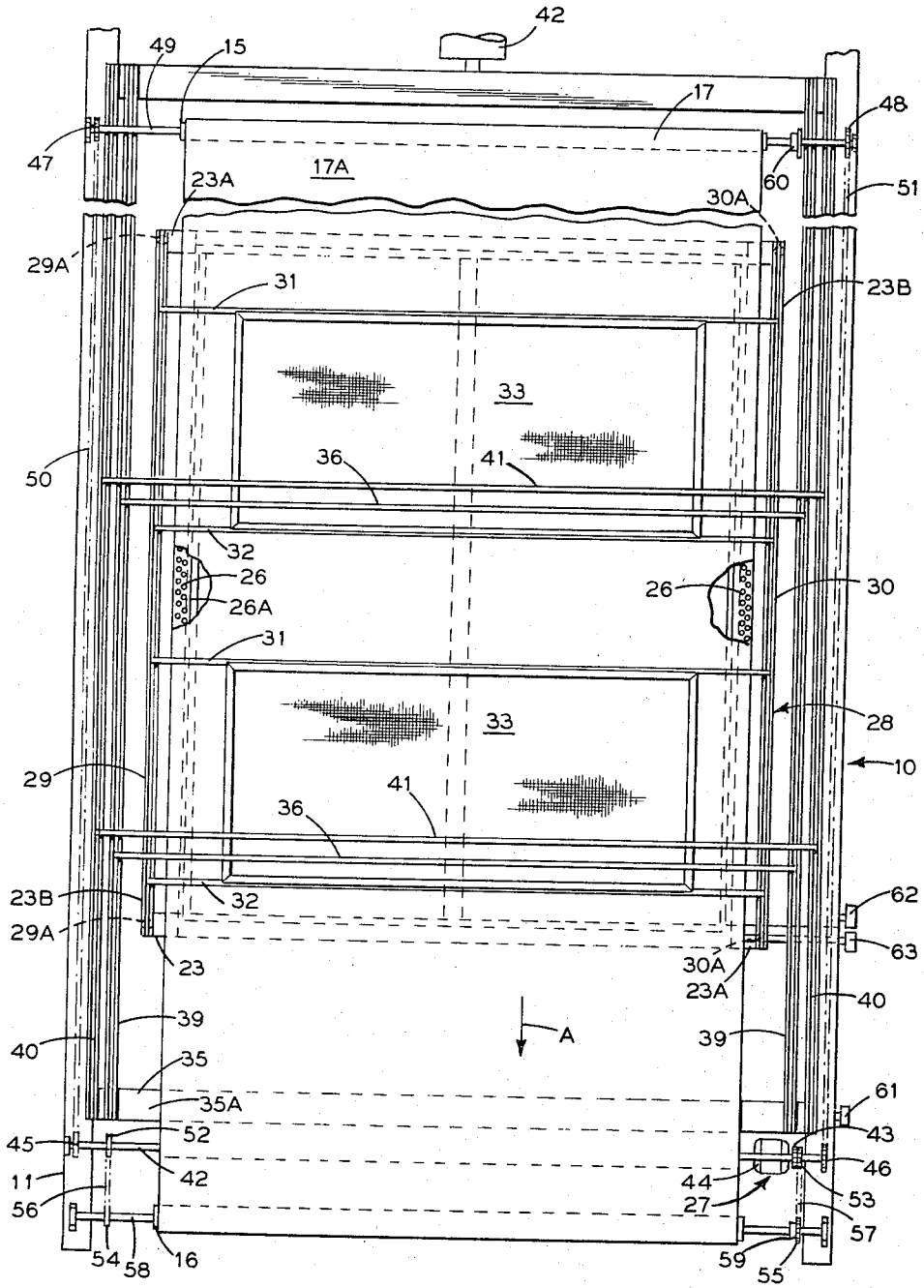
Dec. 12, 1967 M. L. JAFFA ET AL 3,357,350

METHOD AND APPARATUS FOR SCREEN PRINTING WHILE WORK IS INDEXED

Filed May 28, 1965 2 Sheets-Sheet 1

FIG. 1



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METHOD AND APPARATUS FOR SCREEN PRINTING WHILE WORK IS INDEXED

Filed May 28, 1965 2 Sheets-Sheet 2

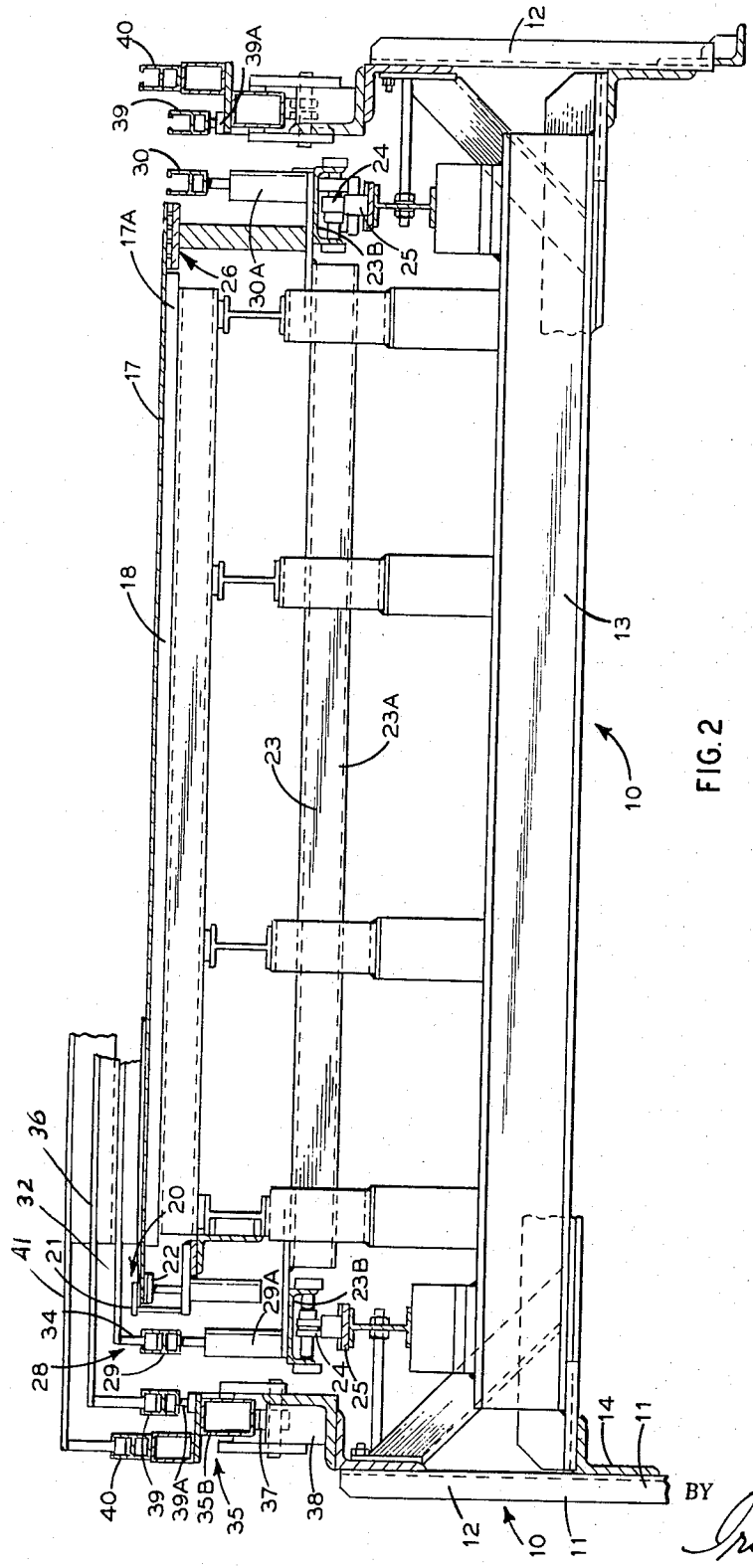


FIG. 2

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3,357,350

METHOD AND APPARATUS FOR SCREEN PRINTING WHILE WORK IS INDEXED

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13 Claims. (Cl. 101—123)

This invention relates generally to a method and apparatus for screen printing, and more specifically to an improved method and apparatus for screen repeating or sequential designs on a continuous strip of material. More particularly, this invention relates to improvements in a screen printing method and apparatus relating to prior co-pending applications Ser. No. 159,956 filed Dec. 18, 1961, now Patent No. 3,199,449; Ser. No. 185,113 filed Apr. 4, 1962, now Patent No. 3,199,447; Ser. No. 407,822 filed Oct. 30, 1964, now Patent No. 3,199,448.

It is an object of this invention to provide an improved method and apparatus for screen printing successive designs by effecting simultaneous relative movement of both the squeegee and the screen with the material secured thereto in the same direction of travel so as to enhance the penetration of the ink or dye in the material during a printing and indexing movement of the material.

Another object of this invention resides in the method and apparatus wherein the squeegee is moved in the same direction as the movement of the screen and material secured thereto during the printing thereof to thereby reduce the relative rate of speed therebetween during a simultaneous indexing and printing operation.

It is another object of this invention to provide a method and apparatus wherein the printing and indexing operation is simultaneously performed and wherein the screen is raised with a side-to-side movement upon the completion of the indexing and printing operation.

The foregoing objects and other fetaures and advantages of this invention are attained by an improved screen printing method and apparatus for printing on a continuous strip of material in which both the indexing and printing operations are being simultaneously conducted, that is, the printing of the material is occurring at the same time that the material is being indexed for the next repeat. In accordance with this invention the printing of certain types of material may be enhanced by effecting a relative movement between a moving squeegee and a moving printing screen which are both traveling in the same direction during a printing and indexing operation. In this manner an optimum penetration of ink may be had in the material being printed, while the same is being simultaneously indexed and printed. The method of indexing and printing by effecting relative independent movement of both the squeegee and the screen in the same direction in which material is being moved is preferably automatically carried out on a machine or apparatus that comprises a frame having mounted thereon an endless belt upon which the material to be printed is supported. A means is provided for positively securing the material to the belt, and for maintaining the belt and material fixed in an exact stopping position between indexing operations. A carriage is reciprocally mounted on the frame. Means are provided for detachably connecting the carriage to the belt and material thereon so that the drive of the carriage affects belt and material fixed thereon during the printing and indexing operation. Accordingly, a suitable drive is operatively connected to the carriage to effect the movement thereof, the carriage in turn being connected to the endless belt by gripper means for effecting the drive thereof.

In accordance with this invention a printing head is carried on the carriage for movement therewith. The printing head comprises a screen which is mounted for vertical movement between a printing and non-printing position. More particularly, the printing head is mounted for vertical movement on the carriage in a manner permitting one side of the screen to be raised before the other side of the screen, the arrangement being such that at the end of a printing and indexing operation the printing screen is gradually raised above the material by a side-to-side movement.

Operatively associated with the screen is a squeegee which is likewise mounted for vertical movement between a printing and non-printing position. In accordance with this invention, a means is provided for moving the squeegee independently of the screen during the printing operation. The arrangement is such that the movement of the squeegee during a printing operation is in the same direction as that of the screen, but at a varying relative speed with respect thereto. Accordingly, the respective carriage supporting the printing head which includes the printing screen is synchronized with the movement of the squeegee so that the squeegee traverses the stencil portion of the screen to effect a complete printing operation while the printing screen is indexed through a repeat of the design. At the end of the printing and indexing operation the squeegee is raised above the screen to its non-printing position. The screen thereafter is gradually raised off the material printed by first raising one side of the screen and then raising the other side of the screen so that the screen is spaced above the screen and material printed thereby. With the squeegee and screen raised above the printed material the screen and squeegee are returned to their initial starting position whereupon the squeegee and screen are again lowered into their respective printing position in readiness to repeat the operation.

A feature of this invention resides in the provision wherein both the squeegee and the printing screen are moved in the same direction at varying relative speeds with respect to one another during a printing and indexing operation.

Another feature of this invention resides in the provision wherein the screen is raised off the material at the end of a screen printing operation by gradually lifting first one side of the screen and then the other to separate the screen from the printed material.

Another feature of this invention resides in the provision wherein the respective movements of the squeegee and the screen in the same direction are synchronized so that at the end of the indexing and printing operation, the squeegee is disposed in the trailing well portion of the screen.

Other features and advantages will become more readily apparent when considered in view of the drawings in which:

FIGURE 1 is a plan view of the screen printing apparatus in accordance with this invention.

FIGURE 2 is a sectional end view of the apparatus.

The instant invention relates to an improved method and apparatus for screen printing repeating designs or successive designs on a continuous strip of material, as for example paper, cardboard, metal, glass, woven fabrics, and the like.

The improved method of this invention comprises the steps of successively taking a section of a continuous strip of material from a source of continuous supply and placing the same on the surface of a movable or indexing endless belt or conveyor. If the material to be printed is of a porous type, as for example a woven fabric, it may be held in a fixed position on the indexing belt or conveyor by means of a suitable adhesive. If the material is non-porous in nature, the indexing belt or conveyor

may be formed with a perforated surface arranged to pass over a negative pressure producing means which when actuated produces a vacuum beneath the belt. Accordingly, the material is held fast to the belt or conveyor so long as the vacuum created is operating thereon. A similar arrangement is disclosed in our co-pending application Ser. No. 159,956 filed Dec. 18, 1961. With the material fixed to the belt and the belt held fast, a printing screen is positioned over the material, the screen being arranged for vertical movement between a printing and non-printing position. An independently vertically movable squeegee is operatively associated with the screen. In the printing position, the screen and associated squeegee are lowered onto the material at which time the screen is secured to the belt and material thereon. In a printing position, the squeegee is disposed in the leading well portion of the screen. The screen, the belt, and the material thus secured are then moved in unison in the direction of belt travel a predetermined amount, e.g. a distance equal to the repeat of the design.

In accordance with this invention, the squeegee is simultaneously moved across the screen independently and relative to the movement of the screen to effect the printing step. The movement of the squeegee according to this invention is in the same direction as that of the belt but at a speed different from the speed of the belt. It is preferred that the squeegee be moved at a slower rate of speed than the rate at which the screen, belt, and material secured thereto is traveling. Consequently, the arrangement is such that the indexing and printing steps are simultaneously performed, with the printing action being effected by a squeegee moving in the same direction as the movement of the screen and the material therebeneath, but at a varying relative speed thereto. The respective relative movements of the screen, belt, material, and of the squeegee are synchronized so that at the end of the printing and indexing operation, the squeegee would have traversed from the leading well portion of the screen to the trailing well portion thereof. At the end of the screen printing operation, the material is also indexed and readied for the next print. The squeegee is then vertically moved to its non-printing position above the screen.

In accordance with this invention, the screen is then separated from the material just printed by first raising one side of the screen and then gradually raising the other side of the screen. Accordingly, the screen is raised with a side-to-side movement to a non-printing position above the material at the end of a printing and indexing step. With squeegee and screen raised to their respective non-printing positions, the screen and squeegee are then returned to their initial starting position whereupon both the squeegee and the screen are again lowered to their respective printing positions in readiness to repeat the printing and indexing cycle. The return of the screen and squeegee to their initial starting position is effected by first fixing the position of the belt or conveyor with the material secured thereon and then releasing the screen from the belt and material so that the screen may be returned to its initial starting position.

While it is possible to perform the method above described by hand, practical commercial requirements require that the described method be automatically performed by an apparatus of the type to be now described.

Referring to the drawings, there is shown therein a screen printing apparatus **10** capable of automatically performing a screen printing method herein described. The machine **10** comprises essentially of a frame **11** formed of rectangularly disposed upright leg members **12** which are suitably interconnected by longitudinally and transversely extending structural members **13** and **14**. Journalled in suitable bearings adjacent the opposed ends of the frame **11** are roller means **15**, **16** over which an endless conveyor or belt **17** is stretched. The material to be printed is supported on the upper flight **17A** of the conveyor or belt **17**. The supply roll of continuous material (not shown) may be suitably supported adjacent one end of the belt, the strip of continuous material fed from the roll being positioned over the upper flight **17A** of the belt.

Connected to the frame **11** and located immediately below the upper flight **17A** of the belt is a supporting surface or table **13**. If desired, the central portion of the supporting surface or table may be provided with a stationary vacuum gripping portion which when actuated will hold the belt firmly to the table in the exact fixed or stopped position at the end of an indexing and printing operation, as will be hereinafter described. The vacuum gripping portion may comprise essentially elongated manifold which has a perforated top portion disposed in the plane of the table immediately below the upper flight of the belt. The manifold in turn is connected to a suitable source of negative pressure, as for example a vacuum pump or the like, which is not shown. The operation of the gripping section is such that whenever the vacuum or source of negative pressure is energized, the air within the manifold is evacuated. When this occurs, the negative pressures created beneath the belt will cause the belt **18** to be held fast to the table surface due to the pressure of the atmospheric pressure acting on the upper surface of the belt. Alternatively, a fixed clamping means **20** may be provided along the opposed side edges of the frame to fix the belt to the table. As shown in FIG. 2, the clamp **20** comprises a fixed jaw **21** and a movable jaw **22** which cooperate to open and close in the marginal portion of the belt **7**. Accordingly, it will be understood that the clamps may be used in lieu of the vacuum holding means herein described.

A printing carriage **23** is reciprocally mounted on the frame **11**. The carriage **23** comprises essentially of a rectangularly disposed structural side and end members **23A**, **23B** suitably connected together. The carriage **23** is provided with suitable rollers **24** by which it is placed in rolling movement with track members **25** carried along each side of the frame **11**. In this manner, the carriage **23** is free to reciprocate longitudinally of the frame **11** as will be hereinafter described.

Disposed on opposite sides of the carriage **23** are vacuum gripping means **26** of the type disclosed in the co-pending application Ser. No. 185,113 filed Apr. 4, 1962, which when actuated will serve to securely grip the printing carriage **23** to the belt **17** and material disposed thereon. As shown in FIG. 1, the carriage vacuum gripping means **26** extend along each side of the carriage adjacent the marginal ends of the belt **17**. Each vacuum gripping means includes an elongated manifold **26A** having a perforated top disposed immediately below the marginal edges of the belt **17**. Each carriage manifold **26A** in turn is connected up to a vacuum pump (not shown). In operation, the actuation of the vacuum pumps for the carriage manifolds **26A** evacuates the air from within the respective manifolds. When this occurs, the marginal portions of the belt are held fast to the perforated surface of the manifolds **26A** carried on the carriage **23**, as described in said copending application Ser. No. 185,113 filed Apr. 4, 1962. To assist gripping of the carriage to the belt and material thereon, mechanical grippers of the type disclosed in co-pending application S.N. 436,847, filed Mar. 3, 1965, may also be provided on the carriage. Thus, it will be apparent that the movement of the carriage **23** longitudinally of the frame when the gripping means **26** are actuated will thereby effect drive of the belt **17** upon the actuation of the carriage drive means **27** as will be more fully described herein.

A printing head **28** is mounted for vertical movement on the carriage **23**. In accordance with this invention, the printing head **28** is vertically moved between a printing and non-printing position. As shown, the printing head **28** comprises a pair of opposed parallel rails **29**, **30**, one each being mounted on opposed sides of the carriage **23**. As

shown, each rail 29, 30 comprises essentially of a U-shaped member having inturned flanges extending longitudinally along the opposed upright leg portions thereof. Each rail 29, 30 is mounted for vertical movement relative to the carriage 23 by a pair of pistons and cylinders assemblies 29A, 29A and 30A, 30A respectively. In operation, actuation of the rail piston and cylinder assemblies 29A, 29A and 30A, 30A is such that one rail will rise before the other one, for reasons as will be hereinafter more fully set forth.

Connected between the opposed rails 29, 30 of the printing head are a pair of cross heads 31, 32 for supporting therebetween the screen printing screen 33. Accordingly, the screen is of conventional construction which is provided with a central stenciled portion which defines the design to be printed and opposed leading well portion and a trailing well portion between which the ink or dye is shifted during the screen printing operation. Accordingly, the cross heads 31, 32 supporting the screen 33 are hingedly connected on the ends of upwardly extending struts 34 which are carried in the associated rails 29, 30 of the printing head 28.

In the illustrated embodiment two such screens 33 are shown in space relationship. However, it will be understood that depending upon the length of the apparatus, one or more such screens 33 may carry on the printing head wherein the spacing between respective printing screen 33 is equal to the index of the repeat. While only two such screens 33 are illustrated, any reasonable number of printing screens may be provided depending upon the nature of the design and number of colors to be printed. Machines having as many as fourteen screens 33 are readily possible.

In the apparatus described, a squeegee carriage 34 is provided to impart independent movement to the squeegee 36, the squeegee carriage 34 comprises rectangular disposed side and end structural members 35A, 35B suitably secured together. The squeegee carriage 35 is mounted on the frame 11 on suitable roller 37 and track means 38 for longitudinal movement relative to the printing carriage and frame.

Connected along each side of the squeegee carriage 35 are a pair of rail members 39, 40, the construction of which is similar to the rails 29, 30 of the printing head 28. The opposed rails 39, 39 of the squeegee carriage 35 are each mounted for vertical movement on respective front and rear piston and cylinder assemblies 39A. The outside rails 40, 40 are fixed relative to the squeegee carriage 35. The arrangement of the inside rails 39, 39 is such that both are mounted for vertical movement wherein they will move simultaneously between a raised and lowered position whereas the outside rails 40, 40 are fixed to the squeegee carriage.

Between the inner pair of rails 39, 39 there is supported a squeegee 36. Extending between the opposed outside pair of rails 40, 40 is a flood bar 41. Accordingly, each screen 33 has its own respective squeegee 36 and flood bar 41 associated therewith. Thus, it will be noted that when the piston and cylinder assemblies 39A supporting the squeegee rails 39 are actuated the respective squeegees 36 are raised and lowered accordingly between the printing and non-printing positions.

The squeegee carriage 35 is rendered independently movable relative to the printing head 28 during a printing operation by an independently controlled drive means 42. In the illustrated embodiment, the squeegee carriage 35 is driven by a piston and cylinder assembly 42. However, it will be understood that any suitable drive may be utilized in lieu thereof. In accordance with this invention, the squeegee drive means 42 when energized will effect reciprocation of the squeegee carriage 35 relative to that of the printing carriage 23 and the screens 33 carried thereby in the same direction as the printing head is moved during a printing and indexing operation. For example, during a printing operation, the printing carriage

23 will move in the same direction as the belt travel which is indicated by arrow A. The squeegee carriage 35 will also move in the same direction. However, the arrangement is such that the speed of the squeege carriage 35 is less than that of the printing carriage 23. The respective relative speed of the squeegee 36 and the carriage 23, screen 33, material and belts secured thereto in the direction of belt travel during an indexing and printing operation are synchronized so that at the end of the printing and indexing stroke, the squeegee 36 ends up in the trailing well portion of its associated printing screen 33.

The flood bar 41 is fixed to the squeegee carriage 35 for relative movement to the screen upon the return of the screen 33 to its initial position. In operation, the flood bars 41 are rendered operative at the end of the printing and indexing stroke when the printing screen 33 has been raised to its non-printing position. At this time, the flood bar 41 is located in the trailing well portion of the screen. The operation between the flood bar 41 and the respective screen 33 is such that the flood bars 41 will engage in their respective screens 33 only in a raised position of the screen. As the printing screen 33 is returned to its start position, the screen 33 will automatically be coated with ink or dye by action of the flood bars engaging the same upon setting the screen to printing position. In essence, the flood bar 41 carries the ink or dye back to the initial or leading well portion of the screen, while at the same time causing the mesh of the screen to fill with ink.

The drive of the belt and the material may be assisted during the printing operation by a drive means 27 which is acting directly on the carriage. As shown in FIG. 1, a shaft 42 is rotatably journalled on the frame. A master drive sprocket 43 mounted on shaft 42 is connected in driving relationship to the spindle of a reversible motor 44 by a suitable flexible drive. Sprockets 45 and 46 are connected on each end of the idler shaft, extending beyond the sides of the carriage. Accordingly, the sprockets 45, 46 on the idler shaft 42 are connected in driving relationship with sprockets 47, 48 connected to the shaft or axle 49 of one end roller 15 by a suitable driving chain 50, 51. Other sprockets 52, and 53 of the idler shaft are connected in driving relationship to sprockets 54 and 55 connected to the axle 58 of the other end roller 16 by a suitable chain drive 56 and 57. The printing carriage 23 in turn is connected to the upper flights of the respective chain drive 50 and 51 which are located on either side of the carriage. It will therefore become noted that energization of the motor 44 causes the master sprocket 43 to rotate the idler shaft 42 accordingly. Rotation of this idler shaft 42 in turn will effect movement of the carriage 23 and also effect drive of the respective end rollers 15, 16 to assist in driving the belt 17. A unidirectional drive clutch 59 is associated with the axle or shaft 58 of the end roller 16. Accordingly, the unidirectional clutch 59 is rendered operative to index the belt when moved in the direction of arrow A and rendered inoperative when the motor 44 is reversed to return the carriage to the start position.

A holding unidirectional clutch 60 is operatively associated with the shaft 49 of the end roller 15. This holding clutch 60 when rendered operative will prevent overriding of the belt 17.

To vary the amount of the index or belt travel in accordance with the length of repeat, a suitable indexing means may be provided. In the illustrated embodiment, the indexing means comprises an indexing stop 61 which is fixed to the side of the frame 11, and an adjustable stop 62 which is spaced therefrom. Carried on the printing carrier 23 is an index bumper 63 disposed in alignment with respect to the fix and adjustable stops 61, 62 respectively. Accordingly, in operation the adjustment of the index for repeat is effected by positioning the adjustable stop 62 relative to the fixed stop 61 at an approximate distance corresponding to the desired repeat. Accordingly, movement of the carriage 23 and the belt 17 secured

thereto is limited by the indexing block 63 carried thereby engaging with the limiting blocks 61 and 62. The indexing limiting blocks 61, 62 in turn are operatively associated with a suitable control circuit which upon engagement or actuation, will effect operation of the motor drive 27 accordingly.

The essential elements of the machine elements thus being described, the operation thereof is as follows. The length of repeat is first adjusted by the proper determination or positioning of the limiting blocks 61, 62 of the indexing means. With this adjustment set, the material to be printed is then positioned on the upper flight 17A of the belt 17. The operation will be described with reference to a woven textile fabric that has a nobby or coarse surface or texture, as such fabric requires a greater penetration of the dye to effect proper design to be formed thereon. With the printing carriage 23 disposed in start position, and with the screens 33 and associated squeegees 36 in the raised position, the printing head 28 and the associated screens and squeegees are lowered into printing position by actuation of the printing head piston and cylinder assemblies 29A, 30A and the squeegee actuating piston and cylinder assemblies 39A. With the screen 33 now in position on the material, and the associated squeegee 36 initially disposed in the leading or forward well portion of the associated screen, the carriage gripping means 26 are actuated to firmly secure the belt to the carriage. Accordingly the carriage 23, screen 33 carried thereon, belt and material are secured for driving in union. With the carriage 23, belt 17, and material thus secured, the fixed gripping means holding the belt 17 and the material fixed to the supporting table 18 is deenergized to release the belt 17 for movement relative thereto. At this point of the cycle, the carriage drive means 27 is actuated, i.e. the motor 44 is energized to drive the carriage 23, screen carried thereon, the belt and material secured thereto a distance equal to the repeat of the design, which is governed by the indexing blocks 61, 62. In doing so, the screen 33 will move in the direction of the belt travel past their respective squeegees 36. To assist the carriage 23 in driving the belt and the material carried thereon, the carriage drive means 28 acts directly on the respective end roller 15, 16 by chain drives 50, 51 and 56, 57. In this manner, positive registration between the carriage 23, screen 33, and belt 17 and the material is assured.

In accordance with this invention, the drive means 42 operating on the squeege carriage 35 is also actuated to drive the squeegee carriage 35 and the squeegee 36 supported thereon in the same direction as the printing head 28 and screen 33 carried thereon. However, the speed at which the squeege carriage 35 is being driven is controlled so that it travels at relatively slower rates than that of the printing carriage 28, screen 33, and belt 17 secured thereto. Accordingly, the relative speed between the moving printing head 28 and the moving squeegee 36 in the same direction effects a greater penetration of the ink or dye onto the material being printed in that the time that the squeegee 36 is in contact with the screen 33 is enhanced, while at the same time permitting the printing and indexing operation to be simultaneously performed. The relative speeds of the squeegee 36 and the screen 33 moving in the same direction are further synchronized so that the respective squeegees 36 send up in the trailing well portion of the associated screens 33 at the end of the indexing movement of the belt and material. Accordingly, at the end of the printing and indexing operation, the squeegee actuating cylinder and piston assemblies 39A are actuated to raise the squeegees 36 off their respective screens 33 to a non-printing position. Upon the raising of the respective squeeges 36 off their respective screens 33, the piston and cylinder assemblies 29A operating on one of the side rails 29 of the printing head are raised to gradually separate one side of the screen 33 from the material being printed. Sequentially thereafter, the other piston and cylinder assemblies 30A operating on the other rail 30 of the screen printing head 28 are actuated to complete the raising of the screen 33 above the level of the material.

At this point, the screen 33 is raised in a horizontal position to engage the flood bar 41. With the flood bar 41 in engagement with the screen 33, the motor 44 is reversed to drive the carriage 23 and screen 33 secured thereon in the opposite direction to return the same to start position. During this portion of the operation, the carriage grippers 26 are released to free the belt and material, and the fixed grippers 20 actuated to hold the belt and matereial fast in its stopped position. As the screen 33 is being returned to its initial start position, the squeegee drive means 42 is also actuated to return the squeegee carriage 35 to its normal start position.

In returning the screen 33 to its start position, the flood bar 41 acting on the raised screen 33 coats the surface of the screen 33 with ink or dye as the ink is returned to the leading well portion of the screen. Upon completion of the return stroke, the flood bar 41 and the squeegee 36 are located in the leading well portion of the screen. At this point of the cycle, the screen 33 and the respective squeegee 36 are lowered from their non-printing position to their printing position whereupon the carriage gripping means 26 are again actuated to secure the carriage to the belt and material supported, and the fixed gripper 20 released to free the belt and material. Thus, the cycle from the table 18 is to be repeated.

From the foregoing description, it will be noted that the printing and indexing operations are simultaneously performed while both the squeegee 36 and screen 33 are being independently moved in the same direction and at varying relative speeds. Also, the arrangement is such that at the end of a screen printing and indexing operation, the screens 33 are angularly raised in a gradual manner off the screen by a side-to-side sequential movement.

While the instant invention has been described with respect to a particular embodiment thereof, it will be appreciated that the invention is not to be taken as limited to all of the details thereof, as modifications and variations thereof may be made without departing from the scope or spirit of the invention.

What is claimed is:

1. A method of screen printing successive designs on a continuous strip of material comprising the steps of:
   - positioning a screen having a stenciled portion with a leading and trailing well portion on opposite sides thereof and an associated movable squeegee onto the material to be printed whereby said squeegee is adapted to be disposed in the leading well portion of the screen, and
   - printing and indexing said material simultaneously by moving both the screen and the material to be printed in the same direction and at the same speed at predetermined amounts relative to said associated squeegee acting on said screen, and
   - moving said squeegee during said printing and indexing step in the same direction as the travel of said moving screen and material whereby said moving squeegee forces the color in the leading well of the moving screen through the stenciled portion thereof and onto the material moving with said screen and squeegee, and
   - including the step of moving the screen and material at a rate of speed which is greater than the speed of the squeegee moving in the same direction during the indexing and printing step.

2. The invention as defined in claim 1 and including the steps of:
   - (a) maintaining the material fixed after the termination of the printing and indexing step, and
   - (b) raising the screen and associated squeegee off the material, and

(c) returning the screen and associated squeegee to their respective starting position in readiness to repeat the operation.

3. The invention as defined in claim 2 and including the step of raising the screen off the material by first raising one side thereof and then raising the other side thereof.

4. A method of screen printing repeating designs on a continuous strip of fabric material comprising the steps of:

(a) positioning a strip of fabric material on a support,

(b) fixing said material to said support so as to be immovable relative thereto,

(c) placing a printing head including a screen having a stenciled portion with oppositely disposed leading and trailing well portions, and an associated movable squeegee onto the material fixed on the support so that the squeegee is initially disposed in the leading well portion of the screen and extends transversely thereof,

(d) securing the printing head positioned on said material to said support in a manner to prohibit relative linear movement between said support, material, and printing head,

(e) indexing and printing the material simultaneously by longitudinally moving the printing head and the support secured thereto with the material fixed therebetween in a linear direction a predetermined amount relative to said associated squeegee acting on the screen to force the color through stenciled portions of the screen and onto the material,

(f) moving said associated squeegee longitudinally relative to said moving screen in the same direction in which screen and material is moving an amount sufficient to position said moving squeegee in the trailing well portion of the screen and at the end of the indexing and printing movement of said printing head whereby the moving squeegee acting on the moving screen forces the color through the stencil portion of the screen, and

(g) moving said squeegee in said same direction at a slower rate of speed than that of said screen and material,

(h) raising the squeegee vertically above the screen at the termination of said printing and indexing movement, to repositioning the screen to a level plane above the material at the end of said indexing and printing step,

(i) and raising one side of the screen off the material before the other side of the screen at the end of said printing and indexing movement of the screen so that the screen is completely off the material,

(j) and returning the printing head and associated squeegee to their respective initial starting non-printing position in readiness to repeat the operation.

5. A method of continuously screen printing sequential designs on a continuous strip of material comprising the steps of:

(a) positioning a screen having a stenciled portion with an associated movable squeegee onto the material to be printed whereby the squeegee is disposed normal to the movement of the material to be printed,

(b) indexing said material by simultaneously moving both the screen and material to be printed at the same speed and in the same direction through a predetermined amount sufficient to cover the area to be printed,

(c) printing said material simultaneously with the indexing of said material by moving said squeegee at a slower rate of speed relative to the speed of said screen and in the same direction in which the screen and material is being indexed, and

(d) synchronizing the relative movement of said squeegee and the movement of the screen traveling in the same direction so that the printing stroke of the squeegee terminates with the termination of the indexing movement of the screen and material.

6. An apparatus for continuously screen printing repeating designs on a strip of material comprising a frame, a movable conveyor for the material to be printed, a printing head including a carriage movably mounted on said frame, a screen carried by said carriage, a squeegee associated with said screen mounted on said frame, means for moving said screen and mounted squeegee between operative printing position and inoperative non-printing position, means for gripping said movable conveyor and material supported thereon to said carriage in the printing position of said screen and associated squeegee, means for moving said carriage, said screen carried thereby and the conveyor gripped thereto a predetermined amount to index said material, and means for independently moving said squeegee in the same direction as the indexing material to effect a printing operation, and including means for moving the squeegee at a slower rate than the movement of said screen during the indexing and printing operation.

7. The invention as defined in claim 6 and including means to synchronize the relative movements of the screen and squeegee traveling in the same direction so that at the end of the indexing and printing step the squeegee would have traversed the width of said screen.

8. An apparatus for screen printing a continuous strip of material comprising a frame, a printing means including a screen reciprocally mounted on said frame and vertically movable between printing and non-printing positions, a squeegee means extending transversely of said printing head, said squeegee being movable vertically between printing and non-printing position, conveyor means disposed below said printing head, means for securing a strip of material in said conveyor means, means for independently moving said printing head and squeegee into printing position onto said material, means for securing said printing head to said conveyor means in printing position, means reciprocating said printing head, conveyor and material connected thereto during a printing operation, and means for effecting independent movement of said squeegee in the same direction as the movement of said printing head and connected belt and material during a printing operation, said reciprocating means moving said printing head, conveyor means, and material at a rate of speed which is greater than the movement of the squeegee.

9. An apparatus for screen printing repeating designs on a continuous strip of material comprising:

(a) a frame,

(b) a movable means mounted on said frame for supporting thereon the material to be printed,

(c) a printing head including a carriage reciprocally mounted on said frame,

(d) a screen supported on said carriage for movement therewith,

(e) means for effecting vertical movement of said screen between printing and non-printing positions,

(f) means for securely gripping the movable support to said printing head as said screen is moved into printing position on said material,

(g) a squeegee means operatively associated with said screen,

(h) means for moving said squeegee between printing and non-printing positions relative to said screen,

(i) drive means for indexing said carriage and said movable support with the material fixed thereon and gripped thereto when said screen and associated squeegee are disposed in printing position whereby said printing head moves said screen relative said squeegee to force the color through the screen and onto said material,

(j) and means for effecting independent movement of said squeegee in the same direction as the movement of said printing head during a printing operation at a

slower rate of speed relative to that of the printing head and material secured thereto.

10. An apparatus for successively screen printing a series of sequential designs as a strip of material comprising:

(a) a frame means,
(b) an endless conveyor for supporting the material to be printed mounted on said frame means,
(c) means for holding said conveyor fast to said frame means between indexing and printing operations,
(d) a printing means including a screen movably mounted on said frame,
(e) means for moving said screen between printing and non-printing positions,
(f) and means for securing said printing means to said conveyor during a printing and indexing operation,
(g) a squeegee associated with said screen,
(h) means for effecting independent vertical movement of said squeegee between printing and non-printing positions,
(i) means for driving said printing head and screen with conveyor secured thereto for indexing said conveyor a predetermined amount to cover the area to be printed relative to said squeegee, and
(j) means for simultaneously moving said squeegee at a slower rate of speed relative to said moving printing head and in the same direction as the movement of said printing head and screen during the printing and indexing operation.

11. An apparatus for screen printing a continuous strip of material comprising:

(a) a frame,
(b) an endless conveyor adapted to support the material to be printed mounted on said frame,
(c) a carriage reciprocally mounted on said frame,
(d) a printing head including a screen carried by said carriage, said screen being disposed above the conveyor and the material disposed thereon,
(e) means for effecting vertical movement of said screen between printing and non-printing positions,
(f) a squeegee extending transversely of said screen,
(g) means for effecting independent vertical movement of said squeegee relative to the screen between printing and non-printing positions,
(h) means for securing said carriage to said conveyor when said printing head and screen are in printing position,
(i) means for driving said carriage, printing head and screen carried thereby, and the belt secured thereto for indexing said belt and material carried thereon an amount sufficient to cover the area of the material to be printed relative to said squeegee, and
(j) means for simultaneously moving said squeegee across the screen and in the same direction at a slower rate of speed relative to that and screen is moving during a printing operation.

12. An apparatus for screen printing a continuous strip of material comprising:

(a) a frame,
(b) a conveyor adapted to support the material to be printed movably mounted on said frame,
(c) a printing carriage reciprocally mounted on said frame,
(d) a printing carriage including a screen disposed above the conveyor and the material disposed thereon,
(e) means for effecting vertical movement of said screen between printing and non-printing positions,
(f) a squeegee extending transversely of said screen,
(g) means for effecting independent vertical movement

of said squeegee relative to the screen between printing and non-printing positions,
(h) means for driving said carriage conveyor to synchronize the movement of said carriage and conveyor during a printing operation,
(i) means for simultaneously moving said squeegee across the screen in the same direction and at a slower rate of speed relative to the movement of said printing carriage and conveyor during a printing operation.

13. An apparatus for successively screen printing a series of sequential designs on a strip of material comprising:

(a) a frame,
(b) a pair of spaced apart end rollers journalled on said frame,
(c) an endless belt stretched over said end rollers, said belt being adapted and supported thereon the material to be printed,
(d) a printing carriage reciprocally mounted on said frame for movement longitudinally of said frame,
(e) a printing head carried on said carriage,
(f) said printing head including a single rail member mounted on each side of said carriage,
(g) means for mounting each of said rails for vertical movement relative to said carriage whereby each of said rails are sequentially actuated to effect raising one rail before the other from a printing position to a non-printing position,
(h) said means including a piston and cylinder assembly,
(i) a pair of space cross-heads are connected between said rails,
(j) a screen connected to and between said cross-heads,
(k) said piston and cylinder assembly being actuated to raise and lower said printing head and screen carried thereon between printing and non-printing position,
(l) a squeegee carriage reciprocally mounted on said frame for movement relative to said printing carriage,
(m) said squeegee carriage including a rail disposed along either side thereof,
(n) means for mounting said squeegee rails for vertical movement between a printing and non-printing position,
(o) a squeegee connected to and between said squeegee rail,
(p) means for securing said printing carriage to said belt, said means being rendered operative to effect its indexing of said belt and material supported thereon upon movement of said carriage,
(q) drive means for moving said printing carriage and belt secured thereto during an indexing operation,
(r) and, an independent drive means for moving said squeegee carriage in the same direction at a lesser rate of speed than the movement of said printing carriage so that said squeegee and printing head move in the same direction at relative rates of speed to enhance the penetration of color through said screen.

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