ENGINEERING | AND | SCIENCE

MARCH/1951

Morgan Memorial . . . page 18

PUBLISHED AT THE CALIFORNIA INSTITUTE OF TECHNOLOGY

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- ☐ Thermodynamicist
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- ☐ Electronics Engineer
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- ☐ Instrumentation Engineer
- ☐ Rocket Motor Development Engineer
- ☐ Structural Designer
- ☐ Rocket Motor Test Engineer
- ☐ Missile Coordinator
- ☐ Flight Test Engineer
- ☐ Transmission Design Engineer
- ☐ Project Engineer
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- ☐ Static Test Engineer
- ☐ Vibrations Engineer
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In the column at the right of this page we have listed many of the positions now available to qualified engineers, physicists, and applied mathematicians. Whether your interest lies with guided missiles, helicopters or supersonic aircraft, it is time to seriously consider YOUR future. Bell Aircraft's accomplishments in research, development and design provide the opportunity for permanent employment in all of our long-range programs.

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BOOKS

SCIENCE MARCHES ON

Edited by James Stokley

Ives Washburn, New York $3.75

SINCE 1936 the General Electric Company has conducted a popular weekly radio program known as the General Electric Science Forum, in which distinguished scientists give brief talks concerning their own work, or work being done in their fields of interest.

During this time the program has presented some 700 talks, and one book has already been devoted to selections from these (*Excursions in Science*, edited by Neil B. Reynolds and Ellis L. Manning, and published by McGraw-Hill in 1939). The present book contains 50 of the 500-odd talks which have been given since 1939. Its editor, Dr. James Stokely, is a member of the General Electric Company's News Bureau.

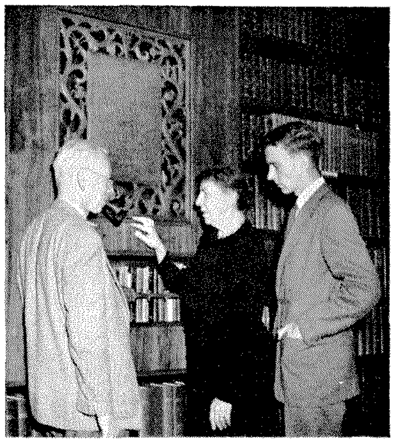
Though Dr. Stokely has neatly packaged his 50 selections into six compartments, with labels like "What Science Can Do", "The Earth and Its Surroundings", "The Living World", and "Man's Life and Health", the subjects—and speakers—range over the whole field of science.

John Quincy Stewart, Associate Professor of Astronomical Physics at Princeton, discusses Social Physics; John W. Campbell, Jr., editor of *Astounding Science Fiction*, writes on The Value of Science Fiction; Edward S. C. Smith, Professor of Geology at Union College, discusses Why Do Ice Ages Occur?; Maurice Ewing, Professor of Geology at Columbia University, tells about Photographing the Ocean Bottom; Hans Bethe, Professor of Physics at Columbia, covers The Structure of Atomic Nuclei; Robert E. Marshak, Professor of Physics at the University of Rochester discusses The Energy of the Sun; James A. Reyniers, head of the Laboratories of Bacteriology at Notre Dame, writes on Germ-Free Animals; Clarence A. Mills, director of the Laboratories for Experimental Medicine at the University of Cincinnati, writes on Climate and Man; Glenn Seaborg, Professor of Chemistry at the University of California, discusses The New Elements.

This is a random sampling of the contents of the book. Most of the talks have been revised and brought up to date by the men who originally delivered them on the air. None of them is more than about 2,000 words long, and all of them are remarkably clear—and consistently interesting. They make a fine introduction for the layman to a good many unfamiliar branches of science. And they furnish solid proof that the scientist *can* explain his work to the layman, in layman's language, when he wants to.

ENGINEERING AND SCIENCE

IN THIS ISSUE



This month's cover shows Dr. A. H. Sturtevant, Mrs. Lilian Morgan Philip Thayer and the Thomas Hunt Morgan Memorial Plaque which was dedicated at the Institute on February 23.

At the dedication ceremonies in the library of the Kerckhoff Laboratories, Dr. Sturtevant—Professor of Genetics and a onetime student of Dr. Morgan's—was appointed the first Thomas Hunt Morgan Professor of Biology at the Institute. And Philip Thayer was named as the first recipient of the Morgan Award, which is to be given annually to a graduate student who is completing his Phi.D. requirements in biology at the Institute.

You'll find a picture of the Morgan Memorial Plaque, and more information about it, on page 18.

THE EARTH'S CRUST

Albert E. J. Engel, author of "The Earth's Crust" on page 5 of this issue, is Associate Professor of Geology at the Institute. A graduate of the University of Missouri, he received his M.A. there in 1939, then served as Instructor in Geology in 1939-40. After taking his Ph.D. at Princeton in 1942 he returned to Missouri as an Assistant Professor.

From 1942 to 1948 he worked as a geologist for the U. S. Geological Survey in the Department of the Interior. His work was largely devoted to in-

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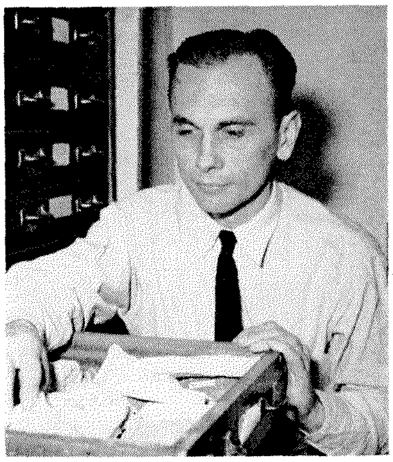


Engel

vestigating strategic and critical mineral deposits—particularly deposits of quartz crystals, asbestos, talc (steatite) and other industrial minerals.

Dr. Engel came to Caltech in 1948 to teach courses in physical geology. His principal research is directed toward unraveling the origin and evolution of some of the oldest rocks in the earth's crust.

For those interested in further discussions of the evolution of the earth's crust, Dr. Engel has supplied the following bibliography:

Daly, R. A., *Architecture of the Earth*, Appleton-Century, New York, 1938.

DuToit, A. L., *Our Wandering Continents*, Oliver and Boyd, Edinburgh, 1937.

Gutenberg, B., et. al. *Internal Constitution of the Earth. Physics of the Earth*, vol. 7, McGraw-Hill, New York, 1939.

Gutenberg, B. and Richter, C. F., "Seismicity of the Earth," *Geological Society of America*, Spec. Paper 34, 1941.

Hills, G. F. S. *The Formation of the Continents by Convection*, Arnold, London, 1947.

Kuenen, Ph.H., *Marine Geology*, John Wiley and Sons, Inc., New York, 1950.

Wegener, Alfred, *The Origin of Continents and Oceans*, E. P. Dutton and Co., New York, 1922.

NEO-THOMISM

Dr. Alfred Stern, author of "Neo-Thomism and Modern Science," on page 12, is Assistant Professor of Languages and Philosophy at the Institute. He is the author of numerous books on philosophy—the most recent being *Filosofia de la Risa y del Llanto* (Buenos Aires, 1950), and *Sarte's Philosophy and Existentialist Psychoanalysis*, now on the press.

Stern

Dr. Stern was awarded his doctor's degree, with honors, at the University of Vienna in 1923. He has taught at the University of Paris, and, since 1946, he has been a Lecturer in French at the University of Southern California. Last year he was awarded the Academic Palms with the title Officer of the Academy by the French Government. He has been at the California Institute of Technology since 1947.

THE EARTH'S CRUST

Have the nature and pattern of continents and ocean basins been essentially the same since the origin of the earth — or are they constantly undergoing change?

by A. E. J. ENGEL

A SOMEWHAT CRUDE but useful analogy of man's span of time on earth has been offered by Sir James Jeans. He pointed out that if we took the height of the Woolworth Building as representative of the total age of the earth (some 2-1/3 billions of years), the period of man's occupancy here could be represented by the thickness of a nickel placed upon the top of the building. Obviously we've come late to the party. Our limited impressions are probably highly tainted, and our data of the past extremely fragmentary.

Even in our short tenure on the earth, however, we are able to watch rivers, wind, and ice erode segments of the continents and carry the detritus to the sea, where sediments are formed. Volcanoes are born, flourish, and die; and earthquakes and related crustal movements suggest some ways in which mountains may grow. We may infer readily that the present is a key to much in the past, and use this concept as a philosophical basis in our geologic reconstructions.

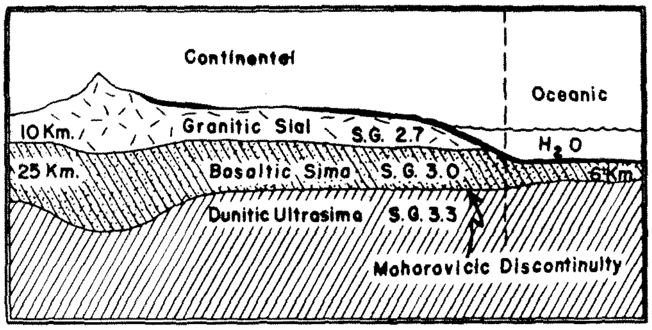
It is apparent, however, that these sequences of irregular but *somewhat repetitive events cannot* be extrapolated backward forever. Some gross processes and resulting features are bound to seem more or less unique to our short-lived earthly point of view. For example, to an earthling, the origin of our solar system, and of the earth, was a cataclysmic sort of thing. But even in this instance, though the labor may have been awful, the period of birth seems to have been extremely short in terms of the earth's after life.

Are there features of the earth itself—formed in the many tens or hundreds or millions of years after its birth —which are unique, or special, in their origin? Very possibly because of the time and scale factor, or perhaps because the material record is so fragmentary, such features would not be perceived readily.

We may confine our speculations to the crust of the earth, which is most readily examined, and—in the earth, as well as in *pies*—is worth inspection. Actually, the upper crust in the continental areas is about the only part of the earth subject to detailed geological observation and study. From geological data we can readily infer earth features in some places to a depth of at least several kilometers, and possibly locally to 10 kilometers. Geophysical data are invaluable in filling out our information of the deeper parts of the crust.

The earth's crust is frequently thought of in terms of its response to deformation—that is, in terms of its strength. Strengthwise, geophysicists find that at depths of about 80 kilometers in the earth there is a marked change in the strength of the material, although probably no change in composition. At this depth the resistance to plastic flow is presumably less than 1/100 of that near the surface. This susceptibility of the lower crust to plastic flow has special significance in conjunction with any movements of parts or all of the crust, relative to the earth's interior.

Let us first, however, think of a crust in terms of composition, or rock types. So considered, we find that the crust under continents is quite different from that under oceanic basins. The general relations of continental to



Vertical section through earth's crust shows inferred compositions of continental and oceanic segments.

oceanic segments of the earth's crust, as inferred from geological and geophysical data, are shown in the diagram above.

These data indicate unequivocally that in the continental areas the patchy deposits of sedimentary rocks are underlain by granitic rock (called sial because of the preponderance of silica, alumina and alkalis). The sial layer under the continents averages perhaps 10 kilometers in thickness. Interestingly enough, the sial thins or terminates abruptly at the continental margins and is very thin or absent in the oceanic basins.

Below this granitic zone of the continents the velocities of elastic waves (earthquake shock waves) suggest a zone of basalt—possibly grading downward into olivine basalt—with a total thickness of 20 to 25 kilometers.

Variations in the earth's crust

This so-called sima also thins abruptly in the oceanic basins. There it is apparently 5 to 8 kilometers thick, and is overlain only by patchy sediments and perhaps by minor sial and basaltic lava flows.

The base of the basaltic layer or sima in both continental and oceanic areas is marked by a sharp discontinuity in wave velocities (the so-called Mohorovicic discontinuity). This discontinuity is arbitrarily taken as the base of the compositionally unique rind or crust of the earth.

Immediately below, we may infer that there is material presumably kindred to the olivine rich rock dunite, and it is in this inferred dunitic rock, some 80 kilometers below the surface, that the marked change in resistance to plastic flow is found.

On the whole it is reasonable to think of the crustal masses composing the continents as lighter, thicker bodies of distinctive sial buoyed up above the heavier simatic ocean floors.

Along the belts of great mountain ranges such as the Sierra Nevada, or the Alps, the sial and/or sima are especially thickened. These and most other major mountain chains seem to have roots extending downward and depressing the Mohorovicic discontinuity.

The question may be asked, have these lighter, upstanding continental masses of the crust persisted through geologic time, essentially unique in form, in geographic distribution and structure, as contrasted with ocean basins—or have there been various modifications in the space and character of the major crustal features of the globe? An unequivocal answer to this question may be a long way off.

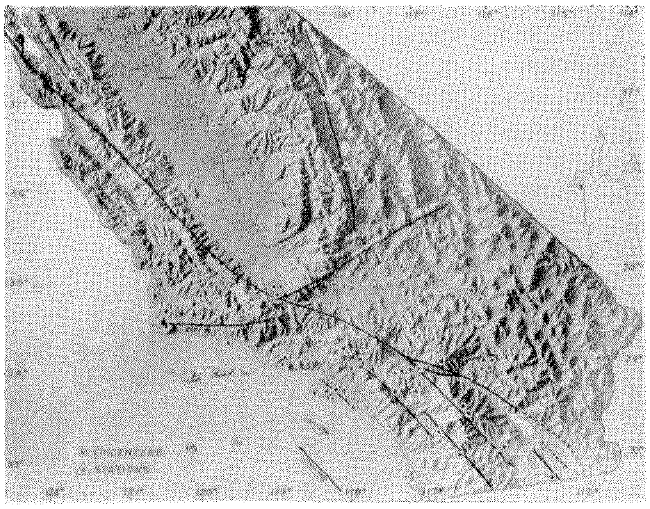
But let's very briefly explore the possibilities that these continental masses may have led a somewhat nomadic life on earth—not at all settled or quiescent.

Southern California residents need no assurance that the boundary area between this continent and the Pacific is in a state of unrest. On the map below, Dr. Gutenberg has plotted the epicenters of numerous earthquakes—many of which are clearly concentrated along and directly associated with the major faults in California. Relative motions of opposite blocks of the crust along the San Andreas fault alone are believed to total 25 miles. The same motion pattern appears to exist on many other subparallel faults of this area; much of the displacement is horizontal, with the west side of each fault moving northwest, relative to the east side.

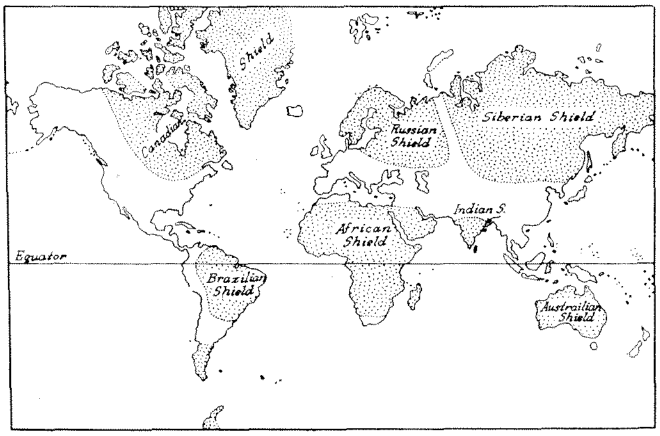
Had our earlier politicians known about these faults and their movement patterns, they wouldn't have had to argue with Mexico about boundaries. We can just settle down and wait, and in a few geologic periods much of Mexico will be within the latitudes of the U. S. A.

True, these motions are not large in terms of the face of the earth—but they represent movements in a minute part of the crust, in only a minute fraction of geologic time.

Major vertical oscillations of the continents are forcefully displayed by their present relief. Obviously, if no major elevation of continents relative to oceans took place, erosion would have reduced all parts of the earth's crust to a featureless plane in a short space of geologic time. Marine fossils impressed the ancients with the fact that the floors of shallow seas had been elevated to the tops of mountains.


Relief map of part of California shows close association of major faults and earthquake epicenters as plotted by Gutenberg. San Andreas fault is long line passing into ocean near San Francisco.

The patterns and history of such continental oscillations are in themselves peculiar and interesting. We find on each continent two general types of areas—shown on the right. One is commonly called a shield area or stable shield since the geologic evidence indicates that it has been remarkably stable, relative to sea level, since the Cambrian period—or for about the last 500 million years. These shield areas are bordered by so-called shelf seas and geosynclinal belts which are elongate zones along which transgressions of seas have occurred repeatedly since Cambrian time. The geosynclinal belts are major sites of deposition of sediments in these last 500 million years. The history of these geosynclines is that of lineaments on the earth along which the crust has been appreciably depressed, filled with great prisms of sediments, and then constricted and elevated into the great mountain chains of the world.

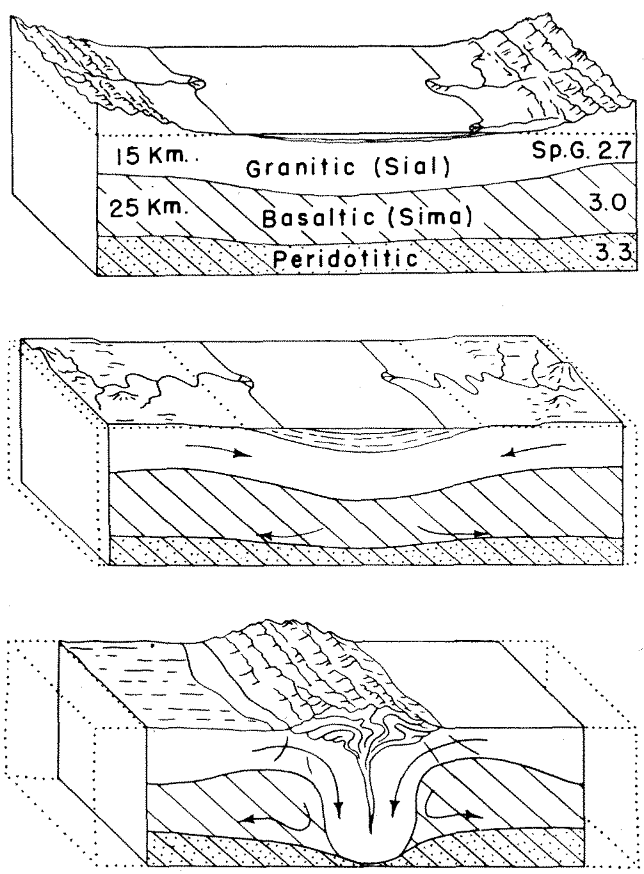


The world in Mercator's projection, showing the distribution of continental shield areas which have remained stable relative to sea level during last 500 million years.

Curiously enough, the features of the stable shield show that prior to the Cambrian period, these now-stable shield areas had histories comparable to the present areas of shelf seas and geosynclinal belts. Consequently we know of no continental area that has remained stable and quiescent throughout geologic time.

Studies of the crudely cyclical evolution of downwarped segments of the crust into mountain ranges offer perhaps the most conclusive evidence of appreciable *lateral* as well as vertical movement of at least large segments of continental blocks. Almost invariably the dominant features along the mountain belts of the world suggest constriction and lateral migration as well as elevation of the earth's crust.

The various geological and geophysical data derived along such mountain belts suggest the following sequence, as shown on the left.



Schematic block diagrams represent stages in the hypothetical evolution of a mountain belt from a geosyncline in the earth's crust.

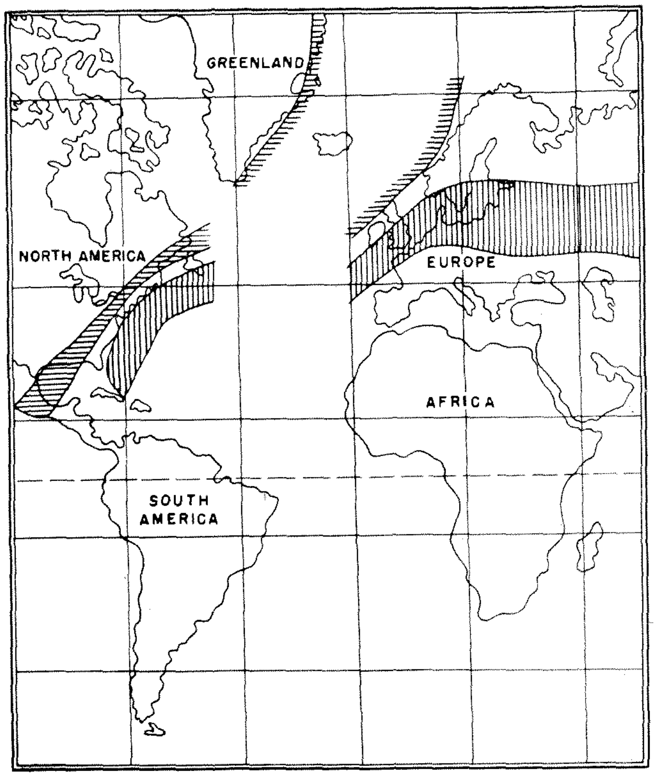
1. Successive downwarping of at least the sial or granitic part of the crust—actually in some examples the sial and underlying basaltic layer may both act as a unit in this downwarping. This is the geosynclinal stage, with detritus from adjacent continental highs contributing sediments to the trough.

2. With increased downbuckling and constriction of the crust the soft sediments and commonly imbricate slices of the granitic sial are forced upward and laterally to form a positive mountain belt. This is accompanied by a downward depression or buckling of the sial into the earth and by profound plastic flow in the subcrustal layers.

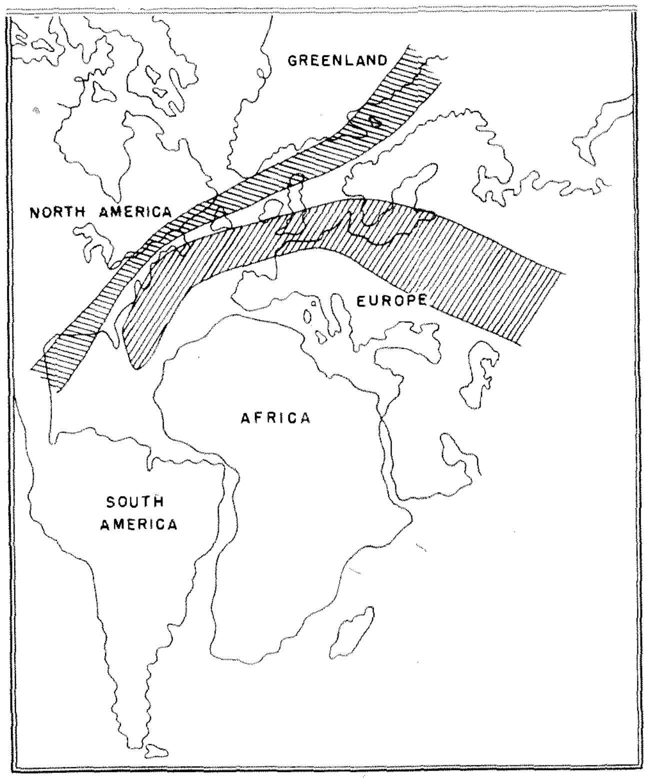
The sequence outlined briefly above, and shown in diagrammatic form, left, fits most known mountain ranges of the world. A classic example is the Alpine Himalayan type of mountain belt, which stretches from at least Gibraltar eastward through the northern Mediterranean into Asia as the Himalayan Range.

Most of the great island arcs of the world—the Japanese island arc, Java, the Philippines, Formosa, and the West Indies—appear to represent intermediate steps in what may be a somewhat analogous orogenic cycle.

If we consider any one of the great mountain chains on the crust of the earth we do find ample evidence of crustal shortening of appreciable dimensions. For example, in the Alpine Himalayan belt geological features seem to indicate that the Eurasian continental segment on the north and the African-Indian segments on the south have moved relatively much closer together. Certainly in the vicinity of the Alps a horizontal constriction of 200 miles or much more is possible, if not probable.



Map shows distribution of several mountain ranges formed during the upper Paleozoic Era of earth's history.



Possible relationship between continental masses at the time of evolution of the upper Paleozoic mountains.

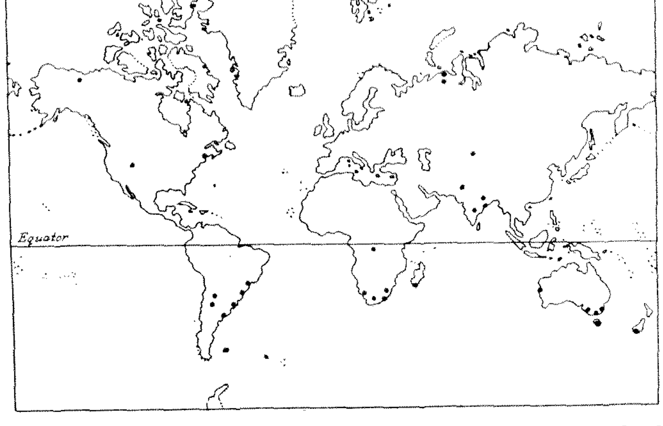
In view of the great frequency of such orogenic cycles in the crust throughout geologic time, the amount of lateral migration of parts or all of the continental blocks may be very great. We may ask, have the crustal motions in these orogenic cycles been localized or taken such directions as to cancel out each other; or do the numerous orogenic belts of the world represent evidence of crustal crumpling as the continental blocks have migrated rather extensively in some systematic way over a yielding substratum?

The fact is that we are too short on good data to provide an unequivocal answer. Certainly some orogenic patterns do suggest a common direction sense for continental sliding and close genetic relationships between now widely separated continents. In the diagram above, for example, are plotted several of the mountain belts of Carboniferous and Permian age, which may be of possible kinship. The diagram beside it is a reconstruction of a possible initial relationship between these mountain belts. Their many similar features suggest that during their evolution these ranges were contiguous units. To make them so, we have moved North and South America into the arms of Europe and Africa on the diagram.

The willingness of some geophysicists and geologists to consider such extensive travels of some of our continental masses is not prompted by data from orogenic belts alone.

For example, the projection of the world on the right shows the distribution of glacial deposits of the Carboniferous period—some 250 million years ago. One striking thing about these glacial deposits is that some of them lie within 25 degrees of the equator, in areas clearly not elevated at the time of glaciation. We do not know the source of the ice but if it is near the equator, a remarkable change in the near-equatorial climates is necessary. Alternatives are, of course, to assume a quite distant source area for the ice. One expedient is to postulate migration of the continents relative to the Pole, into their present position after the Carboniferous glaciation.

More than a few workers have been struck by the fact



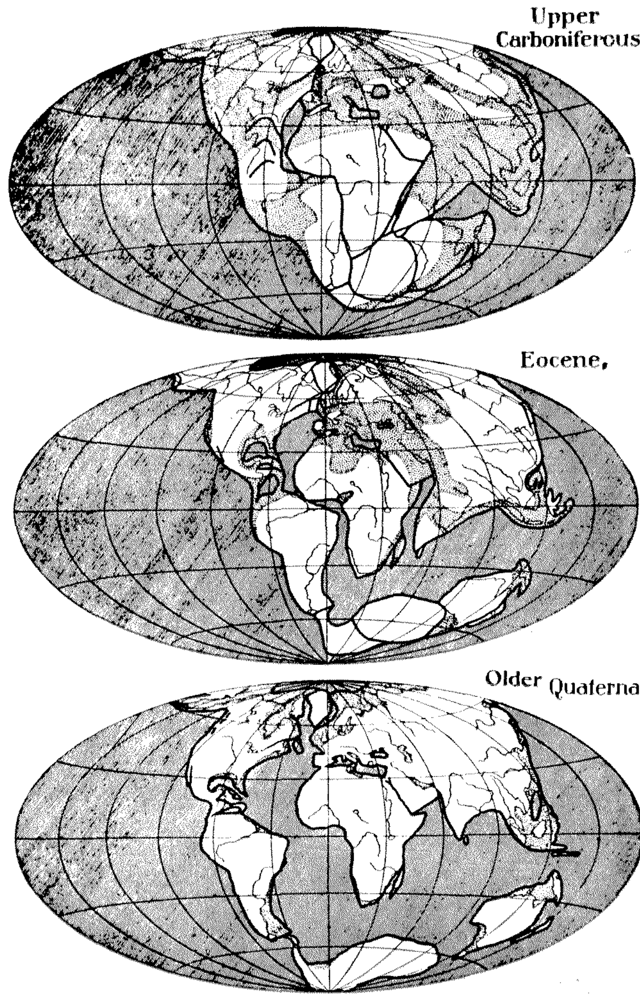
World map showing the distribution of deposits laid down by upper Paleozoic glaciers.

that the same reunion of the continents that tends to bring together the loose ends of possible kindred mountain ranges also brings these glacial deposits into areas of the globe where the climate is more consistent with great snow fields and ice sheets.

There are other data which may be explained by the assumption of continental displacements. For example, if we plot for any period in geologic time the distribution of certain closely related fossil organisms, or of some quite distinctive types of sedimentary rocks, patterns emerge which also suggest a hypothesis of continental displacement or scattering from a more common point.

The critical problem is of course to acquire reliable data on earth features and climates at successive geological dates, and then to see if these are consistent with a path or paths of continental drift.

This has been attempted by several courageous workers. One of the earliest and best known attempts at such reconstruction, made by the geophysicist Wegener, is shown on the right.



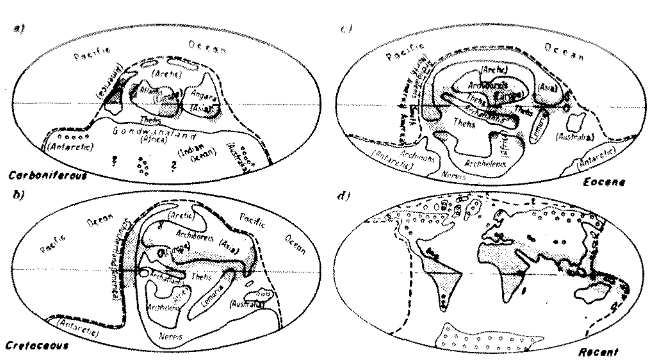
World maps showing successive stages in the migration of continents from a common nucleus, as postulated by Wegener.

Wegener's hypothesis

Wegener postulated a single large granitic cluster from which North America, South America, Antarctica, and Australia seceded in about Eocene time (let's say 50 million years ago—only yesterday in geologic time). Historically speaking, the secession movement, you see, is quite an old one.

Wegener's hypothesis got into grave troubles in large part because he employed as a cause of drift the tidal forces—which seem quite inadequate to move large segments of sial, or sial and sima, across a plastically yielding subcrust.

Subsequently many modifications of Wegener's hypothesis of continental drift have been proposed. Gutenberg has offered the suggestion that the continents flowed apart in the manner shown in the drawing below. Gutenberg suggests that the movements of the continents was accomplished by plastic flow in both the continents and the substratum. In the continental flow thin connections of continental material were left in the Atlantic and Indian Oceans—this suggestion to account for certain fundamental differences in the structure of these basins from that of the Pacific. Subcrustal currents, possible convection currents in the earth's interior, have been invoked as a possible mechanism to induce flow.



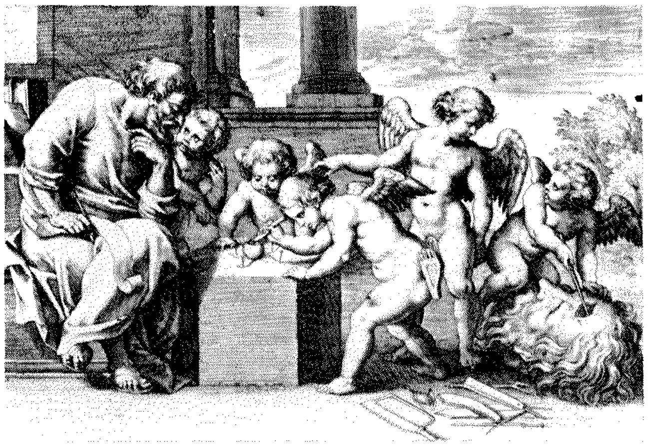
Pattern of continental spreading suggested by Gutenberg.

A problem for all the sciences

Clearly these proposals are highly speculative. To deal with them in a serious way demands a comprehensive knowledge of the history of the earth and its inhabitants. This can be had only with a thorough mapping of the face of the earth and a study of geological features and fossils of all ages. In addition, of course, the problems require the attention of all branches of science—physical, chemical, biological, astronomical, and mathematical, if they are to be solved.

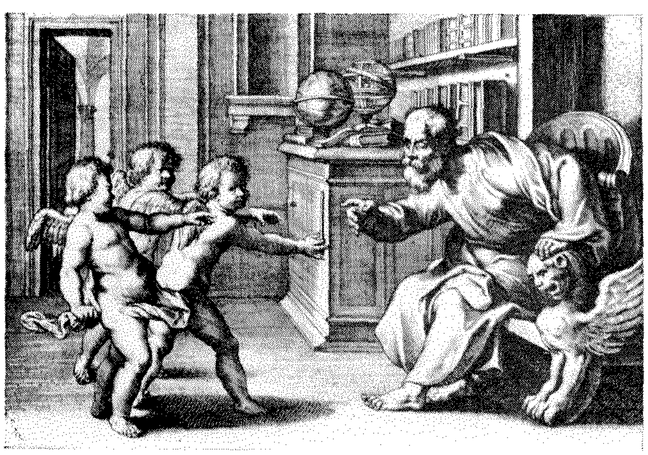
To the geologist and geophysicist they are problems of compelling interest. Inasmuch as all of us must live here until death, or until space travel is accomplished, these problems have a common interest. There is undoubtedly here to be answered a question as fascinating as any in all science.

RUBENS AS A



1. *Rubens' illustration for the first of the* SIX BOOKS ON OPTICS *shows cherubs dissecting the eye of a cyclops.*

2. *Second book describes uses of optical instruments that depend upon the linear propogation of light.*



3. *The third book discusses the perception of such things as size, shape, position, distance, and motion.*

WHILE PETER PAUL RUBENS (1577-1640), the great Flemish painter, exerted an enormous influence upon the art of engraving and designed frontispieces for approximately 50 books, only seven or eight books are known with certainty to have been fully illustrated by him. Fortunately, one of these seven is of considerable scientific interest, and Rubens' illustrations make it one of the finest scientific books of its period.

The *Opticorum libri sex philosophis iuxta ac mathematicis utiles* by Francis Aguilon is a thick folio volume of more than 700 pages published at Antwerp in 1613. As the title indicates, it consists of six books on optics. Each book is introduced by a large allegorical vignette engraved by Th. Galle from drawings made by Rubens. The work derives its importance from the fact that it lays the foundations of horopterology, provides excellent treatments of such subjects as binocular vision, projections, and so on, and introduces the term "stereographic projection."

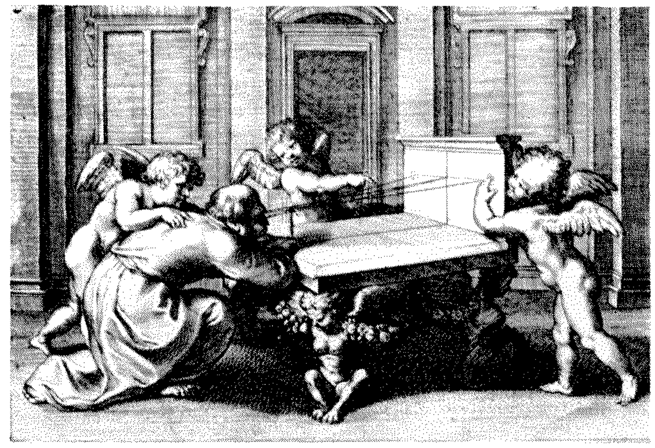
The first of the *Six Books on Optics* deals with "The Organ, Object and Nature of Vision"—the term "object" being used with its original meaning, of that which presents itself to the senses. Thus light and color are "objects" of vision. Plate 1 reproduces the vignette that introduces this book. It shows cherubs dissecting the eye of a cyclops under the scrutiny of a teacher.

The second book deals with "Optical Rays and the Horopter." Its vignette (Plate 2) shows the same fig-

One of a series of articles devoted to reproductions of print drawings and paintings of interest in the history of science.

SCIENTIFIC ILLUSTRATOR

by E. C. WATSON

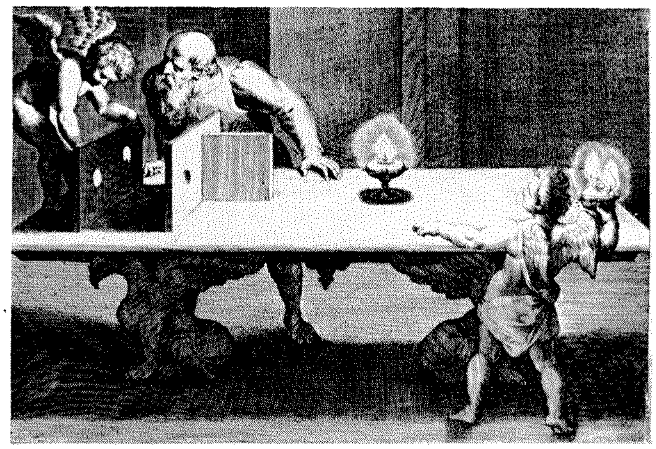


4. *Rubens' illustration for the fourth book, "Visual Fallacies," shows a typical optical illusion.*

ures using a variety of optical instruments that depend upon the linear propagation of light.

The third book discusses the perception of such common "objects" as size, shape, position, orientation, distance, continuity, discontinuity, motion, rest, and so forth. It is charmingly summarized by the vignette reproduced here as Plate 3.

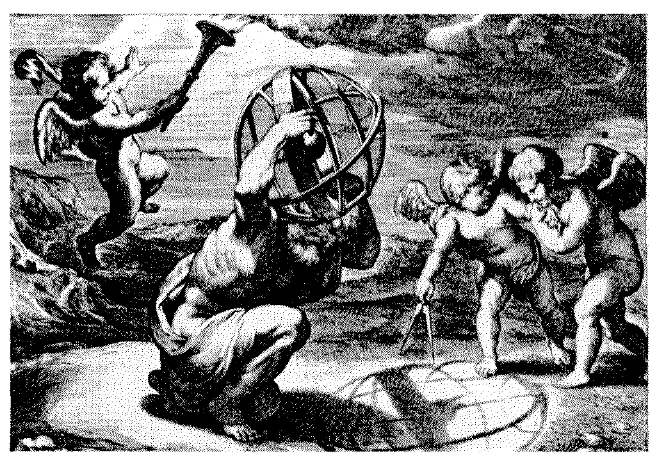
The fourth book is entitled "Visual Fallacies" and Plate 4 illustrates one of the many optical illusions that are discussed in detail.



5. *Illustration for the fifth book, which deals with "Light and Shade," portrays a photometer experiment.*

The fifth book deals with "Light and Shade." The vignette in this case (Plate 5) is of especial interest for it clearly portrays a photometer experiment. The invention of the photometer is usually credited to Pierre Bouguer (1698-1758), but here in an engraving executed more than a hundred years before Bouguer's first publication we have a clear, as well as artistic, portrayal of a working photometer with all its essentials.

The sixth and last book occupies nearly a third of the whole volume. It is entitled "Projections," and deals with perspective and scenography as well as with both orthographic and stereographic projections. Its vignette (Plate 6), like the other five, is not only artistic but also quite appropriate to the text.



6. *Sixth book deals with perspective, scenography and orthographic and stereographic projections.*

Taken together, these six beautiful engravings display a very considerable comprehension of the principles of optics on the part of one of the world's greatest and most prolific artists.

drawn from the famous collection of E. C. Watson, Professor of Physics and Dean of the Faculty of the California Institute.

NEO-THOMISM AND MODERN SCIENCE

A critical analysis of the powerful movement in contemporary philosophy which maintains that the truths established by modern science must be in agreement with the teachings of the Church

by ALFRED STERN

NEO-THOMISM is the renewal of the philosophy of Saint Thomas Aquinas (1225-1274), the famous medieval Italian thinker, whose system was declared to be the official philosophy of the Roman Catholic Church. Neo-Thomism is a very powerful movement in contemporary philosophy, since in all Catholic institutions that teach philosophy, Saint Thomas' system has to be taught as the only right one. This has been a rule since the encyclical *Aeterni Patris* of 1879 by Pope Leo XIII. In 1910 a message of Pope Pius X (*Motu proprio*) emphasized again the duty of any Catholic philosopher and scientist to accept Thomas Aquinas' philosophy as the only true one and to interpret all discoveries of modern science and all phenomena of contemporary social life in terms of the philosophy of that Saint.

This is a rather difficult task, since Saint Thomas built his system seven hundred years ago. To be precise, we must even say that Thomas' philosophy is twenty-three hundred years old, for—as he admitted himself—it is mainly the philosophy of Aristotle, adapted to Christianity. Thomas Aquinas considered the pagan Aristotle as the precursor of Christ in the scientific sphere and required that philosophy be an *ancilla Aristotelis* (a servant of Aristotle).

Thus, the Greek pagan Aristotle, who, toward the end of his life, was accused of atheism and compelled to retire to a remote island, has acquired among Catholic philosophers and theologians almost the authority of one of the Church fathers. To criticize Aristotle has come to be thought almost impious. When Lord Bertrand Russell, the British philosopher who recently won the Nobel prize, criticized Aristotle in a broadcast, many protests from Catholics resulted.

Now, there is no doubt that Aristotle's system, which was not only a philosophy but an encyclopedia of the whole scientific knowledge of ancient Greece, is one of the most grandiose achievements of the human mind. It enlightened the way of human intelligence for many centuries. In our day, however, almost all of Aristotle's system has been superseded by the rapid evolution of modern science, and there are people who doubt whether the doctrine of the Aristotelian Thomas Aquinas is still the fittest philosophical framework for our contemporary knowledge. Other people would not tolerate any doubt about this. In any case we have to admire the intellectual flexibility and the skill with which the Neo-Thomists try to adapt the philosophy of their master to the requirements of modern science.

Completely forgotten during the first thousand years of Christianity, Aristotle became known in the Christian world through the Arabic and Jewish translators of the Colegio de Toledo in Spain, at that epoch under Arabic rule. The Arab Averröes, and the Jew, Maimonides, the two greatest Aristotelians of the pre-Aquinian Middle Ages, became the main sources for Saint Thomas—especially Maimonides, who tried to reconcile Aristotle with the Jewish theology.

Saint Thomas tried to achieve a similar task when, a hundred years later, he adapted Aristotle's philosophy to Catholic dogma. Maimonides, for the first time, proclaimed the autonomy of philosophy relative to theology, as Saint Thomas did later. In this doctrine lies the greatest merit of these thinkers as contributors to the development of Western philosophy. But both insisted that philosophy has to confirm the truths of faith. Thus, for Saint Thomas, philosophy became pure apologetics and, as he termed it, an *ancilla ecclesiae*, a servant of the Church. And this is still true today, as far as Neo-Thomism is concerned.

Saint Thomas tried to show, with great penetration, that there cannot be any contradiction between rational and empirical knowledge on the one hand and religious dogma on the other hand. He rejected the so-called thesis of "double truth", which had come to the Occident through the Arabic schoolmen. It stated that scientific truth may be error in the realm of religion, while religious truth may be untrue in the realm of science. Thomas Aquinas insisted that double truth exists only as far as origin is concerned—the religious truth originating in revelation, the scientific or philosophical truth originating in reason. But there cannot be any kind of contradiction between these two kinds of truth because they both have a common origin in divine veracity.

Thus, metaphysically, Saint Thomas says, truth is not *duplex* but *una et simplex*, and this solution has been adopted as a dogma by the Catholic Church.

With this dogma the task of Neo-Thomism is clearly outlined: to show that the truths established by modern science are in agreement with the teachings of the Church. But the whole metaphysical presupposition of Saint Thomas' contention that there cannot be any contradiction between faith and science—the veracity of God—is itself built on faith and not on any kind of scientific or philosophical knowledge.

Saint Thomas admitted that besides the truths common to faith and reason there are pure or authentic truths of faith, which cannot be inferred by natural reason and are known only by revelation. Reason, he taught, can prove the existence of God and the immortality of the soul, but not Trinity, Incarnation, or the Last Judgment. Reason precedes faith, and the truths knowable by reason are only "preambles of faith." Therefore Thomas and Neo-Thomists state that no philosophy is legitimate that does not take revelation for its starting point and return to it as its final goal. With his declaration the autonomy of philosophy, which Thomas had proclaimed, was again denied.

According to the idea of philosophy as outlined by Socrates and emphasized by Kant, he who philosophizes sets out to follow wherever the investigation may lead. The philosopher is engaged in an inquiry the result of which is impossible to be known in advance. However, before they begin to philosophize, the Thomists already know the result of their investigation: that which is declared in the Catholic faith. We see this clearly in reading Saint Thomas' works and those of his modern disciples, the Neo-Thomists.

Jacques Maritain, leading Neo-Thomist philosopher

The leading figure in contemporary Neo-Thomism is Jacques Maritain, a philosopher of great erudition and acumen. He was born in France in 1882, the son of a Protestant family. In his autobiographical sketch, *Confession de Foi*, Maritain described how dissatisfied he had been when he was still a science student. All the benefit he got from his science courses at the Sorbonne, he says, was that he met his future wife, Raissa, there. They then took philosophy courses together under Professor Bergson, who, as Maritain writes, "was the first who met our deep desire for metaphysical truth. He awakened in us the sense of the absolute."

Later, the Protestant Jacques Maritain and his bride, who was Jewish, became Catholics. From that moment on Maritain found in the philosophy of Saint Thomas all the spiritual security he had been looking for in vain while studying the sciences. He certainly belongs among those persons who prefer spiritual security to spiritual freedom. Maritain would not agree with Bertrand Russell's affirmation that the chief thing that philosophy can still do for us in our age is "to teach us how to live without certainty, and yet without being paralyzed by hesitation."

With the zeal of the neophyte Maritain now declares, in a recent book, that instead of being called a Neo-Thomist he would prefer to be called a "Paleo-Thomist", an old-time Thomist, of the most orthodox type.

Teaching at the Institut Catholique in Paris, Maritain fled from France when the Nazis overran the country and became President of the Ecole Libre des Hautes Etudes, the French university in New York. In 1945, after France's liberation, he was appointed French Ambassador to the Holy See. Now he is a professor of philosophy at Princeton University.

Principles of Neo-Thomism

In order to understand Maritain's neo-Thomistic attitude towards modern science, we have, at first, to recall some of the principles on which Neo-Thomism rests: those of Aristotle's and Saint Thomas' philosophy.

Aristotle's philosophy is basically teleological, assuming that matter (in Greek *hyle*) is striving for a goal, which he calls form (*morphé*). The latter represents perfection. Thus, everything carries its goal or purpose within itself. That is what Aristotle calls *entelechy* (from *télos*, purpose, and *échein*, to have).

While the purpose is still unrealized it is said to be in potentiality, and when realized, in act. Motion is the transformation of potentiality into actuality.

Thus, according to Aristotle, movement is already in the movable body, but in the state of potentiality, and the fire is potential in the combustible object. These primitive conceptions of Aristotle's physics have been wiped out by modern science, but they form the basis of Thomas Aquinas' philosophy. Consequently, the Neo-

Thomist philosophers of our day have to maintain them without question, or expose themselves to the sin of heresy.

But how do they do *this?* It is very similar to the way the Catholic Church acted in the case of Copernicus and Galileo. At the famous trial of Galileo, when he was summoned to recant his doctrine, it was not a question of his swearing that he no longer believed in the motion of the earth around the sun. What the Church actually wanted of Galileo was only that he confess that the Copernican theory was correct merely as an astronomical hypothesis—and false as a philosophical doctrine. Thereby the Church could refer to Saint Thomas' writings, where it is said:

> The assumptions made by the astronomers are *not necessarily true.* Although these hypotheses seem to be in agreement with the observed phenomena we must not claim that they are true . . .
> [*Summa Theologiae*]

And he explains that the legitimate truth is that of assertions logically derived from first principles—which, of course, are those of Aristotle's philosophy. This is what the Church called, and still calls, philosophical truth.

In this way the Roman Holy Office never denied that the Copernican heliocentric system was in agreement with observed facts and did not even utter an official judgment on it during Copernicus' life time. Only in 1616 did the Church condemn his heliocentric theory—not as scientifically false, but as "philosophically absurd and heretic."

In a similar way, the leading Neo-Thomist, Jacques Maritain, now recognizes in full the scientific merits of a system like Einstein's theory of relativity, but he denies its philosophical validity. On the one hand Maritain writes:

> The mark of genius in Einstein is that he has bent . . . geometry itself to the needs of physics, and conceived of a space whose geometric properties can account for all the phenomena of gravitation . . . The geometrical properties of so conceived space-time are themselves modified by the matter which occupies it (i.e., by what is able to disturb the measuring instruments of our exploration: clocks, graded rulers, light rays, compasses, electroscopes, etc.)."
> [*The Degrees of Knowledge*]

But on the other hand, Maritain denies that these conquests of modern science can in any way influence or modify the philosophical conceptions of the universe, which are still those of Aristotle and Saint Thomas.

"To imagine," Maritain writes in *The Degrees of Knowledge,*" that philosophical doctrines need to be radically transformed to fit in with scientific revolutions is as absurd as to suggest that our souls are vitally affected . . . by a variation in the elements of our dietary." Furthermore: "It is an illusion to believe that any appeal to scientific facts . . . can ever nullify a philosophical assertion, such as, for example, hylomorphism"—that is, the Aristotelian theory that matter strives for a goal, which is its form or essence or soul, the actuality of its potentialities.

And Maritain asks: "If philosophy is in itself independent of the sciences, cannot the latter, nevertheless, indirectly exhibit the falsity of some philosophical doctrine?" He answers this by saying: "This is not the case when the philosophy of Aristotle is brought back to its authentic principles . . . "

Since Aristotle has been declared sacrosanct by the Church, a Neo-Thomist philosopher cannot and dare not see any contradiction between the Stagirite's teleological conception and the mathematical conceptions of modern science.

"The whole edifice of the experimental science of the ancients," Maritain writes, "could fall in ruins, and this immense wreck has seemed to hurried minds as if it were the ruin of all the ancients had thought; in reality, their metaphysics and their philosophy of nature, in their essential principles, as we are able to disengage these in the Thomist synthesis, have been no more affected than the spiritual soul is altered by the dissolution of the body."

Einstein and Maritain

Thus, after having recognized in full all the scientific implications of Einstein's theory of relativity, Maritain philosophizes just as if this theory did not exist, by affirming literally: "The philosopher *knows* that bodies have absolute dimensions, that there is a world of absolute motions, an absolute time, simultaneities which are absolute for events divided as far as may be in space," although all these things have been refuted by Einstein's theory. But, philosophically, these scientific refutations are not valid because they disagree with Aristotle's and Saint Thomas' teachings.

Maritain continues by saying: "The knowledge of *what* these are, the discernments of these absolute dimensions, movements, simultaneities (at a distance), absolute time, etc., by the aid of our means of observation and measurement, the philosopher renounces, *voluntarily* conceding that it is not possible. It is sufficient for him that they can be discerned by pure minds, which know *without* observing from a given point of space and time."

These pure minds, which know without observing from a given point of space and time are the *angels,* which, as immaterial, do not occupy a definite place in space or time. The angels play a very important part in the philosophy of Saint Thomas as well as in Neo-Thomism. "He who has never meditated on the angels," Maritain writes, "will never be a perfect metaphysician."

If Einstein eliminated as meaningless the concepts of absolute space, absolute time and absolute simultaneity, it was because he recognized that no definite operations exist by which such absolute entities could be verified. The Thomist Maritain agrees with this result, as far as

CONTINUED ON PAGE 16

science is concerned. Philosophically, however, he *affirms* the existence of absolute space, absolute time and absolute simultaneity, independently of any observer, for there are the angels "which know without observing from a given point of space and time." And the Neo-Thomists know exactly how the angels think, since Saint Thomas revealed it in his treatises.

The knowledge of the angels

I shall translate here some sentences from Maritain's book, *Descartes ou l'Incarnation de l'Ange*, especially from its chapter, "L'Ange et la Raison": "The three basic features of angelic knowledge are: it is intuitive in its modus, innate as far as its origin is concerned, and independent of things, in its nature . . . "

Furthermore: "The Angel does not infer, he only has one intellectual act, which consists in seeing and judging at the same time. He sees the consequences not successively but immediately, in the origin".

"The intellect of the angels," Maritain says in another passage, "does not, like ours, draw its ideas from the things, but receives them direct from God . . . The life of the angels, without fatigue nor sleep, is an endless gushing of thought, of knowledge and will . . . Able to modify the movements of the atoms at will, the angels can play with them just as they would play a guitar." These sentences were not written by Saint Thomas, in the thirteenth century, but in 1925, by the contemporary leading Neo-Thomist philosopher Jacques Maritain, currently at Princeton University!

The obvious contradiction between Maritain's full recognition of the correctness of modern quantum mechanics and his affirmation that the angels can play with the atoms as if they were toys, is supposed to be reconciled by his hierarchic order of so-called "degrees of knowledge." In fact, Maritain distinguishes five such degrees, but he always speaks of three degrees, in order to avoid the heresy of a deviation from Aristotle and Saint Thomas.

The Aristotelian tradition recognized three principal types of sciences which correspond to what the Thomists call three degrees of abstraction. The first degree of abstraction is represented by *physics* as the account of principles and laws governing the perceptible mobile world called nature. The second degree of abstraction is represented by *mathematics*, considered as the account of the universe of quantity. The third degree of abstraction is represented by *metaphysics*, defined as an account of the universe of "being as being, and of intelligible objects, which, as such, do not require matter as a condition of their realization".

If physics and mathematics, especially in their synthesis in mathematical physics, deal with nature, Thomism introduces another discipline dealing with nature, representing a higher degree of knowledge than physics and mathematics. This additional discipline is philosophy of nature. As Maritain says in his book *Science and Wisdom*, philosophy of nature "is an indispensable mediator which reconciles the world of particular sciences (which is inferior to it) with the world of metaphysical wisdom, which it obeys".

This philosophy of nature, placed above mathematical physics, is considered as the study of "corporeal natures" or "essences." The meaning of these medieval terms in their relation to the results of modern science becomes clear by the following quotations from Maritains monumental work, *The Degrees of Knowledge:* "The configuration of a body may be a compound of electrons and atoms, but the *essence* is a substantial compound of potentiality and act . . . The theory of hylomorphism (that is, Aristotle's theory of matter striving for form as its goal) is as true today as it was in the time of Aristotle."

Furthermore, Maritain writes: "The authentic conception of the organism as the *animist, hylomorphist* conception, for which the principle of life is the formal principle itself, in the Aristotelian sense of the word, the substantial 'act' or 'entelechy'."

These quotations make it obvious that Maritain's so-called "philosophy of nature" is nothing but the old Aristotelian-Thomist medieval physics, with all its outdated conceptions, which he tries to superimpose on modern science, as a pretended *higher* degree of knowledge. This Neo-Thomist philosophy of nature is the most refined attempt to preserve, under a different name, all the medieval conceptions of nature. The historical succession of certain interpretations of nature is changed into a hierarchial simultaneity, where the day before yesterday is supposed to rule over today.

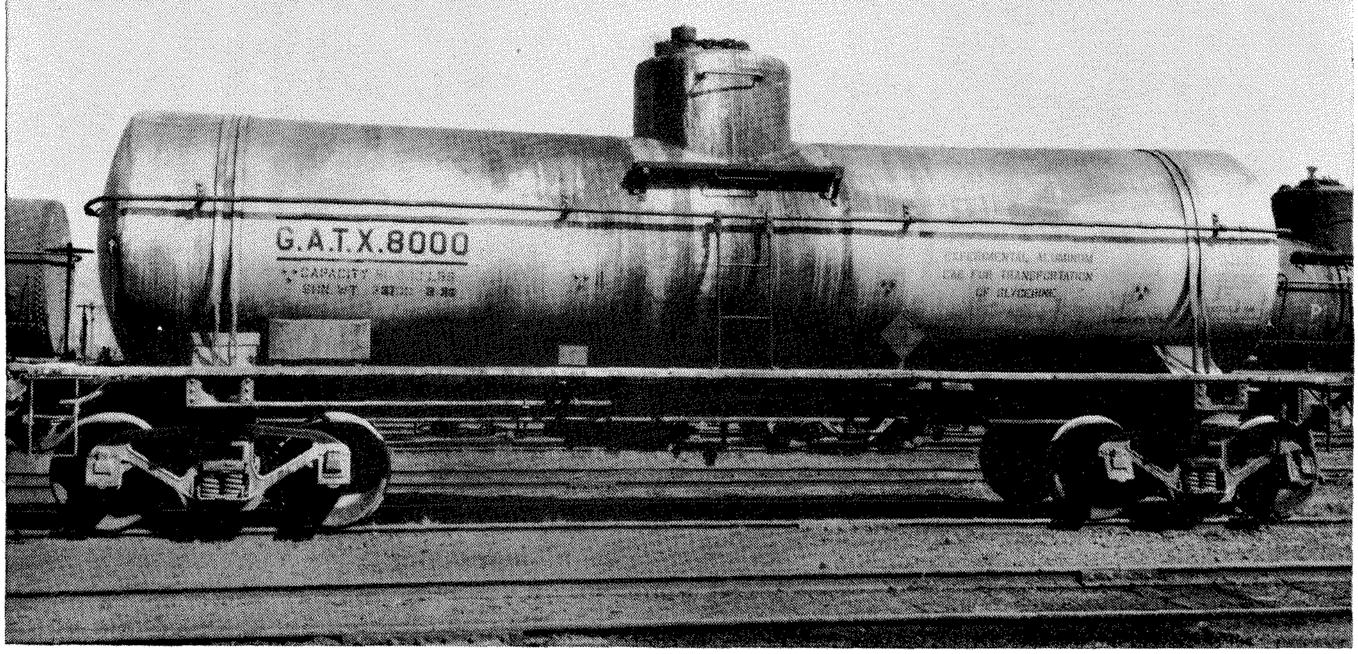
Recognition of modern science

For many centuries the Catholic Church struggled against science. This period has ended, since—as Neo-Thomism shows—the Church now recognizes modern science and its results; but only as the lowest degree of knowledge, without any philosophical bearing. Above modern science Neo-Thomism places the higher authority of medieval scholastic science, under the name of "philosophy of nature." And since the head of the Neo-Thomist school, Jacques Maritain, declares "that it is an illusion to believe that any appeal to scientific facts can ever nullify a philosophical assertion, such as, for example, hylomorphism," the Neo-Thomist medieval philosophy of nature has become a fortress, unassailable by science. Of course—only as long as science respects Maritain's strategic rules!

While physics and mathematics represent the two lowest degrees of knowledge, and philosophy of nature the third degree, metaphysics becomes the fourth degree, above which we find, as the fifth and highest degree, the so-called mystical knowledge or mystical experience, which characterizes the saints. But, since—as Maritain affirms—"this highest degree of knowledge presupposes the renunciation of knowledge," it lies outside our competence as scientists and philosophers.

THEY MADE HISTORY!

This car, and the men who designed it



Back in 1928 Alcoa engineers pointed out the advantages that aluminum would bring to railroad tank cars carrying hard to hold chemicals; easily contaminated foods. So Alcoa designed and undertook to pay for the first aluminum tank car. The car builder and a shipper became interested. On completion of the car, the builder assumed the cost and leased it to the shipper for regular service.

Interest in aluminum tank cars increased. Impact recorders and strain gauges gave the designers new data. The aluminum production men rolled the heaviest plate; made the largest rivets produced up to that time. The second car was made from 8 instead of 16 plates. Joining time cut in half!

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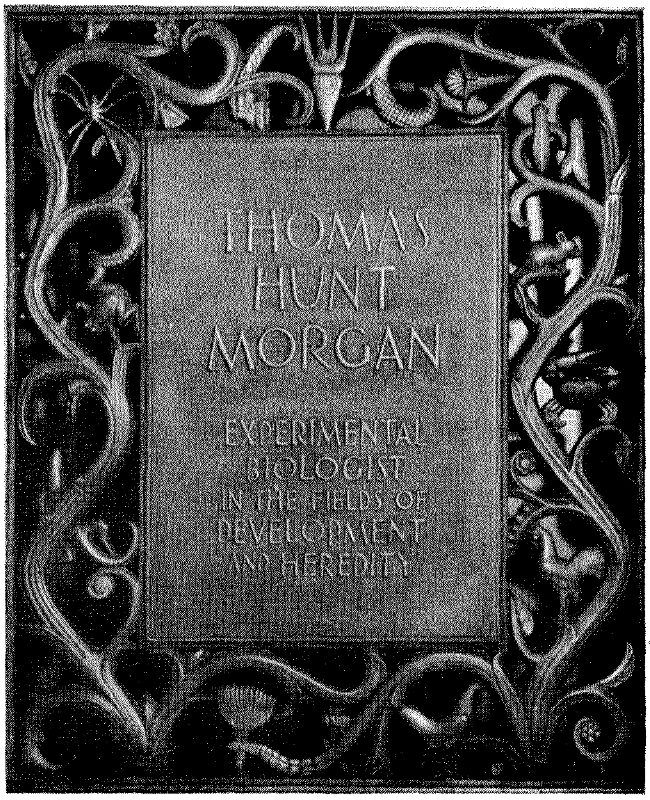

THE MONTH AT CALTECH

Morgan Memorial

On February 23 the Biology Division of the Institute dedicated a Thomas Hunt Morgan Memorial Plaque in the library of the Kerckhoff Laboratories.

At the same time Dr. A. H. Sturtevant, Professor of Genetics and a former student of Dr. Morgan's, was appointed the first Thomas Hunt Morgan Professor of Biology at the Institute. And Philip S. Thayer was named as the first recipient of the Morgan Award, which is to be given annually to a graduate student who is completing his Ph. D. requirements in biology.

Dr. Morgan, the great experimental biologist who founded Caltech's Biology Division, was awarded the Nobel Prize in 1933 for his work with fruit flies (Drosophila) which led to the chromosome theory of heredity, and thereby revolutionized genetic research. His widow, Mrs. Lilian V. Morgan, still helps to carry on his work at the Institute, where she is a Research Associate in Genetics.

Dr. Sturtevant has been at the Institute since 1928, when the Biology Division was founded. Working with Drosophila, he first established that the genes, which control heredity, are distributed in the chromosomes like beads on a string. He holds honorary Sc.D. degrees from Princeton and the University of Pennsylvania for his work.

Funds for the Morgan memorial were contributed by colleagues, students and friends of Dr. Morgan, and by trustees of the Institute. The plaque, cast in bronze, was designed by Dr. Albert Stewart of Scripps College, who incorporated in his design all the various plants and animals with which Dr. Morgan worked. It has been set up in the Kerckhoff library above a shelf containing all the books written by Dr. Morgan.

Science Advisor

Dr. Joseph B. Koepfli, Research Associate in Chemistry, took leave of absence from the Institute this month to accept the newly-created post of Science Advisor to the Secretary of State. As Special Assistant to the Secretary of State he will head a Science Office, which will help shape U. S. foreign policies and advise on the administration of programs in their science aspects.

In assuming this responsibility, Dr. Koepfli's office will seek to bring about the closest teamwork between American scientists and government officials in policy formation. Top-flight American scientists will be placed in important foreign service posts to keep the Office of Science Advisor abreast of scientific developments abroad, and to facilitate the flow of scientific information between this country and friendly nations.

Dr. Koepfli, a graduate of Stanford University, went to Oxford University for graduate study in chemistry and received his Ph.D. in 1928. He was a Research Fellow in Chemistry at the California Institute in 1928-29, and Instructor in Pharmacology at the Johns Hopkins School of Medicine in 1930-32. Since 1932 he has been Research Associate in Chemistry at Caltech,

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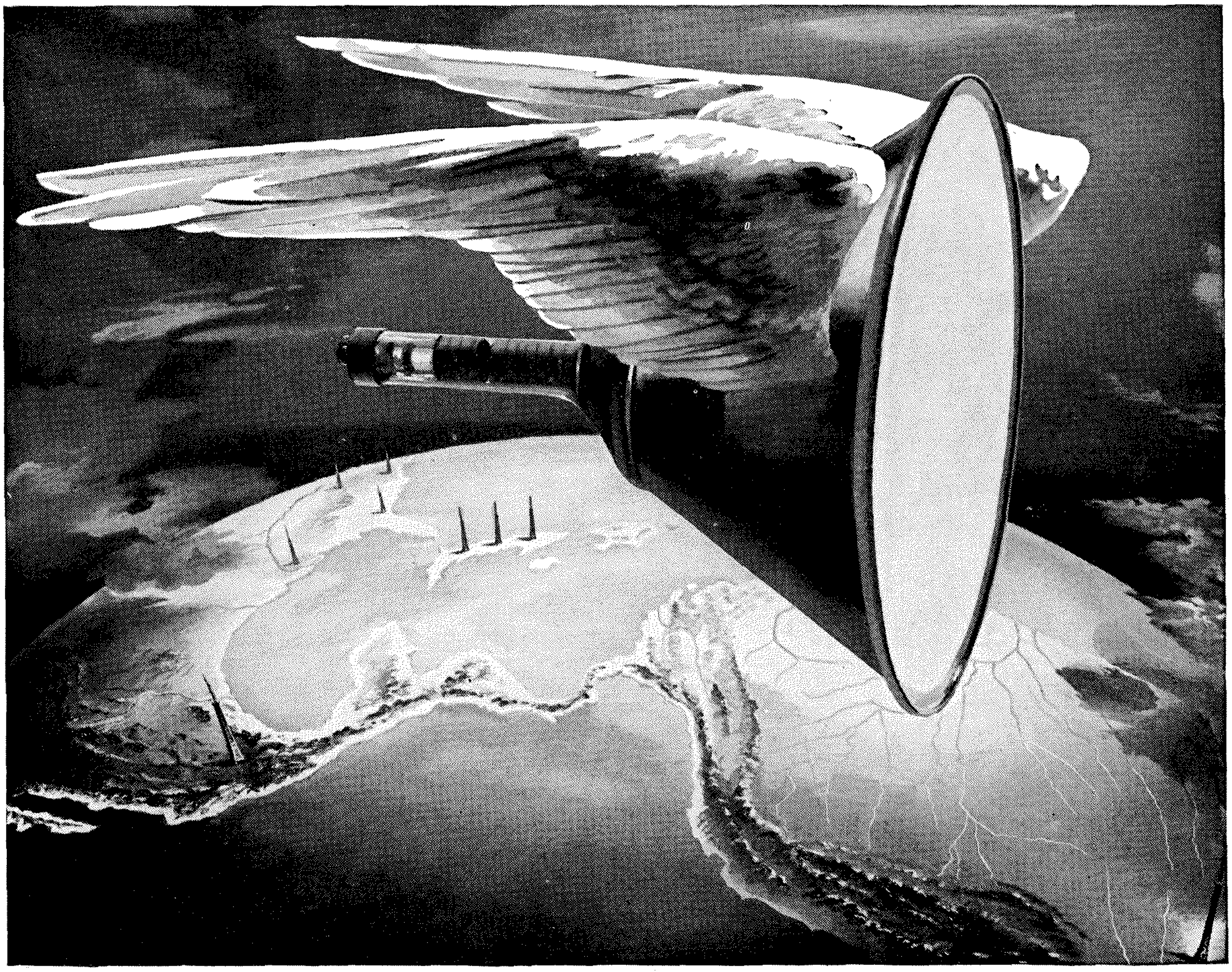

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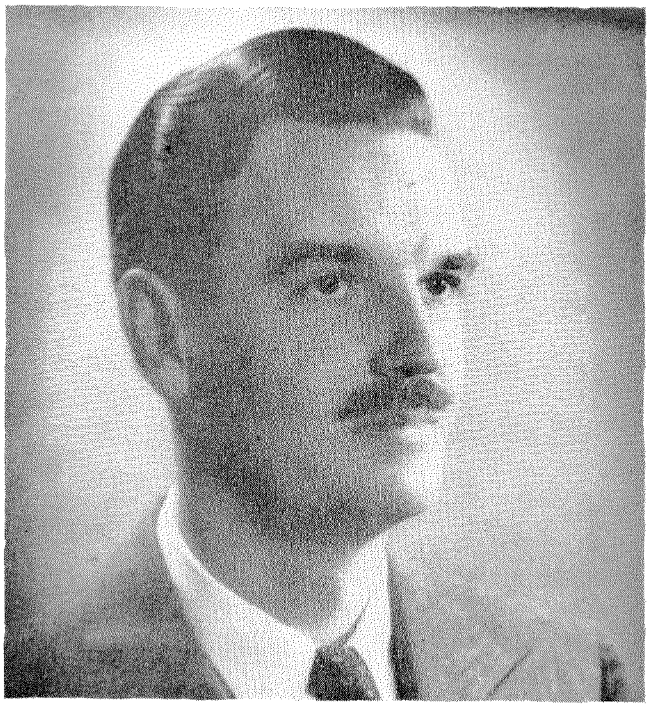

Dr. J. B. Koepfli, State Department Science Advisor

where his fields of special interest are organic chemistry, chemotherapy, plant hormones and alkaloids.

During the recent war Dr. Koepfli served as Special Assistant to the Chairman of the Division of Chemistry and Chemical Engineering of the National Research Council. In 1923-43 he was a member of the Caltech research group which developed oxypolygelatin, a substitute for blood plasma. And from 1942 to 1946 he was administrator of a contract between Caltech and the Office of Scientific Research and Development for research on the synthesis of antimalarial drugs.

In 1947-48, Dr. Koepfli took leave of absence from the Institute to serve as science attaché of the United States Embassy in London.

Kirkwood to Yale

Dr. John Gamble Kirkwood, Arthur Amos Noyes Professor of Chemistry at the Institute, will resign at the end of the academic year to accept an appointment as Sterling Professor of Chemistry and Chairman of the Department of Chemistry at Yale University. He takes up his new duties on July 1.

Dr. Kirkwood came to Caltech in 1947 from Cornell University, where he had been Todd Professor of Chemistry. He is particularly noted for his work in the field of statistical mechanics, and its application in the problems of chemistry. In the field of protein chemistry he recently developed a new method of separating proteins known as electrophoresis.

Dr. Kirkwood was graduated from the Massachusetts Institute of Technology in 1929. In 1936 he was one of the youngest men ever to receive the American Chemical Society Award in Pure Chemistry. Last year he won the A.C.S. Richards Medal, one of the highest awards in the field of chemistry, for "conspicuous achievement."

Haynes Lectures

Dr. C. E. Kenneth Mees, vice-president in charge of research at the Eastman Kodak Co., will deliver the 1951 Haynes Foundation lecture series at the Institute next month. The three lectures, on "Science, Technology and Civilization," will be given at the Athenaeum on the evenings of April 2, 4 and 6.

Dr. Mees, a native of England, received his Sc.D. degree from the University of London. He came to this country as research director for Eastman Kodak in 1912, and has been a vice-president of the company since 1934. His contributions to the theory of the photographic process have brought him honors and awards from many European and American scientific organizations.

Dr. Mees' lectures will be sponsored by the Haynes Foundation, created in 1926 by Dr. John Randolph Haynes and his wife, Dora, to extend and continue their work for the betterment of California and the Los Angeles region "in everything tending to promote civic and economic progress; in assisting to improve the physical and educational standards of our people; and in helping in matters designed to better the conditions under which working people live and labor."

Dr. C. E. Kenneth Mees, Haynes Foundation Lecturer

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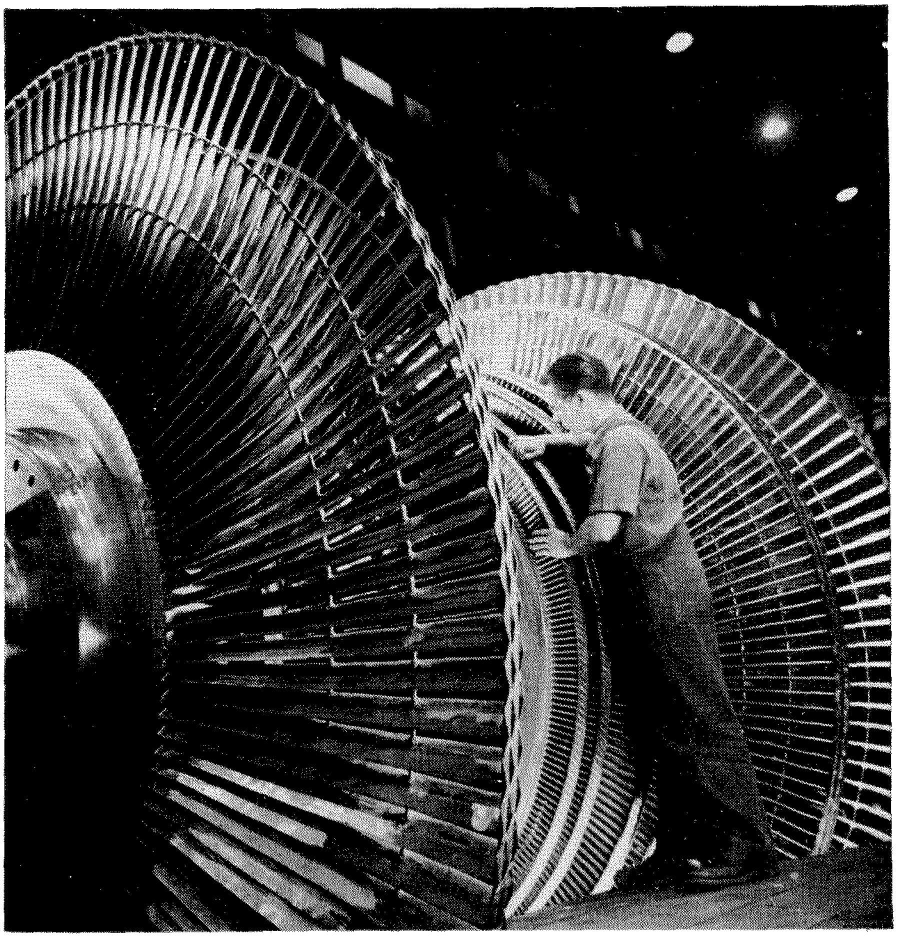
It's a good credo for salesmen, but it takes broad experience to carry it out. It's the kind of experience you must deliberately set about acquiring as early as possible. I had heard of Allis-Chalmers equipment, seen A-C's giant Corliss engines in Australia's biggest power plant and decided to study design at Allis-Chalmers. It looked like the best place in the world to get a broad engineering background.



High temperatures and speeds raise tough design and production problems on giant steam turbine spindles like these.

Textile mills are getting adjustable speed at lower cost by using new automatic Vari-Pitch sheaves on spinning frames as shown.

I joined the Allis-Chalmers Graduate Training Course after graduation from Sydney Technical College in 1908 . . . worked on steam turbines, wound coils of all types, performed tests for the electrical department. After that there were field trips to erect electrical equipment. It was soon apparent that I wasn't a designer at heart, and my sales career started.

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And the Allis-Chalmers Graduate Training Course is still flexible. Students help plan their own courses. They can switch to design, manufacturing, research, application, sales, or advertising—divide their time between shops and offices—and can earn advanced degrees in engineering at the same time.

Men at Allis-Chalmers get a close-up of the basic industries. No matter what path they take in the industrial world, experience gained with this broad organization lays a foundation for the confidence that comes with all-around knowledge.

ALLIS-CHALMERS

A-C
ALLIS-CHALMERS

Allis-Chalmers Manufacturing Company, Milwaukee 1, Wisconsin

THE BEAVER

Some notes on student life

THE BEAVER VIEWED WITH DISMAY the perennial financial crises that plagued the operation of the student houses. Last month a tremendous discussion was brought on by a proposed raise in rates in the houses. Several plans were finally put forth for the students' perusual: An outright raise; a slight raise, with a cut in room service; or no raise, but a cut in both room service and dining service—this latter meaning a reversion to a cafeteria plan.

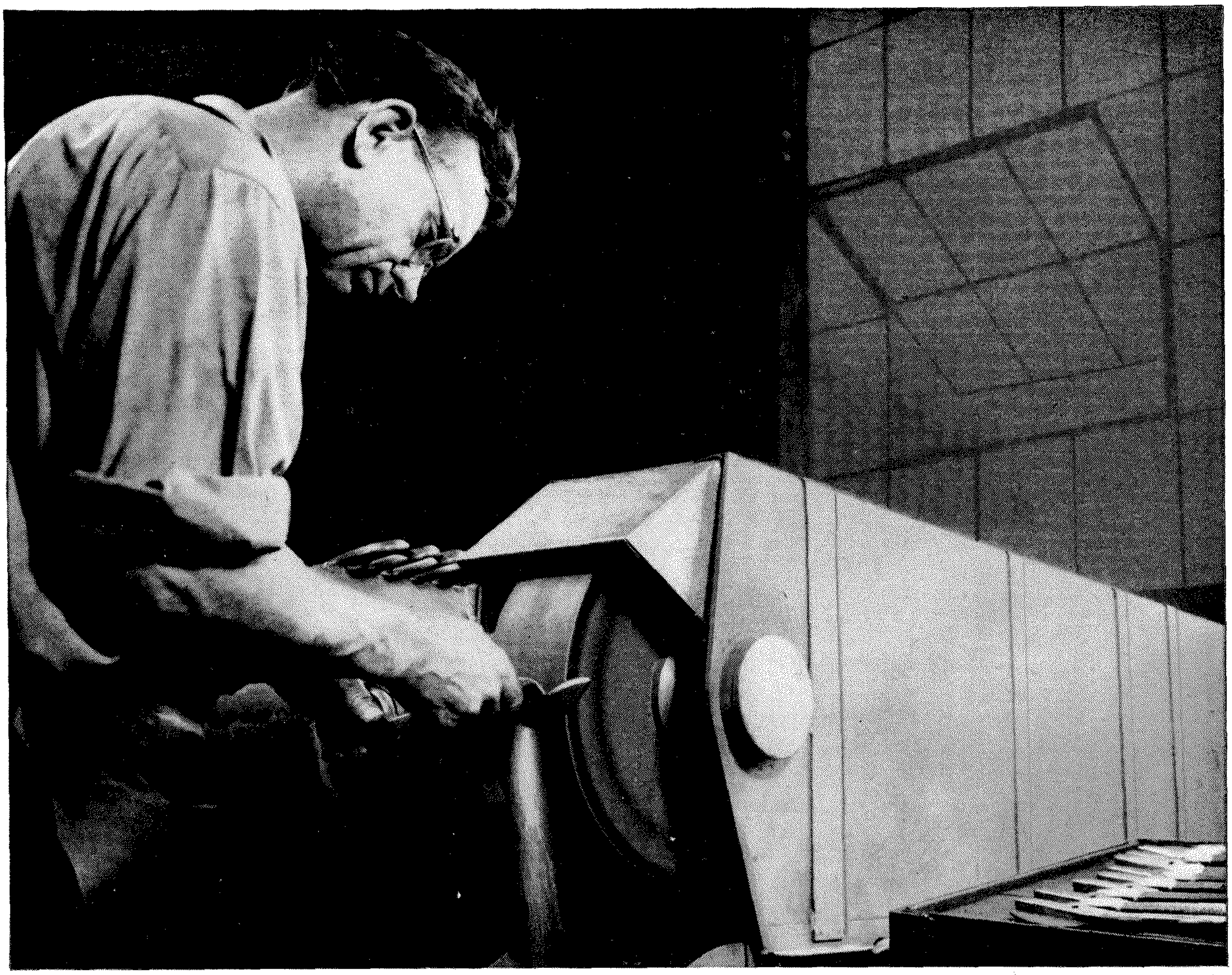
The students groaned audibly. So audible was the groan, in fact, that the powers reviewed the whole matter and decided that if maid service was done away with in the rooms, there would be no need to raise rates. This plan, rather than an increase in rates for continued room service, was accepted by the students. It now behooves the students to make their own beds and keep their rooms clean—though there will be one professional room cleaning a week.

The Beaver joined in on the great discussion that this change brought forth. There had been an outright raise of five cents a day per room in 1948. In 1949 it became necessary to charge for vacations, whether a student stayed at school or not. So it was understandable why there was great sound and fury at another increase. But after all the discussion the Beaver noticed that there were few students who were not satisfied that the cut in service was necessary.

CONTINUED ON PAGE 24

Student Elections—1951

Left, top: Carpenters and painters put the finishing touches to one of the campaign posters. Left, below: Up the creek without a paddle, the dummy who didn't vote for McCarty was one of the liveliest items in this year's campaign. Above: The winners—ASCIT President Dave Hanna and Vice-President Mike Callaghan.



THE BEAVER . . . CONTINUED

What was the best-attended function in the social life of the undergraduate? The Beaver mused on the question and concluded that the Barn Dances held most of the devotion of the Techman's heart. Their very multiplicity gave evidence of their great popularity—and the Beaver thought that their popularity reflected the Techman's distaste for white shirts and creased pants.

Barn Dances are invariably a joint effort of two or more of the houses and, with little deviation, are held at Mountain Oaks. Costumes at these affairs are ruled by one restriction—that they be as garish as possible. Techmen search arduously for decorative leather boots as well as multicolored berets to match the most insane ensemble that can be mustered up. As a rule, a most satisfying clash is obtained. The girls, not to be outdone, don gaudy cotton prints.

Both beer and soft drinks are served at a Barn Dance. Barkeepers are usually stag frosh, brought along for the sole purpose of doling out refreshments—which may account for the fact that, in his several years of attendance at these functions, the Beaver had yet to see a successful keg starter. The evening inevitably gets under way with a tremendous gush of white spray and, as a result, full mugs of foam are served for the remainder of the night. On standing for an hour or two, the mugs may even yield a half an inch or so of warm beer.

The highlight of the evening's entertainment, however, is the crew race, with its satellite, the flamer contest. These events take place when the band—usually a questionable combo composed of six recorders, one drummer and several mutes—is blue from effort and exhausted from the inhalation of many cigars.

The crew race is run off between several teams, each comprised of about ten men. Stripped to the waist, the men on each team line up one behind the other and toss down bottles of beer in relay. The winning team receives the usual varsity cheer and then proceeds to the shower room. The flamer contest is a more awesome spectacle. Again, organized teams come forth and each man is equipped with a jigger of brandy. The brandy is then set on fire and the glass allowed to warm. The contestant raises it to his lips and, in one rapid motion, tosses the liquid into his throat. If the brandy is all gone, but a blue flame still licks at the sides of the glass, this is rated a "Class A" flamer. There are two other classifications, as well, but, shuddering, the Beaver recalled that he had not even approached the lowest of these, the first—and last—time *he* had attempted this daring feat.

—*Bob Madden '51*

ALUMNI NEWS

New Board Members

THE BOARD OF DIRECTORS of the Alumni Association met as a nominating committee on February 20, 1951, in accordance with Section 3.04 of the By-Laws. Five vacancies will occur on the Board at the end of the current fiscal year, one vacancy to be filled from the present Board and four members to be elected by the Association. The present members of the Board and the years in which their terms of office expire, follow:

R. C. Armstrong '28....1951	J. E. Sherborne '34....1952
T. C. Coleman '28.........1952	D. C. Tillman '45.........1952
E. J. Macartney '43....1951	A. C. Tutschulte '31....1951
R. P. Sharp '34.............1951	W. O. Wetmore '37.......1952
G. K. Whitworth '20....1951	

The four members of the Association nominated by the Directors are:

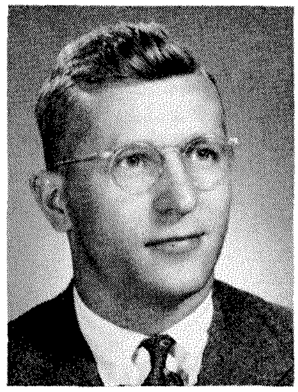
G. K. Foster '40	K. E. Kingman '29
P. W. Hubay '49	H. N. Marsh '22

Section 3.04 of the By-Laws provides that the membership may make additional nominations by petition, signed by at least ten (10) regular members in good standing, provided the petition is received by the Secretary not later than April 15. If further nominations are not received by April 15, the Secretary casts a unanimous ballot for the members nominated by the Board. Otherwise a letter ballot is required.

Statements about the nominees of the Directors are presented in this issue of *Engineering and Science*.

—*Donald S. Clark, Secretary*

The Nominees



PAUL HUBAY started out at Tech as a member of the class of '43, but wound up getting his B.S. in '49. At the start of his senior year, in 1942, Paul enlisted in the Air Corps as an aviation cadet. He was in the service for five and a half years, coming out in the spring of 1948 as a captain. In September 1948, he came back to Tech to finish his last year. After graduation Paul worked for a year with the Harman Equipment Company in Los Angeles, then joined U. S. Electrical Motors last June as a Field Engineer.

ALUMNI ASSOCIATION OFFICERS

PRESIDENT
G. K. Whitworth '20

VICE-PRESIDENT
R. P. Sharp '34

SECRETARY
D. S. Clark '29

TREASURER
H. R. Freeman '25

BOARD OF DIRECTORS
R. C. Armstrong '28
Theodore Coleman '26
Everett J. Macartney '43
John E. Sherborne '34
Donald C. Tillman '45
A. C. Tutschulte '31
William O. Wetmore '37

ALUMNI CHAPTER OFFICERS

Chicago Chapter:

PRESIDENT Jack M. Roehm, M.S. '35
Hagen Lane, Flossmoor, Ill.
Pullman-Standard Car Mfg. Co., 1414 Field St., Hammond, Ind.

VICE-PRESIDENT Le Van Griffis '37
11141 S. Longwood Dr., Chicago 43
Armour Research Foundation, 35 W. 33rd St., Chicago 16

SECRETARY-TREASURER Eben Vey '41
5125 S. Kenwood, Chicago 15
Illinois Institute of Tech., 3300 S. Federal St., Chicago

San Francisco Chapter:

PRESIDENT R. I. Stirton '30
745 Alvarado Road, Berkeley
Oronite Chemical Co., 38 Sansome St., San Francisco

VICE-PRESIDENT Jerome Kohl '40
53 Lenox Rd., Berkeley 7
Tracerlab, Inc., 2295 San Pablo Ave., Berkeley

SECRETARY-TREASURER R. R. Bowles '41
7960 Terrace Drive, El Cerrito
Calif. Research Corp., 576 Standard Ave., Richmond

The San Francisco Chapter meets for lunch at the Fraternity Club, 345 Bush Street, every Thursday.

New York Chapter:

PRESIDENT Richard K. Pond '39
95 Forest Road, Fanwood, N. J.
Westinghouse Electric Co., 150 Pacific Ave., Jersey City, N. J.

VICE-PRESIDENT Mason A. Logan '27
17 Pittsford Way, Summit, N. J.
Bell Telephone Labs, 463 West St., New York City

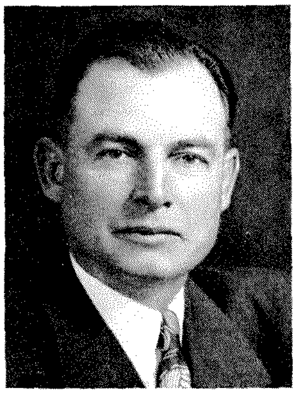
SECRETARY-TREASURER Erwin Baumgarten '40
302 E. Front St., Apt. B-16, Plainfield, N. J.
Calco Division, American Cyanamid Co., Bound Brook, N. J.

Washington, D. C., Chapter:

PRESIDENT James Boyd '27
Bureau of Mines
Department of the Interior
Washington 25, D. C.

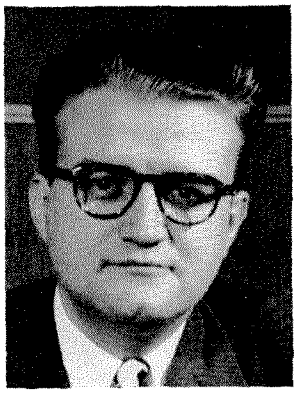
SECRETARY-TREASURER P. G. Nutting '36
5112 Connecticut Ave., N.W.
Washington 8, D. C.

ALUMNI NEWS . . . CONTINUED



KENNETH E. KINGMAN was graduated from Caltech in 1929 with a B.S. in Chemical Engineering. After a brief period of employment with the Texas Company in its gasoline testing operations, he went to work for the Union Oil Company of California, where his experience has covered such positions as Research Chemist, Assistant Superintendent at both the Los Angeles and Oleum Refineries, Manager of the Los Angeles Refinery for more than four years, and Manager of Manufacturing in charge of all refining operations for more than a year. In January 1951, he was elected Vice President in charge of Manufacturing.

HALLAN N. MARSH received his B.S. in 1922, then stayed on at Tech as a teaching fellow until 1923. From 1923 to date he has been with the General Petroleum Corporation of California—first in the Production Department and, from 1927 to date, in charge of the Production Engineering Section, including investigations of equipment and methods of drilling for and producing oil. He is a former National Chairman of the Petroleum Division of A.I.M.E., and former Chairman of the Committee on Drawing and Production Practice of A.P.I. At present he is National Chairman of the A.P.I. Committee of Standardization of Pumping Equipment and Engines.



GERALD FOSTER received his B.S. in Mechanical Engineering in 1940. After graduation, he joined the staff of the Union Oil Co. as an engineering trainee. In January 1942, he enlisted in the Marine Corps, was commissioned a Second Lieutenant on completion of training at Quantico, Va., and was assigned to sea duty as Commanding Officer, Marine Detachment, USS West Point. Back on land again in 1944, he entered Tank school and after completing six months' training at San Diego and Fort Knox, was assigned to the 3rd Marine Division. Joining the Division on Guam, he served as executive officer of the 3rd Tank Battalion through the Iwo Jima operation.

After his release from the service in 1946, he attended Stanford Graduate School of Business from which he received his M.B.A. in 1947. Returning to the staff of the Union Oil Co., he accepted a position as a Project Engineer in the Refineries Dept. In 1948 he joined the Naval Ordnance Test Station in Pasadena, and now serves there as Technical Administrative Aide to the Associate Director for Engineering.

Discovery

Thomas Clements, B.S. '29, Ph.D. '32, recently discovered a small collection of rocks which furnish the first proof that man lived here in California in the Pleistocene ice age—at least 15,000 years ago. Clements, who is now Hancock Professor and head of the Geology Department at U.S.C., discovered the stones in an old dry lake terrace in Death Valley. The stones had been shaped and sharpened into scrapers and blades by being struck repeatedly with larger rocks. The rough workmanship on the implements gave the clue to their age, for it was not so advanced as that of implements of more recent origin which have been found in the Mojave Desert region.

Chapter Note

The next meeting of the Washington Chapter will be held on Thursday, April 26, following the first day's session of the American Physical Society's Spring meeting in Washington. The Chapter dinner will be held at 2400 Sixteenth Street, N. W. at 7:00 P.M. Advance reservation is desirable but not absolutely necessary. A post card to Mr. P. G. Nutting, 5112 Connecticut Ave., N. W., Washington 8, D. C., or a call to Mr. Robecheck (Hotel 2400, Telephone, COlumbia 7200) would do the trick.

Defense Minerals Administrator

James Boyd '27, Director of the U. S. Bureau of Mines since 1947, now heads up the newly created Defense Minerals Administration. The agency has been set up to increase our supplies of the metals we produce ourselves, and—even more important—those we import. As the defense program has speeded up, and the steel industry has broken production records week after week, there has been a steadily increasing demand for the alloys used to strengthen steel—tungsten, manganese, chromium, molybdenum and cobalt. In this new and highly important position it will be Boyd's job to find ways of increasing output of ores from existing facilities, to develop known deposits, and to uncover new sources of supply of the metals and alloys needed to keep defense plants booming.

Fourteenth Annual Alumni Seminar - Saturday, April 14, 1951

8:00-8:45 A.M.—REGISTRATION

DABNEY HALL OF THE HUMANITIES

MORNING PROGRAM

8:45 to 9:30 A.M.
Your choice of the following:

A. THE PHILOSOPHY OF SCIENCE
Charles Bures, Assistant Professor of Philosophy
This is for those amateur philosophers who like to think a little more deeply about science. Dr. Bures will discuss these questions:
What are some of the implications of scientific knowledge?
What does the philosopher contribute to the fields of science and engineering?
Does the engineer and the scientist need to study logic?

B. USES OF RADIOACTIVE TRACERS
G. C. Dacey, Research Fellow in Engineering
Many remarkable uses have been found for radioactive tracers in the short time that they have been available. Mr. Dacey will discuss the use of radioactive tracers in industrial, medical and other fields, and he will present information of general interest on the protection of personnel from radioactivity experiments.

9:45 to 10:30 A.M.
HIGH ENERGY PHYSICS
R. F. Bacher, Professor of Physics and Chairman of the Division of Physics, Mathematics and Astronomy.
Dr. Bacher was a member of the U. S. Atomic Energy Commission before he came to Caltech in 1949, and now leads the Institute's research program in nuclear physics and related fields. His discussion will be of great interest and everyone, including the ladies, should hear this in order to fully appreciate the synchrotron exhibit in the afternoon.

10:30 to 10:50 A.M. COFFEE TIME

10:50 to 11:35 A.M.
Your choice of the following:

A. ORGANIC CHEMISTRY AND ITS PLACE IN SCIENCE
L. Zechmeister, Professor of Organic Chemistry
New commercial products of organic chemistry are creating changes daily in our living, yet synthetic organic chemistry is little more than a century old. When we contrast its youth with the age of other sciences, we may wonder what can be expected of this field in the future. Dr. Zechmeister will tell us of the place of this rapidly developing branch of chemistry in the great structure of science.

B. AUTOMOBILE DESIGN TRENDS
Peter Kyropoulos, Assistant Professor of Mechanical Engineering.
Dr. Kyropoulos will tell us how and why body styles are being changed, what the difference is between the various automatic transmissions, and why some cars require more constant attention than others. Dr. Kyropoulos is a Technical Supervisor for the AAA's Grand Canyon Economy Run and will give us a first hand view of this year's results.

11:45 A.M. to 12:45 P.M.
OUR STRATEGIC MINERAL RESOURCES
Dr. James Boyd, Director, U. S. Bureau of Mines, Washington, D. C.
James Boyd, Class of 1927, is one of Tech's most distinguished alumni. As Director of the Bureau of Mines, he is the best qualified person to bring us the latest and most authoritative information on our strategic mineral resources.

1:00 to 2:00 P.M. LUNCH—STUDENT HOUSES

AFTERNOON PROGRAM

2:30 to 3:40 P.M. EXHIBITS
First half hour (2:30-3:00 P.M.)

Group A: BILLION-VOLT SYNCHROTRON—Optical Shop Building (West of Student Houses)
Caltech's new electron accelerator is the most powerful atom-smasher of its type ever built. It will be used in research on the nature of the forces that hold atomic nuclei together. These investigations are expected to increase our understanding of nuclear energy, which is the main source of energy of the universe. This giant machine will be on display and a guide will explain its construction and operation.

Group B: NEW ENGINEERING BUILDING
Visit the new $555,000 Engineering building completed last year. The following exhibits warrant your special attention.

005	Viscosimeter Laboratory
0013	Spectrographic Laboratory
0018	Metals Processing Laboratory
012	Soils Testing Laboratory
106	Combustion Research Laboratory
108	Concrete Testing Laboratory
110	Materials Testing Laboratory
310	Earthquake Laboratory
312	Vibrations Laboratory

Second half hour (3:10-3:40)

Group A: ENGINEERING BUILDING

Group B: SYNCHROTRON

4:00 to 4:45 P.M.
GENES AND THE CHEMISTRY OF THE ORGANISM
George Beadle, Professor of Biology, Chairman of the Division of Biology.
We are all familiar with the "genes." The hereditary differences in men—all of them—are due to the presence, absence and combinations of about 10,000 of them in each cell. How these exert their profound influence through individual chemical effects are demonstrable by the methods of chemical genetics. Our speaker, Dr. Beadle, is one of this country's outstanding leaders in the field.

5:00 to 6:00 P.M. SOCIAL HOUR
Relax and meet your friends in Dabney Lounge.

EVENING PROGRAM

6:30 P.M. DINNER
Masonic Temple
200 South Euclid Avenue, Pasadena
Dress—informal for men and women

AFTER DINNER Introductions
Mr. G. K. Whitworth, President of the Caltech Alumni Association.

A REPORT ON THE INSTITUTE
Dr. L. A. DuBridge,
President of California Institute of Technology.

GERMANY—HISTORY IN THE MAKING
Horace N. Gilbert, Professor of Economics.
In 1945, Professor Gilbert spent four months in Germany as a member of the U. S. Strategic Bombing Survey. He returned there last year, on leave from the Institute, to accept an appointment on the staff of the U. S. High Commissioner. Professor Gilbert will present a first hand report on German recovery, and share with us some of his unique personal experiences. You won't want to miss this "welcome home" for Professor Gilbert.

PERSONALS

1918

William B. Nulsen reports that he's still Professor of Electrical Engineering at the University of New Hampshire in Durham, N. H.

1922

Linne C. Larson, Executive Officer of the Los Angeles Regional Water Pollution Control Board, writes that his son, Linne, entered Occidental College last fall, played on the Frosh football team, and is going out for the Frosh track team this spring.

1926

Alpheus S. Ball writes from Minneapolis that his daughter, Elizabeth, now in her 3rd year at Antioch College in Yellow Springs, Ohio, was married during Christmas vacation to engineer John Waldhauer, also an Antioch student.

1930

Ray Hoeppel, M.S. '31, has resigned his position as research chemist with the Baroid Labs Division of the National Lead Co., after nine years, to become Director of Research for the Ken Corporation of Long Beach, which manufactures and sells oil base drilling mud. Ray is living in Arcadia.

Roland F. Hodder, of the Stanolind Oil and Gas Company, recently became staff geologist in the company's division office in Houston, Texas. Roland, who has been with Stanolind since 1943, was formerly located in San Antonio.

1932

J. C. Mouzon, Ph.D., spent the years from 1932 to 1944 as a member of the Physics Department of Duke University—with an 18-month leave to the Naval Ordnance Lab. After five years with the Brown Instrument Company in Philadelphia, as Director of Research, he resigned to serve with the Planning Division of the Research and Development Board for one year. At present he is Acting Chief of the Atomic Warfare Division, Operations Analysis, at USAF Headquarters in Washington, D. C.

1933

Gregory K. Hartmann, Ph.D. '39, now Chief of the Explosives Research Department at the Naval Ordnance Laboratory in White Oak, Md., writes that it's "fascinating, variable and important work," and that he'd be glad to see any Tech men who might be interested in explosives research or who are looking for new, stimulating and worthwhile employment. There's a new member of the Hartmann family—John W., six months old.

1934

Jack Desmond was married to Marguerite Lusted on December 27 in Regina, Saskatchewan. They will make their home in Casper, Wyoming, where Jack is working for Western Geophysical Co.

1936

Carroll R. Baker says he's finally made it back to God's Country. He's left New York, now lives in Pasadena and works for the Oil Well Manufacturing Company in Huntington Park, as Sales Manager. Though this means a restful drive morning and evening in the famous Los Angeles traffic, Carroll admits it beats New York's subways.

1937

Dean Nichols, M.D., who has been practicing medicine—specializing in diseases of the skin—in Helena, Montana, has decided to take on the specialty of Radiology. He has obtained a Residency in Radiology at the Scott and White Clinic in Temple, Texas, where he will spend the next three years.

1938

Frank B. Jewett, Jr., brings us up to date with the information that he's living in Minneapolis, has three children (Terry, 6½, Bobby, 5, and Becky, 2), and works for General Mills, Inc.—where he is Director of Development and Business Administration in the Research Laboratories, and Director of the Aeronautical Research Laboratories (this latter being devoted to contract research for government agencies).

Frank was elected a trustee of Rockford College, in Rockford, Ill., in January, 1950, and has been a member of its Executive Committee since September, 1950. He's a member of ASME and of the Industrial Research Institute of the American Standards Association.

Incidentally, Frank adds, the maps are all wrong—Minneapolis is only about 10 miles from the North Pole. It was 32° F there in February.

Henry K. Evans writes from Washington, D. C., that he has become a father for the fourth time. It's another boy, which makes four of the same—9, 7 and 3 years old, and the new arrival is now aged 3 months. Henry, who is a highway transportation specialist for the U. S. Chamber of Commerce, was recently made Chairman of the Montgomery County Safety Board Engineering Committee, and Technical Editor of the Institute of Traffic Engineers' Reference Notebook. To fill out his time he now has a dance orchestra of his own, and plays Saturday nights at the Bethesda Medical Center Officers Club.

William F. Nash, Jr., M.S. '39, Ph.D. '42, is now superintendent of the eight-acre factory of C. F. Braun & Co. in Alhambra. He joined Braun in 1947 as staff-consultant in the field of metallurgy, and took a large part in setting up the company's facilities and organization for metallurgical research. The Nashs have a seven-year-old daughter, Janet.

1939

C. F. Carstarphen, M.S. '40, was transferred from Staten Island, New York, to Kansas City, Kansas, last November, to assume the job of General Supervisor in charge of production of the local Proctor and Gamble factory. On February 1 he received orders to report to the Commander of the Long Beach Naval Shipyard for active duty. His company has requested deferrment, but to date approval hasn't been granted.

Paul O. Engelder, M.S. '40, was promoted to the rank of Lieutenant Colonel in the United States Marine Corps Reserve last month while serving with the G-2 (Intelligence) section at Headquarters of the Fleet Marine Force, Atlantic, at the Norfolk Naval Base.

Paul enlisted in the Marine Corps Reserve in 1937, while he was at Tech. After he received his M.S. here he was commissioned in the Reserve, going on active duty with the 7th Defense Battalion, Fleet Marine Force, Pacific, in 1941. In 1943 he was assigned to staff duties at Marine Corps Headquarters in Washington, followed by similar duties with the III Amphibious Corps Artillery in 1944-45, before he returned to inactive duty and a position as physicist with the Stratograph Corporation in Long Beach.

Paul was recalled to active duty in August, 1950. His wife and three sons are still living in Long Beach.

1940

Robert S. Moore, M.S., writes from Detroit that he's convalescing (nicely) from an abdominal operation. Says that his firm, Quaker, is going great guns; volume has more than trebled since he took over the district managership four years ago. Last year they moved into a new plant, and now they're worrying about expansion again. Bob is the proud father of two adopted children—Jon, 4, and Cynthia, 1½.

Miller Quarles, Jr., M.S., '41, Houston, Texas, district supervisor for the United Geophysical Company, addressed the Dallas Geological Society recently—on the Salt Ridge Hypothesis on the Origin of Texas Gulf Coast Type Faulting. Miller specializes in problems of faulting, and has been active in seismograph exploration in South Texas.

1941

M. V. Eusey, Jr. is working as Branch Sales Manager in Baltimore, Md., for the Minneapolis Honeywell Regulation Co.

1942

Sheldon W. Brown, Captain, USN, has recently been transferred from the Office of the Under Secretary of the Navy (where he was Special Assistant for Research and Development) to Director of the Ships' Installations Division of the Bureau of Aeronautics.

Victor Bruce is now at the Polytechnic Institute of Brooklyn.

Allan B. Elliott has been promoted to Merchandise Budgets and Statistical Manager with Montgomery Ward in Chicago. The Elliotts recently bought a new home in Northbrook, Ill.

Roy Weller is still doing engineering sales work for Ingersoll Rand out of their St. Louis office. Most recent addition to the Weller family was in May, 1949, when Constance Ann was born.

Roy says that *Orin Mead*, '43, was in Wichita, Kansas, with Boeing Aircraft for the past few months, but has now been moved back to Seattle. And *Harrison Price*, '42, is now the father of four, including one set of twins. Buzz Price is finishing two years of graduate work at Stanford, for an M.B.A. degree.

Warren Gillette received his M.D. degree from George Washington University in Washington, D. C., in May, 1950. He is now interning at the U. S. Naval Hospital in Newport, Rhode Island. He's planning to do general practice when he leaves the service. Warren's married and has a 4½-year-old son.

1943

Willard M. Hangar, MS., Cmdr., USN, served in the Bureau of Aeronautics of the Navy Department as Head of Airship Design from 1946 to 1949. During that time specifications, preliminary design work and mockup were completed for the Navy's newest non-rigid airship, the model ZPN. This is the largest non-rigid airship constructed in this country. Since 1949 Bill has served on the staff of the Commander of the Air Force, Atlantic Fleet Staff, as Aircraft Maintenance and Material Officer of the Atlantic Fleet.

Edward I. Brown is moving into a new home in Encino. He writes that things are looking up at Marquardt Aircraft Co. Anyone interested in jet propulsion work might contact Ed there.

Edward A. Wheeler is still operating Station WEAW in Evanston, Ill., as well as WOK2 in Alton, Ill. The Wheelers have a new (second) offspring, Robert.

Stanley A. Dunn has bought a new home in Wilmington, Delaware, where he's working for DuPont. Stan finished work on his Ph.D. in Chemistry in November, 1950, and was immediately employed by DuPont in the Organic Chemicals Department of the Jackson Lab at Pennsgrove, N. J. The Dunns' second son, Randolph Austin, was born in January, 1950.

Mel Merritt, Ph.D. '50, is working for the Sandia Corporation, and living in Albuquerque, New Mexico. He was married on December 26, 1949. The Merritts' first son, Melvin III, was born on December 6, 1950.

Blakemore E. Thomas, Ph.D. '49, is Assistant Professor of Geology at the University of Kansas, teaching geology and petrography. He plans to spend the first half of next summer in charge of the K.U. field geology camp in Colorado—but hopes to get out to the West Coast for a while at the end of the academic year.

R. E. McWethy reports no new news in the last year; he's still in the insurance business in Aurora, Ill., has three kids, and is freezing to death in the Illinois winter.

1944

Frank A. Barnes is a Research Engineer at M.I.T. He has a year-old daughter.

B. H. Golding, M.S. '48, is working in the research department of the United Gas Corporation in Shreveport, La. He has a son, Bruce, ten months old, and is building a new home in Shreveport.

Elmer Scott Hall has been promoted to Assistant Chief Engineer of the Evening Star Broadcasting Co., which operates WMAL—AM, FM and TV in Washington, D. C. They're in the process of remodeling the second floor of the Chevy Chase Ice Palace for new TV studios now, and it will be about the largest outside New York on the East Coast. Elmer's second son, David Martin, was born on January 14. Douglas Scott is now 2½ year old.

Ronald S. Johnson is still teaching business statistics at the University of Michigan School of Business Administration in Ann Arbor. The Johnsons' second daughter was born on February 8.

1945

Philip B. Smith is teaching in the Department of Physics at the University of Sao Paulo, Brazil.

Jerome Harrington, M.S. '47, writes from Nutley, N. J., that he's a field engineer with the Micro-Switch Co., a division of Minneapolis Honeywell; couldn't like his job better; and—most important of all—that his son, Mark Smyth, was born on September 11, 1950.

Raymond O. Fredette, M.S., is an aerodynamicist-mathematician at the Navy Department, Bureau of Ordnance, in Washington, D. C.

R. F. Schmoker, Lt. (JG), USN, is still in the Civil Engineering Corps of the Navy, teaching physics at the Naval Academy in Annapolis.

1946

Lt. Cmdr. Clyde C. Andrews, M.S., was transferred to Point Mugu, Calif. last June, where he is in the Sparrow Project Office. He's living in Oxnard, and has a new son—born September 28, 1950.

Bennett Bovarnick is a physicist in a research and development group with the U. S. Navy Underwater Sound Laboratory in New London, Conn. He received an M.A. in physics from Boston University in 1949, is now working for his Ph.D. there. He's been married to a Boston girl for two years.

W. W. Butler, M.S., has been transferred from the Arlington, Va., office to the St. Paul, Minn., office of Engineering Research Associates. His new duties will include the design and development of systems employing Engineering Research Associates' Magnetic Drum Storage Systems.

John Seagrave, M.S. '48, who is working for his Ph.D. at Tech, is engaged to Sara Gibson of Orcas Island, Wash.

1947

J. P. Terry is with the Miniature Lamp Manufacturing Department of the Westinghouse Electric Corp. in Bloomfield, N. J.

1948

Conway W. Snyder, Ph.D., has just moved from Lexington, Ky., to Oak Ridge, Tenn., where he will be in charge of research with a new 5.5-Mev electrostatic accelerator which is being installed in the Y-12 (electromagnetic separation plant) area. The accelerator is being built and installed by the High Voltage Engineering Corporation of Cambridge, Mass., and when it is in operation at Oak Ridge, it should be posible to use, for research, proton and deuteron beams of at least a million volts higher energy than are available on any similar machines in the world at present.

Robert J. S. Brown was married last summer of Phyllis White of St. Paul, a medical student at the University of Minnesota. The Browns went on a camping trip to Alaska for a honeymoon. Bob is still a grad student in physics at the U. of Minn.

Stuart Butler, Jr. was married to Joanne Fistere in April, 1950. He's working as structural designer for a St. Louis, Mo., contracting and engineering firm

R. L. Winchester was married last December to Judith Alice McTerney in Schenectady, New York. One of his ushers was *Jim Malone* '49, who is working in New York City. Bob is now in the last year of the General Electric Company's Advanced Engineering Program in Schenectady.

Arthur N. Cox recently returned from South Africa, where he was on an expedition for astronomical research at the Royal Observatory in Capetown. He's back at work now in the Astronomy Department of Indiana University in Bloomington.

Matthew Kent Wilson, Ph.D., has been appointed Assistant Professor of Chemistry at Harvard University, effective July 1, 1951. Matt was a research assistant and graduate assistant at Tech from 1943 to 1947. Since 1948 he has been an instructor at Harvard.

1949

J. B. Cooley, Cmdr., USN, writes that, since leaving Caltech, he has been on the following duty: Operations Officer of the U.S.S. Juneau, which included seven months of duty in the Korea-China theater of operation; returned to the U.S.A. after being promoted to Commander, and he was made Executive Officer of the USS Sarasota (APA-204) which went into commission on February 3, 1951.

Wharton W. Bryan is working in the I.B.M. Section of the Theoretical Division of the Los Alamos Scientific Laboratory in New Mexico. He's got a four-year-old daughter.

Richard Ferrell, M.S., is at Princeton University, studying for his Ph.D., which he hopes to obtain next summer. He's working on his thesis now—a theoretical calculation on electron-positron interaction. If all goes well, Dick hopes to spend next year in Göttingen, Germany, doing research under Heisenberg.

Bob Pons has been at Johns-Hopkins University in Baltimore since leaving Tech. He's studying for a Ph.D. in Mechanical Engineering, and also doing some part-time teaching and research on a Navy-sponsored project there.

1950

Philip J. Closmann is doing grad work in physics at Rice Institute in Houston, Texas.

John R. Reese, M.S., is working as a geophysicist for the California Co., a subsidiary of Standard Oil of California.

Edward A. Revay has joined the staff of the Stamford (Conn.) Research Laboratories of the American Cyanamid Company.

Alfred B. Brown, Jr., Ph.D., has been working at the General Electric Research Laboratory in Schenectady since last August. He's in the Communications Research Division there.

Ralph Lovberg writes that he hasn't given up photography, but physics is taking up most of his available time these days. He's currently at the University of Minnesota in Minneapolis, working on the 66-MEV Linear Accelerator which is due for completion sometime next year.

"The climatic adjustment is the roughest, I think," says Ralph. "Four years of California must have made me soft."

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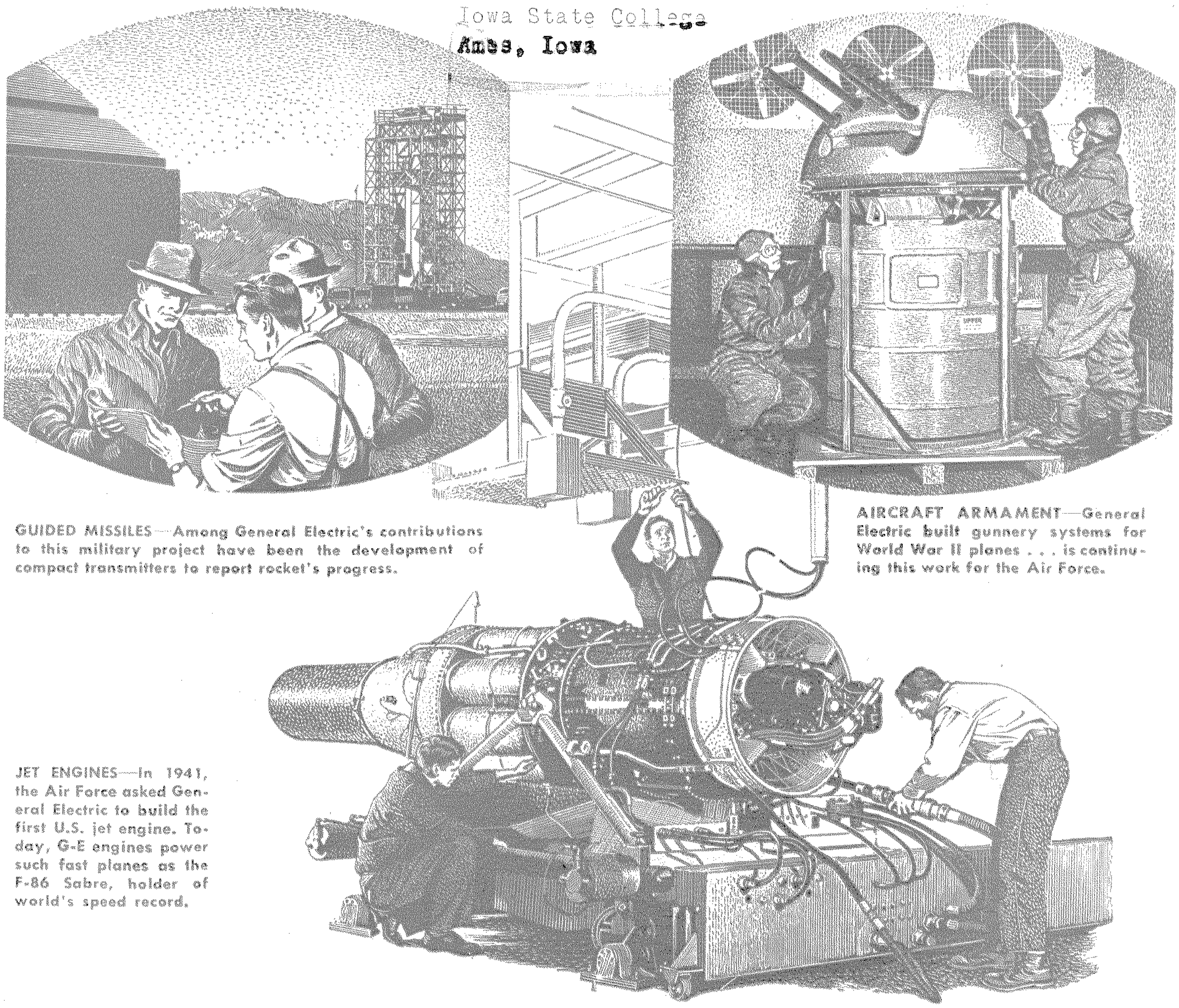

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