Feb. 22, 1949. S. R. WELLBORN 2,462,447

SILK-SCREEN PRINTING APPARATUS

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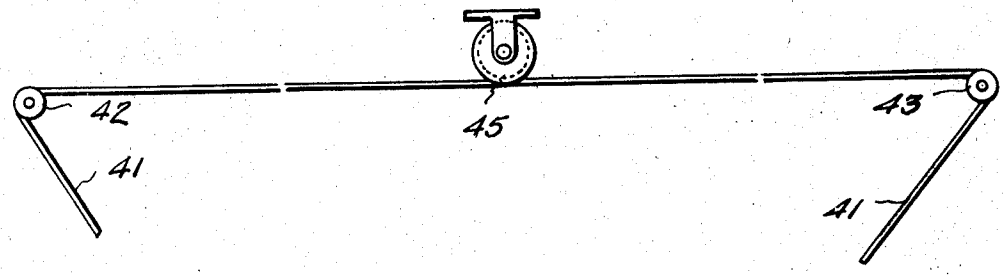


Fig. 1.

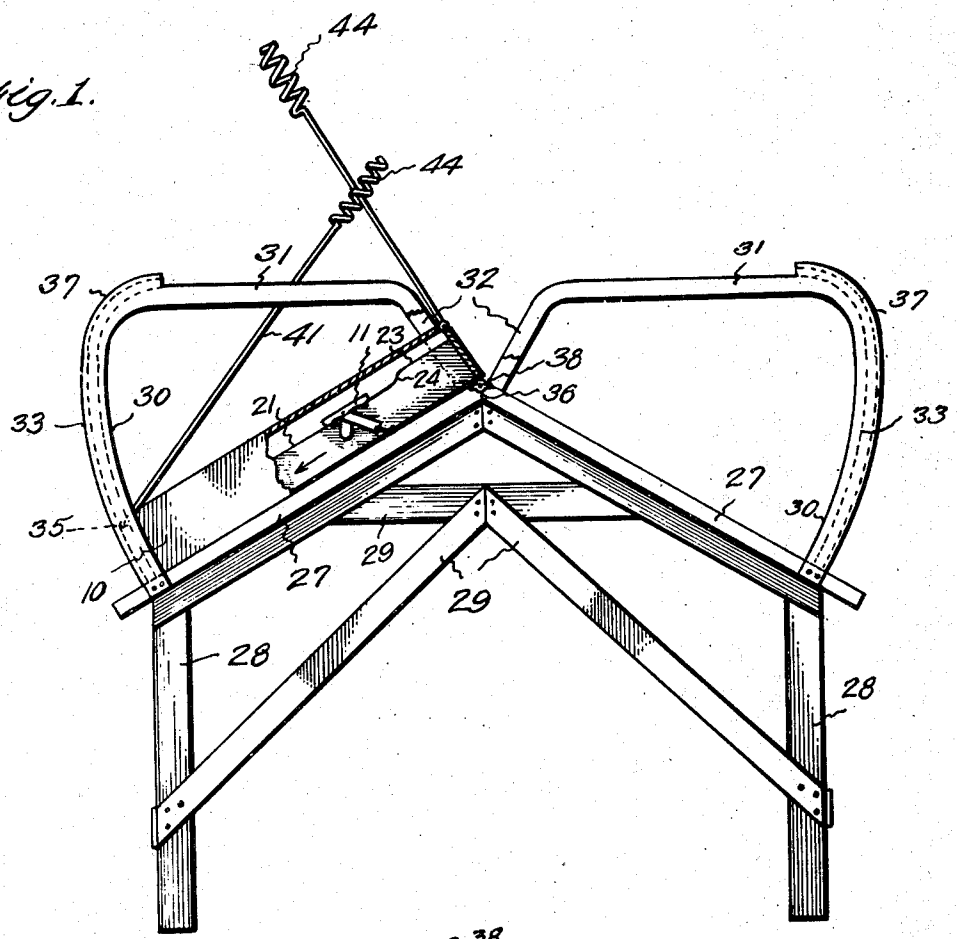


Fig. 6.

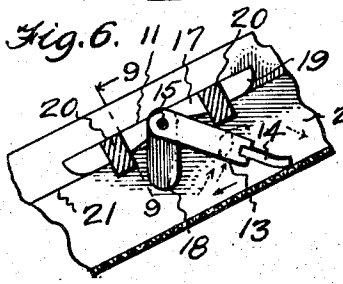
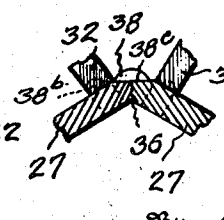


Fig. 14.



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Fig. 2.

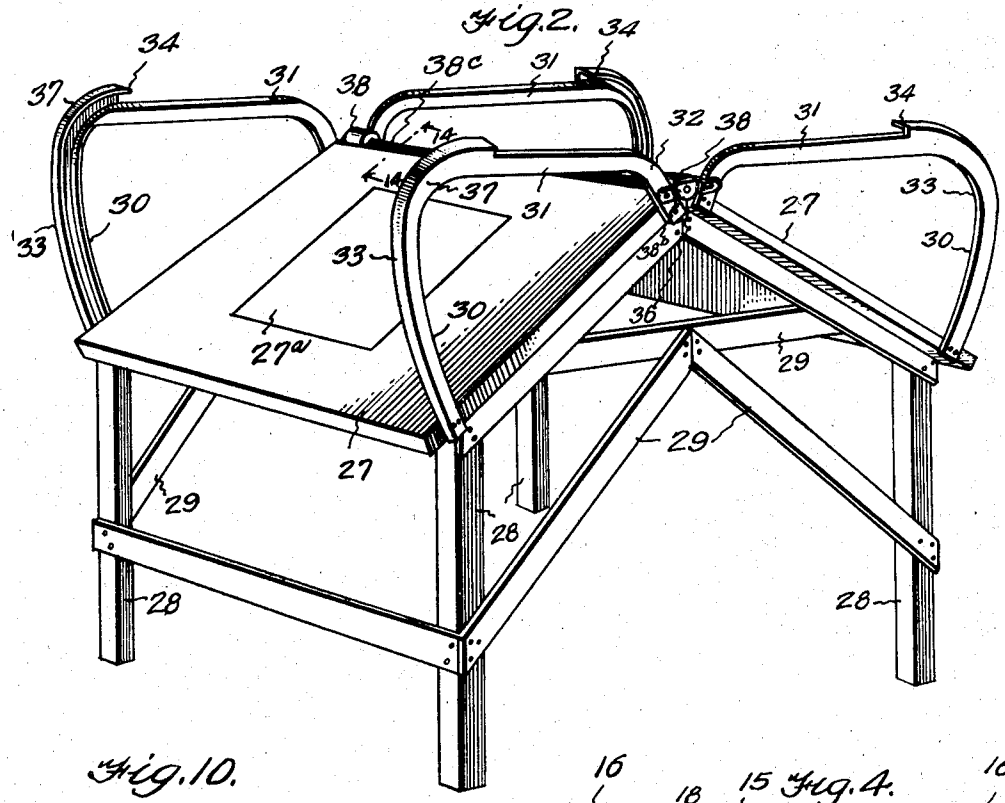


Fig. 10.

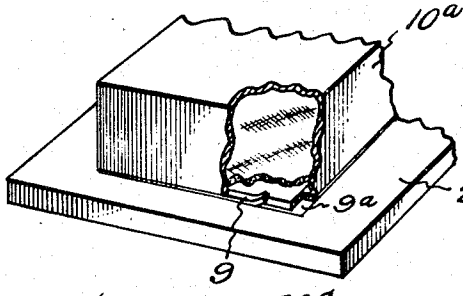


Fig. 4.

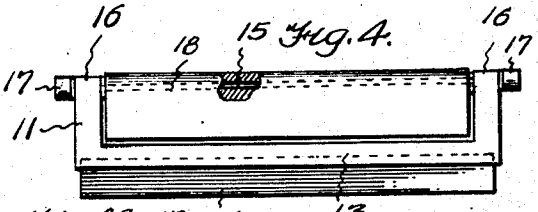


Fig. 4a

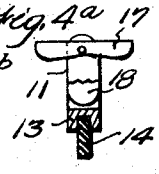


Fig. 5.

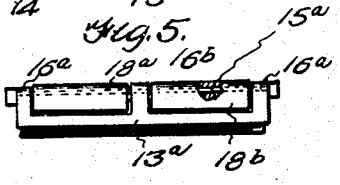


Fig. 11.

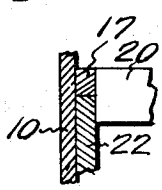


Fig. 12.

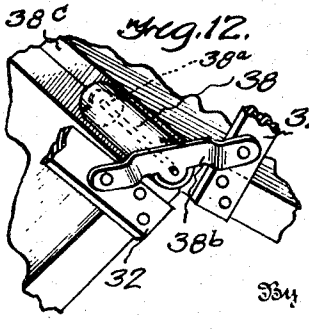
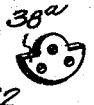


Fig. 13.



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SILK-SCREEN PRINTING APPARATUS

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Fig. 3.

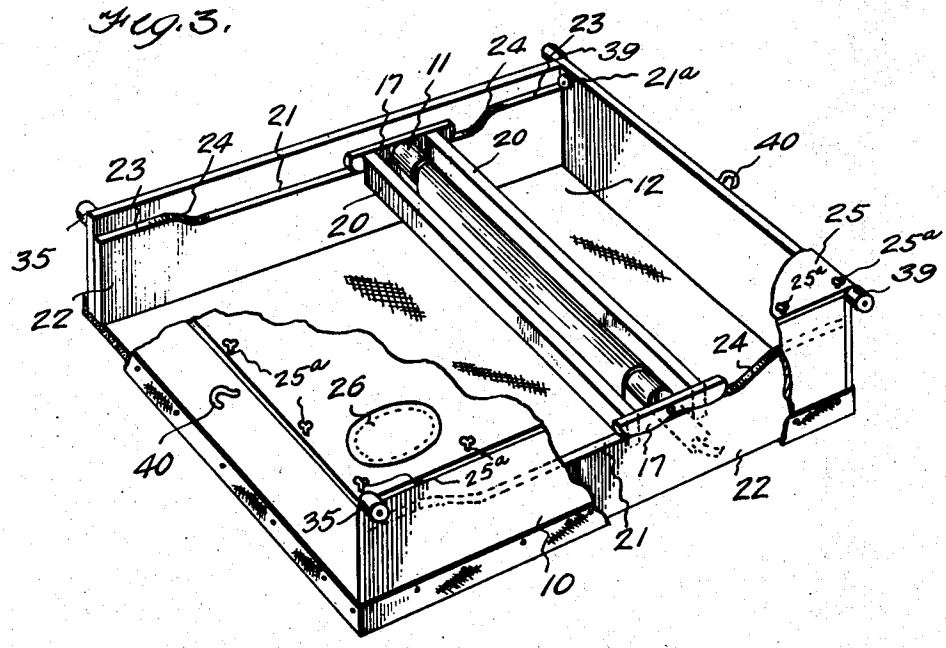


Fig. 17.

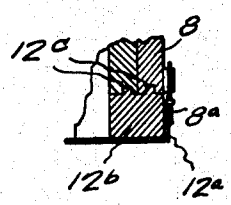


Fig. 15.

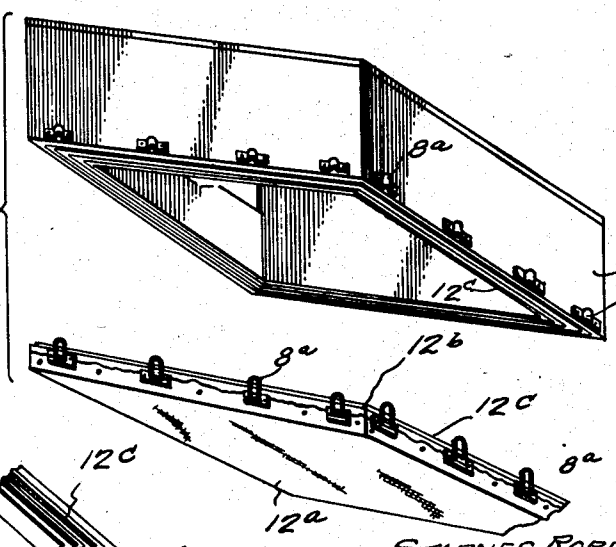
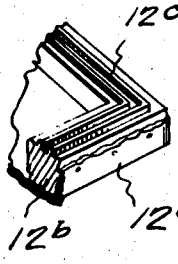


Fig. 16.



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SILK-SCREEN PRINTING APPARATUS

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Fig. 7.

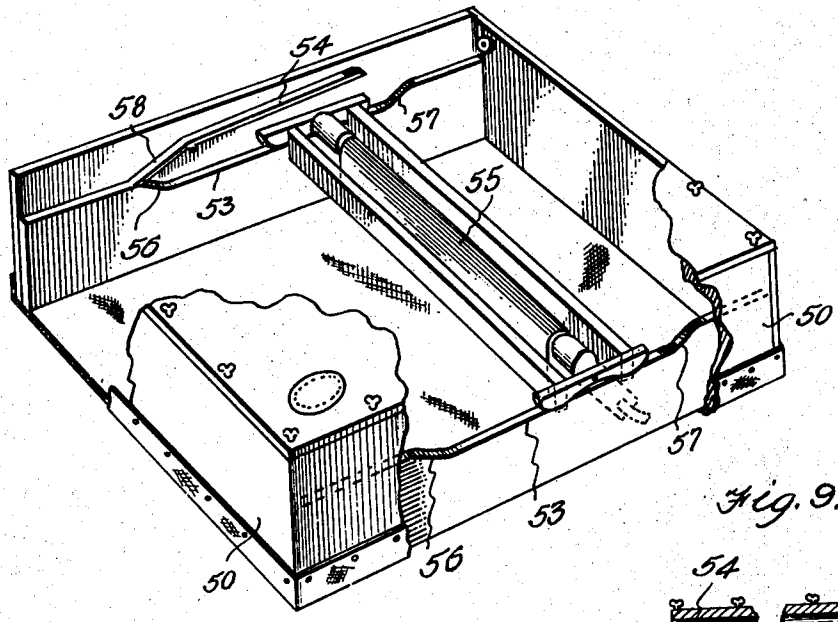


Fig. 9.

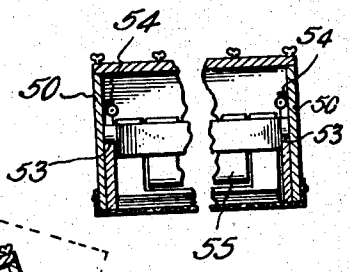
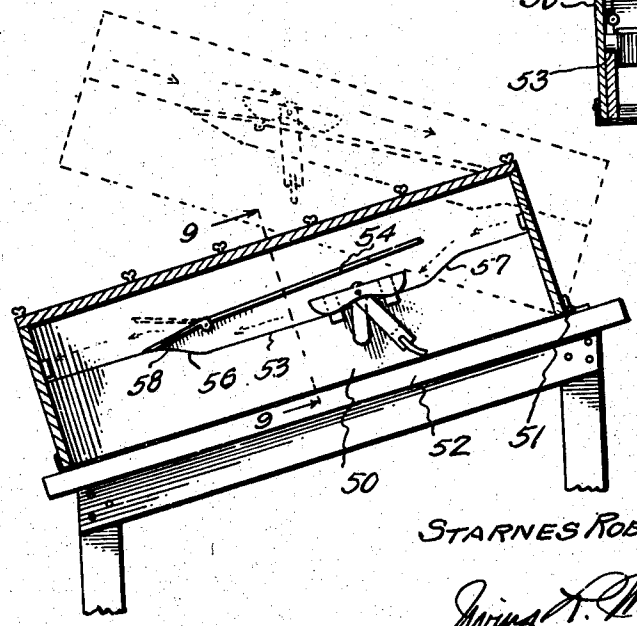


Fig. 8.



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Fig. 18.

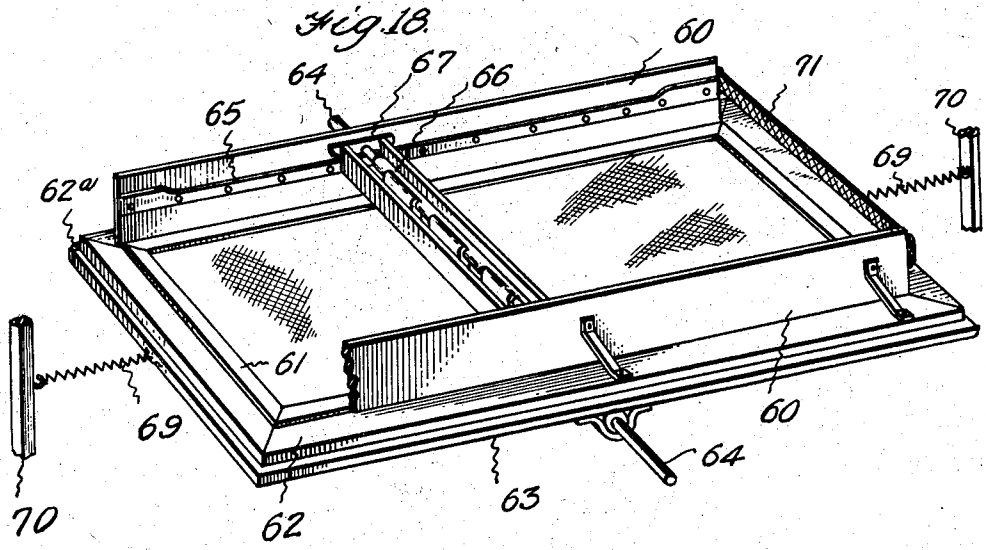


Fig. 19.

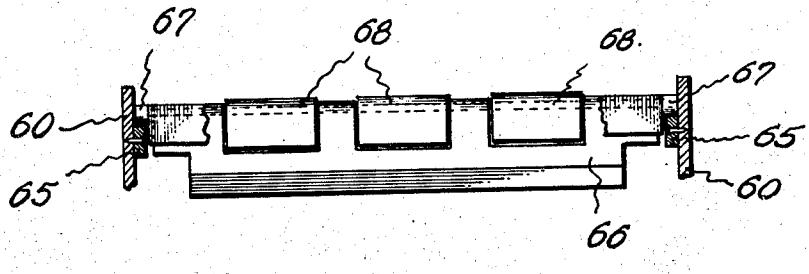
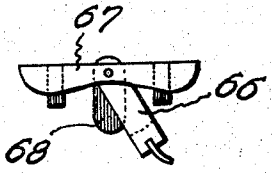


Fig. 20.



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Patented Feb. 22, 1949 2,462,447

UNITED STATES PATENT OFFICE

2,462,447

SILK-SCREEN PRINTING APPARATUS

Starnes Robert Wellborn, Nashville, Tenn.

Application May 17, 1946, Serial No. 670,468

10 Claims. (Cl. 101—123)

1

This invention relates to the silk screen process of printing, and has for one of its objects the production of an efficient means for mechanically operating the squeegee, which mechanical operation takes the place of the simple squeegee that is now commonly operated manually.

Another object of this invention is the production of a new and more efficient kind of silk screen frame which will keep the process printing paints from drying while in the frame by exposure to air.

A further object of this invention is the production of a simple and efficient means for eliminating the cause of "messy" or dirty printing by enclosing the paint inside the frame, and thus eliminating the disadvantages of paint spilling over the edge of the frame.

Other objects and advantages of the present invention will appear throughout the following specification and claims.

In the drawings:

Figure 1 is a side elevational view of a double-bed silk screen process printing press;

Figure 2 is a perspective view of the twin printing bases or beds, the frame being omitted;

Figure 3 is a perspective view of the silk screen frame, certain parts being broken away;

Figure 4 is a front view of the weighted squeegee;

Figure 4a is an end elevational view of the squeegee partly in section;

Figure 5 is a front view of a modified form of weighted squeegee;

Figure 6 is an enlarged end elevational view of the weighted squeegee, illustrating its position in its downward movement;

Figure 7 is a perspective view of a modified form of frame having a return track for the squeegee, certain parts of the frame being broken away;

Figure 8 is a longitudinal sectional view of the frame shown in Figure 7, illustrating the mounting of the frame upon a press having a single bed;

Figure 9 is a transverse sectional view of the frame shown in Figures 7 and 8, certain parts being broken away, the section being taken on line 9—9 of Figure 8;

Figure 10 is a fragmentary perspective view of a modified form of the invention illustrating one method of mounting a rubber strip upon the bed of the press to support the lower edge of the box frame;

Figure 11 is a fragmentary transverse sectional view showing the manner in which the slides or shoes rest upon the trackway;

Figure 12 is a fragmentary perspective view

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of the apex portion of the double bed silk screen process printing press;

Figure 13 is a perspective view of one of the bearing plates used to support the inner ends of the rollers mounted at the apex of the press;

Figure 14 is a fragmentary sectional view taken on line 14—14 of Figure 2;

Figure 15 is a group perspective view of a modified type of silk screen frame;

Figure 16 is a fragmentary perspective view of the frame which supports the screen shown in Figure 15;

Figure 17 is a fragmentary vertical sectional view of the screen frame and box illustrating the tongue structure carried by the screen-carrying frame;

Figure 18 is a perspective view of a modified type of press particularly designed for printing large posters, certain parts being broken away;

Figure 19 is a front view of the squeegee used by the press shown in Figure 18, certain parts of the box and support being broken away.

Figure 20 is an end view of the squeegee unit.

By referring to the drawings, it will be seen that 10 designates the box frame in which a squeegee unit 11 is mounted, as shown in Figure 3. The box frame 10 is a four-sided reservoir which holds the process paint, and a silk or metal mesh screen 12 is tightly stretched across the bottom of the box frame 10 in the same manner as the skin or head of a drum. The screen is secured in any suitable manner common to the trade. All four sides of the frame are sufficiently high to more than completely cover the squeegee unit 11.

The squeegee unit 11 comprises a hanger member 13 which carries a squeegee strip or rubber blade 14. The squeegee is hung from a suitable shaft 15 which extends through the end portions 16 and supports the slides 17 at the ends thereof which protrude beyond the end portions 16. An elongated weight 18 of iron or lead, or other heavy material, is hung on the shaft 15 and swings between the end portions 16—see Figures 1 and 6. Both the hanger member 13 and the weight 18 swing freely upon the shaft 15. The squeegee or hanger member 13 is made of a sturdy light-weight material such as wood, magnesium or aluminum. It is important that the squeegee be made of light-weight material, so that the thick mass of paint will force the squeegee into its correct printing position, that is to say, in a position pointing opposite to the direction in which the squeegee is descending.

A modified form of squeegee is shown in Figure 5, wherein the hanger member 13a is provided

with end portions 16a and a central journal portion 16b for supporting the shaft 15a, the shaft 15a suspending a pair of weights 18a and 18b. Should a relatively longer squeegee be desired, a greater number of weights may be used in a manner as shown in Figure 5, merely by multiplying the number of weights.

The slides 17 are elongated and are provided with inwardly and downwardly curved ends 19. Spaced transversely extending bracing bars connect the slides 17, and these bars 20 extend longitudinally of and upon opposite sides of the squeegee 11, as shown in Figure 3. These bars 20 extend below the trackways 21 which are formed on the upper edges of the side panels 22 of the box frame 10. The ends of the bars 20 abut the inner faces of these side panels 22 to hold the squeegee in a proper position transversely of the box frame 10 and against twisting while in operation and while it is sliding downwardly over the surface of the screen 12. The trackways 21 are upon opposite sides of the box frame 10 and these trackways 21 are provided with elevated ends 23. The trackways 21 preferably extend parallel with the base or screen 12, but the elevated ends 23 may slightly incline downwardly or may extend parallel to the base. The ends 23 are connected with the trackways 21 by an inclined portion 24 to cause the slides to ride upon the ends 23 as the slides move toward the ends of the trackways 21. Bumpers 21a of any suitable type may be located at the ends of the trackways. A cover 25 preferably closes the top of the box frame, and a suitable filling opening is closed by means of a closure cap 26. The box frame 10 and cover 25 are preferably formed of solid material such as metal, plastic, wood, or any material common to the trade. The bottom 12 is formed of silk or metal mesh, etc., and when the bottom 12 is secured to the lower edges of the box frame 10, the entire box frame 10 is sealed in a manner to prevent air from being readily admitted.

The desired amount of process paint is now placed through the filling opening and the cap 26 is closed and sealed after each filling. The paint now covers the screen and the paint will not come through the screen 12 unless pushed therethrough by the squeegee blade 14. It should be understood that the box frame 10 is actually a square airtight container which is filled with screen process paint. The squeegee unit 11 is submerged in the mass of paint and moves easily longitudinally of the box frame 10 by force of gravity when the frame 10 is tilted at an angle, as shown in Figure 1, thereby performing mechanically and automatically the same action and printing results as a manually operated squeegee. The oil paint will act as a lubricant between the slides 17 and the trackways 21, thereby facilitating the desired sliding movement.

Because of the fact that the box frame 10 is sealed, it will not be necessary for the operator to clean the screen 12 before leaving his work, and the box frame 10 may be left after the press is stopped for long lengths of time, without the necessity of cleaning. The press frame preferably comprises a pair of converging or inclined bed plates 27 which are supported by legs 28. These legs 28 are suitably braced by braces 29. When the box frame 10 rests upon the bed plates 27 of the press, a suitable amount of stiff grease, soap, or the like, is placed around the joint of the box frame 10 and the bed plates 27, thus making the box frame 10 perfectly airtight so

the paint will not dry while the device is not in operation. When the operation is resumed, the grease is wiped away and work is continued. When the press is stopped only for a short time, no complete sealing of the frame is necessary.

Since the box frame 10 is sealed, there will be no spilling of paint over the edges of the frame, and all surfaces will normally be clean, thus making it possible to employ strips of rubber along the edges of the press in a selected arrangement on either the box frame or bed. The box frame 10 may be firmly clamped to the bed plates 27 if desired, to efficiently air-proof the frame 10. The top 25 of the frame 10 may be removable for facilitating the cleaning of the interior of the box frame, for a color change of inks, or for changing the screen 12. Due to the constant submersion in oil paints, the squeegee blade 14 is preferably made of oil resistant rubber or other suitable material. The top 25 may be removably held in place by butterfly hand-screws 25a, or by means of any suitable clamping means.

As shown in Figure 10, sponge rubber strips 9 may be fitted in suitable channels 9a which are recessed in the bed of the press 27b. The lower edge of the box frame 10a rests on these strips 9. These strips 9 may be fixed in the channels 9a by means of cement or in any suitable manner. The rubber strips should be of sufficient thickness to extend slightly above the level of the press bed 27b as shown.

Track rails 30 are secured to the side edges of the bed plates 27 of the press frame, and extend upwardly, one rail on each side of each plate 27. Each track rail 30 comprises a horizontal portion 31, a downwardly inclined inner end portion 32 which extends to the point of junction or apex of the converging bed plates 27, and an outwardly and downwardly curved portion 33. The portion 33 of each track rail 30 is provided with an inwardly extending overhanging flange 34. These curved portions 33 of the rails 30 are shaped to follow the path of movement of the rollers 35 carried by the outer corners of the box frame 10, which rollers 35 travel in the curved portions 33 and are retained against displacement by the overhanging flanges 34. The curvature of the portions 33 is the same degree that the outer edge of the frame 10 which carries the rollers 35 would normally swing when hinged at the apex 36 of the upwardly inclined and converging bed plates 27. The curved portion 33 is curved abruptly inwardly toward the junction of the plates 27, as at 32, at the point of connection of the curved portion 33 and the horizontal portion 31. Supporting rollers 38 are carried near the opposite side edges adjacent the junction of the converging bed plates 27, as shown in Figure 2, to support the box frame 10 and to facilitate moving the box frame 10 from one bed plate 27 to the other. Rollers 39 are carried by the box frame 10 at the corners opposite the rollers 35, as shown in detail in Figure 3. The bottom or lower side edges of the box frame 10 roll over the rollers 38 as the box frame 10 is moved from one bed plate 27 to the other. The rollers 38 are supported or journaled at their inner ends upon suitable journal or bearing plates such as the plates 38a shown in detail in Figure 13. The outer end of each roller 38 is journaled upon a journal plate 38b, such as is shown in Figure 12, the plate 38b spanning the lower ends 32 of the adjacent track rails 30. The meeting upper ends of the bed plates 27 are beveled, as at 38c, so as to extend below the rollers 38 and out of the way

of the box frame 10 as this frame passes over the apex of the adjoining plates 27.

Any suitable means may be employed for rocking the box frame 10. One mechanism is illustrated in Figure 1, and is described in the following:

A suitable operating rope 41 is connected at its opposite ends to hooks 40, at opposite ends of the box frame 10. This rope 41 crosses and passes around two guide pulleys 42 and 43 placed high above the press and evenly spaced in relation to the apex 36 of the press. Suitable tension springs 44 are placed in the rope 41 intermediate the ends of the rope and the pulleys 42 and 43 to take up the slack of rope when the box frame 10 is in a horizontal position and resting on the horizontal portions 31 of the rails 30. The rope 41 passes also around the central supporting pulley 45, which pulley 45 may be suspended or supported in any suitable manner. The pulley 45 may be driven by any suitable means for operating the rope 41 to shift the position of the box frame 10 from one bed plate 27 to the other, or this movement may be accomplished manually if desired, by lifting one end of the box frame 10 and shifting the box frame 10 along the rails 30. When the device is operated manually, the springs 44 and rope 41 are used as a shock absorber for the descending frame 10. This is accomplished by eliminating the drive pulley 45 and the rope 41 may be removed from the pulley 45 when the device is operated manually.

As the end of the box frame 10 which carries the rollers 35 is in its lowered position, shown in Figure 1, the squeegee unit 11 will slide down the trackway 21 in the direction of the arrow. This movement of the squeegee 11 will cause the squeegee strip 14 to wipe downwardly over the bottom screen 12, thereby pushing the paint through the screen upon the paper sheet 27a. The weight 18 will hang in a vertical position, as shown in detail in Figure 6. This position of the parts will permit the paint to flow under the weight 18 and through the hanger member 13 in the direction of the arrows shown in Figure 6. When the slides 17 of the squeegee unit 11 reach the elevated end 23 of the trackways 21 the squeegee unit 11 will be raised to permit the weight 18 and hanger member 13 to swing into realignment and be ready for a return or reverse movement. When the unit 11 reaches its lower position at the end of the trackways 21, the box frame 10 is raised to cause the rollers 35 to travel upwardly upon the curved portions 33 of the rails 30 and then to travel along the horizontal portions 31 toward the apex 36. The box frame slides over the rollers 38 and the rollers 39 roll up the inclined end portions 32 of the adjoining rails 30 which are carried by the opposite bed plate 27. These rollers 39 carry the forwardly moving end of the box frame 10 along the horizontal portion of the adjoining rails and then down the curved portions 33 at which time the squeegee unit 11 slides down the trackways 21 toward the lowered end of the box frame 10 to force paint through the screen 12 upon a sheet of paper similar to the sheet 27a carried by the adjoining bed plate 27. This operation is repeated to bring the box frame 10 alternately into a printing position over the adjoining or converging bed plates 27.

The pulley 45 is preferably operated to provide an alternating movement with a delay between each return movement to allow sufficient time for the squeegee unit 11 to slide down the inclined trackway.

In Figure 8, there is illustrated a further modified form of box frame 50 which is a closed frame, hinged as at 51, upon a single bed plate 52. The closed frame and squeegee unit will operate in a similar manner to the first described silk screen frame. The bed plate 52 is on an incline plane as shown, and the frame 50 is hinged at the top of the incline. In this form of press as shown in detail in Figures 7 and 8, I provide a lower trackway 53 and an upper trackway 54, the lower trackway 53 having upwardly inclined end portions 56 and 57 communicating with the upper trackway 54 to permit the squeegee unit 55 to pass from the lower trackway to the upper trackway and vice versa, as the box frame 50 is tilted. A spring gate closure 58 normally closes the inclined portion 56 but swings open to permit the squeegee 55 to pass to the upper trackway. Bumpers 53a of any suitable type are preferably located at the ends of the trackways.

The screen may be secured to the box frame either in the manner shown in Figures 3 and 7, or the screen 12a may be mounted on a frame 12b which may be detachably secured to the box frame 8 by suitable separable fasteners 8a. The frame 12b is preferably fitted to the frame 8 by a double tongue and groove connection 12c as shown in Figures 15, 16 and 17.

In Figure 18 there is shown an open box frame designed for printing billboard or other large posters, wherein a box frame 60 carries a screen frame 61. The frames 60 and 61 rest on a master frame 62, which frame 62 in turn is mounted on the bed or printing base 63 and is preferably hinged at the side edge 62a thereto. This base 63 is carried by an axle 64 for tilting the frame 60. A trackway 65 is carried longitudinally of each side of the frame 60 and a squeegee unit 66 is mounted in the box frame 60. This unit 66 carries shoes 67 at each end for traveling on the trackways 65 in the same manner as described relative to Figures 3 and 7. The squeegee unit 66 is of greater length than that shown in Figures 3 and 7, and carries a plurality of weights 68 which may be in any desired number. Springs 69 are secured at each end of the bed or printing base 63 and are anchored at their opposite ends to suitable anchoring elements 70. Bumpers are preferably located at each end of the frame 60, such as the bumper 71 which is formed of web belting and acts as a shock absorber for the squeegee 66.

It should be noted that the gravity propelled squeegee unit shown in the various forms operating on an incline plane is an underlying feature of the invention. It should be further understood that certain detail changes in mechanical design may be made without departing from the spirit of the invention so long as these changes fall within the scope of the appended claims.

From the foregoing description it will be noted that two types of presses have been described, one the double bed press shown in Figures 1 and 2, and the other the single bed press shown in Figure 8. The single bed press shown in Figure 8 may be operated by one pressman. It is simply constructed, may be economically manufactured, and may therefore be made available to a large number of users. Because of these facts and its wider use, the single bed press may be used to advantage by individual owners or hobbyists.

The double bed press is adapted to be used by two pressmen, and its advantage over the single bed press is that is produces twice the number of prints from the same screen within a given period of time. The double bed press is especially advantageous in large printing establishments and factories where quantity production on long runs is essential. The single bed press and double bed press have the advantage of being suitable to factory use where the screen process of printing is continuously used day by day, usually with a permanent design to be printed, since there is no bother of "make-ready" or continuous cleaning, and getting the paints ready for use.

Having described the invention, what I claim is:

1. A machine of the class described comprising an inclined bed plate, a printing means mounted to swing into and out of an inclined printing position relative to said bed plate, a screen carried by the printing means, a gravity propelled squeegee having wiping contact with the screen as said printing means is swung to an inclined printing position, a trackway carried by said printing means, means carried by the squeegee and slidable upon said trackway for guiding the squeegee in its movement longitudinally of said printing means, means at one end of said trackway for guiding said squeegee to a position out of contact with said screen when the squeegee reaches one end of the trackway, and a second trackway at a higher elevation than the first mentioned trackway and communicating with said last mentioned means for guiding the squeegee to the opposite end of the first mentioned trackway and to a screen-engaging position.

2. A machine of the class described comprising an inclined bed plate, a printing means mounted to swing into and out of an inclined printing position relative to said bed plate, a screen carried by the printing means, a gravity propelled squeegee having wiping contact with the screen as said printing means is swung to an inclined printing position, a trackway carried by said printing means, supporting shoes carried by the squeegee and slidable upon said trackway for guiding the squeegee in its movement longitudinally of said printing means, and means at one end of said trackway for guiding said squeegee to a position out of contact with said screen when the squeegee reaches said one end of said trackway.

3. A machine of the class described comprising an inclined bed plate, a printing means mounted to swing into and out of an inclined printing position relative to said bed plate, a screen carried by the printing means, a gravity propelled squeegee having wiping contact with the screen as said printing means is swung to an inclined printing position, a trackway carried by said printing means, means carried by the squeegee and slidable upon said trackway for guiding the squeegee in its movement longitudinally of said printing means, and said trackways having elevated end portions for automatically raising said squeegee out of wiping contact with the screen when the squeegee reaches the ends of the trackways.

4. A machine of the class described comprising an inclined bed plate, a printing means mounted to swing into and out of an inclined printing position relative to said bed plate, a screen carried by the printing means, a gravity propelled squeegee having wiping contact with the screen as said printing means is swung to an inclined printing position, said squeegee having a pivotally hung wiping element adapted to swing to an inclined wiping position, a pendulously hung weight adapted to swing away from said wiping element and hang in a vertical position by force of gravity as said squeegee moves longitudinally of said printing means, means at one end of said trackway for guiding said squeegee to a position out of contact with said screen, and means communicating with the last mentioned means for guiding the squeegee to a screen contacting position when said printing means is swung from an inclined printing position.

5. A machine of the class described comprising an inclined bed plate, a printing means mounted to swing into and out of an inclined printing position relative to said bed plate, a screen carried by the printing means, a gravity propelled squeegee having wiping contact with the screen as said printing means is swung to an inclined printing position, said squeegee having a pivotally hung wiping element adapted to swing to an inclined wiping position, a pendulously hung weight adapted to swing away from said wiping element and hang in a vertical position by force of gravity as said squeegee moves longitudinally of said printing means in one direction, said weight being hung within the wiping element and permitting the flow of the contents of the printing means through the wiping element as the weight swings away from the wiping element, means at one end of said trackway for guiding said squeegee to a position out of contact with said screen, and means communicating with the last mentioned means for guiding the squeegee to a screen contacting position when said printing means is swung from an inclined printing position.

6. A machine of the class described comprising an inclined bed plate, a printing means mounted to swing into and out of an inclined printing position relative to said bed plate, a screen carried by the printing means, a gravity propelled squeegee having wiping contact with the screen as said printing means is swung to an inclined printing position, said squeegee having a pivotally hung wiping element adapted to swing to an inclined wiping position, a plurality of pendulously hung weights adapted to swing away from said wiping element and hang in a vertical position by force of gravity as said squeegee moves longitudinally of said printing means in one direction, means at one end of said trackway for guiding said squeegee to a position out of contact with said screen, and means communicating with the last mentioned means for guiding the squeegee to a screen contacting position when said printing means is swung from an inclined printing position.

7. A machine of the class described comprising an inclined bed plate, a printing means mounted to swing into and out of a printing position relative to said bed plate, a screen carried by the printing means, a gravity propelled squeegee having wiping contact with the screen as said printing means is swung to a printing position, a trackway carried by said printing means, supporting shoes carried by the squeegee and slidable upon said trackway for guiding the squeegee in its movement longitudinally of said printing means, said trackways having elevated end portions for raising said squeegee out of wiping contact with the screen when the squeegee reaches the ends of the trackways, a second return trackway above

and communicating with said first mentioned trackway for receiving said supporting shoes, and gateways normally closing the communication between the trackways at one end and adapted to open and close to allow the shoes to pass from the first to the second return trackway.

8. A mechanism of the class described comprising a pair of upwardly inclined converging bed plates, a printing means mounted to swing into and out of an inclined printing position upon a selected bed plate, and track-rails supporting the printing means, said printing means being slidable upon said track-rails to move the printing means from one bed plate to the adjoining bed plate.

9. A mechanism of the class described comprising a tiltable support, a gravity propelled squeegee automatically movable longitudinally of the support as the same is tilted in one direction, a main trackway for holding said squeegee in an operative position and an elevated return trackway located above said main trackway for receiving the squeegee and for automatically lifting the squeegee to an inoperative position in its return movement as the support is tilted in an opposite direction.

10. A mechanism of the class described comprising upwardly converging bed plates defining an apex at the upper end, rollers carried at the apex of the plates, the plates being beveled intermediate the rollers, and a printing means movable from one bed plate to the other across the apex, and the rollers supporting the printing means out of contact with the apex as the printing means is moved thereacross.

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