Sept. 11, 1973 B. A. QUAME 3,758,275

APPARATUS FOR PROVIDING TEST SPECIMENS IN FORM OF SPOTS

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FIG. 1

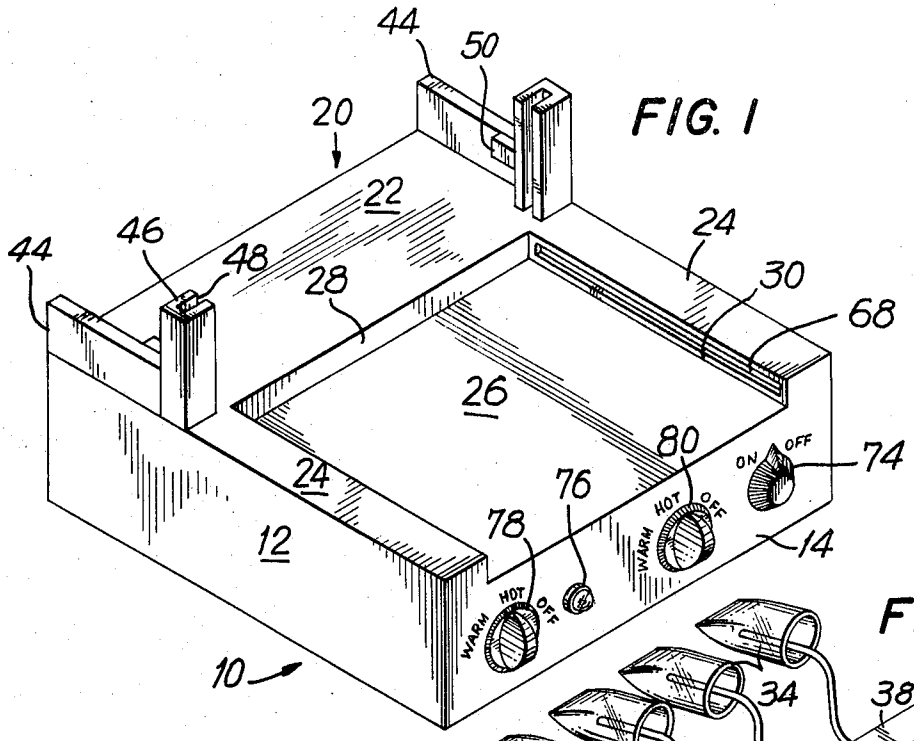


FIG. 2

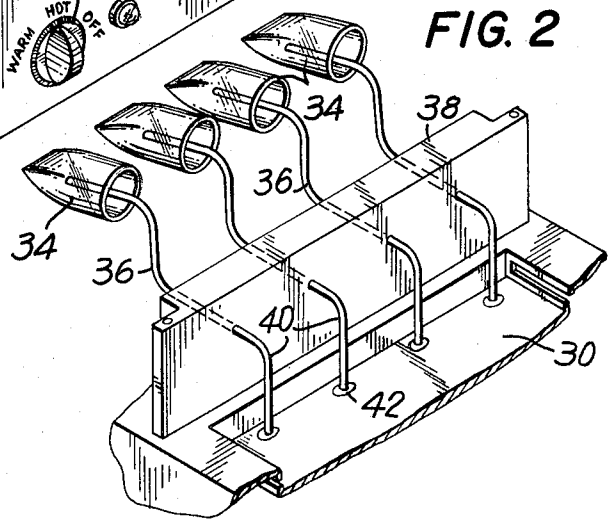
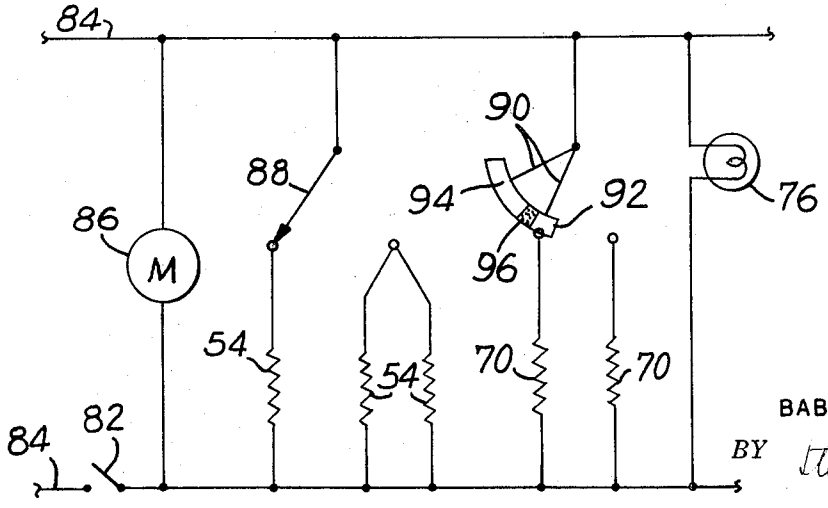


FIG. 5



INVENTOR.
BABINGTON A. QUAME
BY Steinberg & Blake
ATTORNEYS

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FIG. 3

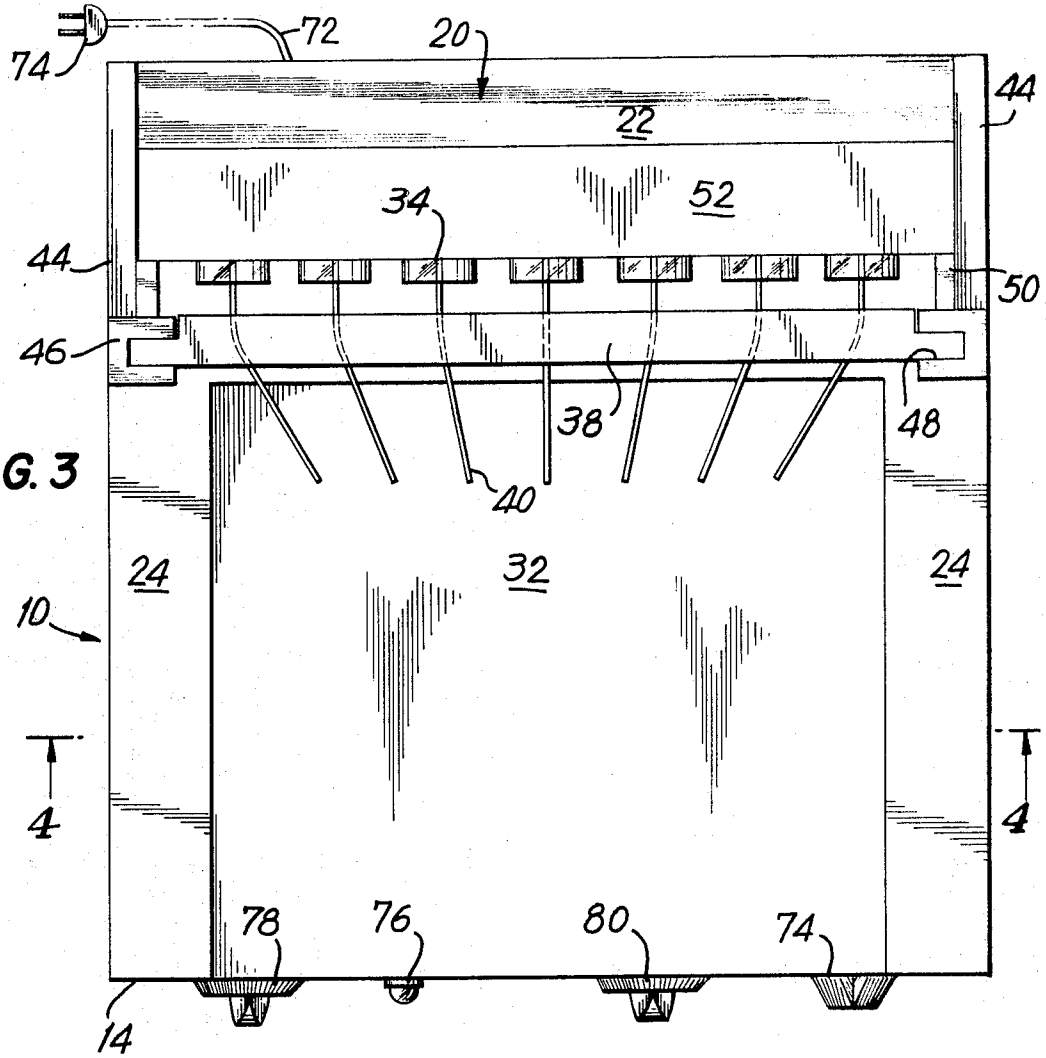
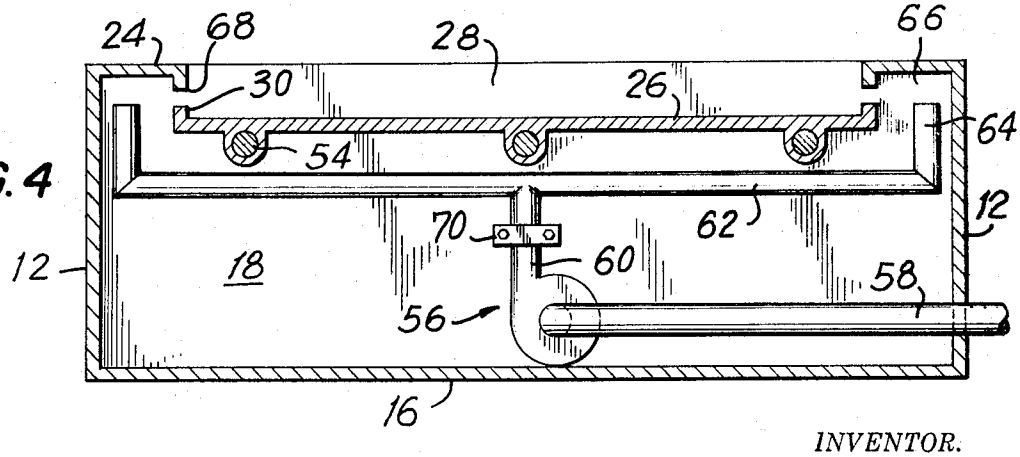


FIG. 4



INVENTOR.
BABINGTON A. QUAME

BY Stenberg & Blake

ATTORNEYS

United States Patent Office 3,758,275 Patented Sept. 11, 1973

3,758,275

APPARATUS FOR PROVIDING TEST SPECIMENS IN THE FORM OF SPOTS

Babington A. Quame, 331 E. 29th St., New York, N.Y. 10016

Filed July 2, 1971, Ser. No. 159,346
Int. Cl. G01n 1/14
U.S. Cl. 23—259 10 Claims

ABSTRACT OF THE DISCLOSURE

An apparatus for providing test specimens in the form of spots. The apparatus includes a supporting structure for supporting a sheet material which is to receive the spots. A rack is provided to hold beakers or other containers in which the specimen material is situated dissolved in suitable liquid solvent. A carrier structure carries a plurality of capillary tubes which have receiving ends situated in the beakers in communication with the solvent therein when the rack is placed at a predetermined position with respect to the carrier structure for the capillary tubes. These tubes respectively have discharge ends which are spaced suitably from each other and located over the supporting structure for the sheet material so that through capillary action the specimens dissolved in the solvent will be deposited on the sheet material to form thereon specimens in the form of dry spots resulting from evaporation of the solvent.

BACKGROUND OF THE INVENTION

The present invention relates to an apparatus for providing specimens in the form of spots situated on suitable sheet material.

At the present time it is known that specimens or samples can be provided in the form of spots on suitable sheet material. The specimen is usually located initially in a beaker forming a residue therein. A solvent is added to the beaker to dissolve the specimen, and then it is conventional through tedious time-consuming manual operations to utilize a capillary tube for transferring the dissolved specimen together with the solvent to a suitable thin-layer plate or paper. Particularly where a number of spots are to be provided on such sheet material, an extreme amount of time-consuming manual operations are required.

A further disadvantage encountered with conventional arrangements of this type resides in the fact that when the solvent with the desired specimen or sample dissolved therein is applied through the above operations in the form of a spot on suitable sheet material, it is necessary to permit the solvent to evaporate so that a dry spot will be achieved. This requirement also involves loss of time.

SUMMARY OF THE INVENTION

It is accordingly a primary object of the present invention to provide an apparatus which will avoid the above drawbacks.

In particular, it is an object of the present invention to provide an apparatus which is capable of providing a relatively large number of specimens in the form of dry spots on suitable sheet material in a manner which will provide these specimens in a period of time which is far shorter than has heretofore been possible and in a manner which will eliminate all of the tedious time-consuming manual operations previously required.

A further object of the present invention is to provide an apparatus of this type which can be manufactured at a relatively low cost and which can be used by relatively unskilled personnel.

In addition it is an object of the present invention to provide for an apparatus of the above type a structure which will reduce to a minimum the time required for the solvent to evaporate.

Also it is an object of the present invention to provide an arrangement which will conveniently be capable of handling a relatively large number of specimens.

According to the invention the apparatus includes a support means for supporting a sheet material which is to receive the spots. A rack carries a plurality of containers in which the specimens are located, dissolved in a suitable solvent. A carrier means is carried by the support means between the rack and the sheet material, and this carrier means carries a plurality of capillary tubes which have receiving ends respectively situated within and communicating with the solvent in the containers carried by the rack when the latter is placed in the predetermined position on the support means. These capillary tubes respectively have discharge ends which are suitably spaced from each other and which are located over the support means above the sheet material thereon so that through capillary action the solvent in the several containers is delivered through the capillary tubes onto the sheet material. A suitable heating means is provided for hastening the evaporation of the solvent on the sheet material so that dry spots of the specimens will remain on the sheet material suitably spaced from each other in accordance with the spacing of the discharge ends of the capillary tubes from each other.

BRIEF DESCRIPTION OF DRAWINGS

The invention is illustrated by way of example in the accompanying drawings which form part of this application and in which:

FIG. 1 is a perspective illustration of an apparatus according to the present invention shown without the carrier means for the capillary tubes, without the sheet material which receives the spots, and without the rack for the beakers which contain the specimens dissolved in suitable solvent;

FIG. 2 is a schematic perspective illustration of the manner in which a plurality of capillary tubes are arranged with respect to beakers and a sheet material which is to receive the spots;

FIG. 3 is a top plan view of the apparatus of FIG. 1 shown with the rack for the beakers and with the carrier means and capillary tubes carried thereby;

FIG. 4 is a transverse sectional elevation of the structure of FIG. 3 taken along line 4—4 of FIG. 3 in the direction of the arrows; and

FIG. 5 is a wiring diagram showing the electrical circuitry of the apparatus of the invention.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to the drawings, there is shown in FIG. 1 a support means 10 made of any suitable rigid material such as wood, plastic, metal, or the like or any combination of these materials. The support means 10 includes side walls 12 and a front wall 14. The side walls 12 and front wall 14 are fixed to extend upwardly from a bottom wall 16 which is visible in FIG. 4, and behind the front wall 14 is a rear wall 18, the inner surface of which is visible in FIG. 4.

The support means 10 also includes a top wall 20 having a rear elongated portion 22 extending all the way across the space between and being fixed to the top edges of the side walls 12 and rear wall 18. This top wall 20 includes also a pair of side portions 24 which extend forwardly from the rear transverse portion 22. These portions 22 and 24 of the top wall 20 are situated at an elevation higher than the central front portion 26 of the

top wall **20** of the support means **10**. Between the upper portions **22** and **24** of the top wall **20** and the lower portion **26** thereof is a vertically extending part of the top wall **20**, this vertically extending part having a rear transversely extending portion **28** extending between and fixed to the wall portion **22** and wall portion **26**, and the top wall **20** has a pair of vertically extending side portions **30** extending between and fixed to the wall portion **26** and the portions **24** of the top wall **20**. These wall portions **30** are also illustrated in FIG. 4.

Thus, the vertically extending wall portions **28** and **30** of the top wall **20** extend upwardly from the periphery of the wall portion **26** of the support means **10**. This wall portion **26** is adapted to support a sheet material **32**, fragmentarily illustrated in FIG. 2. This sheet material **32** will have a size corresponding to the area of the wall portion **26**, and the vertical wall portions **28** and **30** will extend upwardly from the edges of the sheet material **32**. This sheet material **32** may be a suitable precoated thin-layer chromatographic plate or paper to receive the spots which initially are in the form of specimens dissolved in suitable organic solvent, the specimens or samples being spotted on the thin-layer plate or paper to concentrate the specimen or sample to a small diameter at the location where they are applied to the sheet material **32**. This sheet material **32** may, for example, have dimensions on the order of 20 cm. by 20 cm. As is also indicated in FIG. 2, the samples or specimens are initially located in organic solvent within the containers such as the several beakers **34** schematically represented in FIG. 2. A plurality of capillary tubes **36** have receiving ends located in these beakers **34** so that the solvent with the specimens dissolved therein will travel by capillary action through the several capillary tubes **36**. These capillary tubes are carried by an elongated carrier means **38** in the form of a suitable elongated bar formed with bores through which the several capillary tubes **36** extend so as to be carried by the carrier means **38**. This elongated bar **38** may be in the form of any elongated rod of rigid material, made of wood, plastic, metal or the like, and having a rectangular or square cross section. The several capillary tubes **36** have discharge ends **40**, respectively, which become situated over the sheet material **32** carried by the support means **10** at the area **26** thereof, so that through capillary action the solvent with the specimens dissolved therein is deposited from the several containers **34** onto the sheet material **32** in the form of a plurality of spots **42**, and upon evaporation of the solvent the specimens will remain in the form of dry spots on the sheet material **32**. Of course it is to be understood that the illustration in FIG. 2 is schematic only and that actually in the apparatus of the invention it is possible to locate a relatively large number of capillary tubes and beakers **34** in order to provide a relatively large number of spots **42** distributed across the sheet material **32**.

Referring now to FIG. 1, the support means **10** further includes a pair of opposed side walls **44** fixed to and extending upwardly from the rear portion **22** of the top wall **20**. At their front ends the side walls **44** terminate next to a pair of upstanding channels **46** of substantially U-shaped cross section. These channels **46** are fixed to and extend from the top surface of the top wall **20**. While the channels **46** are shown at the region of the rear of the wall portion **26**, they may be located at the front region of the rear portion **22** of the top wall **20**, if desired.

The hollow interiors **48** of the channels **46** are directed toward each other. These hollow interiors **48** have top open ends and may extend all the way down to the top surface of the top wall **20**. However, the hollow interiors **48** may be terminated at a suitable distance above the top surface of the top wall **20**, if desired, depending upon the height of the carrier means **38**. The length of the carrier means **38** is such that its opposed end regions can be slipped down into the channels **48** so that when the carrier means **38** is introduced into these channels it will be properly held thereby with the several capillary tubes situated at a proper elevation with respect to support means **10**.

The inner side surfaces of the upstanding walls **44** fixedly carry elongated stop bears **50** which have rear ends situated at locations which will determine the position of a rack which carries several beakers **34**.

Referring to FIG. 3, it will be seen that a rack **52** is illustrated carrying a plurality of beakers **34**. This rack **52** may be in the form of an elongated bar of wood, plastic, metal, or the like, formed with suitable openings in which the several beakers **34** are located. The carrier means **38** is also illustrated within the channels of the upstanding members **46**. The rack **52** simply rests directly on the rear portion **22** of the top wall **20**, and after the carrier means **38** is situated within the hollow interiors **48** of the channels **46**, the rack **52** is moved forwardly along the top surface of the rear portion **22** of the top wall **20**. The result will be that the several receiving ends of the several capillary tubes **36** will extend into solvent in the several beakers **34**. The discharge ends **40** of the several capillary tubes **36** are arranged as illustrated in FIG. 3 so as to provide a row of spots **42** suitably distributed with respect to each other across the sheet **32**.

Thus, in order to use the apparatus the operator will first place a plurality of capillary tubes **36** in clean, dry condition, carried by the carrier means **38** on the apparatus in the manner illustrated in FIG. 3, and then the beakers **34** carried by the rack **52** will be placed in the position illustrated so that the receiving ends of the capillary tubes will extend into the solvent so that the latter will travel through the capillary tubes onto the sheet **32** in order to provide the spots thereon. As the operator moves the rack **52** forwardly it will extend up to the stop members **50** to be held thereby at locations which will assure that the receiving ends of the capillary tubes **36** extend into the solvent.

In order to provide a relatively rapid absorption and evaporation of the organic solvent specimens, a heating means is provided. This heating means includes electrical heating elements **54** suitably insulated and arranged beneath the wall portion **26** of the support means **10** in the manner shown in FIG. 4.

In addition to the heating provided by the heating elements **54**, a blower means **56** is provided. This blower means is in the form of a suitable fan or blower driven by a suitable motor and sucking air in from the exterior through an inlet pipe **58**. This pipe extends to the exterior through one of the side walls **12** and the blower and motor assembly is carried by the bottom wall **16** beneath the wall portion **26**.

The blower means **56** has an upwardly directed discharge end **60** communicating with an elongated tube **62** which extends across the wall **26** beneath the latter, and this tube **62** has upwardly directed discharge ends **64** directing the air into the elongated channels **66** situated beneath the wall portions **24**. The vertical wall portions **30** are respectively formed with elongated slots **68** which extend from the region of the rear vertical wall portion **28** to the region of the front wall **14**, so that through these slots **68** air streams will be directed across a sheet **32** on the wall portion **26**. Suitable heating elements **70** are situated in the path of flow of the discharge air flowing from the discharge **60** into the tube **62**, so that the air will be heated by the heating elements **70**.

The front wall **14** carries the controls for the apparatus. As may be seen from FIG. 3, through a suitable cord **72** having electrical conductors therein a plug **74** may be situated in any suitable wall outlet to provide the electrical energy required to operate the apparatus of the invention. The front wall **14** carries a switch-operating element **74** for turning the apparatus on an off. In addition there is a pilot light **76**. Also the front wall **14** carries a rotary con-

trol knob **78** for controlling the heating elements **54** and a rotary control knob **80** for controlling the heating elements **70**.

Referring now to FIG. 5, the switch-operating element **74** is operatively connected with a switch **82** for turning the entire apparatus on and off. This switch is situated in one of the lines **84** to which the apparatus is connected by the plug **74**. Between these lines is connected a motor **86** connected to the blower means **56**, so that when the switch **82** is closed by manipulation of the knob **74** the blower means **56** will be operated.

The rotary control knob **70** is connected to a rotary contact **88** which can connect into the circuit either the left heating element **54** shown in FIG. 5 or the pair of right heating elements **54** shown in FIG. 5 depending upon the position of the control **78**. This control **78** can locate the rotary contact **88** in an off position where it does not connect any of the heating elements **54** into the circuit or it may have a warm position connecting only one element into the circuit or a hot position connecting a pair of the heating elements into the circuit. Thus, in a position shown in FIG. 5 the central heating element **54** will be connected into the circuit while in the hot position the pair of heating elements **54**, located at opposite sides of the central element **54**, will be connected into the circuit.

The heating elements **70** are also shown in FIG. 5. The manipulation of the knob **80** will connect one or both of these elements into the circuit. Thus, the knob **80** is connected to a rotary contact member **90** carrying an electrically conductive element **92** and an elongated electrically conductive element **94** extending along an arc of a circle whose center is in the turning axis of the rotary contact **90**. The element **92** will contact only the left contact **70** while the element **94** which is insulated by material **96** from the element **92** will engage both of the heating elements **70** to connect them both into the circuit. Thus in the hot position of control **80** both elements will be located in the path of air while in the warm position shown in FIG. 5 only one element **70** will be located in the path of heating air. This control **80** also has an off position where neither one of the heating elements **70** will be connected into the circuit.

FIG. 5 also shows the manner in which the pilot lamp **76** is connected into the circuit.

Thus, with the apparatus of the invention it is possible to provide controls according to which the sheet material **32** is heated either by heating elements **54** or by an air stream which may be heated to an adjustable extent, or both of these expedients may be used simultaneously if desired, and in this way an extremely rapid evaporation of the solvent is achieved to provide the dry spots on the paper.

It is apparent from the above description that the apparatus of the invention can be manufactured at relatively low cost in order to achieve a substantially automatic deposition of spots on the paper or plate. The only manual operations required is placing of the beakers into engagement with the stops **50** so that the receiving ends of the capillary tubes will extend into the solvent, and then all of the operations will follow automatically. A sheet **32** with the spots thereon is easily removed from the wall **26** because the side wall portions **30** extend all the way to the front wall **14** so that a sheet or plate which is to receive the spots can be readily slipped onto and off from the wall **26** through the space between the vertical wall portions **30** at the front end regions of the latter.

What is claimed is:

1. In an apparatus for providing specimens in the form of spots on a given sheet material, stationary support means for supporting the sheet material which is to receive the spots and for maintaining the sheet stationary while it is supported by said support means, a rack for carrying containers having specimen material dissolved in solvent therein, and a plurality of capillary tubes respectively having receiving ends to be situated at the containers carried by the rack in communication with the interiors of the containers, respectively, for receiving the specimens dissolved in the solvent and respectively having discharge ends spaced from each other and situated over said support means to deposit the solvent with the specimens dissolved therein onto the stationary sheet material carried by said support means, whereby upon evaporation of the solvent the specimens in the form of spots will be situated on the sheet material which may then be manually removed from the stationary support means.

2. The combination of claim **1** and wherein an elongated carrier means carries the capillary tubes.

3. The combination of claim **2** and wherein said support means supports said carrier means at a position for situating the receiving ends of said capillary tubes in said containers when the rack with containers carried thereby is placed in a predetermined position on the support means.

4. The combination of claim **3** and wherein a heating means is carried by said support means for heating the sheet material to hasten the evaporation of the solvent.

5. The combination of claim **3** and wherein a blower means is carried by said support means for blowing warm air over said sheet material carried by the support means for hastening the evaporation of the solvent.

6. The combination of claim **5** and wherein said support means includes a supporting wall on which the sheet material is to be placed beneath the discharge ends of said capillary tubes, said wall having a pair of upstanding portions situated at opposed side edges of the sheet material and formed with elongated openings, said blower means communicating with said openings for directing air streams toward each other from the side edges of the sheet across the latter.

7. The combination of claim **3** and wherein a heating means coats with said support means for heating sheet material carried thereby to hasten evaporation of the solvent, and wherein a blower means communicates with the space over the sheet material for directing across the sheet material a stream of air for also contributing to the rapidity of the evaporation of the solvent.

8. The combination of claim **3** and wherein said support means removably supports said carrier means so that the latter and the capillary tubes can be readily placed on or removed from said support means.

9. The combination of claim **8** and wherein said rack carries a plurality of beakers having open ends through which the receiving ends of said capillary tubes are received to be placed in communication with specimens dissolved in a solvent in the beakers.

10. The combination of claim **9** and wherein a positioning means carried by said support means coacts with said rack for positioning the latter to situate the receiving ends of the capillary tubes in the beakers in communication with the solvent therein.

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MORRIS O. WOLK, Primary Examiner

R. E. SERWIN, Assistant Examiner

U.S. Cl. X.R.

23—253 TP, R; 141—130