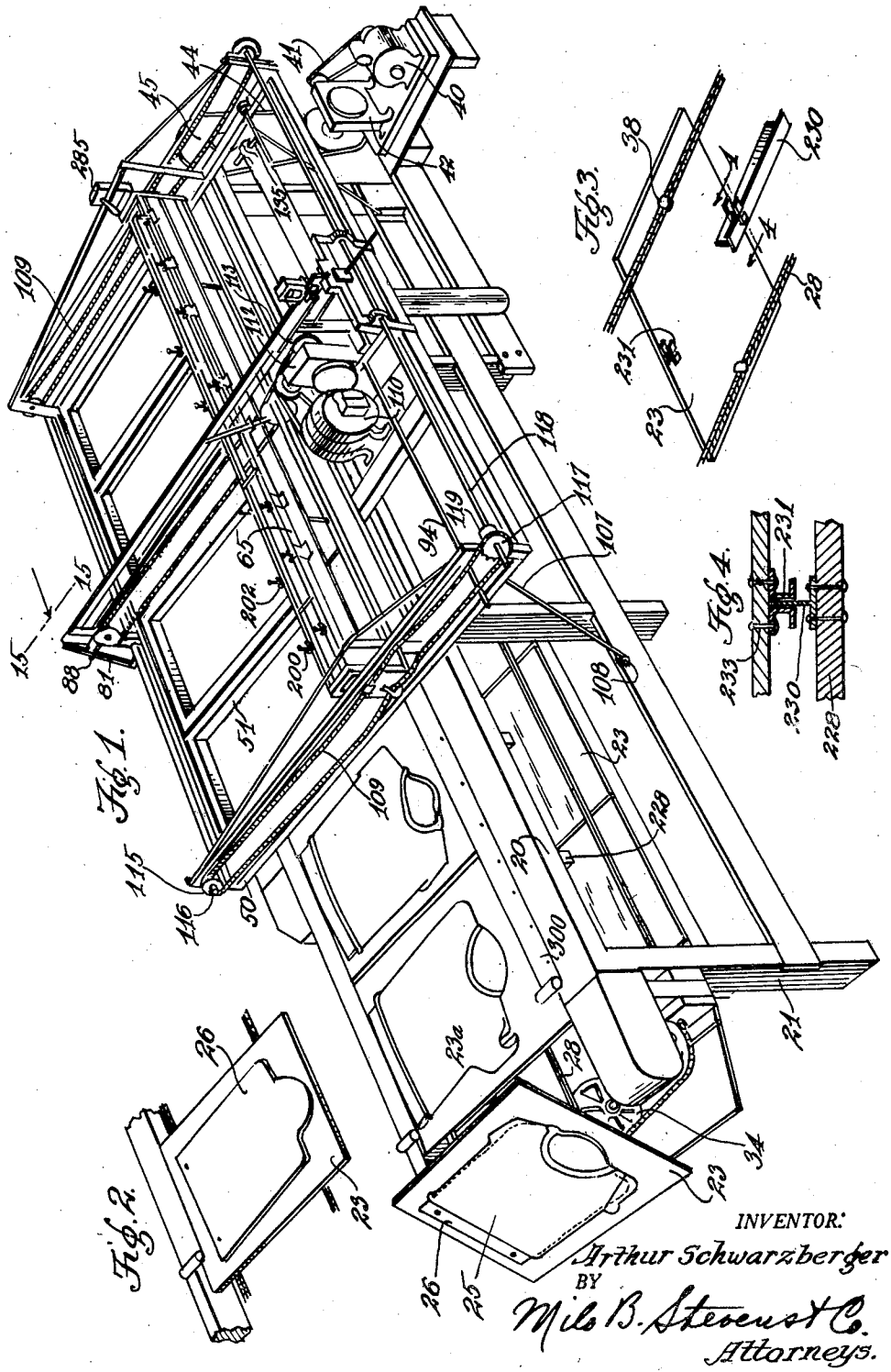
Aug. 12, 1958 A. SCHWARZBERGER 2,846,946

SILK SCREEN PRINTING MACHINES

Filed Jan. 30, 1956 5 Sheets-Sheet 1



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SILK SCREEN PRINTING MACHINES

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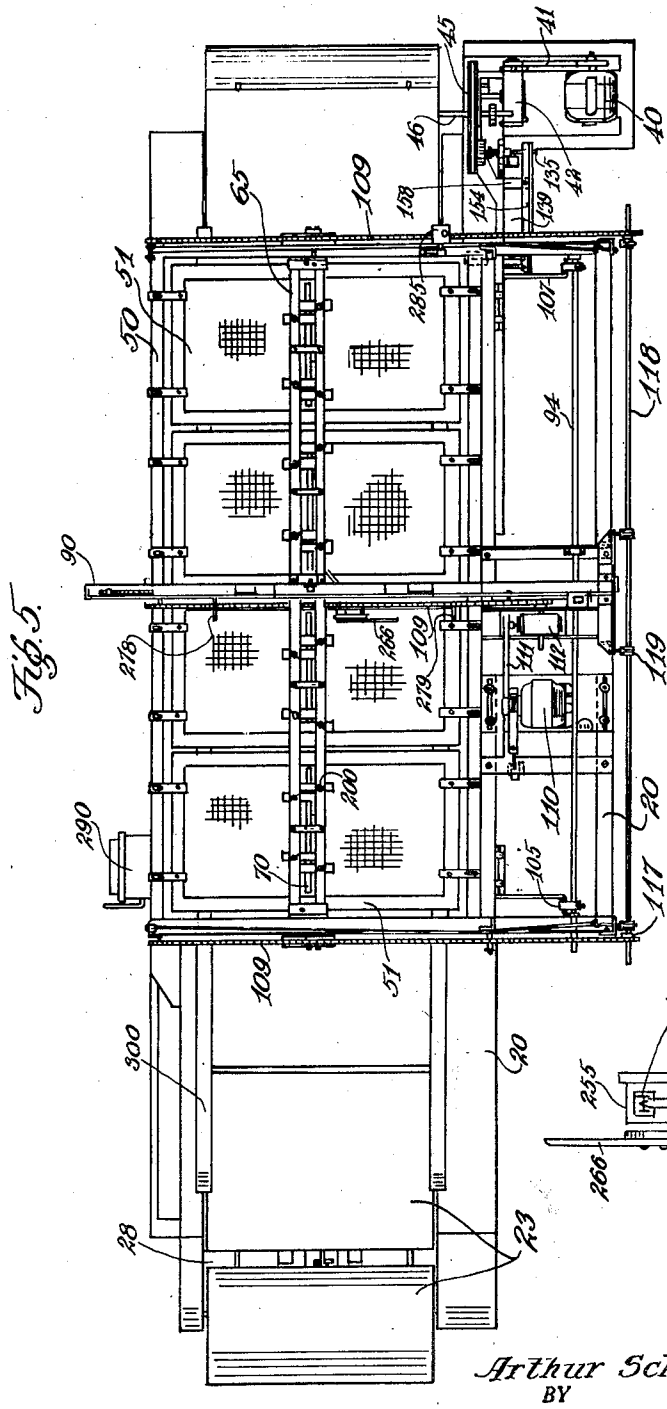


Fig. 5.

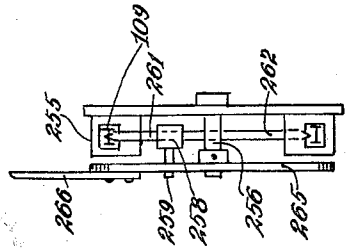


Fig. 17.

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SILK SCREEN PRINTING MACHINES

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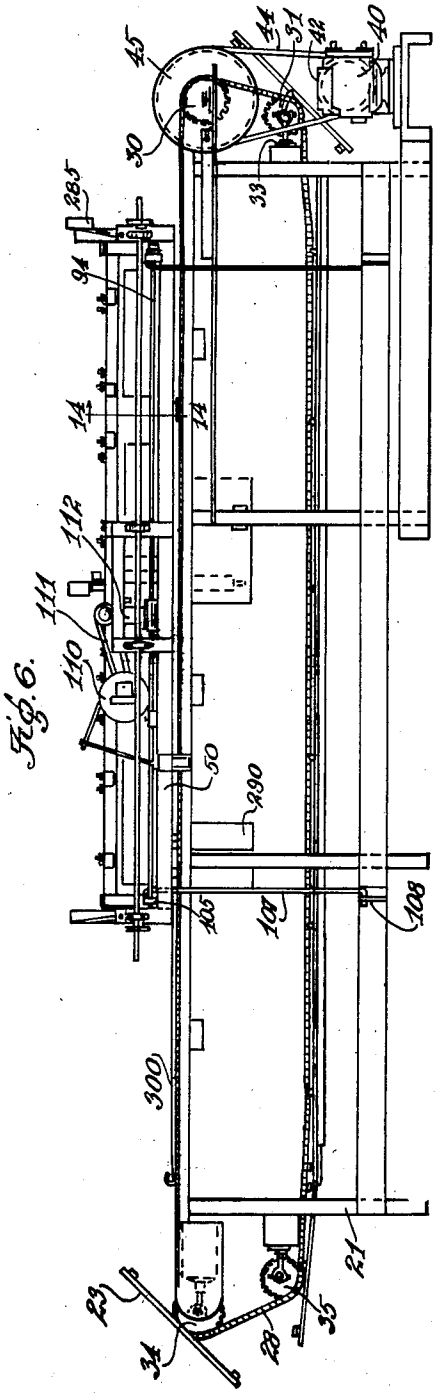


Fig. 6.

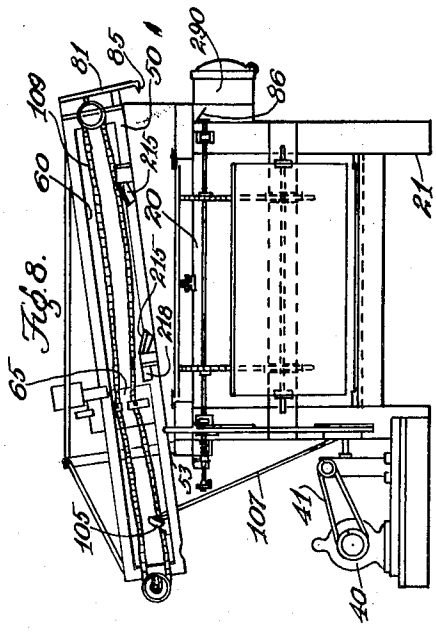


Fig. 8.

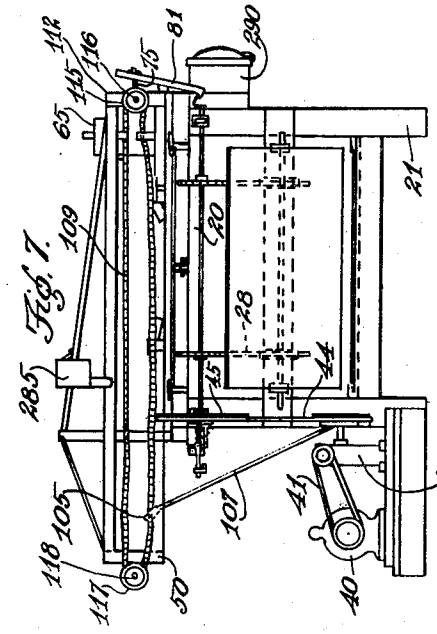


Fig. 7.

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SILK SCREEN PRINTING MACHINES

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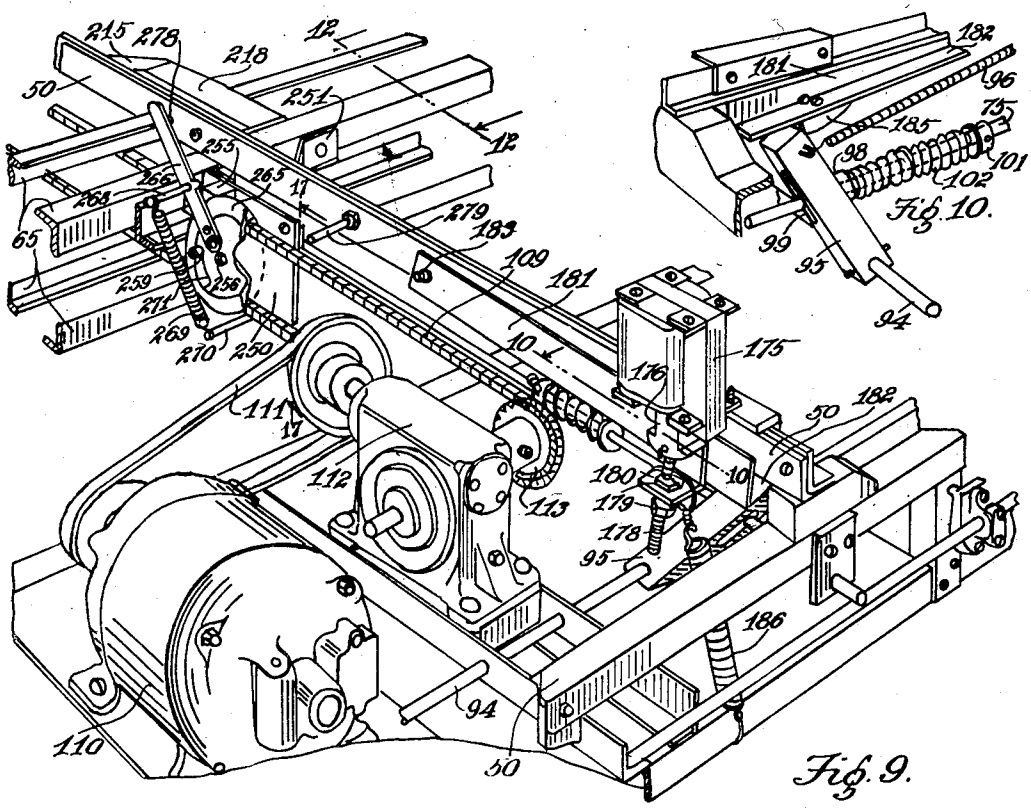


Fig. 9.

Fig. 10.

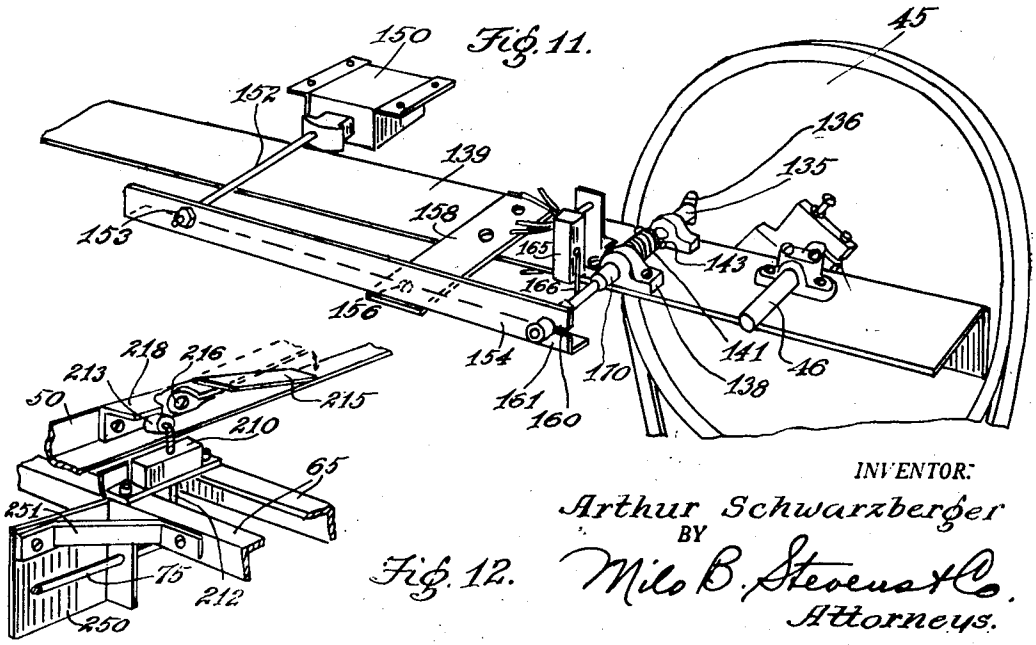


Fig. 11.

Fig. 12.

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Fig. 13.

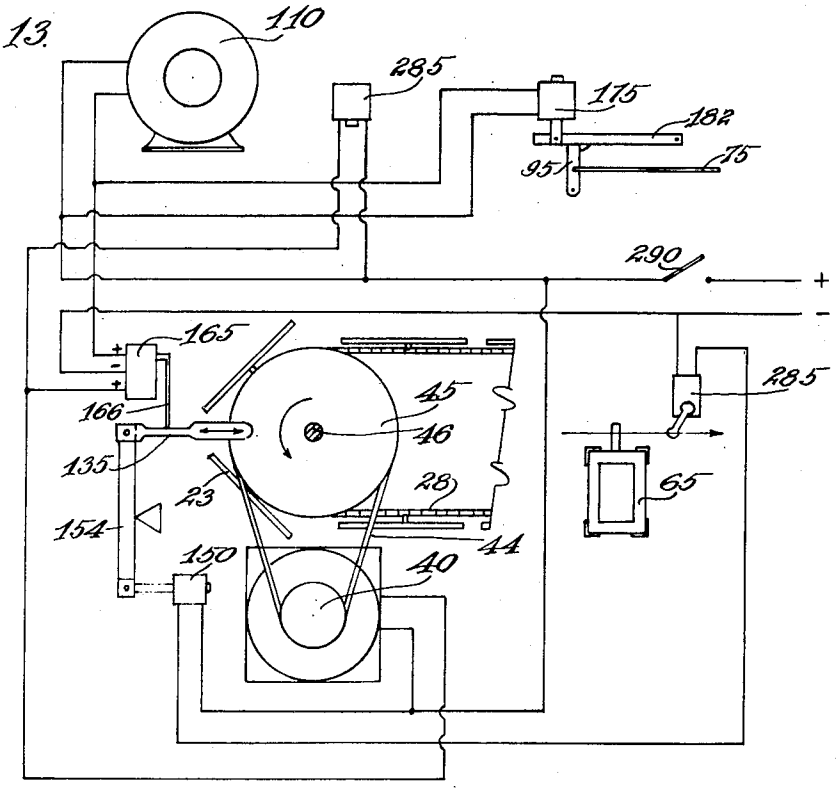


Fig. 14.

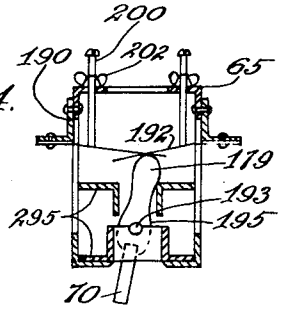


Fig. 15.

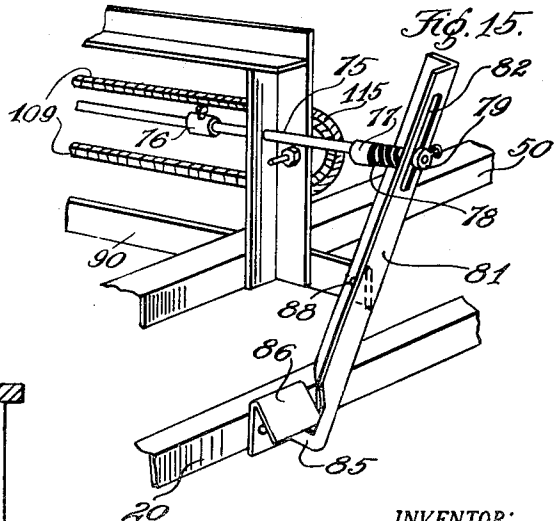
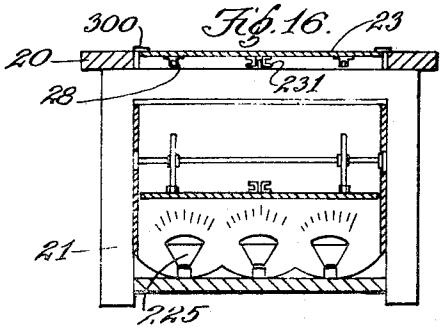


Fig. 16.



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2,846,946

SILK SCREEN PRINTING MACHINES

Arthur Schwarzberger, Chicago, Ill., assignor to American Automation, Inc., Chicago, Ill.

Application January 30, 1956, Serial No. 562,167

5 Claims. (Cl. 101—115)

My invention relates to the multi-color type of silk screen printing machine, and has for its main object to provide a machine of this kind in which the colors are printed on work units in continuous succession.

A further object is to provide a machine on which the work unit may be fed singly or in multiple groups.

Another object is to provide means whereby to interpose a time factor between the application of different colors, so that one color may receive a drying action before the next color is printed.

An additional object is to establish a given relation between the number of work units and color screens, whereby to obtain the successive application of colors to the work units with the benefit of running time for drying purposes.

With the above objects in view, a better understanding of the invention may be had by reference to the accompanying drawings, in which—

Fig. 1 is a perspective view of the machine from the rear;

Fig. 2 is a perspective view of one of the work units;

Fig. 3 is a perspective view of one of the work units from underneath, showing a motive support for the same;

Fig. 4 is a section on the line 4—4 of Fig. 3;

Fig. 5 is a top plan view of the machine according to Fig. 1;

Fig. 6 is a side elevation;

Fig. 7 is a left-hand side view of the machine in the position for printing;

Fig. 8 is a similar view with the printing facility raised to permit the feed of work units;

Fig. 9 is an enlarged duplication of the right-hand center portion of Fig. 1;

Fig. 10 is a perspective view of a control seen from the line 10—10 of Fig. 9;

Fig. 11 is an enlarged perspective view of a conveyor chain drive shown at the right-hand end of Fig. 6;

Fig. 12 is a perspective view of a detail seen from the line 12—12 of Fig. 9;

Fig. 13 is a diagrammatic view of an electrical circuit entering into the operation and control of the machine;

Fig. 14 is a cross-section of a squeegee carrier;

Fig. 15 is a perspective view taken from the line 15—15 of Fig. 1, showing a locking device for a screen frame;

Fig. 16 is a cross-section of the lower portion of the machine, showing a drying facility therein; and

Fig. 17 is an edge view of a reversing device seen in the upper left-hand portion of Fig. 9 from the section line 17—17.

Referring specifically to the drawings, the frame 20 of the machine is in the nature of a long table, and formed with supporting legs 21. The frame is designed to receive a series of work units in the form of platforms 23 on which the work to be printed is secured temporarily. The work —such as shirts 25—is mounted on plates 26 adhesively or otherwise secured to the platforms 23 at one end, the goods being slid onto the same.

The platforms are carried over the frame 20 in the direction of arrow 23a and returned underneath the frame in endless conveyor fashion. The conveyor comprises two chains 28 in parallel relation and rotatably supported in the ends of the frame 20. Fig. 6 shows that one of the end portions of each chain is trained over drive sprockets 30 at table height and idler sprockets 31 underneath, the latter having endwise adjustment means 33 to take up slack; and the chains are trained over similar adjustable upper and lower idler sprockets 34 and 35 at the opposite end. As indicated in Fig. 3, the platforms carry links 38 underneath interposed in those of the chains 28 for support by the latter in the horizontal and tilting positions shown in the left-hand portion of Fig. 1. The chains are driven by an electric motor 40 through a belt 41 and reducing gear 42. From this unit a belt drive 44 is taken to a disc 45 carried by a shaft 46. This disc forms a part of a control to stop the motor 40 by switch means and the disc by positive locking means, so that the platforms 23 may stop at exact locations to receive silk screen printing in accurate registration.

The silk screen printing facility mainly involves a large rectangular frame 50 which carries a set of silk screens 51 in longitudinal succession. The frame 50 is hinged to the machine frame 20 at 53—near the rear—so that it may occupy the horizontal position shown in Fig. 7 for the printing function, or be tilted upwardly as seen in Fig. 8 to create a clearance for the advance of the platforms 23 to a succeeding position.

The silk screen frame 50 has open ends, as seen at 60 in Fig. 8, to afford a rolling support for a carriage 65 which is designed to travel between front and rear positions over the screens 51. The carriage 65 has a squeegee 70 (see Fig. 14) for each screen and is carried back and forth to accomplish the printing operation. For multi-color work each screen holds a different colored dye; and the latter is pushed by the squeegee across the screen to a given limit where the squeegee receives an onward hurdle to land ahead of the dye mass and return, pushing the dye back to an opposite limit, as is the practice in hand-type silk screen printing.

The silk screen frame 50 is held down when in the lowered position by a device in front of the machine and illustrated in Fig. 15. Thus, the frame 50 carries a horizontal rod 75 in slidable relation, such rod receiving an inner collar 76, an outer collar 77, a spring 78 beyond the latter, and a head 79 at its outer end. An angle bar 81 is situated crosswise of the rod 75 in front of the machine, and is formed with a slot 82 near its upper end for the passage of the rod 75 between the spring 78 and the head 79. The bar 81 has a hook 85 at the bottom which engages a latch 86 carried by the machine frame 20. The bar 81 is pivoted at an intermediate point as indicated at 88 to a cross-bar 90 of the screen frame 50, so that the hook 85 is in the engaging position shown when the rod 75 is in forwardly slid position, the latter being accomplished when the carriage 65 has attained the front end of its travel. However, when the carriage 65 assumes the rear stroke, it is intended that the engagement of the hook 85 be severed and the frame 50 to become raised to the position of Fig. 8 as the carriage reaches its rearmost position.

The bottom part of Fig. 10 shows a rod 94, the latter also appearing in the central lower part of Fig. 1. This rod is journaled endwise in the screen frame 50; and it carries a radial block 95. The latter is normally drawn forwardly by a spring 96 to a vertical position whereby to abut a washer 98 on the shaft 75. The block 95 is slotted, as indicated at 99, to permit the passage of the shaft 75. As the carriage 65 travels rearwardly it eventually strikes a collar 101 fast on the shaft 75 and slides the latter through the block 95, while impinging on the

block through a spring **102** and the washer **98** loose on the shaft. This action swings the block rearwardly to the position shown in Figs. 9 and 10. This sliding travel of the shaft **75** first draws on the angle bar **81** so that it rocks and retracts the hook **85** from the latch **86** and releases the front end of the screen frame from the machine frame.

The ends of the rod **94** carry a pair of cranks **105**, and these are swung from the inclined position shown in the left-hand upper portion of Fig. 7 to the poised position of Fig. 8. The cranks extend with rods **107** to points in the rear lower part of the frame **50**, where the rods make pivotal connections **108** with the frame. Thus, when the cranks **105** swing up as stated, their drawing effect on the rods **107** will procure a downward pull on the rear portion of the screen frame, so that it tilts to the position of Fig. 8.

The squeegee carriage **65** is propelled uniformly by a set of three parallel chains **109** mounted at the ends and center of the silk screen frame **50** as seen in Fig. 1. A drive to operate these chains to effect the reciprocating travel of the carriage **65** originates with an electric motor **110** mounted toward the rear of the machine frame **20** as seen in Fig. 1. Fig. 9 shows that the motor **110** has a belt drive **111** to a speed reducing unit **112** terminating with a sprocket **113**. The latter drives the rear end of the middle chain **109**, the forepart of the same passing through a reversing unit shown more clearly in Fig. 17. This unit is attached to the carriage **65** and has the function of automatically reversing the motion of the carriage at each end of squeegee travel while the screen frame is down and the platforms **23** are stationary. The outer chains **109** ride on frontal sprockets **115** carried by stub shafts **116** projecting from the screen frame, and on rear sprockets **117** mounted on a long shaft **118** journaled in bearings **119** projecting rearwardly from the frame.

The stop motion for the conveyor chains **28** will now be described. This motion primarily involves the platforms **23** in single order, which is feasible where the printing is done on cloth and the dye sets before a given platform moves from one color screen to the next one. However, the timing of the stop motion may be adjusted to cover the unitary travel of several platforms, as will be explained in a later section. The shaft **46** of the disc **45** carries sprockets **30** for driving the chains **28**.

The stop motion to advance the platforms **23** in single succession is accomplished by the rotation of the disc **45** through one revolution. The stopping of the disc is controlled positively by a latch rod **135** which is adapted to enter a slot **136** made in the disc, as shown in Fig. 11, when the disc is to be stopped. The rod **135** is slidable in bearings **138** mounted on an angle bar **139** carried by the machine frame; and a compression spring **141** between the bearings **138** urges a pin **143** to normally keep the rod **135** advanced. However, when the disc **45** is to be allowed to rotate for the feed of the conveyor chains, the rod **135** is withdrawn from the slot **136** of the disc by the action of a solenoid **150** in the electric motor circuit illustrated in Fig. 13. Thus, the armature of the solenoid draws on a rod **152** connected at **153** to an angle lever **154**, the base wing of the latter being pivoted at **156** to a bracket **158** carried by the angle bar **139**. The lever **154** is slotted at **160** to secure the divided outer portion **161** of the rod **135**, so that the action of the solenoid swings the lever **154** with the effect of withdrawing the rod **135** as stated. A microswitch **165** is attached upon the angle bar **139**, the control arm **166** of this switch being shown in Fig. 11 in the "off" position. The microswitch controls the electric motor **40**, and it therefore may be assumed that when the switch is "off" as stated, the drive from the motor has not only stopped, but the position of the rod **135** in the slot **136** makes it certain that the disc **45** has stopped at a desired point effective to secure registration of the platforms **23** with the printing facility of the machine. However, when the solenoid **150** acts to withdraw the rod **135** from the disc **45**, a collar **170** impinges on the switch arm **166** to put the switch in the "on" position the moment the rod **135** clears the disc **45**, so that the latter may be rotated through one revolution to accomplish the single platform feed. For multiple-platform stop motion, the action of the rod **135** may be withheld by a time switch for the solenoid **150**.

When the switch **165** was "off," indicating that the platform conveyor was stationary, the switch operated at the same time to turn on the motor **110** for the purpose of starting the squeegee carriage **65** on its way forward. However, the switch **165** also operated to energize a solenoid **175**, seen prominently in the right-hand portion of Fig. 9. This solenoid is carried by the screen frame **50** and has an armature **176** connected by means of a bolt **178** and adjustable nuts **179** to draw upwardly on the bracket **180** of a wing **181** of an angle bar **182**, such wing being pivoted at **183** to the screen frame **50**. As seen in Fig. 10, this angle bar has a pendent lug **185** which is in the way of the forward motion of the block **95** while the screen frame is up. However, when the angle bar **182** is raised by the action of the solenoid **175** as stated, the lug **185** rises clear of the block **95** which is now drawn forwardly by the spring **96**. This action rotates the rod **94** in a direction reverse from that which occurred when the screen frame was to open, so that the cranks **105** and rods **107** involved will operate to close the screen frame from the position of Fig. 8 to that of Fig. 7. A spring **186** normally holds angle bar **182** down on block **95**.

The squeegee carriage **65** has a series of longitudinal angle plates **190** to which alternating pairs of spring blades **192** are attached at the bottom as seen in Fig. 14. Below these, the carriage has a pivot **193** for the headpieces **195** of a series of squeegees **70**, one designed for each silk screen **51**. The blades **192** are tensioned to hold the headpieces **195** after each rocking stroke during the reciprocating movements of the carriage for the printing operation; and the carriage receives adjustable bolts **200** from above in order to vary the tension of the blades **192**, the position of such bolts being fixed by wing nuts **202**.

It will be recalled that the action of the squeegee carriage **65** was altered endwise for the propulsion of the dye carried by the screens, the performance being in the nature of a hurdle. Fig. 12 illustrates the mechanism involved at each end of the carriage travel to accomplish this purpose. Thus, the top bars of the carriage **65** are shown, the same being surmounted by a block **210**. The latter carries a vertical rod **212** equipped with a roller **213**. The top bar of the screen frame is indicated at **50**, and the roller **213** is designed to travel on the base of such top bar during the normal movement of the carriage. Thus, when this movement is in the right-hand direction, as seen in Fig. 12, the roller will raise and pass beyond an inclined plate **215** hinged at **216** to a bracket **218** carried by the bar **50**, as indicated by dotted lines in the same figure. However, on the return of the carriage **65** toward the left, the plate **215** will have fallen to the full line position, causing the roller **213** to climb the plate **215** onto the bracket **218**, and eventually to fall from the same on its continued travel. The roller thus acts through the carriage **65** and the squeegees to accomplish the hurdling action previously referred to in respect to the dye. An internal slide **295** is connected and operated by the rod **212**.

Figs. 3, 4 and 16 show a device for keeping the platforms in line as they travel. Thus, a number of cross-sills **228** are carried by the machine frame underneath the platforms and are surmounted by a T-rail **230**. The platforms carry a series of channel bars **231** arranged in spaced back-to-back formation, as shown in Fig. 4, the bars being secured to the platforms by rivets **233**. The

channel bars 231 receive the web of the T-rail 230 between them, as shown in the same figure, and are thus guided by the same. Retainer strips 300 serve to hold the platforms down.

The reversing device mentioned previously is illustrated in Figs. 9 and 17. The carriage 65 has a side plate 250 which is seen more clearly in Fig. 12, the plate being reinforced by a corner bracket 251. Fig. 17 shows that the plate 250 is extended outwardly with a pair of bearings 255 which are spaced vertically on opposite sides of a shaft 256 projected from the plate 250. The bearings 255 allow the free passage of the upper and lower runs of the middle chain 109. Between the two bearings 255 is a block 258 which has an outstanding stud 259. The block 258 carries a vertical pin 261 which is pointed at the ends, as indicated at 262, and is slidable vertically to have either end engage a link in the corresponding run of the chain 109. The shaft 256 has a disc 265 rotatable on its outer end, the disc having a radial arm 266. As shown in Fig. 9, this arm has a side pin 268 which is connected by a spring 269 to a bottom pin 270 extended from the plate 250. The arm 266 operates in the manner of a toggle. Thus, the arm is inclined toward the front as shown at one end of its swing, but may be swung to assume a similar position toward the rear, so that the disc 265 turns accordingly. The stud 259 projects through a slot 271 in the disc 265. The swing of the arm 266 determines whether the stud 259 is in a high or low position by the effect of the slotted disc 265 on the stud. Thus, when the stud is in a high position, the upper end of the pin 261 engages the upper run of the chain 109; and when the stud 259 is in a low position, the bottom end of the pin 261 engages the lower run of the chain. As seen in Fig. 9, the arm 266 lies behind a frontal pin 278 (see upper center, Fig. 5) projecting from the screen frame 50; and the frame has a similar pin 279 at a point to the rear. The pins 278 and 279 form limits for the arm 266 to change the inclination thereof, the spring 269 holding the arm at either limit of its swing. When such limit is attained by the arm the chain 109, which is in continuous operation, secures hold of the carriage 65 according to the run engaged by the pin 261, and the carriage is therefore moved with such run until the pin 278—or 279—is engaged by the arm 266 to effect the reversal of the operation. At the rear end of its travel, the carriage 65 turns on a switch 285 to energize solenoid 150. A routine switch 290 is indicated in the diagram, to turn the machine on and off.

While, as was previously mentioned, the printing of cloth or other porous material is practicable with the platforms 23 moving in single order over the color screens, this cannot be done when the material to be printed is paper or other hard substance. The factor of drying therefore must be utilized after one color is printed before the next one can be applied. Where four color screens are involved, as shown in the drawings, it is necessary to have an uneven number of platforms in the conveyor structure in order to secure an overrun of the platforms in respect to the screens as the platforms travel over the conveyor and under the same to gain the advantage of the drying facility 225. Thus, the use of an uneven number of platforms brings each work unit which has received the first color into registration with the second color screen on the next trip of the conveyor, each trip of the conveyor procuring the gain of a platform. Thus, additional work units can be put on the conveyor to receive the first color, and when all the platforms have passed through the set of color screens and dried, every fourth work unit will be a finished one and can be removed and replaced by a new work unit for first color printing.

It will not be apparent that the novel silk screen printing machine departs from the hand-operated machines first by providing automatic squeegee action, and second by carrying the work on a conveyor in a manner to receive work units at one end and have them printed and dried as they travel over the conveyor. Further, the receiving end of the machine is open and devoid of moving parts or complications, so that the placement of the work is in the clear and in accordance with safety measures. Finally, the machine is of a nature to permit changes in the number of work units and printing screens as may best suit one job or another.

While I have described the invention along specific lines, various minor changes or refinements may be made therein without departing from its principle, and I reserve the right to employ all such changes and refinements as may come within the scope and spirit of the appended claims.

I claim:

1. A silk screen printing machine comprising a frame, a conveyor designed to move work units from one side of the frame to the other, a silk screen frame pivoted over the machine frame to open and close with silk screen sections in relation to said work units, said conveyor being operated with a stop motion registering the work units with the silk screen frame sections, a squeegee carriage in the silk screen frame and having a series of of squeegee elements engageable with said sections to print the work units, and means to operate said conveyor when the silk screen frame is in the open position, said stop motion involving a rotary disc operated by a power source and having a slot, a latch rod supported alongside the disc and adapted to enter said slot at a point in the rotation of the disc whereby to stop the latter, an electrical circuit, second means in said circuit operative to close the silk screen frame over the work units stationed by said stopping action, and third means in said circuit actuated by the latch rod during said stopping action to operate said second means.

2. A silk screen printing machine comprising a frame, a conveyor designed to move work units from one side of the frame to the other, a silk screen frame pivoted over the machine frame to open and close with silk screen sections in relation to said work units, said conveyor being operated with a stop motion registering the work units with the silk screen frame sections, a squeegee carriage in the silk screen frame and having a series of squeegee elements engageable with said sections to print the work units, and means to operate said conveyor when the silk screen frame is in the open position, said stop motion involving a rotary disc operated by a power source and having a slot, a latch rod supported alongside the disc and adapted to enter said slot at a point in the rotation of the disc whereby to stop the latter, an electrical circuit, second means in said circuit operative to close the silk screen frame over the work units stationed by said stopping action, and third means in said circuit actuated by the latch rod during said stopping action to operate said second means, the latter including a solenoid and a linkage between the silk screen frame and the machine frame.

3. A silk screen printing machine comprising a frame, a conveyor designed to move work units from one side of the frame to the other, a silk screen frame pivoted over the machine frame to open and close with silk screen sections in relation to said work units, said conveyor being operated with a stop motion registering the work units with the silk screen frame sections, a squeegee carriage in the silk screen frame and having a series of squeegee elements engageable with said sections to print the work units, and means to operate said conveyor when the silk screen frame is in the open position, said stop motion involving a rotary disc operated by a power source and having a slot, a latch rod supported alongside the disc and adapted to enter said slot at a point in the rotation of the disc whereby to stop the latter, an electrical circuit, a solenoid in said circuit operative to close the silk screen frame over the work units stationed by said stopping action, second means in said circuit actuated

by the latch rod during said stopping action to operate said solenoid, said circuit including said power source, and a switch effective to cut off the power source and energize the solenoid in the event of said stopping action.

4. A silk screen printing machine comprising a frame, a conveyor designed to move work units from one side of the frame to the other, a silk screen frame pivoted over the machine frame to open and close with silk screen sections in relation to said work units, said conveyor being operated with a stop motion registering the work units with silk screen frame sections, a squeegee carriage in the silk screen frame and having a series of squeegee elements engageable with said sections to print the work units, and means to operate said conveyor when the silk screen frame is in the open position, said stop motion involving a rotary disc operated by a power source and having a slot, a latch rod supported alongside the disc and adapted to enter said slot at a point in the rotation of the disc whereby to stop the latter, an electrical circuit, second means in said circuit operative to close the silk screen frame over the work units stationed by said stopping action, third means in said circuit actuated by the latch rod during said stopping action to operate said second means, and fourth means to lock the silk screen frame to the machine frame on the closing action of the silk screen frame.

5. A printing machine comprising a frame, an endless belt conveyor having a plurality of equally spaced work unit supporting platforms, said conveyor having advancing and returning runs and arranged to move said platforms through said runs; printing means comprising a series of equally spaced printing elements each of which is adapted to print upon said work units successively in a given color, means supporting said printing means for movement toward and away from said conveyor, drying means adjacent said returning run adapted to dry the work units, the spacing between said work unit supporting platforms and said printing elements being equal, means cyclically advancing and stopping said work unit supporting platforms in such manner that in each cycle a platform travels the distance equal to the total conveyor length plus the spacing between adjacent printing elements, and means for moving said printing elements in timed relation to the advancing of the conveyor.

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