XXXII. AN AUTOMATIC DEVELOPING MACHINE FOR LARGE PHOTOGRAPHIC PLATES

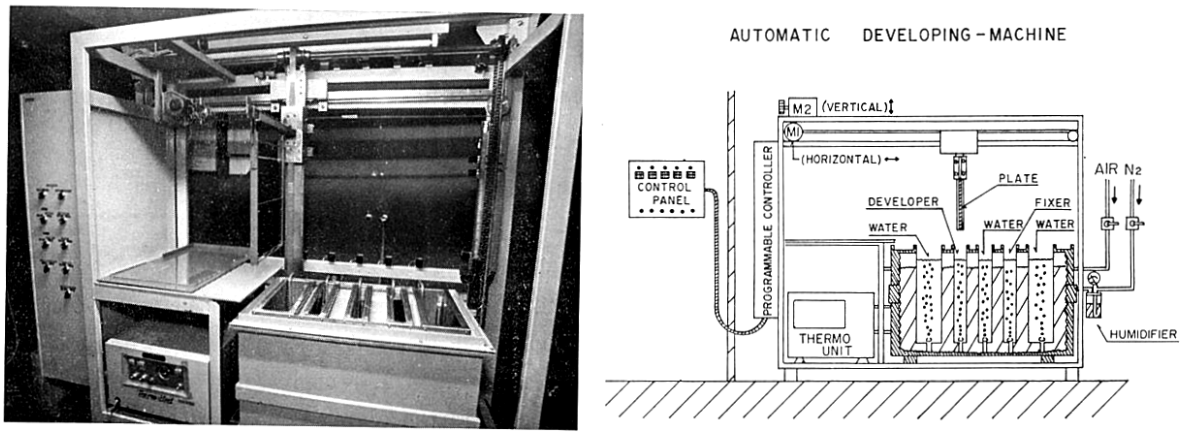
Takeshi NOGUCHI, Tsutomu AOKI, Takao SOYANO,
and Bunshiro TAKASE

1. Introduction

Since the beginning of the observation at the Kiso Observatory we have practised the gaseous burst agitation method for developing and fixing exposed Schmidt plates of the size of 14″×14″ (Takase et al. 1977). We have found it quite efficient, but since the manual handling of the large and thin plates in the dark room is laborious and dangerous, an automatic processing machine adopting the same method of agitation has been designed and manufactured. An outline of this equipment and the result of a test concerning the uniformity of development are reported.

2. Design of the Machine

The machine is composed of a main body, a controller unit, and a control and display panel. Figure 1 shows its appearance and illustration.



(a) (b)

Fig. 1. An appearance (a) and an illustration (b) of the front-view of the automatic developing machine. The size is 187 cm (hight)×190 cm (width)×95 cm (depth).

1) Main body

Five vertical vats are placed in a tub side by side, which are filled with water for prewashing, developer, water for stopping development, fixer, and again water for rinsing, respectively. At the bottom of each vat lies a piece of pipe with holes which are 0.3 mm in diameter and line up with separations of 8 mm, for gaseous burst agitation of the liquids.

A "thermo-unit" which controls the temperature of liquids to be kept constant is attached to the tub of vats. Above the vats is a carrier of the frame which can hold two plates. This frame is moved horizontally and vertically so that the plates are dipped sequentially into five vats. During the processing, nitrogen gas and compressed air are supplied into the developer vat and other four vats, respectively, for the bubble-burst agitation of each liquid.

2) Controller unit

A controller unit is located at the left side of the main body. It contains a microcomputer

which controls (a) motion of the plate frame carrier, (b) duration and interval of the ejection of nitrogen or air, and (c) durations of the development and other processings through an appropriate program.

3) Control and display panel (See figure 2)

This panel is put outside of the dark room. Time duration of each processing can be set with the corresponding digi-switch in a range from 0.1 sec to 999.9 sec. Once setting these processing times and pressing a start button, the plate frame carrier moves from vat to vat and stays in each vat for the preset time. Where the carrier is and how many seconds elapsed in each vat, are displayed on the panel.

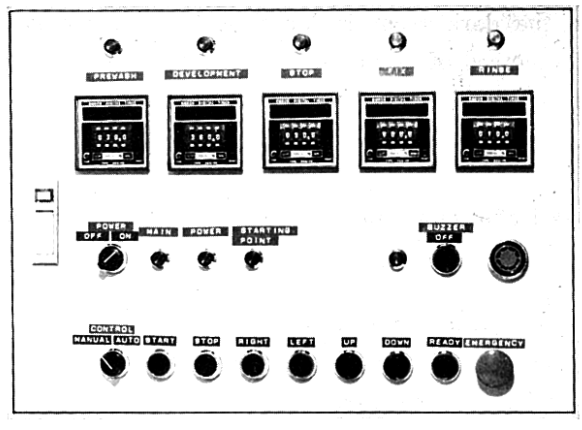


Fig. 2. The control and display panel. Digital timers of each processing and control buttons are seen.

3. Procedure of the Processing

Several manual operations should be added to complete the procedure of the plate processing with this automatic machine. They include supplying and draining the liquids, switching the "thermo-unit" buttons, opening and closing the cocks of nitrogen and compressed air, setting the processing times on the control panel, loading the plates onto the plate frame, removing the frame from the rinsing vat, removing the plates from the frame, and further rinsing and drying the plates.

Following suggestions obtained from the result of some experimental tests have been introduced into our practice.

1) The pressure of nitrogen gas and air is adjusted to be 0.25~0.5 kg/cm^2. The gas pipe should be laid duly horizontally so that the bubbles go up vertically and cover well all portions of the plate surface.

2) A humidifier which adds humidity to the gas is placed before an electric valve to supply nitrogen to the developer vat. This is helpful to avoid the situation that dry nitrogen crystalizes chemicals in developer and clogs holes of the pipe through which the gas ejects.

3) The duration and interval of the gas ejection are set to be 1 sec and 10 sec, respectively.

4) A pair of exposed plates are held face to face in the frame, the separation between the emulsion-side surfaces being 7 mm. When only one plate is to be developed, a dummy glass is used as one of the pair, otherwise the bubbles do not sweep well the surface of the plate.

4. Performance Test of the Processing

To test the uniformity of development, densities of several points distributed over the sample plate were measured with a digital densitometer (Dainippon Screen Manufacturing Co. Ltd, Type DM-257), the reading of which were in advance calibrated to give the diffuse density.

Figure 3 shows the density of the points along the horizontal center line of the plate. Further figure 4 gives isodensity contours over the whole plate, the separations of which are 0.01 in unit of the diffuse density. The result is that the uniformity is satisfactorily good. It has been thus proved that the gaseous burst agitation method which we adopt is by no means inferior to the result obtained by Miller (1971) who made a test of development with the tray rocker method.

For general reference of the gaseous burst agitation in processing, the Kodak Publication No. E-57 might be helpful.

Other experimental tests show that there are no appreciable differences between the cases

1) when the prewashing stage is included and when excluded, and
2) when the water is used after development and when the normal stopper is used.

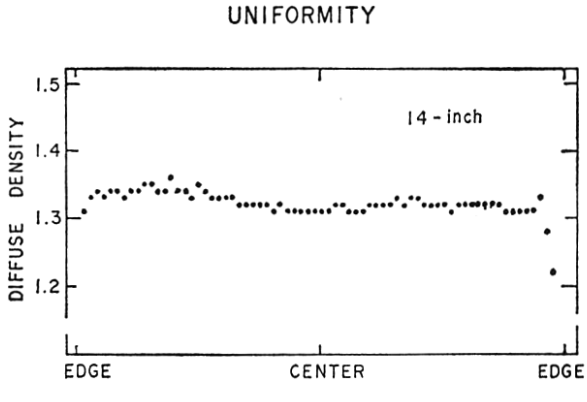


Fig. 3. The diffuse density of the points along the horizontal center line of the plate of which length is 14 inch.

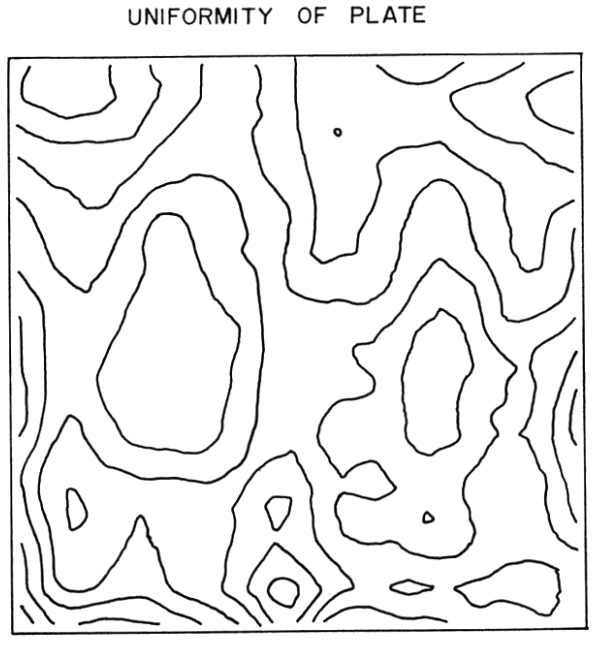


Fig. 4. Isodensity contour lines on a plate, separations of which are 0.01 in units of the dffiuse density.

References

Miller, C.W. 1971, American Astron. Soc. Photo-Bulletin, No. 2 (1971), 3.

Takase, B., Ishida, K., Simizu, M., Maehara, H., Hamajima, K., Noguchi, T. and Ohashi, M. 1977, Ann. Tokyo Astron. Obs., 2nd Ser., 16, 74.