this: the altazimuth and the equatorial. The **altazimuth** mounting, as its name implies, allows the telescope to move round in azimuth and up and down in altitude. It is a simple mounting (Fig. 9·7), inexpensive to construct, and has long been used for amateur telescopes. Unfortunately, it suffers from one great disadvantage – two movements, one in azimuth and one in altitude, have to be made to follow a celestial object as it drifts across the field-of-view of the telescope – and for this reason it has dropped out of use for large instruments since the early nineteenth century. Only now, in the late twentieth, with the widespread use of electronics, has automatic control of two movements rather than one become a practical possibility, and beginning with two large optical telescopes – the Russian 6 m reflector and the American MMT (page 232) – an increasing number of telescopes are being mounted in this way. An altazimuth mounting cannot readily follow a star across the zenith – in theory the azimuth and plate rotation would have to be infinitely fast – but this is a very minor disadvantage. The convenience of being able to carry heavy auxiliary instrumentation and, even more important, the much smaller cost for both the mounting itself and for the protective enclosure, mean that it is likely to be used on all new large telescopes. In professional telescopes this means the end of the alternative, which has held supremacy up to now, the equatorial mounting.

The **equatorial** can take a variety of forms, but basically it is an altazimuth tilted over so that the vertical or azimuth axis is parallel to the Earth's axis at that point on the Earth's surface where the telescope is situated. At the north or south geographical poles the equatorial would, in fact, be indistinguishable from an altazimuth, but elsewhere the difference is clear. Because of the tilt, rotation about one axis – the polar axis – allows a celestial body to be tracked with one movement only. The way the polar axis is supported and the telescope fixed to it can vary (overleaf), but the 'horseshoe' and 'English' types are the most common among modern optical instruments. Now such mountings always make provision for having observing equipment fixed at a number of different positions, as Fig. 9·3 shows. For an equatorial large aperture, observations may be made directly at the prime focus when the utmost sensitivity is required, but in a smaller instrument an observing chamber at the front would block out too much light from the main mirror, and the Newtonian focus is used. When heavy ancillary equipment is being used the professional often makes use of the Cassegrain focus (page 229) since quite heavy instruments can be supported below the primary mirror. The third position, the coudé focus, brings the light out to a stationary point. (In an altazimuth mounting, this is known as the **Nasmyth focus**, after its nineteenth century inventor James Nasmyth.) Here, very heavy equipment – a large high-resolution spectroscope, for instance – can be set up, possibly in a chamber of its own. Changing the foci is carried out by changing a mirror at the prime focus, and bringing into operation any other mirrors as necessary. The mirrors at the prime focus – and the observing cage, if there is one – are suspended by narrow section

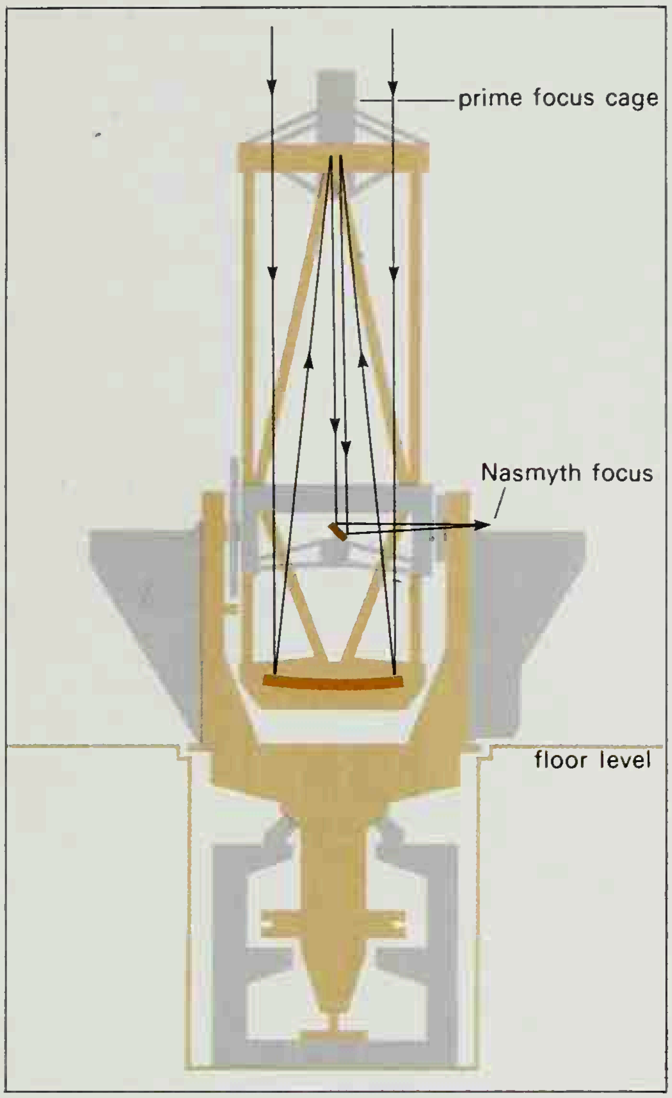

Fig. 9·7 Altazimuth mounting of a modern telescope, showing the prime focus and the Nasmyth focus.

supports, and diffraction patterns from these give rise to the spikes seen crossing bright stars on photographs.

Other optical equipment

Besides cameras, telescopes may feed other ancillary equipment, of which spectroscopes are the chief. These are now made in two forms, either to take photographs or to use photosensitive devices to permit the results to be given in digital form for immediate processing by a computer. This additional use of electronics is an example of a much wider revolution that has come in the handling of observational results. No more than thirty years ago, one could say that for every night spent at the telescope, one spent five nights measuring the plates or otherwise 'reducing' one's data, but now the situation has entirely changed. Plates taken at the telescope are now automatically processed in a machine like the Edinburgh Observatory's COSMOS – so called because it measures the Co-Ordinates, Sizes, Magnitudes, Orientation and Shape of every object on a plate – which now makes it possible to make full use of the large photographic plates (356 mm × 356 mm) taken on a modern Schmidt like the United Kingdom 1·2 m instrument which is surveying the southern skies down to magnitude 23·5 (in blue light). Each plate may contain half a million images and to measure only positions by hand would take many years, so for purely practical reasons the astronomer once had to select which images he would measure.