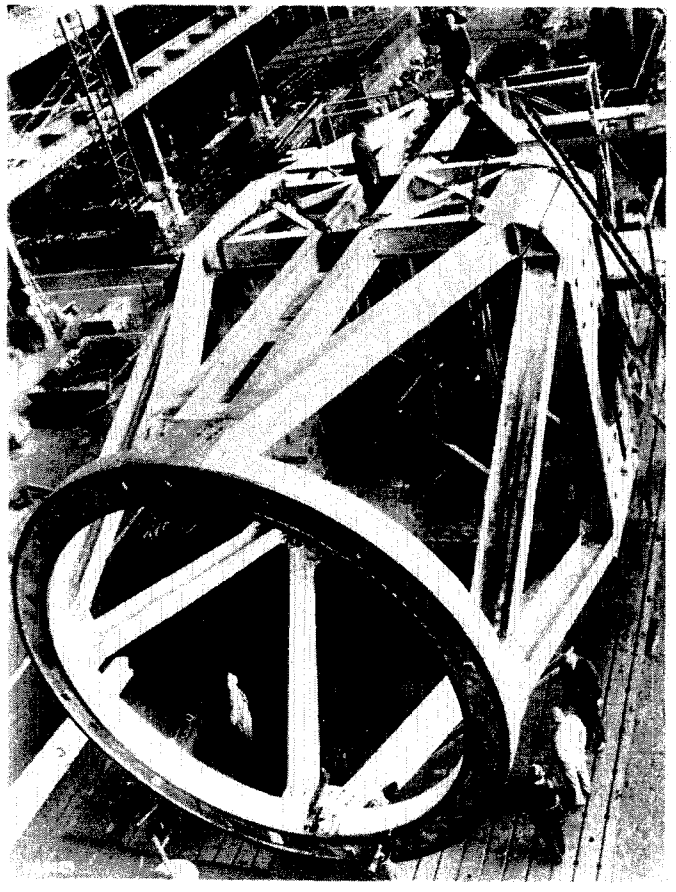

Telescope Frame During Construction at Westinghouse Plant

floor will be given over to various offices, a library, and laboratory. The mezzanine floor will contain machinery rooms for the telescope and elevator, the main switchboard, the battery room, telescope control cables and racks. The observing floor, covered by the round insulated dome with its shutters, will contain, of course, the telescope proper will all the necessary control desks, panels and equipment to operate the instrument. In addition, there will be an insulated visitors' gallery (to prevent temperature rise in the room rather than from exclusiveness), dark rooms, coudé observing room, small instrument shop, and mirror handling equipment. Stairway and elevator lead to the rotating balcony platform above, on which will be located switchboards, machinery for the shutter, wind screen in shutter opening, and the prime focus elevator which will carry observers up to the cage located at the top of the telescope tube. A stairway leading from the balcony level to the dome attic gives access to the main crane and the electrical machinery and working lights that serve in conjunction with lower wall units to illuminate the interior and floor 92 feet below. These units are heat insulated from the interior room.

The crane is a 60 ton main hoist and 5 ton auxiliary hoist that rotates as part of the dome. Electrical connection for this, along with other dome power and light, must be fed through collectors and slip rings that total about two miles long, for connections must finally be made to the switchboard room, control points, or balanced telescope cables leading to the polar axis of the telescope.

THE TELESCOPE

By M. B. Karelitz, '25

A large reflecting telescope is a complicated instrument which collects light from celestial objects and concentrates it either at its focal point, called the prime focus, or, by a series of additional reflections from auxiliary mirrors, at other focal points on the telescope convenient for direct photographic or spectrographic work.

The major advantages of the 200-inch telescope over other large instruments in existence are (1) its considerably larger light collecting capacity, permitting reduction in the time of exposures and the photographing of more distant objects in space, and (2) its design permitting astronomical work directly on the telescope tube at the prime focus of the 200-inch mirror, thus avoiding the loss of light through additional reflections that were required in the 100-inch and other smaller telescopes used to date.

In the design of the 200-inch telescope special attention is being paid to reducing the time necessary for changing the auxiliary mirror combinations for work at different focal points. Instead of changing cages at the top of the tube in order to use the different auxiliary mirrors, as has been done up to the present, all mirrors will be permanently located on the telescope and will be swung in and out of position by means of motorized mechanisms. Not only can the auxiliary mirrors be placed by pushing buttons, but even the telescope itself can be set into the desired field of vision automatically.

In its optical and mechanical parts such as bearings, drives, etc., the 200-inch telescope differs materially from the older ones, since recent advances in different engineering fields can be incorporated in their design.

The large size and necessary accuracy of the component parts of the telescope require machines and equipment of unusual size. Special machines for cutting the large driving gears had to be built on the campus. The tube proper, the mounting and bearing assemblies of the telescope are being manufactured by the Westinghouse Electric and Manufacturing Company at its S. Philadelphia and E. Pittsburgh plants. Even there large machine tools had to be modified and a huge annealing oven had to be installed. Smaller parts, especially those requiring great accuracy, are being manufactured in the Astrophysics Instrument Shop on the campus.

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THE SCHMIDT TELESCOPE

William H. Pickering, '32

The first astronomical instrument actually installed and put into operation on Palomar is an 18" Schmidt telescope which took its first photograph on September 5, 1936. This telescope is a new type of instrument designed for photographing large areas of the sky. It is essentially a camera with an 18" lens working at an aperture of F2. By astronomical standards it is also a very wide angle lens. Actually the field of view is about 10° in diameter. This field is free of distortion to the very edge. By taking forty minute exposures, objects down to about magnitude 17.5 can be photographed.

Since its installation the Schmidt has been in continuous use carrying out a program of investigation of the extra-galactic nebulae. The persevering camera fiends are J. J. Johnson and F. Zwicky, who, for over a year, have been taking turns commuting to Palomar for a little night life.

The Schmidt type of telescope is well suited for an investigation of the distribution of the distant nebulae in clusters and groups. With an ordinary telescope having a small field of view a photograph will usually reveal only one or two nebulae and accordingly it is difficult to determine whether or not these nebulae are in groups. With the Schmidt, however, the large field of view reveals at once the presence of nebular groups. Hence one object of the program has been a survey over as much of the sky as possible, in order to investigate the distribution of the nebulae down to about the sixteenth magnitude, which corresponds to a distance of about one hundred million light years. As a result of this survey Dr. Zwicky announced the discovery of at least two new clusters, and furthermore he believes that eventually all the nebulae will be found to be in clusters. Dr. Zwicky says that these studies lead him to the conclusion that the time scale of the universe, established by the astronomers from the theory of the expanding universe must be greatly lengthened and hence that the whole expanding universe idea must be modified.

The other main objective of the program has been the discovery and investigation of super-novae. About once in a thousand years more or less, in each galaxy a star seems to suffer some sort of convulsion and flare up until it is actually brighter than the whole galaxy of millions of stars, of which it is a part. In our local galaxy, which comprises all the stars visible to the naked eye, such a super-nova probably occured in 1570, when a star suddenly became bright enough to be visible in the daytime. These super-novae are of great interest to physicists and the Schmidt photographs constitute the best possible source material for them. Selected fields are chosen which contain a lot of nebulae and by photographing these at intervals changes can be noted. Such changes, in the more distant objects, can only be due to super-novae. Already several have been found, one of which, last August, was comparatively close, and a fine specimen.

Editor's Note: There are quite a number of Alumni employed on the construction of the 200-inch telescope. Among the mechanical engineers are to be found M. Karelitz, '25, and E. Grant, '30; while among the civil engineers are B. Hill, '25, Mark Serrurier, '26, and R. A. Phillco, '27. The electrical engineers are represented by the following group of alumni: E. M. Irwin, '24, R. H. Duval, '28, George Lewis, '31, and Bruce Rule, '32. One physicist Dr. Sinclair Smith, '21, is also a member of the staff.

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Study of safety factors to guard against the destruction of buildings by major earthquakes is being investigated by the Institute under the direction of Professor R. R. Martel. This work was made possible through funds allotted by the Los Angeles County Supervisors.

THEORY OF GENES CHALLENGED

In the November 29 issue of Newsweek appears an article which tells that Dr. Richard B. Goldschmidt, professor of Zoology at the University of California, recently announced in Nature and by subsequent interview stated that he had obtained experimental proof that genes, hereditary factors in germ cells, do not exist.

The gene theory is the accepted theory of heredity and is principally the development of famed 71 year old Dr. Thomas Hunt Morgan. Dr. Morgan, head of the Biology Department at the Institute was awarded the Nobel Prize for his development and lifelong research on the theory of genes.

Were a lesser person than Dr. Goldschmidt, former director of the Kaiser Wilhelm Institute, and long a leader in experimental biology, to attack such an accepted theory scant notice would be taken. Dr. Goldschmidt backs his challenge with the conception that the chromosone is an infinitely complex protein molecule built on a chain pattern; and he thinks that any disorder within the molecule will produce what has previously been known as mutation.

Whatever the outcome there is certain to be an interesting controversy in the world of genetics.

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First issued as a textbook on practical fluid mechanics twenty-one years ago, when its author was a teacher at Cornell University, Professor Robert L. Daugherty's "Hydraulics" is just out in a fourth edition with the McGraw-Hill Book Company. This new edition has been rewritten and greatly enlarged to include the latest developments in hydrodynamics.

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GRADUATE ENROLLMENT GROWS

California Institute of Technology's present student body, graduate and undergraduate, comes from 40 states, 3 dependencies and 13 foreign countries, according to figures released by Philip S. Fogg, registrar.

This is a much wider geographical distribution of the student body than ever before in the Institute's history. Along with this, the total of students shows a larger proportion than ever coming here from beyond the bounds of California, the statistics show.

Some of the foreign countries now represented at Caltech are Canada, China, Japan, Mexico, Panama, South Africa, Newfoundland, Denmark, England, Germany and Switzerland.

Final registration figures tabulated in Professor Fogg's office show a total enrollment of 850 students subdivided into 609 undergraduates, and 241 graduates, who are working for master's and doctor's degrees. There are in addition about 60 research fellows, who come here under the terms of various foundations, like the Commonwealth Research Fund, the International Research Association, American Petroleum Institute, Kellogg and other funds.