

**HILGER  
CATALOGUE  
E  
SPECTROGRAPHS**

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**ADAM HILGER LTD., OPTICAL INSTRUMENT MAKERS**

**98 KINGS ROAD, CAMDEN ROAD, LONDON, N.W. 1., ENGLAND**

**DR. MÜLLER'S IMPROVED X-RAY SPECTROGRAPHS**

**FOR PHYSICAL, CHEMICAL, METALLURGICAL, CRYSTALLOGRAPHIC AND RADIOGRAPHIC LABORATORIES, AND FOR THE GENERAL STUDY OF X-RAYS**

*Fully illustrated descriptive booklet post free on application—Hilger Publication No. 58.*

Dr. Müller's X-ray spectrograph was the first complete apparatus to be put on the market which was capable of undertaking most of the better known photographic methods of X-ray crystallography and spectrography.

The latest model is capable of being used for any of the principal methods of X-ray spectrography and crystallography in which photographic recording is made use of and in addition can be employed as an optical crystal goniometer.

It is suitable for X-ray spectroscopic work in that region of wavelengths where air absorption is not high.

The number of moving parts is kept to a minimum so that, as a consequence, the instrument has considerable mechanical rigidity despite its moderate weight and size.

In designing it due regard has been paid to the peculiar requirements of an instrument to be used with X-ray apparatus, both as regards constructional details and materials. Recourse to kinematical principles of design ensures the interchangeability of accessory parts in a simple and accurate manner, avoiding the necessity of frequent adjustments. The extensive use of stainless steel overcomes tendencies to corrosion of important scales and circles in the highly active atmosphere in the immediate neighbourhood of X-ray apparatus; a matter which does not always receive the attention it deserves.

**GENERAL DESCRIPTION OF CONSTRUCTION**

The instrument is made in two forms whose main constructional details are closely similar, since the variations consist chiefly of additions to the simpler model. The simpler model has no goniometer, telescope, collimator, or the special camera and plateholder that necessarily accompany these.

Both instruments are built up (see Fig. E 404a) on a rectangular box-shaped casting containing a powerful clockwork motor, and standing upon levelling screws (16) whose ebonite tops minimise the chances of shock, should the apparatus become charged in use. The motor, which is wound with the key (18), can be started and stopped by means of a brake of which the ebonite disc (24) is the handle. A substantial clamp (13) is provided for fitting either a support for accessories or an optical collimator.

The main triangular section bar (1) upon which the plateholders, slit systems, etc., are supported, is mounted upon a casting (12), a Y-shaped extension (7) of which provides two of the three kinematical points of support for the circular cameras.

A stainless steel divided circle (2) is mounted upon a hollow spindle of standard internal taper, passing through bearings in the casting (12). This circle is divided every degree and can be read by means of a vernier to ten minutes (10') of arc.

The axis of the divided circle carries a lever with a roller (26), which is held by an adjustable spiral spring in contact with any one of a series of cams which may be mounted on the motor spindle (27). In the case of the Goniometer Model continuous rotation of the goniometer and specimen are obtained by means of a gear train consisting of a pair of bevel wheels, and worm and worm wheel which can be disconnected at will by moving a bracket along a slide.

The various accessory parts which fit on this main base will be found in the following description of the two instruments.

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Fig. E 404a

Dr. Müller's X-ray Goniometer Spectrograph, arranged for X-ray Spectrography.

Accessories included in Dr. Müller's Improved X-ray Spectrograph Catalogue Number E 403:

**For X-ray Spectrography**, when the instrument is usually set up as shown in Fig. E 404a, the following parts are provided. A slit system mounted with screw adjustment for position. The width is set by means of feeler gauges, and the height can be exposed in three separate portions with the aid of diaphragms supplied. The crystal mount (3) fits the hollow, tapered, centre of the circle (2) by means of a standard taper spindle to which it is attached with screw adjustments. The plate holder takes plates  $4\frac{3}{4}'' \times \frac{3}{4}''$ , and can be set at any desired position on the main bar (1). It has a movable screen in front, which is used in conjunction with the slit diaphragms when comparison spectra are required. There are also gauge plates, pins, and a steel ruler for setting the relative positions of the slit, the crystal, and the plate.

**For the X-ray Crystallography of Powders.**—A nest of three circular cameras is provided, which permits the selection of a radius of curvature suitable to the problem.

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of the moment. This triple camera is located by a "hole-slot-plane" type of fitting, and is used in conjunction with the same slit system as the above. A pin mount for the powder and a mount for wires and fibres are also supplied on standard taper fittings corresponding with the centre of the circle. A rod and clamp with a little platform to which such accessory apparatus as thermometers, electric heaters, etc., can be secured is provided, and fits the clamp (13) on the side of the body.

**E 403.—Dr. Müller's Improved X-ray Spectrograph** with all accessories necessary for the Spectrographic and Powder Crystallographic methods as described above. Complete in well-made mahogany case with lock and key.

Accessories included in Dr. Müller's Improved X-ray Goniometer Spectrograph, Catalogue Number E 404:

All the apparatus listed above is included in this instrument together with the following.

**For taking Laue Photographs.**—An X-ray collimator with a series of drilled plugs whereby the size of the X-ray pencil can be regulated. A plateholder, taking plates  $4\frac{1}{4}'' \times 3\frac{1}{4}''$ , fitting a mount with kinematical locating devices. A stainless steel two-circle goniometer. This last is the most important of the accessory parts of the E 404. It is very carefully designed to obtain the greatest possible accuracy for its size. Every part is made of stainless steel. The circles are engraved to each degree, and can be read by verniers to  $10'$  ( $\frac{1}{6}''$ ). In the standard goniometer supplied there is a range of motion of  $120^\circ$  in two directions at right angles to one another. Another goniometer having a maximum range of  $15^\circ$  can be supplied if desired. The accuracy of the goniometers is such that no greater departure of the crystal mount from a fixed point than  $\pm 0.1$  mm. is permitted.

**For setting up the Crystal and for use as a Crystal Goniometer.**—The two-circle goniometer above is used, and a special telescope in a mount having precise but simple adjustments is used in conjunction with a simple optical collimator. The telescope mount, like the plateholder mounts, slides on the main triangular bar. It has a raising and lowering motion and screw movements for rotating the telescope in two planes over small angles. The telescope has an auxiliary lens whose use converts it to a low-power microscope. The collimator is attached to a rod and clamped to the main body of the instrument. It is furnished with a Websky signal and 4v. lamp. A simple tangent screw slow motion on the goniometer spindle gives fine adjustment of the crystal position about a vertical axis.

**For Revolving Crystal Photographs** the crystal can be mounted on the goniometer and slowly revolved by a worm and bevel gear train set in motion by the clock-work motor. The pattern can be recorded, if desired, on a flat plate using the  $4\frac{1}{4}'' \times 3\frac{1}{4}''$  plateholder mentioned above, or on a film held in a cylindrical camera. A large double cylindrical camera is provided so that the user has the choice of two radii.

**E 404.—Dr. Müller's Improved Goniometer X-ray Spectrograph** with all accessories necessary for the methods of X-ray spectrography and crystallography and for use as an optical crystal goniometer as described above with  $60^\circ$  goniometer only. Complete in two well-made mahogany cases with locks and keys.

**E 444.—Dr. Müller's Improved Goniometer X-ray Spectrograph.** As above, but with  $15^\circ$  goniometer only.

**E 435.—Extra  $15^\circ$  Goniometer for E 404 above.**

The foregoing descriptions are only brief summaries of the important points of this unique instrument. Complete details will be found in Hilger Publication No. 58.

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