Feb. 20, 1968 E. G. CROSS 3,369,484

DIAGONAL-PRINTING SCREENING MACHINE

Filed March 6, 1967 3 Sheets-Sheet 1

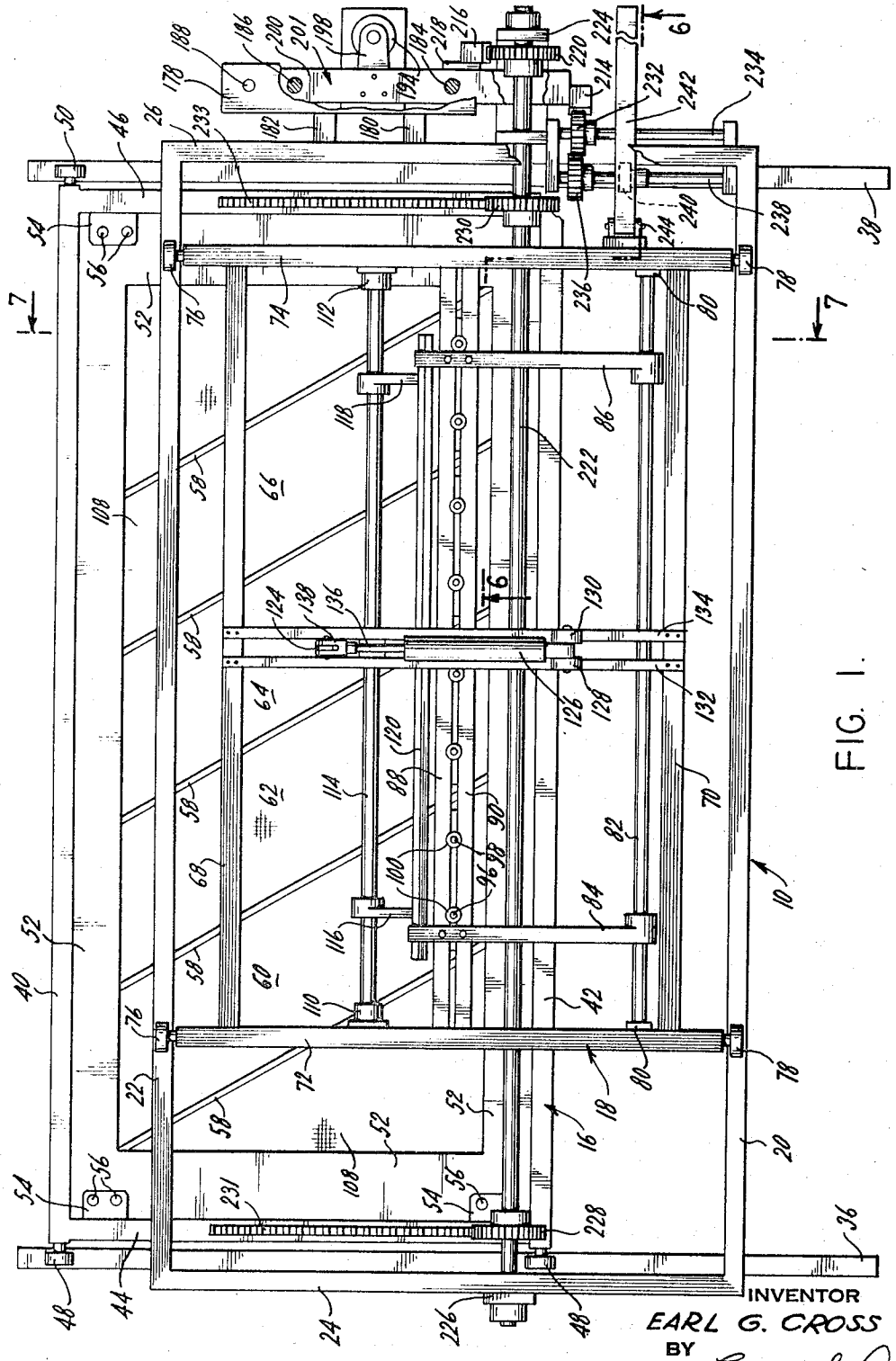


FIG. 1.

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DIAGONAL-PRINTING SCREENING MACHINE

Filed March 6, 1967 3 Sheets-Sheet 2

FIG. 5.

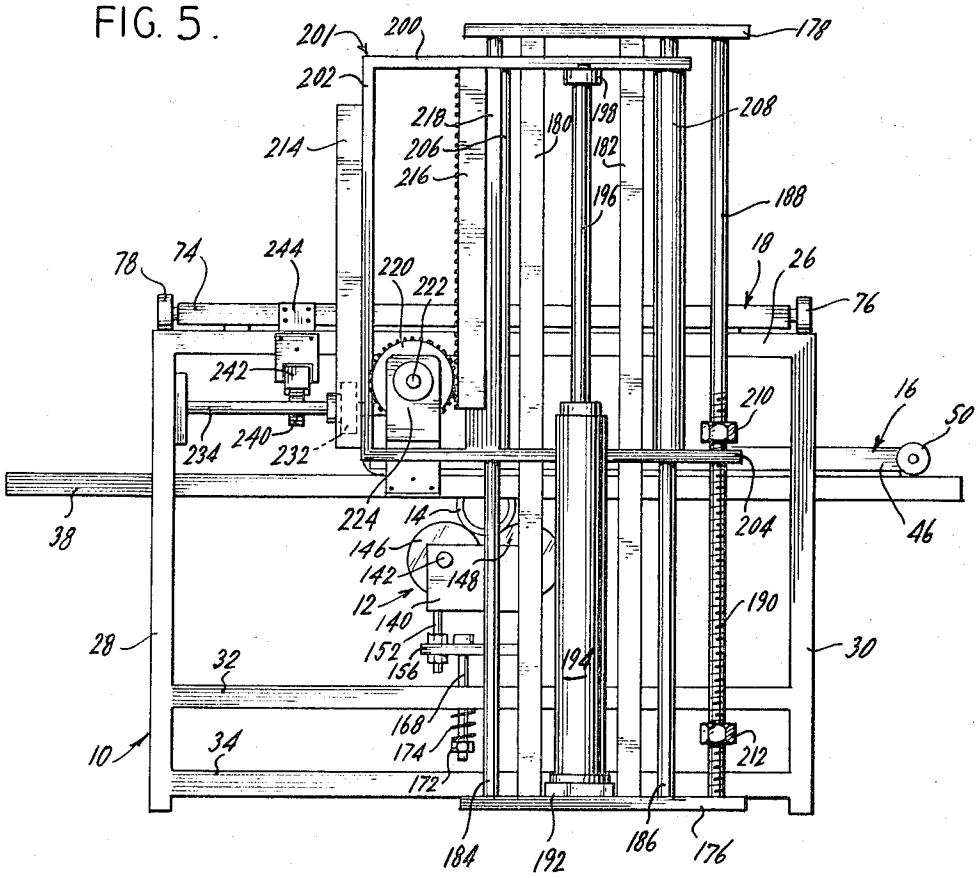


FIG. 2.

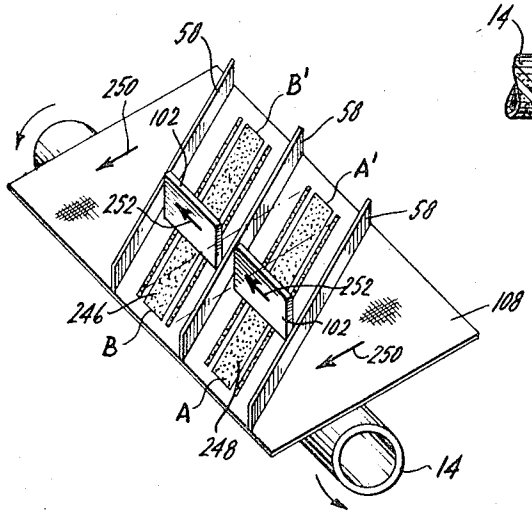


FIG. 4.

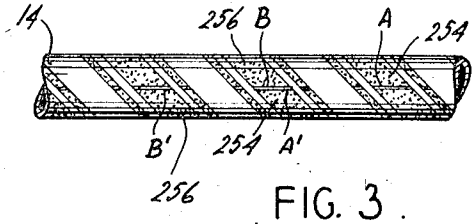
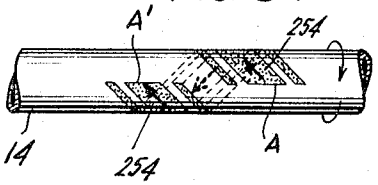


FIG. 3.



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Feb. 20, 1968 E. G. CROSS 3,369,484

DIAGONAL-PRINTING SCREENING MACHINE

Filed March 6, 1967 3 Sheets-Sheet 3

FIG. 6.

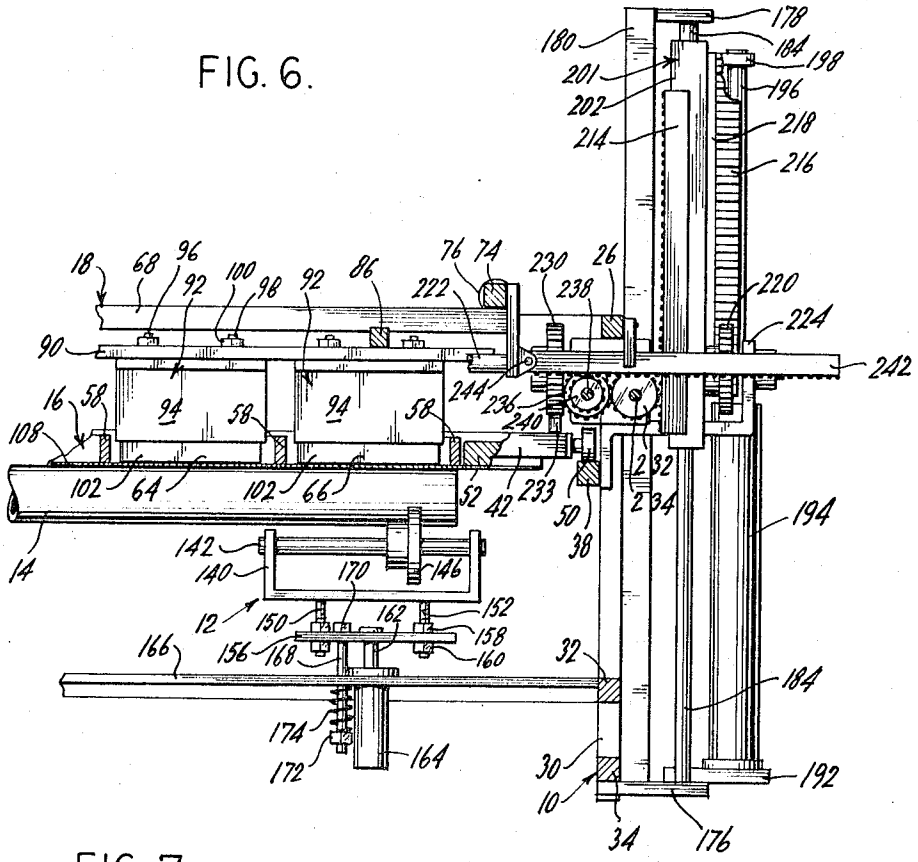
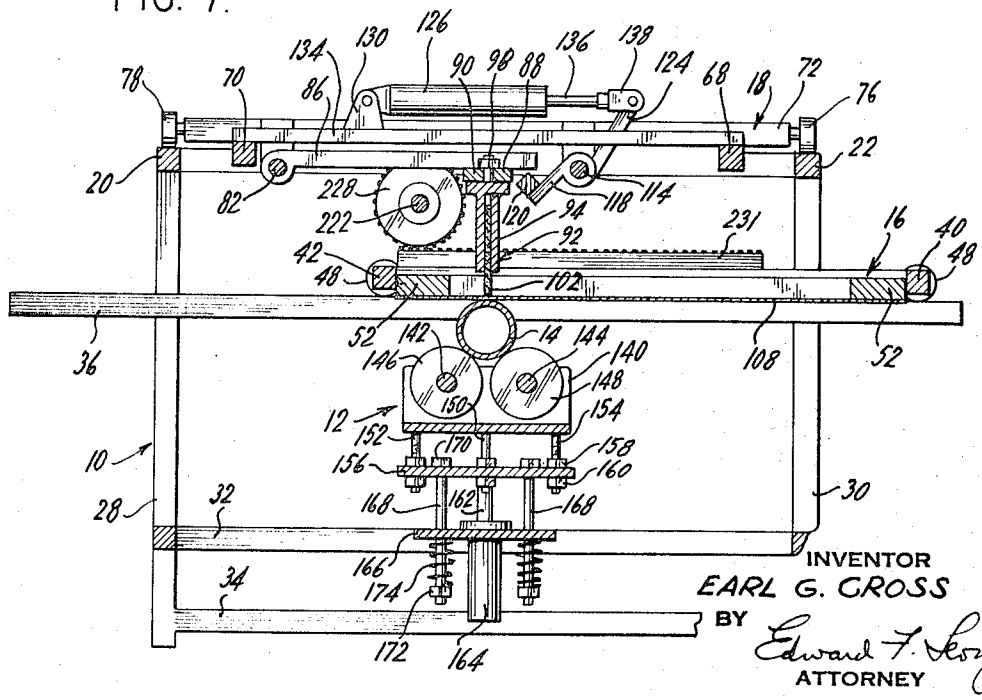


FIG. 7.



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United States Patent Office

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DIAGONAL-PRINTING SCREENING MACHINE

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10 Claims. (Cl. 101—38)

ABSTRACT OF THE DISCLOSURE

A screening machine for printing multi-color spiral patterns around the circumference of a cylindrical object. A screen frame partitioned into diagonal color compartments is moved across the object, with the screen in contact therewith, in one uni-directional printing stroke normal to the axis of the object, while the object is supported for rotation therebeneath. A squeegee member is located within each diagonal compartment of the screen frame and the squeegee members are moved together in synchronization with the movement of the screen frame, in a direction axially of the object to follow the diagonal extent of the moving color compartments.

The use of silk-screen processes for the printing of multi-colored patterns on objects has been found desirable, but its use in providing diagonal or spiral patterns on objects has been restricted by the structural limitations of conventional screening machines. It has recently become the trend to decorate cylindrical objects or parts of products with attractive and colorful designs or stripes arranged in spiral multi-color form around the circumference of the cylindrical object. As one example, the tubular legs and cross-bars of children's playground and back-yard gym sets have been provided with multi-color designs to enhance the visual appeal of the product. To produce such designs, particularly in spiral form by silk-screening, complex procedures and successive printing operations are required if conventional machines are employed.

An object of the present invention is to provide a machine utilizing a silk-screen process for printing multi-color patterns or designs in spiral form around the circumference of cylindrical objects.

Another object of the invention is the provision of a screening machine of the character described in which the printing screen is mounted to move across the tubular object in a single printing stroke with the object rotating therebeneath, in such a manner that the spiral pattern is printed around the circumference of the object during the single printing stroke. The printing operation is therefore extremely rapid, efficient, and commercially economic.

A further object of the invention is the provision of a screening machine of the character described which is capable of printing a cylindrical object of appreciable length over its entire extent in a single operation in successive patterns of many different colors, a commercial embodiment having, for example fourteen separated screen compartments each capable of holding and applying a different color.

In accordance with the invention, there is provided a screening machine comprising a base frame upon which is movably mounted a screen frame having a printing screen covering the open interior thereof. The screen frame is divided into a plurality of diagonal color compartments which overlie the screen and are each capable of holding and segregating liquid printing medium of a selected color, and the screen has a diagonally-disposed transfer pattern within each of said color compartments. Work-supporting means rotatably supports the cylindrical object

to be printed beneath the screen frame with the object in engagement with the bottom surface of the screen. Means are provided for moving the screen frame in a uni-directional printing stroke across the cylindrical object in a direction normal to the axis of the object such that the object rotates beneath the screen and each color compartment provides a printed pattern portion around the circumference of the tube, which pattern portions are continuous to form a multi-color spiral print along the extent of the cylindrical object.

Squeegee members are also employed to force the liquid printing medium through the screen, a squeegee member being located in each diagonal color chamber. Means are provided for moving the squeegee members in unison in a direction along the axis of the tubular object, in synchronization with the movement of the screen frame, such that the squeegee members remain centered in their respective diagonal color compartments.

Additional objects and advantages of the invention will become apparent during the course of the following specification when taken in connection with the accompanying drawings, in which:

FIG. 1 is a top plan view of a screening machine made in accordance with the present invention, with the screen frame thereof shown in its starting position for the printing stroke;

FIG. 2 is a perspective view showing schematically a portion of the screen frame and screen, the squeegee members therefor, and the cylindrical object, showing the screen transfer patterns and indicating the relative movements of these parts during the printing stroke;

FIG. 3 is a side elevational view of a portion of a tubular object showing the manner in which the transfer pattern of a single diagonal screen color compartment is printed thereon;

FIG. 4 is a side elevational view of a portion of a cylindrical object showing the manner in which a plurality of adjacent screen patterns are printed thereon;

FIG. 5 is an end elevational view of the screening machine as viewed from the right-hand side of FIG. 1;

FIG. 6 is a vertical section taken along line 6—6 of FIG. 1; and

FIG. 7 is a vertical section taken along line 7—7 of FIG. 1.

Referring in detail to the drawings, the diagonal screening machine made in accordance with the present invention is shown as generally comprising a stationary base frame **10** upon which is mounted work-supporting means **12** for rotatably supporting the object to be screened, such object being shown as an elongated metal tube **14**. A movable screen carriage **16** is mounted above the tube **14**, and a movable squeegee carriage **18** is mounted above the screen carriage **16**.

The base frame **10** constitutes an open metal framework having a top rectangular section comprising a pair of spaced longitudinally-extending bars **20** and **22** connected at their ends by transverse end bars **24** and **26**. The top section is supported and maintained spaced above the floor surface by end sections, each comprising a pair of upright bars **28** and **30** connected at their lower ends by cross-bars **32** and **34**, as shown in FIGS. 5 and 7. At its ends, the frame **10** also supports a pair of respective elongated transverse bars **36** and **38** which act as rails for movably mounting the screen carriage **16**.

The screen carriage **16** comprises a rectangular metal frame formed by a pair of longitudinally-extending bars **40** and **42** connected by transverse end bars **44** and **46**. At one end the screen carriage is provided with a pair of spaced wheels **48** which ride upon the transverse rail **36**, while at the other end the frame is provided with a similar pair of spaced wheels **50** which ride upon the

transverse rail 38. In this manner the open metal frame formed by the bars 40, 42, 44 and 46 may be rolled transversely on the stationary frame 10, above the supported tube 14 and perpendicular to the axis of said tube.

The rectangular inner recess of the screen carriage 16 is filled with a large rectangular wooden screen frame 52, which, as shown in FIGS. 6 and 7, projects slightly below the bottom surface of the screen carriage. The screen frame 52 is removably secured in mounted position by brackets 54 secured to the bars 44 and 46 and containing mounting bolts 56 (FIG. 1).

The interior of the wooden screen frame 52 is divided into a series of adjacent color compartments by a number of parallel upstanding partition walls 58 which extend diagonally between the longitudinally-extending walls of the screen frame 52. In FIG. 1, for convenience of illustration, five such diagonal walls 58 are shown, dividing the frame interior into four diagonal color compartments 60, 62, 64 and 66 each capable of receiving a different color ink paint, or other liquid printing medium and maintaining the color separated from the colored medium in adjacent compartments. It is to be understood, however, that a greater number of diagonal compartments would ordinarily be employed, depending upon the length of the object to be screened, and in actual practice a screen frame with fourteen diagonal compartments has been employed for the multi-color spiral screening of elongated metal tubes.

The squeegee carriage 18 is formed by a pair of spaced longitudinal side bars 68 and 70 connected at their ends by transverse bars 72 and 74. The transverse end bars 72 and 74 overlie and project beyond the ends of the bars 68 and 70, as best shown in FIGS. 6 and 7, and each carries at its ends a pair of wheels 76 and 78. The pair of wheels 76 ride upon the base frame bar 22, while the pair of wheels 78 ride upon the base frame bar 20 so that the squeegee carriage 18 may roll in a direction longitudinal of the base frame 10, that is to say in a direction parallel to the axis of the supported tubular object 14.

Journalled in bearings 80 carried by the squeegee carriage end walls 72, 74 is a longitudinally-extending shaft 82. A pair of lever arms 84 and 86 are affixed or keyed to the shaft 82 so that both arms may turn in unison with rod 82. Secured to the under surface of the arms 84, 86 and carried thereby are a pair of spaced bars 88 and 90 which extend parallel to the rod 82. These bars 88 and 90 support a plurality of squeegee members 92 which are suspended therefrom. For this purpose, the squeegee members 92 each comprise a housing 94, to the upper wall of which are secured a pair of upstanding threaded bolts 96, 98. The bolts 96, 98 project upwardly through the space between the parallel bars 88 and 90, and a nut 100 is threaded on each bolt to clamp the squeegee housing to the bottom surfaces of the bars 88, 90.

Each squeegee housing 94 mounts a wiper member 102 which projects downwardly from the bottom end thereof. The weight of the squeegee housings and the lever arms 84, 86 normally maintains the wiper members 102 in firm flush engagement with the upper surface of the screen 108 attached to and stretched across the lower surface of the wooden frame 52. The screen 108 is of the usual silk-screen type, comprising a liquid permeable fabric body which is masked by portions delineating the design to be applied to the work. The masking portions may be applied to the fabric by conventional and well-known photographic techniques. A permeable design pattern is formed in the screen within each of the diagonal color compartments 60, 62, 64 and 66, each of these patterns being preferably arranged diagonally and parallel to the axis of its respective color compartment as indicated in FIG. 2, and as will be presently described.

Also journalled in bearings 110, 112 on the squeegee carriage end walls 72, 74 is a shaft 114. Secured to shaft 114 are a pair of arms 116, 118 connected at their ends by a bar 120. At the center of the shaft 114, an upwardly-extending arm 124 is affixed, the free end of the arm 124

being actuated by a pneumatic cylinder 126. The cylinder 126 is pivotally mounted between a pair of lugs 128, 130 upstanding from a pair of spaced bars 132, 134 mounted upon and bridging the squeegee carriage walls 68, 70. Projecting from the cylinder 126 is a piston rod 136 pivotally connected by yoke 138 to the end of arm 124.

The pneumatic cylinder 126 is connected by the usual lines (not shown) to a source of air under pressure, in such a manner that when the piston rod 136 is extended from the cylinder, it pushes upon the arm 124 and causes rod 114 to turn in a clockwise direction as viewed in FIG. 7. This moves arms 116, 118, and the bar 120 carried thereby, in an upward direction, causing bar 120 to engage lever arms 84, 86 and turn the latter about rod 82, thereby lifting the squeegee member 92 from the screen chambers so that the wiper members 102 are spaced above the screen 108. This lifting of the squeegee members occurs automatically at the end of the printing stroke and allows the screen to move in an inoperative return stroke to its starting position, without performing any printing.

The work supporting means 12 includes an identical pair of roller assemblies mounted at opposite ends of the machine, one of which is illustrated in FIGS. 5, 6 and 7. The roller assembly includes a U-shaped bracket 140, between the upright arms of which a pair of spaced shafts 142, 144 are journalled. These shafts mount respective rollers 146 and 148 for free rotation of the latter. The rollers 146 and 148 are spaced from each other a sufficient distance to support and cradle the end of tube 14 in the manner shown in FIGS. 6 and 7.

The bracket 140 has three depending screw shanks 150, 152 and 154 secured to the bottom surface thereof and extending through corresponding apertures in a plate 156. Each of said screw shanks is secured to plate 156 by a pair of nuts 158 and 160 respectively located above and below plate 156. The plate 156 is mounted at its center on a piston rod 162 projecting from a pneumatic cylinder 164. The cylinder 164 is mounted on a flat beam 166 extending longitudinally the length of the frame 10.

When a tube 14 is inserted into the machine, it is cradled in the rollers 146, 148 at each end of the machine, and is spaced well below the screen 108. At the beginning of the printing cycle, the pneumatic cylinders 164 at each end of the machine are simultaneously charged with air, so that the piston rod 162 raises plate 156 and bracket 140 to elevate the tube 14 into firm engagement with the lower surface of screen 108. During the printing stroke, the screen 108 tranverses the tube 14, and this movement of the screen causes the tube to rotate on the rollers 146, 148 so that its entire surface is printed. The nuts 158, 160 provide for selective vertical adjustment of the rollers 146, 148, which may be raised or lowered to accommodate tubes of varying diameters, such that when the piston rod 162 is fully elevated, the tube will be pressed against the bottom surface of the screen, but without excessive pressure.

The plate 156 also carries a plurality of depending rods 168 which extend slidably through beam 166, each rod having a nut 170 secured to its upper end, a nut 172 secured to its bottom end, and a compression spring 174 surrounding the lower portion thereof and seated at one end on the nut 172 and at its other end on the lower surface of beam 166. The springs 174 serve to lower the rollers 146, 148 and the tube 14 carried thereby when the cylinder 164 is deactivated.

As previously indicated, during the printing operation, the screen carriage 16 is moved across the top of the tube 14 in a single uni-directional printing stroke, while simultaneously the squeegee carriage 18 is moved in a direction perpendicular to the path of movement of the screen carriage so that the squeegee members 92 follow the lateral component of movement of the respective diagonal color compartments and remain centered therein. Means are provided for driving the screen carriage and squeegee carriage simultaneously and in synchronization during the printing stroke, which drive means will now be described.

At one end of the base frame 10 is a vertically-elongated stationary extension frame formed of a base plate 176 and a top plate 178 connected by a pair of spaced upright bars 180 and 182. Between the base plate 176 and top plate 178 are also mounted three upright cylindrical rods 184, 186 and 188, the rod 188 having threading 190 at its lower end portion.

Mounted on the base plate 176 is a laterally-offset platform 192, upon which is mounted an upstanding pneumatic cylinder 194 having a piston rod 196. At its top end the piston rod 196 carries a lateral extension 198 to which is secured the top arm 200 of a C-shaped drive frame 201. As best seen in FIG. 5, the drive frame 201 also has a vertically-disposed arm 202 and a bottom arm 204. The top arm 200 and bottom arm 204 have registering apertures receiving the cylindrical rods 184, 186 in such a manner that the drive frame 201 is slidably mounted for vertical movement on the rods 184, 186 and is raised and lowered by the piston rod 196. A pair of tubular sleeves 206 and 208 mounted between the arms 200 and 204, enclose the respective rods 184 and 186 and guide the vertical movement of the drive frame. The cylinder 194 is connected to air lines (not shown) and is of the type to be charged with air to retract piston 196 in an actuating stroke for lowering drive frame 201, and also be charged with air so as to elevate piston rod 196 in a return stroke, thereby raising drive frame 201 to its starting position shown in the drawings. For adjustably limiting the upward and downward movement of the drive frame 201, its bottom arm 204 is slidable on the cylindrical rod 188, and a pair of nuts 210 and 212 are adjustably mounted on the threaded portion 190 thereof, the nut 210 acting as an upper stop and the nut 212 acting as a lower stop. By adjusting nuts 210 and 212 the length of the stroke of drive frame 201 and the corresponding printing stroke of the screen carriage 14 can be varied to conform to the diameter of the object to be printed.

A vertically-disposed rack 214 is affixed to the frame arm 202, while a second vertically-disposed rack 216 is secured to the lower surface of frame top arm 200 and to an upstanding bar 218 extending between the top and bottom frame arms 200 and 204. The teeth of rack 216 mesh with a pinion 220 affixed to a shaft 222 journalled at its ends in respective brackets 224 and 226 secured to the base frame end rails 38 and 36 respectively.

Also affixed to shaft 222, adjacent each end thereof, are a pair of pinions 228 and 230, the teeth of which mesh with respective racks 231 and 233 secured to the top surfaces of the end bars 44 and 46 of the screen carriage 16. When the drive frame 201 is lowered from its starting position shown in the drawings, through an operative stroke, by action of the piston rod 196, the rack 216 is carried downwardly therewith, causing pinion 220 to turn in a clockwise direction as viewed in FIG. 5, and the shaft 222 and pinions 228 and 230 to turn in the same direction. The pinions 228 and 230 act upon racks 231 and 233 to move the screen carriage 16 forwardly in a direction transverse to the axis of the machine base frame 10, that is to say in a left-hand direction from its starting position as viewed in FIG. 5. When the drive frame 201 is lowered, the screen carriage 16 is moved in the opposite direction and returned to its starting position.

The rack 214 meshes with a pinion 232 mounted on a transverse shaft 234 journalled in the machine frame, the pinion 232 meshing with a gear 236 mounted on a transverse shaft 238 also journalled in the machine frame. Also affixed to shaft 238 is a smaller pinion 240 which meshes with a rack 242 connected by a hinge 244 to the transverse bar 74 of squeegee carriage 18, and projecting laterally therefrom. When the drive frame 201 is lowered by cylinder 194, it also lowers rack 214 which, through meshed gears 232 and 236, turns pinion 240 in a direction to drive rack 242 and its connected squeegee carriage 18 in a direction parallel to the longitudinal axis of the machine frame, or to the left as viewed in FIG. 1. Thus, by movement of the single drive frame 201, the screen carriage 16 is moved in a direction transverse of the machine, while simultaneously the squeegee carriage 18 is moved in a direction longitudinally of the machine. The movement of the squeegee carriage is synchronized with movement of the screen carriage, and the size and ratio of the gears 232, 236 and 240 is so selected that the squeegee members are moved longitudinally of the base frame at a slower rate than the screen carriage is moved transversely, and such that each squeegee member remains centered between the diagonal screen partition walls which define the color compartment in which the squeegee member is located.

In operation of the machine, the parts are initially in a loading position with the work-supporting assembly 12 lowered by the pneumatic cylinder 164 to a position in which the rollers 146, 148 are spaced well below the screen 108. The cylinder 194 also maintains the piston rod 196 and the drive frame 201 in the fully-elevated position shown in FIGS. 5 and 6, so that the screen carriage is at its starting position shown in FIGS. 1–5 and 7, rearwardly of the base frame 10. In this position, the forward end of the screen 108 is above the work-supporting assembly 12. The squeegee members 92 are also elevated by pneumatic cylinder 126 so that the wiper blades 102 are located well above the screen. Each of the diagonal color compartments 60, 62, 64 and 66 are filled with a layer of fluent printing medium which may be lacquer, paint, ink or the like. Since the diagonal partition walls 58 of the screen frame separate and isolate each color compartment, a different color medium may be used in each compartment to produce a multi-color spiral design on the work piece. The cylindrical tube 14 or similar object to be painted, is now placed or conveyed to its proper position, supported at its ends by the lowered rollers 146 and 148.

The operating cycle is commenced by simultaneous actuation of the pneumatic cylinders 126 and 164. Cylinder 164 elevates the work-supporting assembly 12 to its uppermost adjusted position in which the tube 14 is pressed firmly against the lower surface of screen 108. Cylinder 126 lowers the squeegee members 92 until a wiper blade 102 is located in each of the screen chambers 60, 62, 64 and 66, and all of the wiper blades are in contact with the upper surface of screen 108 and are directly above tube 14.

The pneumatic cylinder 194 is now energized to draw the piston rod 196 downwardly therein and lower the drive frame 201 to its fully depressed position. This single downward movement of the drive frame results in the complete printing of tube 14 by the application of the spiral design around the circumference of the tube and along the length thereof. As the rack 216 descends with the drive frame, it turns pinion 220 so as to move the screen carriage 16 forwardly of the machine in its printing stroke, with the screen 108 traversing the tube 14 in a direction perpendicular to the longitudinal axis of said tube. Since the tube 14 is pressing against the lower surface of screen 108 under the force of cylinder 164, the movement of the screen along the tube causes the tube 14 to rotate upon rollers 146, 148.

Downward movement of drive frame 201 also lowers rack 214 which turns pinion 232 and the coupled pistons 236 and 240 in such a manner as to move the squeegee carriage 18 at a reduced speed in a direction parallel to the axis of the tube 14, and to the left as viewed in FIG. 1. This movement causes the wiper blades 102 to remain centered in the respective diagonal color compartments 60, 62, 64 and 66. As each diagonal color compartment traverses the tube 14 rotating therebeneath, the entire diagonal screen pattern therein passes between the tube 14 and the corresponding squeegee wiper blade 102, with the latter forcing the printing medium through the pattern and onto the surface of the tube 14.

Each diagonal screen pattern is made of a length corresponding to the diagonal circumferential distance around the tube **14**, and the distance of the stroke of piston rod **158** is so adjusted that upon one full forward printing stroke of screen carriage **16**, the tube **14** is rotated through substantially 360°. Thus, when the screen carriage has reached its fully forward position at the completion of the printing stroke, each diagonal screen pattern has been applied in a full helical turn extending substantially 360° around the circumference of tube **14**. The pattern of each screen compartment is preferably continuous with adjacent patterns, so that the tube **14** is provided with a continuous spiral design along its length, or as much of its length as is desired to be printed.

When the printing stroke of the screen is concluded, the cylinders **126** and **164** are energized to raise the squeegee members **92** and to lower the work-supporting assembly **12** so that the painted tube **14** can be removed and replaced by another tube. The cylinder **194** is also energized to lower the drive frame **201** and thus move the screen carriage **16** in a return stroke rearwardly to its starting position, with corresponding return movement of the elevated squeegee members. The cycle may now be repeated to paint a succeeding tube.

FIGS. 2, 3 and 4 illustrate schematically the manner in which the wiper blades cooperate with the diagonal color compartments to print a continuous spiral design on the tube **14**. For clarity of description, only a portion of screen **108** is shown in these views, this portion being divided by the screen frame walls **58** into two diagonal screen chambers **60** and **62**, each containing a squeegee wiper member **102**. The screen **108** is provided with identical liquid-permeable patterns **246** and **248** each centered within a respective compartment **60** and **62**, and each disposed diagonally and parallel to the axis of the color compartment. Each pattern **246** and **248** is shown as an elongated band for producing a spiral print in the form of a continuous stripe, although it is to be understood that the pattern may be in other forms, for example in the form of a diagonal column of individual designs. For purposes of illustration, it will be assumed that the compartments contain layers of paint of different colors, the compartment **60** containing blue paint and the compartment **62** containing red paint.

Each screen pattern **246** and **248** is of a length equal to the diagonal circumference of the tube **14**. At the start of the screening cycle, the respective leading edges A and B of the patterns **248** and **246** are directly above and in contact with the surface of tube **14**. As the machine is operated to move the screen **108** forwardly in the direction shown by the arrows **250**, each pattern **246** moves along the upper surface of the tube **14** which rotates therebeneath under the frictional drive of the screen **108**. At the same time, the squeegee wipers **102** remain in registry with tube **14**, but move along the axis of the tube in the direction indicated by arrows **252**, so that they press paint through the permeable patterns **246**, **248** and onto the surface of the tube.

At the end of the forward printing stroke of the screen **108**, the tube **14** has rotated through substantially 360°, and the trailing edges A′ and B′ of patterns **248** and **246** are directly above tube **14**. FIG. 3 shows the spiral print **254** reproduced from the screen pattern **248** upon pipe **14**. The end edge A of print **254** corresponds to the leading edge A of pattern **248** while the end edge A′ of pattern **254** corresponds to the trailing edge A′ of pattern **248**. The leading edge A of print **254** is substantially aligned with the trailing edge A′ on tube **14**, although in practice a slight spacing is provided between the planes of edges A and A′ to prevent color bleeding between adjacent prints.

FIG. 4 shows the prints **254** and **256** reproduced simultaneously on tube **14** by both patterns **248** and **246**. The leading edge B of pattern **246** initially engages tube **14** at a point immediately adjacent the point where the trailing edge A′ of pattern **248** will subsequently register with the tube at the completion of the printing stroke. As a result, during one forward stroke of screen **108**, the trailing edge A′ of print **254** is adjacent the leading edge B of print **256**, and the prints are continuous with each other along the length of the tube, although print **248** is red, print **246** is blue, and the adjacent prints are of different colors.

While a preferred embodiment of the invention has been shown and described herein, it is obvious that numerous omissions, changes and additions may be made in said embodiment without departing from the spirit and scope of the invention.

What is claimed is:

1. A screening machine for printing a spiral pattern upon a cylindrical object, said machine comprising a base frame, a screen frame movably mounted on said base frame and having a screen covering the open interior thereof, partition means dividing the interior of the screen frame into a plurality of diagonal color compartments overlying said screen, said screen having a diagonally disposed transfer pattern located within the area defined by each of said compartments, work supporting means on said base frame for rotatably supporting said cylindrical object beneath said screen frame with said object in engagement with the bottom surface of said screen, means for moving said screen frame in a uni-directional printing stroke across said cylindrical object in a direction normal to the longitudinal axis of said object with the object rotating therebeneath to print the screen pattern on said object around substantially the entire circumference thereof, a squeegee member for each of said diagonal compartments, a squeegee carriage for supporting said squeegee members in a linear row with each squeegee member engaging the upper surface of said screen within its respective compartment above said cylindrical object, and means for moving said squeegee carriage in a direction along the axis of said cylindrical object and in synchronization with the movement of said screen frame, whereby each squeegee member remains centered within its respective diagonal compartment during movement of said screen frame.

2. A screening machine according to claim **1** in which said partition means comprises spaced parallel walls extending angularly across said screen frame and defining adjacent diagonal compartments each capable of receiving and holding a quantity of printing material of a color different from that of the material in the adjacent trays.

3. A screening machine according to claim **1** in which said screen frame is carried by a screen carriage mounted on said base frame for reciprocating movement across the axis of said object in a first direction constituting said printing stroke and in a reverse direction constituting a return, non-printing stroke.

4. A screening machine according to claim **3** in which the means for moving said screen frame and said squeegee carriage includes a drive frame movably mounted on said base frame, drive means for moving said drive frame in an operative stroke in one direction and in an inoperative return stroke in the opposite direction, first gear means connecting said drive frame to said screen carriage for movement of the latter in one direction through said printing stroke during the operative stroke of said drive frame, second gear means connecting said drive frame to said squeegee carriage for movement of the latter in a direction perpendicular to the path of movement of said screen carriage and in synchronization therewith during the operative stroke of said drive frame.

5. A screening machine according to claim **4** in which said first gear means comprises a first rack affixed to said drive frame, at least one second rack on said screen carriage and gearing operatively connecting said first and second racks, and in which said second drive means comprises a third rack affixed to said drive frame, a fourth rack on said squeegee carriage, and gearing operatively connecting said third and fourth racks.

6. A screening machine according to claim 1 in which said work supporting means comprises a plurality of rollers mounting said cylindrical object for free rotation upon the base frame and in pressing engagement with the bottom surface of said screen, whereby movement of said screen frame in said printing stroke causes corresponding rotation of said cylindrical object.

7. A screening machine according to claim 6 which also includes means for adjusting the length of the printing stroke of the screen frame whereby said cylindrical object is rotated through substantially one complete revolution during said printing stroke.

8. A screening machine according to claim 7 in which each transfer pattern of said screen is of a length substantially equal to the diagonal distance around the circumference of said cylindrical object.

9. A screening machine according to claim 1 which also includes drive means for elevating said work supporting means to an operative position in which the cylindrical object supported thereon is pressed against the bottom surface of said screen, and for lowering said work

supporting means at the conclusion of the printing stroke of the screen to a position in which said cylindrical object is spaced below said screen.

10. A screening machine according to claim 1 which also includes drive means for elevating said squeegee members on said squeegee carriage to a position spaced above said screen frame at the conclusion of said printing stroke, and for lowering said squeegee members into contact with said screen immediately prior to the commencement of the next printing stroke.

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