United States Patent [19]

LaFleur et al.

[11] **3,780,700**

[45] **Dec. 25, 1973**

[54] **TEMPLATE FOR THIN LAYER CHROMATOGRAPHY SAMPLES**

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[73] Assignee: **Eastman Kodak Company,** Rochester, N.Y.

[22] Filed: **Oct. 14, 1971**

[21] Appl. No.: **189,112**

[52] **U.S. Cl.** **118/503,** 118/504

[51] **Int. Cl.** **B05c 11/12**

[58] **Field of Search** ..... 118/504, 505, 406, 118/301, 503; 117/8.5, 38; 101/126; 83/454, 459, 465; 408/241 B, 72; 51/310, 262; 269/91, 93, 92, 94, 87.2, 87.3

[56] **References Cited**

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Primary Examiner—Morris Kaplan
Attorney—William T. French et al.

[57] **ABSTRACT**

A template for holding a chromatographic sheet while permitting the application of a series of liquid samples rapidly, and on a well defined area of fixed size, comprises a base plate adapted to receive a chromatographic sheet on its surface, an applicator plate mating with the base plate and adapted to lie on top of the sheet, and means for clamping the parts together to hold the sheet in place. The applicator plate and the base plate are hinged together and provided with latches for clamping them together. To provide wells for receiving liquid samples, the applicator plate has a plurality of bores therethrough within which are pressed plastic bushings for engaging the chromatographic sheet without damaging its delicate surface. Also, two stop springs ease the movement of the applicator plate into register with the base plate so as to avoid damage to the chromatographic sheet. The base plate is provided with an abutment against which an edge of a chromatographic sheet is precisely positioned. The hinges are readily disengaged and reengaged to permit cleaning of the parts. Evaporation of solvent from the samples can be assisted by providing a suitable electrical heater in the base plate.

9 Claims, 3 Drawing Figures

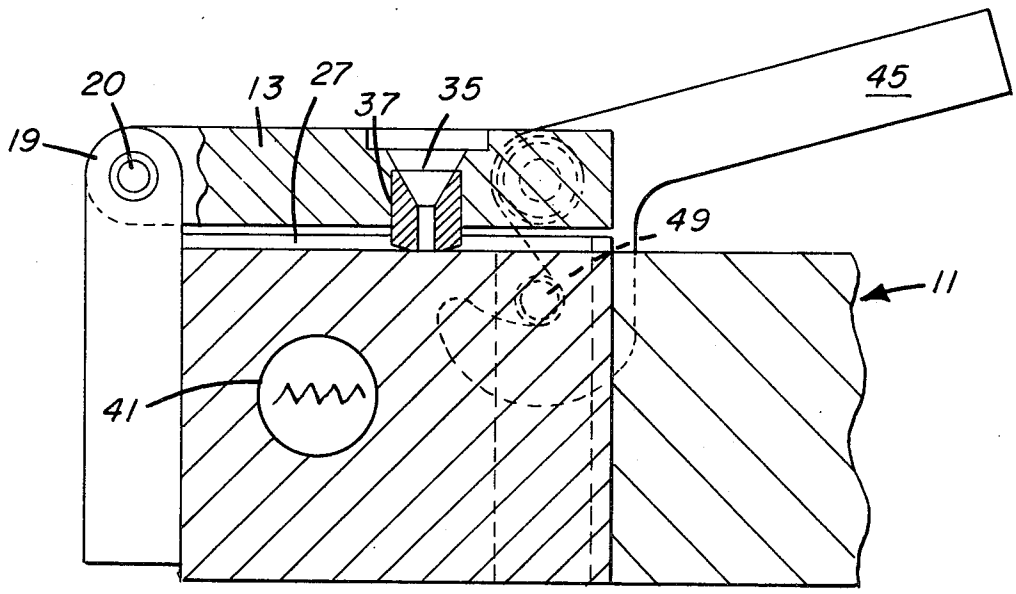


FIG. 1

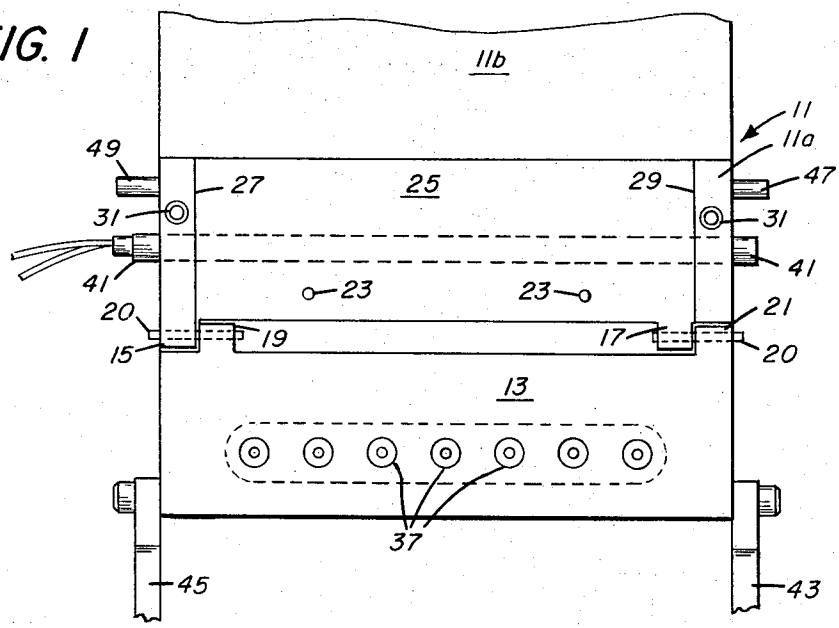


FIG. 2

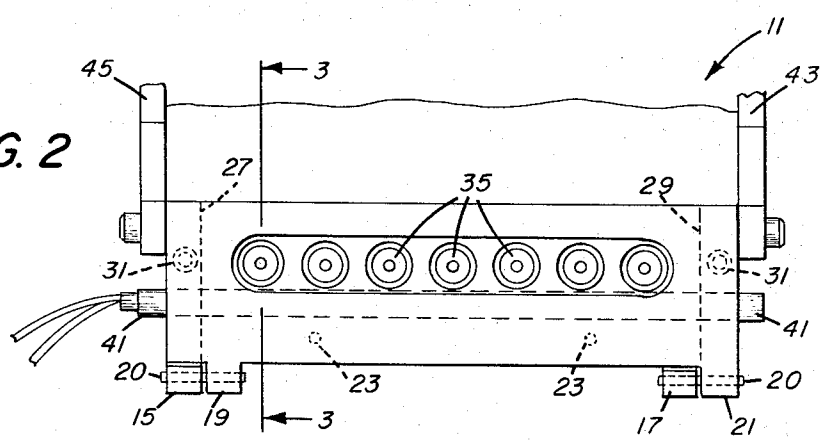
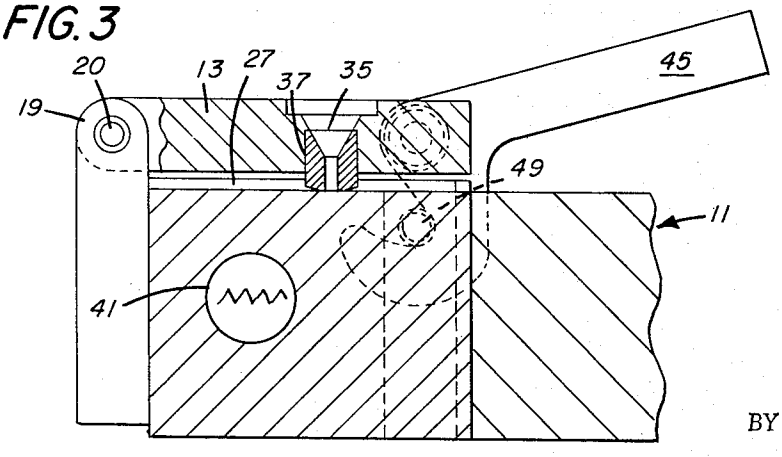


FIG. 3



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TEMPLATE FOR THIN LAYER CHROMATOGRAPHY SAMPLES

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a novel improved apparatus for rapidly applying samples to a chromatographic sheet.

2. The Prior Art

The chemical analysis of many compositions has been conducted successfully by spotting the compositions on a thin sheet of paper, glass or synthetic resin which carries an adsorbent coating on a surface thereof, such as powdered cellulose, silica gel, alumina, nylon, polyethylene, etc. Reference is made to U.S. Pat. Nos. 3,418,152; 3,418,158; 3,492,155; 3,498,830 for more details.

After the sheet has been spotted with one sample or a series of spaced samples and dried, it is dipped into a chromatographic eluant solvent such as benzene, alcohols, chloroform, water, etc. and developed in a closed chamber such as that shown in U.S. Pat. No. 3,413,842. The solvent migrates along the sheet, carrying the components of the sample spots with it, with individual components travelling at different rates. The components are identified by comparison with a chromatograph of a known composition.

Usually the spots have been applied by dissolving the unknown composition in a volatile solvent such as methyl or ethyl alcohol, or acetone to form a liquid sample, and then repeatedly dabbing small quantities of the sample on the chromatographic sheet while allowing solvent to evaporate between dabs. This is a slow and expensive procedure, and also is disadvantageous because it is difficult to confine the sample to a well defined small area.

In U.S. application Ser. No. 176,627 which was filed on or about Aug. 31, 1971 by A.D. Baitsholts, N.E. Jackobs and I. Timrots, entitled "Template For Applying Samples To A Thin Layer Chromatographic Sheet," there is disclosed a novel apparatus and method for solving the above problems of the prior art. The present invention is an improved template apparatus, which is so constructed as to prevent damage to the thin layer surface of a chromatographic sheet while assuring that a seal is maintained at that surface to confine the sample spots to a small area. Our novel apparatus is also so constructed that a chromatographic sheet can be precisely and quickly positioned for receiving samples; and that the parts can be easily and rapidly disassembled for cleaning, and just as rapidly and easily reassembled for use.

SUMMARY OF THE INVENTION

As in the application mentioned above, our novel apparatus comprises a base plate adapted to receive a chromatographic sheet on its surface, an applicator plate mating with the base plate and adapted to lie on top of the sheet, and means for clamping the various parts together to hold the chromatographic sheet in place.

The applicator plate has at least one hole therein acting as a well for receiving a liquid sample solution, and advantageously a plurality of such holes such as up to 19 or more lying on a straight line so that all samples are applied to a chromatographic sheet the same distance from its edge.

Evaporation of the solvent from the sample to leave a defined dry spot of the substance to be analyzed occurs while it is confined to the well, and may be accomplished under ambient conditions, or by providing means for heating the apparatus if a greater evaporation rate is desired.

The improvements of our invention over the prior application include the hinging of the applicator plate to the base plate for pivotting movement into and out of register with the base plate, and the provision of one or more rapid acting latches on one of the plates which are movable into and out of engagement with the other of the plates for clamping a chromatographic sheet between the plates. The hinge mounting advantageously comprises two half hinges which can be moved into and out of engagement with one another to separate the plates for cleaning.

Another improvement lies in the provision of abutment means, such as properly positioned dowels and/or shoulders on the base plate, against which an edge of a chromatographic sheet is accurately positioned for receiving samples.

When moving the applicator plate into position on top of a chromatographic sheet, a seal with the surface of the chromatographic sheet at each hole or bore is assured by a bushing of resilient plastic material such as Teflon polytetrafluorethylene within each bore and protruding therefrom. The resilience of each bushing causes it to yield slightly when engaging the chromatographic sheet, and thus avoids removing surface material. Additionally, the surface is protected against damage by providing resilient stop means, such as two coil springs, which are carried by one of the plates and are adapted to engage the other plate just before the applicator plate contacts the chromatographic sheet, so as to ease or arrest its movement and prevent harmful impact against the sheet.

THE DRAWINGS

FIG. **1** is a plan view showing our novel template apparatus in open position ready to receive a chromatographic sheet;

FIG. **2** is a plan view showing the applicator plate closed into operating position on top of the base plate as though a chromatographic sheet were positioned therein; and

FIG. **3** is a cross sectional view on an enlarged scale taken along the line **3—3** in FIG. **2.**

THE SPECIFIC EMBODIMENT

Referring to the drawings it will be seen that our novel apparatus comprises a base plate **11,** and an applicator plate **13** which is hingedly mounted on the base plate by cooperating half hinges **15, 17** on one side of the base plate, and **19, 21** on a side of the applicator plate. The half hinges **19, 21** are laterally slidable on hinge pins **20** for disengagement of applicator plate **13** from base plate **11,** and reengagement therewith.

Both plates **11** and **13** can be constructed of a metal such as stainless steel to resist corrosion by sample solutions. If desired, base plate **11** can be formed of two elements, the main part **11*a*** being stainless steel, and extension **11*b*** being formed of a lighter and less expensive material such as a plastic, for example, a phenol-formaldehyde resin. The two elements can be bolted together.

Base plate **11** is provided with two protruding abutment pins **23** arranged on a line parallel to and spaced slightly from the hinged edge of the plate for contact with an edge of a rectangular chromatographic sheet which is positioned on top of the base plate for receiving samples. Instead of pins **23**, a shoulder may be formed by milling or otherwise providing a concave or depressed area in the base plate within which the chromatographic sheet lies. The side edges of the chromatographic sheet are also guided and positioned properly by engagement with a pair of side shoulders **27** and **29**. A slight flaring of these shoulders at their entrance ends will ease the introduction of a chromatographic sheet.

When the chromatographic sheet has been positioned on base plate **11**, the applicator plate **13** is swung over on top of the sheet in position for applying samples. Just before the applicator plate reaches the sheet it encounters a pair of stop springs **31** embedded in the sides of the base plate which ease the downward movement and prevent the applicator plate from damaging the thin adsorbent layer on the chromatographic sheet.

Applicator plate **13** is provided with a plurality of holes or bores **35** therethrough which are aligned with one another, and spaced slightly apart, in position for applying samples to a series of areas of the chromatographic sheet which are evenly spaced from shoulder **23** and the coactng edge of the chromatographic sheet. Holes **35** are frusto conical in their upper portions, and merge smoothly at their lower portions into cylindrical portions.

As shown in FIG. **3**, each bore **35** comprises a bushing **37** which protrudes a short distance beyond that surface of applicator plate **13** which registers with base plate **11**, so as to engage the surface of the chromatographic sheet and form a tight seal therewith, thus preventing migration of a liquid sample outside the circular area of engagement. The protruding part of each bushing is bevelled to assure tight engagement with a sheet. The bushings **37** should be a resilient material, for example a plastic such as Teflon polytetrafluorethylene, polyethylene, polypropylene, or other well known plastic materials which will resist the action of solvents employed for applying the samples to the chromatographic sheet.

In order to expedite evaporation of solvent from the samples, base plate **11** is provided with a lateral bore within which is positioned a cylindrical electrical resistance heating element **41**. A rheostat can be provided for regulating the temperature so as to avoid charring or melting the chromatographic sheet.

When using the apparatus the chromatographic sheet is positioned on base plate **11** with its leading edge against abutments **23** and its side edges confined between abutments **27** and **29**. Applicator plate **13** is then swung into position with all of the bushings **37** in contact with the sheet, and the latches **43, 35** are actuated into engagement with pins **47, 49** to assure such contact. Then the full amount of each sample, dissolved in its solvent, is introduced into each sample hole **35** and heat is applied from the heater **41** to cause the solvent to evaporate and leave a well defined circular area of dried solvent on the chromatographic sheet. Then the latches are disengaged and the plates are swung apart from one another so that the chromatographic sheet can be removed for subsequent introduction into elution apparatus in a conventional way.

With this construction there is no longer reason to apply a sample by repeatedly dabbing it onto the surface of a chromatographic sheet over a long period of time, because the full amount of a sample can be introduced at one time and the solvent allowed to evaporate therefrom in one fifth the time or less. When a series of samples are to be analyzed on the same chromatographic sheet they can all be introduced in full volume at the same time through a series of the sample holes **31** and then allowed to dry much more rapidly than was previously possible.

Rapid application of samples, as by the above described apparatus and method is of prime importance in clinical laboratories or drug detoxification centers where thousands of samples are chromatographed every week. Where it previously required 5 minutes to apply each sample, using a hot air dryer between dabs of only 2—3 microliters, it is now possible to apply each sample in less than 15 seconds.

The invention has been described in detail with particular reference to preferred embodiments thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention.

We claim:

1. Apparatus for applying liquid samples to a chromatographic sheet comprising, in combination,

a base plate adapted to receive a chromatographic sheet on the surface thereof;

an applicator plate hingedly mounted on said base plate for movement into and out of register with the top of said base plate, said applicator plate being adapted to lie on such a sheet and having a plurality of holes therethrough for receiving a plurality of liquid samples to spot said sheet; and

said applicator plate comprising a bushing of resilient material in each of said holes and projecting therefrom in position to engage and to form a tight seal with such a sheet.

2. Apparatus in accordance with claim **1** wherein said base plate has abutment means thereon adapted to engage an edge of such a chromatographic sheet to position such a sheet for receiving a sample.

3. Apparatus in accordance with claim **1**, also comprising resilient stop means carried by one of said plates and adapted to engage the other of said plates during movement into register with one another, to arrest such movement and prevent harmful impact against such a chromatographic sheet.

4. Apparatus in accordance with claim **1** wherein said base plate and said applicator plate each has half hinge means thereon, said half hinge means being movable into and out of engagement with one another for detaching said applicator plate from said base plate at will.

5. Apparatus in accordance with claim **1** wherein said base plate has abutment means thereon adapted to engage an edge of such a chromatographic sheet to position such a sheet for receiving a sample;

said apparatus also comprising resilient stop means carried by one of said plates and adapted to engage the other of said plates during movement into register with one another, to arrest such movement and prevent harmful impact against such a chromatographic sheet.

6. Apparatus in accordance with claim **5** wherein said base plate and said applicator plate each has half hinge

means thereon, said half hinge means being movable into and out of engagement with one another for detaching said applicator plate from said base plate at will.

7. Apparatus in accordance with claim **2,** wherein said holes arranged in a straight line parallel to said abutment means for applying a plurality of samples to such a chromatographic sheet along a straight line parallel to such edge thereof.

8. Apparatus in accordance with claim **1,** also comprising latch means on one of said plates movable into and out of engagement with the other of said plates and acting to clamp a chromatographic sheet between said

plates with said bushings engaging said chromatographic sheet.

9. Apparatus in accordance with claim **8** wherein said half hinge means on one of said plates comprises hinge pin means projecting laterally in one direction therefrom adjacent and parallel to an edge thereof, and wherein said half hinge means on the other of said plates comprises bearing means on said other of said plates extending laterally thereof adjacent and parallel to an edge thereof and slideable on and off said hinge pin means.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,780,700 Dated December 25, 1973

Inventor(s) Bob A. LaFleur, Robert J. O'Brien

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Claim 7, line 2, after "holes" insert --are--.
Claim 9, line 1, change "8" to --6--.

Signed and sealed this 30th day of April 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents