

Nov. 25, 1969

D. I. GOOD ET AL

3,480,504

AUTOMATIC APPARATUS FOR APPLYING COVERS TO BIOLOGICAL SLIDES

Filed Sept. 13, 1966

5 Sheets-Sheet 1

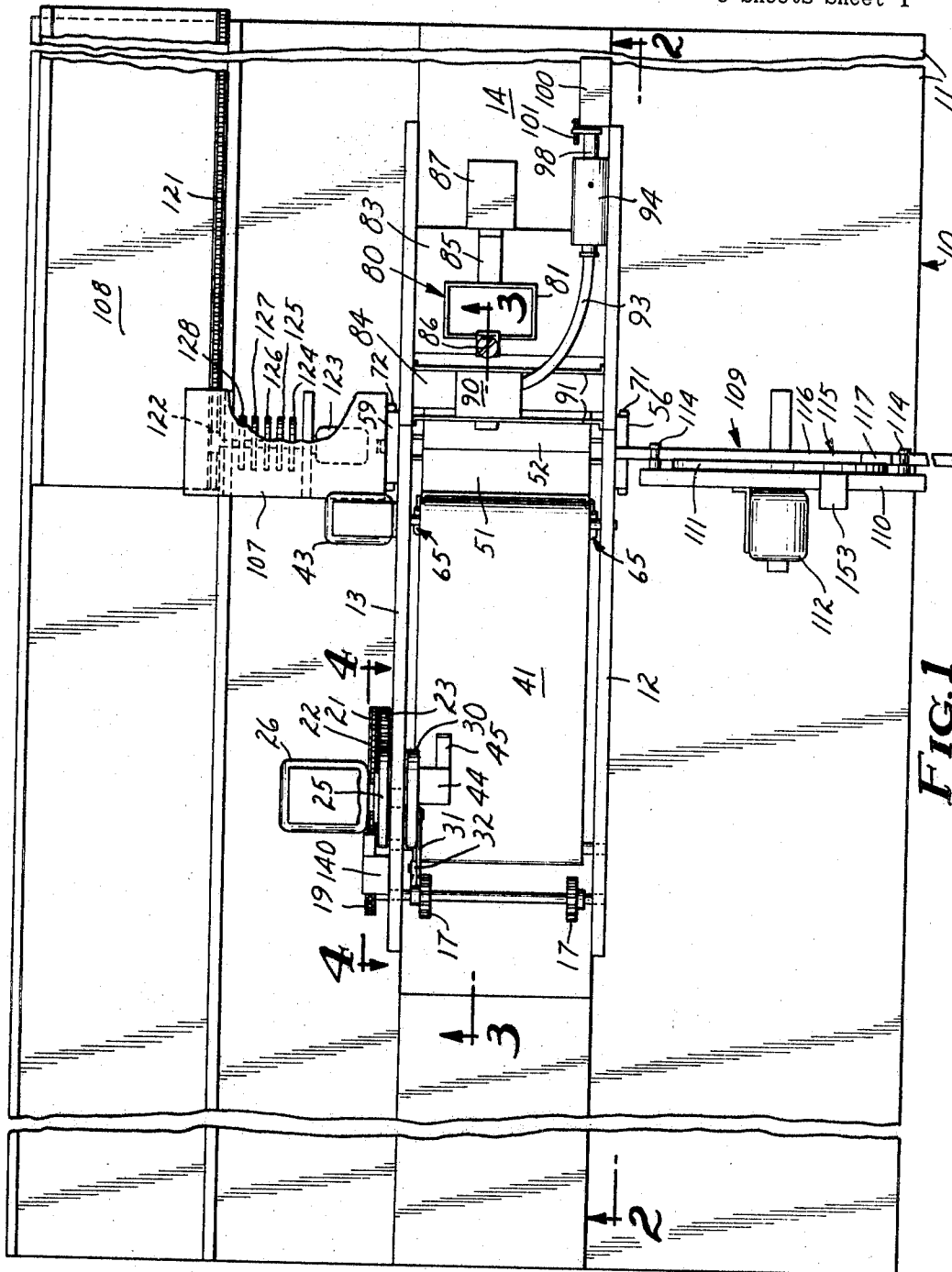


FIG. 1

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5 Sheets-Sheet 2

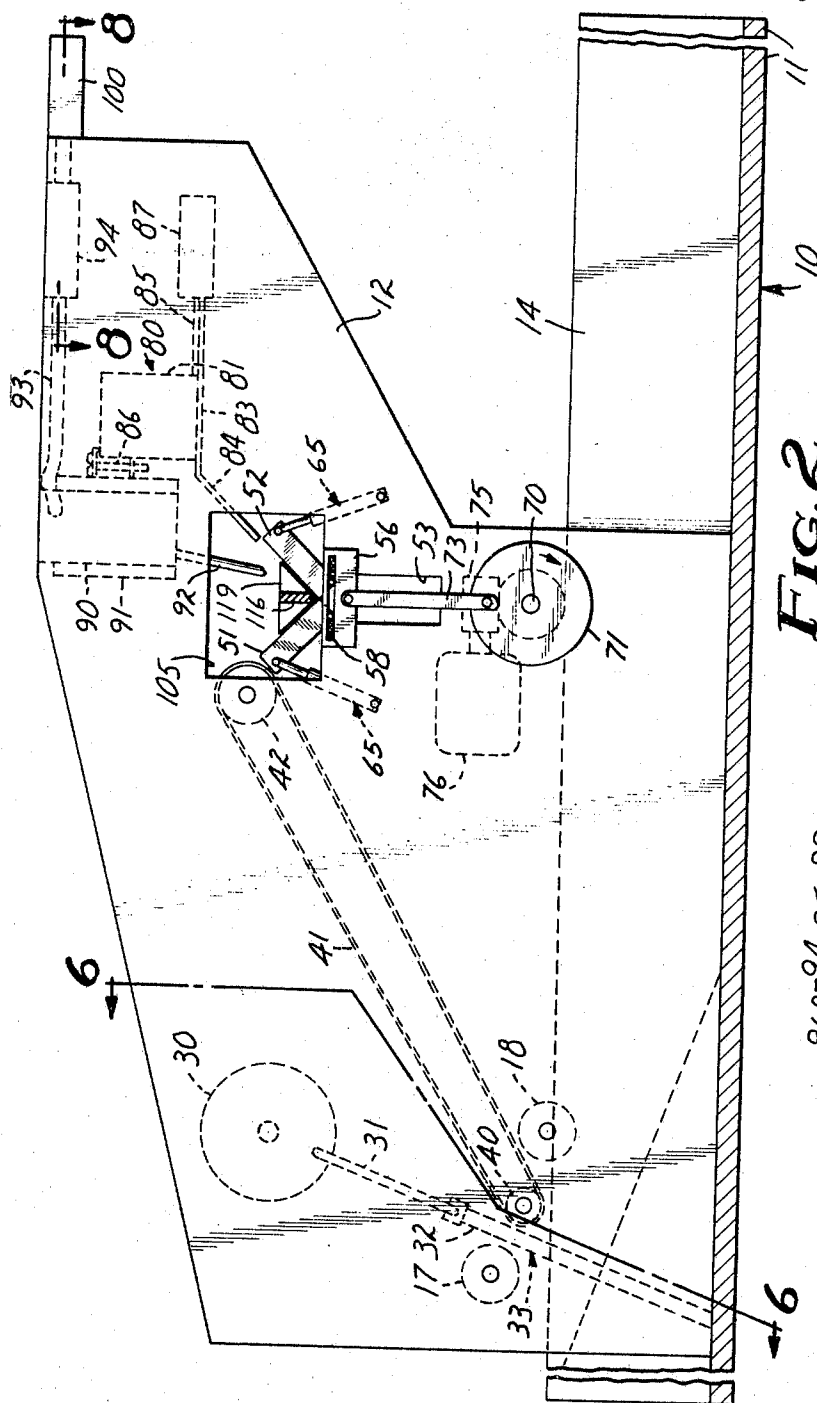


FIG. 2

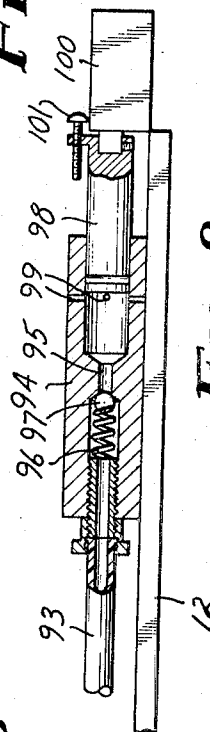


FIG. 8

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5 Sheets-Sheet 3

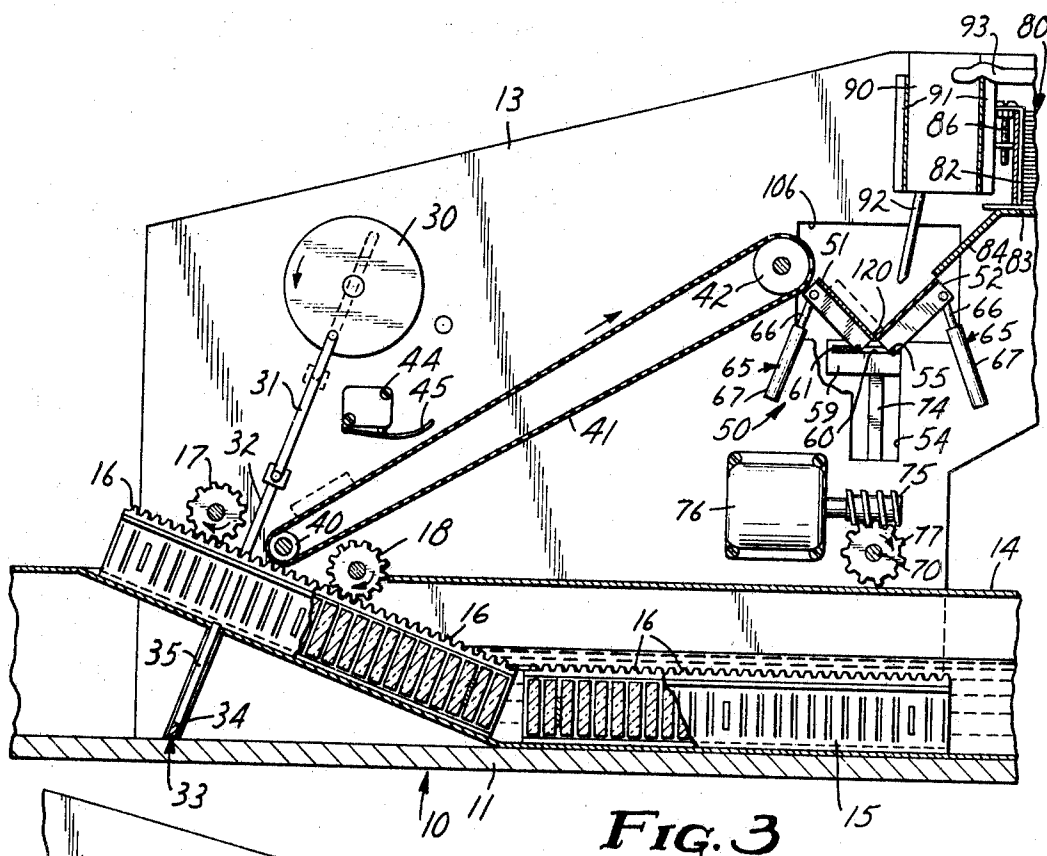


FIG. 3

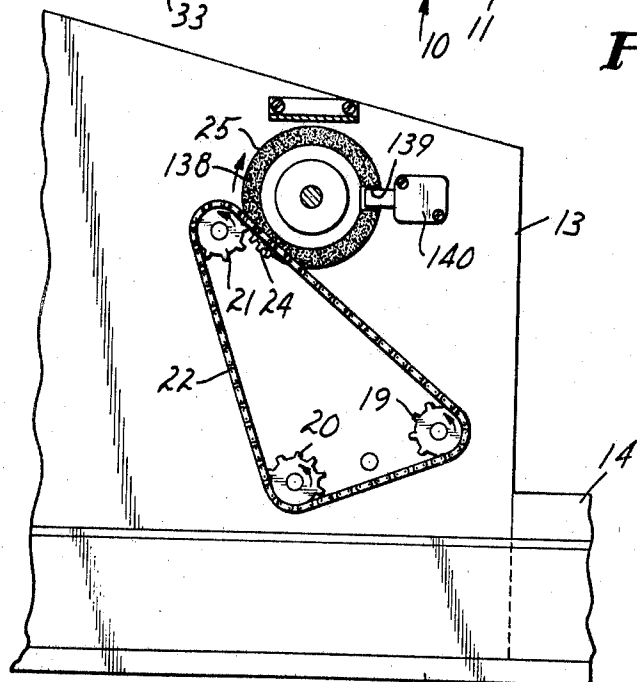


FIG. 4

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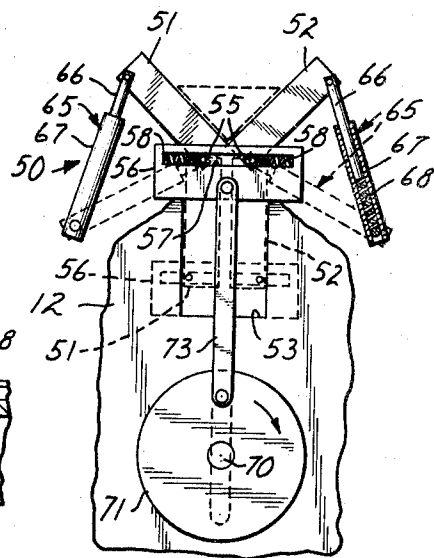
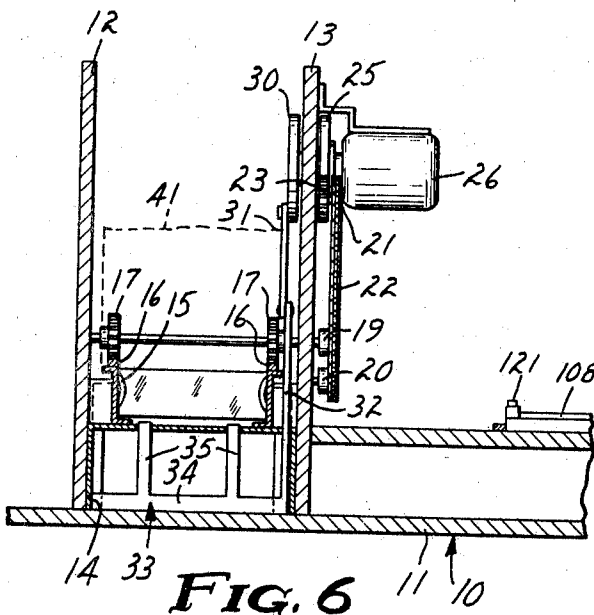
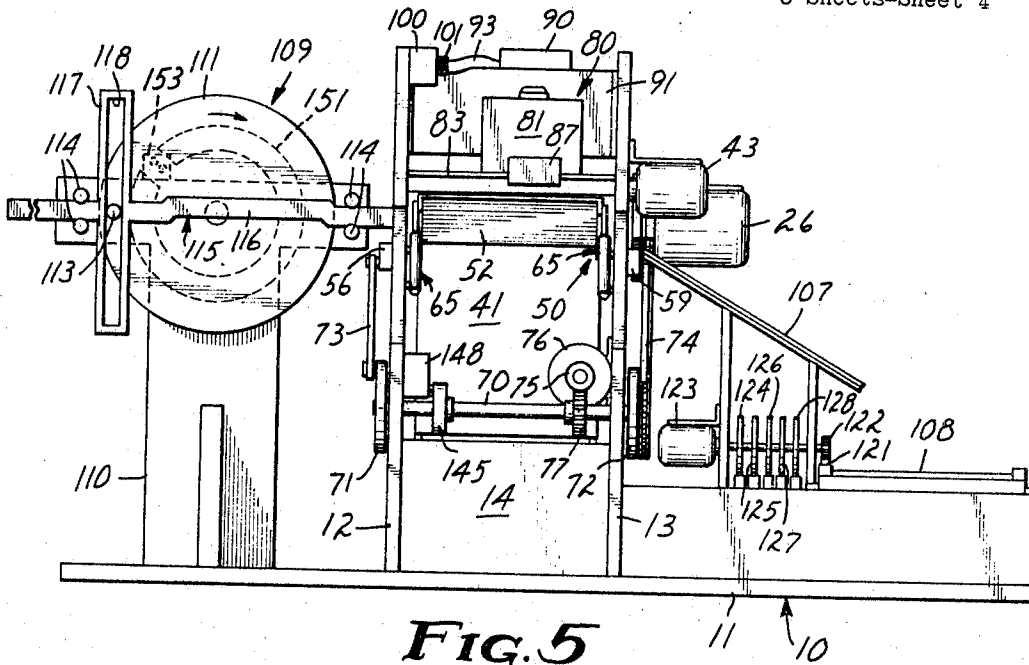
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5 Sheets-Sheet 4



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5 Sheets-Sheet 5

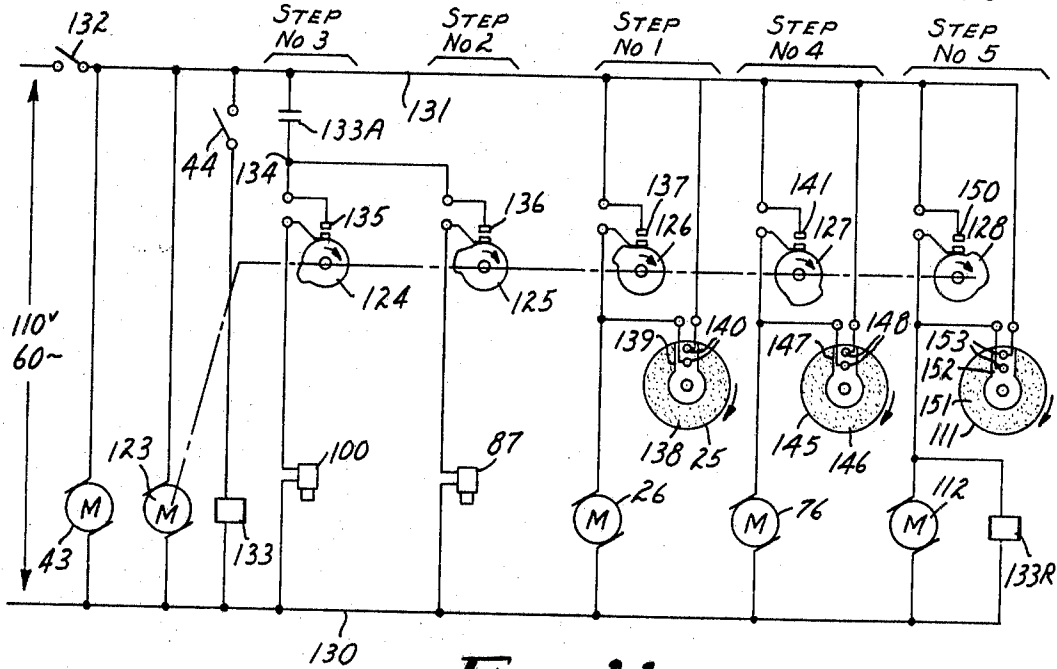


FIG. 11

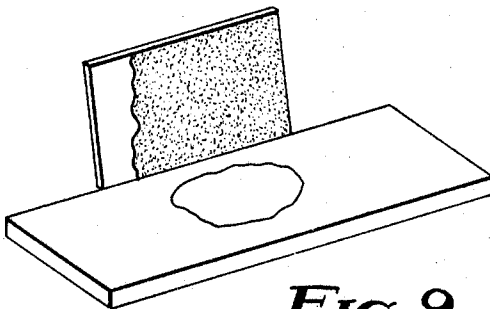


FIG. 9

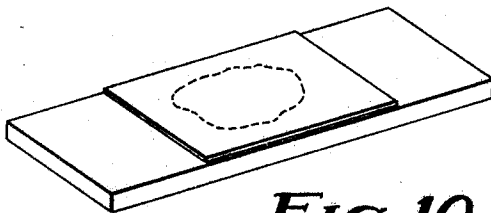


FIG. 10

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COVERS TO BIOLOGICAL SLIDES

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U.S. Cl. 156—356

9 Claims

## ABSTRACT OF THE DISCLOSURE

Two pivotal members positioned in a V-shaped configuration with conveying means for depositing a slide on one member and a cover on the opposite member, a motor for pivoting the members to press the cover and slide tightly together, adhesive ejecting means for applying adhesive to the adjacent surface of either the slide or cover and timing means for sequentially operating the apparatus positioning the slide and the cover, the adhesive ejecting means and the pivotally mounted members to automatically fix covers on slides.

This invention pertains to apparatus for automatically applying covers to slides having specimens thereon and more particularly to apparatus in which a large number of slides having specimens thereon can be positioned therein and upon energization said apparatus will automatically apply covers to each of the slides and will store the finished slides until they are ready for use.

In the research and medicinal fields, great quantities of slides containing any variety of specimens such as tissue, exfoliative cytologic smears, blood, etc., are handled every day. Each of these slides must be prepared by placing the specimen approximately in the center of one side of the slide and adhering a thin cover thereover. The slide is generally made of glass and is approximately three inches by one inch in size. The cover is generally made of a thinner glass and is usually either 24 millimeters by 40 millimeters or 24 millimeters by 50 millimeters in size. It should be understood that these dimensions are simply stated for informative purposes and have no effect on the present invention. The most common adhesive utilized to maintain the cover over the specimen on the slide is balsam, which dries clear and has little or no effect on the subsequent viewing of the specimen or upon the specimen itself.

In the prior art the cover is normally applied to a slide by hand with the operator using a medicine-type dropper to apply the balsam to either the cover or the slide after which the cover is placed in overlying relationship to the specimen on the slide. In some slides the specimen is dry, while in others the specimen must be maintained wet with a type of solution, such as xylene, which is miscible with the balsam. In either case the operator must be sure that the balsam flows in an even layer under every portion of the cover. It is essential that some balsam is on every portion of the slide under the cover since some specimens may not be exposed to the air for any extended length of time. Once the cover is placed over the balsam on the slide, a period of about an hour is required for the balsam to dry before the slide can be handled, and approximately a week before the balsam is completely dry so there is no danger of the cover being removed. Thus, in the prior art the task of placing covers on slides is extremely tedious and slow since an operator can only work with a single slide at one time and much care must be utilized so that the cover is not moved until the balsam is dry.

In the present invention, a large number of slides are

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placed in holders wherein the identity of each of the slides may be easily marked. The holders are then placed in the present apparatus which, when energized, removes the slides from the holders one at a time, and places the slide in a press means. Either simultaneously or shortly before the slide is placed in the press means, cover selecting means place a single cover in the press means and adhesive ejecting means place the correct amount of adhesive on the surface of the cover. The press means is then energized and the cover is forced tightly against the the surface of the slide immediately above the specimen with the adhesive sandwiched therebetween. The press means then opens and slide ejecting means removes the finished slide from the press means. The slide is conveyed to a position somewhat remote from the device where it may dry without being handled and can subsequently be easily identified by its position. Thus, the present device can automatically complete the operation of adhering covers over specimens on slides and store the slides until the adhesive dries with no handling by an operator required.

It is an object of the present invention to provide a new and improved apparatus for applying covers to slides.

It is a further object of the present invention to provide apparatus for applying covers to slides which is completely automatic and which greatly reduces the amount of work and time required by an operator.

These and other objects of this invention will become apparent to those skilled in the art upon consideration of the accompanying specification, claims, and drawings.

Referring to the drawings, wherein like characters indicate like parts throughout the figures:

FIG. 1 is a view in top plan of the present apparatus, parts thereof removed;

FIG. 2 is a sectional view as seen from the line 2—2 in FIG. 1;

FIG. 3 is a sectional view as seen from the line 3—3 in FIG. 1, some parts shown in elevation;

FIG. 4 is a sectional view as seen from the line 4—4 in FIG. 1;

FIG. 5 is an end view of the apparatus illustrated in FIG. 1 as seen from the right end thereof;

FIG. 6 is a sectional view as seen from the irregular line 6—6 in FIG. 2;

FIG. 7 is an enlarged detailed view of the press means, parts thereof broken away and shown in sections;

FIG. 8 is an enlarged sectional view as seen from the line 8—8 in FIG. 2;

FIG. 9 is an enlarged view in perspective illustrating the slide having a specimen thereon and a cover coated with adhesive;

FIG. 10 is an enlarged view in perspective of the slide having the cover correctly positioned thereon; and

FIG. 11 is a schematic view of the electrical circuitry in the apparatus illustrated in FIG. 1.

In the figures, the numeral 10 generally designates a frame having a flat rectangular shaped base member 11 and a pair of parallel spaced apart, flat upright members 12 and 13. An elongated tank 14 is located on the upper surface of the base member 11 between the spaced apart upright members 12 and 13. One end of the tank 14 extends outwardly in front of the upright members 12 and 13 a distance sufficient to allow holders 15 to be placed therein. The holders 15 are an elongated frame-like device adapted to receive a plurality, in this embodiment twenty-five, of slides in an upright position therein. The slides are positioned in a parallel spaced apart relationship in the holders 15 so that the longitudinal axis of the slides are perpendicular to the longitudinal axis of the holders 15. Each of the holders 15 is constructed with

a smooth lower surface and a rack-type gear 16 extending along both longitudinal upper edges. The rear end of the tank 14 adjacent the rear end of the upright members 12 and 13 is inclined upwardly at such an angle that the holders 15 can be slid readily from the front end of the tank 14 up the incline and out the back end thereof. The tank 14 is adapted to be filled with a solution in the event that the specimens on the slides in the holders 15 are the type that must be maintained wet.

The upright members 12 and 13 each have a pair of pinion gears 17 and 18 spaced along the incline and positioned to engage the rack-type gear 16 along the upper edges of the holders 15. The pinion gears 17 and 18 are fixedly mounted on shafts each having one end rotatably mounted in the upright member 12 and the other ends extending through the upright member 13 and rotatably mounted therein. A second set of gears 19 and 20 are fixedly mounted on the opposite ends of the shafts at the other side of the upright member 13. The gears 19 and 20 are operatively attached to a third gear 21 by a chain 22. The third gear 21 is attached to a shaft which is mounted for rotation in the upright member 13, and a gear 23 is also mounted on the shaft between the upright member 13 and the gear 21 for rotation with the gear 21. The gear 23 is mounted to periodically engage several teeth 24 in the outer periphery of a flat disc 25. The disc 25 only has a few teeth in the outer periphery thereof so that the gears 23, 21, 20, and 19 only rotate a short distance each time the disc 25 rotates one complete turn. The distance the gears 19 and 20 rotate should be sufficient so that the pinion gears 17 and 18 move the holders 15 up the incline in the tank 14 approximately the distance between two adjacent slides in the holders 15. The disc 25 is fixedly attached to the shaft of a motor 26 for rotation therewith. The motor 26 is fixedly attached to the outer surface of the upright member 13 in a standard fashion.

The shaft of the motor 26 also has a disc 30 fixedly attached thereto adjacent the inner surface of the upright member 13. One end of a link 31 is pivotally attached to the disc 30 adjacent the outer periphery thereof, and the other end is pivotally attached to an upright arm 32 of a slide lifting mechanism generally designated 33. The slide lifting mechanism 33 includes a horizontal bar 34 which is fixedly attached to the lower end of the upright arm 32. The bar 34 is positioned in a slot below the inclined portion of the tank 14 and approximately perpendicular thereto. Thus, the slot is in a plane parallel to the plane of each of the slides in the holders 15 as they are positioned on the incline in the tank 14. As the motor 26 rotates the disc 30, the pivotally connected link 31 provides the arm 32 and the horizontal bar 34 with a linear oscillating movement, which is limited to a plane parallel to the slides by the slot. The bar 34 has a pair of fingers 35 extending upwardly therefrom in the direction of movement of the bar 34. The fingers 35 extend slightly above the incline in the tank 14 and through an opening in the lower surface of the holders 15 when the bar 34 is in its lowermost position. As the motor 26 rotates and the disc 30 turns, the bar 34 and the fingers 35 move upwardly in the slot. The teeth 24 in the disc 25, also attached to the motor 26, rotate the pinion gears 17 and 18, through the gears 19, 20, 21, and 23 and the chain 22, to position the holders 15 so that a slide is immediately above the slot in the incline portion of the tank 14. As the motor 26 continues to rotate, the disc 30 moves the bar 34 and the fingers 35 upwardly until the upper end of the fingers 35 engage the slide thereabove. Additional rotation of the disc 30 causes the fingers 35 to move the slide out of the holder 15 and to a position somewhat thereabove.

An idler roller 40 having a conveyor belt 41 operatively engaged thereover is positioned above the incline portion of the tank 14 so the holders 15 will pass thereunder, and the slides, when raised vertically by the fingers 35,

will drop on to the conveyor belt 41. The other end of the conveyor belt 41 is engaged over a drive roller 42 which is fixedly attached to the shaft of a motor 43 for rotation therewith. The motor 43 is attached to the outer surface of the upright member 13 and the shaft passes through the upright member 13 with the extreme end mounted for rotation in the upright member 12. The length of the rollers 40 and 42 and the width of the conveyor belt 41 is somewhat shorter than the distance between the two upright members 12 and 13, but greater than the length of the slide. The fingers 35, which push the slides vertically upward when the motor 26 rotates the disc 30, position the slides on the conveyor belt 41 in approximately the same position that they were in the holder 15. That is, the longitudinal axis of each of the slides is approximately perpendicular to the direction of movement. A normally open switch 44, which may be any switch of the type requiring a small amount of movement for the operation thereof such as a micro switch, is positioned on the inner surface of the upright member 13 adjacent the upper surface of the conveyor belt 41. The switch 44 has an elongated actuating arm 45, the end of which is positioned at an angle with and adjacent the upper surface of the conveyor belt 41, so that slides passing thereunder will actuate the switch 44 without being hindered in their movements by the arm 45. The operation of the switch 44 will be explained in detail presently in conjunction with the schematic diagram in FIG. 11.

The drive roller 42 is located somewhat above and to the left of press means generally designated 50. The press means 50 includes a pair of plates 51 and 52, each of which has a surface area somewhat longer and wider than a slide. Each of the upright members 12 and 13 have an elongated vertical slot 53 and 54 respectively therein, the width of which is somewhat greater than the combined thickness of the plates 51 and 52 and the length of which is somewhat greater than the width of either of the plates 51 or 52. The plates 51 and 52 are positioned between the upright members 12 and 13 and each has a pivotal mounting pin 55 extending outwardly from either lower corner through the slots 53 and 54. An elongated rectangular shaped block 56, having a length somewhat greater than the width of the slot 53 in the upright member 12, has an elongated slot 57 therein which extends from adjacent one end to adjacent the other end. The block 56 is mounted in sliding engagement with the outer surface of the upright member 12 with the slot 57 approximately horizontal. The pins 55 in the ends of the plates 51 and 52 are engaged in the slot 57 of the block 56, and a pair of springs 58 are positioned in the slot 57 adjacent either end thereof to bias the pins 55 inwardly toward the center thereof. A similar rectangular shaped block 59 is positioned in sliding engagement with the outer surface of the upright member 13 with the pins 55 at the ends of the plates 51 and 52 engaged in a slot 60 therein. The slot 60 in the block 59 also has a pair of springs 61 positioned therein to bias the pins 55 toward the center thereof.

Each upper corner of the plates 51 and 52 has one end of a telescoping member 65 pivotally attached thereto. The four telescoping members 65 are each similar and include a solid rod 66 which telescopes within a hollow cylinder 67. The hollow cylinder 67 contains a spring 68 therein which biases the rod 66 outwardly from the telescoped position within the hollow cylinder 67. The free end of each of the solid rods 66 are pivotally attached to the corners of the plates 51 and 52 and the free ends of the hollow cylinders 67 and pivotally attached to the inner surfaces of the upright members 12 and 13. The free ends of the hollow cylinders 67 in the telescoping members 65 are attached to the upright members 12 and 13 so that the plates 51 and 52 are normally in an open or V-shaped configuration when the blocks 56 and 59 are at the top of the slots 53 and 54. As the blocks 56 and 59 are slid simultaneously downwardly to the bot-

toms of the slots 53 and 54, the telescoping members 65 force the upper ends of the plates 51 and 52 together until the plates 51 and 52 are in a parallel abutting relationship. The springs 58 in the block 56 and the springs 61 in the block 59 biasing the pins 55 inwardly, and the springs 68 in the telescoping members 65 all cooperate to provide forces on both of the plates 51 and 52 tending to press them tightly together.

A shaft 70 is rotatably mounted in the upright members 12 and 13 so that the ends extend therethrough. The shaft 70 is located directly below the slots 53 and 54 in the upright members 12 and 13. The end of the shaft 70 extending through the upright member 12 has a disc 71 fixedly attached thereto for rotation therewith having a diameter somewhat greater than the distance the block 56 must move to place the plates 51 and 52 in tight parallel abutting relationship. A similar disc 72 is fixedly mounted on the other end of the shaft 70 adjacent the outer surface of the upright member 13. One end of a link 73 is pivotally attached to the block 56 at approximately its longitudinal center, while the other end of the link 73 is pivotally attached to the disc 71 adjacent its outer periphery. One end of a link 74 is pivotally attached to the block 59 adjacent its longitudinal center, while the other end of the link 74 is pivotally attached adjacent the outer periphery of the disc 72. Thus, rotation of the shaft 70 rotates the disc 71 and 72 which causes the blocks 56 and 59 to move vertically. The shaft 70 has a pinion gear 77 fixedly attached thereto adjacent the inner surface of the upright member 13. The pinion gear 77 has a worm gear 75 engaged therewith which is fixedly attached to the shaft of a motor 76. Thus, activation of the motor 76 causes the worm gear 75 to turn the pinion gear 77 which turns the shaft 70 and moves the blocks 56 and 59 vertically.

The plate 51 of the press means 50 is located directly below the end of the conveyor belt 41 engaged over the drive roller 42 when the press means 50 is opened or in the V configuration so that slides traveling up the conveyor belt 41 move off the end thereof onto the plate 51. A cover selecting means 80 is positioned over the plate 52 so that activation thereof will cause a cover to be positioned approximately centrally on the plate 52. The cover selecting means 80 includes a cover repository 81, which is an open top rectangular shaped box having dimensions such that a vertical stack of covers fit therein, positioned centrally above and to the right of the press means 50. The horizontal dimensions of the repository 81 will generally be adjustable in some manner, such as removable side walls or inserts, to allow an operator to adjust the repository 81 to the correct internal dimensions for the size of cover being used. The repository 81 has an adjustable front wall 82 which is normally spaced from the bottom thereof a distance slightly greater than the thickness of a cover. Thus, the repository 81 has an opening in the front thereof through which a cover may be ejected. The repository 81 is fixedly positioned on a platform 83 having a downwardly inclined lip 84, which extends from immediately in front of the opening in the repository 81 to directly above the plate 52 in the press means 50. The rear wall of the repository 81 has an opening therein with a plunger 85 mounted for horizontal movement therethrough. The plunger 85 is connected to the core of a solenoid 87 which, when activated, moves the plunger 85 horizontally to eject one cover from the repository 81. The front wall 82 of the repository 81 is adjustable in a vertical direction by means of a screw 86 so that different thickness of covers may be utilized if desired.

A tank 90 containing an adhesive, which in this embodiment is balsam in the liquid state, is supported centrally above the press means 50 by a pair of brackets 91. The tank 90 has an outlet 92 including a spout which directs the adhesive on to the upper surface of a cover lying on the plate 52. The tank 90 also has an inlet with

a flexible hose 93 attached thereto for the introduction of air to force the adhesive out of the outlet 92. The apparatus for supplying air under pressure to the end of the flexible hose 93 is illustrated in cross section in FIG. 8. Referring to FIG. 8, a cylindrical body 94 has a passageway 95 therethrough the outlet end of which is enlarged to accommodate a spring 96 and ball 97 positioned in the enlarged portion of the passageway 95 to operate as a check valve, normally closing the passageway 95, but allowing air under pressure to pass through the passageway 95 toward the tank 90. The inlet end of the passageway 95 is enlarged to accommodate a piston 98 mounted for axial movement therein. A plurality of openings 99 are formed in the body 94 and extend radially outwardly from the passageway 95 at the enlarged inlet and to allow air to enter the passageway 95 when the piston 98 is in its outer most position. The piston 98 is fixedly attached to the core of the solenoid 100, which when energized, causes the piston 98 to move inwardly forcing air through the passageway 95, the flexible hose 93, and into the tank 90. As the solenoid 100 is deenergized, the piston 98 is returned to its normal position by a spring, not shown, the ball 97 prevents air from leaving the tank 90 and more air enters the passageway 95 through the openings 99. A screw 101 attached to the piston 98 is positioned to strike the end of the body 94 and limit the length of the stroke of the piston 98. The screw 101 is adjustable to vary the length of the stroke and thus, limit the amount of balsam ejected from the outlet 92.

The upright members 12 and 13 each have a rectangularly shaped opening 105 and 106, respectively, therein adjacent the plates 51 and 52 of the press means 50 when they are in the open or V configuration. The opening 106 in the upright member 13 has a ramp 107 immediately therebelow extending from the outer surface of the upright member 13 to a movable receiving tray 108 positioned adjacent the outer edge of the base member 11. Slide ejecting means generally designated 109 are mounted on the base member 11 adjacent the opening 105 in the upright member 12, and when activated, operate to push finished slides out of the open press means 50 on to the ramp 107 where they slide onto the receiving tray 108 and are allowed to dry. The slide ejecting means 109 includes a T-shaped base member 110 mounted in the vertically upright position on the base member 11 with the horizontal arm approximately perpendicular to the plane of the upright member 12. A disc 111, having a diameter somewhat greater than the distance between the upright members 12 and 13, but smaller than the length of the horizontal arm of the T-shaped base member 110, is fixedly attached to the shaft of a motor 112 for rotation therewith. The motor 112 is fixedly mounted to the T-shaped base member 110 with the rotor extending therethrough and the disc 111 attached at the other side thereof for rotation about a point approximately at the longitudinal center of the horizontal arm of the T-shaped base member 110. The disc 111 has a pivot pin 113 extending outwardly from the outer surface thereof adjacent the outer periphery. The extreme outer ends of the horizontal arm of the T-shaped base member 110 each have a pair of spaced apart parallel pins 114 extending outwardly therefrom somewhat past the outer surface of the disc 111. A cruciform shaped ram 115 is mounted with one leg 116 horizontal, and the other leg 117 vertical. The horizontal leg 116 is mounted between the pins 114 for sliding horizontal movement relative thereto. The vertical leg 117 has a vertical slot 118 therein which is engaged over the pivot pin 113 in the disc 111. The length of the slot 118 is approximately equal to the diameter of the disc 111 so that rotation of the disc 111 causes horizontal movement of the ram 115. The end of the horizontal leg 116 of the ram 115 has a triangular shaped member 119 attached thereto with an angle approximately equal to the angle between the plates 51 and 52 when the press means 50 is in the open position. Thus, energization of the

motor 112 causes rotation of the disc 111 and horizontal movement of the ram 115 which forces the triangularly shaped member 119 through the press means 50 and any slides therein are ejected onto the ramp 107. The horizontal leg 116 has an offset portion in the center thereof to allow the triangularly shaped member 119 to ride on the surface of the plates 51 and 52 once it has moved horizontally to within the press means 50. This insures a clean press means 50 after each slide is finished. The plate 52 may have a thin ledge 120 extending outwardly from the surface thereof adjacent the lower edge toward the plate 51 to provide a stop for the covers and insure the correct positioning thereof on the slides. In the event that a ledge 120 is utilized in the device, the triangularly shaped member 119 must have a small notch cut therefrom to conform with the position of the ledge 120.

The receiving tray 108 is slidably mounted for horizontal movement on a raised portion of the base member 11. The inner edge of the receiving tray 108 has a rack type gear 121 therealong which is adapted to mesh with a pinion gear 122 attached to the shaft of a motor 123 for rotation therewith. The motor 123 is mounted below the ramp 107, for convenience, and has an elongated shaft with five cams 124 through 128 fixedly attached thereto for rotation therewith. The cams 124 through 128 are utilized to operate the various motors and solenoids previously described, and to assure the correct timing thereof. Thus, when the motor 123 is energized, the cams 124 through 128 rotate operating the remainder of the circuitry, as will be described in conjunction with FIG. 11, and the pinion gear 122 moves the receiving tray 108 horizontally so that slides moving down the ramp 107 do not strike each other and break. It should be noted that the ramp 107 and receiving tray 108 are positioned, relative to each other, so that completed slides always come to rest on the receiving tray 108 with the cover in the up, or vertical overlying, position.

Referring to FIG. 11, two power lines 130 and 131 are adapted to be connected at their left ends to a suitable source of power. The line 131 has in series therewith adjacent the left end an on-off switch 132, the operation of which energizes or deenergizes the remainder of the circuit. The motor 43 attached to the drive roller 42 is connected directly between the lines 130 and 131 for continuous rotation when the switch 132 is closed. The motor 123 which drives the cams 124 through 128 is also connected directly between the lines 130 and 131 for continuous rotation when the switch 132 is closed. The normally opened switch 44, which serves to indicate a slide is correctly positioned on the conveyor belt 41, is connected in series with the actuating coil 133 of a locking relay and this series circuit is connected between the lines 130 and 131. Thus, when the switch 44 is closed, the coil 133 of the locking relay is energized. The coil 133 has associated therewith a pair of contacts 133A, one of which is connected directly to the line 131 and the other of which is connected to a junction point 134. One of a pair of contacts 135 associated with the cam 124 is connected to the junction point 134, while the other contact is connected to one lead of the solenoid 100 in the balsam ejecting apparatus. The opposite lead of the solenoid 100 is connected to the line 130. One contact of a set of contacts 136 associated with the cam 125 is also connected to the terminal 134, while the opposite contact is connected to one lead of the solenoid 87 associated with the cover selecting means 80. The opposite lead of the solenoid 87 is connected to the line 130. Thus, when the coil 133 is energized and the contacts 133A close, rotation of the cams 124 and 125 closing the sets of contacts 135 and 136, respectively, energizes the solenoids 100 and 87. One contact of a set of contacts 137 associated with the cam 126 is connected to the line 131. The opposite contact of the contacts 137 is connected to one lead of the motor 26. The opposite lead of the motor 26 is connected to the line 130. Thus, when the

cam 126 rotates closing the contacts 137, the motor 26 is energized. However, it is desirable that the motor 26 make one complete revolution before it turns off and to insure correct timing the following circuit is added.

The disc 25, which is attached to the shaft of the motor 26 and rotates therewith has a conducting ring 138, which may consist of copper or the like, fixedly attached to the outer surface by adhesive, deposition, etc., positioned on the surface adjacent the outer periphery thereof. The conducting ring 138 has a break 139 therein on which a pair of contacts 140 normally reside. Both the pair of contacts 140 are positioned along the same radius of the disc 25 so that they are both in the break 139 or on the conducting ring 138 simultaneously. As illustrated in FIG. 11, the pair of contacts 140 are connected in parallel with the pair of contacts 137. Thus, when the cam 126 rotates and closes the contacts 137, the motor 26 is energized and begins to rotate. After a small amount of rotation of the motor 26 the contacts 140 are positioned on the conducting ring 138 and a circuit is completed therethrough for the motor 26. After a short period of time, the cam 126 has rotated sufficiently far for the contacts 137 to open, however, a circuit is completed through the contact 140 to the motor 26 until the motor 26 has made a complete revolution and the contacts 140 are again positioned in the break 139.

One contact of a pair of contacts 141 associated with the cam 127 is connected directly to the line 131 while the opposite contact is connected to one lead of the motor 76. The opposite lead of the motor 76 is connected directly to the line 130. Thus, rotation of the cam 127 closing the contacts 141 energizes the motor 76 and causes the press means 50 to operate. Since the motor 76 must make one complete revolution for the press means 50 to close and open to the correct position, a disc 145 having a conducting ring 146 and break 147, similar to the conducting ring 138 and break 139 on the disc 25, is fixedly attached to the shaft 70 (see FIG. 5). The disc 145 has a pair of contacts 148 associated therewith in a fashion similar to the association of the contacts 140 with the disc 25. The contacts 148 are connected in parallel with the contacts 141 and operate to complete a circuit to the motor 76 after the cam 127 has rotated sufficiently far to allow the contacts 141 to open.

One of the contacts of a pair of contacts 150 associated with the cam 128 is connected directly to the line 131 while the other contact is connected to one lead of the motor 112. The opposite lead of the motor 112 is connected directly to the other line 130. A conducting ring 151 and break 152 are positioned adjacent the outer periphery of the disc 111 and have a pair of contacts 153 associated therewith. The contacts 153, break 152, and conducting ring 151 operate in a fashion similar to that described for the contacts 140, break 139, and conducting ring 138 associated with the disc 25. The contacts 153 are connected in parallel with the contacts 150 so that a circuit is completed to the motor 112, after the cam 128 has rotated sufficiently far for the contacts 150 to open. The additional circuits, including the contacts 140, 148, and 153, and conducting rings 138, 146, and 151, serve to insure that each of the motor 26, 76, and 112 will make a complete revolution each time they are energized. It should be understood that other circuits could be utilized which would serve the same purpose, such as longer cam surfaces on the cams 126, 127, and 128, but the present circuit is described because of its dependability.

A reset coil 133R is connected in parallel across the motor 112 and is energized when the motor 112 is energized. The reset coil 133R is associated with the contacts 133A and coil 133 of the locking relay. The locking relay is the type of relay in which the contacts 133A remain closed once the coil 133 is energized until the reset coil 133R is energized. Thus, when a slide engages

the arm 45 of the switch 44 closing the switch 44, the coil 133 is energized closing the contacts 133A and preparing the circuits, including the solenoid 100 and solenoid 87, for operation. Once the contacts 133A are closed, they remain closed until the cam 128 rotates closing the contacts 150 and energizing the reset coil 133R. If no slides are present on the conveyor belt 41, the switch 44 is not closed and the solenoids 87 and 100 cannot operate. It should be understood that the circuit containing the switch 44, coil 133, reset coil 133R, and contacts 133A is a safety feature to prevent covers and balsam from being supplied to the press means 50 when there are no slides present, and the device would operate if this feature were removed therefrom.

In the operation of the present device at least one holder 15 is placed in the tank 14 and started up the incline at the rear thereof. If it is desired, additional holders can be attached to the first holder and will be transported therewith by the action of the pinion gears 17 and 18. When the on-off switch 132 is closed, the motors 43 and 123 are operating continuously. The motor 43 drives the conveyor belt 41 continuously, while the motor 123 drives the cams 124 through 128, the pinion gear 122 and the receiving tray 108 continuously. As the motor 123 rotates, the cam 126 is set to close the contacts 137 prior to any other operation. Closing of the contacts 137 energizes the motor 26 which causes the fingers 35 to raise a slide on to the conveyor belt 41. The slide passes the actuating arm 45 closing the switch 44 which energizes the relay coil 133 and closes the contacts 133A. The slide continues up the conveyor belt 41 and drops on to the plate 51 of the press means 50. While the slide is traveling along with the conveyor belt 41, the cam 125 closes the contacts 136 energizing the solenoid 87. As the solenoid 87 is energized, it ejects a cover onto the plate 52 of the press means 50. A short period thereafter the cam 124 closes the contact 135 energizing the solenoid 100. Energizing the solenoid 100 causes compressed air to be forced into the tank 90 pushing adhesive through the outlet 92 onto the cover positioned on the plate 52 of the press means 50. At approximately the same time, or shortly after, the balsam is applied to the cover, the conveyor belt 41 deposits the slide onto the plate 51. It should be noted that after raising the slide onto the conveyor belt 41 the motor 26 continues a complete rotation, and the disc 25 activates the pinion gears 17 and 18 to move the holder 15 so that the next slide is positioned above the fingers 35. Shortly after the slide is positioned on the plate 51 of the press means 50, the cam 127 closes the contacts 141 actuating the motor 76. Because of the circuitry, previously explained, the motor 76 makes one complete turn before stopping which causes the plates 51 and 52 to move into a parallel position forcing the cover tightly against the slide and distributing the adhesive thoroughly thereunder. After the plates 51 and 52 move back to the open position, the cam 128 closes the contacts 150 energizing the motor 112 and the reset coil 133R. Because of the circuitry, previously described, the motor 112 makes one complete revolution which causes the ram 115 to push the completed slide from the press means 50 on the ramp 107 where it slides into the receiving tray 108. The continuously operating motor 123 moves the receiving tray 108 a short distance horizontally before the next completed slide is ejected from the press means 50.

In the event that an operator should forget to put a slide in one of the openings in the holder 15, the motor 26 would operate in sequence as previously described, but since no slide is present on the conveyor belt 41, the switch 44 would not close and the contacts 133A would remain open. All of the cams 124 through 128 would operate their associated contacts in the proper sequence; however, neither the solenoid 87 nor the solenoid 100 would operate to eject a cover and adhesive since the contacts 133A remain open and prevent energization thereof.

Thus, apparatus for applying covers to slides is described which is completely automatic. The only attention required by the operator is to place slides correctly in the holders 15 and place the holders in the tank 14. Also, there is little danger of losing the identity of any particular slide since the slides will appear on the receiving tray 108 in exactly the same sequence as they were placed in the holder 15. In addition to the above advantages, the present device insures a correct amount of adhesive on each of the slides and a uniform positioning of the covers thereon.

While we have shown and described the specific embodiment of this invention, further modifications and improvements will occur to those skilled in the art.

We claim:

1. Apparatus for applying covers to slides comprising:

(a) press means normally in an open position adapted to receive a slide and a cover therein and energizable to a second closed position for supplying a force to the slide and cover therein bringing them into parallel relationship and urging them into juxtaposition;

(b) cover ejecting means for supplying a single cover to said press means upon energization of said ejecting means;

(c) adhesive ejecting means for ejecting a desired amount of adhesive upon energization of said ejecting means mounted adjacent said press means so that ejected adhesive is applied to one of a portion of the slide adjacent a cover and the side of a cover adjacent a slide in said press means; and

(d) timing means for sequentially energizing said cover ejecting means, said adhesive ejecting means and said press means respectively.

2. Apparatus for applying covers to slides as set forth in claim 1 having in addition conveying means for placing a slide in the press means upon energization thereof, said conveying means being energized by the timing means prior to the energization of the cover ejecting means, the adhesive ejecting means and the press means.

3. Apparatus for applying covers to slides as set forth in claim 1 having in addition slides ejecting means mounted adjacent the press means for ejecting the covered slide after a complete sequence, said slide ejecting means being energizable by said timing means subsequent to the operation of the press means and while the press means is in the open position.

4. Apparatus for applying covers to slides as set forth in claim 1 wherein the cover ejecting means has associated therewith a repository for covers having adjustable means therein so that only a single cover is ejected over a relatively wide range of cover dimensions.

5. Apparatus for applying covers to slides as set forth in claim 1 wherein the adhesive ejecting means includes a container adapted to receive a supply of adhesive therein and having an outlet for the adhesive and an inlet, said adhesive ejecting means further including an oscillating device attached to air compression means which is in turn connected to said inlet of said container for supplying air under pressure to said container upon energization of said oscillating device.

6. Apparatus for applying covers to slides as set forth in claim 2 having in addition a repository for slides including a tank for maintaining in solution desired specimens mounted on the slides, the conveying means removing slides from said repository one at a time and placing them in the press means.

7. Apparatus for applying covers to slides as set forth in claim 4 wherein the repository is adapted to receive a vertical stack of covers and has an adjustable opening at the bottom thereof to allow a single cover at the bottom of the stack to pass therethrough and the cover ejecting means is an oscillating device having a plunger adapted for linear movement attached thereto for supplying a force to the bottom cover of the stack upon energization of said oscillating device.

8. Apparatus for applying covers to slides as set forth

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in claim 5 wherein the adhesive ejecting means is adjustable to eject the desired amount of adhesive by adjusting the amount of movement of the oscillating device.

9. Apparatus for applying covers to slides comprising:

- (a) press means including a pair of plates pivotally mounted to normally reside in an open position in which said plates form a V and energizable to a second closed position in which said plates pivot into a substantially parallel position for supplying a force therebetween urging objects therein into substantially parallel juxtaposition; 5 10
- (b) a repository for slides having specimens mounted thereon;
- (c) conveying means for removing a single slide from said repository and placing it on one of said plates in said press means upon energization thereof; 15
- (d) a repository for covers;
- (e) cover ejecting means for rejecting a single cover from said cover repository upon energization of the ejecting means, said ejecting means being mounted adjacent said press means so that ejected covers are automatically positioned on the other of said plates in said press means; 20
- (f) adhesive ejecting means for ejecting a desired amount of adhesive upon energization thereof 25 mounted adjacent said press means so that ejected

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adhesive is applied to the exposed surface of a cover lying on said other plate in said press means;

- (g) slide ejecting means mounted adjacent said press means for ejecting slides from said press means;
- (h) storage conveying means for receiving ejected slides from said press means and storing said ejected slides to prevent breakage and allow the adhesive thereon to dry; and
- (i) timing means for energizing said conveying means, said cover ejecting means and said adhesive ejecting means while said press means is in the open position and for energizing said press means, and said slide ejecting means respectively thereafter.

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