

March 5, 1957

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2,783,709

STENCIL PRINTING APPARATUS

Filed April 19, 1951

5 Sheets-Sheet 1

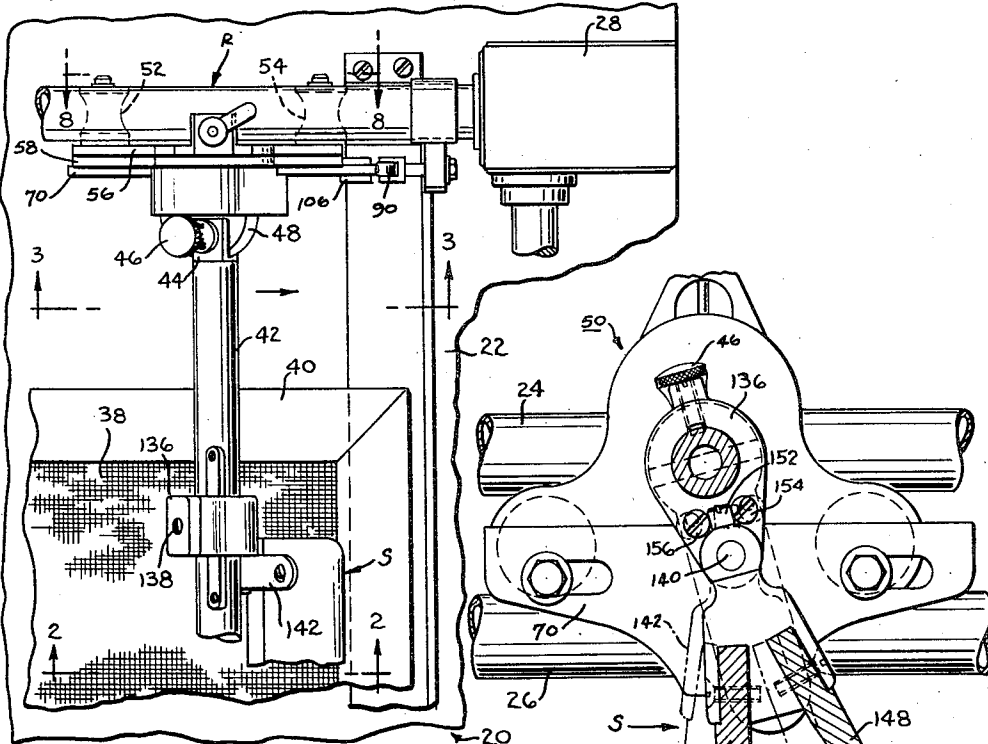


Fig. 1.

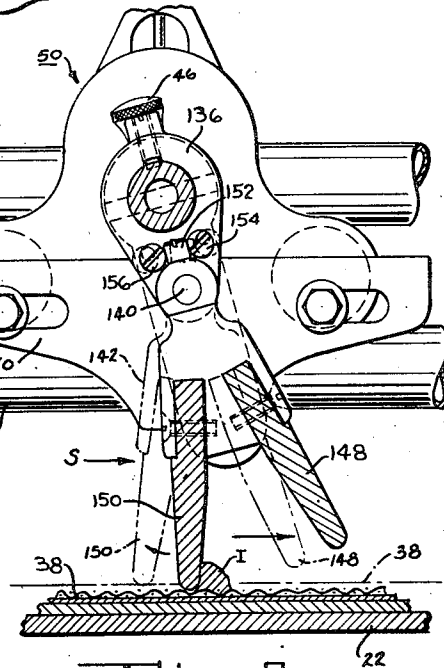


Fig. 2.

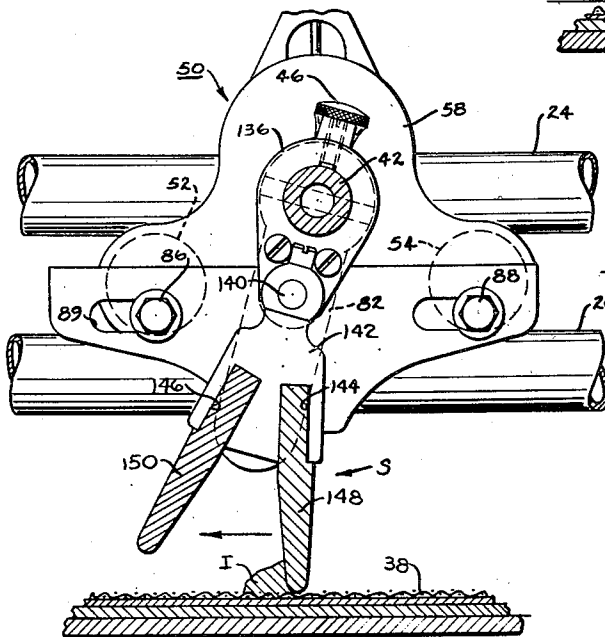


Fig. 7.

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5 Sheets-Sheet 2

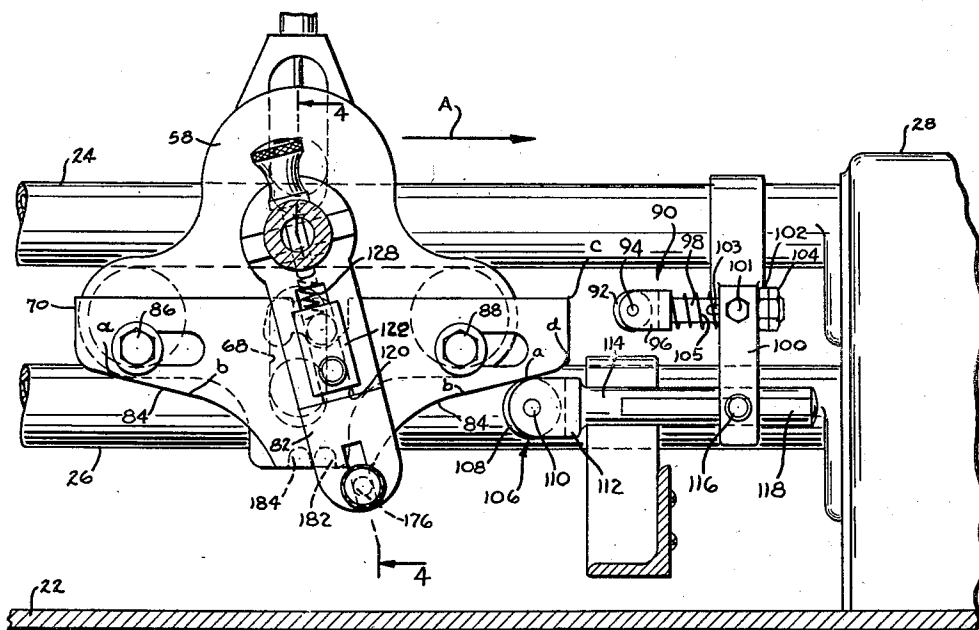


Fig. 3.

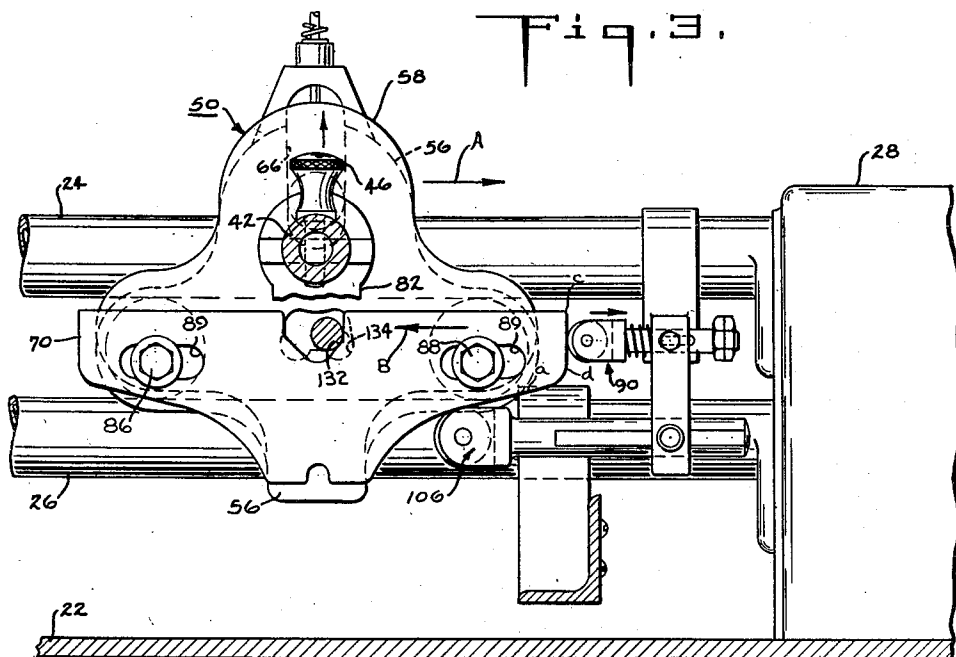


Fig. 5.

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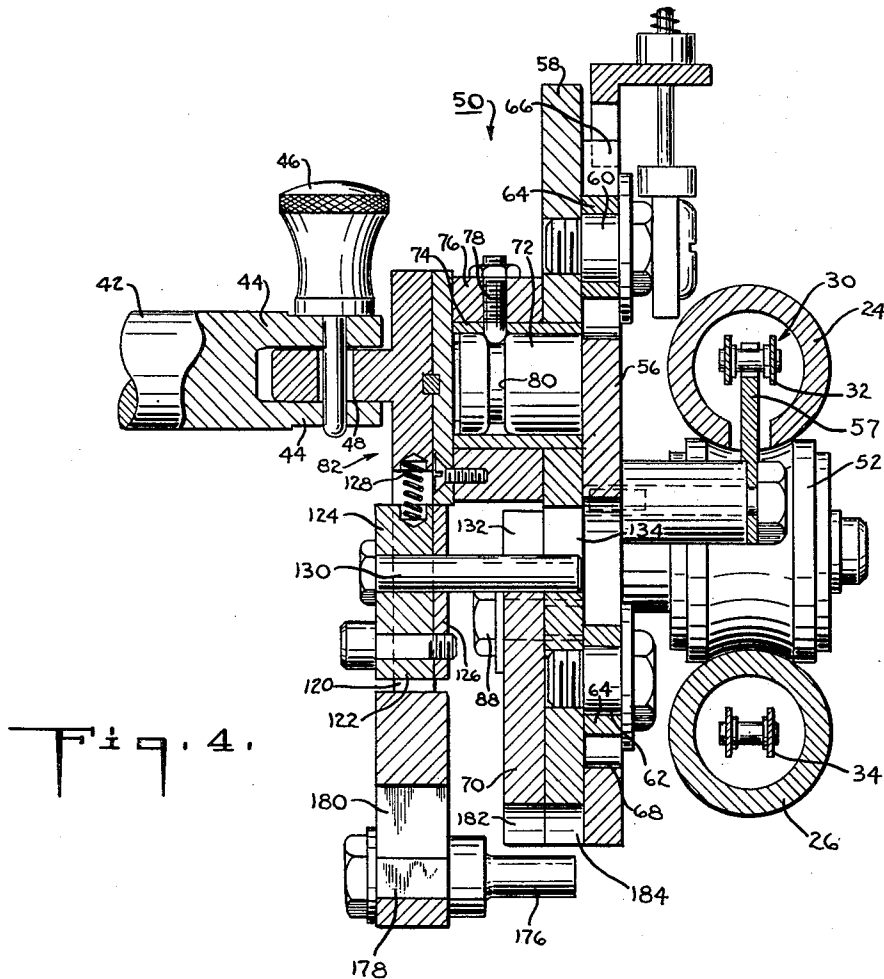
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STENCIL PRINTING APPARATUS

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5 Sheets-Sheet 4

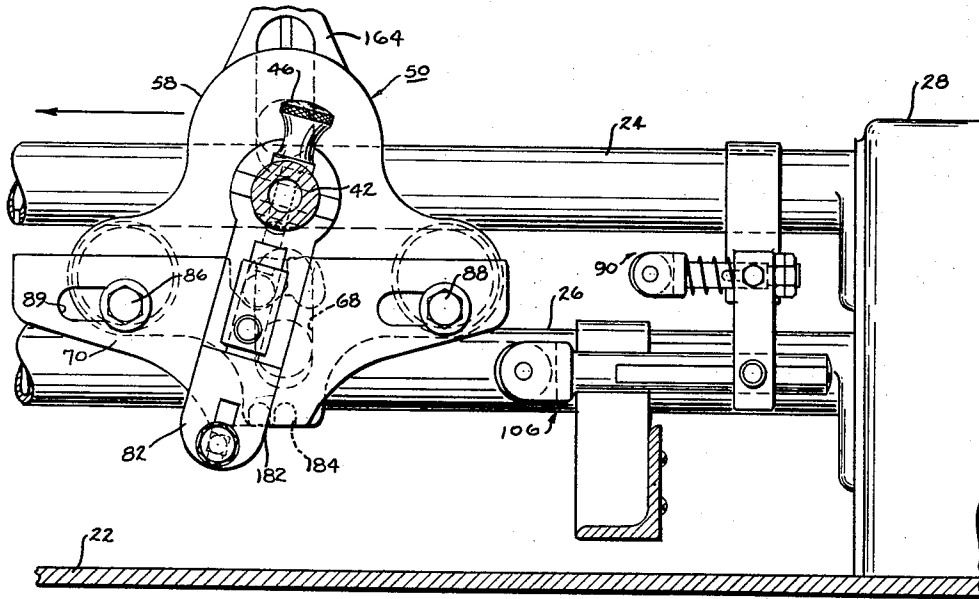


Fig. 6.

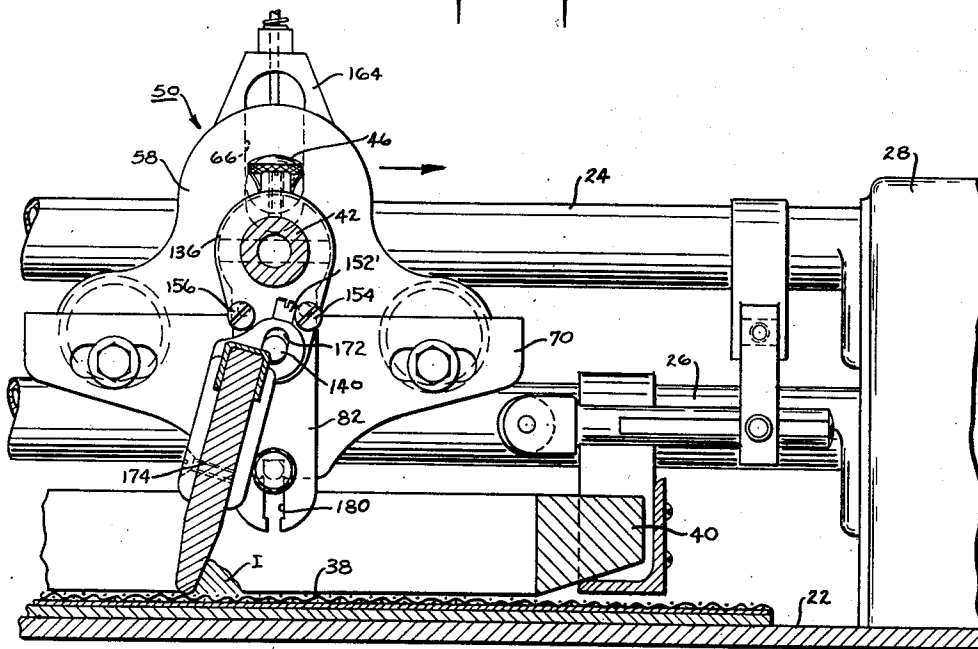


Fig. 10.

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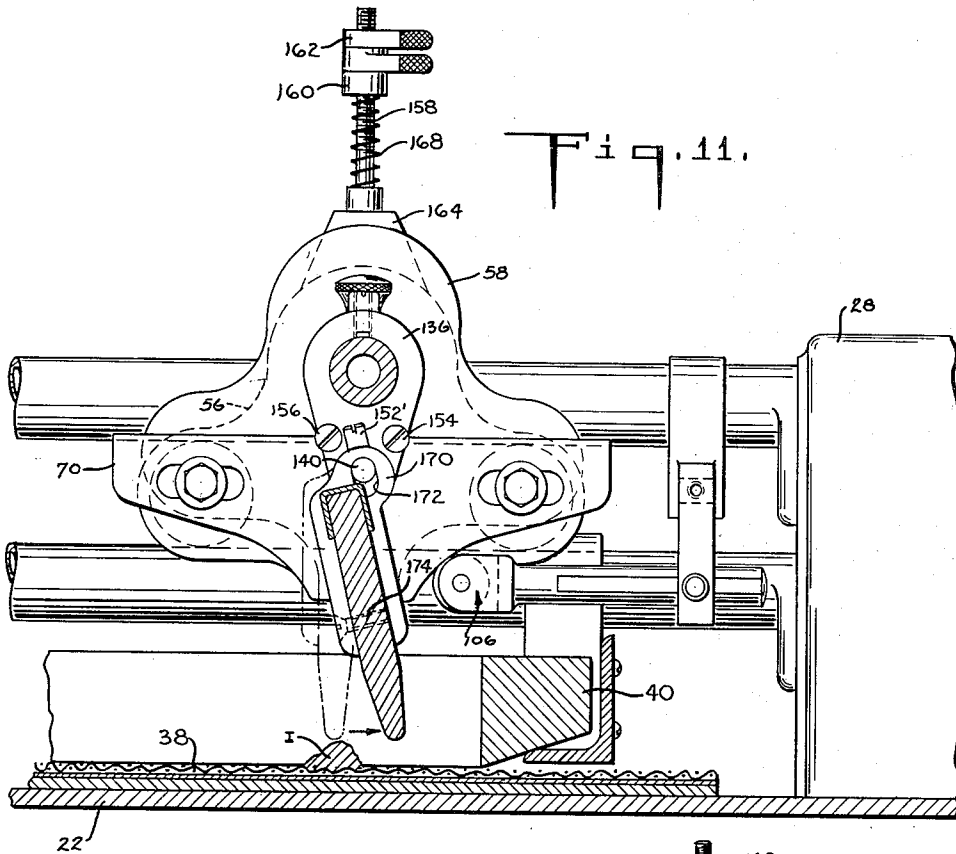


Fig. 11.

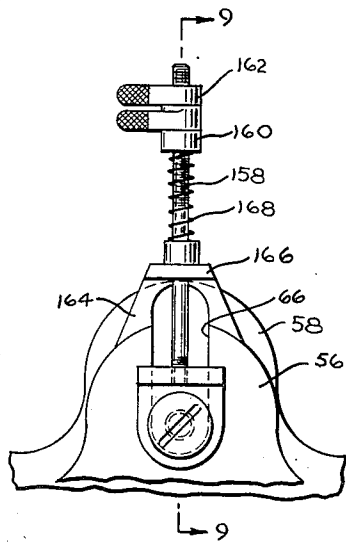


Fig. 8.

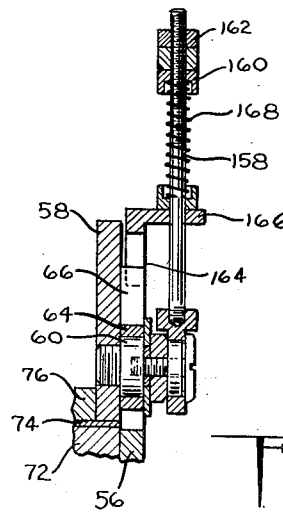


Fig. 9.

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2,783,709

STENCIL PRINTING APPARATUS

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Application April 19, 1951, Serial No. 221,793

6 Claims. (Cl. 101—123)

This invention relates to an apparatus for printing sheets such as textile fabric webs, plastic films and paper with the aid of a stencil. For simplicity, such apparatus will be referred to hereinafter simply as a "silk screen printing machine," it being understood that this term merely is a trade designation for a stencil printing machine and does not indicate that the stencil necessarily is of silk. More particularly, the invention pertains to a scraper for use in a machine of the character described.

It is an object of the invention to provide a two-blade scraper having a rapid-acting and efficient mechanism for raising one blade and lowering the other at opposite ends of the scraper stroke whereby to prevent the scraper from occasionally depositing drops of "tears" of ink from its rear face as it traverses the screen.

It is another object of the invention to provide a mechanism which can be set up rapidly and at will as either a two-blade scraper or a single-blade scraper.

It is another object of the invention to provide a scraper of the floating type, i. e., one mounted to permit the scraper weight to rest on the operative edge of the blade, wherein a counteracting force, preferably adjustable in nature, is adapted to relieve the stencil screen of part of the weight of the scraper.

In the latter connection, it is a more specific object of the invention to provide a floating scraper of the character described wherein a simple and easily adjustable arrangement is included to vary the counter-acting force.

It is another object of the invention to provide a scraper of the character described which comprises comparatively few and simple parts and is of a durable construction.

It is another object of the invention to provide a scraper of the character described whose action is rapid enough to permit the same to be used as part of a power-driven silk screen machine.

Other objects of the invention will in part be obvious and in part will be pointed out hereinafter.

The invention accordingly consists in the features of construction, combination of elements and arrangements of parts which will be exemplified in the machine hereinafter described and of which the scope of application will be indicated in the appended claims.

In the accompanying drawings, in which is shown one of the various possible embodiments of this invention,

Fig. 1 is a fragmentary plan view of a front corner of a silk screen printing machine constructed in accordance with the present invention, the scraper being shown approaching the front of the machine;

Figs. 2 and 3 are enlarged sectional views taken substantially along the lines 2—2 and 3—3, respectively, of Fig. 1;

Fig. 4 is a sectional view taken substantially along the line 4—4 of Fig. 3;

Fig. 5 is a view similar to Fig. 3, but at a later stage of operation, to wit the midpoint of reversal;

Fig. 6 is a view similar to Fig. 5, but at a still later stage, to wit shortly after reversal;

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Fig. 7 is a view similar to Fig. 2 but at a stage of operation corresponding to Fig. 6;

Fig. 8 is an enlarged sectional view taken substantially along the line 8—8 of Fig. 1;

Fig. 9 is the sectional view taken substantially along the line 9—9 of Fig. 8;

Fig. 10 is a view similar to Fig. 2, but showing a scraper with a single, rather than a double, blade; and

Fig. 11 is a view similar to Fig. 10 but with the scraper at the midpoint of reversal.

Referring now in detail to the drawings, the reference numeral 20 denotes a silk screen printing machine embodying the invention and including a conventional printing table 22. At the opposite sides of the table, front-to-back rails R are provided which are of suitable construction and are supported from the table in a suitable manner. Typical constructions and supports for the rails are shown in the co-pending application of John B. Thomas and Courtney E. Moornhouse, Serial No. 726,504, for Stencil Printing Apparatus, filed February 5, 1947, now Patent No. 2,631,988, and in co-pending application, Serial No. 221,794, filed simultaneously with the present application, for Stencil Printing Apparatus, now Patent No. 2,637,269 both said applications being assigned to the assignee of the present application.

The rails shown herein constitute a pair of hollow tubular tracks 24, 26 at each side of the machine, said tracks being parallel to one another and horizontal when the machine is printing. The two tracks of each pair are secured to one another at the front of the machine by a housing 28 in which there is located a sprocket (not shown) about which a chain 30 is trained. The upper flight 32 of the chain is disposed in the upper track 24, and the lower flight 34 in the lower track. A suitable mechanism, for instance sprockets (not shown), engages the chains at the rear ends of the tracks and is alternately power-driven in opposite directions, for example as shown in said applications.

The machine further includes a stencil screen 38 carried by a stencil frame 40, that is supported for movement toward the table for printing and away from the table after printing. In the normal use of the machine, a scraper S is moved to and fro across the screen pushing a pool of ink I in front of it. Said scraper is carried by a support whose ends are mounted for movement on the rails R, being power-driven by the chains 30.

The present invention is concerned with the construction of the scraper, the scraper support and the mount for the ends of the scraper support.

More specifically, the scraper support includes a draw bar 42 each of whose opposite ends is formed into a yoke 44. The yoke at each end of the bar is vertically pierced to receive a locking pin 46 (see Fig. 4). Said yoke is adapted to receive a flange 48 which is provided with an elongated opening to pass the locking pin 46. This arrangement enables the bar to be disengaged from the flanges simply by lifting the locking pins.

The flanges 48 on opposite sides of the machine are identical and are supported and moved in identical manner so that only one of such flanges and its mount has been shown and will be described in detail.

Said flange is carried by a truck 50 including a pair of wheels 52, 54 which ride on and between the tracks 24, 26 and are journaled for rotation about parallel horizontal axes on a vertical plate 56 so that the plate only is able to move axially on the rails R. This plate is secured to the upper flight of the chains by a bracket 57 (see Fig. 4) extending through a longitudinal slot in the bottom of the upper track 24.

A second vertical plate 58 is disposed in face-to-face contact with the inside surface of the outer plate 56. The

plate 58 carries two outwardly extending studs 60, 62 on which rollers 64 are journaled, these rollers being slidable in vertical slots 66, 68 in the plate 56 whereby the plate 58 is mounted for vertical movement with respect to plate 56. In order to hold the plate 58 captive, the heads of the studs 60, 62 are enlarged to exceed the width of the slots 66, 68. Vertical movement of the plate 58 is limited by abutment of the rollers against the ends of the slots 66, 68.

A third vertical plate 70 is disposed in face-to-face contact with the inside surface of the second plate 58. For convenience, the third plate 70 will be referred to as the inner plate, the second plate 58 as the intermediate plate, and the first plate 56 as the outer plate.

The intermediate plate may have a peripheral contour substantially the same as that of the outer plate (see Figs. 3 and 5); however, the inner plate is considerably shorter than the intermediate plate and its top edge lower in order to permit the flange 48 to be supported from said intermediate plate.

A horizontal stub shaft 72 is set in a bushing 74 that is force-fitted in the intermediate plate, said shaft extending inwardly in a direction perpendicular to the plates. Rotatable on the bushing is a collar 76 that is held captive by a screw 78 threaded in the collar with its tip riding in an annular groove 80 in the shaft 72. Secured to the collar 76 is an arm 82 at whose upper end the flange 48 is mounted. Said flange extends across the axis of rotation of the collar 76.

Each side edge 84 of the inner plate includes a cam section *a—b* which slopes upwardly and outwardly at a slight angle to the horizontal, e. g. about 15°, and a vertical section, *c—d*. The different sections are designed to be engaged by different followers as will be described hereinafter.

The intermediate plate mounts a second pair of studs 86, 88 which extend laterally inwardly in a horizontal direction perpendicular to said plate and rotatably support rollers that are slidable in horizontally extending slots 89 in the inner plate so that said inner plate is constrained for horizontal movement with respect to the intermediate plate. To captively secure the inner plate to the intermediate plate, the heads of the studs 86, 88 are enlarged to a size greater than the slots 89.

It thus will be appreciated that only relative horizontal movement can take place between the inner and intermediate plates, and only relative vertical movement can take place between the intermediate and outer plates.

The followers heretofore mentioned for engaging the cam sections of the inner plate are located at both ends of the both sets of rails R. Inasmuch as all sets of followers are the same, only one such set is illustrated and described.

One follower 90 is provided consisting of a roller 92 rotatable on a horizontal spindle 94 carried by a clevis 96 on the end of a horizontal rod 98 whose longitudinal axis is parallel to the direction of movement of the truck 50. The roller is in horizontal alignment with the cam section *c—d*. The rod is slidable in a bore in a bracket 100 adjustably clamped on the tracks 24, 26 and the far end of the rod is threaded to receive a stop nut 102 and a lock nut 104. A helical compression spring 105 encircles the rod and is held under compression between the base of the clevis 96 and the bracket 100. A transverse pin 101 sliding in a slot 103 in the rod prevents the rod from turning.

The follower 90 thus is positioned to engage the cam section *c—d* when the scraper approaches the end of the machine at which the follower is located. The follower upon initial contact with the inner plate will yield against the action of the spring 105. But after a relatively short movement of the follower, the spring is sufficiently compressed to cause the inner plate to shift horizontally with respect to the intermediate plate in a direction away from the follower.

The second follower 106 includes a roller 108 rotatable on a horizontal spindle 110 carried by a clevis 112 on the end of a rod 114 parallel to the rod 98. The roller is in horizontal alignment with the cam section *a—b*. Said rod is slidable in a bore in the bracket 100. A set screw 116 threaded in the bracket has its tip disposed to engage an elongated flat 118 running axially of the rod 114 so that the follower 106 can be adjusted with respect to the follower 90. These two followers should be so relatively set that the follower 106 initiates its action slightly in advance of that of the follower 90.

As a truck 50 approaches one end or the other of the rails R in a direction, for example, indicated by the arrow A, the follower 106 first will engage the cam section *a—b* on the inner plate. Inasmuch as this section slopes downwardly away from the follower, when the inner plate encounters the follower, said plate will be lifted vertically. Since the inner and intermediate plates can experience no relative vertical movement, the intermediate plate also will be lifted, the latter being shiftable vertically with respect to the outer plate. Lifting the intermediate plate raises the flange 48, and, hence, the drawbar and scraper. The relative positions of the various plates and followers at the moment the follower 106 first contacts the inner plate is shown in Fig. 3.

Further movement of the truck in the direction A will cause the follower 90 to engage the section *c—d*. At first the spring 105 will be compressed; but after a certain degree of compression is reached the roller 92 will not give any further, and, upon subsequent movement of the truck toward said follower, the inner plate will be shifted horizontally with respect to the intermediate plate in a direction away from this follower.

Therefore, as a truck reaches an end of a stroke, the intermediate plate first will rise and then the inner plate will shift horizontally. This sequence of motions is employed, as soon will be apparent, to secure a proper reversal in the position of a two-blade scraper at the ends of its stroke.

The arm 82 which oscillates about the shaft 72 has a radial through slot 120 within which a block 122 is slidable. The block is captively retained in the arm by forming one side of the block with an enlarged head 124 and by mounting a plate 126 on the opposite side of the block, both the enlarged head and plate sliding on the inner and outer surfaces of the arm. Said block is urged in a direction away from the axis of oscillation of the arm by a helical compression spring 128.

The block fixedly carries a long outwardly extending spindle 130 which passes through a central notch 132 (Fig. 5) in the top edge of the inner plate 70 and through a central notch 134 in the intermediate plate 58. These two notches are of such configuration that they will co-operate with the spindle 130 upon relative horizontal movement of the inner and intermediate plates at the ends of the scraper stroke to oscillate the arm 82 from one extreme angular position shown in Fig. 3 to another extreme angular position shown in Fig. 6.

More specifically, the notch 132 has a bottom edge of V-shaped profile with its lower tip rounded to substantially the curvature of the spindle 130. The bottom edge of the notch 134 is of W-shaped configuration with its central hump flat and its two lower tips rounded to the curvature of the spindle.

When the truck is moving in any given direction, for example in the direction A toward the front of the machine as shown in Fig. 3, the arm 82 is inclined in this direction and the spindle 130 is situated in the lower tip of the W-shaped notch 134 which is closest to the end of the machine being approached by the truck. At the same time the spindle is seated in the lower tip of the V-shaped notch 132 and the inner plate leads the intermediate plate in the direction the truck is moving. Engagement of the cam section *a—b* with the follower 106 will

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raise the inner and intermediate plates but will not affect their relative horizontal position.

When the cam section *c-d* engages the follower 90 and the spring 105 has compressed, the inner plate will shift relative to the intermediate plate in a direction B (Fig. 5) away from the direction of movement A of the truck, causing the inclined edge of the V-shaped notch 132 nearer the engaged follower to urge the spindle 130 upwardly and toward the other lower tip of the W-shaped notch 134. This shifts the spindle upwardly toward the central hump of the W-shaped notch. As such movement occurs the block 122 will ride upwardly against the force of the spring 128, permitting the spindle to clear the hump and be biased by said spring into the other lower tip of the W-shaped notch. Due to this motion of the spindle, the arm 82 will shift to its opposite extreme angular position shown in Fig. 6. Upon movement of the scraper to the opposite end of the machine, the inner plate 70 will be shifted by a follower back to the position with respect to the intermediate plate shown in Fig. 3, so that the arm 82 will be oscillated to its first angular position.

Thus, upon reaching either end of the machine, the bar 42 first will be raised and immediately thereafter rotated through a small angle, in the illustrated machine about 30°.

The bar 42 has secured thereto a pair of spaced hangers 136, only one of which is shown on the drawings. A hanger is located near each end of the bar, being adjustably secured thereto, as by a set screw 138 which engages a key set in the drawbar, so that its position can be varied to centralize the scraper S on the screen.

Each hanger 136 has rotatably mounted thereon, as by a pin 140, a blade clamp 142. The pins 140 of the two hangers are horizontally registered so that the blade clamps may oscillate in unison. Each clamp is provided with two slots 144, 146 which are arranged to converge upwardly, the longitudinal center lines of the slots if extended intersecting at the longitudinal axis of the pins 140. Two scraper blades 148, 150 are included, these being of conventional shape and material. Each blade extends between the two clamps and has its ends secured in either the registered slots 144 or the registered slots 146. The rounded tips of both blades are equidistant from the longitudinal axis of the pins 140.

Each blade clamp has mounted on its upper edge an abutment lug 152 which oscillates with the clamp about the pin 140. Extending inwardly from the hanger are two stop screws 154, 156 which lie in the path of travel of the abutment lug 152. Said screws have their shanks disposed eccentrically of their heads and are secured in any desired angular position by jam nuts (not shown) on the opposite side of the hanger. As illustrated in Figs. 2 and 7, the screws 154, 156 are disposed to lock the blade clamp against oscillation with the clamp so located that when the arm 82 is in one extreme angular position, the blade 150 is substantially perpendicular to the screen 38 (Fig. 2) and when the arm 82 is in its other extreme angular position the blade 148 is substantially perpendicular to the screen (Fig. 7).

It has been observed that by varying the angle between the scraper blade and screen, different printing effects can be secured, and it is for this reason that the heads of the screws 154, 156 are disposed eccentrically relative to their shanks, for, by turning the screws so as to increase the spacing between their heads and thereby to allow oscillation of the blade clamps, the angle between each scraper blade and the stencil screen can be reduced below 90°. Such alternative positions of the scraper blades and of the stop screws and blade clamp have been illustrated in dot-and-dash lines in Figs. 2 and 7.

It should be noted that the foregoing scraper mount lends itself to such adjustment due to the fact that the scraper is "free floating"; that is to say, the scraper has an unrestrained vertical movement within the range of

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shifting of the rollers 64 in the slots 66, 68. This range is sufficient to permit the weight of the scraper and its mount to rest on the stencil screen. Thus, when the angle of the scraper blade engaging the screen is slightly varied, and therefore the distance from the bar 42 to said screen is changed, this variance will be taken up by vertical descent of the intermediate plate 58 with respect to the outer plate 56.

For certain types of stencils and certain types of inks, the weight of the scraper and its mount may be too great, causing for example, too much ink to be expressed through the stencil. In order that this may be regulated, means is provided to resiliently carry a selectively variable part of the weight of the scraper and its mount. Said means includes a vertical post 158 whose base is secured to the stud 68. The post is threaded at its upper end to receive an adjusting nut 160 and a lock nut 162, each of which is provided with a handle to facilitate its manipulation. Seated on the upper edge of the outer plate 56 is a bracket 164 having an outwardly extending horizontal flange 166 which is apertured to pass the post 158. A compression spring 168 encircles the post and is located between the adjusting nut 160 and the flange 166, said flange and nut being provided with wells to maintain the spring 168 in position. To relieve the stencil from the full weight of the scraper and its mount, the adjusting nut 160 is screwed downwardly. This has the effect of tending to raise the intermediate plate and therefore the scraper and its mount, the support for the raising action being the spring 168 so that said support is resilient.

The scraper can be arranged to operate with a single blade simply by substituting a different form of clamp 170 (see Figs. 10 and 11) for the clamps 142. The clamp 170 includes a through slot 172 in which the pin 140 is received. Said clamp also has an abutment lug 152' designed to oscillate between the two adjustable stop screws 154, 156. The clamps support a single scraper blade 174 which is allowed to oscillate as much as is desired by movement of the lug 152' between the two stop screws, it being understood that the blade does not oscillate during a stroke but only upon reversal; that is to say, the blade will lean forward in the direction in which it is traveling the extent of its inclination being determined by the positions of the stop screws. Such inclination and reversal at the two ends of the stroke is facilitated by the slots 172 and by offsetting the center of gravity of the blades relative to the pins 140, although it is within the scope of my invention to eliminate such offset.

When using the scraper with a single-blade, it is unnecessary and undesirable for the arm 82 to rock at opposite ends of the scraper stroke, and to prevent this from occurring said arm is provided with a lock pin 176, having a non-circular portion 178 of its shank disposed in a radial slot 180 in the arm 82. Said pin extends outwardly as far as the intermediate plate 58, and the bottom edges of the inner plate and intermediate plate are formed with notches 182, 184, respectively, which are adapted to receive the tip of said locking pin.

When the two-blade clamp 142 is employed, the locking pin is disposed at the lower end of the slot 180 where its tip will clear the inner and intermediate plates. When the single-blade clamp 170 is used, the arm 82 is forced to a vertical position (with the spindle 130 on top of the hump of the W-shaped notch 134) and the pin 178 raised and tightened in such position. Movement of the arm 82 to vertical position shifts the inner plate in respect to the intermediate plate and thereby aligns the two notches 182, 184 so that they are able to receive the lock pin when the same is raised. In addition, when the single-blade clamp 170 is used, the follower 90 is removed from the machine as indicated in Figs. 10 and 11. Thus, when the scraper approaches an end of the machine, the cam section *a-b* will be engaged by the follower 106 to raise the scraper and permit the blade 174 to clear the pool of ink I so that when the scraper moves in the opposite

direction it will drop down with its free edge behind said pool. It will be observed that the inertia of the pendant scraper blade will suffice to change its inclination and therefore descend on the proper side of the pool of ink, this being assisted by the offset position of the center of gravity of the scraper.

It thus will be seen that there is provided a device in which the several objects of this invention are achieved, and which is well adapted to meet the conditions of practical use.

As various possible embodiments might be made of the above invention, and as various changes might be made in the embodiment above set forth, it is to be understood that all matter herein described or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having thus described the invention, there is claimed as new and desired to be secured by Letters Patent:

1. In a silk screen printing machine having a scraper-carrying bar, means to support the ends of the bar, said means comprising a pair of members at each end of the bar, means to mount one member of each pair for free vertical movement, means to oscillatably support an end of said bar from said one member, means to mount the other member of each pair on the first member for relative horizontal movement, means near an end of the machine for engaging one of the members of each pair to lift the same vertically whereby the bar will be raised as it approaches said end of the machine, means at an end of the machine to engage the second-named member and shift the same horizontally with respect to the first member as said members reach said end of the machine, and means operable upon such horizontal shifting of the second-named member to move the bar from one extreme angular position to another.

2. A combination as set forth in claim 1, wherein the last-named means includes an arm oscillatable with the bar, a horizontal spindle carried by said arm, each member having a notch, the notch in the first-named member having two indentations in its bottom edge, said spindle being located in one indentation of the notch in the first-named member and in the other notch so that when the second-named member shifts horizontally with respect to the first-named member, the spindle will be moved from one indentation to the other of the notch in the first-named member, thereby oscillating the bar.

3. A combination as set forth in claim 2, wherein the spindle is mounted on a block slidable in the arm and wherein a spring biases the block into engagement with the indentations.

4. In a silk screen printing machine having a scraper-carrying bar, means to support the ends of the bar, said means comprising a truck at each end of the bar, each truck including an outer plate, an intermediate plate and an inner plate, means to fix said outer plate to said truck, means to mount said intermediate plate on said outer plate for relative vertical movement, means to mount said inner plate on said intermediate plate for relative

horizontal movement, means to oscillatably support said bar from said intermediate plate, oscillatable with said bar an arm, a block, means to slidably mount said block in said arm for movement toward and away from the axis of oscillation of the bar, means to resiliently urge said block away from said axis, an outwardly extending spindle carried by said block, a W-shaped notch in said intermediate plate, a V-shaped notch in said outer plate, said spindle being located in said notches and resting on the base of the W-shaped notch whereby when the inner plate is shifted horizontally with respect to the intermediate plate it will cause the spindle to be moved from one side of the W-shaped notch to the other and thereby oscillate the bar, a vertical cam section on said inner plate, a cam follower at an end of the machine for engaging the cam section and shifting the inner plate horizontally with respect to the outer plate when the truck reaches said end of the machine, an inclined cam section on the inner plate, a cam follower engaging said second cam section as the truck approaches said end of the machine to raise the bar, a pair of hangers, means to secure said hangers to said bar, a pair of blade clamps, means to mount a blade clamp on each hanger for relative pivotal movement about a common horizontal axis, means adjustably to limit the pivotal movement of the blade clamps, a horizontal spindle, means to slidably mount said spindle in said arm for movement toward and away from the axis of oscillation of the bar, a pair of notches in the inner and outer plates, said notches being in registry when the spindle is disposed centrally in the W-shaped notch, and means to lock the pin in any selected position in the arm whereby the pin can be located to permit the arm to swing freely or can be disposed in the last-named pair of notches to prevent relative horizontal movement of the inner and intermediate plates.

5. A combination as set forth in claim 4, wherein a vertically extending compression spring has its lower end seated on the outer plate, wherein a member is seated on the upper end of the compression spring, and wherein said member is secured to the intermediate plate for vertical selectively adjustable movement.

6. In a silk screen printing machine having a scraper carrying bar, a truck, means to mount an end of said bar on said truck for free vertical movement, means to carry a selectively variable portion of the weight of the bar and scraper, said means comprising a vertically extending compression spring, means to seat the lower end of said spring on said truck, a member seated on the upper end of said spring, and means to secure said member to an end of said bar for vertical selectively adjustable movement.

References Cited in the file of this patent

UNITED STATES PATENTS

1,832,828	Borregard	Nov. 17, 1931
2,039,909	Kem et al.	May 5, 1936
2,207,818	Perry et al.	July 16, 1940