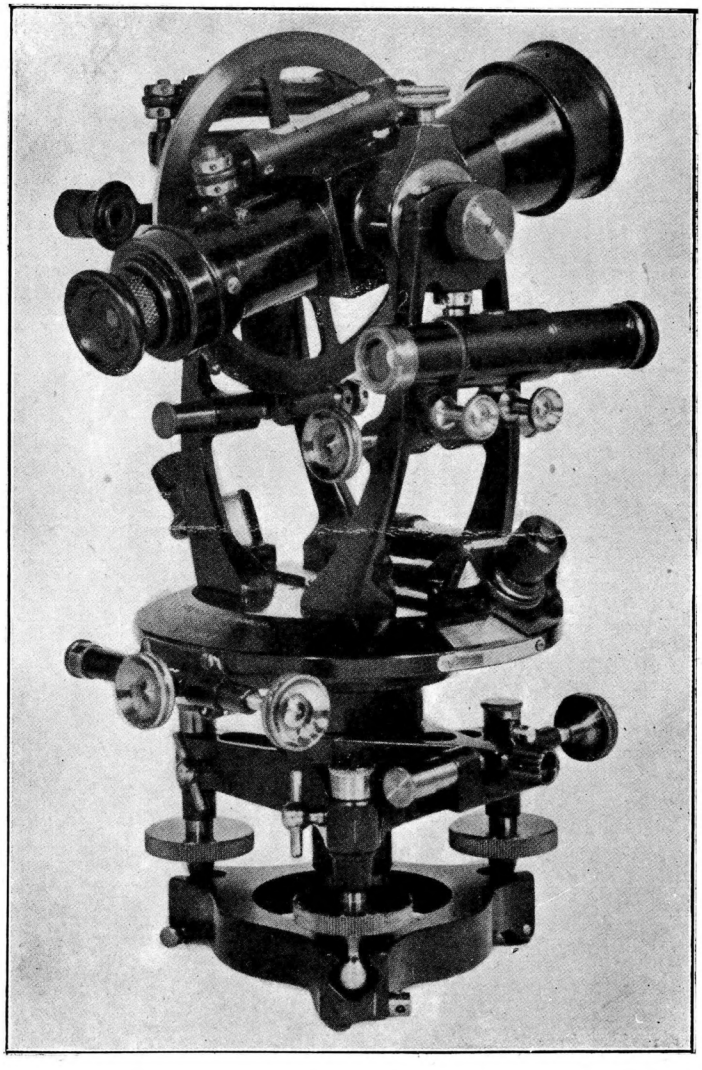

Fig. 1

INTERNAL-FOCUSSING ANALLATIC TACHEOMETER

Fig. 1 illustrates an anallatic tacheometer, in which the makers, Messrs. COOKE, TROUGHTON and SIMMS, Limited, of Broadway Court, Westminster, London S.W.I., have combined exceptional optical and mechanical qualities. The telescope, though the objective has a clear aperture of 1 ½ ins. in overall length, yet has actually as much light-gathering power and as perfect definition as the much longer and heavier telescopes previously used in instruments of this class. It is fitted with internal-focussing gear, and is thus sealed against the entrance of dirt or moisture. The optical system is sensibly anallatic, the correction being only 0.6 ins. even if the staff is only 12 ft. away.

A very simple but effective device has been introduced for ensuring the easy replacement of the instrument in its case. The figures 1, 2 and 3 are engraved in bold characters on appropriate part of the instrument, and similar figures are engraved on the case. By bringing each figure on the instrument up to its opposite number on the case, proper packing is ensured. This is further facilited by the fact that since internal focussing is used, the length of the telescope is always the same.

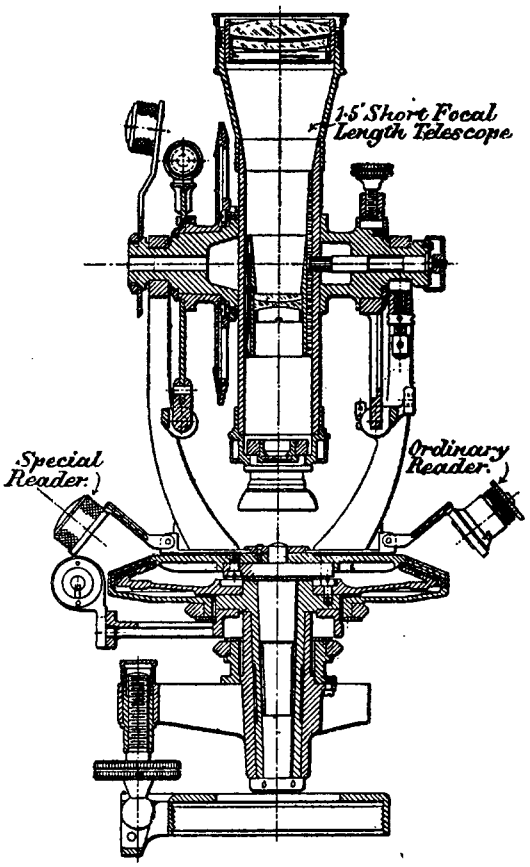

Fig. 2

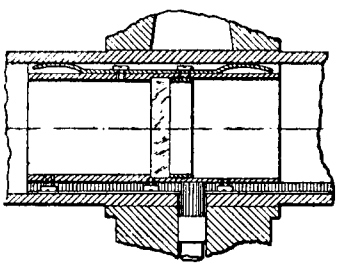

Fig. 3

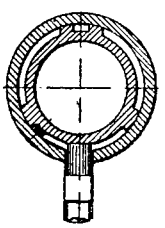

Fig. 4

Figure 2 shows very clearly one characteristic feature of the maker's systems of internal focussing. The focussing head is on the horizontal axis of the telescope, and is thus always in the same position whatever the inclination of the telescope. This arrangement, moreover, tends to give rigidity in use, since there is no tendency to deflect the telescope by the weight of the hand during the operation of focussing. As already mentioned, the object glass has a clear diameter of 1 ½ in. It is an achromatic doublet, with a focal length of 6 ins. The focussing lens is also achromatic, and is of course, negative, the focal length being equal, but opposite, to that of the objective. It is this quality of focal lengths that has made it possible to render the telescope sensibly anallatic without the use of an additional lens. As both the lenses used are achromatic, the definition of the telescope is unusually perfect at short distances.

The details of the carrier in which the focussing lens is mounted are represented diagrammatically in Figures 3 and 4. The telescope body is machined out of duralumin tubing, and the bore is truly parellel and cylindrical. The lens carrier is guided by the ribs shown, and is maintained in easy frictional contact with the telescope tube by the flat spring visible in Fig. 3, An additional spring, not shown in the figure, tends to rotate the carrier in such a direction as to maintain in engagement the teeth of the rack and the pinion, thus eliminating backlash. Thus the focussing movement is exceptionally smooth, the meshing of rack and pinion not being felt.

The diaphragm on which the stadia lines are engraved is of glass.

With the special reader, shown on the left of Fig. 2, perfect definition is secured with the eye 5 or 6 ins. away from the lens, which is an achromatic doublet.

The horizontal circle is totally enclosed. The graduations are cut on a conical surface inclined to the horizontal at an angle of 22 ½ deg. They are thus more conveniently read than if engraved on a flat surface, as is usual in some foreign instruments. The gaps at the verniers are covered with glass, optically worked to a conical surface, so that readings taken through the glass are free from errors of parallax. Careful provision is made for illuminating the graduations solely by scattered light.

Fig. 5. SECTIONAL ELEVATION.

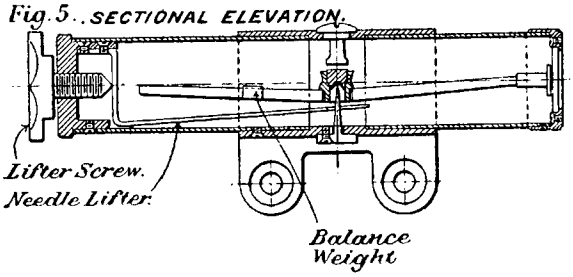

Fig. 6. PLAN.

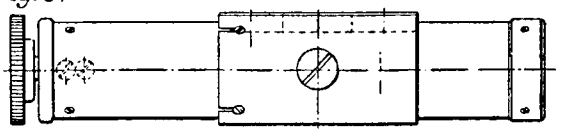

Fig. 8. END VIEW.

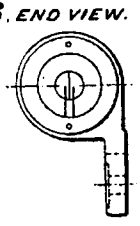

Fig. 7.

Fig. 9
END VIEW OF NEEDLE.

The conical centres of the instrument are finished by scraping to a fit, and not by grinding, as is the general practice. It is, however, quite impracticable to remove the last traces of the abrasive used in a grinding operation, and centres thus finished tend to lose their accuracy in the course of time. As stated, no abrasive whatever is used by Messrs. COOKE, TROUGHTON and SIMMS, but the surfaces are bedded by hand scraping, for which a highly-skilled craftsman is required. The difference in the feel of scraped and ground centres is very striking.

The tacheometer is mounted on three levelling screws, the ball feet of which do not, however, rest in cylindrical holes, as is common practice, but bear on flat surfaces as seen in Fig. 1, Any wear is, therefore, easily taken up by means of the tightening screws shown, and great rigidity is thus secured. As will be seen on reference to Fig. 2, the levelling screws are not screwed directly into the three-armed spider, but into split sleeves, which can be tightened up by adjusting screws. In case of wear, it is not necessary to scrap the whole head, but merely to replace the worn sleeves.

Following the invariable practice of the makers, the screw by which the tacheometer is attached to its tripod is a standard size. Any of the firm's medium-sized surveying instruments will therefore screw on to any one of their tripods.

Three spirit levels are provided, one on the horizontal plate, another on the vernier carrier for the vertical circle, and a third on the telescope. These differ in sensitiveness, but are otherwise interchangeable. Hence, in case of accident in the field, they can be changed about as may be necessary.

The compass supplied with the instrument is of a somewhat special type, and is illustrated in detail in Fig. 5 to 9. The needle is mounted inside a dust-tight tube, and at its right-hand end (see Fig. 5) carries a small disc, on which is engraved a fine line as indicated in Fig. 9. At the same end, the tube is closed by a glass diaphragm, engraved as indicated in Figs. 7 and 8. In taking a magnetic bearing, the line shown in Fig. 9 is brought midway between the lines on the glass diaphgragm, and the bearing can then be read from the horizontal circle of the tacheometer within five minutes of arc. Readings accurate to within one minute of arc may be taken with a somewhat more elaborate compass, in which the knife edge of the end of the needle is observed against a suitably marked diaphragm by an eyepiece of power 20.