to the kindness of Mr Christie, astronomer royal. The object-glass will be actually outside the dome when the telescope is pointed near the zenith or near the horizon. The dew-cap, not shown in the model, will be always outside the dome, and it is not impossible that this arrangement may be favourable to good definition, except in case of high wind. When the telescope is not in use the dew­cap slides backwards on four rails parallel to the axis of the tele­scope, and the whole is housed in the position shown in fig. 19. The spectroscope is used at right angles to the telescope tube, a right-angled prism of total reflexion being interposed in the con­verging cone of rays near the focus. This prism can be turned 180o and an eye-piece inserted on the opposite side from the spectro­scope for observations near the zenith or horizon, otherwise the eye end would be too near the floor or northern pier.@@@1

A figure of the new photographic telescope erected at the Paris observatory may be seen in *Nature,* 13th May 1886. The object­glass is by MM. Paul and Prosper Henry, the mounting by Μ. Gautier. Here Airy’s braced tubes are replaced by hollow metal beams of triangular shape (as for the Liverpool equatorial). The hour circle has two toothed circles cut upon it, one acted upon by a screw attached to the pier and driven by the clock, the other by a second screw attached to the polar axis, which can be turned very slowly by a handle in the observer’s hand. Thus a very slow movement can be given to the telescope in right ascension, inde­pendently of the clock. Slow motion in declination can be com­municated by a screw acting on a long arm, which can be clamped at pleasure to the polar axis by a convenient handle. An oblong metallic box, fitted with pivots, whose bearings are attached to the triangular beams, forms the tube for two parallel telescopes ; these are separated throughout their length by a metallic diaphragm. The chromatic aberration of the object-glass of one of these tele­scopes is corrected for photographic rays, and the image formed by it is received on a highly sensitive photographic plate. The other telescope is corrected for visual rays and its image is formed on the plane of the spider lines of a filar micrometer. The peculiar form of the tube is eminently suited for rigid preservation of the relative parallelism of the axes of the two telescopes, so that, if a certain selected star is retained in bisection by two intersecting wires in the micrometer, by means of the driving clock, aided by small corrections given by the observer in right ascension and de­clination (required on account of irregularity in the clock move­ment, error in astronomical adjustment of the polar axis, or changes in the star’s apparent place produced by refraction), the image of a star will continue on the same spot of the photographic plate during the whole time of exposure. Exquisite photographs of star clusters, double stars, the moon, and planets have been obtained by MM. Henry, and they are the most eloquent testimony to the optical perfection of the object-glass and the efficiency of the mounting. They show also that we are entering upon a new era in practical astronomy, in which photography is destined to play a leading part. The Henry photographic object-glass is of 13∙4-inches aperture and only 10 apertures in focal length. The “guiding telescope ” is of 9½-inches aperture and nearly 12-feet focus. The photographic object-glass, notwithstanding its small proportional focal length, covers a field of 2½o in diameter with perfect precision.

Many more telescopes have been made of type C than of any

other, and it is now almost exclusively employed for the mounting of modern refractors. Its essential features are (1) a comparatively short polar axis and (2) a cross-head attached to the extension of the upper pivot of the polar axis, to carry the bearings of the declination axis. Fig. 20 shows the Dorpat refractor, the *chef d’œuvre* of Fraunhofer, and the

first equatorial of any importance that was pro­vided with clockwork. AA is the polar axis, B the

hour circle graduated on the face and read by the

vernier V. C' is the driving clock, which turns an

endless screw S, that gears in the toothed edge of the

circle B. D is the cross head supporting at its

extremities the bearings of the declination axis.

The wooden telescope tube rests in a strong

cradle FF of cast brass, which is screwed to a

flange on one end of the declination axis ; the de­clination circle EE, which is attached to its op­posite end, serves to clamp the instrument in

declination to the arm G. H is a weight acting on a

lever which presses the wheels *k*  (one only seen

in the figure) against the upper pivot of the polar

axis in order to relieve the friction of that pivot

on its bearing. The counterpoise W balances the tube about the polar axis. Μ, M are counterpoise weights which act on levers *m, m,* whose fulcra are universal joints at *n* attached to the cradle.

These weights serve to counterpoise the longer end of the tube and to check its flexure. QQ is the finder, a small telescope whose axis is parallel to the great telescope; having a low magnifying power and a large field of view, it serves to direct the large telescope to any object seen in the sky, which otherwise would be difficult to find in the comparatively limited field of the large tele­scope. The stand TTT is of oak. The instrument is described in detail by Struve (*Beschreibung des auf der Sternwarte zu Dorpat befindlichen grossen Refractors von Fraunhofer,* Dorpat, 1825, fol.). The instrument was an enormous advance upon all previous tele­scopes for micrometric research. In the hands of Struve results were obtained by it which in combined quality and quantity had never before been reached in micrometric research. Its success was such that the type of Fraunhofer’s telescope became stereotyped for many years not only by his successors but throughout Germany. When twelve years afterwards Struve ordered the 15-inch refractor for the new observatory at Pulkowa, the only important change made by Fraunhofer’s successors was, at Struve’s suggestion, the substitution of a stone pier for the wooden stand in the original instrument.

Both the Dorpat and the Pulkowa refractor are defective in rigidity, especially in right ascension. The declination circle is most inconvenient of access, and slow motion in declination can only be effected when the instrument is clamped by a long and inconvenient handle, so that practically clamping in declination was not employed. The slow motion in right ascension is defective, being accomplished in the Dorpat refractor by changing the rate

@@@1 These inconvenient conditions are imposed by the dimensions of the exist­ing dome and may lead to accidents in practice.