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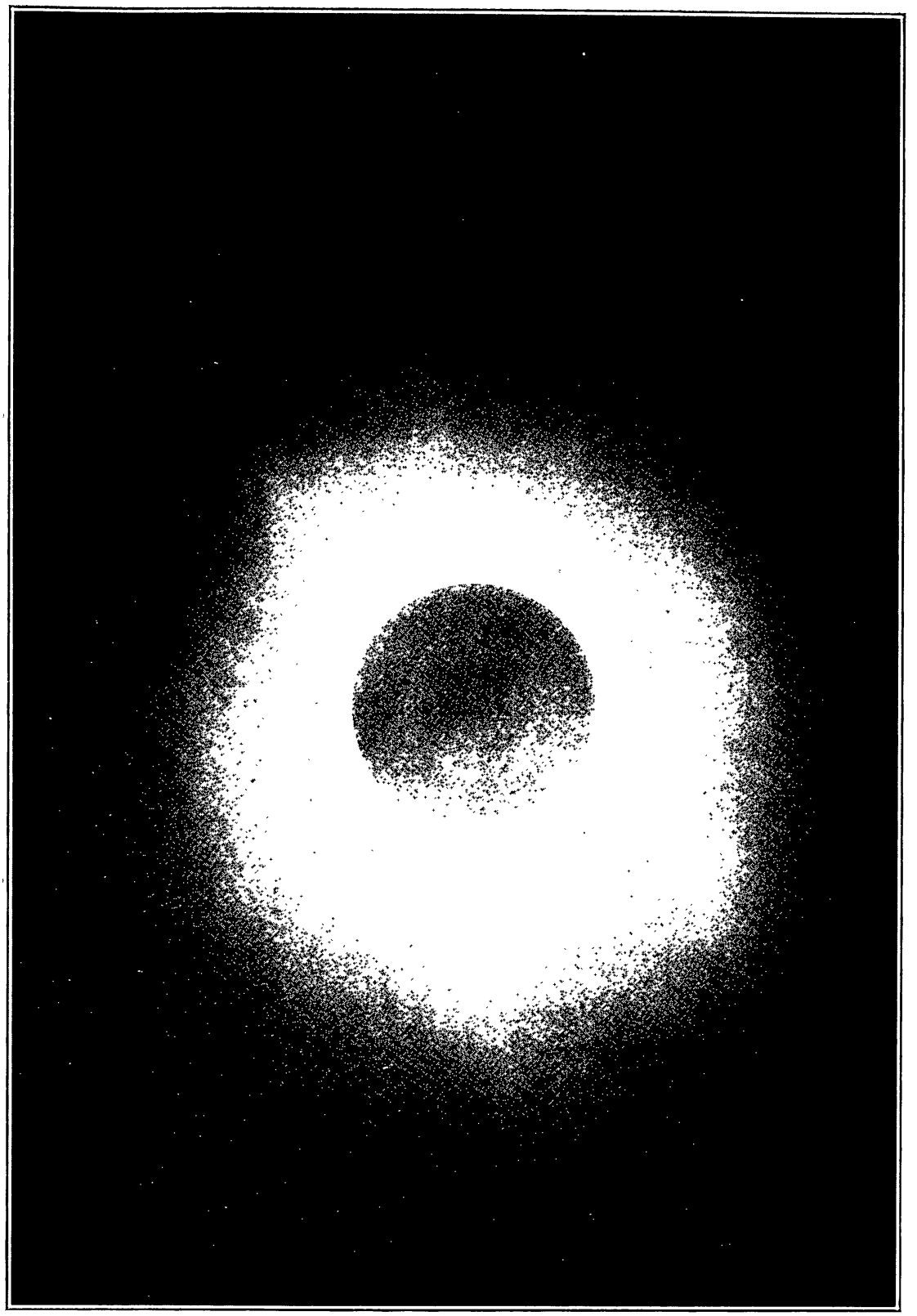
THE ECLIPSE CAMP AT WALLAL

By C. A. CHANT

THE site chosen for the camp was about one and a half miles from the sea. It was covered with a very light loam and was bordered on three sides with wattle trees, which seem able to exist with the minimum of moisture. The soil was very dry and finely pulverized, and when one walked over it a cloud of dust rose behind him, and, being carried by a land or a sea breeze, would penetrate everywhere and settle on everything. We found it wise to dispense with table-cloths and some other accompaniments of good housekeeping. About one quarter of a mile to the south was the Government well. It was constructed in 1875 by Alexander Forrest, one of Australia's great explorers, when he was preparing a route near the west coast for driving cattle southward on the way to market. It is only 16 feet deep, the water is excellent and it never fails. Indeed we were told that Wallal means "good water" or "abundant water". Another quarter mile south is the post office and telegraph station. Why locate a telegraph station in this deserted country? The reason given was that it was necessary to have a line-repairer near here so that when any accident to the line occurred it might be repaired with little delay. Much of the country about is covered with red sand, on the surface of which, as well as at a depth of at least two feet, shells were found

PLATE I.



Solar Corona, September 21, 1923. Taken at Wallal, W.A., with 11-foot Einstein Camera. Exposure 45 sec.

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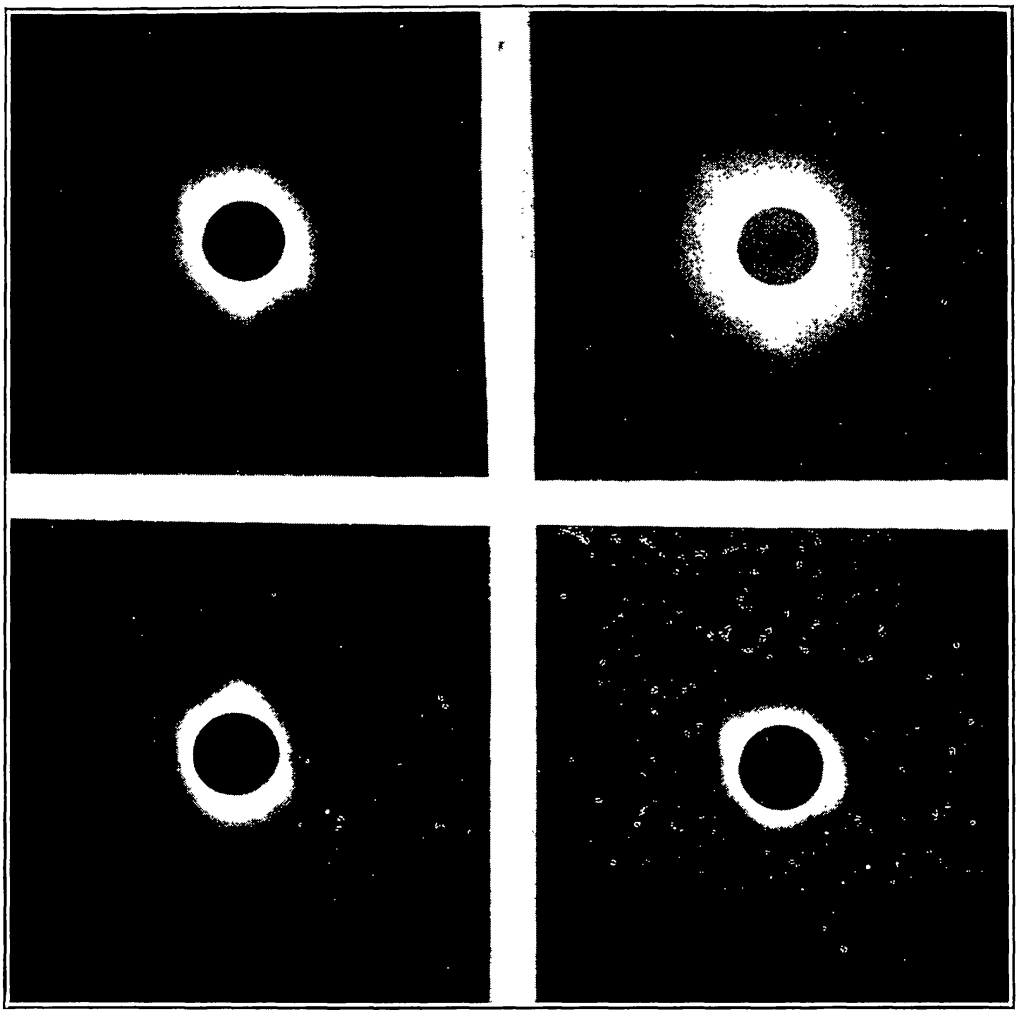
PLATE II.

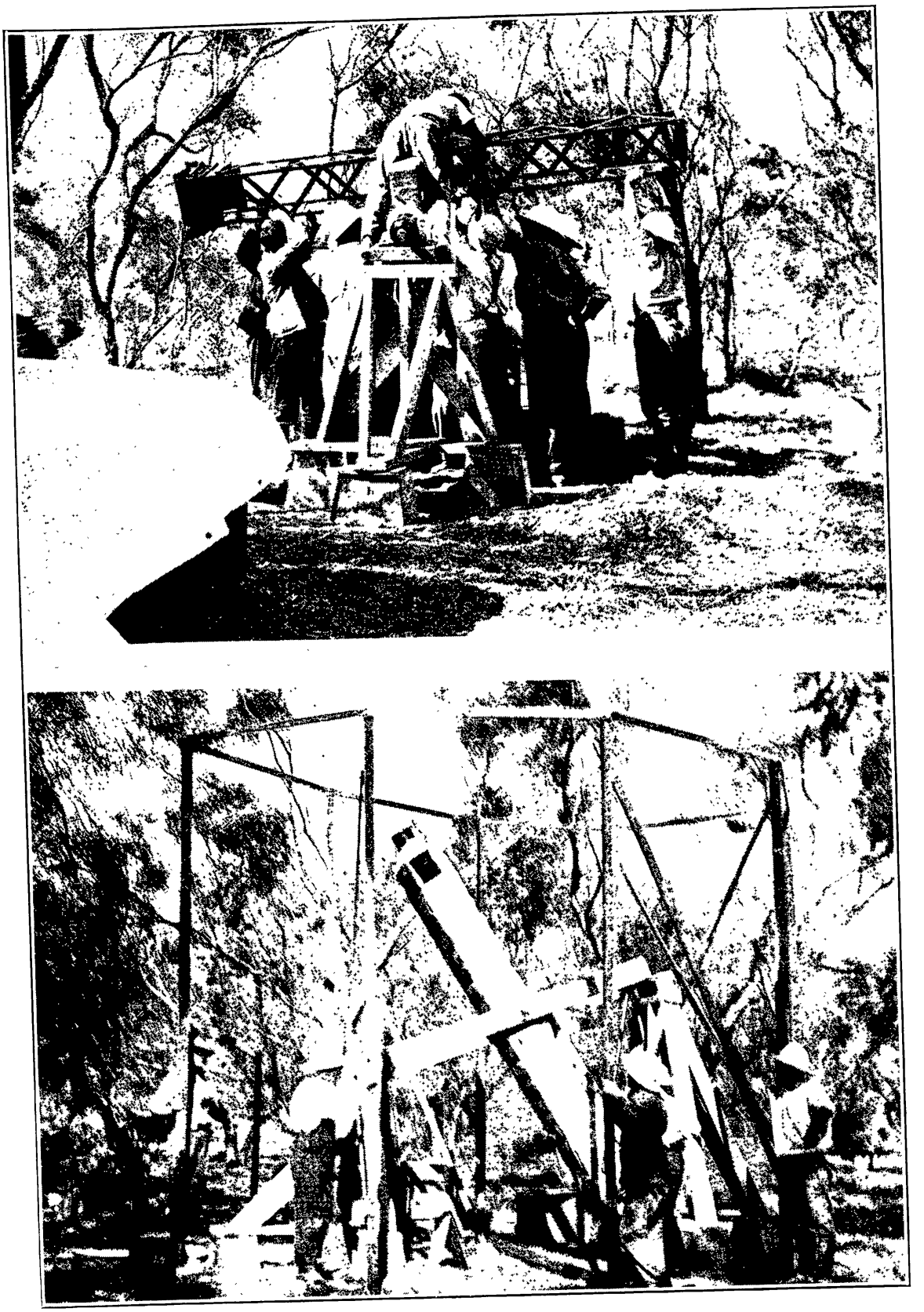


Solar Corona, September 21, 1923. Taken at Wallal, W.A. Upper photograph with lens of f = 33¾ in.; exposures 10 sec. (left) and 20 sec. (right). Lower, with lens of f = 36 in. and Nicol prism before it. Nicol turned through 90° between exposures, each of which was 5 sec.

PLATE III.

Scientific Part of the Eclipse Expedition, taken at Perth, August 18, 1922.

Standing from left to right: Maxwell Quick, Hargreaves, Hosking, Trumpler, Dwyer, Nossiter, Matthews, Yeates, Moore, Nunn.
Sitting: Miss Chant, Mrs. Adams, Adams, Mrs. Campbell, Campbell, Mrs. Chant, Chant, Ross, Young.



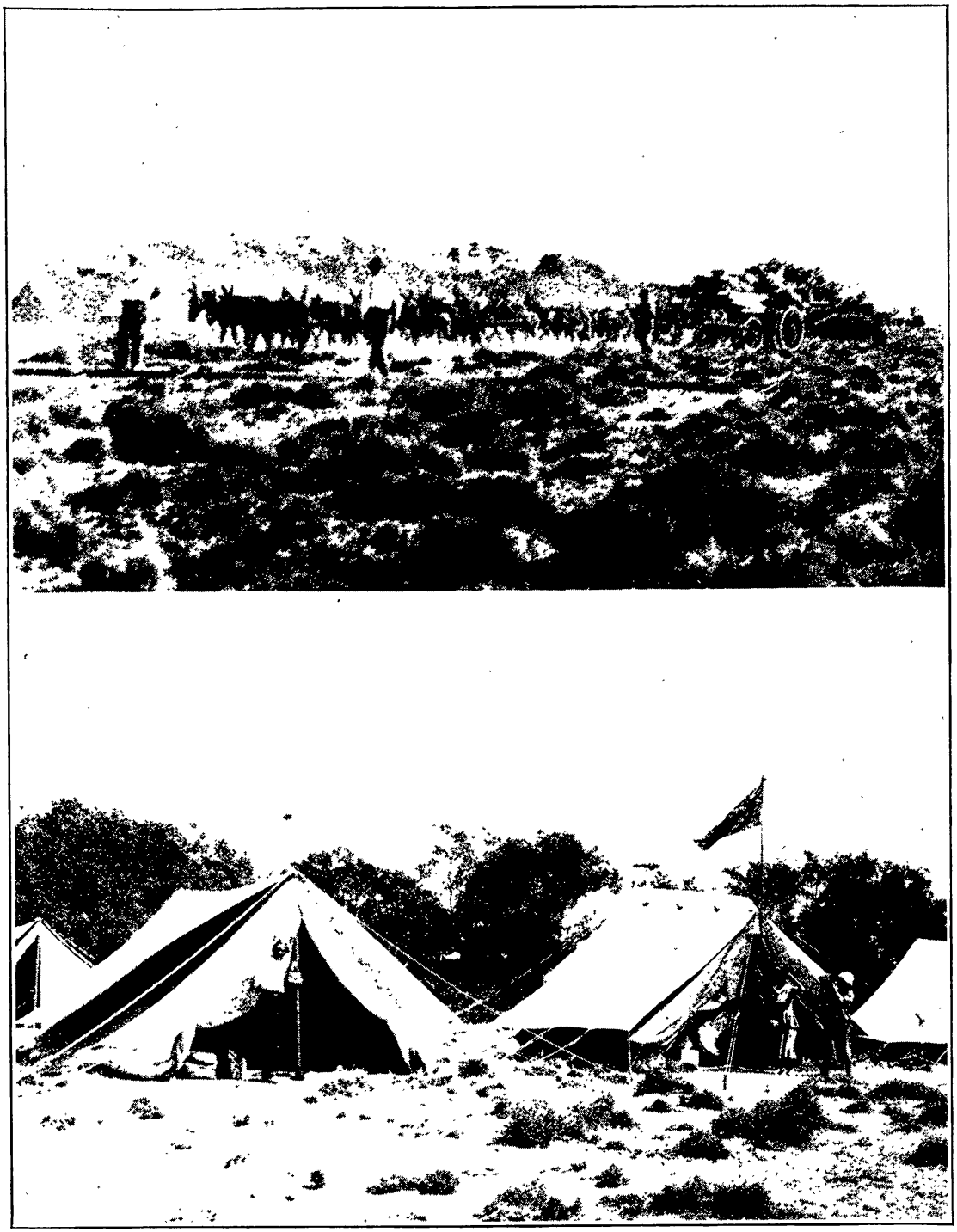
Upper: Placing the Einstein Camera in the Polar Axis. Lower: The Camera mounted and tube covered. Framework in place for receiving cotton duck covering.

Journal of the Royal Astronomical Society of Canada, 1923.

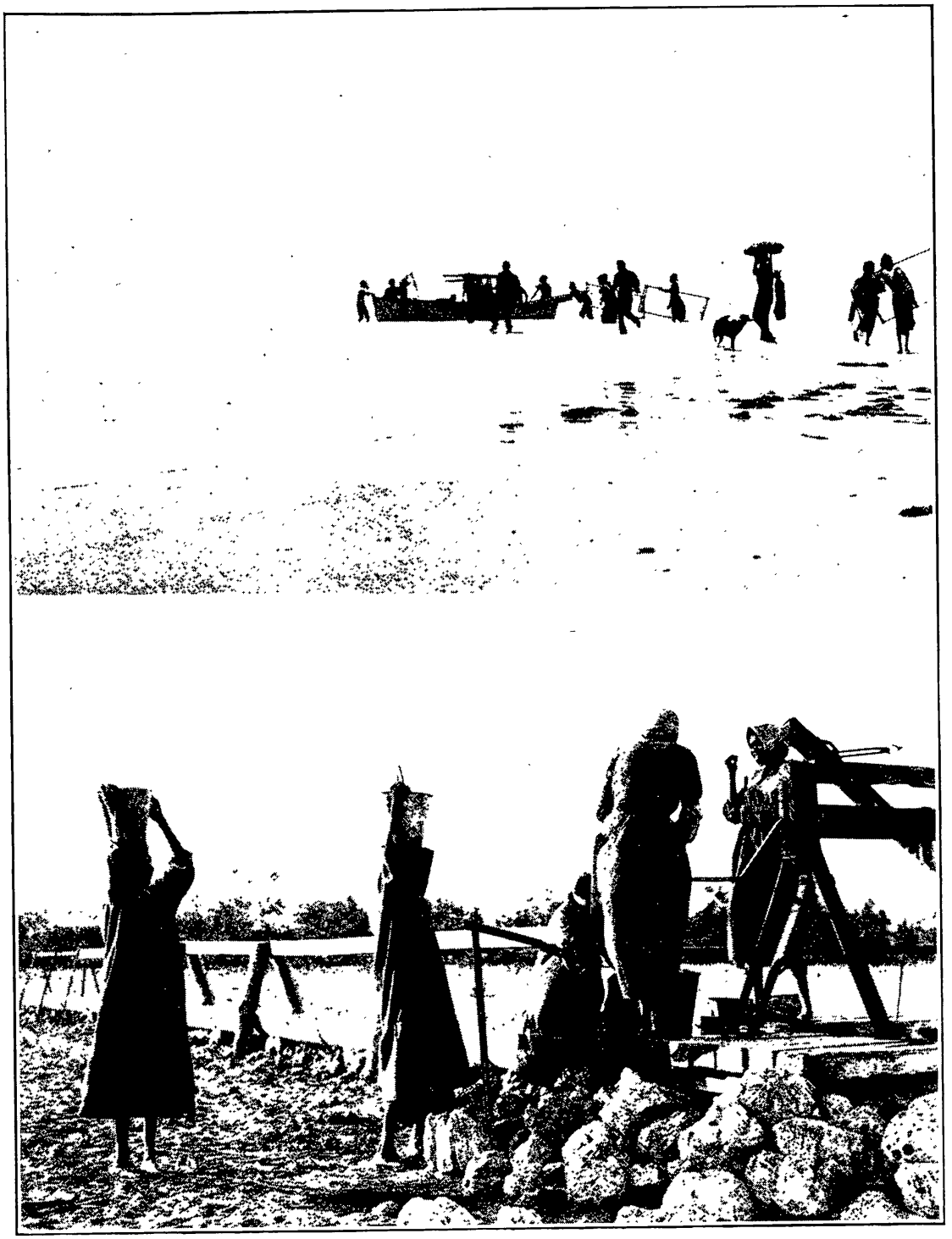
PLATE V.

Upper: Naval Party. Standing from left to right: Sinclair, Hutchins, Barker, Cushing, Kenny. Sitting: Rhodes, Com. Quick, Starling, Kean.
Lower: Lick Observatory 40-ft. camera and, at the right, shelter for Einstein Cameras.

Journal of the Royal Astronomical Society of Canada, 1923.

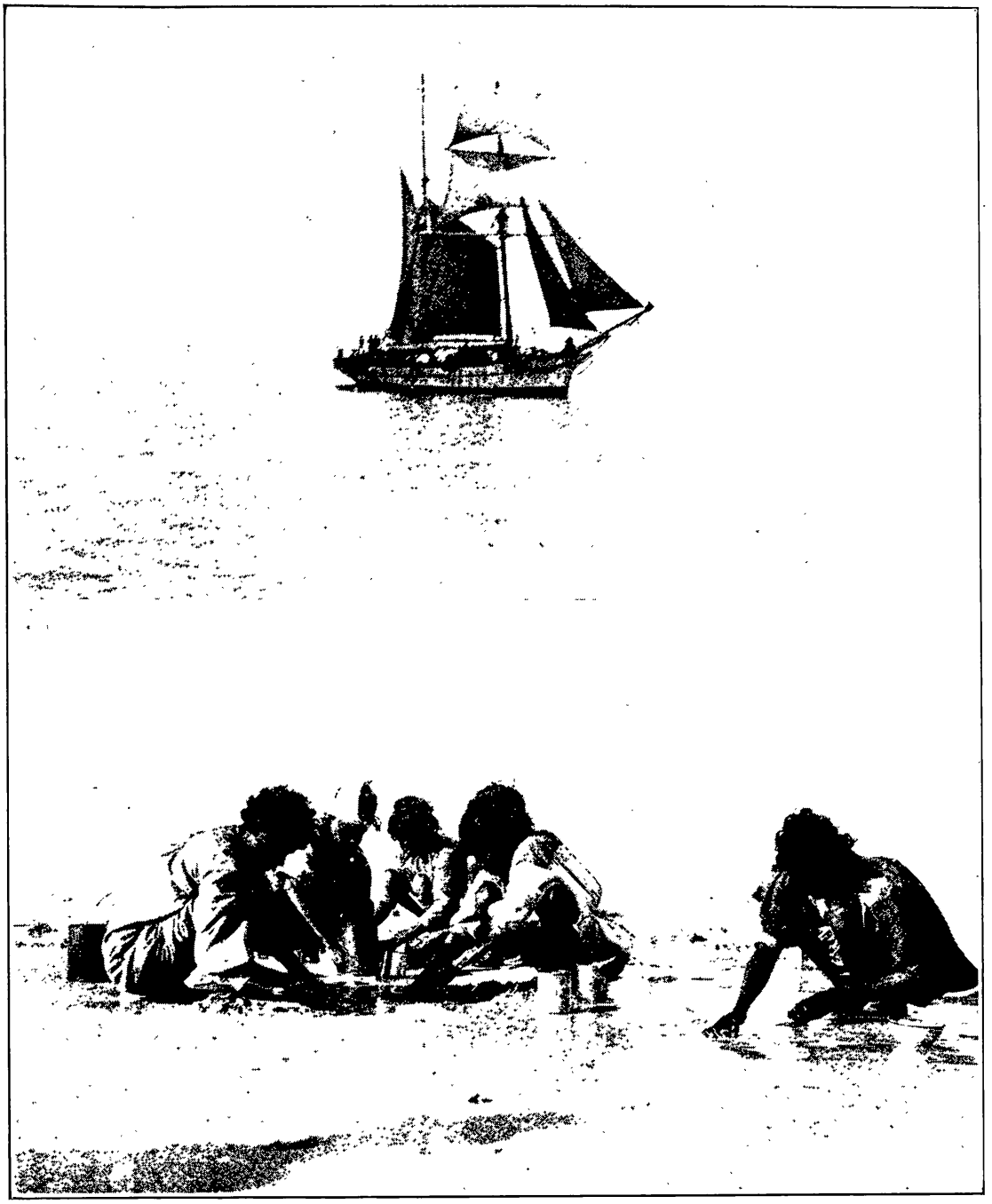


Upper: the 26-donkey team bringing in a load from the beach. Note the dust. Lower: the tents occupied by the Canadian Party. In both pictures clumps of spinifex are seen in the foreground.



In the upper photograph is shown the process of unloading and loading the whaleboat in the surf. Lower: aboriginal water-carriers at the well—a little gossip before starting for the camp 500 yards away.

PLATE VIII.



Upper: the schooner "Gwendoline". Lower: Aboriginal women gathering mussels on the beach.

quite like those on the shore of the ocean. Our altitude was about 30 feet and it would thus appear that we were on a raised sea-beach.

The camp was in longitude 120° 41′ E. and latitude 19° 46′ S. About three miles away was a small sheep farm, or "station", as it is called in Australia; some twenty miles off was a larger one; and at a distance of 66 miles was a large and important station. The area of some of these sheep or cattle stations is immense. I talked with a gentleman on board our ship who had 600,000 acres near Roebourne in Western Australia, but the largest of all is in Queensland and contains 60,000 square miles or 38,000,000 acres. The land itself, however, is very poor, requiring 5 to 10 acres to maintain one sheep. It was not at all unusual for a station to contain 30,000 or 80,000 sheep, and the monster estate in Queensland carries 250,000 cattle and many thousand horses.

After the great State Luncheon at Perth on August 17 the scientific members of the expedition were photographed in the rear of the Parliament House (Plate III). The Lick Observatory Party comprised Director and Mrs. Campbell, Dr. J. H. Moore and Dr. R. J. Trumpler from Mount Hamilton, Cal.; Dr. and Mrs. C. E. Adams, of Wellington, N.Z.; Mr. J. B. O. Hosking of Melbourne Observatory and Prof. A. D. Ross of the W. A. University, Perth. Messrs. J. Hargreaves and G. S. Clark Maxwell made up the English party. From Western Australia were Messrs. C. Nossiter (Chief Assistant in Perth Observatory), V. J. Matthews, G. M. Nunn, C. S. Yeates and J. J. Dwyer. In the Canadian party were Prof. C. A. Chant, Mrs. Chant and Miss Elizabeth H. Chant of Toronto, and Dr. R. K. Young, of the Astrophysical Observatory at Victoria, B.C. At Broome we were joined by Dr. and Mrs. John Evershed, of Kodaikanal Solar Observatory, South India, and they were assisted by Mr. D. Everson, of Perth. Each party was quite independent of the others and had its own programme, but Dr. Campbell was considered to be the leader of the whole.

The members of the Naval Party were Lieut.-Com. H. L. Quick, Warrant Officer W. S. Rhoades and Messrs. W. Kenny, L. W. Starling, F. Sinclair, H. Hutchins, J. Barker, S. Cushing, T. Roberts and J. R. Kean. They were mostly Chief Petty Officers and Petty Officers. In addition, there were two "movie"

men, Messrs. E. Brandon-Cremer and C. Sharpe, of Adelaide; and also Mr. Dewar, of Broome, the policeman for this district.

With the least possible delay the naval men prepared the camp for occupation. There were twelve tents for sleeping in, two large mess-tents, two store-tents and the cook's galley. The locations for the different parties were soon arranged. The Lick party settled among the wattle trees east of the tents and the Canadian party took the adjoining space just south of them so that both parties might hear the same time-announcer during the eclipse. The English party went some distance north-east and the party from India a short distance west. The Perth party went to the sheep station, three miles away.

By observation north-and-south lines were laid down, and the places for the foundations were then pegged out. Professor Ross had telegraphed ahead orders for broken stone and it was ready for us. There was plenty of good sand near the well and we had brought cement with us. The aborigines carried the stone and sand and water and in a very few days the cement foundations were constructed. At the same time the instruments were taken from their cases, put together and got ready for erection when the foundations had hardened sufficiently. In the case of some of the Lick instruments chains and pulleys were required to lift them.

Our chief instrument was the Einstein camera. The "tube" was 13 inches square and 11 feet long. The corner-strips were of angle-iron and it was made strong and rigid by truss-work braces as shown in the picture (Plate IV). To render it portable it was cut into three portions, each of which fitted its own packing-case. It could be put together or taken to pieces in perhaps an hour. For its design and the working drawings from which it was made thanks are due to Prof. C. R. Young, of the Faculty of Applied Science and Engineering. The plate-holders were of aluminium and were made with great care so that when any one of them was in the camera the front surface of the plate should be at the same distance from the lens. The camera was built by the Consolidated Optical Co., at Toronto. The plates used in testing for the Einstein effect were of plate-glass, 3/16 inch thick, specially supplied by the Eastman Kodak Co., of Rochester. The emulsion was "Seed 30". The camera was covered first with heavy farmer's satin

and then with rubber sheeting. The lens, which was made by Brashear, had a clear aperture of 6 inches and a focal length of 11 feet, and it weighed 37½ pounds. The camera tube weighed about 250 pounds.

The polar axis consisted of a rectangular wooden frame 8 feet long and 23 inches wide (outside measurement) and 6 inches deep. The frame was made from hard maple, three strips 6 inches wide and 7/8 in. thick being glued and then bolted together. It is seen in Plate IV. At the lower or north end the steel axis was 1 7/16 in. in diameter, that at the upper or south end was 1 3/16 in., and they turned in S.K.F. bearings.

The piers, or supports, at the two ends were made of pine, except the tops, which were of hard maple. They were bolted and screwed together, and when taken to pieces were packed in a single box.

The camera was held in declination by an iron rod having one end fastened to the camera and the other to the wooden rectangle. A slot at the camera end allowed a certain amount of change in declination, but during the observations the rod was clamped tight, that is, the declination was fixed.

The camera was moved in right ascension by a clock (made by Cooke) mounted on the inner face of the lower pier. The worm-wheel, which could be clamped to the axis, is seen in the photograph. There was a differential slow motion on the clock which was operated by means of a cord held by the observer at the plate-end of the camera, as he looked into the guiding telescope. This had an aperture of 4½ inches and a length of about 6 feet, and it was mounted on the camera in such a way that it pointed to Beta Virginis, which was about 2½° from the sun, when the sun was at the centre of the photographic plate.

To protect the camera from the wind and from direct sunlight a wall of cotton duck 14 feet high was built around it. The framework for this is seen in the photograph. This shelter also had a roof, which could be pulled aside for observations. In order to keep down the dust as much as possible the ground inside and around the shelter was covered with red sand carried to us by the aborigines Moses and Tommy,—father and son. Much of the time this sand was kept moist with water brought to us in empty kerosene cans by the same useful people.

A few feet east of the Einstein camera another polar axis was erected, on which were mounted two cameras, one of one inch aperture with a Nicol prism over it and the other one stopped down to give an equally bright image. The focal length of the former was 36 inches, of the latter 33¾. The object was to secure photographs in natural light and also in light polarized in different azimuths and with varying exposures. The plates were 3¼ by 5½, mostly of Seed Emulsion 30. Before being developed the plates were placed in a sensitometer behind a brass plate in which were holes near its edge of different sizes, and then exposed to a constant source of light for the same number of seconds as the photographic plate was exposed during the eclipse. In this way there were obtained spots on the plate of varying density which, by means of a photometer, could be compared with the photographs of the corona. The method is that used by Parkhurst at the Yerkes Observatory.

In addition, observations were made on the shadow-bands. By means of two ordinary cameras and one "movie" camera, attempts were made to secure photographs of these weird apparitions, but without success. Interesting visual observations, however, were secured. Two white sheets were stretched on level ground and a rod about six feet long, pivoted near its middle, was laid on each. One sheet was used for the bands before totality and the other for those after it. As soon as the bands appeared the rod was moved about so that its length was parallel to the crests of the waves.

Further, measurements of the general sky-light during totality were made by reading print of different sizes and also by exposing two photographic plates in the sensitometer. A photographic plate was exposed to the corona only, in an endeavour to determine its general brightness, but the plate was somewhat over-exposed.

Practically everyone had arrived at the camp by the evening of Thursday, August 31, but the last package of freight was not delivered until Saturday afternoon. By the following Saturday, September 9, the erection of the instruments was nearly completed and during most of the following week we were busy adjusting them. Every day we would make some little alteration or

improvement suggested by experience in handling them. The camera mounting was adjusted with great care in azimuth and altitude and the focus of the lens was determined by photographing the stars at night. The development of these test plates was done under difficult conditions. Mr. Owen, the line-repairer, offered us the use of his house, but we found it almost impossible to keep the developer and the fixer cool enough, and the gelatine films on the plates became soft and easily mutilated. Also there was much dust in the air which settled on the plates if they were placed in a current of air to dry and yet if they were not so placed but kept in a closed space the films required a very long time to dry and would sometimes flow under the high temperature prevailing. As a consequence Dr. Young and I decided that we would not attempt to develop our critical plates at the camp at all, but would take them to Broome, after the eclipse, and try to secure better conditions there.

For the first week the work went forward with anxious haste. At about 6.30 a.m. the camp would be roused by the musical voice of Mr. Rhoades, who walked amongst the tents shouting out an old getting-up call used on board ship. We would rise and don our working clothes, and by this time the sun would be up and the flies would begin to swarm about us. They were the ordinary house-fly though not so large as those we had left at home. But they were very annoying and we continually wore nets hanging from our hats. The continued motion of the net as we were working kept the flies away. However they always disappeared at sunset and allowed us to rest comfortably during the cool nights.

After an hour's work mixing cement or putting instruments together or making necessary alterations to apparatus we would have breakfast—a substantial and well-prepared meal—and then to work again! Lemonade was served in the mess-tent at 11 a.m. and lunch at 1 p.m. At 4 p.m. was the inevitable afternoon tea, and when darkness came on we would wash up for dinner at 7, eaten in peace after the flies had gone

At the end of a week the preparations were rather ahead of schedule time and we spent Sunday at the sea-shore, bathing in the surf and walking the beach in search of shells, many beautiful specimens of which we found. During the second week most of

the observations for adjustment were made at night, but as almost every night was clear good progress was made in this work. During the third week we held numerous rehearsals of our programme. Mr. James Kean, one of the Naval party, would stand on a box with a chronometer before him A certain second would be chosen for the beginning of the total phase, the zero hour, and at precisely six minutes before that epoch Mr. Kean would call out "Six minutes before!" Everyone would be at his post. Four minutes later he would call, "Two minutes before!" Then "Thirty seconds before!" Director Campbell would be looking through the finder of his Einstein camera and when he would (in imagination) see the moon just cover the sun and the corona flash out he would shout "Go!" Then Mr. Kean would count the seconds, One! Two! Three! . . . Fifty-nine! One minute! One! Two! etc., until some seconds after the time totality was supposed to end. This practice continued until the fateful day arrived, and then the last performance was enacted under perfect weather conditions.

Dr. Young and the writer handled the Einstein camera. He did the guiding and also assisted to insert the plate-holders and to remove them. Mr. William Owen, the telegraph-line repairman, removed and replaced the cap from the lens. The exposures with the two smaller cameras and the orienting of the Nicol prism were carried out by Miss Elizabeth H. Chant, while the plate-holders were handled by Messrs. L. Starling and F. Sinclair, of the Naval party. Mrs. Chant made observations on the shadow-bands; she also tested the brightness of the sky by reading type of different sizes, and exposed two plates to register the sky-light. The shadow-bands were very faint. They appeared about two minutes before totality and 15 seconds after. The general illumination was roughly equal to a candle at a distance of two feet. More accurate results will be given at a later time. In the evening one more exposure to stars was made and our observations were over!

Next day (Friday) we began to take down and pack up and by Saturday noon our last case was closed. They were transported to the beach as they had been brought up, namely, by donkey team. We slept at the camp for the last time on Sunday night. The navy warship *Geranium* reached Wallal, anchoring about seven miles out, ready to tow the *Gwendoline* back to Broome.

The schooner had arrived some days before. After some delay through heavy surf we at last got started. There were many interesting and amusing experiences before we were all stowed away and ready to go, but I have not space here to describe them.

We reached Broome on the morning of Thursday the 28th. Here we were entertained at the Palace of Bishop Trower and at the "Residency", the house of Colonel Mansbridge, the Resident Magistrate, and received many kind attentions from the citizens in general. Dr. Young's room at the hotel was made suitable for photographic work, and the Mayor, Mr. Clarke Hall, furnished an abundant supply of rain-water, while the local ice-making company made us ice from rain-water. In this way the developing of our plates was carried out with comparative comfort. We found that we had two Einstein plates of good quality; a third plate taken in the Einstein camera on a Seed 23 plate with a shorter exposure, not for the Einstein problem, was not quite so satisfactory. With the smaller cameras some 20 exposures were made and about 14 of the plates will be suitable for photometric measurement. The Einstein comparison plates had been secured through the generous assistance of Director Campbell. Dr. Trumpler went to Tahiti in April taking the Lick cameras with him. There he mounted them and secured the required night comparison plates in May and June. The Toronto camera was shipped to Tahiti in May. It was there placed in the Lick mounting, which it had been made to fit, and Dr. Trumpler obtained seven plates for comparison purposes. All the plates are being measured at the Dominion Astrophysical Observatory at Victoria, but it is impossible to state when the reductions will be completed and the results ready for announcement.

In closing this brief descriptive account of our work I wish to mention some bodies and persons to whom the expedition from Canada is indebted. The University of Toronto defrayed the quite considerable cost of the apparatus and of the freight on it to and from Australia. The University also made a generous contribution to the travelling expenses of the writer. The Dominion Government, with the approval of Director J. S. Plaskett, gave leave of absence to Dr. Young and also contributed to his ocean travel. The Council of the Royal Astronomical Society of Canada,

from its limited funds, made a generous grant to the writer towards the expenses of the expedition. However, in view of the urgent need of better accommodation for the headquarters of the Society, this has been returned, with the request that it be added to a building fund started some years ago, but which has grown very slowly lately. But especial acknowledgment should be made of the assistance and hospitality received in Australia. The Federal Government provided the transport of the expedition from Sydney across the continent to Freemantle by rail and thence to Wallal by water, steamer and schooner; and, after the eclipse, the return to Sydney. This Government also supplied the men from the Royal Australian Navy who put up the camp, provided our sustenance and assisted in the erection of the instruments. This was indeed a great service and was fully appreciated by all the members of the expedition. The Governments of the states, and of the cities at which we stopped gave us a cordial and generous welcome which will always remain a bright incident in our lives. In addition many valued personal friendships were made. Indeed everyone we met seemed anxious to render us all possible help to make our expedition pleasant and successful. It was the experience of a life-time.