to be considered, and we should abolish all complicated anti-friction apparatus for the declination axis, retaining it only for the polar axis to save wear in the teeth of the driving arc. Finally, instead of making the finder a short telescope attached to the eye end of the instrument, we should give it a focal length equal to that of the great object-glass, attaching the cell of its object-glass rigidly to the cell of the large object-glass and its eye end to the butt end of the main telescope, in order to secure the utmost rigidity in the relations of the axes of the two tele­scopes. Such a finder would corre­spond in efficiency to that of the Henry photographic telescope, and would be available as a guid­ing telescope in photographic work, or for keeping a star exactly on the slit of a spectroscope.

The first important in­struments of type D

were Mr Lassell's re­flectors, the largest of which, and the last, is represented in fig. 29. The polar axis is suffici­ently rigid, but the long and comparative­ly slender

forks which carry the pivots of the central cradle are elements of instability, especially when the instrument is directed to an object of considerable hour angle. There is practical confession of this instability in the cross-bracing which connects the two forks, and which must be removed if the telescope is pointed to an object between the zenith and the elevated pole.

The best example of type D is the reflecting telescope of 36-inches aperture designed by Mr. A. A. Common, with which his exquisite photographs of nebulæ, &c., were made. The principal preliminary conditions which he laid down as necessary were the following@@1 :— (1) no tube properly so called, to avoid air-currents in the tube ; (2) no mass of metal either below or at the side of the line joining the large and small mirrors, to avoid currents from possible difference of tempera­ture between the mass of metal and the surrounding air ; (3) an equatorial mounting capable of direction to any part of the visible hea­vens and of con­tinued observation past the meridian without reversal ; (4) an efficient means of supporting the mirror without flexure; (5) driving clock ; circles to find or identify an object, and motions taken to eye end ; (6) a mounting which will give the greatest amount of steadiness with the least amount of friction. Fig. 30 is a section of the instrument in the plane of the meridian. DD1 is a cast-iron hollow cylinder, accu­rately bored out, attached to a strong base block. D2 is a cover bolted on the bottom of this cylinder, in the centre of which is a tapering steel pin D3, which enters a corresponding hole in the bottom of the polar axis E, and serves as the lower pivot of

the polar axis. The cylindrical part of the polar axis is accu­rately turned to a diameter one-eighth of an inch less than the outer cylinder, and the otherwise severe friction on the pin D3 is relieved by filling in the space between D and E with mercury, so far as sufficient nearly to float the whole moving part of the telescope. The upper elbow-shaped part of the polar axis E2 is flanged and bolted to the lower part. In the section at right angles to that exhibited in fig. 30 this elbow-shaped part is T-shaped, and the cross of the T is bored to receive the declination axis ; and, as the elbow puts the polar axis considerably out of balance, the T-shaped head is carried forward of the axial line about 1¼ inches, so that the whole weight of the telescope above just restores the balance. Two heavy weights X, X counterpoise the eye end F with the four braced tubes T, T which support it. B is the declination circle. It is impossible to describe this fine instrument adequately within our limits ; we mention as specially worthy of study the method of supporting the mirror and the eminently ingenious and practical form of the observatory, and refer the reader to Common’s illustrated account of the instrument in *Mem. R.A.S.,* vol. xlvi. pp. 173-182.

There is also an admirable mounting of type D designed by Lord Rosse for his 3-foot reflector at Birr Castle, described by him in *Phil. Trans.,* vol. clxxi. p. 153. The instrument is planned on the broad lines of Lassell’s telescope (fig. 29), but the badly planned and weak fork of the latter is replaced by a thoroughly rigid bent fork made of boiler plate a quarter of an inch thick, firmly riveted to angle iron of 2¼ × 2¼ × 5/16 inch scantling along each angle, the whole, as we have proved by trial, being exceedingly rigid. It would be an improvement to adopt Mr Common’s plan of putting the declination axis a little out of the line of prolongation of the polar axis, and thus dispense with the counter-weight ; and we should prefer hollow steel tubes with push and pull bracing rather than the angle iron rods and bracing which form the tube.

In the *Proceedings* of the Royal Dublin Society (vol. ii. p. 362) Grubb describes a “ siderostatic telescope,” which forms a good elementary example of type E. In fig. 31 TT is the tube of a tele­scope of 4-inches aperture, which is mounted to rotate about its axis, the latter forming the polar axis. MM is a plane mirror reflecting rays from a star S to the object-glass, so that its image can be viewed from the eye-piece at E. The star is retained in the field by the clock C. Stars of different declination can be viewed by rotating the mirror on its axis G, and in different hour angles by rotating the tube upon its axis. The instrument in European latitudes cannot command a view of the heavens between the elevated pole and the zenith unless the distance OG is made exceedingly great ; even then only a limited range beyond the zenith is possible. The instrument is pri­marily intended for solar spectro­scopy, and thus these draw­backs do not apply. The resulting ad­vantage is that the ob­server may be in complete darkness and his observa­tions are not interrupted by change of posi­tion.

In *Comptes Rendus* for the year 1883, vol. xcvi. pp. 735-741, Μ. Loewy gives an account of an instrument which he calls an “equatorial coudé,” designed (1) to attain greater stability and so to measure larger angles than is generally possible with the ordinary equatorial ; (2) to enable a single astronomer to point the telescope and make observations in any part of the sky without changing his position ; (3) to abolish the usual expensive dome, and to substitute a covered shed on wheels (which can be run back at pleasure), leaving the telescope in the open air, the observer alone being sheltered. These conditions are fulfilled in the manner shown in fig. 32. EP is the polar axis, rotating on bearings at E and P. The object-glass is at O, the eye-piece at E. There is a plane mirror at M, which reflects rays converging from the object-glass to the eye-piece at E. A second mirror N, placed at 45o to the optical axis of the object-glass, reflects rays from a star at the pole ; but by rotating the box which contains this mirror on the axis of its supporting tube T a star of any declination can be observed, and by combining this motion with rotation of the polar axis the astronomer seated at E is able to view any object whatever in the visible heavens, except those situated between 10h and 12h hour

@@@1 *Monthly Notices R.A.S.,* vol. xxxix. p. 384.