United States Patent

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[54] **SLIDE DISPENSER**
7 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **221/135,** 221/279
[51] **Int. Cl.** **A24f 27/14**
[50] **Field of Search** 221/135, 199, 1, 22, 279, 285, 303, 304, 307

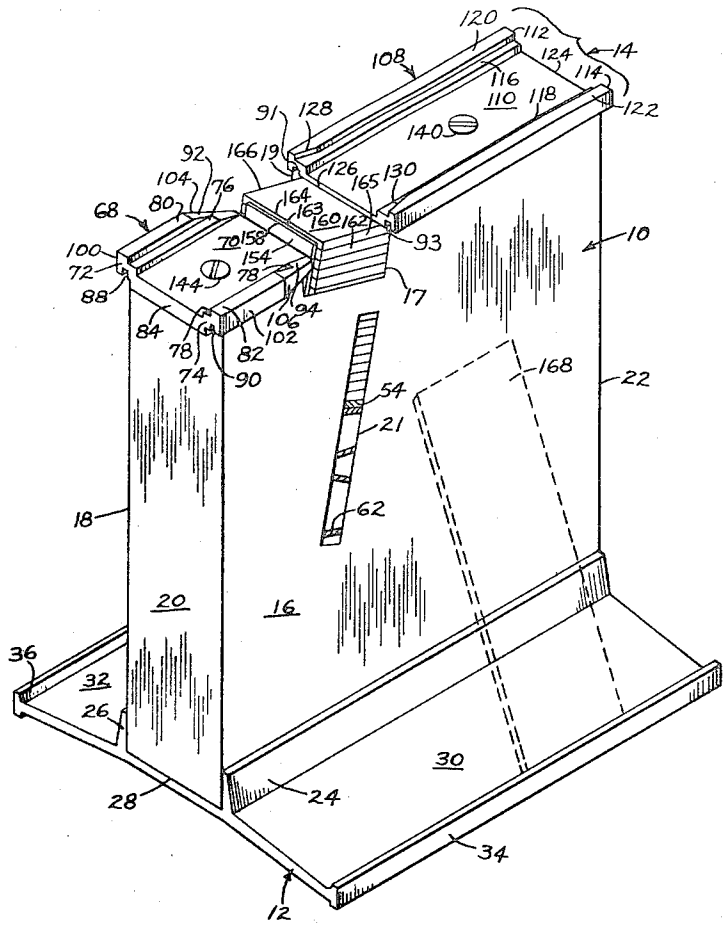
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ABSTRACT: Apparatus is provided for dispensing rectangular platelike objects, such as microscope slides, one at a time. This dispenser also provides means for producing desirable liquid smears on microscope slides. A supporting track is located along the top of the dispenser for supporting a slide having a blood drop, for example, on its lower face. A stored slide protrudes from a storage magazine and forms an acute angle with the plane of the supporting track. The leading edge of the protruding slide projects slightly above the plane of the supporting tract and is capable of being depressed so as to be in the same plane as the supporting tract. The slide having the blood drop is moved in one direction along the track in depressing engagement with the leading edge of the protruding slide until the blood drop on its under side contacts said protruding slide and forms a liquid capillary meniscus in the acute angular space between the two slides. The slide having the blood drop is then moved along the supporting track in the opposite direction to spread out the liquid along the lower surface of such slide and form a desired liquid smear.



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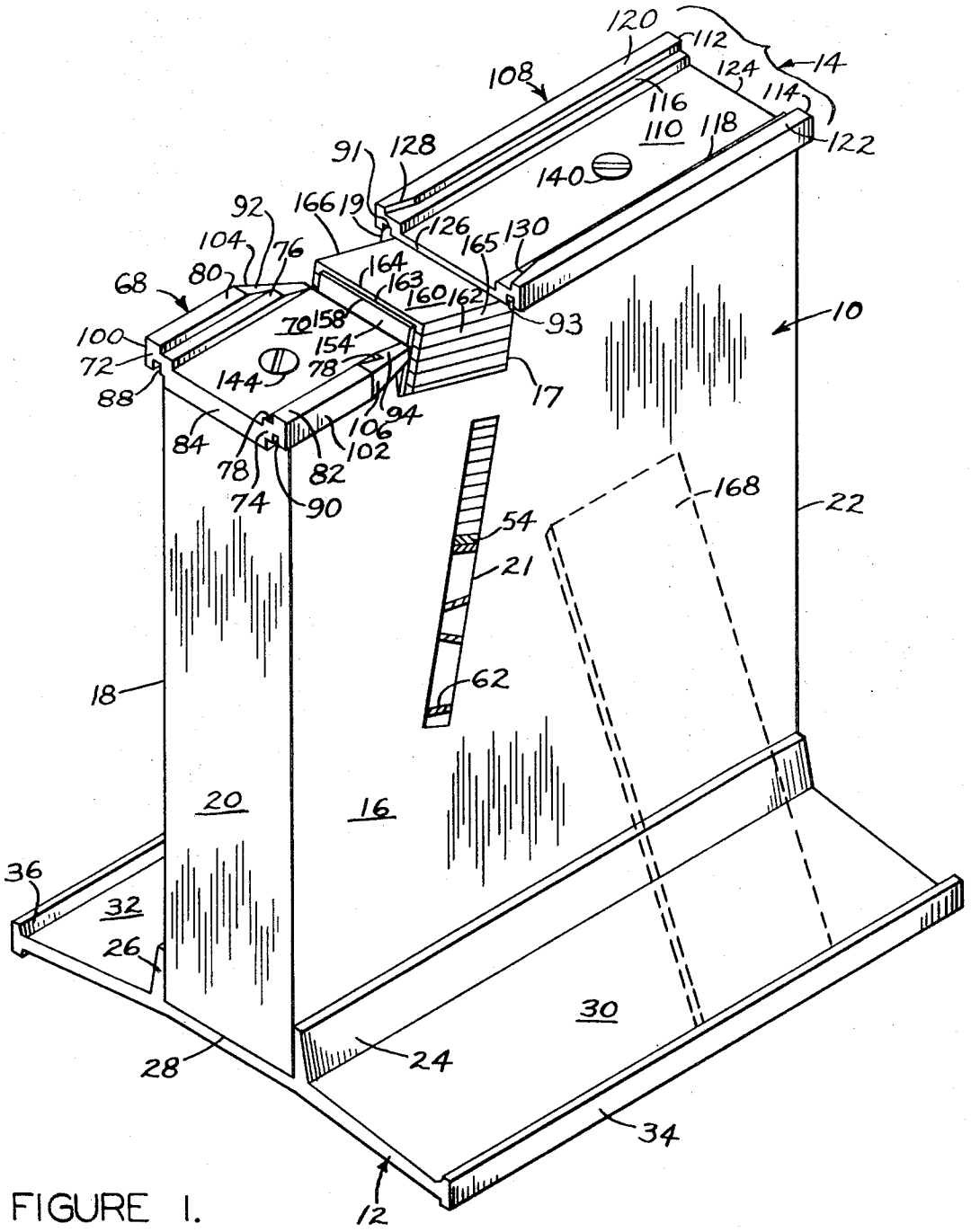


FIGURE 1.

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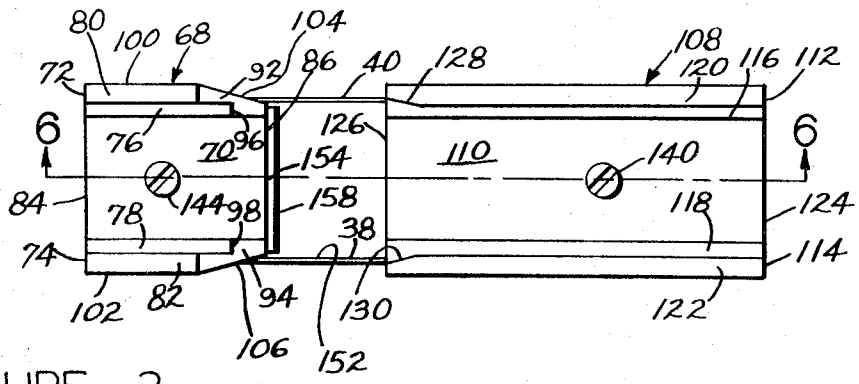


FIGURE 3.

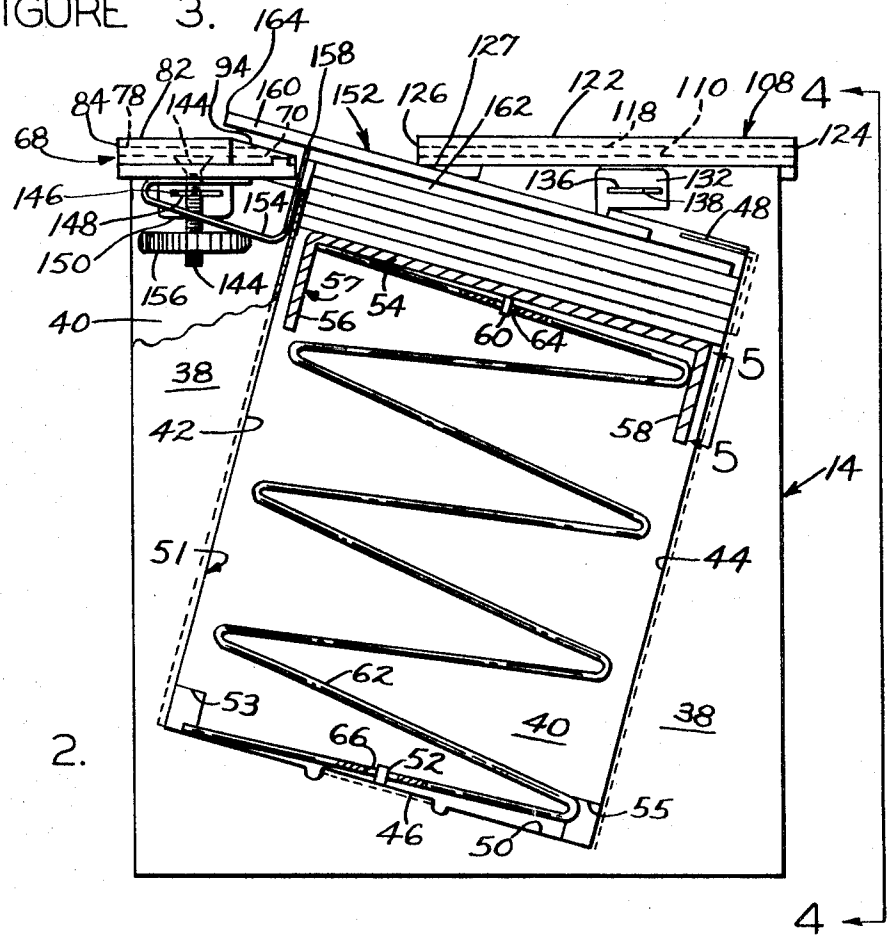


FIGURE 2.

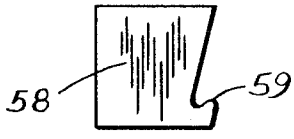


FIGURE 5.

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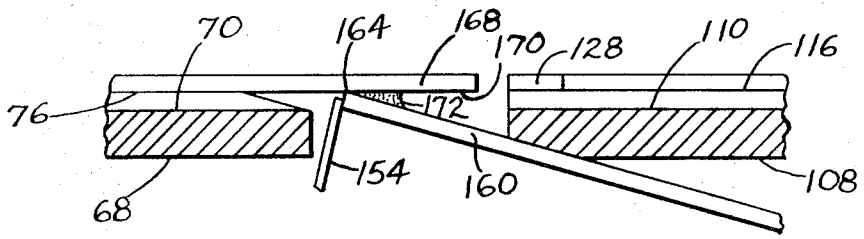


FIGURE 6.

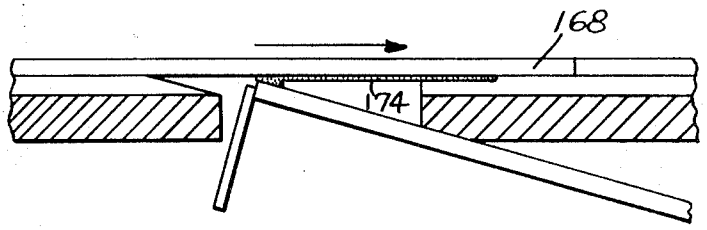


FIGURE 7.

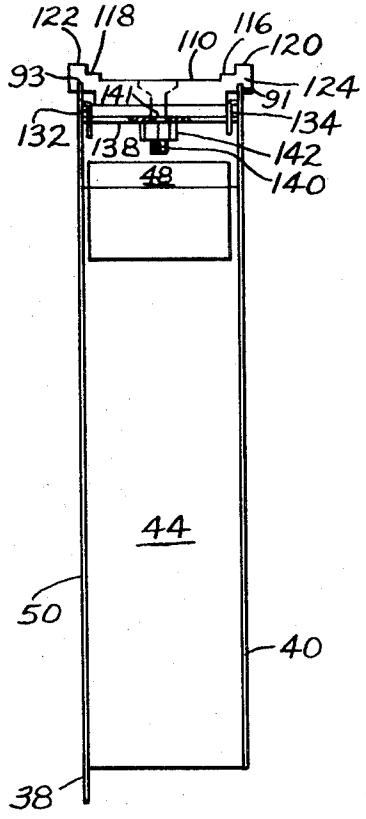


FIGURE 4

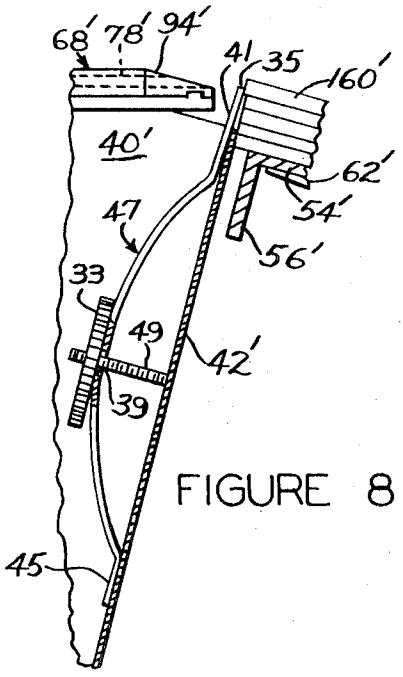


FIGURE 8

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SLIDE DISPENSER

BACKGROUND AND PRIOR ART

It is well known in the art that microscope slides should be as clean as possible, i.e., free of surface dirt and fingerprints, prior to use in the preparation of liquid smears, for example, for subsequent microscopic examination. Microscope glass slides are generally available in clean form in original packages, but they become dirty, especially with fingerprints, when they are removed from such packages and handled prior to microscopic examination. This is especially true when the glass slides are employed to prepare liquid smears, such as blood smears.

There have been various efforts in the prior art to provide mechanical dispensers for dispensing clean slides, but these efforts have not been commercially successful, especially for the dispensing of slides one at a time.

It is also well known in the art that liquid smears, such as blood smears, on a microscope slide are generally prepared in the following manner. A drop of blood is applied to the upper surface of a first glass slide near one end of the slide. A second glass slide having a substantially straight leading edge is positioned over the first slide with the leading edge of its lower surface in contact with the blood drop and the upper surface of the first slide and with the plane of the lower surface of the second slide forming an acute angle with the plane of the upper surface of the first slide. The blood drop forms a liquid capillary meniscus in the acute angular space between the two slides. The second slide is then moved along the first slide with the liquid-containing acute angular space in a trailing position. This forms a liquid smear along the upper surface of the first slide. This prior art manual procedure has the disadvantage that the production of a high quality liquid smear is dependent upon the maintenance of a proper liquid capillary meniscus in the acute angular space between the two slides during the formation of the liquid smear. In this manual operation the maintenance of the desired acute angle is dependent primarily on the dexterity of the person handling the slides. The uniformity of consecutive liquid smears made by the same operator is often of a low order and between liquid smears made by different operators can be even worse.

OBJECTS AND SUMMARY OF THE INVENTION

It is an object of the present invention to provide improved apparatus for dispensing rectangular platelike objects, such as microscope slides.

It is another object of the present invention to provide apparatus for the production of consistent acceptable quality liquid smears on slides.

In accordance with the present invention, apparatus for storing and dispensing rectangular platelike objects, such as slides, having substantially flat upper and lower surfaces and substantially straight end edges is provided which comprises a magazine having a boxlike cavity capable of storing a plurality of such objects in stacked relation, means in said cavity biasing the topmost object stacked therein to a predetermined position, said magazine also having an opening positioned to permit said topmost object to be withdrawn from said cavity by endwise movement, means for preventing more than said topmost object from being withdrawn from said cavity when said topmost object is withdrawn through said opening, supporting track means adjacent said opening adapted to receive and support one of said objects for longitudinal movement therealong, said track means and cavity being positioned such that one of said objects when placed flat against said track means has its lower surface engaged by an end edge portion of the topmost of any objects stacked in said cavity and forms an acute angle with the upper surface of said topmost object. The end edge portion of said topmost object normally projects slightly above the plane of said track means and is depressable against said biasing means unto said plane by slight downward pressure on said object on said track means.

When a slide having a drop of liquid depending from its lower surface is placed on said supporting track and is moved so that the liquid contacts the upper surface of the slide projecting from the magazine, a liquid capillary meniscus is formed in the acute angular space between the upper surface of the projecting slide and lower surface of the slide on said tract. Subsequent longitudinal movement of the slide on said track along and flat against said supporting track is effective to cause the liquid to be spread out over the lower surface of the supported slide and form a desired liquid smear thereon.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of the assembled dispenser of the present invention shown containing slides to be dispensed;

FIG. **2** is a side view with a portion removed of the slide magazine unit removed from the assembly of FIG. **1**;

FIG. **3** is a plan view of the magazine unit of FIG. **2**;

FIG. **4** is an end view of the magazine unit taken along line **4–4** of FIG. **2**;

FIG. **5** is an end view of a portion of the magazine unit taken along line **5–5** of FIG. **2**;

FIG. **6** is a partial cross-sectional view taken along line **6–6** of FIG. **3** showing the relationship between two slides and a drop of liquid contained therebetween at the start of the preparation of a liquid smear on one of the slides;

FIG. **7** is a similar view to FIG. **6** showing the partially formed liquid smear; and

FIG. **8** is a side view similar to FIG. **2** showing a portion of the magazine unit having a preferred apparatus configuration.

DESCRIPTION OF THE INVENTION

Referring to FIG. **1**, the dispenser of the present invention comprises a rectangular boxlike case **10**, an attached base **12**, and a magazine unit **14**, shown in more detail in FIG. **2**, which is removably positioned within case **10**. Case **10** as shown has vertical sidewalls **16** and **18** and vertical end walls **20** and **22**. A notched portion **17** is cut out of the upper edge of sidewall **16** as shown in FIG. **1**. A corresponding notched portion **19** is cut out of sidewall **18** directly opposite the notched portion **17**. A slanted slot **21** is also cut through sidewall **16**. Base **12** has spaced parallel upstanding ribs **24** and **26** forming a channel **28** therebetween. Case **10** is positioned within channel **28** and is attached to the base **12** by suitable means. Base **12** also has flange portions **30** and **32** extending laterally outwardly from ribs **24** and **26** respectively. Flange portions **30** and **32** terminate in longitudinal rib members **34** and **36** respectively of T-shaped cross section.

The removable magazine unit **14** is shown in detail in FIGS. **2**, **3** and **4**. Magazine unit **14** has parallel rectangular sidewalls **38** and **40**. Sidewall **38** has a rectangular opening **50** formed therein. At opposite side margins of said opening **50** parallel transverse end walls **42** and **44** are bent inwardly from wall **38** toward sidewall **40** and are joined by welding, for example, to sidewall **40**. Along the bottom margin of the opening **50** a transverse bottom plate **46** is bent inward from sidewall **38** toward sidewall **40** and is also attached by welding, for example, to sidewall **40**. Bottom plate **46** is provided with an upstanding pin **52** as shown. An angled top plate member **48** has one leg thereof attached to the upper edge portion of end wall **44** and another leg thereof extending parallel to bottom plate **46** as shown. The planes of bottom plate **46** and top plate **48** are normal to the planes of the end walls **42** and **44**. A rectangular boxlike magazine cavity **51** is thus formed having end walls **42** and **44**, bottom plate **46**, top plate **48**, closed sidewall **40** and an open side **50** formed in sidewall **38**. Apertures **53** and **55**, as shown in FIG. **2**, are formed in sidewall **40** near the two lower corners of cavity **51**.

Cavity **51** is tilted with respect to magazine unit **14** so that end walls **42** and **44** are from about 10° to about 20°, preferably about 15°, from the vertical, and parallel bottom and top plates **46** and **48** are from about 10° to about 20°, preferably about 15°, from the horizontal. A channel-shaped

pressure plate 57 having an elongated rectangular substantially flat upper surface portion 54 and depending end flanges 56 and 58 is located in the cavity. Upper surface portion 54 is substantially parallel to bottom and top plates 46 and 48 and end flanges 56 and 58 are substantially parallel to end walls 42 and 44. As shown in FIG. 5, the flange 58 has a hook portion 59 formed therein. Flange 56 has a similar hook portion. The pressure plate 57 is positioned in the cavity 51 in such manner that the the hook portions of the end flanges 56 and 58 are adjacent to sidewall 40. The pressure plate 57 is capable of sliding movement within cavity 51 along and between the end walls 42 and 44 thereof. Pressure plate portion 54 has a vertically depending pin 60 attached thereto.

A single leaf pleated compression spring 62 having an upper aperture 64 and a lower aperture 66 therein is placed in the cavity 51 between portion 54 of the pressure plate 57 and bottom plate 46 with the pin 60 of pressure plate portion 54 extending through upper aperture 64 and the pin 52 of bottom plate 46 extending through lower aperture 66. Compression spring 62 thus biases the pressure plate 57 upwardly toward the top plate 48. The cooperation between pins 52 and 60 and apertures 64 and 66 tends to keep the pressure plate 57 and compression spring 62 within the cavity 51.

A first supporting track member 68 is located along the top of magazine unit 14 and is attached thereto between sidewalls 38 and 40 in a manner to be described hereinafter. Member 68 has a generally U-shaped transverse cross section with a flat bottom wall portion 70 and stepped side portions 72 and 74 shown in FIGS. 1 and 3. The side portions 72 and 74 are formed with elongated spaced parallel coplanar supporting track surfaces 76 and 78, respectively, elongated spaced parallel coplanar top surface portions 80 and 82, respectively, and coplanar inclined top surface portions 92 and 94, respectively. Member 68 has an outer end surface 84 and a narrower inner end surface 86. Inclined top surface portions 92 and 94 intersect the upper surface of bottom portion 70 at inner end surface 86. Coplanar supporting track surfaces 76 and 78 intersect inclined surface portions 92 and 94 along edges 96 and 98, respectively. Track member 68 also has parallel side surface portions 100 and 102 and converging side surface portions 104 and 106. Side surface portions 100 and 102 extend in a longitudinal direction from outer end surface 84 for a distance equal to the longitudinal dimension of top surface portions 80 and 82, and converging side surface portions 104 and 106 extend longitudinally from the inner end surface 86 a distance equal to the longitudinal dimension of the inclined surface portions 92 and 94. Elongated longitudinal parallel slots 88 and 90 extend inwardly along the undersurface of side portions 72 and 74 respectively as shown in FIG. 1.

A second supporting track member 108 is also located along the top of magazine unit 14 between sidewalls 38 and 40 and is spaced from and aligned with the first supporting track member 68. Member 108 also has a generally U-shaped transverse cross section, as viewed in FIGS. 1, 3 and 4, with a flat bottom wall portion 110 and stepped side portions 112 and 114. The side portions 112 and 114 are formed with elongated spaced parallel coplanar supporting track surfaces 116 and 118, respectively, and elongated spaced parallel coplanar top surfaces 120 and 122, respectively. Elongated longitudinal parallel slots 91 and 93 extend inwardly along the undersurface of side portions 112 and 114 respectively as shown in FIGS. 1 and 4. Member 108 has an outer end surface 124 and an inner end surface 126. A lower portion of inner end surface 126 is cut away to form a flat inclined surface 127 which is disposed at an angle of from about 10° to about 20°, preferably about 15°, from the supporting track surfaces 116 and 118. This is shown in FIG. 2. Supporting track surfaces 116 and 118 are slightly widened near the inner end surface 126 by divergent surfaces 128 and 130 which cut through side portions 112 and 114 between top surfaces 120 and 122 and track surfaces 116 and 118. Track surfaces 76 and 78 of the first supporting tract member 68 are coplanar respectively with track surfaces 116 and 118 of the second supporting track member 108.

The second supporting track member 108 is conveniently attached to magazine unit 14 in the following manner. Indent portions 132 and 134 are partially cut out of sidewalls 38 and 40 respectively and indented as shown in FIG. 4. Appropriate slots, such as slot 136, shown in FIG. 2, are formed in the indent portions 132 and 134 to receive the opposite end portions of a flat transversely extending bar 138 having a centrally located threaded aperture 141 formed therein. A screw 140 passing transversely through an appropriate passage in the bottom wall portion 110 of member 108 may be threaded into the aperture 141 to secure member 108 in place. Alternatively, as shown in FIG. 4, screw 140 can be of a size to pass freely through the aperture 141 and be threaded into a nut 142 positioned below the bar 138. When supporting track member 108 is attached to magazine unit 14, sidewalls 38 and 40 extend into the elongated longitudinal slots 93 and 91 respectively as shown in FIG. 4.

The first supporting tract member 68 can be attached to the magazine unit 14 in a similar manner. As shown in FIG. 2, with a portion of sidewall 38 removed, a screw 144 is threaded through a threaded aperture in bar 146 the ends of which respectively fit into appropriate slots such as slot 148 of indent portion 150 of sidewall 40. The opposite end of bar 146 fits into a similar slot (not shown) in sidewall 38. When supporting track member 68 is attached to magazine unit 14, sidewalls 38 and 40 extend into the elongated slots 90 and 88 respectively of member 68.

Supporting track members 68 and 108 are longitudinally spaced from each other along the top of magazine unit 14 so as to form an opening 152 therebetween which communicates with cavity 51.

Abutment means consisting of a generally V-shaped member 154 of flat spring stock has an upturned abutment portion 158 which extends into opening 152 and terminates adjacent and parallel with the inner end surface 86 of member 68. Member 154 is located as shown in FIG. 2 with one leg thereof underlaying the bottom surface of member 68 and with supporting screw 144 passing through appropriate apertures in member 154. As shown in FIG. 2, a knurled nut 156 is threaded onto screw 144 and compressively engages the V-shaped portion of member 154. Rotational movement of nut 156 adjusts the vertical position of the abutment portion 158, the upper edge of which is preferably adjacent to and slightly below the plane of coplanar surfaces 76, 78, 116 and 118 of track members 68 and 108.

The improved dispenser apparatus of the present invention is filled with microscope slides in the following manner. Magazine unit 14 is removed vertically from case 10. Pressure plate 57 is depressed toward bottom plate 46 against the pressure of spring 62 until the hook portions 59 of the flanges 56 and 58 engage in the apertures 53 and 55 of sidewall 40 near the bottom of cavity 51. Engagement of the hook portions 59 in said apertures holds the pressure plate in the loading position. A box of clean microscope slides is opened and the clean slides, generally about 60—65 slides, are placed into the cavity by stacking them on top of each other in face-to-face relation. During this stacking care should be taken to handle the slides on their edges only, thus minimizing the chances of placing fingerprints on the faces of the slides. When the cavity is fully loaded, the hook portions 59 of the pressure plate 57 are disengaged from apertures 53 and 55 whereupon the compression spring 62 expands, forcing the pressure plate 57 against the slides and forcing the slides against the top plate 48 and against the inclined undersurface 127 of second track member 108. The uppermost slide 160 in the magazine cavity then protrudes into opening 152 and can abut against the portion 158 of abutment member 154. The substantially straight end edge 164 of the uppermost slide 160 is then positioned slightly above the plane of coplanar surfaces 76, 78, 116 and 118. Slide 160 now forms an acute angle of from about 10° to about 20°, preferably about 15°, with the plane of the above coplanar surfaces. The magazine unit 14 is then placed into case 10 as shown in FIG. 1.

To remove a slide from the dispenser the side surfaces **165** and **166** of the uppermost slide **160**, as shown in FIG. **1**, are grasped between two fingers and said slide is pulled up and out. Notches **17** and **19** in sidewalls **16** and **18** of case **10** enable the side surfaces of the uppermost slide to be exposed for ease in removal. The reduced width of the inner end **86** of track member **68** also facilitates access to the slides. As long as the upper edge portion **158** of abutment member **154** is located along the leading end surface **163** of the slide **160** while it is stored in the magazine, it will abut against the next below slide **162** and prevent it from being removed during withdrawal of slide **160** from the dispenser. Abutment member **154** is adjusted by nut **156** to achieve this condition and such adjustment permits slides of various thicknesses to be used in the improved dispenser.

In FIG. **2**, slide **160** is shown being withdrawn over the top of the abutment portion **158** of member **154** while the remaining slides are maintained within the magazine. This apparatus thus provides means for dispensing slides one at a time. Once slide **160** is completely removed, spring **62** will force the next slide **162** into the uppermost position for subsequent removal. This procedure is repeated every time a slide is withdrawn from the dispenser. The slanted slot **21** in sidewall **16** of case **10** exposes a portion of the interior of magazine **14** to view and allows one to determine how many slides are available for use before the magazine needs refilling.

This improved dispenser apparatus can be used to prepare uniformly desirable liquid smears on slides, and in such use, the coplanar surfaces **76**, **78**, **116** and **118** of supporting track members **68** and **108** provide a supporting track which engages longitudinal edge portions only of the lower surface of a slide placed therein. As shown in FIG. **6**, a slide **168** having a liquid drop, such as a blood drop, applied to one surface thereof generally along the longitudinal centerline is placed on the above-described supporting track with the liquid-bearing surface thereof facing downwardly and with the liquid drop on the right hand side of the leading edge **164** of uppermost slide **160** stored in the magazine, as viewed in said FIG. The leading edge **164** of uppermost slide **160** is then in contact with lower surface **170** of slide **168**. Slide **168** is then moved to the left, as viewed in FIG. **6**, until the depending liquid drop contacts slide **160** and forms a liquid capillary meniscus **172** in the acute angular space formed between the protruding slide **160** and the lower surface **170** of the supported slide **168**. Slide **168** is then moved to the right, as shown in FIG. **7**, with the simultaneous application of a light downward pressure sufficient to depress the leading edge **164** of the uppermost slide **160** into substantially the same plane as the supporting surfaces **76**, **78**, **116** and **118**. Such longitudinal movement of the slide **168** spreads out the liquid along lower surface **170** thereof and forms a desirable liquid smear **174**. The slanted surfaces **128** and **130** of member **108** guide the slide **168** onto the supporting track surfaces **116** and **118** during such slide movement. This apparatus is capable of producing uniformly acceptable liquid smears, because it provides a substantially constant angle between the lower surface of the supported slide and the upper surface of the coacting protruding slide. This substantially constant angle, which is predetermined to be from about 10° to about **20°**, preferably about 15°, has been found to be most satisfactory for the production of acceptable liquid smears.

Slide **168** is generally moved to the right, as viewed in FIG. **7**, for a sufficient distance to enable all of the liquid contained in the acute angular space between slides **168** and **160** to be spread along undersurface **170** of slide **168**. In the event that all the liquid is not spread along slide **168**, any liquid residue remaining on the upper surface of slide **160** will not interfere with subsequent use of slide **160** so long as it is withdrawn from the dispenser and its leading edge portion is not subsequently employed for the production of another liquid smear.

Once the liquid smear is applied to slide **168**, it is then removed from the supporting track and dried. The configuration of the apparatus of the present invention also aids in drying of applied smears. To this end the slide **168** bearing the liquid smear can be leaned against a sidewall of the case **10** with its lower end portion rested against a longitudinal rib **34** of the base **12**. This is shown in phantom in FIG. **1**.

A preferred form of the abutment means is shown in FIG. **8**. A threaded shaft **49** is fixed to and projects generally normal to cavity end wall **42'**. A bowed spring member **47** having substantially flat opposite end portions **41** and **45** and a generally centrally located aperture **39** is positioned with said end portions in contact with the end wall **42'** and the threaded shaft **49** extending through aperture **39**. Lower end portion **45** of spring member **47** is attached to the end wall **42'** near the lower end thereof by welding, for example. Upper end portion **41** of spring member **47** has an outer edge **35** positioned subjacent the plane of supporting track **78'** of track member **68'**. A knurled nut **33** is threaded onto shaft **49** and compressively engages spring member **47** as shown. As nut **33** is rotated inwardly along the shaft **49**, it depresses spring member **47** and causes edge **35** to move upward as shown in FIG. **8**. If nut **33** is rotated so that it moves outwardly along the shaft **49**, it relaxes member **47** and allows edge **35** to move downward. This movement of outer edge **35** achieves the same function as similar movement of outer edge portion **158** of abutment member **154** described above.

What I claim is:

1. Apparatus for storing and dispensing rectangular platelike objects, such as slides, having substantially flat upper and lower surfaces and substantially straight end edges, which apparatus comprises a magazine having a boxlike cavity capable of storing a plurality of such objects in stacked relation, means in said cavity biasing the topmost object stacked therein to a predetermined position, said magazine also having an opening positioned to permit said topmost object to be withdrawn from said cavity by endwise movement, means for preventing more than said topmost object from being withdrawn from said cavity when said topmost object is withdrawn through said opening, supporting track means adjacent said opening adapted to receive and support one of said objects for longitudinal movement therealong, said track means and cavity being positioned such that one of said objects when placed flat against said track means has its lower surface engaged by an end edge portion of the topmost of any objects stacked in said cavity and forms an acute angle with the upper surface of said topmost object.

2. Apparatus according to claim **1** wherein said end edge portion of said topmost object normally projects slightly above the plane of said track means and is depressable against said biasing means into said plane by slight downward pressure on said object on said track means.

3. Apparatus according to claim **1** wherein the acute angle between the upper surface of the topmost object in the cavity and the lower surface of an object placed flat along said supporting track means is from about 10° to about 20°.

4. Apparatus according to claim **3** wherein the acute angle is about 15°.

5. Apparatus according to claim **1** wherein the means for preventing withdrawal of more than the topmost object from said cavity is adjustable to compensate for variations in object thickness.

6. Apparatus according to claim **1** wherein said cavity is defined by a bottom plate portion, a top plate portion, and two substantially parallel end wall portions which have planes which are substantially normal to the planes of the bottom and top plate portions, and said biasing means comprises a pressure plate having a substantially flat upper surface and which is capable of sliding movement along and between said end wall portions and a compression spring located between said bottom plate portion of said cavity and the pressure plate, the objects stored in said cavity being located between the substantially flat upper surface of the pressure plate and the top plate portion of the cavity, the pressure of said compression spring against the pressure plate being operable to force the

topmost stored object against said top plate portion and position said end edge of said topmost stored object slightly above the plane of the supporting track means.

7. Apparatus according to claim 6 wherein the cavity has an open side for insertion of objects into said cavity and wherein there is releasable retention means for retaining the pressure plate in a position in which the compression spring is substantially fully compressed to thereby facilitate insertion of objects into said cavity.