Some modern telescope constructions

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SOME MODERN TELESCOPE CONSTRUCTIONS.

By Mr. Arthur R. Hinks, M.A.
(Chief Assistant at Cambridge Observatory).

Lecture delivered on Thursday, January 11th, 1912.

Mr. Arthur R. Hinks, M.A. (Chief Assistant at the Cambridge Observatory), first described the 19-ft. *coudé* equatorial erected at Cambridge to the design of Sir Howard Grubb. The bearings of the polar tube were mounted on heavy concrete piers, the upper end of the tube entering the observer's room, while at its lower end a second tube was pivoted at right angles and carried the object glass, the rays from which were reflected to the eye-piece by a plane mirror. This mirror was caused to bisect the angle formed between the tubes by means of flexible steel bands passing round drums, one of half the diameter of the other. The driving mechanism was the only example of Grubb's electrically controlled clockwork thus far installed in this country. It was timed from a 120 lb. free pendulum bob, which made electrical contact through a blob of mercury at the lowest point of each excursion. The pendulum was given an impulse every now and then, as might be necessary. An exactly uniform movement was not wanted for the telescope, owing to the influence of refraction, which was responsible for a losing rate of from two to three hundred seconds daily. In order to compensate the effect of refraction the observer had to be able to vary the rate of the pendulum, which was done by means of lumps of lead placed in or removed

from a dish fixed half-way up the pendulum, each ounce of the lead corresponding to about 10 seconds per day. The objective was a Cooke photo-visual of 12½ins.; and it had the great advantage that the visual qualities were as good as the photographic. Unfortunately, they could not get so large a glass as they would have liked. A difficulty they found was that mottled patches and threads appeared on the surface of the lens, as had been described by Sir Norman Lockyer; but a much more serious defect was that the objective was highly subject to temperature changes.

Mr. Hinks then referred to an important paper on "The Modern Reflecting Telescope," contributed to the proceedings of the Smithsonian Institution by Prof. G. W. Ritchie, of the Yerkes Observatory. The methods used by that gentleman in constructing his reflecting surfaces were of a very elaborate nature, and correspondingly expensive; but having the advantage of large funds at his disposal, Mr. Ritchie had produced extraordinarily perfect instruments. He had made spherical mirrors of 20 feet focal length, with zonal errors not amounting to one-hundredth of an inch, as shown by the application of the knife-edge test at the centre of curvature. For the testing of a paraboloid, after the spherical mirror had been figured to that curvature, Prof. Ritchie used a plane mirror of the same diameter; and that flat surface was in the first place tested by means of the spherical mirror (by successive reflection of the rays from an illuminated pinhole at the centre of curvature). Then this paraboloidal mirror was used for testing the convex hyperboloid of the telescope; and the final result was that a superfluous plane mirror was left on hand. Prof. Ritchie's methods were unnecessarily refined; as in practice it was found that the size of the photographed star images did not correspond with the indications of theory. Many of his stellar photographs, however (shown on

the screen), were remarkably fine, and, in fact, unique; and his 5 ft. reflector was probably the finest piece of optical work that had ever been done and testified to the superb skill of the maker.

A noteworthy fact observed was that slight tarnishing of the silvered surface of a mirror had been found to interfere very little with its photographic efficiency. The lecturer also added the remark that they (at Cambridge) sent their objective to the makers at York for the purpose of having the alkaline efflorescence removed by dipping the affected lens in dilute sulphuric acid. That part of the work could be done in five minutes; but they did not attempt to deal with it at Cambridge because of the difficulty of correctly re-centering the lenses after taking them apart.

A Modern "Lost Art."

The Chairman having referred to the beauty of the stellar photographs shown, and the great interest of the subject which had been so ably brought before them, invited a discussion.

Mr. Butler suggested that part of the temperature change that had been complained of in the Cambridge objective might be due not to the glass but to the air space. He mentioned, among other matters, a remarkable two lens objective at South Kensington, of which the achromatism was practically perfect. He was anxious that an investigation should be made to determine the chemical constitution of the glass, if it were possible to do so.

In reply to the Chairman, Mr. Butler said that the glass in question was manufactured by Messrs. Henri, of Paris, in 1891.