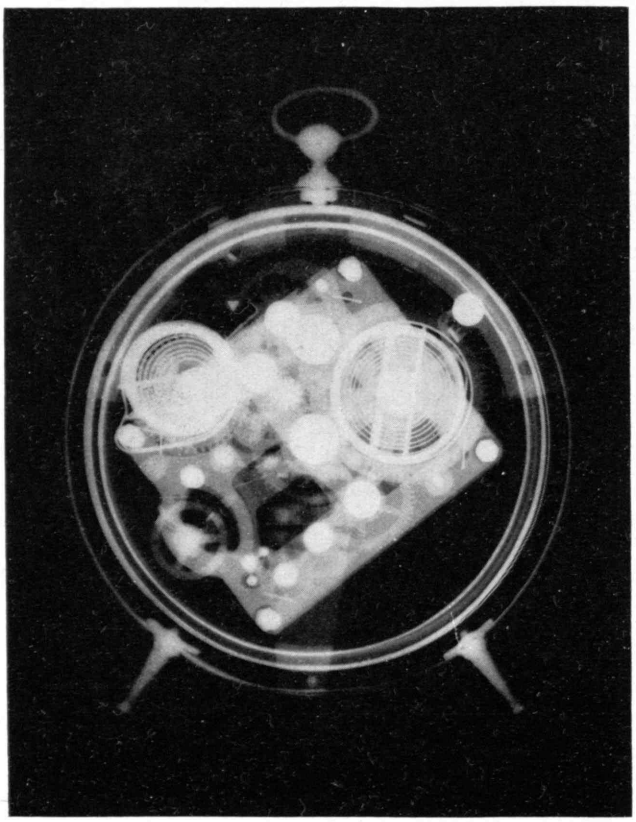


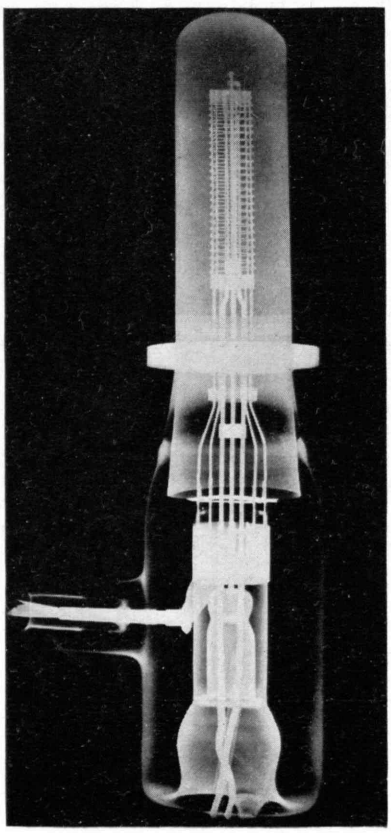
General Electric X-Ray Corp.

We Look Inside

Radiographic portraits of a snake (which had just devoured a fowl), a 0.45 calibre automatic pistol, an alarm clock, and a radio transmitting tube.

Since its discovery in 1895, the x-ray has become an enormously important tool in science, medicine, and industry. As a supermicroscope, the x-ray shows the internal arrangement of crystals, makes possible the determination of the architectural plan of matter — the patterns of atoms and molecules in space. Radiographic examination of cast metals and welds, by detecting blowholes, inclusions, and cracks, has resulted in greater safety and improved metallurgical processes.





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The Trend of Affairs

The following report, we are happy to note, deals with the work of a member of the M.I.T. Corporation and was prepared by President Karl T. Compton who attended the conference at which the results outlined below were disclosed. — THE EDITOR

Electric Brain Waves

MORE than 50 of the country's leading medical men, biophysicists, and biochemists, were the guests of Mr. Alfred L. Loomis on November 10 for a conference on one of the most fascinating of the newer discoveries of science in relation to life processes — waves of electrical voltage which are detectable in and near the brain and which are markedly influenced by mental processes. The conference was held in a palatial residence in Tuxedo Park, N. Y., now transformed by Mr. Loomis into one of the finest small laboratories of the world — the Loomis Institute for Scientific Research.*

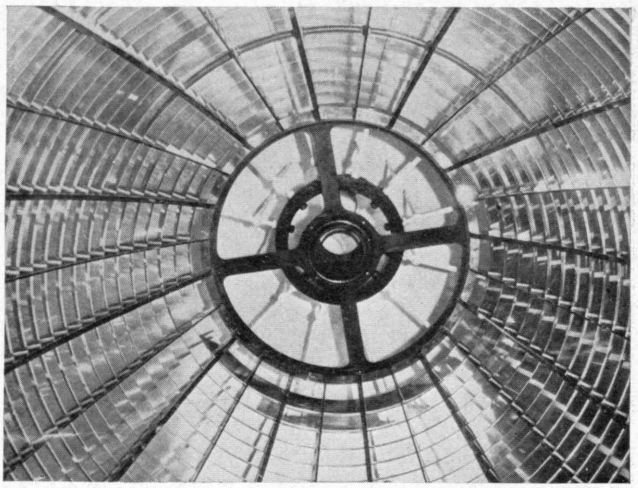
Although differences of electrical potential between parts of the brain, under circumstances such as injury, were discovered as early as 1875, recent activity in this field dates from about 1929 and has been made possible largely by the development of new electronic apparatus — vacuum tube amplifiers and oscillographs. It is only of late that experiments have been made on human beings and under conditions in which the correlation of electrical activity and mental state can be studied.

In the work at the Loomis laboratories, the subject undergoes no particular hardship. A moist cloth band, placed around his head just above the ears, forms one electrode and the other is a small metal plate placed against the skull (after shaving a small, clear spot) and held in contact with adhesive tape. These electrodes pick up whatever electric potential differences occur between these parts of the skull and feed them into an amplifier, whence they are recorded by an oscillograph or chronograph which can print a continuous record for 10 hours, if desired. Usually the subject lies in a bed fitted with devices for simultaneously recording his movements, together with pulse and respiratory rates. Sounds, lights, or directions can be conveyed to him, as desired.

Normal persons, in a state of mental relaxation and with eyes closed, but not asleep, give predominantly a potential difference of the order of 10 microvolts, alternating in direction at the rate of 10 cycles per second. If the subject is made mentally active by being asked to perform mental numerical computations or especially by looking at any object, these 10-cycle waves disappear and are replaced by a very irregular electric disturbance of much smaller voltage. The response to these changes, as eyes are opened or closed or as light is flashed on or off, is not instantaneous, but occurs a considerable fraction of a second after the change.

If the subject falls asleep, the 10-cycle waves disappear and there is only an occasional, small, irregular electric disturbance. Once in a while, however, a large

* Opened in 1926 and operated by Mr. Loomis and invited guest scientists, this laboratory has already made a notable record of achievement. In it Loomis and Wood investigated the nature and effects of supersonic mechanical vibrations, and Wood and Kistiakowsky have conducted important spectroscopic studies. Loomis has made the most accurate investigation ever conducted into the accuracy of clocks and of wireless time signals from Arlington, Greenwich, and Eiffel Tower, from which there have been discovered tides in the solid earth and a periodic small widening and narrowing of the Atlantic Ocean. Loomis and Harvey invented a centrifugal microscope and a new form of chronograph for making a continuous long record of variations in periodic processes like pulse or respiratory rates. Recently attention is being concentrated on development of new physical apparatus for the study of vital processes in animals and plants.



Fairbanks

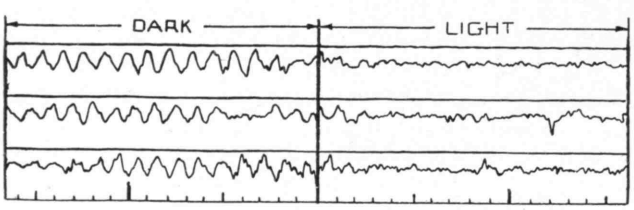
Light on Makapuu Head, near Honolulu. It contains, as shown in these interior and exterior views, one of the world's largest lighthouse lenses. With 1,140 separate prisms of highly polished glass, the lens is 9 feet in diameter and 13 feet high

regular disturbance appears and lasts for a second or two. Peculiarly, these have a characteristic frequency of about 14 cycles per second, instead of 10. There is some suggestion that periods of electrical activity in sleep are associated with dreams.

Epileptics give very different results. Their natural rhythm is slow and of large amplitude. For as much as 15 seconds before a seizure occurs, the voltages show marked progressive changes which settle down into characteristic patterns during the seizure. In mild seizures (*petit mal*) the voltage pattern is three cycles per second of large but slow voltage variations, alternating with very sudden voltage jumps. In severe seizures (*grand mal*) the pattern is exceedingly violent and irregular, but the voltages almost completely vanish during the subsequent period of stupor.

Similar interesting results have been obtained from men under hypnosis, blind from birth, or under the influence of various drugs. In the latter case, frequencies may occur up to well over 100 cycles. Under certain conditions the normal 10-cycle waves can be temporarily changed and brought into step with a periodically flickering light flashing in the eyes, though there is a marked tendency suddenly to slip back into the 10-cycle type.

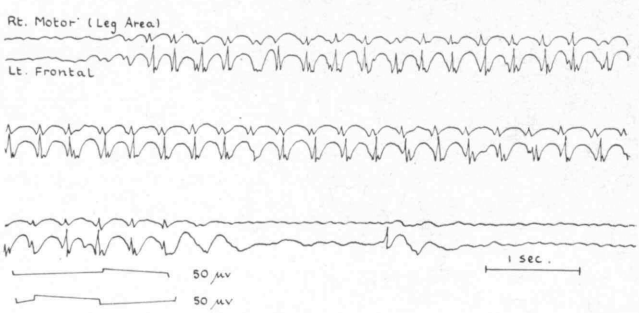
All of these phenomena are most puzzling, but so interesting as to suggest the possibility of extremely important interpretations. As seismic waves reveal conditions in the interior of the earth, these external electric waves undoubtedly signify events in the interior of the brain. What are they? Unfortunately, as in the case of seismic waves, we measure on the surface only the averaged effect of what may be a number of separate disturbances. By moving the electrodes to various places on the skull, some information is gained as to which parts of the brain are predominantly active. By inserting needle electrodes into the brains of animals it is actually found that different brain territories behave electrically with marked differences. It is believed that the potentials in the brain itself may be 100 or 1,000 times greater than those detected on the outside of the skull.



Three samples of records of brain potentials. Read from left to right. Time scale in tenths of a second at bottom. In each case subject with eyes opened was lying in a completely darkened room. At point on record indicated by the center line a dim light was flashed on. Note the regular rhythm (ten per second) when in the dark and how this rhythm stops within a tenth of a second when light appears. (From the laboratory of Mr. Alfred Loomis)

New Barometer of Health

WHILE Mr. Loomis and his associates study electrical currents related to mental processes, a great hospital in Boston is obtaining equally fascinating results by measuring, with equipment designed at Technology, other electrical properties of living tissue.



Oscillograph record (Davis and Gibbs) of a petit mal *epileptic seizure which is quite typical. At the Harvard Medical School, Drs. Hallowell Davis and Frederic A. Gibbs, both of whom participated in the Loomis conference, are using two-channel recording; the upper record shown above was made with the grid lead on the right motor region (leg area), the lower with the grid on the left frontal regions. The lobes of the ears are connected together and used as a common ground*