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AUTOMATIC SILK SCREEN PRINTING MACHINE

Filed July 22, 1958

3 Sheets-Sheet 1

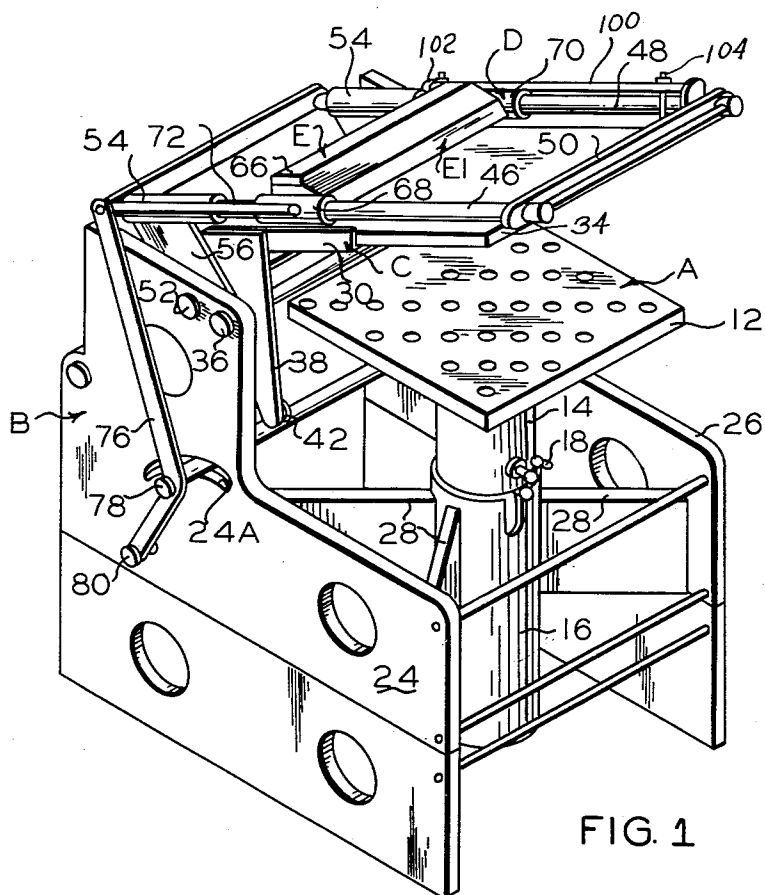


FIG. 1

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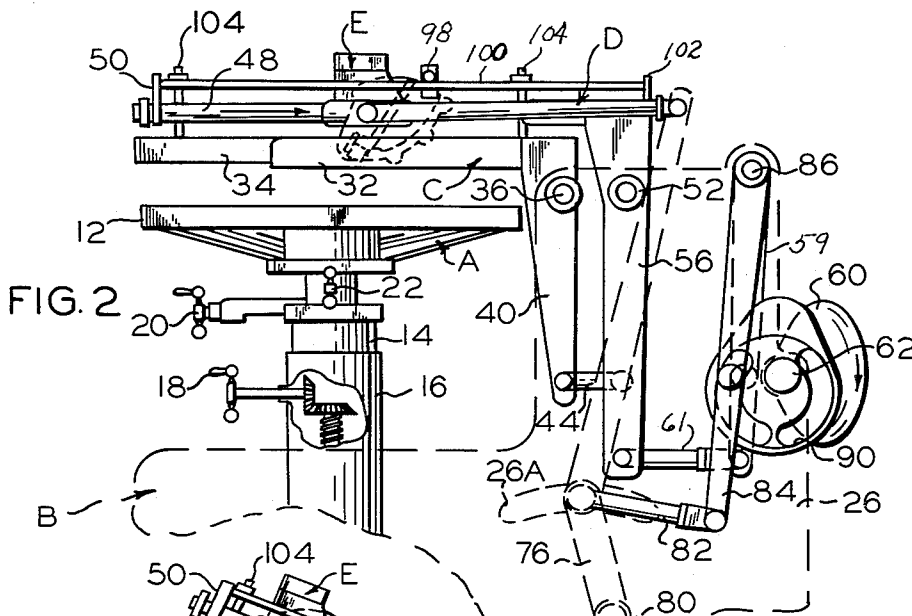
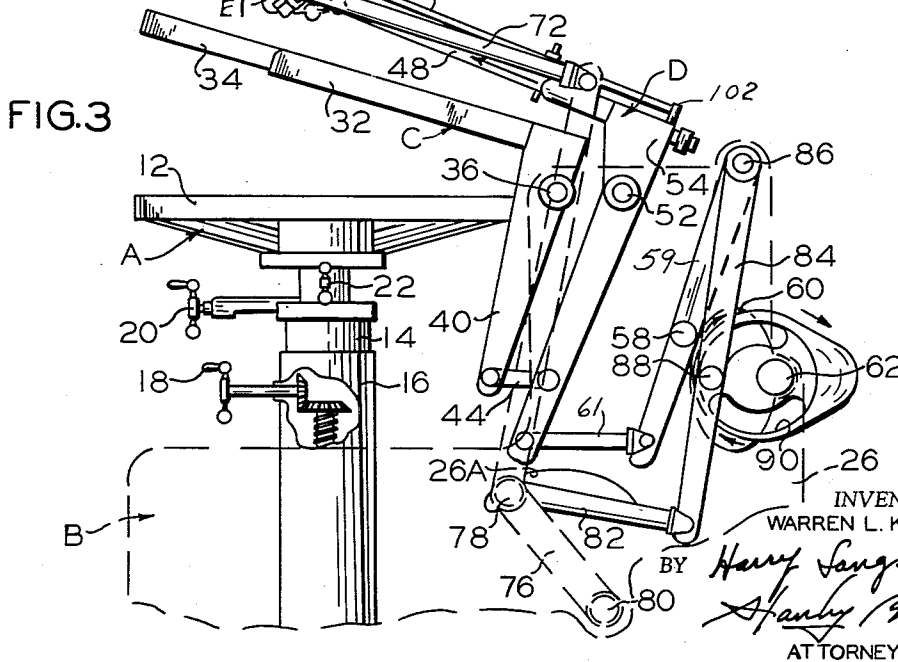
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AUTOMATIC SILK SCREEN PRINTING MACHINE

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3 Sheets-Sheet 2



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AUTOMATIC SILK SCREEN PRINTING MACHINE

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3 Sheets-Sheet 3

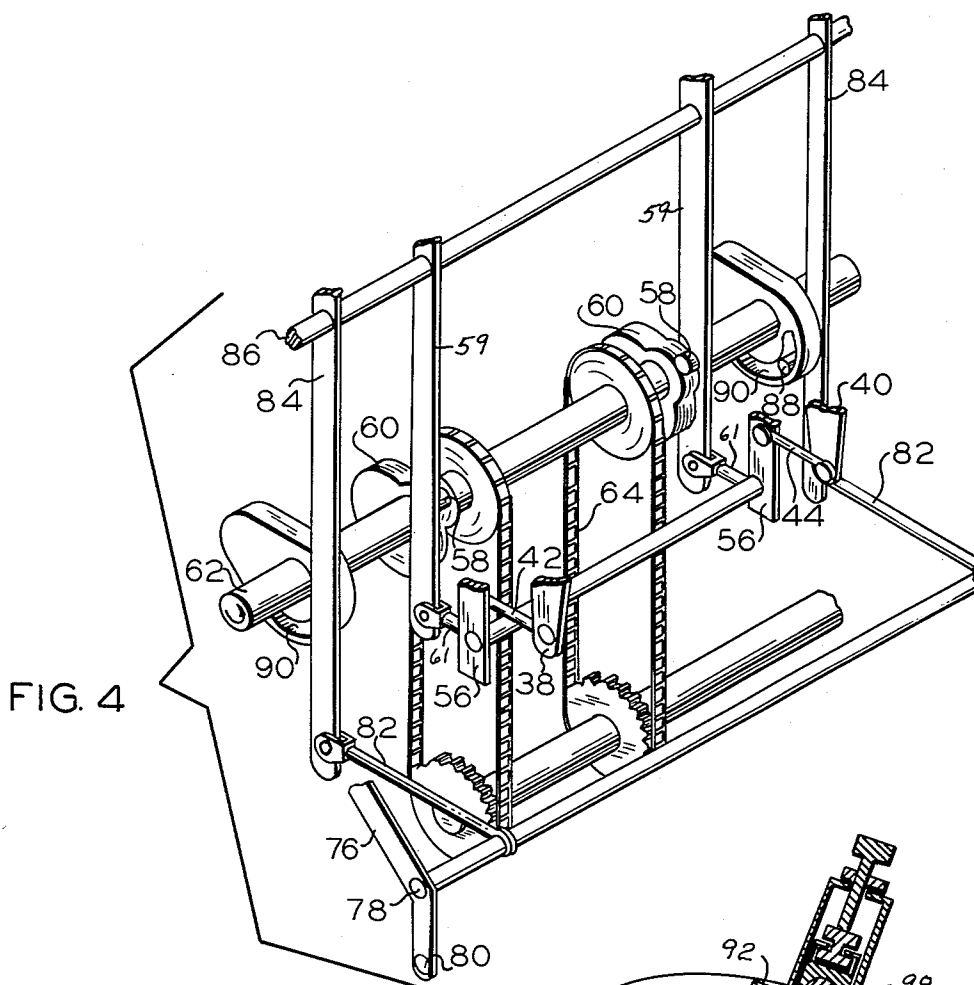


FIG. 4

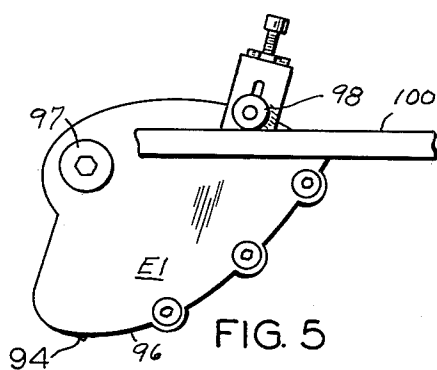


FIG. 5

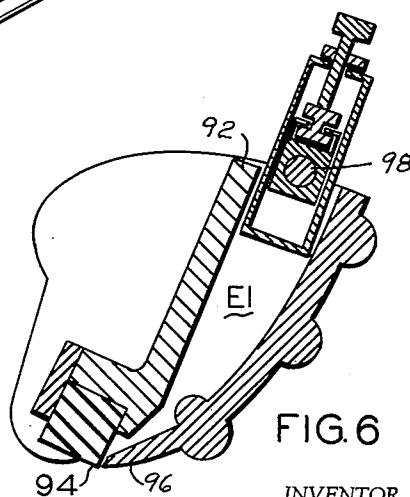


FIG. 6

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AUTOMATIC SILK SCREEN PRINTING MACHINE

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7 Claims. (Cl. 101—123)

My invention relates to a silk screen printing machine, and more particularly relates to a fully automatic silk screen printing press wherein all operations are performed automatically.

The prior art shows silk screen printing machines wherein means are provided for depositing and distributing ink upon the screen at the beginning of the stroke, and for collecting the surplus ink after a traverse stroke in the printing direction, the surplus ink being carried back over the screen and redistributed at the initial position of the cycle. Such prior art silk screen printing machines are at best semi-automatic in operation whereby a cycle must be initiated by manual closing of the press at the beginning of the operation and each subsequent cycle begun in the same manner. Thus, in the past, at least a partial manual or hand operation was necessary in order to procure accurate registration of the silk screen application upon the sheet of paper or card upon which the printing was to be placed.

Another problem encountered in silk screen printing, is providing accurate registration upon articles having considerable depth such as radio chassis and/or printed circuit components, and articles having depressions within their surfaces. That is, prior art devices utilized vertically fixed tables or base plates upon which the silk screen frame was hinged and adapted to be placed in abutment thereover with the sheet of paper or card therebetween, and thereafter drawing the silk screen squeegee across the stencil. As is readily apparent such silk screening procedures upon articles having considerable depth or with depressions in the surface thereof, naturally cause the silk screen ink or paint to flow about the exterior of the article and also into the depressions unless absolutely accurate registration was provided. Therefore, because of extensive set up time necessary to place such article in position, prior art applications utilized direct printing presses which do not afford the clarity and sharpness of a silk screening process.

It is therefore an object of this invention to provide a silk screen printing machine wherein all operations are fully automatic.

Another object of my invention is to provide a fully automatic silk screen printing machine wherein rapid and accurate registration on successive operations are consistently obtained upon any thickness of article.

Another object of my invention is to provide a fully automatic silk screen printing machine wherein ink may be automatically supplied in regulated amounts upon the face of the stencil and thereafter drawn over the stencil uniformly and accurately.

Another object of my invention is to provide a fully automatic silk screen printing machine which may be easily and rapidly adjusted to accommodate for any article thickness and for accurately providing registration upon articles having surface depressions or holes therein.

Another object of my invention is to provide a fully

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automatic silk screen printing machine for radio chassis and printed circuits.

Another object of my invention is to provide a fully automatic silk screen printing machine wherein needle sharp line contact of the squeegee is consistently obtained at all times.

Another object of my invention is to provide a fully automatic silk screen printing machine wherein the ink supply is fully automatic and never need be touched by the operator.

Another object of my invention is to provide a fully automatic silk screen printing machine wherein the article to be imprinted may be rapidly and efficiently adjusted vertically, laterally and longitudinally.

Another object of my invention is to provide a fully automatic silk screen printing machine wherein a minimum of manual effort is exerted by the operator.

Other objects of my invention are to provide an improved device of the character described, that is easily and economically produced, which is sturdy in construction, and which is highly efficient in operation.

With the above and related objects in view, my invention consists in the details of construction and combination of parts, as will be more fully understood from the following description, when read in conjunction with the accompanying drawings, in which:

Fig. 1 is a perspective view of a fully automatic silk screen printing machine embodying my invention.

Fig. 2 is a side view thereof showing the squeegee in stroke position.

Fig. 3 is a side view thereof with the carriage in upwardly hinged position.

Fig. 4 is an exploded view showing the automatic drive means for the silk screen printing machine.

Fig. 5 is a fragmentary side sectional view showing the squeegee assembly at the beginning of the stroke.

Fig. 6 is a fragmentary side sectional view showing the squeegee assembly at the end of the stroke.

Referring now in greater detail to the drawings, in which similar reference characters refer to similar parts, I show a fully automatic silk screen process printing machine comprising an adjustable printing bed, generally designated as A, a housing, generally designated as B, and supporting said bed, a printing frame bracket, generally designated as C, hinged above said bed within the housing, a carriage, generally designated as D, hinged within the housing cooperatively with the bracket, and a squeegee fountain assembly, generally designated as E, slidably supported upon the carriage.

The printing bed A comprises a foraminous steel plate 12 having a column 14 medially mounted upon the lower surface thereof and supported within a piston-like casing 16 whereby operation of internal gears within the column 14 by a crank 18 adjustably elevates the plate to any vertical position desired. Longitudinal and lateral traverse of the plate 12 upon the column 14 is attained by rack driving cranks 20 and 22 respectively. The plate 12 is cored and has a plurality of holes drilled therein which communicate with a vacuum system (not shown) to maintain sheets placed upon the surface of the table in positive flat abutment during the printing cycle.

The housing B comprises a pair of side plates 24 and 26 having a plurality of trusses 28 extending therebetween for securing positively the piston casing 16 in firm position.

The frame bracket C comprises a pair of arms 30 and 32 which are L-shaped in cross section and adapted to support therein a printing frame 34 containing the usual stencil at the bottom surface thereof. The rear end of the arms 30 and 32 are coupled fixedly upon a shaft 36 which is rotatably supported between the side plates 24 and 26 of the frame B and actuated by lever

arms 38 and 40 respectively at each side thereof. As shown in Fig. 3 the lever arms are coupled by links 42 and 44 respectively to the same driving mechanism which hinges the carriage D.

The carriage D is a rectangular annulus having a pair of heavy gauge slide rods 46 and 48 at each side thereof supported transversely at the front by a cross bar 50. The rear ends of each of the rods 46 and 48 are rotatably coupled to a shaft 52 supported within the side plates 24 and 26 of the frame B by tubular collars 54. It is to be observed that the shaft 52 is spaced behind the shaft 36 within the frame B, and although the carriage D of the bracket C is operated unitarily, as will be more fully described hereinafter, the hinge points of the carriage D and the bracket C are spaced from each other. Crank arms 56 are also rotatably supported upon the shaft 52 and downwardly extend therefrom and the lower portion of each of the arms 56 is coupled to the lower portion of the lever arms 38 and 40 through the links 42 and 44 respectively. A cam follower 58 is rotatably supported upon an intermediate portion of cam follower arms 59 and engage a cardioid cam 60 fixed upon a cam shaft 62 as shown in Fig. 4. The lower portion of the follower arms are linked to crank arms 56 by a coupling 61. A chain drive 64 from a single common motor drive serves to perform all of the automatic operations of the machine upon the single cam shaft 62. As the cam 60 rotates, both the bracket C and the carriage D hingedly cycle above the top of the plate 12. Because of the linkage 42 and 44 and the spacing of the shafts 36 and 52 defining hinge points between the bracket C and the carriage D, a slight displacement between the forward portions thereof is sufficient to actuate the squeegee fountain assembly E in the proper sequence of operation.

The squeegee E comprises a fountain E1 downwardly extending from a transverse bar 66 which is slidably supported upon the slide rods 46 and 48 by bearings 68 and 70 respectively. Drive rods 72 couple the bearings 68 and 70 respectively to a hinged crank arm 76 mounted exteriorly of the side plates 24 and 26 of the housing B whereby reciprocation of the squeegee assembly E upon the slide rods 46 and 48 is effected. The crank arms 76 are coupled by a central shaft 78 which passes through slots 24A and 26A in the frame B and are further connected upon a shaft 80 pivotally supported within the housing B. A driving leg 82 is pivotally mounted at one end upon the shaft 78 and the other end of the leg 82 is pivotally mounted upon the lower portion of a cam follower arm 84. The upper end of the cam follower arm 84 is pivotally mounted upon a rod 86 supported between the side plates 24 and 26. A cam follower 88 is rotatably supported upon an intermediate portion of the cam follower arm 84 and engages a C-shaped raceway of a push-pull type cam 90 mounted on the central cam shaft 62. As the cam 90 rotates, the cam follower 88 rolls within the C-shaped raceway and causes a push-pull action to be exerted upon the cam follower arm 84 thereby causing oscillation of the shaft 78 within slots 24A, 26A to effect a hinged action upon the crank arms 76 about shaft 80. Thus, as a result of the hinged action of the crank arm 76, the rods 72 reciprocate the squeegee assembly E within the carriage D. It is to be observed that each of the cams 60 and 90 are arranged in duplicate upon the shaft 62 intermediate the side plates 24 and 26 immediately adjacent respectively the interior portion thereof. The duplication of the cams 60 and 90 as well as their accompanying linkage and crank arms are necessary to perform a balancing operation upon each side of both the brackets C and carriage D so that proper synchronization will occur and accurate registration performed.

The squeegee fountain E1 comprises a transverse wiper element 92 having a rectangular squeegee blade 94 supported in a slot at its lower portion thereof. The squeegee blade 94 can be rotated within the slot at 90° displacement

ment intervals as desired, in order that a sharp edge may always be impressed against the stencil. See Figs. 5 and 6. That is, as each corner of the squeegee element 94 wears, it may be rotated so that a subsequent sharp corner may be set in position. A scoop 96 is hingedly supported to the wiper element at each end thereof in the manner of a clam shell. A roller 98 extends from each end of the scoop 96 and is respectively supported upon a rail or track 100. The track 100 is slidably supported at one end in a vertically extending slot in the cross bar 50 and at the other end within an ear 102 on the carriage D at the back portion thereof. Adjusting screws 104 are threaded through the track 100 and abut upon the squeegee printing frame 34 when the bracket C and carriage D are in their downwardly hinged position. Thus, the track 100 floats within slots upon the carriage D but when the carriage is in its downwardly hinged position the screws 104 engage the printing frame 34 and move the track 100 vertically a slight distance. Since the rollers 98 ride upon the track 100, elevation of the track will cause the scoop to open and permit ink contained within the fountain E1 to flow downwardly upon the stencil. Ink will flow from the fountain E1 as it is drawn across the stencil in the printing frame 34 when both the brackets C and the carriage D are in their downwardly hinged position. At the end of the printing stroke both the brackets C and the carriage D will be hingedly urged upwardly by the cam 60 thereby causing the angle between the printing frame 34 and the carriage D to increase slightly and release the abutment of the track screws 104 from the frame 34. The track 100 will then gravitationally fall to the bottom of its containing slots and accordingly lower the position of the rollers 98. The scoop 96 will close against the wiper element 92 and stop the flow of ink from the fountain E1 until the fountain once more is at the forward portion of its stroke.

As it is apparent from the foregoing description, the operation of the silk screen process printing machine is fully automatic. Preliminary adjustments may be made on the printing bed A with respect to elevation, lateral and longitudinal position with respect to the particular series of articles to be screened. The articles which are to be screened are placed upon the bed A during each up position of the carriage D. That is, at the initial portion of the cycle, the carriage D is tilted upwardly along with the printing bracket C, the track 100 is freely suspended within the carriage D, and the squeegee assembly E is at the rear position. The ink is thereby retained in the scoop 96 until the carriage D and the printing brackets C are hingedly urged downwardly into abutment with the articles upon the printing bed A. The squeegee fountain D1 will be urged forwardly while the carriage D is still coming down but before the track screws 104 engage the printing frame 34. When the bracket C and carriage D are in the downward position, the track screws 104 will abut the frame 34 and elevate the track 100. At this time the rollers 98 will engage the rails and be urged upwardly thereby causing the scoop to open slightly and deposit ink in front of the wiper element 92. Immediately thereafter the cam 90 will cause the squeegee assembly E to move backwardly through its full printing stroke whereupon at the end of the stroke, both the bracket C and the carriage D will hinge upwardly as resulting from rotation of cam 60 and complete the cycle once more preparatory for insertion of new article to have silk screen printing thereon.

It is to be particularly observed that all adjustments of table height are made from below. That is, elevation of the table is accomplished until the article itself is positioned immediately below the printing frame 34 and its stencil when the printing frame brackets B are in their lowermost position. Thus, the articles may be laterally or longitudinally spaced and depressions in the article surfaces may be easily accommodated. Thus, by proper adjustment of the article below the stencil means are pro-

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vided to have proper stencil pressure against the article surface. Since the pressure is quite critical on depressed surfaces and articles having considerable depth hair line adjustment of the table A is easily provided from below.

Although my invention has been described in considerable detail, such description is intended as being illustrative, rather than limiting, since the invention may be variously embodied, and the scope of the invention is to be determined as claimed.

I claim:

1. A fully automatic silk screen printing machine comprising a frame, a printing bed mounted within said frame, a vertically adjustable table on said printing bed, a printing frame bracket hinged within said frame upon a fixed horizontal axis, a printing frame mounted within said bracket, a carriage hingedly supported within said frame on a fixed horizontal axis spaced from the printing bracket axis, a linkage coupling said carriage with said printing bracket, said bracket and said carriage having capacity for common generally longitudinal reciprocation with variable displacement between them transverse to said axes during said reciprocation, a cardioid cam rotatably supported in said frame and coupled to said carriage, a squeegee assembly longitudinally slidable within said carriage, a crank arm pivotally supported within said frame and reciprocating said squeegee assembly and a cam having a C-shaped raceway therein coupled to said crank arm and effecting oscillation thereof whereby rotation of said cams will effect hinged motion of said bracket and carriage together with reciprocation of said squeegee assembly within said carriage.

2. A fully automatic silk screen comprising a frame, a printing bed mounted within said frame, a vertically adjustable table on said printing bed, a printing frame bracket hinged within said frame upon a horizontal axis, a printing frame mounted within said bracket, a carriage hingedly supported within said frame on a horizontal axis spaced from the printing bracket axis, a linkage coupling said carriage with said printing bracket, a cardioid cam rotatably supported in said frame and coupled to said carriage, a squeegee assembly longitudinally slidable within said carriage, a crank arm pivotally supported within said frame and reciprocating said squeegee assembly and a cam having a C-shaped raceway therein coupled to said crank arm and effecting oscillation thereof whereby rotation of said cams will effect hinged motion of said bracket and carriage together with reciprocation of said squeegee assembly within said carriage, a longitudinal track vertically slidable in said carriage, pins in said track downwardly extending therefrom and abutting said printing frame in the downwardly hinged position thereof to vertically elevate said track, a fountain freely pivoted on said squeegee assembly, and rollers on said fountain in engagement with said track whereby said fountain will automatically distribute ink within said printing frame during printing strokes and collect surplus ink therefrom at the end of the printing stroke.

3. In a printing machine, a support column, a printing bed, members supporting said bed on said column for

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longitudinal and transverse movement relative to said column, a printing frame pivotably mounted above said bed about a first fixed axis, said printing frame being pivotable from a position away from said bed to a position juxtaposed to said bed, a carriage disposed above said frame, said carriage being pivotably mounted about a second fixed axis spaced from said first axis, a lever arm on said frame and a crank arm on said carriage, a link connecting said lever arm and said crank arm, and a member connecting one of said arms to a mechanical actuator so that movement of said member by said mechanical actuator causes said frame and said carriage to pivot about their axes in unison.

4. In a machine as set forth in claim 3 including a squeegee assembly mounted on said carriage, and lever members connected between said assembly and said actuator for reciprocating said assembly along said carriage.

5. In a machine, as set forth in claim 4 including a floating track on said carriage, a depending element on said track, said element contacting said frame when said frame is juxtaposed to said bed thereby raising said track, a scoop hingedly supported in said squeegee assembly, members on said scoop operatively associated with said track so that the raising movement of said track pivots said scoop away from a wiper blade, thereby permitting a liquid in said scoop to be deposited on said frame.

6. In a silk screen printing machine comprising a frame structure, a printing frame bracket hinged within such structure, a printing frame mounted within said bracket, a carriage hingedly supported within said structure separate from the mounting of said frame, a squeegee assembly longitudinally slidable on said carriage, means for reciprocating said squeegee assembly along said carriage, a longitudinal track vertically slidable in said carriage, means for elevating said track when said printing frame is in its downwardly hinged position, a scoop pivoted on said squeegee assembly, said scoop cooperating with a wiper blade to retain printing ink therebetween, means on said scoop cooperating with said track for pivoting said scoop away from said wiper blade thereby distributing ink on said printing frame when said frame is in its downwardly hinged position.

7. In a machine as set forth in claim 6 including a mechanical actuator, elements structurally interrelating said actuator and said bracket, elements structurally interrelating said actuator and said carriage, said actuator and said elements hingedly moving said bracket and said carriage in unison, and said means for reciprocating said squeegee assembly including lever elements between said actuator and said squeegee assembly.

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