Opposite page, top:
The Wyoming 2.34-m infrared telescope is typical of modern designs, allthough its English Yoke equatorial mounting is not frequently encountered.

Now, all five kinds of information can be obtained in no more than 18 hours. At the University of Cambridge there is a still newer Automatic Plate Measuring machine, designed by Edward Kibble-white. It utilises laser scanning and has elaborate electronic circuitry. A result of its work is shown on page 226.

In one field of astronomical research – the Sun – some specialist equipment has been devised, since here there is plenty of light available and special forms of analysis may be carried out. Usually the Sun's light is fed by a **coelostat** – an arrangement of two mirrors, one of which is equatorially mounted – to a large high-resolution spectroscope. The mirrors may be mounted – as at Mount Hamilton in California – on a tower and made to feed sunlight down to a cool underground chamber where the spectroscope is situated, or to feed the spectroscope by way of a sloping tunnel as at Kitt Peak Observatory in Arizona (Fig. 9·8). Another development is the **spectrohelioscope** – a spectroscope which scans the Sun's image in the light of a particular spectral line, and effectively acts like a very selective filter; it allows the observer to examine some way down into the photosphere (page 76). Highly selective **narrow band filters** are also available for solar work. Yet even the spectroheliscope and the narrow band filter can not show up the corona (page 77) and to do this without waiting for a total solar eclipse the coronagraph must be used. This is essentially a refractor in which an occulting disc acts in place of the Moon to cause a total eclipse, blotting out the light from the photosphere. Great attention has to be paid to avoiding stray light, the object glass has to be extraordinarily highly polished, and the instrument used at high-altitude observatories, where the atmosphere is clean. Even here special precautions have to be taken against dust which otherwise scatters light and degrades the image of the corona.

Another field of recent advancement has been infrared astronomy. Its growth has really been due to the development of highly efficient infrared detectors, typically small semiconductors of germanium or indium antimonide, which, for full efficiency, have to be operated at a very low temperature, being cooled by liquid nitrogen to 77 K, or even to 4 K by liquid helium. There are two serious problems in observing infrared from an Earth-based observatory; the absorption of infrared by water vapour in the atmosphere and the infrared radiation of the atmosphere itself which produces a 'fogging' effect, all but obliterating the infrared signals from celestial objects. The first, the absorption by water vapour, can be reduced by siting an infrared telescope on a high mountain, and it is for this reason that the world's largest infrared telescope or flux collector, the British 3·8 m instrument, is sited on Mauna Kea in Hawaii at a height of 4 200 m. Although the entire range of infrared wavelengths (0·75 μm to 1 000 μm) cannot be observed, even from Mauna Kea, the windows in the atmosphere (near 2 μm, 3·5 μm, 5 μm and 10 μm) allow very valuable work to be done. To minimize atmospheric fogging a 'chopping' technique is used; vibrating mirrors compare the section of sky with an infrared source with another section without a source. This method is also used at optical wavelengths for studies of the magnitude of dim sources.

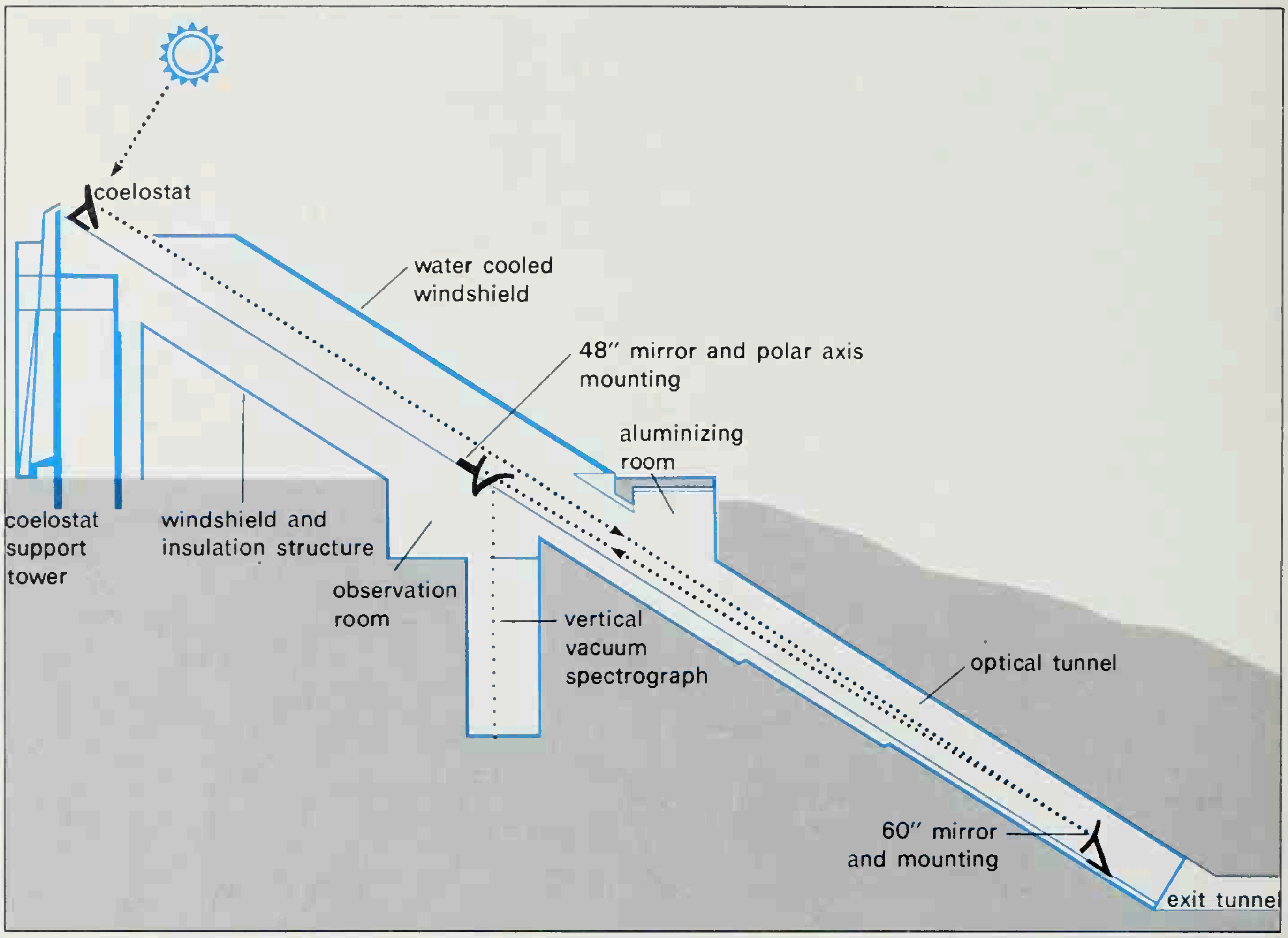

Fig. 9·8 A sectional drawing of the Kitt Peak solar telescope which has a focal length of 91·4 m, and is fed by a coelostat.

Opposite page, bottom:
The 76 m steerable dish at Jodrell Bank. It is on an altazimuth mounting.