great in breadth of view; great in simplicity and forthrightness; great in sympathies and spirituality; great in appreciation of the essentials and obligations of life; 'maker of machines, institutions, and men'; a very noble gentleman, an engineer worthy to stand in the Washington succession, a worker with helping hand outstretched and heart aglow for his fellow men. I am persuaded that as he walked the Earth among us he walked with eyes uplifted toward the eternal stars."

PHILIP FOX.

The Hayden Planetarium-Grace Eclipse Expedition

By DOROTHY A. BENNETT

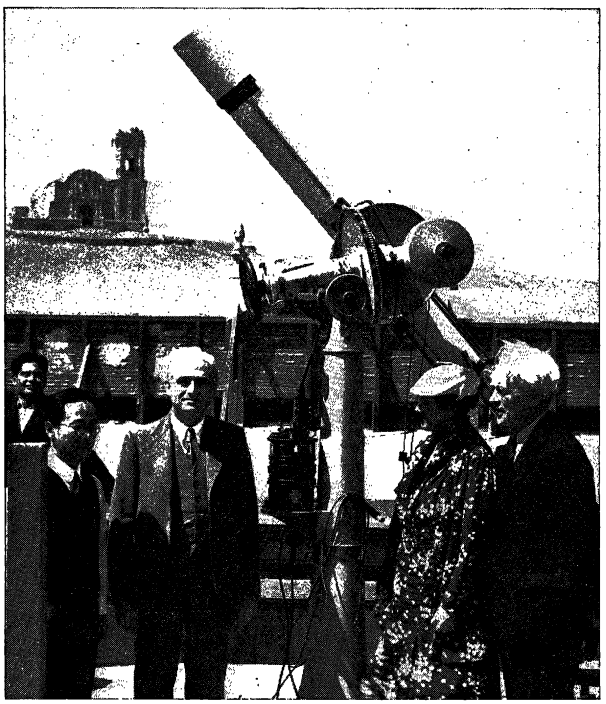
The Hayden Planetarium-Grace expedition to the path of the total solar eclipse, which occurred on June 8, 1937, was planned with several well-defined objectives: to photograph the eclipse with telescopic cameras, movie, and still cameras, to paint it, observe it, and describe it to the radio listeners, visitors to the planetarium, and the readers of THE SKY (monthly magazine of the Planetarium).

The members of the party went into the field equipped to carry out this program. There were two polar axes, four telescopic cameras, two driving-clocks, two small refracting telescopes, Longines-Wittehaur chronometers, one Fairchild aerial camera, seven motion picture cameras, five still cameras, and numerous personal cameras that were used for occasional shots. Many of these cameras were equipped with telephoto lenses. Then, of course, in addition to these things there was a wealth of miscellaneous expedition material including two portable dark-rooms, transits, etc., artists' canvas, binoculars, and a complete set-up for broadcasting.

This battery of equipment was to be set up in the path of the total eclipse to occur in the afternoon in Peru, along a path that stretched from the coast back of Chimbote on the central line to cross high in the mountains.

Five stations were finally selected so that every possible place where the eclipse would be well observed and reported would be used. Dr. Fisher, leader of he expedition, was located at Huanchaco, Lat. —8° 4′ 46″, Long. W. 79° 7′ 40″, where he and Mrs. Isabel M. Lewis, associate astronomer, were the guests of the Peruvian Expedition under Dr. Godofredo Garcia. Here, too, was Dr. Issei Yamamoto of Japan with his associates and equipment. This station had the highest sun, 9½°, and afforded a fine view of the eclipse in a clear sky over the Pacific Ocean. Totality occurred at $5^h\ 18^m$ and lasted two minutes and 33 seconds. Dr. Fisher made motion pictures of the progress of the eclipse, the "diamond ring," and the corona with his Akeley motion picture cam-

era, using a 12-inch telephoto lens and supersensitive panchromatic film. He also made color photographs on Kodachrome (supplied by Eastman) with his Graflex and with a Contax carrying a 6-inch telephoto. Mrs. Lewis used a two and a half-inch telescope and in an exposure of a thirtieth of a second with Kodachrome secured extensive corona and excellent red prominences. She also photographed "Bailey's Beads" at second and third contacts. While Dr. Fisher has yet to see his color pictures with the Graflex he can report complete success with the movies, some of which were used by the news reels. Accompanying Dr. Fisher and Mrs. Lewis were Miss Johnson, artist, and Te Ata.

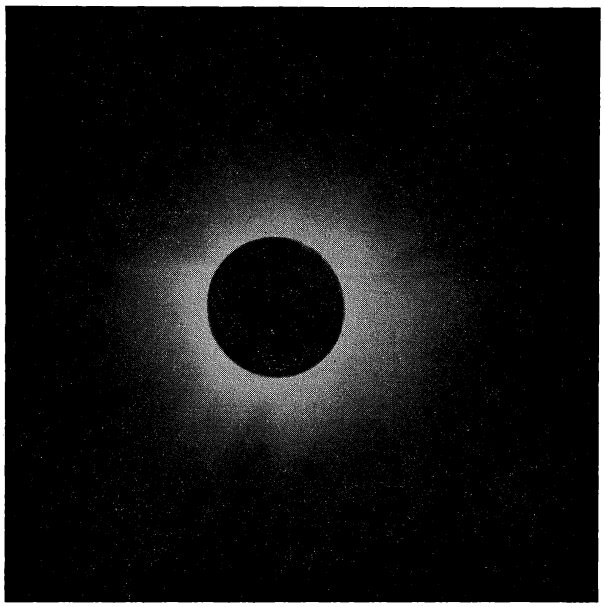


HUANCHACO STATION
Issei Yamamoto, Godofredo Garcia, Mrs. Isabel Lewis, Dr. Clyde Fisher

Almost as far west and much nearer to the center of the eclipse path was the second station at Moro, Peru, (Lat. —9° 8′ 5″, Long. W. 78° 10′ 5″) under associate astronomers, Dana K. Bailey and Dr. Serge Korff. This was almost exactly on the center of the path about 40 miles inland from Chimbote in the Callejon de Huaylas. Here during the three minutes and a half of totality, eight exposures were made with a 6-inch lens having a 72-inch focus and a 6-inch lens having a 90-inch focus. With the 90-inch, Korff made five exposures on Eastman 40 plates (backed with blacking the night before the eclipse) according to

the following exposure schedule: 1^s, 4^s, 8^s, 16^s, 4^s, 24^s, 32^s, 51^s. In addition to these, two exposures on Kodachrome, one of which was lost through a faulty holder, were made. With the 72-inch, Bailey made eight exposures, six on Eastman 1G spectroscopic plates and two (numbers 5 and 6 as with Korff) on 4x5 artificial light Kodachrome supplied by Eastman, using a type A filter. His exposure schedule was the following: 2^s, 4^s, 8^s, 16^s, 2^s, 12^s, 32^s, 37^s. One of these Kodachrome exposures also was lost because of the faulty holder.

The two Kodachrome exposures were mailed to Rochester for development along with two exposures during totality on 35 mm Kodachrome taken by Bailey on his Retina. The 35 mm have been returned and are excellent, showing not only the whole spectacle of totality in the



EIGHT SECONDS EXPOSURE AT TOTAL PHASE WITH SIX-FOOT CAMERA, BY DANA K. BAILEY AT MORO, PERU

true color of the corona but also sky and sunset shades at the horizon with surprising faithfulness. The 4x5 have not been returned at the time of this writing. The other plates were given careful development in D-76 at uniform temperature, and some show wonderful detail and extreme extension of coronal streamers to beyond two solar diameters. Volunteer Alberto Barrios operated Dr. Korff's Graflex, which carried a 17-inch telephoto lens, and made a sequence of exposures of the progress of the eclipse and some others not yet developed. Using a pendulum devised at Mr. Rosenshine's Colquipocro mine where the group first located, Mrs. Korff was time-keeper for the group.

The other polar axis was at an altitude of 15,000 feet in the Andes at Cerro de Pasco, Peru, (Lat. —10° 43′ 36″, Long. W. 76° 15′ 54″) where William H. Barton, executive officer of the expedition, was in charge of the station with Charles Coles, photographer; D. Owen Stephens, artist; and Dorothy Bennett, observer. Here were mounted two telescopic cameras, one 6½-inch Ross lens with 84-inch focus and a 4-inch lens with 136-inch focus, to take advantage of the 143 seconds of totality. These lenses as well as the driving clocks for each station and the 6-inch lens with 72-inch focus were loaned by Swarthmore College through Dr. John A. Miller, who acted as Technical Director of the expedition. Eight exposures were made with each of these cameras on the following schedule: 1^s, 4^s, 16^s, 24^s, 16^s, 8^s, 1^s. Due to the slipping of the axis from an unknown cause, some plates from the 136-inch were lost, but a fine set of negatives was obtained from both this and the 84-inch. Dr. Miller says that the plates are not only both sharp and useful, but are among the finest he has ever seen.

The motion picture program at Cerro was carried through with 35 mm Eyemo with 20-inch Zeiss triplet f3.8; 35 mm DeBrie with 12-inch, f5.6 telephoto; 35 mm Eyemo with 6-inch at f4.5; 35 mm Sept. with 16-inch lens at f4.5; and 16 mm Filmo with 3¾-inch telephoto at f3.3. From the Eyemo carrying the 6-inch lens came satisfactory pictures of the corona made at 4 frames per second, and from the Filmo using Kodachrome, at 8 frames per second, a sequence at the end of totality in which the prominences are over-exposed, but the corona is satisfactory and very bright.

Visual observations of the eclipse made by Dorothy A. Bennett included sketches of the corona and locations of the prominences which were used by Mr. Stephens as a check upon his own observations as well as a record of the various phenomena which occurred at the time of the eclipse. The corona was seen to extend to more than a diameter and a half and six groups of prominences were recorded. Two of these near the sun's western edge were gradually revealed by the passing of the moon and at first appearance seemed to be rising rapidly—but the same two actually were eruptive as the upper extensions changed noticeably under observation, rising and swirling to a full tenth of the sun's diameter. Shadow bands were seen just before second contact and Mr. Stephens reported that he saw Mars on the eastern horizon just as the shadow was receding. Mr. Bailey from Moro reported that he saw Mars, the Southern Cross, Canopus, Sirius, and stars down to the third magnitude.

At Cerro, too, D. Owen Stephens made for the Junior Astronomy Club an excellent record of the phenomenon on four paintings which were finished in the week following the eclipse. This was the third eclipse that Mr. Stephens had observed scientifically with the express purpose of making an accurate record of it in color. Unusually well qualified for such a task was this Swarthmore-trained student with ma-

jor in astronomy who came from a long line of artists. He combined to a rare degree an artist's eye with a scientist's mind.

He made a 30x36-inch canvas of the "diamond ring" at second contact which is particularly beautiful and one 48x72-inch of totality which represents the corona with remarkable transparency and shows the wealth of streamers, arches, and brushes that were observed, as well as the prominences. The most unusual one is the 30x36-inch canvas showing the retreating shadow with Mars barely visible and the startling first-light on the ground after totality. Then he also delineated the sun setting like a crescent moon over the snow-capped peaks of the Andes.

Add to this the very delicate and interesting canvas of the zodiacal light, which was made before the eclipse, and the most impressive 48x72-inch canvas of the southern Milky Way, which pictures the rich star clouds in Sagittarius and Scorpio, and you have before you a beautiful group of paintings as well as a scientific record of which both painter—and astronomer—Stephens could well be proud. It was the greatest of tragedies that this able member of the expedition did not return to New York. He died of a thrombotic stroke in the Gorgas Hospital in the Panama Canal Zone.

To successful programs from the most western station, the most central station, and the highest land station, was added a surprisingly effective group of results from the Pan American Airways plane, piloted by Disher and Gray, in which Major Albert W. Stevens made still pictures with a Fairchild Aerial Camera with a 24-inch Bausch and Lomb lens at f6. One image secured showed the moon 6 mm in diameter and a radial extension of the corona of 11 mm. There is excellent detail even on the short exposures, and the 16 mm Cinè-Kodak Kodachrome movie is reported from Rochester to be good. Major Stevens has already started work on the improvement of this aerial equipment to make it even more useful for future eclipses, because the aerial photography bids fair to be a most valuable adjunct to the work on terra firma.

To carry a word picture of the wonderful spectacle of the eclipse to a large number of people, Mr. Adamson, in charge of Public Relations for the Museum, Mr. William Perry and Mr. Raymond Newby of Columbia Broadcasting Company, arranged to broadcast a description of it from the mountains at Pira. The difficult task of running a line there was cared for by Mr. Newby. Mr. Perry was official announcer for Columbia.

To Miss Sally Pyle, secretary of the expedition, fell the task of coördinating, in Lima, messages from all the staitons.

The personnel of the expedition was as follows:

Dr. John A. Miller, Emeritus Director of the Sproul Observatory, Technical Director, who did not accompany group.
Dr. Clyde Fisher, Curator of the Hayden Planetarium, Leader.
Mr. William H. Barton, Associate Curator of the Planetarium, Executive Officer.
Dr. Serge Korff, of the Carnegie Institution, Associate Astronomer.