An efficient and convenient drier for thin-layer chromatograms

The increasing use of thin-layer chromatography has created the need for a means of rapidly drying large numbers of thin-layer plates. Several stages occur when drying is necessary, *e.g.* during layer preparation, following chromatography, following spraying of chromogenic reagents etc. Ideally apparatus used for such drying should fulfil the following conditions:

(1) It should be possible to control the drying temperature, as many compounds of interest are unstable.

(2) Drying should be as rapid as possible even when carried out at room temperatures.

(3) The drying process must not disturb fragile layers.

(4) Drying must be such that migration of compounds does not occur. Elaborate procedures, such as freeze drying of chromatograms, have been recommended[1] to prevent such movement.

The following apparatus which can be readily and cheaply constructed in many laboratory workshops has been found to satisfy all these requirements.

Description of apparatus

The complete apparatus with drying rack in position is shown in Fig. 1 and a cutaway diagram and working drawing are given in Fig. 2. The case is fabricated from folded, spot welded, stainless steel. Runners and stops for the drying racks are bolted in position. All steel is 20 gauge (0.035 in.) except for the door, which is 18 gauge (0.05 in.). The door aperture (9 × 11 in.) is reinforced with a spot welded strip.

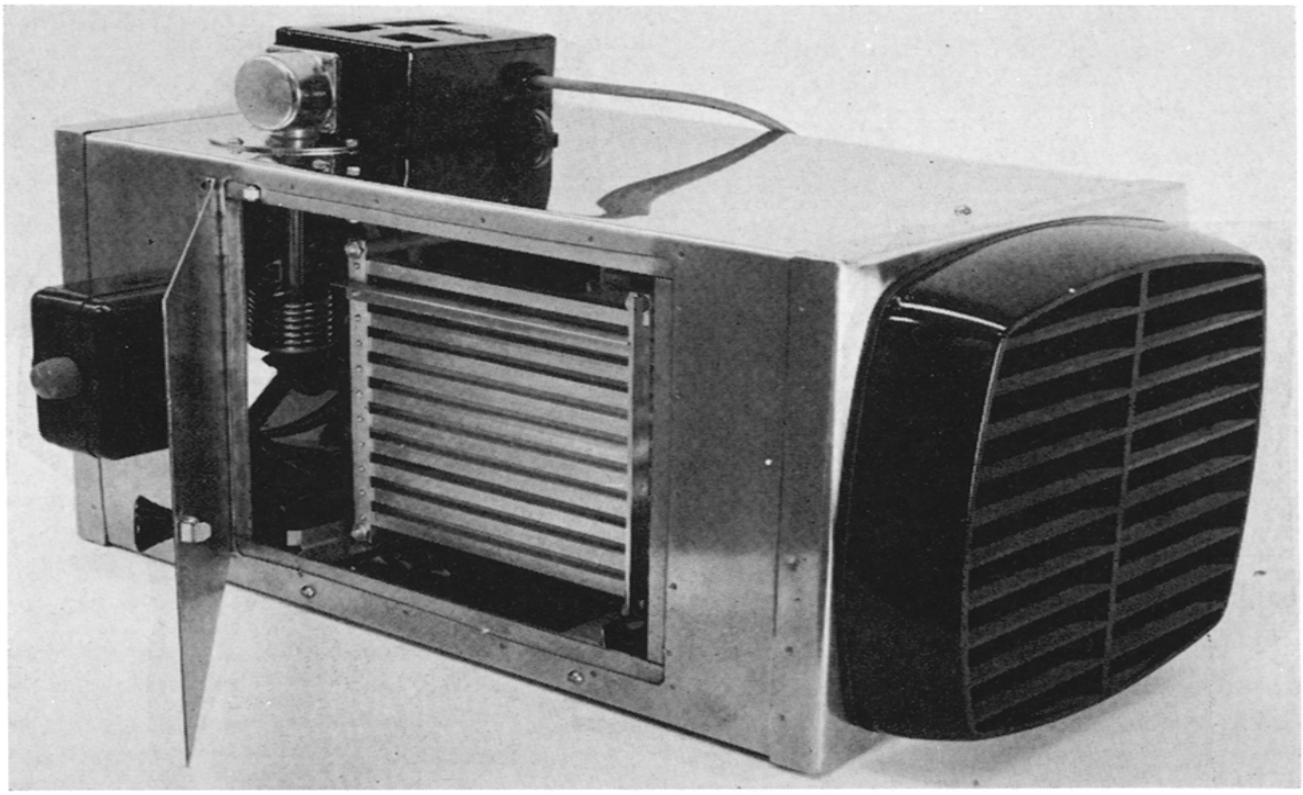

Fig. 1. Complete chromatogram drier with rack in position.

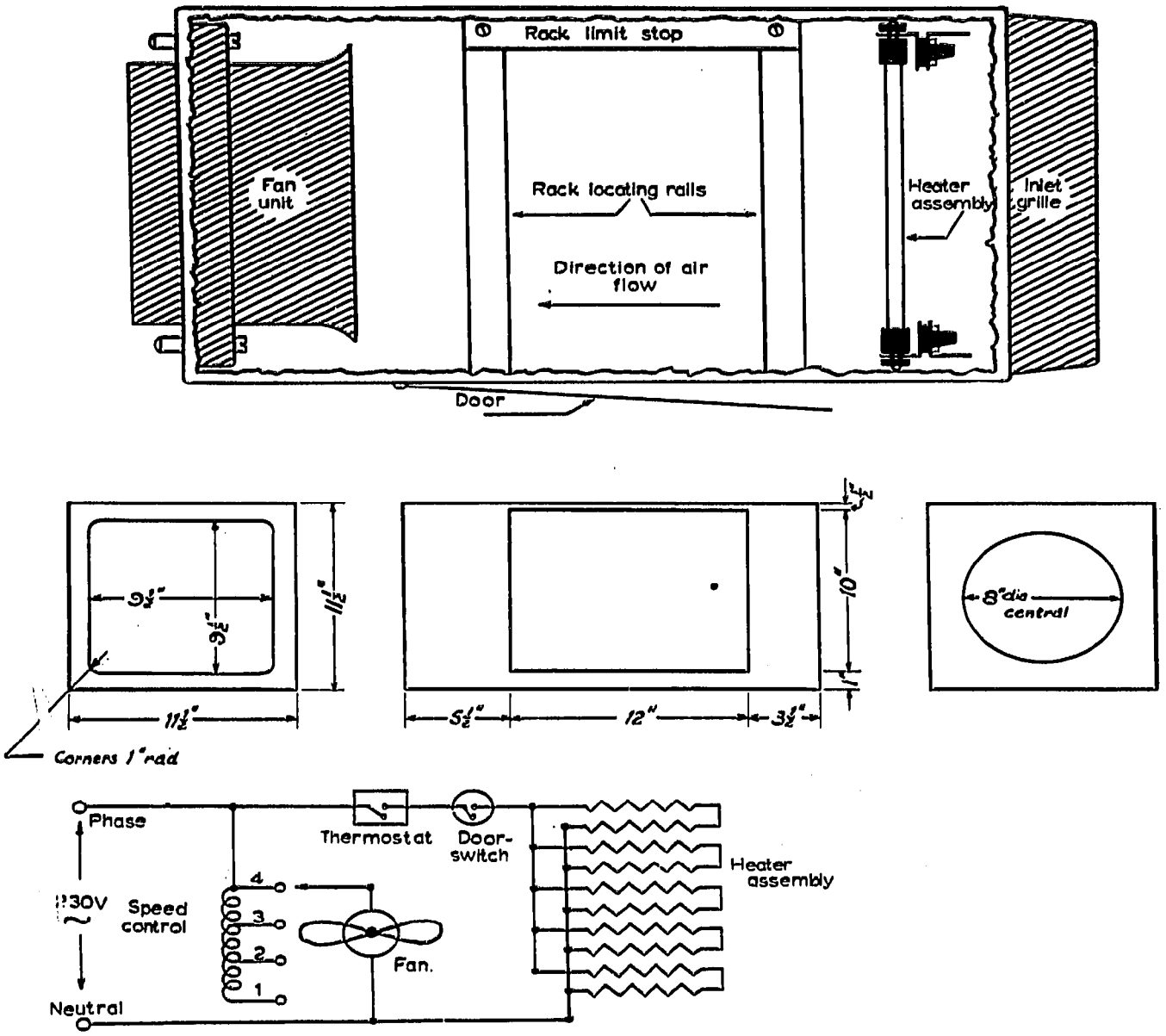

Fig. 2. Construction details of chromatogram drier.

The fan unit used is a domestic 7½ in. window fan with brushless motor and speed control. It is also desirable for the fan to be corrosion-resistant. We used a General Electric Corporation "Xpelair" fan with a capacity of 250 cu.ft./min. The normal louvre outlet of the fan is mounted at the inlet end of the cabinet to shield the heaters and assist in producing laminar air flow in the body of the drier. The fan itself is mounted at the other end so that it draws air through the cabinet.

The heating unit is built from ten silica-enclosed elements (Fig. 3), each 9 in. long and of 150 W rating. These are wired with five pairs in parallel so that for a 230 V supply each element has 115 V (Fig. 2) (for a 115 V supply all 10 elements should be in parallel). A micro-switch is mounted on the door so that power is disconnected from the heating elements whenever the door is opened. The thermostat used was an RT 126 Danfoss (15–45°).

Advantages of the apparatus

(1) *Convenience and cheapness.* The described apparatus can be made in many laboratory workshops from readily available components at a cost which is only a fraction of that of conventional drying ovens. It is portable and occupies considerably less space than other drying units. It accepts most standard thin-layer plate storage racks. Use of silica-encased heating elements obviates the risk of oxidised fragments, which might become detached from bare wire elements, contaminating the thin layers. The inclusion of a microswitch in the circuit prevents any possibility of short circuiting when loading the apparatus and also prevents overheating if the door is left open.

(2) *Speed of drying.* The times required for drying standard 20 cm × 20 cm thin-layer plates following development in different solvents are given in Table I.

These times are significantly shorter than those obtained in most conventional drying ovens operating at higher temperatures. Because of these short drying times the apparatus, though small, will handle a considerable number of plates. It has been noted that the drying times depend somewhat on the relative humidity of the room air. The figures given in Table I were obtained when the room air was at 24° and about 65% relative humidity.

All these layers were spread at a nominal thickness of 250μ. Thicker layers would be expected to take longer to dry.

The results given in Table I were obtained using a mixed layer[2] of cellulose and silica gel. Times required for drying other types of layer are not significantly different. Fragile layers (such as produced by silica gel without binder) remain completely undisturbed even when dried with fan running at full speed.

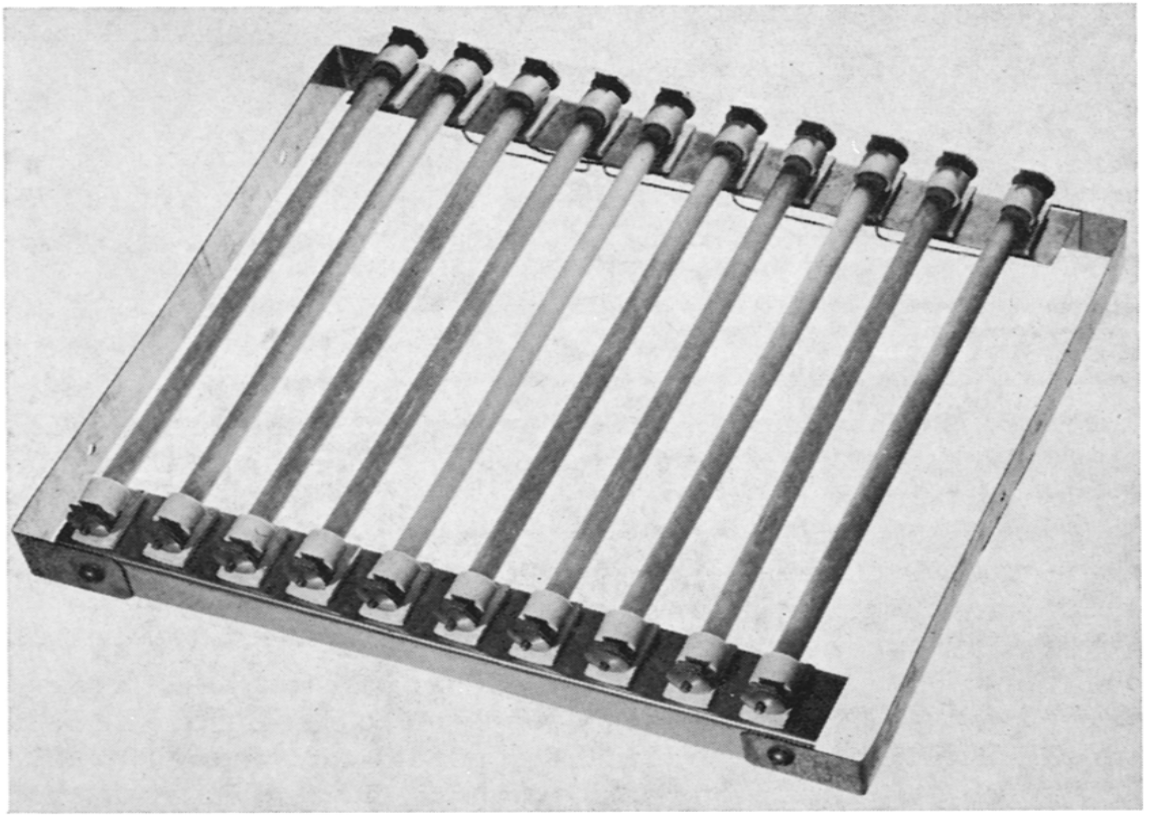

Fig. 3. Heating unit.

TABLE I

TIMES (IN MIN) REQUIRED FOR DRYING, AT 30°, THIN-LAYER PLATES RUN IN THREE CHROMATOGRAPHIC SOLVENTS

No. of plates per rack	*Solvents*		
	Water	*Butanol–acetic acid–water (5:1:4, v/v/v top phase)*	*Phenol–water (80:20, w/v)*
1	15	20	90
5	25	30	120
10	30	40	150

(3) *Evenness of drying.* Our usual procedure is to align the plates in the drier so that the solvent front is nearest to and parallel with the heating elements. Under such conditions drying starts from this front; and we find that these are the conditions for minimal migration of compounds. It is also important that the plates be kept approximately horizontal during drying.

In some recent two-dimensional procedures[3] separation in the first dimension is carried out with the origin as a short (2–5 cm long) band. Prior to separation in the second dimension it is necessary to elute the resulting series of bands back to spot size with water or other solvent. Following such elution rapid and even drying is particularly essential and this can be satisfactorily achieved in the described apparatus.

An essential requirement in the apparatus is that the fan draw (rather than push) a laminar flow of air over the plates. Air pushed over the plates by the same fan apparently travels helically and with much greater turbulence and does not produce the desired pattern of even drying from the front. The various patterns of drying obtained can be followed directly by observing the colour changes that occur during the drying of a layer which has been wet with a dilute solution of cobalt chloride.

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