A 6-METRE POLAR-VIEWING TELESCOPE

E.B. Gajur
Special Astrophysical Observatory, Nizhnij Arkhyz,
Stavropolskij Kraj 357140, USSR.

The construction of a 6 metre polar-viewing telescope has been proposed (Karachentsev and Gajur, 1979), based upon the use of the paraboloidal primary mirror installed originally in the 6m BTA at Zelenchukskaya and later replaced by a mirror of improved performance. The mirror would be mounted with its axis in a fixed orientation pointing to the celestial pole and observations would be made at the prime focus using instrumentation mounted on a pylon. Object tracking is then performed by rotation of the detector around the point which represents the "image" of the celestial pole. In particular, the polar axis may coincide with the optical axis of the system.

The scientific program of the polar telescope consists of an exhaustive study of objects in a small field of the sky with the best seeing. It includes: obtaining direct photographs of the faintest objects by collecting and summing a large number of individual photographs; a spectral survey of galaxies and stars to magnitude 23-24; photometry of objects to magnitude 24-26; and solution of the cosmological problems posed by these observations. Extrapolation of present observational data indicates that there are several thousands of stars brighter than magnitude 28, and tens of thousands of extragalactic objects within the 36 arcmin field of view of the polar telescope. It can be used in many other ways, for example with scientific and technical programs to refine observational equipment, and to test methods of compensation for wave front distortions caused by the objective or atmosphere.

Figure 1 shows the proposed arrangement for the polar telescope. The primary mirror is mounted in a cell and rests on support units which are simpler than those of the BTA. The cell itself is supported at five points above a platform resting on three hydrostatic pads, the surfaces of which are part of a sphere centred at the centre of gravity of the mirror-platform system. This construction allows correct orientation of the optical axis of the mirror. The whole installation is located in a dome of diameter 10m; the dome is fixed, with a shutter on its north surface.

C. M. Humphries (ed.), Instrumentation for Astronomy with Large Optical Telescopes, 45–47.
Copyright © 1982 by D. Reidel Publishing Company.

https://doi.org/10.1017/S0252921100083330 Published online by Cambridge University Press

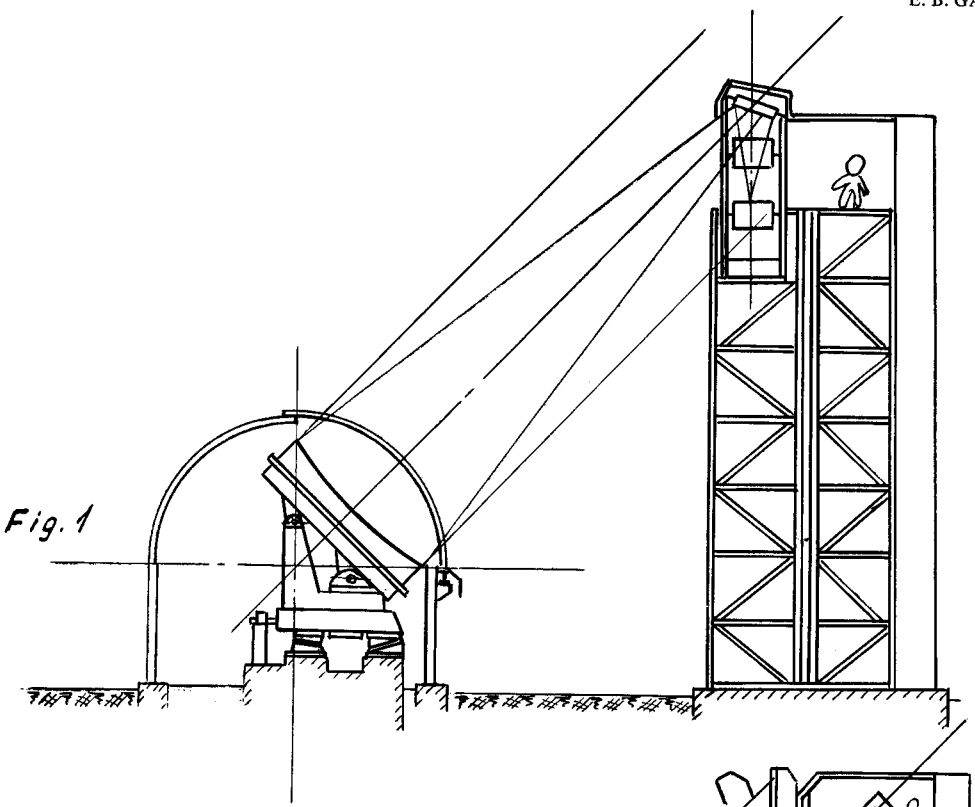

Fig. 1

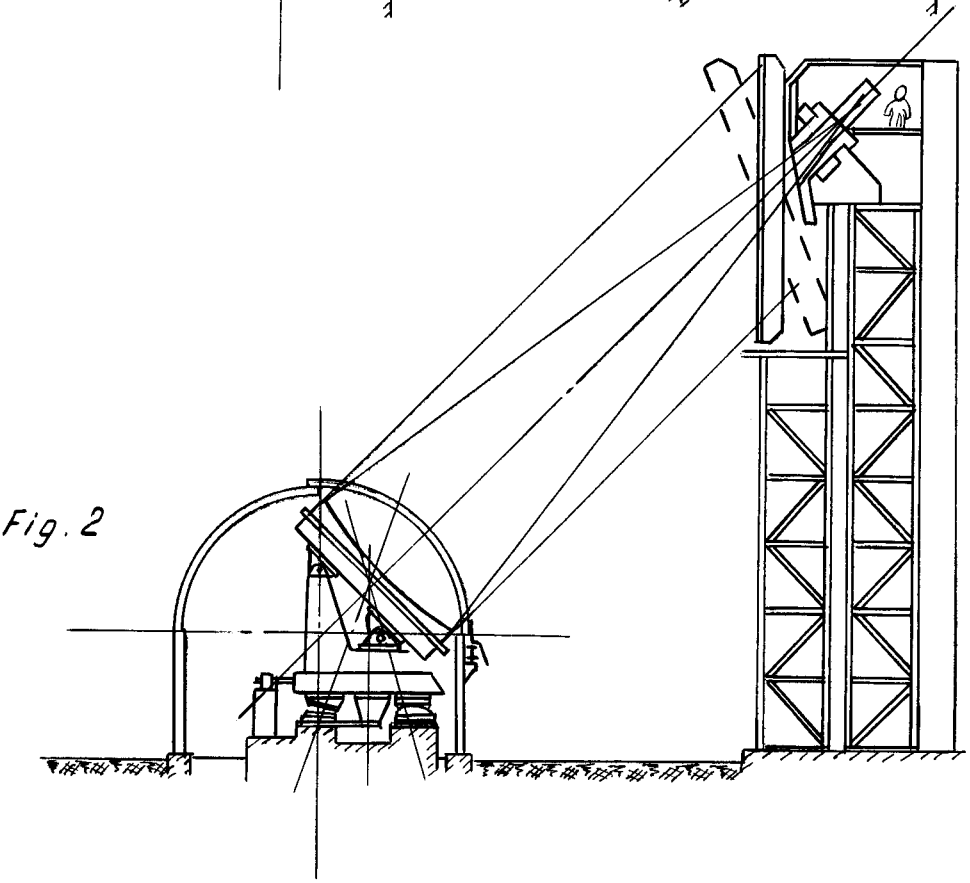

Fig. 2

https://doi.org/10.1017/S0252921100083330 Published online by Cambridge University Press

The flat mirror, the field corrector lens and the focal pier are placed on a steel latticed pylon of height about 20m. The focal pier consists of a cage moving along the optical axis for image focusing, a rotating table, and a radial platform with flanges for mounting detectors. To set the slit or diaphragm on the object, the table is turned to the correct position angle and the platform is adjusted radially. Tracking of an object is accomplished by rotating the table at a velocity of one revolution per 24 hours.

As Figure 1 shows, a modified Newtonian system is used. The focal plane lies above the focal pier and the part of the optical axis below the flat mirror is directed vertically. Such a system possesses certain advantages. The focal pier can be made rigid and compact, and the vertical position of the rotating table's axis is the most suitable from the point of view of load distribution, giving convenience for installing equipment on the flange and for observations. In addition, compensation for wind and for temperature fluctuations of the pylon can be made should these exceed the permissible values. And, since the polar telescope has no tube structure and only a small dome volume so that turbulent effects resulting from temperature gradients within the dome will be small, the images obtained with this telescope are expected to be better than those obtained at the BTA.

An alternative use of the polar telescope would be to transform it into a siderostat for observations in the southern sector of the celestial sphere. Preserving the mounting arrangement described above for the primary mirror, a flat mirror of dimensions 8.5 x 6m held in a fork mounting would be installed on the pylon as shown in Figure 2. The construction of a compound flat mirror of this size is within current technological capabilities and has some features which are similar to those used in recent designs for large telescopes of the future.

REFERENCES

Karachentsev, I.D. and Gajur, E.B. 1979, Project 'POLE' for the use of the 6-meter mirror, SAO, Academy of Sciences, USSR.

https://doi.org/10.1017/S0252921100083330 Published online by Cambridge University Press