

Photography and the Public Analyst

by MISS A. COOK AND A. J. HARRISON

(*Public Analyst's Dept., Clive Road, Portsmouth*)

A description is given of the Edixa Reflex camera and accessories, and ways in which they can be applied to the work of the Public Analyst. Details of the adaptation to photomicrography, document copying, etc., are supplemented by a summary of the lighting, development and printing techniques involved.

Two years ago it was decided that it would be an advantage to have a camera in this laboratory capable of a wide range of uses and not limited to photomicrography only. A thorough examination of the available types of camera was made with a view to obtaining an instrument with maximum flexibility. The type most suited to this requirement is that known as the "Single Lens Reflex", with a "seen through the lens" viewing system. Of the models available we purchased an Edixamat Reflex Model D camera with various accessories.

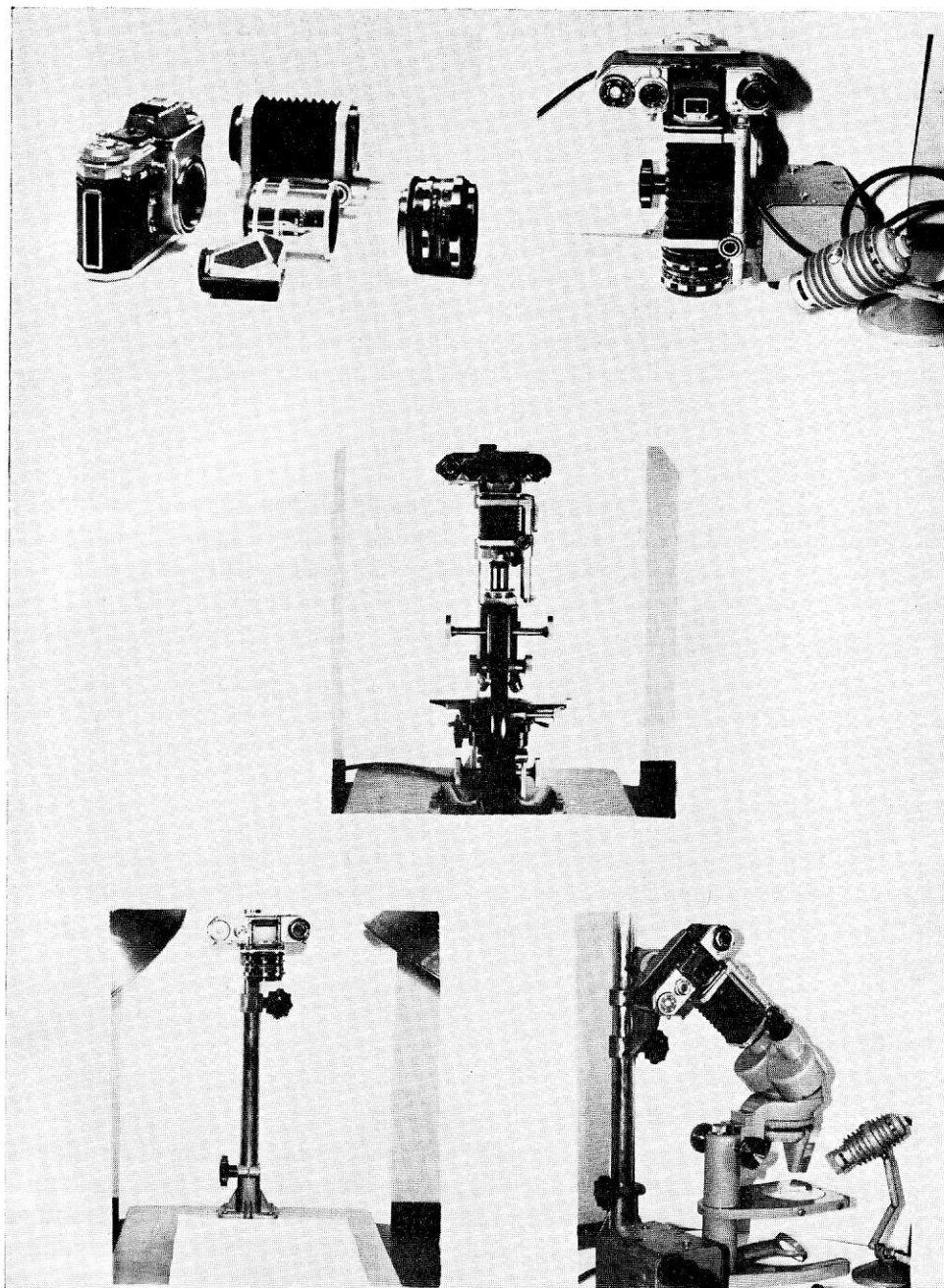
The camera is a 35-mm model. The viewing screen is fitted with a waist-level viewfinder and a plano-convex lens ground on the under-side, incorporating a 4 $\times$ magnifier for more accurate viewing. The camera lens serves both for taking the picture and also for focusing, the proposed picture being seen the right way up but laterally reversed. This is achieved by a mirror system built into the camera. The waist-level viewfinder may be replaced by a penta-prism for eye level viewing in which case the screen image is seen the right way up and not laterally reversed. The camera has a focal plane shutter which enables the lens or accessories to be changed whilst the camera is loaded with film. The shutter incorporates a delayed action release system with adjustable delay from 2 sec. to 9 sec. and a total range of automatic shutter settings from 9 sec. to 1/1000th sec. It is fully synchronised for bulb or electronic flash.

The lens is a "Xenar", f2.8, of focal length 5 cm, with a fully automatic, spring loaded, iris diaphragm. This is set to the aperture required beforehand, when the iris will remain fully open for reflex viewing, but stops down automatically to the pre-selected opening an instant before the shutter opens. The iris then returns to the full opening immediately after use. The lens is capable of focusing from infinity to 1.25 feet.

Accessories

1. *Extension Bellows* (see Fig. 1)

For greater adaptability and a wide range of close up work this attachment is essential. It screws in between the camera body and the lens. The focusing



Top left: Fig. 1. Top right: Fig. 2. Centre: Fig. 3.
Bottom left: Fig. 4. Bottom right: Fig. 5.

range with bellows is continuous and very extensive; with a lens of focal length 5 cm, the scale of reproduction is from $0.5 \times$ image size to $2.3 \times$ image size.

2. *Extension Rings (see Fig. 1)*

A set of 4 extension rings of varying length act similarly to the bellows attachment but are somewhat more limited in use. Subject area, when using these rings in various combinations, ranges from 24 in $\times$ 36 in to $\frac{7}{8}$ in $\times$ $1\frac{3}{8}$ in which gives a scale of reproduction of $0.04 \times$ to $1.02 \times$ on the film in relation to the natural size of the subject.

3. *Copying Unit (see Fig. 4)*

This consists of a stand with an adapter clamp which allows the camera to be attached and rotated to any angle required for copying and photomicrography.

4. *Light Meter*

The Japanese Sekonic light meter is used, which has high and low scales ideal for photomicrography and similar conditions involving low light values. The meter is operated by a cadmium sulphide cell which works in conjunction with a small battery.

5. *Lighting Equipment (see Figs. 2, 3, 4, and 5)*

Various lighting sources are used which include photofloods of selected powers housed in aluminium holders (see Fig. 4); an electronic flashlight, the Bactil light, is fitted permanently in the Watson High Power Binocular microscope with a variable power control and small microscope lights with focusing lens and power control unit.

6. Other equipment includes an Edixa automatic focusing enlarger with f3.5 lens, developing tanks and the usual basic photographic equipment.

The total cost of the above equipment for professional purposes is in the region of £130.

Applications

1. *Photomicrography*

(a) *High Power Microscopy (see Fig. 3)*

Photomicrographs are easily obtained using the camera with the bellows attachment and no lens. The camera is used with the waist-level viewfinder. The ground glass viewing screen is a distinct advantage when focusing the image, particularly when used with the $4 \times$ magnifier. The camera is set up as in the diagram (Fig. 3), with the bellows attachment fitted over the monocular head of the microscope which contains the $10 \times$ compensating eyepiece. It is loaded with Ilford Pan F film which

is a fine grain film ideal for this kind of work. When the image is focused, the Bactil light fitted to the microscope is set at 6 volts and the photograph taken using the cable release together with the "delayed action release" to avoid camera shake. A normal exposure time for photographs of this nature is 1/10th to 1/5th second.

(b) *Low Power Microscopy (see Fig. 5)*

In a similar manner, for photographs of slightly larger objects, the camera is used in conjunction with the low power Watson Stereoscopic microscope. The camera, in this instance, is fitted over the focusing eyepiece of the microscope with general illumination from two No. 1 photofloods and highlighting the object with a small microscope light with focusing lens (see Fig. 5). Exposure is carried out as for high power work, suitable exposures ranging from one tenth to a half second, depending upon the nature of the subject.

Determination of Exposure Times for Photomicrography

In our experience it is an advantage to carry out a series of test exposures under fixed lighting conditions, using a suitably mounted specimen for the subject. The negatives are used as reference standards for future work carried out under similar conditions.

Estimation of Final Magnification

It is often desirable to know the final magnification achieved on the print of the photomicrograph. This is determined by the use of a graticule on the microscope stage. The camera, with bellows attachment and no lens, is positioned at different heights above the eyepiece of the microscope and the image focused on the "seen through the lens" viewing screen. With a knowledge of the height of the camera above the microscope and a simple measurement of the distance between the graticule lines seen in the screen, a graph of the magnification can be obtained. One must also bear in mind that this should be multiplied by the magnification produced when enlarging the print to give the final magnification.

2. *Document Copying (see Fig. 4)*

Here again the advantages of the ground glass viewing screen with magnifier are apparent, giving a sharp image of the type. For all copying work, Ilford Fine Grain Safety Positive film is used which has a fine grain and gives faithful reproduction of coloured print, an advantage over some commercial copying machines which have varying record response with blues and reds.

The camera is attached to the adapter clamp and focused on to the document to be copied. Two photofloods (No. 2), are placed approximately 1 foot from the base of the stand (see Fig. 4). The light meter is held 10 cm from the

document in order to obtain a suitable exposure time, taking care that the meter aperture is parallel with the document to be copied so that an accurate reading of the illumination of the latter is obtained. Again the exposure is made using the cable release and "delayed action" release to avoid camera shake. Some difficulty due to reflections may be experienced if the document is highly glossy, but this can be avoided by careful positioning of the lights.

3. *Record of Foreign Materials in Food*

Every analyst has the problem of foreign materials in food and the added problem of how to preserve records of their appearance at the time of receipt. The Edixa plus either the bellows attachment or extension rings, depending on the size of the object, is ideal for recording these details. A series of photographs can be taken, e.g. the object in the article as received, and eventual breakdown photographs increasing in magnification to illustrate the true nature of the object. Pan F film is used, lighting systems varying according to the object. For large objects two No. 1 photofloods are adequate for overall illumination and, using the light meter, a suitable shutter speed and lens f-number can be selected. It is advisable to work with a small iris opening in order to obtain the maximum depth of field.

For very small objects the small microscope lights can be incorporated to eliminate shadows when using photofloods for general illumination.

4. *Miscellaneous Uses of the Equipment*

(a) The preparation of a reference collection of photomicrographs of common animal hairs.

(b) Photographs of foreign materials in foodstuffs which have been submitted as a sample or complaint to Local Authorities and which might subsequently be the subject of a prosecution.

(c) The camera has been used successfully for recording on film, information only available from reference libraries, etc. Of course prints can easily be obtained if required, but film is much easier to store.

(d) Permanent records of paper chromatograms can be made using this equipment and it is hoped that this facility will prove invaluable for records of thin layer chromatograms.

(e) Photographs of laboratory equipment set up for special, non-routine determinations have proved to be well worth while when it is desired to reconstruct the apparatus.

(f) Site photographs taken when investigating allegations of excessive atmospheric pollution were used to supplement the report.

(g) Photographs taken in this Department have been used to supplement lectures given to local organisations, and it is intended in the future to produce a series of colour slides for this purpose.

Films and Printing Papers

Experience has shown that the purchase of 35-mm film in bulk is more economical than the purchase of 20- or 36-exposure refills. Variable lengths of film can be used with minimum wastage provided that the film is loaded into the cassette and camera in complete darkness. A suitable notched bench in the darkroom facilitates accurate measurement of cut lengths for loading into cassettes. At each loading, $1\frac{1}{2}$ frames are wasted as "lead in" for cassette and camera.

For photo-copying, Ilford Copying film is used and may also be purchased in bulk lengths (i.e. approximately 100 feet for both Pan F and Copying film). This film has the additional advantage that it may be cut and loaded in a darkroom illuminated with an Orange 902 safelight.

This laboratory has standardised on the Kodak range of printing papers which have been found to be generally applicable to the techniques previously described. The white smooth glossy paper gives good quality prints and faithful reproduction of detail.

Hard, normal and soft grades of this bromide paper are used, depending upon the intensity of the negative. Generally speaking, a negative of average contrast gives a good print on the "normal" grade of paper, showing a full range of tone. A white fine lustre surface is sometimes considered more suitable for site photographs, apparatus, etc.

As with film, printing paper may be purchased more economically in bulk. Large sheets (8 in $\times$ 10 in) are purchased which may be cut into a suitable size with little or no wastage.

Film Development and Fixing

It is more convenient to prepare "home-made" stock solutions of Developer and Fixer as required.

1. Pan F Films

These are developed for $6\frac{1}{2}$ minutes at 20° C using ID.11, fine-grain developer, used at full strength and prepared as follows:—

Metol	4 g
Sodium sulphite (anhydrous)	200 g
Hydroquinone	10 g
Sodium borate	4 g

Dissolve and make up to 2,000 ml with distilled water, adding each reagent in the order given above. Filter into a dark brown bottle for storage.

The exposed film is loaded into the developing tank in the dark room and processed according to the instructions given by the makers of the tank.

There are two Fixers which may be used, either IF.2 Acid Fixer or IF.9 Acid Fixer and Hardener, as follows:—

IF.2 Fixer

This fixer arrests development immediately and is used at full strength.

Sodium thiosulphate (anhydrous)	512 g
Sodium metabisulphite	42.5 g
Dissolve and make up to 2,000 ml with distilled water.	

IF.9 Fixer and Hardener

(used at full strength)

Sodium thiosulphate (anhydrous)	384 g
Sodium metabisulphite	42.5 g
Chrome alum	25 g

Dissolve the thiosulphate and metabisulphite in water (Solution A); dissolve the chrome alum in approximately 200 ml of water. Add this solution to soln. (A) and make up to 2,000 ml with distilled water.

After fixing for 10 minutes, rinse the film once with distilled water and then wash for $\frac{1}{2}$ hour in running tap water. A final rinse with distilled water containing 1 drop of "Teepol" will "wet" the film and allow even drying. The film should be hung in a warm, dust-free atmosphere until dry. In this laboratory, processed film is cut into lengths of up to 6 frames, which are filed in transparent cases attached to information cards. On these cards full details of the subject and conditions of exposure are recorded.

2. Copying Film

This is developed in a similar manner to Pan F film but using ID.2 Developer, prepared by diluting 1 part of stock solution with 2 parts of distilled water *immediately before use*. The film is developed for 4–6 minutes depending on the contrast required (average time 4 minutes), at 20° C. The stock solution has the following formula:—

Metol	2 g
Sodium sulphite (anhydrous)	75 g
Hydroquinone	8 g
Sodium carbonate (anhydrous)	37.5 g
Potassium bromide	2 g

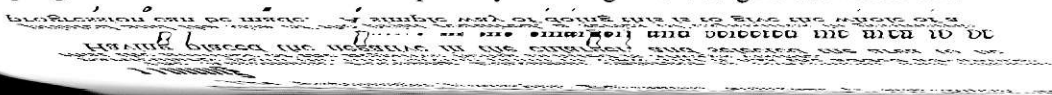
Dissolve and make up to 1,000 ml with distilled water, and filter into a brown storage bottle. Ensure that the reagents are dissolved in the order given above.

Either IF.2 or IF.9 Fixers may be used for fixing the negative. The film is then washed and dried as for Pan F films above.

Printing

The Automatic Focusing Edixamat enlarger is convenient and efficient particularly from the time-saving point of view and it has the added advantage *that the number of the negative being printed is always visible.*

Having placed the negative in the enlarger, and selected the area to be printed and the size of the print required, a series of exposures in geometric progression can be made. A simple way of doing this is to give the whole of a



Printing

The Automatic Focusing Edixamat enlarger is convenient and efficient particularly from the time-saving point of view and it has the added advantage that the number of the negative being printed is always visible.

Having placed the negative in the enlarger, and selected the area to be printed and the size of the print required, a series of exposures in geometric progression can be made. A simple way of doing this is to give the whole of a test strip of paper a 5 seconds exposure, and then to cover up successive strips with a card whilst giving further exposures of 5, 10, and 20 seconds. This results in 4 bands having exposures of 5, 5 + 5 + 10, 5 + 5 + 10 + 20 seconds respectively. The test strip is then developed and fixed to give graded exposures from which a suitable exposure time for the print may be deduced.

The developer used for printing is ID.22 which must be prepared fresh immediately before use as follows:—

Sodium sulphite (anhydrous)	12.5 g
Amidol	3.0 g
Potassium bromide	0.8 g
Make up to 500 ml with distilled water and filter.	

At 20° C the developer will produce a good quality print after 1½ minutes total development time, provided the exposure has been correctly assessed.

After some experience, the test strip procedure will rarely be required as suitable exposure time can be estimated visually with a knowledge of the quality of the negative, etc. The average time for fixing prints is 10 minutes and we use the following IF.4 fixer which arrests development immediately.

Sodium thiosulphate (anhydrous)	256 g
Sodium metabisulphite	42.5 g
Dissolve and make up to 2,000 ml with distilled water.	

Prints, after fixing for 10 minutes, should be washed for ½ hour in running water before drying.

Note: If a halfpenny or penny is suitably placed on the paper before exposing, a blank white spot will be produced on the print in which details of the sample, date, etc., can be recorded.