

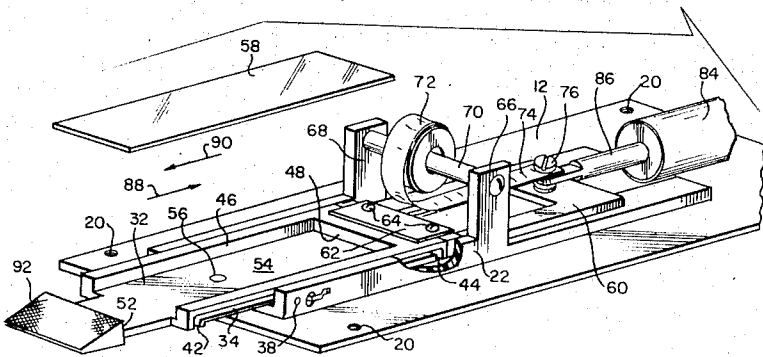
- [54] APPARATUS FOR PREPARING BLOOD SPECIMENS ON SLIDES
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- [73] Assignee: Systematiks, Inc., Indianapolis, Ind.
- [22] Filed: Sept. 14, 1970
- [21] Appl. No.: 71,728
- [52] U.S. Cl.118/100
- [51] Int. Cl.B05c 11/02
- [58] Field of Search....118/120, 100, 506; 117/102 R, 117/64 R, 3; 128/2 R, DIG. 5; 23/253 R

- [56] References Cited
- UNITED STATES PATENTS
- 3,470,847 10/1969 Chapin et al.118/100
- Primary Examiner—Morris Kaplan
Attorney—Hood, Gust, Irish, Lundy & Coffey

- [57] ABSTRACT
- An apparatus for preparing blood specimens on slides

having a test surface comprising guide means, a carrier mounted on the guide means for movement back and forth therealong, the carrier providing means for holding the slide to expose its test surface to receive a drop of blood at a predetermined spot thereon. A member extends toward the path of movement of the carrier preferably but not necessarily to engage the test surface of the slide held thereby. Drive means is provided for moving the carrier at a predetermined speed in one direction along the guide means, the carrier being movable in the opposite direction along the guide means to the point at which such a drop of blood on the said predetermined spot just contacts and wets the said member. The member which engages the slide is preferably a resiliently flexible, thin strip-like member which may be resiliently urged against the test surface of the slide to provide, adjacent the test surface and in contact therewith, a portion of the member which is at least slightly curved about an axis extending generally parallel to the test surface and generally perpendicular to the path of movement of the carrier or which is inclined relative to the test surface.

24 Claims, 17 Drawing Figures



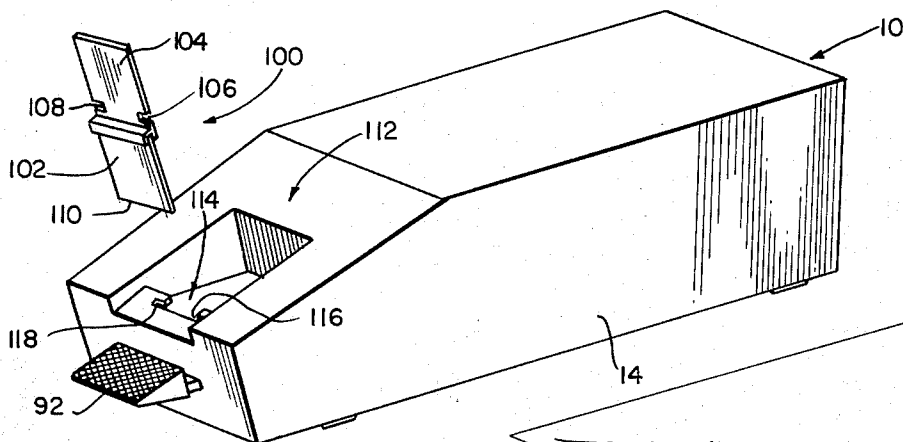


Fig. 1

Fig. 1a

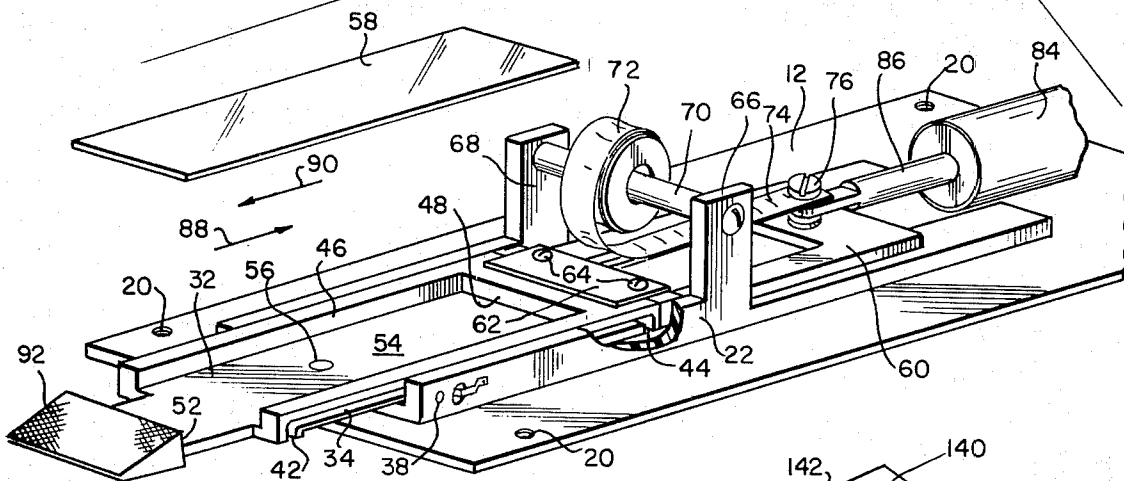
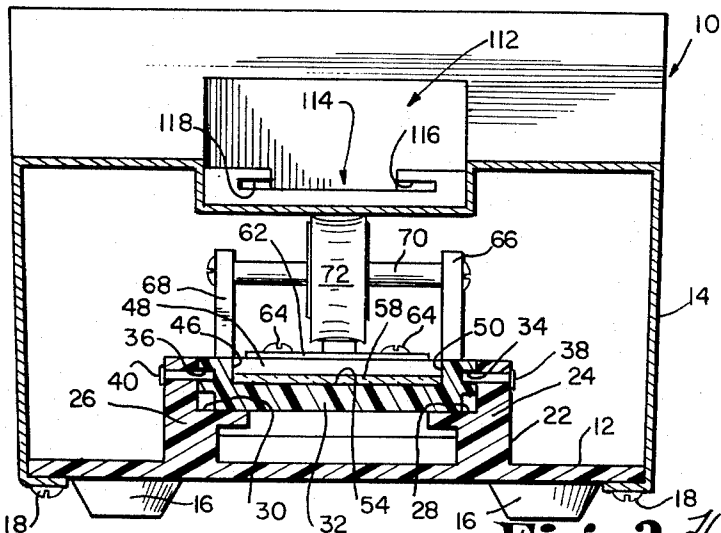


Fig. 2

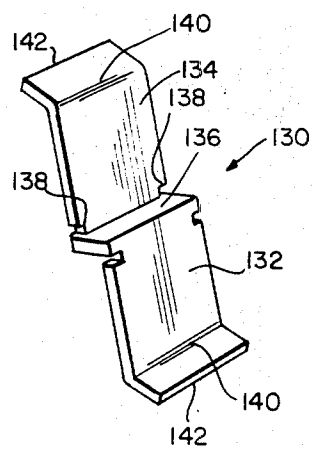


Fig. 3

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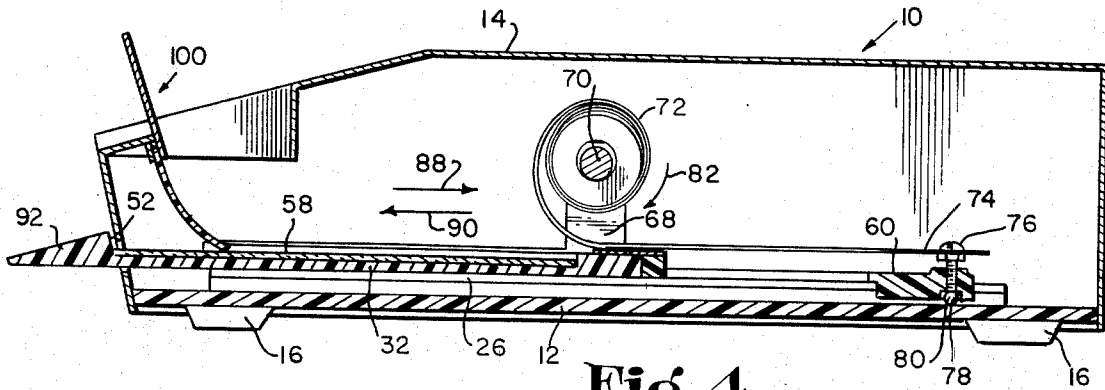


Fig. 4

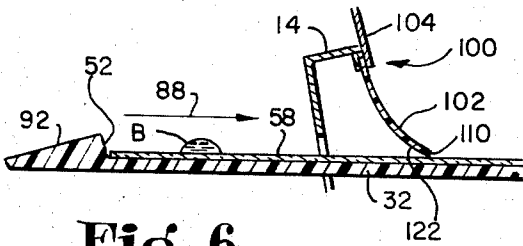


Fig. 6

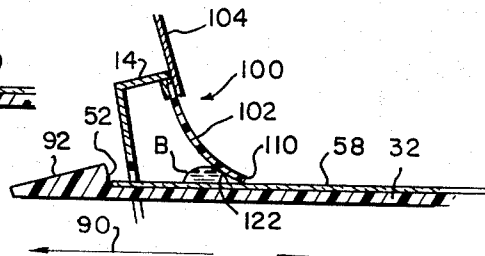


Fig. 7

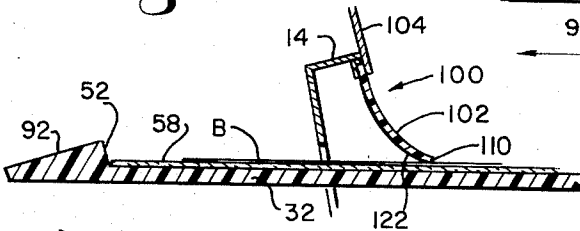


Fig. 8

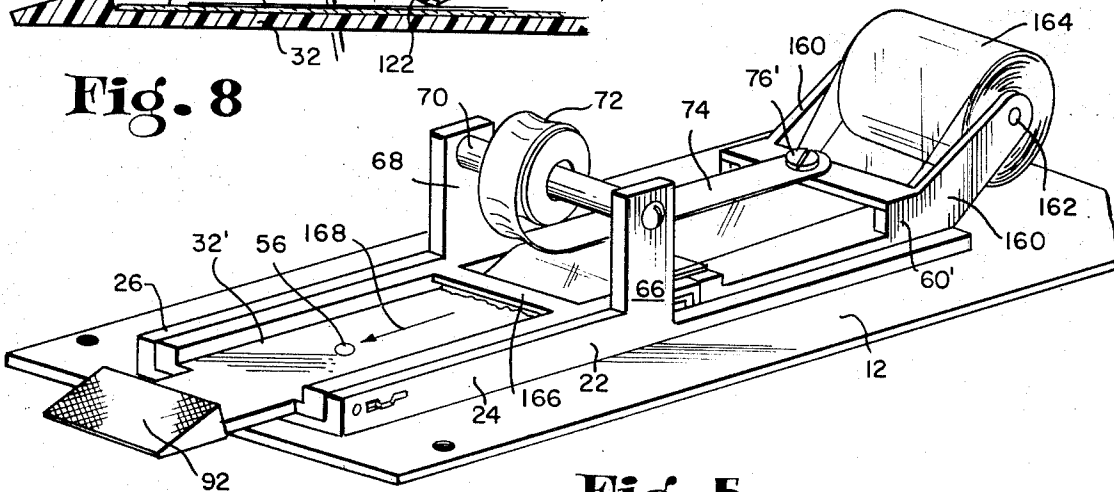


Fig. 5

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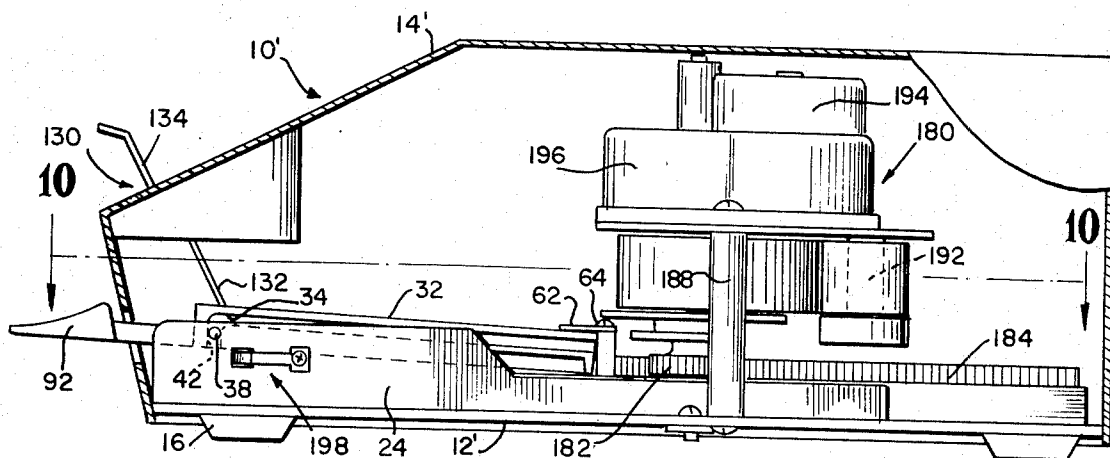


Fig. 9

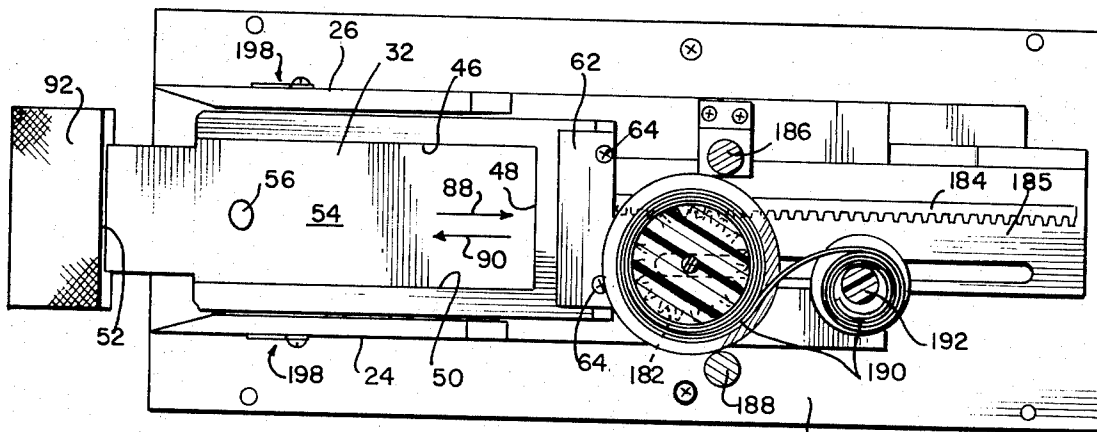


Fig. 10

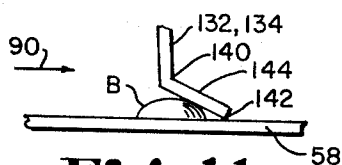


Fig. 11

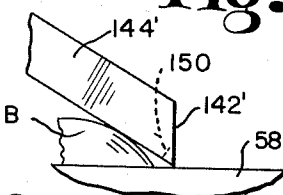


Fig. 12

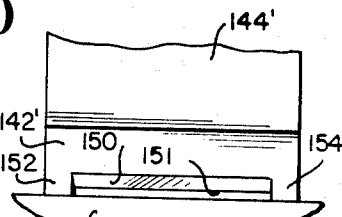


Fig. 13

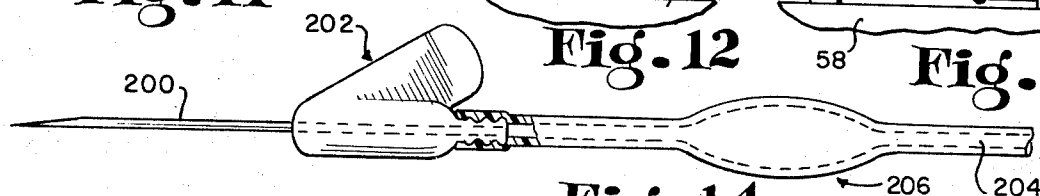


Fig. 14

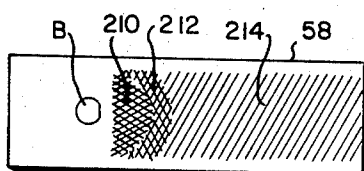


Fig. 15

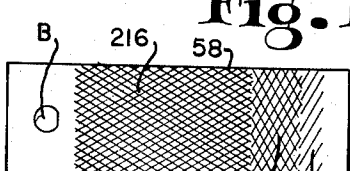


Fig. 16

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APPARATUS FOR PREPARING BLOOD SPECIMENS ON SLIDES

It is a primary object of my present invention to provide an apparatus for systematizing the preparation of blood film specimens on glass slides so that the specimens can be viewed with a microscope. Specifically, it is an object of my present invention to provide an apparatus which will take the guesswork out of preparing such specimens on slides by providing means proportioned and designed correctly and repeatedly to draw a drop of blood placed on a predetermined spot on the slide into a film which is one cell layer thick.

Such specimens are conventionally and presently prepared on thin rectangular pieces of glass, commonly referred to as slides. Conventionally, the technician deposits a drop of blood on one slide and then manually uses another slide to draw the blood into a thin film and, in some cases improperly to scrape or spread the blood into a thin film. The quality of the film obtained presently depends upon the talent and capability and care of the technician processing the specimen. It is well known in the blood testing field that a great many of the slide specimens made using present techniques are worthless for the testing purpose intended. This is true because the manual manipulation of the drop of blood by the second slide often damages blood cells within the drop and often fails to provide a film which is one cell layer thick.

My apparatus is an important improvement in that it includes a carrier mounted on a guide means for movement back and forth therealong, the carrier providing means for holding such a slide to expose its test surface to receive a drop of blood at a predetermined spot thereon. I prefer to place, on the carrier itself, a spot or dot which will be visible through the slide so that the technician can place the drop of blood on the upper surface of the slide, i.e., its test surface, to be in vertical registry with the spot on the carrier. My apparatus includes a member which preferably contacts the test surface of the slide for uniformity purposes. The carrier is preferably manually movable inwardly to the point at which a drop of blood on the said predetermined spot will just contact and wet the portion of the applicator member directly adjacent the test surface. Means are provided for stopping the carrier at this point. At this point, the member contacts and breaks the surface tension of the drop of blood, and the blood spreads laterally on the member by capillary action. Then, my apparatus includes drive means for moving the carrier at a predetermined constant speed outwardly to move the drop of blood away from the member. This outward movement, at the proper speed, is effective to draw the drop of blood into a thin film which is of the proper and desired thickness and the cells of which are undamaged by the drawing process.

Utilization of the apparatus defining my present invention, therefore, includes the steps of obtaining and depositing a drop of blood on the test surface of a slide, moving the slide so that the drop of blood just contacts and wets the portion of the member held adjacent the test surface, and then moving the slide in the opposite direction at a predetermined speed to draw the drop of blood into a thin film.

It is important to note that my apparatus preferably involves using a thin resiliently flexible member held against the test surface on which the drop is deposited

in such a manner that the drop contacts an inclined smooth surface. This is in contrast to using the sharp square and flat portion of a slide as the means for drawing a drop of blood.

I prefer to use an elongated small diameter plastic hose, a length of which has an enlarged cross section, to take the blood specimen. Specifically, in accordance with the disclosures of my copending application Ser. No. 824,977 filed May 15, 1969, now U.S. Pat. No. 3,633,566 and my copending application Ser. No. 165 filed Jan. 2, 1970, now abandoned, I use a small plastic hose or tube, each end of which is connected to the rear end of a sharpened cannula. One cannula is inserted into a person's vein and the other cannula is sequentially penetrated through the closing means or stoppers of tubes which are evacuated. The portion of the hose or tube which has the enlarged cross section is close to the cannula inserted into the vein so that a drop of blood of a predetermined size can be obtained simply by squeezing the portion having the enlarged cross section to force a drop out of the cannula and onto a slide. I prefer to use a 21 thin wall cannula to penetrate the vein, and the bore of this cannula will provide a drop of a desired size when the cannula is first removed from the vein.

When the blood droplet is spread into a film, the cells will randomly spread throughout the film, i.e., some red cells, some white cells and some platelets will be in any area of the film inspected. The red cells, white cells and platelets will appear in much the same manner as a group of three differently sized marbles resting on a flat surface to provide a layer which is one cell thick, but with the cells being of different size. One cubic millimeter of blood has approximately $4\frac{1}{2}$ million red cells, 4,000 white cells and about 150,000 platelets. Thus, there are more red cells than anything else appearing in the film drawn. It is important, therefore, in order to study the morphology of the white cells and platelets that the film be one cell layer thick. Importantly, white cells are studied carefully to classify them as to granulocyte or lymphocyte or variety. Such determinations cannot be made if the red cells are piled up against the white cells.

Blood film specimens, of course, are investigated under a microscope, and unless the blood is drawn into a film which is one cell thick, it is difficult to make any sight comparative evaluations at all. For instance, if the film is properly one cell layer thick and the cells are not damaged, a good comparative determination as to the number of white cells with respect to the number of red cells can be obtained.

Other objects and features of my present invention will become apparent as this description progresses.

To the accomplishment of the above and related objects, my invention may be embodied in the forms illustrated in the accompanying drawings and the method described herein, attention being called to the fact, however, that the drawings are illustrative only, and that change may be made in the specific constructions illustrated and described, or in the specific steps stated, so long as the scope of the appended claims is not violated.

In the drawings:

FIG. 1 is a perspective view showing one embodiment of my apparatus;

FIG. 1a is an exploded perspective view of the internal mechanism of the embodiment of FIG. 1;

FIG. 2 is a transverse sectional view of the embodiment of FIG. 1;

FIG. 3 is a perspective view of a preferred type of applicator member usable in my apparatus;

FIG. 4 is a longitudinal sectional view of the apparatus of FIG. 1;

FIG. 5 is a fragmentary perspective of a portion of another embodiment of my apparatus, this embodiment including means for mounting a roll of tape and feeding discrete pieces of the tape to be used as test surfaces in lieu of the conventional glass slides;

FIG. 6 is a fragmentary sectional view showing the manner in which a slide is moved in the apparatus of FIG. 1 to draw a film;

FIG. 7 is another fragmentary sectional view similar to FIG. 6 except that it shows the blood droplet contacting the applicator member;

FIG. 8 is another fragmentary sectional view similar to FIG. 6 except that it shows the blood drawn into an exaggerated film;

FIG. 9 is a sectional view of another embodiment of my invention, this embodiment including a different drive arrangement than that shown in FIG. 1;

FIG. 10 is a sectional view taken from FIG. 9 generally along the lines 10—10;

FIG. 11 is a fragmentary view showing diagrammatically the action provided by the applicator member of FIG. 3;

FIG. 12 is a fragmentary view showing a different type of applicator member;

FIG. 13 is an end view taken from the right-hand side of FIG. 12 and showing the manner in which the applicator member of FIG. 12 engages the test surface of the slide;

FIG. 14 is a fragmentary view showing one means for obtaining the blood droplet;

FIG. 15 is a view of a slide showing diagrammatically the type of film drawn by my apparatus; and

FIG. 16 is a view of a slide showing the type of film which is drawn by conventional techniques.

Referring now to the drawings, and particularly to FIGS. 1, 1a, 2 and 4, it will be seen that my apparatus, indicated generally at 10, includes a base 12 and a housing cover 14 which is attached to the base. The base 12 may be provided with rubber-like feet 16 and the housing cover 14 may be attached to the base 12 by means such as screws 18 which extend through apertures 20 in the base.

My apparatus 10 includes guide means 22 which may be integrally formed with the base 12 as illustrated in FIG. 2, the guide means including spaced apart longitudinally extending runners 24, 26 providing, respectively, slideways 28, 30. I provide a carrier 32 mounted on the guide means 22 for longitudinal reciprocable movement back and forth therealong, the carrier 32 providing means for holding a test slide as will be discussed hereinafter. It will be seen that the carrier slides on the slideways 28, 30.

As best seen in FIGS. 1a and 2, each side of the carrier 32 is provided with a longitudinally extending slot 34, 36. A pin 38, 40 rigidly attached to each runner 24, 26 extends into each slot 34, 36 to keep the carrier 32 on the slideways 28, 30 as the carrier reciprocates.

Each slot 34, 36 is provided with a down-turned portion 42 at its outer end and a down-turned portion 44 at its inner end, the down-turned portions of slot 34 being seen in FIG. 1a. These down-turned portions 42, 44 provide means for locking the carrier 32 in its inner position or its outer position. Specifically, when the carrier is pushed inwardly and then raised slightly so that the pins 38, 40 engage the down-turned portions 42, the carrier is locked in its inner position; and, conversely, when the carrier 32 is pulled outwardly and the pins 38, 40 are engaged in the down-turned portions 44, the carrier is locked in its outer position.

The carrier 32, which is preferably generally horizontally extending, provides upstanding walls 46, 48, 50, 52 bounding a rectangular surface 54 having means 56 which may be a spot of paint, tape or the like on its upper surface. Test slides, one of which is indicated at 58 in FIGS. 1a and 2, are placed on the surface 54 with the sides of the test slide engaging, respectively, the walls 46, 48, 50 and 52. It will be appreciated that the spot 56 will be visible through the clear glass slide 58.

Thus, the spot on the upper, test surface of the slide 58 which is in direct vertical registry with the spot 56 is the aforesaid predetermined spot on which a drop of blood is deposited in accordance with my present invention.

A slider 60 is engaged with the runners 24, 26 to be longitudinally reciprocable therealong. This slider 60, which is disposed to the right of the carrier as viewed in FIGS. 1a and 4, acts as a pusher for moving the carrier 32 outwardly as will be discussed hereinafter. The slider 60 may or may not be fastened to the carrier 32. In the illustrative embodiment, I show a plate 62 mounted on the outer end of the slider 60 by means of screws 64, the plate 62 engaging the right-hand end of the carrier 32. This plate 62 holds down the right-hand end of the carrier 32.

In the illustrative embodiment, each runner 22, 24 provides an upright 66, 68 between which extends a trunnion 70. A conventional and commercially available wound strip spring 72 is mounted on the trunnion 70 with the free end 74 of the spring being connected to the slider 60 by means of a screw 76. This type of spring 72 is commonly referred to as a NEGATOR spring.

Referring to FIG. 4, it will be seen that the underneath side of the slider 60 is provided with a cavity 78 in vertical registry with and penetrated by the shank of the screw 76. A ball bearing 80 is placed in this cavity to ride on the surface of the base 12, and the shank of the screw 76 extends into the cavity to engage the ball bearing. By tightening the screw 76, the ease with which the slider 60 will move on the runners 24, 26 can be adjusted. Further, in FIG. 1a, I show a dashpot 84, the plunger 86 of which is connected to the slider 66 by, for instance, the screw 76. This dashpot 84 works in a conventional manner controllably to resist movement of the slider, thereby to control movement of the carrier 32 in the direction of the arrow 90. The manner in which a dashpot provides this function will be understood by those familiar with mechanisms.

In FIGS. 1a and 4, I show an arrow 88 representing the movement of the carrier 32 inwardly and an arrow 90 representing movement of the carrier outwardly.

The spring 72 is a drive means for moving the carrier 32 at a predetermined speed in one direction as indicated by the arrow 90 along the guide means 22. The carrier 32 is movable in the opposite direction as indicated by the arrow 88 along the guide means 22 to the point at which a drop of blood placed on the aforesaid predetermined spot of the test surface of the slide 58, i.e., in vertical registry with the spot 56, contacts and wets an applicator member which will be discussed in detail hereinafter.

A finger engageable push member 92 is provided for manually pushing the carrier 32 inwardly to the point at which the drop of blood contacts the applicator member. Stop means are provided for defining this point. For instance, the engagement of the pins 38, 40 in the left-hand ends of the slots 34, 36 may serve as a stop means for the carrier 32 when it moves in the direction of the arrow 88. It will be appreciated that any such stop means may be used.

Referring now to FIGS. 1, 6, 7 and 8, it will be seen that I have illustrated an applicator member 100 including an applicator portion 102 and a gripping portion 104. The gripping portion 104 is provided with side notches 106, 108 and the applicator portion 102 terminates, at its distal end, with a transversely extending straight edge 110. As best seen in FIGS. 1 and 2, the housing 14 is provided with an opening 112 at its upper, left-hand end as viewed in FIG. 1, this opening 112 terminating with a slot 114 into which the applicator member 100 is inserted. The slot 114 provides laterally extending notches 116, 118 which cooperatively engage, respectively, the notches 106, 108 securely to hold the applicator member 100 in position relative to the carrier 32. It will be appreciated that this means of holding the applicator member securely relative to the carrier 32 is illustrative and that any number of such means may be used to accomplish the same purpose.

The applicator portion 102 is preferably a thin resiliently flexible strip-like plastic member. The applicator member 100 is preferably held relative to the carrier 32 in such a manner that the applicator portion 102 will be resiliently urged against the test surface of the slide 58 as best seen in FIGS. 6, 7 and 8. Referring to FIGS. 6, 7 and 8 it will be seen that the applicator portion 102 is held in such a manner that it is curved to provide, adjacent the test surface and in contact therewith, a portion 122 curving about an axis which is above the surface 58 and extending perpendicular to the guide means 22, i.e., the path of movement of the carrier 32. This portion 122 provides an outer peripheral surface which is contacted by the blood drop B. Specifically, as shown in FIG. 6, the blood drop B is placed at the aforesaid predetermined spot on the test surface of the slide 58. Then the carrier 32 is moved in the direction of the arrow 88. The previously discussed stop means stops the carrier 32 at the point at which the drop B just contacts and wets the outer peripherally curved surface of the portion 122 adjacent the test surface of the slide 58. As soon as the drop B contacts the portion 122, the blood spreads laterally against the portion 122 by capillary action because the surface tension of the drop is broken by the applicator member. Then, the carrier 32 is moved in the direction of the arrow 90 at a predetermined preferably constant

speed to draw the blood into a film as shown in FIG. 8. Particularly, when the drop B is in the position shown in FIG. 7, the drop adheres to the portion 122 of the applicator member 100 as well as to the said predetermined spot on which it was initially placed. The movement of the slide in the direction of the arrow 90 causes the blood in the drop B to be drawn into a film.

If the carrier 32 is moved too fast in the direction of the arrow 90, the film will be broken. If the carrier 32 is moved too slow in the direction of the arrow 90, the blood will be drawn into a film which is too thick. Experimentally I have determined that a carrier speed of approximately 1 inch per second is satisfactory. It will be appreciated, however, that this speed will depend upon the particular configuration of the applicator member, etc.

Referring now to FIGS. 3 and 11, it will be seen that I have shown an applicator member 130 having two applicator portions 132, 134 extending away from a central portion 136. Each portion 132, 134 is provided with notches 138 which perform the same function as the notches 106, 108 discussed in conjunction with the applicator member 100. Each applicator portion 132, 134 is bent or formed as indicated at 140 a short distance from its distal edge 142. When the applicator member 130 is snapped into the slot 114, the distal edge 142 of its applicator portion 132 or 134 will engage and extend transversely across the test surface of the slide 58 as shown in FIG. 11. There will be a portion 144 extending between this distal edge 142 and the bend line 140, this portion 144 providing a downwardly facing inclined surface extending toward the test surface of the slide 58 and in the direction of the arrow 90, i.e., the direction in which the slide 58 is pushed inwardly. The slide 58 is stopped by the aforesaid stop means at the point at which the blood drop B contacts and wets this inclined surface as illustrated in FIG. 11. Then, the slide is moved in the direction of the arrow 88 to move the drop B away from the applicator portion 132, 134. I prefer to construct the applicator member so that the portion 144 (FIG. 11) is inclined at an angle of approximately 25° relative to the test surface of the slide 58. It will be appreciated that this angle of inclination also depends on several factors including the size and shape of the applicator member and that the angle of inclination may be from approximately 25° to approximately 45° relative to the test surface of the slide 58.

Referring now to FIGS. 12 and 13, it will be seen that there is illustrated an applicator portion 144' directly adjacent the test surface of the slide 58. The applicator member providing this portion 144' has its distal edge 142' cut or otherwise formed as indicated at 150 to provide spaced apart contact points 152, 154 which engage the lateral edges of the test surface of the slide and a straight edge 151 extending transversely across and above the test surface, the contact points 152, 154 being effective to hold the straight edge 151 at the desired height above and in parallelism with the test surface. This straight edge 151 may only be held, for instance, 0.001 inch above the test surface.

It is not absolutely vital that the applicator member itself touch the test surface of the slide. It is only necessary that the applicator member have a portion which is close enough to the test surface of the slide to be contacted and wetted by the blood drop placed upon the

test surface. I have found that it is more convenient to engage the free end of the cantilevered applicator member with the test surface of the slide in such a manner that the blood drop will engage an inclined surface or a curved surface of the applicator member in the same manner each time a film is made. It will be appreciated that the drop B (FIG. 11) will engage more area of the downwardly facing inclined surface of the portion 144 than it would if the portion 144 were extending perpendicularly to the test surface of the slide 58.

Referring now to FIG. 5, it will be seen that I have constructed the slider indicated at 60' in such a manner that it provides means 160, 162 for mounting a roll of tape 164 for movement with the carrier indicated at 32'. This system of FIG. 5 is adapted to feed discrete pieces of the tape 164 to the carrier 32' so that these discrete pieces of tape can serve as test slides. Specifically, tape is fed under a knife-edge bracket 166 as indicated by the arrow 168 to cover the upwardly facing surface of the carrier 32' on which the spot 56 is marked. The blood is then dropped onto the spot of the tape which is in direct registry with the spot 56 so that the smear or film can be made on the surface of the tape. The means for supporting the roll of tape includes a pair of support arms 160 extending rearwardly and upwardly from the slider 60' and a trunnion 162 extending between the support arms 160. The only significant difference between the structure of FIG. 5 and the structure of FIGS. 1a, 2 and 4 is that the roll of tape is added so that discrete pieces of the tape can be used as test surfaces.

Referring now to FIGS. 9 and 10, it will be seen that I have shown another embodiment of my apparatus, indicated generally by the reference numeral 10', this embodiment being similar to the embodiment of FIGS. 1a, 2 and 4, except that a different drive means 180 is utilized to drive the carrier 32 in the direction of the arrow 90. Like reference numerals in FIGS. 9 and 10 represent like parts in FIGS. 1, 1a, 2 and 4.

The drive means 180 is a commercially available spring-type drive motor having an output gear 182 which I use to drive a rack 184 which reciprocates with the carrier 32. Thus, my apparatus of FIGS. 9 and 10 basically includes a spring motor 180 and transmission means (output gear 182 and rack 184) drivingly connecting the spring motor to the carrier 32. The spring motor of the drive means 180 is mounted above the path of the rack 184 on standoffs 186, 188 to hold its output gear 182 in mesh with the rack 184. While the drive means 180 is commercially available and need not be discussed in detail herein, it does include a strip spring 190 which is also of the type usually referred to as a NEGATOR spring and portions of which are wrapped about a trunnion 192 and another axis concentric with the output gear 182. The drive means 180 includes a fly wheel and clutch arrangement (the housing for which is indicated at 194) which controls the output speed of the gear 182. The gear 182 is drivingly connected to the fly wheel and clutch arrangement by conventional gearing, the housing for which is indicated at 196. Energy is stored in the spring 190 when the carrier 32 is manually pushed in the direction of the arrow 88 to the point at which the drop of blood contacts the applicator member. Then, promptly, the per-

son making the specimen removes his hand to permit the drive means 180 to return the carrier 32 in the direction of the arrow 90.

I have found that I am able to obtain the proper rate of movement of the carrier using the spring-type motor discussed generally in FIGS. 9 and 10.

In the structure of FIGS. 9 and 10, the rack 184 is rigidly fastened to a slider 185 which corresponds to the slider 60 discussed previously. Further, in FIGS. 9 and 10, I show spring-loaded detent means 198 arranged to hold the carrier 32 in its illustrated position in FIG. 9 to keep the pin 38 in the down-turned portion 42 of the slot 34 to hold the carrier in its inner position.

Referring now to FIG. 14, it will be seen that I have illustrated a cannula 200, cannula gripper 202 and a hose 204, a portion 206 of which is enlarged as illustrated. In accordance with the disclosures of my aforementioned patent applications, the cannula 200 is inserted into a person's vein so that the blood flows through the cannula and the hose 204. Generally, a number of blood specimens are deposited into test tubes from the hose 204. When the cannula 200 is removed from the vein, a blood drop of a preferred size can be accurately positioned on the test surface of a slide in registry with the spot 56 on the carrier simply by placing the sharpened end of the cannula at that spot on the slide and then gently applying pressure to the enlarged portion 206. The pressure applied to the enlarged portion 206 will cause a drop of blood to leave the end of the cannula 200. The size of the drop of blood will depend on the bore size of the cannula 200. I prefer to use a No. 21 thin wall cannula 200, and the bore size of this particular cannula will provide a blood drop of the preferred size.

Referring now to FIGS. 15 and 16, a comparison of the type of film made by my apparatus with the type of film made by conventional processes can be had. FIG. 15 is an illustration of a film made by my apparatus. The portion of the indicated at 210 is a longitudinally short film which is, for instance, five cells thick. Then the film gets thinner as indicated by the area 212 which may be, for instance two cells thick. The balance of the test area indicated at 214 is a film which is one cell thick as desired. It will be appreciated that more than half of the test surface includes a film which is one cell thick. In FIG. 16, the film on the area indicated at 216 will be quite thick. The film on the area indicated at 218 will be progressively thinner but it will be several cells thick. Finally, the film on the area indicated at 220 will generally be one cell thick if the conventional process is handled properly. The length and width of the one cell thick film provided by my apparatus 10, 10' is considerably greater than the length and width of the film area indicated at 220 in FIG. 16.

From the above description, it will be appreciated that I have provided an apparatus for using the apparatus which greatly systematizes the making of blood film specimens on slides, i.e., the making of what is known in the medical profession as peripheral smear specimens. When my apparatus 10 is used, the angle of inclination of the applicator member relative to the test surface of the slide is always the same, the speed by which the blood drop is drawn into a film is always the same, the amount and size of the blood drop is always the same, the pressure with which the applicator

member is held against the test surface is always the same, the age of the blood drop deposited on the test surface when the smear is made is always the same, and the location of the blood drop on the slide and the length of the smear is always the same. With respect to the age of the blood when the smear is made, I contemplate that the blood drop will be deposited onto the test surface of the slide just as soon as the cannula 200 is withdrawn from the vein. As soon as the blood drop is placed on the slide, the technician merely has to push inwardly on the carrier 32 until it stops moving, this whole process taking place in a matter of a very few seconds.

What is claimed is:

1. An apparatus for preparing blood specimens on slides having a test surface comprising guide means, a carrier mounted on said guide means for movement back and forth therealong, said carrier providing means for holding such a slide to expose its test surface to receive a drop of blood at a predetermined spot thereon, means for defining said spot, a member extending toward the path of movement of said carrier and the test surface of the slide held thereby, means for holding said member relative to said guide means, and drive means for moving said carrier at a predetermined speed in one direction along said guide means, said carrier being movable in the opposite direction along said guide means to the point at which a drop of blood on said predetermined spot of such a slide contacts said member to effect a capillary spread of said blood and whereby, upon return movement of the carrier in said one direction, a blood smear is obtained.

2. The apparatus of claim 1 in which said member is resiliently flexible and in which said holding means is positioned relative to said carrier so that said member is resiliently urged against the test surface of the slide to provide, adjacent the test surface and in contact therewith, a portion of said member curving about an axis to provide an outer peripheral surface to be contacted by such a drop of blood.

3. The apparatus of claim 2 including means for stopping movement of said carrier in said opposite direction at said point, said stopping means being positioned so that, when said carrier is at said point, such a drop of blood on said spot will contact and wet said portion of said member.

4. The apparatus of claim 3 in which said axis of curvature extends generally parallel to the test surface and generally perpendicular to the path of movement of said carrier, said member being cantilevered from said holding means so that said curved portion is its free end portion.

5. The apparatus of claim 1 in which the portion of said member adjacent and against the test surface is formed to extend toward the test surface and in said opposite direction, and including means for stopping movement of said carrier in said opposite direction at said point, said stopping means being positioned so that, when said carrier is at said point, such a drop of blood on said spot will contact and wet by capillary action said formed portion.

6. The apparatus of claim 5 in which said member is cantilevered from said holding means so that said formed portion is its free end portion.

7. The apparatus of claim 6 in which said member is a thin, strip-like member, said formed portion being curved about an axis extending generally parallel to the test surface and generally perpendicular to the path of movement of said carrier.

8. The apparatus of claim 7 in which said member is resiliently flexible, said holding means being positioned relative to said carrier so that said member is resiliently urged against the test surface of the slide.

9. The apparatus of claim 1 in which said drive means includes a spring for moving said carrier in said one direction away from said point.

10. The apparatus of claim 9 including means for controllably resisting movement of said carrier by said spring, thereby to determine the speed of movement in said one direction away from said point.

11. The apparatus of claim 1 including means for mounting a roll of tape and feeding discrete pieces of said tape to said carrier, said discrete pieces serving as the slides.

12. The apparatus of claim 11 in which said mounting means is connected to said carrier for movement therewith.

13. The apparatus of claim 1 in which the portion of said member adjacent the test surface is formed to provide an inclined surface extending the test surface and in said opposite direction, and including means for stopping movement of said carrier in said opposite direction at said point, said stopping means being positioned so that, when said carrier is at said point, such a drop of blood on said spot will contact and wet said inclined surface.

14. The apparatus of claim 13 in which said member provides spaced apart contact points which engage the test surface and a straight edge portion extending transversely across and above the test surface, said contact points being effective to hold said straight edge portion at the desired height above and in parallelism with the test surface.

15. The apparatus of claim 14 in which there are two of said contact points engaging, respectively, opposite side edges of the test surface and in which said straight edge portion extends between said contact points.

16. The apparatus of claim 13 in which said portion of said member is inclined at an angle of approximately 25° relative to the test surface.

17. The apparatus of claim 13 in which said portion is inclined at an angle of from approximately 25° to approximately 45°.

18. The apparatus of claim 1 in which said drive means includes a spring motor, and transmission means drivingly connecting said spring motor to said carrier.

19. The apparatus of claim 18 in which said transmission means includes a rack connected to said carrier and extending in the direction of said guide means and gear means drivingly connecting said rack to said spring motor.

20. The apparatus of claim 19 including braking means drivingly connected to said transmission means and arranged to control the speed at which said rack is driven.

21. The apparatus of claim 20 in which energy is stored in said spring motor by manually moving said carrier in said opposite direction to said point.

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22. The apparatus of claim 21 including means for stopping movement of said carrier in said opposite direction at said point, said stopping means being positioned so that, when said carrier is at said point, such a drop of blood on said spot will contact said member.

23. The apparatus of claim 21 in which the portion of said member adjacent the test surface is formed to provide an inclined surface extending toward the test surface and in said opposite direction, and including

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means for stopping movement of said carrier in said opposite direction at said point, said stopping means being positioned so that, when said carrier is at said point, such a drop of blood on said spot will contact and wet said inclined surface.

24. The apparatus of claim 23 wherein the means defining said spot is visible through said slide.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,683,850 Dated August 15, 1972

Inventor(s) Robert H. Grabhorn

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

Column 1, line 1 after the title, "may" should be -- my --.
Column 6, line 20, "s" should be -- is --; line 23,
"132,234" should be -- 132,134 --.

Column 8, line 14 should be the beginning of a new paragraph; line 39, after "the" and before "indicated" insert -- film --.

Column 10, line 26 (Claim 13, line 3) after "extending" and before "the", insert -- toward --.

Signed and sealed this 9th day of January 1973.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents