MARCH 1969

E&S ENGINEERING AND SCIENCE
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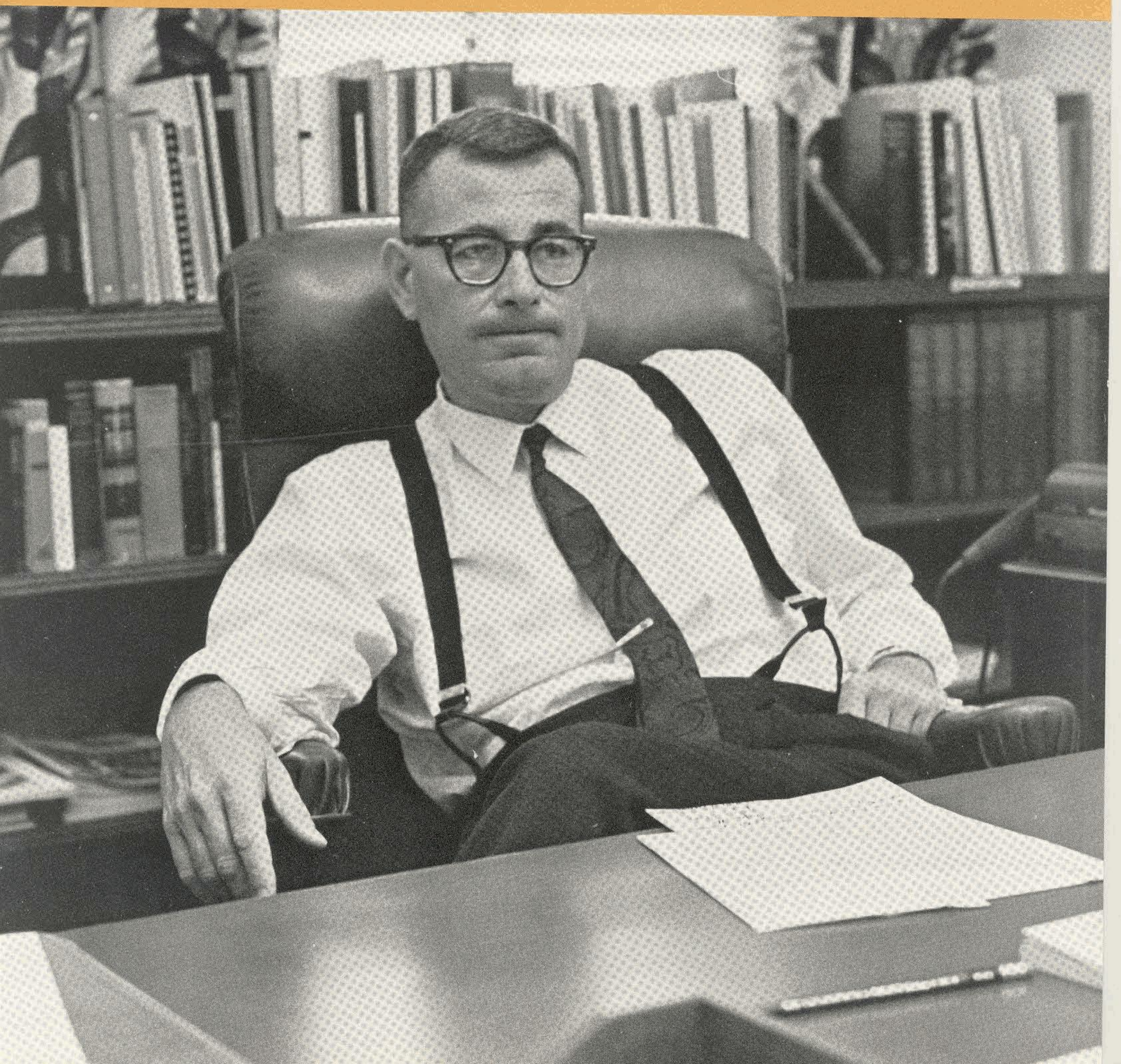

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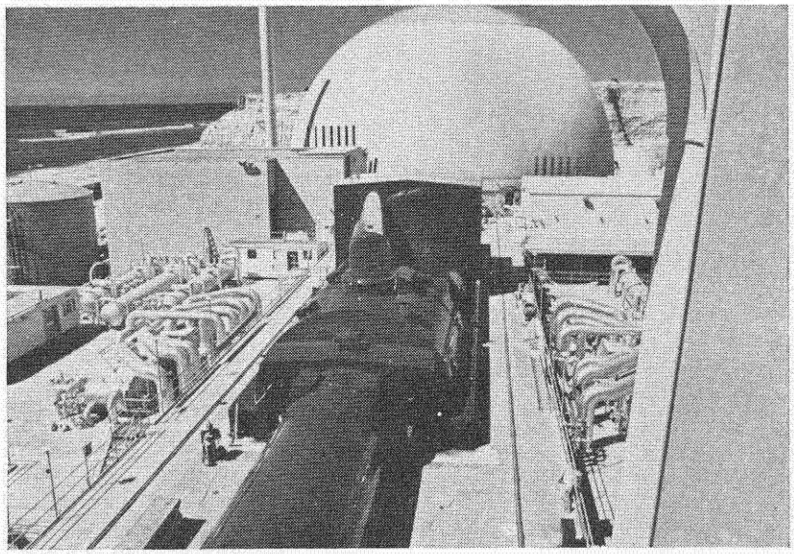

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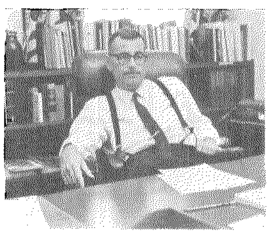

On The Cover

—an eloquent camera study which might well be called "Portrait of a College President." The subject—Harold Brown, brand new president of the California Institute of Technology, at work in his office in Throop Hall. Office work, of course, is only part of the job, and some of its other facets are shown in the pictures of "The Early Days of Harold Brown," beginning on page 14.

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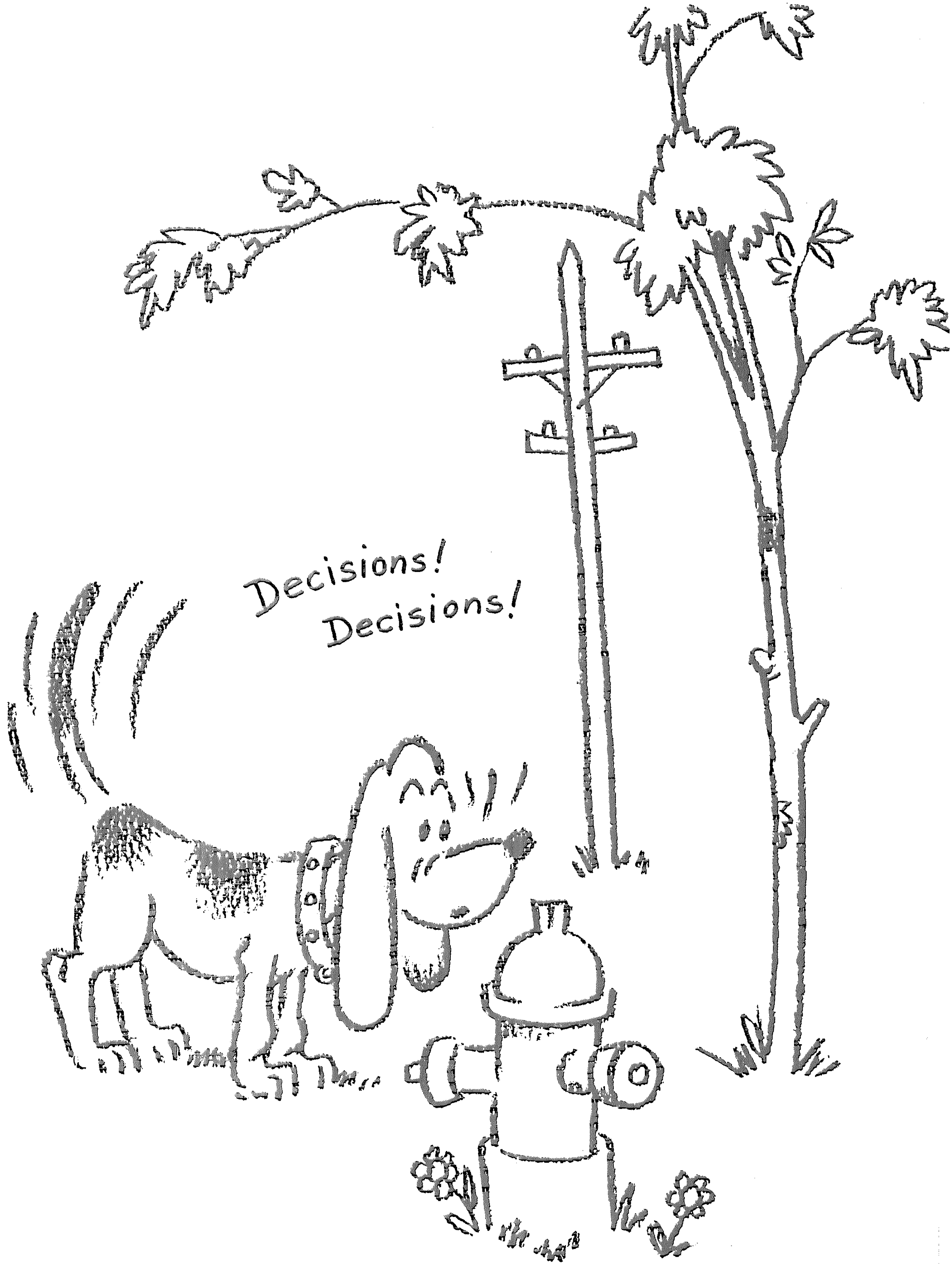
Decisions!
Decisions!

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California's Ground-Moving Weather

We have often heard the expression "earthquake weather," and ordinarily have discounted its implications in favor of alternative factors more fundamentally related to shaking of the ground. But other kinds of ground movement that also are important to California's residents have led to more realistic expressions of unhappy implication, among which are "flood weather" and "landslide weather." Rarely benign in their behavior or effects, these recurring elements of normal geologic activity are figurative mud in the public eye, and they have been especially troublesome in areas of concentrated population.

The climatic norm in California implies a pleasantness that is consonant with reality for much of the time; yet large departures from this norm are not infrequent. In terms of rainfall, for example, the long-time average of about 15 inches per year for several populous areas represents ranges of 30 inches or more between annual extremes. Much of this precipitation results from individual storms that occur chiefly during the period December through March, or from series of storms that tend to be scattered irregularly through this wintertime wet season. The heaviest rainfall also is irregularly distributed in a geographic sense, owing mainly to variations in storm tracks and to marked contrasts in topography. The effects of topography can be very important, as reflected by large local differences in precipitation during numerous regional storms.

WATER ON THE GROUND

In considering relationships between weather and undesirable movements of the ground, we can focus primarily upon two kinds of features—uncontrolled runoff of exceptionally large amounts of water over short periods of time, and the penetration of additional large amounts into the subsurface over longer periods. Here rainfall is the prime factor in most parts of California, although the significance of other kinds of climatic contributions cannot be denied. For example, more than 600 inches of winter snow and an appropriate pattern of temperatures in the Sierra Nevada can lead to disastrous spring flooding in the Sacramento and San Joaquin Valleys, as occurred at least four times between 1880 and 1907. Or combinations of storm waves and extremely high tides can result in accelerated erosion and local collapse of coastal cliffs, even when no heavy precipitation is involved. But such events either are limited in scope or involve inundation more than movement of the ground.

How much water may the ground be required to deal with during periods of extraordinary precipitation? And what kinds of things can happen? The historic record provides some eyebrow-raising data. In the winter of 1861-62, a most uncharacteristic season within a long sequence of near-average to very dry years, repeated storms doused San Francisco with nearly 50 inches of rain, and in Los Angeles the skies leaked without stopping for a full month. Adobe structures seemed to dissolve under the downpours, while on most valley floors buildings became islands in huge lakes and then were heavily pounded by wind-driven waves. Large parts of the Sacramento and San Joaquin Valleys were converted into an enormous inland sea, and the entire state appeared to be drowning as every river, creek, and dry wash became a torrent of muddy, debris-laden water. According to contemporary accounts, mud as much as five feet deep was deposited in the parlors of some Sacramento homes. This must have been a new sad note for those residents of

By RICHARD H. JAHNS

more than a century ago, but it has an all-too-familiar ring for many persons now living in the state.

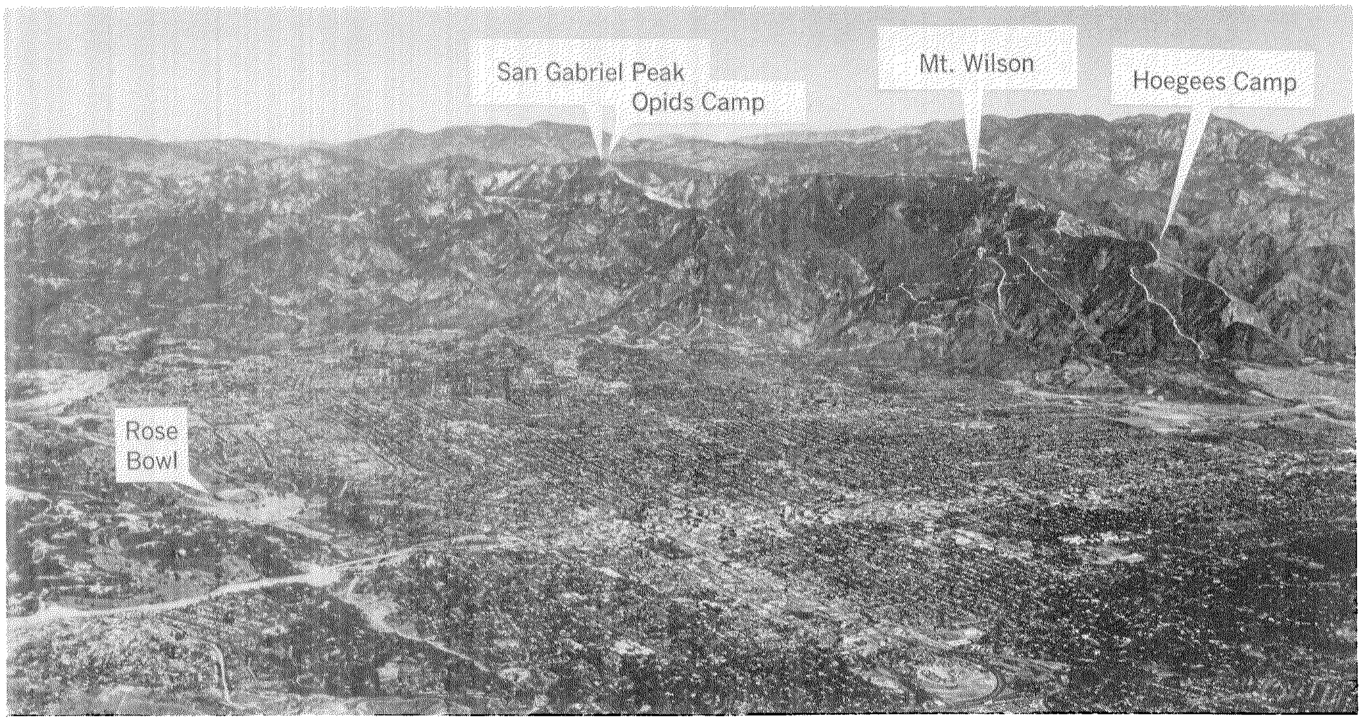
In southern California the shallow Lake Elsinore, which had been essentially dry during the preceding year, filled to a depth of at least 50 feet and overflowed in 1862, all within a period of little more than three months. Since that time the lake has gone through numerous cycles of evaporative shrinkage and rainfall-nourished expansion, with at least eight separate episodes of overflow. Some periods of expansion reflected relatively long wet seasons or successions of such seasons, and all of them marked the occurrence of brief storms characterized by high intensities of precipitation.

The mountain ranges fringing the broad lowland area that includes Los Angeles are in a semi-arid region; yet they have received some remarkable contributions of moisture from time to time. During January 1916, for example, 50 to 60 inches of rain fell over much of the San Gabriel and San Bernardino Mountains, with considerable parts of the total coming from one three-day storm. Adjacent lowland areas received 32 to 40 inches during that same month. The western San Gabriel Mountains are particularly noted for short-term precipitation of great intensity, especially on ridges and canyon walls only short distances from Pasadena and other cities along the southerly base of the range. Gauges at Opids Camp, Mt. Wilson, and Hoegees Camp recorded 21 to nearly 26 inches of rain during the three-day period February 28—March 2, 1938—a moisture dosage that only slightly exceeded one from a similar storm during the period February 14-16, 1927. And on January 22, 1943, a 24-hour record of 26.12 inches was established at Hoegees Camp; during that same day 22.32 inches of rain fell at Opids Camp, where the winter season's ac-

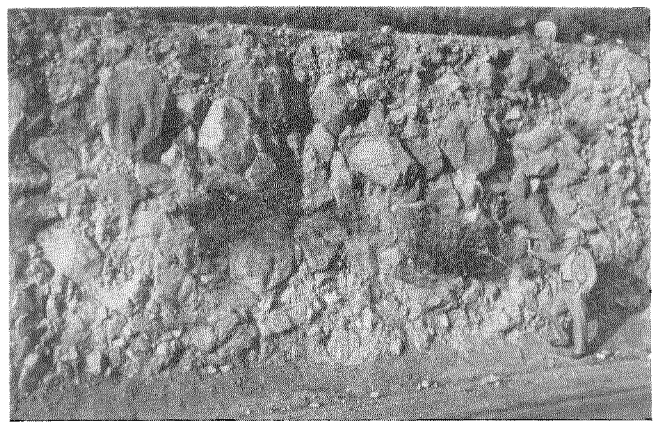
"California's Ground-Moving Weather" has been adapted from the first John P. Buwalda Memorial Lecture, "How Firm is Terra Firma," delivered in Beckman Auditorium on November 18, 1968, by Richard H. Jahns, dean of Stanford University's school of earth sciences. Jahns was a particularly appropriate person to give this lecture. He was a student of John Buwalda's at Caltech, then his colleague on the geology faculty, and he shared many of Dr. Buwalda's professional interests—including the subject of the lecture.

Richard Jahns came to Caltech as a freshman in 1931 and earned two degrees (BS '35, PhD '43) in geology under Buwalda's tutelage. In 1946 he joined Buwalda's staff as assistant professor of geology. In 1960 he left Caltech to become chairman of the department of earth sciences at Penn State.

John Buwalda founded Caltech's division of geology in 1926 and served as its chairman until 1947, when he returned to his "first love," field work on California's faults and earthquakes. He died in 1954. The memorial lectures in his honor, sponsored by the division of geological sciences and made possible largely through the gifts of friends and colleagues, were launched last fall with the Jahns talk. Since that time southern California's weather has provided some interesting punctuation for the author's remarks.



The western San Gabriel Mountains, bordering Pasadena (center) and heavily settled parts of the San Gabriel Valley, are particularly noted for short-term rainfall of great intensity. Hoegees and Opids Camps (out of sight at the bottoms of deep canyons) register record rainfall—26.12 inches during one 24-hour period in January 1943, and a winter season's total of 80 inches that same year.



This fossil debris flow, revealed in cross section by a roadcut near Pala in San Diego County, is a chaotic accumulation of blocks, boulders, tree fragments, and stony rubble —a coarse slurry that debouched from the mouth of a nearby canyon at least 10,000 years ago.

cumulation ultimately reached 80 inches.

Such overly generous contributions of water are potent reshapers of the landscape. They form temporary torrents that carve deeply into the steep mountain slopes and pick up enormous charges of debris en route to adjacent valley and basin areas. There uncontrolled parts of the runoff deposit various assemblages of mud, rubble, boulders, and trash, commonly in places where they are not welcome. Parts of the San Fernando, San Gabriel, and San Bernardino Valleys were thus devastated by the great March Flood of 1938, and four years earlier the La Cañada-La Crescenta Valley was invaded by rushing waters and bouldery slurries during the New Year's Day Flood of 1934. The slurries, much heavier and more slow moving than ordinary flood runoff, filled normal channels of drainage and then thrust across settled areas as great tongues that engulfed all objects in their paths. They resulted from cloudburst precipitation—13 inches or more in 24 hours—on adjacent steep mountainsides that had been denuded of protective vegetation by a forest fire during the previous fall season. Large debris flows of this kind have an impressive capacity for incorporating and transporting boulders, automobiles, buildings, and other heavy objects. Though infrequent and spotty in their occurrence, they have visited many parts of the state during the recent geologic past.

What may have been the most spectacular cloudburst in California's historic record seems to have attracted relatively little attention at the time, even though it occurred only a few miles from Pasadena. In the spring of 1926 a week-long storm brought 25 inches of rain to the area centering about San Gabriel Peak, with half of the total falling during a ten-hour period on April 4. At 3:30 a.m. on that day, a gauge at Opids Camp registered 1.02 inches of rain in a single minute and another inch during the following two minutes! One result of this extraordinary downpour was the detachment and removal of everything that was loose or could be loosened from the precipitous northerly slopes of the peak. An unusually coarse debris flow moved downward to the mouth of a gulch at Opids Camp, where it came to rest as a rampart-like slug of granitic boulders and blocks, trees, and finer-grained detritus—250 feet long, 50 to 75 feet wide, and about 40 feet in maximum thickness.

WATER IN THE GROUND

The surface effects of precipitation and runoff are invariably accompanied by less obvious penetration of water into the ground. Much of this water replenishes any existing deficiencies in the soil, most significantly in the root zone of the plant cover, and during extended wet periods substantial amounts may gradually move to deeper levels. But the orderly processes of infiltration are too slow to handle more than a small fraction of the precipitation from heavy storms. When such precipitation is especially intense, the destructive behavior of runoff can be worsened, rather than eased, by contributions of water augmenting the moisture already present in the shallow subsurface.

Here the recipe for prompt and widespread disaster in populated areas calls for steep slopes, an underlying few feet of soil or other relatively loose and uncompacted materials, and a minimum of surface stabilization from deeply rooted plants. Add very large amounts of water in very short periods of time, and the real action begins. Some of the water soaks into the mantling materials of the slope, where it both reduces their cohesiveness and increases their gross weight. Meanwhile, vigorous surface runoff cuts small gullies into the slope, especially where provisions for drainage have failed to prevent undesirable concentrations of flow. Soon parts of the scored slope are progressively loosened and detached as irregular patches, a few square feet to several acres in extent, that then move downhill. Typically they are broken and internally stirred during this descent, arriving at the foot of the slope as mobile slurries or accumulating there as thick masses of incoherent debris.

This scenario repeatedly has been translated into reality, especially at localities where man has modified the natural topography without sufficient note of possible consequences. Unhappy endings have occurred most often in the San Francisco, Los Angeles, and San Diego regions during the past 25 years of increasingly intensive settlement in hillside areas. It does not follow that catastrophes must attend grading of the land on any scale, but certainly the development of raw cuts in weak ground, emplacement of fill without proper compaction, and loading of soft slope materials with heavy, shallow-rooted plants will not contribute to long-term safety. Though widespread in their occurrence during periods of exceptionally intense rainfall, slope failures of the shallow or "skin" type are rarely large. Yet a home clogged with debris representing a fresh scar on an adjoining slope is nothing less than tragedy for the owner.

Equally wide ranging are many kinds of surficial failures in the hills and mountains beyond centers of population. These are nonetheless of real significance to the public, as they can add enormous amounts of debris to storm runoff that gathers in canyons and invades settled valley areas below. This lesson was offered rather violently to southern California residents in 1811, 1825, 1884, 1890, 1914, 1916, 1934, 1938, and 1943—each succeeding time to increased numbers of them. Indeed, it is recognition of the potential impact of future catastrophic floods on a burgeoning population and on correspondingly expanded areas of valuable property that has numerous geologists, engineers, and public stewards glancing uneasily back over their shoulders. To keep pace with growing requirements is a formidable challenge for an already sophisticated program of flood-control installations.

In contrast to the effects of uncontrolled runoff and shallow soaking of the ground are numerous larger slumps and landslides that have plagued Californians again and again. Most of these failures have involved masses of relatively weak or easily detached bedrock that have moved outward and downward on slopes in response to gravity. Triggering of displacement from positions of equilibrium, whether occurring once or many times at a given locality, can be variously ascribed to several factors, acting either singly or in some combination. Among these are earthquake shaking, selective overloading of the ground, removal of support from downslope areas, and increases in amount of subsurface water. Here man often has revealed himself as a disagreeably effective imitator and competitor of nature, for he has triggered many slides through his own reshaping of the terrain and his introduction of water into the ground as local concentrations.

The historic record clearly indicates that naturally introduced water can be the most important prompter of large-scale ground failure. Such failure may closely follow single storms, especially where attendant, severe runoff removes the toes from existing landslide masses that occupy steep canyon walls. The Eel and Russian Rivers in northern California, for example, have thus triggered numerous large slides at times when they were at very high flood stages. More often, however, landslide movements are delayed by days, weeks, or even months following episodes of unusually heavy precipitation, and a few have followed series of successively wet years. Such irregularities in lag times can be ascribed mainly to differences in the patterns of precipitation, the rates at which water infiltrates the subsurface and raises groundwater levels, and the various interactions between water and the subsurface materials. Detailed relationships among these factors are well understood for relatively few of the known landslides in California.

The extraordinary storm of 1938 immediately activated many earthflows in the Ventura area, and with only a little delay quickened the movements of large landslides that had been causing extensive damage to wells and other installations in the Ventura Avenue Oilfield for more than a decade. The weight of the added water must have been an important factor in this early response, but more than two months later a much greater movement was triggered in one of the slides by a fairly small excavation at its base. A similarly delicate state of near-equilibrium evidently now exists in the large Portuguese Bend landslide near Los Angeles, where slow movement has been continuous during the past 12 years. Here strain-gauge readings have shown that a few inches of rain from a single storm is sufficient immediately to double the rate of movement, evidently from the added increment of weight.

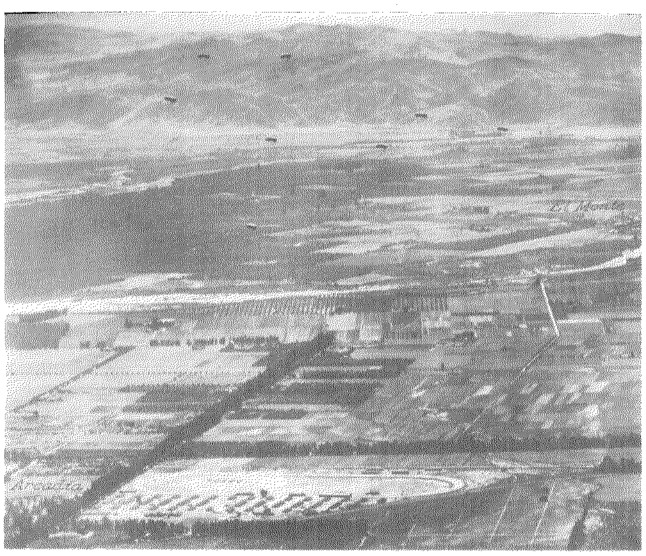
An interesting contrast in timing is provided by a large compound landslide mass in Portola Valley, south of San Francisco, that was originally formed in 1890. Precipitation during the winter of 1889-90 was exceptionally heavy, but it came late in a ten-year period of excess rainfall and hence probably augmented a subsurface accumulation that already was near-critical for massive ground failure at this locality. Various parts of the slide complex have been reactivated in subsequent years, most recently in 1967 (right). Additional examples of large bedrock landslides whose initial movements followed series of severe rainstorms or series of unusually wet years are known elsewhere in the San Francisco Bay region, in the Palos Verdes, San Joaquin, and Puente Hills of the Los Angeles region, and in other coastal parts of the state.

YESTERDAY AND TOMORROW

That ground-moving weather has been a recurring and highly important element of life in California is a matter of historic record, and there is every reason to believe that it will revisit us from time to time in the future. But when, and how often? Granting that our period of direct observation has been all too short and that rainfall records during this period seemingly were made only to be broken later on, what trends or patterns can be reasonably projected into the next few decades? Here it is useful to look again at the past.

During Late Pleistocene times, dating back from about 10,000 years ago, California's climate was considerably wetter than it has been since. Doubtless it was no accident that these were times of vigorous and widespread flooding and landsliding in the state, and tens of thousands of shallow topographic benches in the hills and mountains mark sites of ancient ground failure. Many of these benches are now occupied by dwellings, and it is fortunate that relatively few of the landslides have been reactivated during post-Pleistocene time. Quite apart from trends in the frequency of strong earthquakes, it can be suggested that the ground surface has been somewhat less mobile during the past few millenia than it was earlier. But these mere fragments of geologic time are still much too long to be useful for our present purposes.

Detailed climatic records extending back a little more than a century plainly reveal a cyclic pattern in the temporal distribution of California's rainfall. Sequences of relatively wet years have alternated with sequences of much drier ones, and the trends of accumulating rainfall surplus or deficiency have been interrupted only now and then by individual years of countering dryness or wetness. Moreover, this pattern of recurring wet and dry



This small landslide, which occurred in Portola Valley in San Mateo County in the spring of 1967, was a reactivated portion of a much larger landslide complex that originally developed in 1890 following several years of exceptionally heavy rainfall.

The San Gabriel Valley and Puente Hills as they appeared in 1918 through a telephoto lens from Mt. Wilson. Many parts of these hills are underlain by soft, shaly rocks, and portions of their somewhat dimpled topography reflect the presence of numerous natural landslides—a situation that reveals a challenge for the time when residential and business developments thrust further south and up into the hills. (The old Balloon School in Arcadia is in the foreground, and its students seem to be involved in field work nearby.)

periods evidently has characterized the climate of the state for a period of time far longer than that embraced by our measurements of precipitation.

The late Edmund Schulman and his colleagues at the University of Arizona's Laboratory of Tree-Ring Research devoted years of careful study toward determining a centuries-long chronology of climatic changes in southwestern United States.

Some results of their work on moisture-sensitive conifers in the lower forest zones of California show some impressive similarities among growth patterns for different species of trees from widely separated localities. Particularly striking are correlations of growth patterns that are thought to reflect major shifts in trends of precipitation.

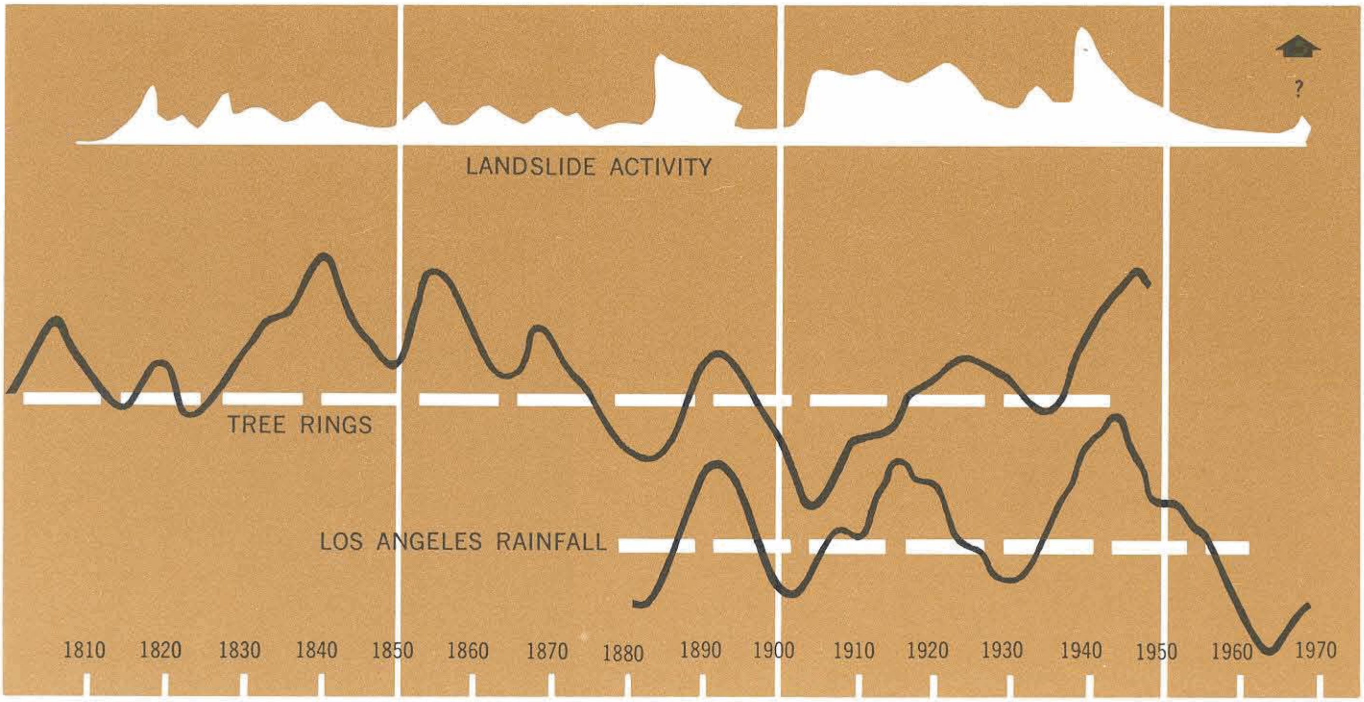
Schulman also turned his attention to some exceptionally long-lived conifers of upper timberline areas, and, since his death in 1958, this work has been continued by C. W. Ferguson and others at the University of Arizona. A 7,100-year tree-ring chronology has been developed for the Bristlecone pine in the White Mountains of east-central California, where a 4,600-year record from living trees has been extended back in time through the addition of data from long-dead ones. Interpretation of this composite record can be expected to indicate the pattern of moisture variations during much of post-Pleistocene time.

Trends in ring growth of carefully selected trees, and their close correlation with available climatic records certainly fortify the notion that California's rainfall has been markedly cyclic in its distribution over many past centuries. During the most recent five and one-half centuries, the average length of dry periods has been 16 years and that of wet periods 13 years. Respective averages of 15 and 12 years apply to the last three and one-half centuries, when the cycles appear to have been somewhat more regular. The latest dry sequence, which began in 1945, was a relatively long one interrupted by a few years of above-average moisture. Yet the record of preceding climatic cycles foretold a shift to a sequence of wet years. This shift appears to have occurred nearly four years ago, but early stages of the new sequence have been partly masked by one very dry year (1968) and by another of about average precipitation. At present we can anticipate a generally wet period that probably will last at least into the mid-seventies. It may well include exceptional storms and ground-moving phenomena reminiscent of those in 1938 and 1943.

Correlations between rainfall and landslide activity in California already have been noted, and the frequency plot (opposite page) reveals the sensitivity to heavy precipitation that has been shown by parts of the ground on which we live. This plot is based upon occurrences of more than a thousand natural landslides in coastal parts of the state between the Eel River and San Diego, as noted in newspapers, journals, and the scientific literature. It is no more than approximate because neither the record nor the survey of the record is complete, but the correlations are nonetheless unmistakable. There also is some indication that ground failure has been most vigorous and widespread during early parts of most wet periods, and that it has tended to taper off during their later parts. The frequency plot dates from 1810 because available reports on older landsliding are too scattered to be of statistical value, and it has not been carried much beyond 1950 because of difficulties in distinguishing wholly natural slides from those prompted in part by the hand of man.

As a sort of final touch, we can recognize yet another correlation that carries interesting implications for our immediate future. Two significant trends were started almost simultaneously a quarter of a century ago—one by nature and the other by man. Just as a long run of wet years gave way to a period of prevailing deficient moisture that was to last for two decades, the end of World War II ushered in a time of tremendous growth in California's population and hillside development. Having mastered powerful new techniques for reshaping the natural terrain, man now applied them on larger and larger scales to provide ever increasing numbers of building sites above the flatlands. The combined effectiveness of bulldozers, backhoes, scrapers, carryalls, and other heavy earth-moving equipment led to substantial changes in the face of the land—as work went forward during year after year of relatively low rainfall. Only with a few heavy wintertime storms did nature give warnings that the existing set of climatic ground rules might be greatly altered for some future series of years.

It is fortunate that these occasional warnings did not go unheeded by everybody. Rainstorms during the 1951-52 season inflicted such grave local damage, especially to newly developed properties in parts of southern California, that the city of Los Angeles instituted its own set of ground rules for hillside development. Through the Grading Ordinance of 1952, specific requirements that included input of geologic data were established for certain kinds of terrain. Partly in response to observed effects of heavy rains in later years, these requirements were subsequently modified and strengthened, especially in the important fields of supervision and inspection. Other cities and several counties have followed the good example of Los Angeles



THE RELATIONSHIP OF NATURAL LANDSLIDE ACTIVITY TO RAINFALL TRENDS IN PARTS OF CALIFORNIA. *The computer-smoothed curve for Los Angeles rainfall, as plotted by students at Stanford University, shows cumulative departures from the long-term annual mean of about 15 inches. Wet and dry periods are indicated independently by the smoothed curve representing cumulative departures of annual tree-ring growth (Bigcone spruce) from a 550-year average. The frequency plot of landslide activity is based on historical data for more than 1,000 episodes of natural sliding in coastal areas of the state.*

in formulating and enforcing new grading codes, and it can be hoped that similar regulatory measures will soon spread with reasonable coordination to all populous areas in the state.

An upward swing in the cyclic moisture curve inescapably promotes higher mobility of the terrain. In some contrast to events of the past two decades, increased flood erosion and deposition, further visitations by flowing masses of debris, the appearance of many new landslides, and some reactivation of existing ones now can be expected during the next decade or so. Ground failures are certain to occur in areas where the hills have been reshaped without proper attention to topographic and geologic relationships, and stern tests will be applied to the effectiveness of grading codes developed during recent years. New scarring of slopes by gullies and slumps will reflect the delivery of mud and other debris to thousands of residential properties, hopefully on a relatively small scale for most of them.

Existing works for flood control will be severely challenged, and immediate needs for additional installations will become rather apparent. As the levels of groundwater gradually rise, a host of more subtle effects may well make an appearance. The lower parts of some cuts will begin to weep, long-dry springs will become active again, and clear streams will grace many canyons that for a long time have been occupied by no more than occasional muddy floodwaters. Where large bodies of relatively impervious fill have been placed in canyons without adequate provision for underdrainage, water may begin to surface at unlikely places above the original canyon bottoms. Seeps beneath homes and in backyards will be among the less pleasant expressions of modified circuits in movement of the augmented groundwater supply.

Thus we can look forward to some interesting and even exciting times. In appraising those happenings that will strike us as most objectionable, we should appreciate the fact that a great number of more serious problems undoubtedly will have been forestalled by established flood-control measures and grading regulations—elements of regimentation that too often have elicited grumblings and resentment from land developers, builders, and the general public. Further, we should have excellent opportunities for improving our understanding of the natural environment, as our attention is perforce drawn to the message repeatedly communicated by Caltech's late John P. Buwalda—"We must never take for granted this ground on which we live."

The Early Days of Harold Brown

The Office of the President at Caltech has a new occupant. Though his official inauguration will not take place until October 30, Harold Brown arrived on campus on February 17 to commence his duties as head of the Institute and to get acquainted, both formally and informally, with Caltech's faculty, trustees, students, and staff, and the Pasadena community.

Herewith, some pictorial highlights of Harold Brown's first crowded days at Caltech.

On his way home to dinner, Harold Brown stops in at a 6 p.m. YMCA cabinet meeting to talk about program plans.

A faculty reception at the Athenaeum on Sunday, February 23, honors the new president and his wife. Colene Brown, with a background of Washington reception lines, not only presides graciously but performs beyond the call of duty and adjusts trustee Arnold Beckman's handkerchief.

On the second day of his presidency Dr. Brown welcomes California business leaders at a Time-Life *conference on "The Far Reach of Science" in Caltech's Beckman Auditorium.*

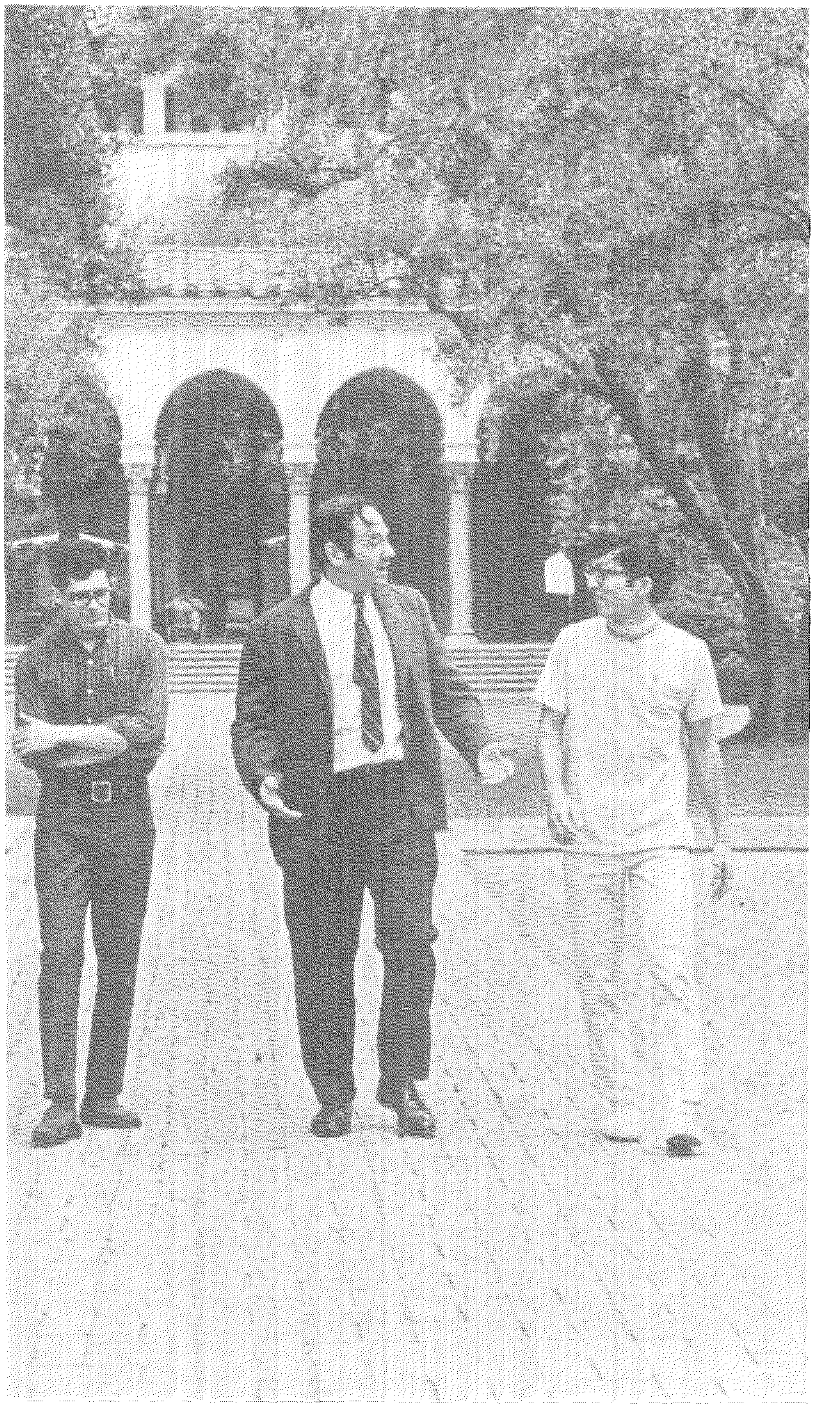
Three speakers check their talks for "The Far Reach of Science"— Harrison Brown, professor of geochemistry and of science and government; Harold Brown; and William Fowler, professor of physics.

Harold Brown gives the president's report at his first board of trustees meeting on March 3.

The Browns with their daughters—Ellen, eleven, and Deborah, thirteen.

CONFESSIONS OF A GENIAL ABBOT—II

By ROBERT A. HUTTENBACK



At the start of the academic year 1959-60 the *California Tech* informed its readers that funds had been raised to construct three new undergraduate student houses. The paper implied, quite correctly, that the integration of the new houses into the Caltech house system—and particularly the question of how to induce members of the old houses to move to the new entities—was going to be the chief problem of the year.

After many weeks of conversation and endless effort, the interhouse committee, made up of house presidents, was induced to accept a proposal that the new student houses be populated through voluntary sign-ups from the old houses and that rotation be abandoned for one year. It was not an easy decision for the interhouse committee to make, and there was little doubt that the suggestion ran counter to house opinion.

As soon as the plans for the new student houses were partially completed, sign-up lists for those wishing to move were posted in my office. But absolutely no one came to register his name. We had hoped to open the new houses with an even balance of the four classes, but the total lack of volunteers forced the elimination of this idea. One ray of light was the decision, made in conjunction with the interhouse committee, to invite some foreign graduate students from Africa and Asia, who might have trouble finding rooms in our far-from-liberal community, to live in some of the houses, both old and new. I hoped it would add a new element to undergraduate living and would also benefit the graduate students.

Population problems or not, the walls of the new houses (eloquently dubbed House A, House B, and House C) were inexorably rising. One day the contractor in charge of construction entered my office carrying a black box that not only clanked ominously but seemed to tick as well. One of the workmen had found it in the forms for the exterior house

Robert Huttenback, new Dean of Students, looks back on his colorful 11-year career as Master of Student Houses

walls, which were to be poured that day. We gingerly took the object and immersed it in a tub of water. After a few moments, we pried it open and were confronted by a few short lengths of chain, a battery, some sort of mechanism, and a maze of wires. Was it a bomb? Time and patience, as in all similar matters, eventually brought enlightenment. If all had gone as planned, the box would have been sealed into the walls of one of the rooms, and the wires would have led to the room next door. At some future date the battery could have been activated, resulting in the clanking of the chains and, it was hoped, the utter terror of the occupant of the "bugged" room. Had the contractor and I known the contents of the mysterious black box, we would gladly have turned a blind eye to the prehaunting of House A.

Eventually the problem of transferring students from the existing student houses to those just being constructed solved itself. Elections for office in the new houses were scheduled for the same time as for the old, and it was announced that only those students already signed up to live in House A, B, or C would be eligible to run. Suddenly it occurred to many would-be politicos that the new houses presented a golden opportunity to achieve power. We were flooded by applications to join them, and our problem became one of preventing an excessive exodus.

Unfortunately, when the new houses set about organizing themselves, they slavishly copied the time-honored customs of the existing establishments, so that we had seven houses that were in inspiration and guiding philosophy essentially the same. I wish now that I had exerted more pressure toward the creation of diversity—to allow Caltech students a variety of living experiences from which to choose.

The student houses at Caltech are essentially effective self-governing democracies, depending for the implementation of such rules as exist on elected house officers and a disciplinary committee of upperclassmen. Over each house presides the resident associate, who is responsible to the master but who influences more by precept and example than by force and coercion.

We have always emphasized good judgment and the spirit of the rules rather than the letter of the law. Some rules we consciously wink at; others are strictly enforced. That the system operates at all is a tribute to the students. Liquor is a case in point. Our rule in 1959 explicitly forbade the consumption of alcohol in the student houses. (It would be some years before Institute and public opinion would allow us to change this position.) In practice we just prohibited its use in the public rooms and corridors. This compromise was one the boys respected. They controlled house members who tended to drink too much and punished all transgressors; for they understood that they were being trusted in an area where the Institute could conceivably be badly embarrassed.

An even more sensitive area concerned the opposite sex. Girls could be in the public rooms at any time, but in bedrooms only until 10:30 p.m. and, on a few specially designated nights, until 12:30 a.m. This does not seem very permissive nowadays, but in 1959 our rule was considered very liberal. Again, the students understood their privileged position, which they owed to the determination of returning veterans after World War II not to be treated like children, and, with draconian severity, they punished any young man who emerged from his room with his date even at 10:31.

Usually the system of student self-government worked very well; once in a while, inevitably, it broke down. One of the rules about which we were absolutely firm forbade storage of arms, ammunitions, and explosives. As luck would have it, one of the most popular boys in Fleming House was discovered cleaning a pistol in his room. Ordinarily the house disciplinary machinery would have smoothly taken over. But the house officers were insecure and afraid of insurrection in the ranks, and indeed there were ominous rumblings. Under pressure from me and the resident associate, the upperclass committee took the only action available to it under the circumstances—it asked the young man in question to move off campus. That night a great uproar broke out in the dining room, and the upperclass committee, allowing itself to be intimidated, rescinded its action and replaced it with a simple reprimand.

Hundreds of voices were heard roaring what sounded like the names of vegetables.

The house government had now essentially ceased to operate, and the resident associate and I, with the not totally unwilling compliance of the house officers, asked for the resignation of the whole upperclass committee. For a few days the house president, the resident associate, and I ruled through a form of martial law. We then allowed applications for positions on the upperclass committee to be made to house officers, and eventually life returned to normal.

This Fleming House incident was the only time in more than a decade that I was forced to intervene directly in the internal operation of a house. Such action is nearly always best avoided. Students, not surprisingly, see any administrative interference in their affairs as unfair and unwarranted. Fortunately for us, many students felt that in the case at hand we had no choice, and we were consequently able to weather the storm. It was, however, to be many months after the reestablishment of normal house government before the house was able to rebuild its morale.

Springtime always brings with it a feeling of restiveness. In 1959 the denizens of one student house turned to raising Venus's-flytraps. In another house a student about to use a toilet was more than mildly surprised to see the head of a large snake peering from the receptacle. A pet anaconda, being kept in a student's bathtub, had decided to investigate the plumbing. He had consequently gone down the commode in one bathroom (from which his tail still protruded) and had materialized next door. It seemed impossible to extricate the beast. Students hauled and tugged; the fire department did likewise. Only the total devastation of one set of bathroom fixtures brought any results.

Of greater moment was the parking issue. The students were convinced that a new set of campus parking regulations was unfair. Clearly a "riot" was the answer. First they managed to squeeze the car of George Green, the vice president for business affairs (whom they identified as the chief culprit) into Throop Hall and park it in the corridor outside his office. This display of engineering skill was followed by a rally in front of Throop, where the marchers took to yelling loudly the names of vegetables. I am sure passersby could not have believed their ears when they heard several hundred voices roaring what sounded just like "Cauliflower!" "Potato!" or "Spinach!"

For a finale the students decided to invade the trustees meeting then in progress, demanding: "We want George Green!" The trustees took it all in good spirit, and the students quickly left—not having found George Green. He was indeed at the meeting, but no one knew what he looked like.

The "parking riot" was followed by the idea of a pilgrimage to the grave of Robert Millikan, who was buried in the so-called Court of Honor in Forest Lawn Memorial Park. Apparently the students were at least partially inspired by their study of Chaucer, for they planned to walk the ten miles from the campus to the cemetery chanting in middle English.

A pet anaconda, that was being kept in a student's bathtub, had decided to investigate the plumbing.

Ostensibly the purpose of the event was to commemorate the 50th anniversary of the original oil-drop experiment. The whole affair was a rather complex internal joke, but it was swallowed whole by the Forest Lawn authorities. Many of us who were aware of what was about to happen were extremely nervous, for unless it was handled with finesse, the Institute might easily find itself considerably embarrassed, though the students meant no disrespect to the memory of Dr. Millikan. The prospects did not look encouraging as 18 other students took the opportunity to picket Forest Lawn for its refusal, they claimed, to bury Negroes or Jews. Undaunted, the pilgrims crossed the picket line and were greeted by cemetery authorities who presented them with a large wreath to lay on Millikan's tomb. The boys approached the grave, and some of their number spoke in sacredotal tones of Millikan the scientist, Millikan the sportsman, and Millikan the humanitarian. It was the most private of jokes, carried out subtly and with style.

It was also, of course, a night in spring when the piano in the Dabney House lounge disappeared. The next night it was followed by the instrument from Fleming. Blacker House placed a guard on theirs, but he fell asleep, and when he awoke the piano-snatcher was found to have struck again. Ricketts prevented disaster by padlocking all the doors to their lounge at night. Frustrated by this move, the piano-nappers expanded their activities. They sent an anonymous note to the manager of the Athenaeum, threatening to remove the grand piano in the dining room if she did not place ten dollars in a certain book in the humanities library. Displaying high good humor and a sense of the fitness of things, the worthy lady turned the whole matter over to the police, much to their embarrassment. But Pasadena's finest were up to the challenge. They noted that the demand to the Athenaeum had been sent via the post office, and that, being extortion through the mail, technically made it fall under the jurisdiction of the FBI. The result was the appearance in my office of a sheepish FBI agent who admitted that he had been assigned to the piano caper. Happily it was about to solve itself. A boy in Blacker, with the aid of a single assistant, had secreted all three of the missing pianos in his second-story, single room. By the time the federal authorities entered the scene, he was more than ready to restore the instruments to their rightful owners.

Agents of the FBI were not infrequent visitors to my office, usually on routine security clearances, but one day a thoroughly exasperated communications expert from the local office arrived. He informed me that he had been sent because a Caltech student had been heard to claim that he could tap the Pentagon phone lines and tie up the entire SAC network. Of course, the agent knew this was impossible, but nevertheless he had to investigate. I called the student in and introduced him to the FBI man. The two were closeted together for two hours, and when they emerged, I thought I noted a

The FBI became interested when a student claimed he could tap the Pentagon phone lines and tie up the entire SAC network.

considerable change in the demeanor of the communications specialist. He looked both incredulous and worried. After the student left, he said, slowly shaking his head, "You know, I'm not sure he can't do it."

I am told that significant changes in the SAC communications system were subsequently effected. The young man's explanation of how he discovered the secret was that it came from published material and the asking of a few questions during a tour of the phone company.

1960-61 was a vintage year for student pranks, and on January 1, 1961, virtually the entire nation saw the culmination of the one that involved the theft of the original University of Washington instruction cards for the half-time stunts at the Rose Bowl Game and the "planting" of substitute instructions for one of the stunts. The subsequent appearance of the word CALTECH before the startled leaders of the Washington card section—and the eyes of millions of TV viewers—is well known.

Not so well known is the amusing denouement, which came some months later when President DuBridge forwarded to the physical education committee of the Institute a letter from the Seattle World's Fair Committee. The letter went something like this: "We all enjoyed your clever little joke last New Year's Day. (Appreciation did not exactly ooze from the lines.) You probably did not realize that you displaced a card trick that was to read SALUTE TO SEATTLE WORLD'S FAIR. We wonder if you would not like to perform a 'make-good' stunt at your next home football game. Perhaps your card section or band might spell out the same words that were unfortunately passed over in January."

The Seattle committee was obviously unaware of the status of football at Caltech. The scruffy handful of fans who turn out to root for any Caltech home game, and the band—which consisted of about ten volunteers led by a conductor with a mop—would hardly have swelled the attendance figures of the Seattle World's Fair.

Second in a series of articles by Robert Huttenback.

BOARD NOMINATIONS

The Board of Directors of the Alumni Association met as a Nominating Committee on February 25, 1969, in accordance with Section 5.01 of the Bylaws. Four vacancies on the Board, in addition to the positions of President, Vice President, Secretary, and Treasurer, are to be filled. The present members of the Board, with the years in which their terms expire, are:

Fred C. Anson '54	1970	John R. Fee '51	1969
Horace W. Baker '35	1970	Robert V. Meghreblian '50	1971
William F. Chapin '41	1970	Robert C. Perpall '52	1970
Donald S. Clark '29	1969	Charles A. Ray '61	1971
Donald D. Davidson '38	1969	Douglas G. Ritchie '57	1971
Manfred Eimer '47	1969	Frederic T. Selleck '49	1969
Craig T. Elliott '58	1969	Arthur O. Spaulding '49	1971
William A. Freed '50	1971	Martin H. Webster '37	1969

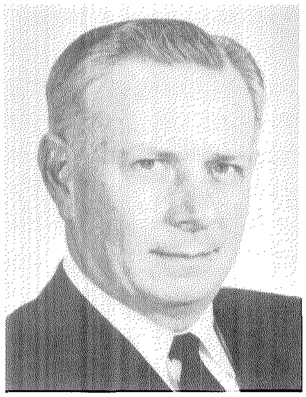
The following individuals have been nominated for the terms beginning at the close of the Annual Meeting in June 1969:

President—Craig T. Elliott, BS58ME	(1 year)
Vice President—William A. Freed, BS50ME	(1 year)
Secretary—Robert V. Meghreblian, MS50Ae, PhD53Ae	(1 year)
Treasurer—Arthur O. Spaulding, BS49Ge, MS58Ge	(1 year)
Director—Clifford C. Burton, BS40ACh	(3 years)
Director—Earl C. Hefner, BS51CE, MS52CE	(3 years)
Director—Reuben B. Moulton, Jr., BS57ME	(3 years)
Director—Warren G. Schlinger, BS44ACh, MS46ChE, PhD49ChE	(3 years)

Section 5.01 of the Bylaws provides that the membership may make additional nominations for Directors or Officers by petition signed by at least fifty regular members in good standing, provided that the petition is received by the Secretary not later than April 15. In accordance with Section 5.02 of the Bylaws, if further nominations are not received by April 15, the Secretary casts the unanimous vote of all regular members of the Association for the election of the candidates nominated by the Board. Otherwise, a letter ballot is required.

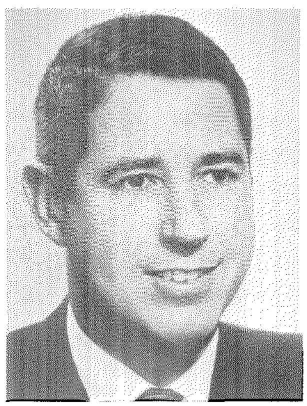
Statements about those nominated for Directors are presented below.

—Donald S. Clark, Secretary



CLIFFORD C. BURTON received his BS degree in applied chemistry in 1940. After graduation he joined the engineering department of The Texas Company in New York City. In 1948 he became a district engineer for C F Braun & Co in their New York office. In 1955 he transferred to California, and since that time he has served as manager of the manufacturing and of the engineering divisions. He is now vice president of the company. He is a life member of the Caltech Alumni Association and headed the New York chapter in 1948.

REUBEN B. MOULTON, JR. received his BS degree in mechanical engineering in 1957. That same year he joined Pacific Telephone in Los Angeles as an assistant engineer and has served the company in various capacities since. He is currently a general statistician in the accounting department. Moulton served on the Caltech YMCA Board of Directors from 1964-1967; he is the Altadena alumni campaign chairman for the Science for Mankind development program; and he is the general chairman of the 1969 Alumni Seminar.



EARL. C. HEFNER received his BS degree in civil engineering in 1951 and his MS in 1952—the year he joined Holly Manufacturing Company. In 11 years with Holly, he was in marketing and sales—served as regional vice president of sales in the San Francisco area, and was vice president and general sales manager. In 1963 he became vice president of sales for Customaire Products, a division of Pacific Industries. In 1965 he joined the Day & Night Manufacturing Company, a division of Carrier Corporation, as manager of the marketing services department. In 1967 he was appointed sales manager—western operations.

WARREN G. SCHLINGER received three degrees from Caltech—his BS in 1944, his MS in 1946, and his PhD in 1949—in chemical engineering. He was a graduate research assistant at the Institute until 1953, when he joined Texaco as a chemical engineer. He served Texaco as a senior chemical engineer and as a supervisor of research until 1968 when he was appointed director of the company's Montebello Laboratory in California. He was on the 1968 nomination proposal committee for directors for the Caltech Alumni Association.

Engineering and Science at IBM

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Don earned a B.S.E.E. in 1965. Today, he's an Associate Engineer in systems design and evaluation at IBM.

Most of his work consists of determining modifications needed to make complex data processing systems fit the specialized requirements of IBM customers.

Small teams

Depending on the size of the project, Don works individually or in a small team. He's now working with three other engineers on part of an air traffic control system that will process radar information by computer.

Says Don: "There are only general guidelines. The assignment is simply to come up with the optimum system."

This informal working environment is typical of engineering and science at IBM

Don sees a lot of possibilities for the future. He says, "My job requires that I keep up to date with all the latest IBM equipment and systems programs. With that broad an outlook, I can move into almost any technical area at IBM."

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Question: *Is there some way we can implement this change by utilizing most of the existing machinery at the plant?*

Problem: *As a modest volume plant, it is imperative that we don't lose valuable time and resulting sales. Suggest you visit the Mexico City Plant where a similar changeover occurred. Would appreciate solution by Friday, next week. Thanks.*

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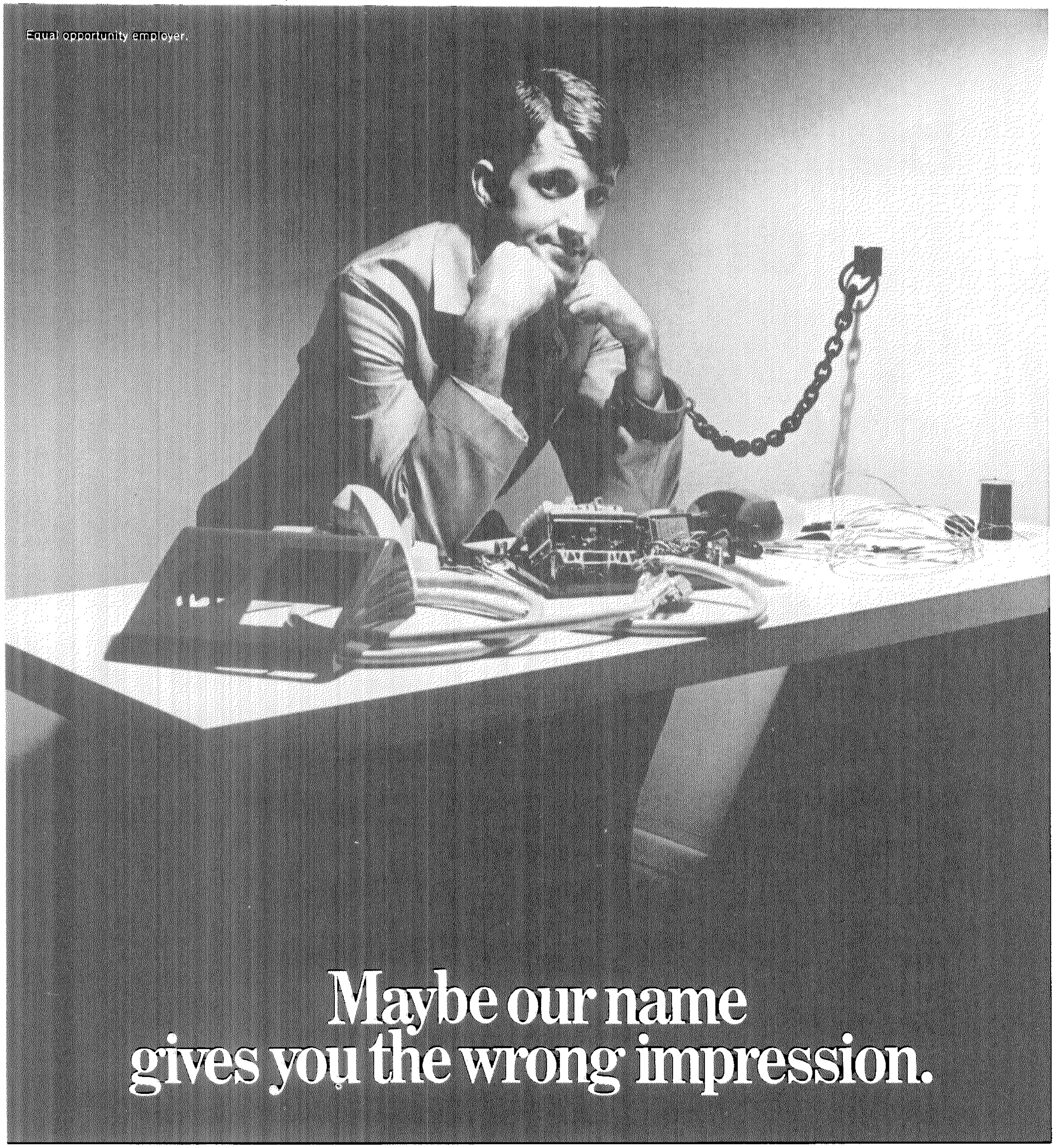

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32nd ANNUAL

ALUMNI SEMINAR

Saturday, May 10

SAVE THIS DATE

BECKMAN AUDITORIUM

SPRING CALENDAR

Lecture Series

April

7 Robert Leighton, professor of physics, "Sunspots and the Solar Magnetic Cycle"

14 Abraham Kaplan, professor of philosophy, University of Michigan, "In Defense of Free Speech"

21 Eberhard K. Jobst, assistant professor of German, "Rebirth of Political Extremism in Germany?"

28 Sheldon K. Friedlander, professor of chemical engineering and environmental health engineering, "Smog: A Modest Proposal"

May

5 Charles Brokaw, professor of biology, "Spermatozoa"

12 H. M. Schurmeier, Mariner Mars 1969 project manager, "Mariner at the Mars Frontier"

Music and Drama

April

13 The Pasadena Symphony, two performances, 3 and 8 p.m.

18 Caltech Band Concert

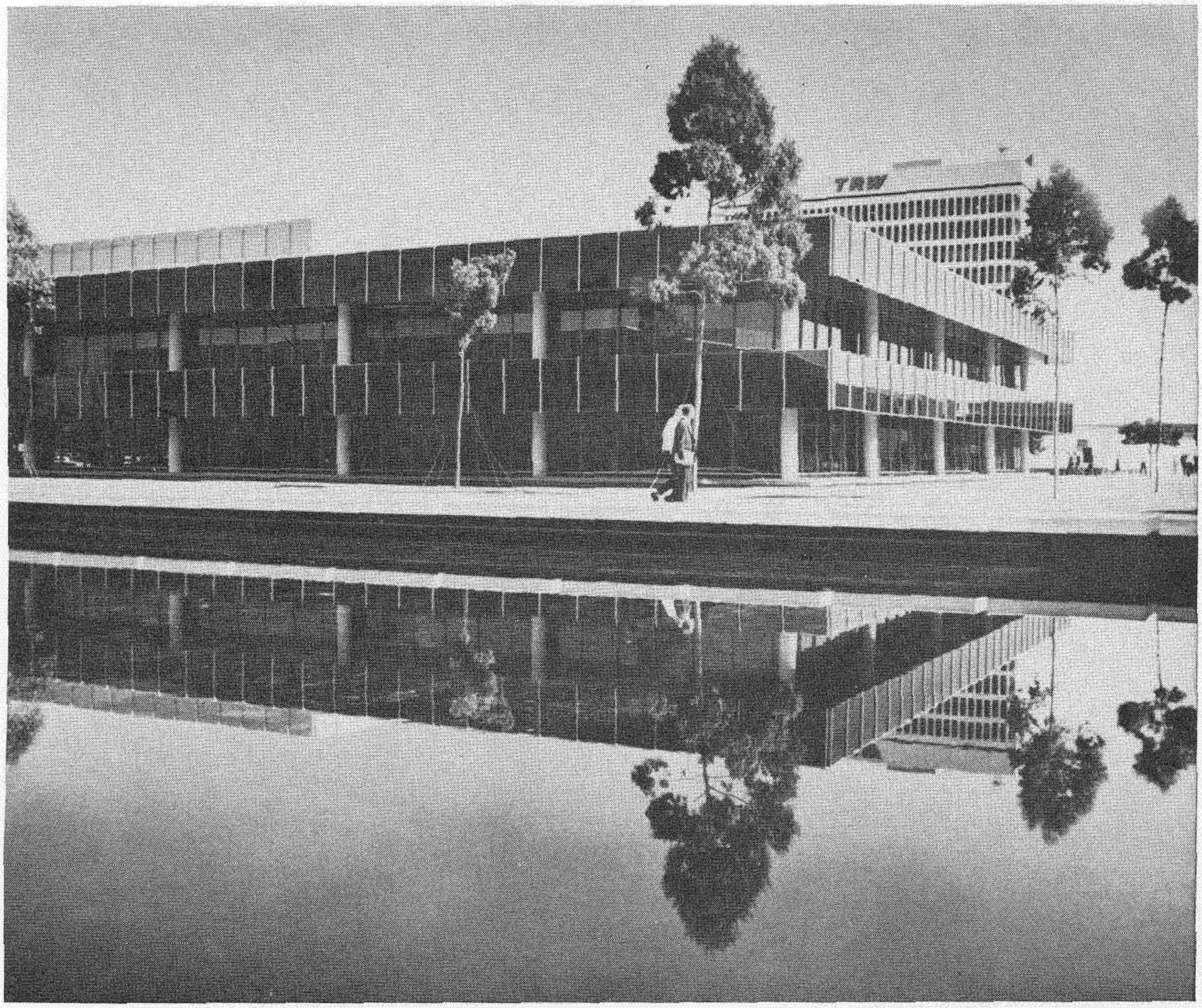
25 Ali Akbar Khan, sarodist, sitarist, drummer

May

2 West Coast premiere of "Prague: The Summer of Tanks" (Czech film) and "The Right to Speak" (French film)

9 Caltech Glee Club Concert

23, 24 ASCIT annual musical, "The Threepenny Opera"



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