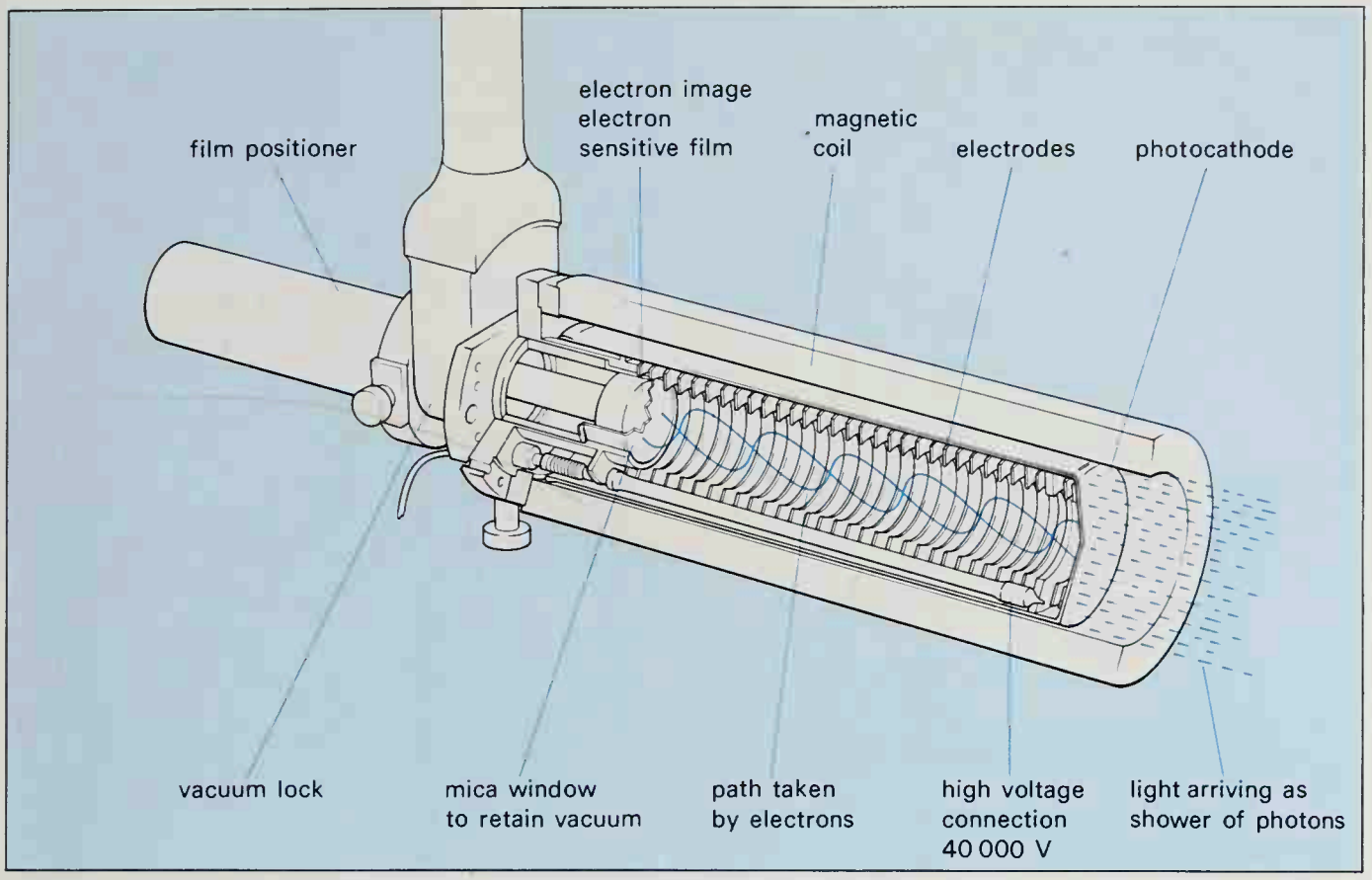
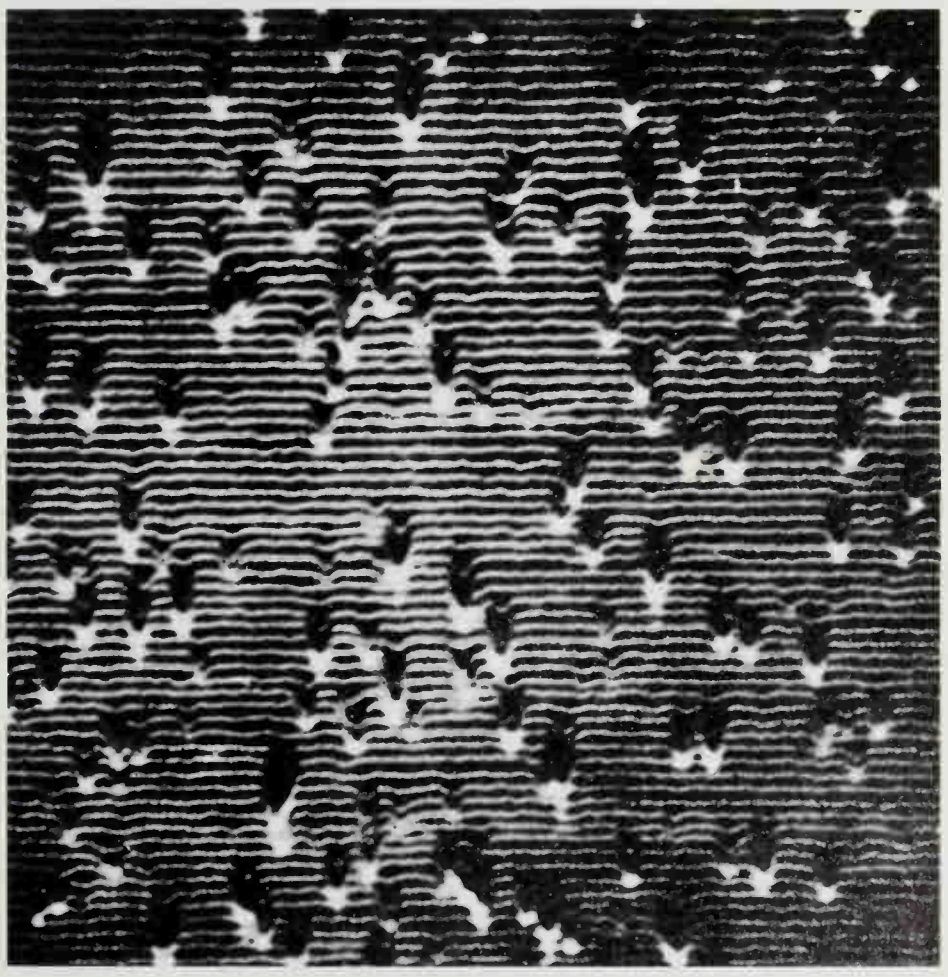


Fig. 9·6. Cut-away drawing of the electronographic camera.

The **image photon counting** system, developed by Alexander Boksenberg, uses a highly sensitive photocathode and electron multiplier which feed a television camera. The electrical signals derived from the incoming light are now dealt with 'digitally', that is, they are converted into a binary code and then analysed by specially developed computer techniques, which eliminate both the unwanted electrical signals generated in the equipment, and also light from the night sky. The equipment is supersensitive, multiplying the incoming light about 7×10^5 times, has good resolving power and measures brightness accurately, while it also terminates observations automatically, so that it can save telescope observing time. With astronomers queueing up to use large telescopes, such saving of observing time has very real advantages.

A further very significant development has been the introduction of the electronic devices known as charge-coupled devices (CCDs). These are microcircuits constructed on a slice of semiconducting silicon in such a way that the active area is divided into an array of picture elements (or pixels), 250 000 or more in a single device. Incoming light photons cause electrons (which are much easier to process) to become trapped in an appropriate 'well' within each pixel. These may then be read out electronically, and, if necessary, subsequently amplified and otherwise manipulated to give a final image which may be displayed on a monitor screen or turned into a standard photographic print. Such tiny devices – no more than a few millimetres square – may be cooled to very low temperatures to reduce 'noise' which degrades the image, and are exceptionally efficient – so much so that they are already beginning to displace the photographic plate in many applications.

Devices such as CCDs, as well as more conventional video equipment (such as the cameras carried by Voyager and other space-probes) and other systems of which the output can be processed electronically, permit the use of computer image-enhancement techniques. Images produced by such methods are very common nowadays, but should not be thought of as just 'pretty pictures'. The various image-enhancement techniques and the use of false colours enable many details to be discerned, in all sorts of astronomical objects.



The raw video output from less than 1 per cent of the image field of the image photon counting system developed at University College, London by Alex Boksenberg. Single photon 'events' are shown.