

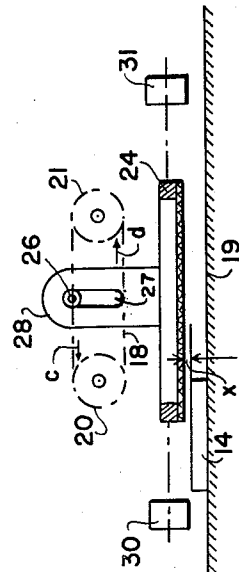
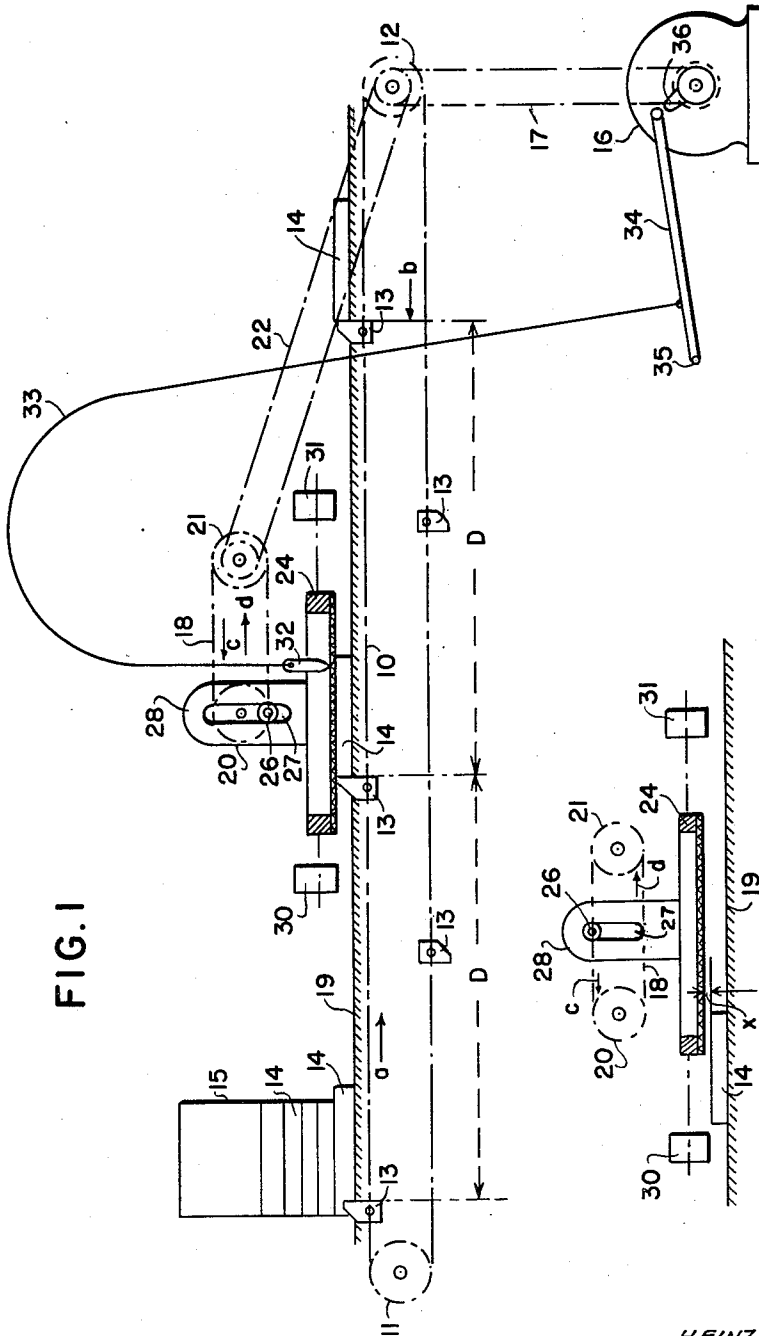
Feb. 26, 1963

HEINZ-ULRICH KERSTAN
SCREEN STENCIL PRINTING MACHINE

3,078,792

Filed May 4, 1961

2 Sheets-Sheet 1



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3,078,792

SCREEN STENCIL PRINTING MACHINE

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Filed May 4, 1961, Ser. No. 107,761

Claims priority, application Germany May 19, 1960

8 Claims. (Cl. 101-126)

The present invention relates to screen stencil printing machines and has for its main object the provision of an automatically operating machine of this type being especially suitable for the printing and/or ornamenting of flat articles or devices having a flat surface and designed both to improve the performance and to increase the operating efficiency in printing or ornamenting large numbers of articles or devices.

The known constructions of screen stencil printing machines all have in common that the articles or devices to be printed and/or the printing screen or screens are fed or operated intermittently or in step-by-step fashion, with the printing operation or ornamentation being carried out either during or at the end of the intermittent feed movements or operations, depending upon the special design and construction of the machine being used.

This intermittent operation or movement of the articles and/or printing screen not only results in a reduced overall operating efficiency, especially in quantity or mass production operations, or where a large number of articles or devices are to be printed at increased speed, but furthermore involves a substantial increase of the number of difficulties in properly aligning or registering the articles in relation to the printing screen or screens, in case of multiple printing and/or ornamenting operations.

Accordingly, further object of the invention is the provision of an improved automatic screen stencil printing machine designed especially for use in connection with flat printing articles or articles having a flat printing surface, whereby any intermittent operation or movement of either the printing articles and/or the printing screen is substantially avoided.

Another object of the invention is the provision of an improved automatic screen stencil printing machine of this type by which the positioning or registry of the printing articles in relation to the printing screen or screens is greatly facilitated, in such a manner as to result in improved operating performance and increased operating speed of the machine in connection with mass or quantity production processes or operations.

Yet another object of the invention is the provision of an automatic screen stencil printing machine of the above type which is both simple in design, efficient in operation, as well as highly reliable in use, compared with printing machine constructions heretofore known in the art.

The invention, both as to its ancillary objects and novel aspects, will be better understood from the following detailed description taken in conjunction with the accompanying drawings, forming part of this specification and wherein:

FIG. 1 is a diagrammatic elevational view of an automatic screen stencil printing machine constructed in accordance with the principles of the invention;

FIG. 2 is a partial view of FIG. 1 showing a modification thereof;

FIGS. 3 to 5 are partial views on an enlarged scale, illustrating different conveyers and pickup means for feeding the printing articles in a machine according to FIG. 1;

FIG. 6 is a diagrammatic elevational view of a modified

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printing machine construction according to the invention; and

FIG. 7 is a top view of the multiple printing screen carrier forming part of FIG. 6.

Like reference characters denote like parts in the different views of the drawings.

With the foregoing objects in view, the invention, in its preferred embodiment, involves generally the provision of a first continuously moving conveyor in the form of a belt, chain, or the like driven by guide rollers, to provide a pair of parallel portions moving in opposite directions, said conveyor being provided with multiple pickup means spaced at equal distances from each other to pick up and feed the articles to be printed to a position of operative relation with a printing screen. The latter is supported and operated by a second continuously moving endless conveyor also passing over or driven by guide rollers, to provide a pair of parallel portions moving in opposite directions and adjoining said first conveyor. Both conveyers are driven by a common drive means in such a manner as to move with equal translatable speeds, with the relative position of the conveyers and the relationship between the length of the second conveyor and the spacing distances of the articles fed by the first conveyor as determined by said pickup means being such as to cause the printing screen to be reciprocated and operated intermittently into relatively stationary printing position with the successive printing articles fed by said first conveyor.

A stationary squeegee or the like device being synchronized with or operated in predeterminedly timed relation to said drive means or conveyers may be provided for cooperation with the screen during the operating or printing periods, for the purpose of working or forcing the color or printing pigment through the screen and unto the printing material, in a manner well known. In other words, despite the continuous movement of both the printing articles and printing screen, the screen is operated intermittently to printing position for cooperation with the articles to be printed, without the necessity of intermittent movement or operation of either the articles or the screen.

As a result of the continuous movement of both the printing articles and printing screen, or the absence of any accelerating or decelerating forces, the operating speed of the machine may be increased at least one hundred percent, compared with known printing machines of similar type and involving the feeding or operation of the articles and/or the printing screen in steps or by intermittent movements or operations, aside from the other advantages, both in respect to construction and operation, of a continuous feed or operation of the printing material and screen, such as positioning or registration of the articles, as will become more apparent as the following description proceeds.

Referring more particularly to FIG. 1 of the drawings, the numeral 10 indicates a first endless continuously moving conveyor passed over guide rollers or gears 11 and 12, to provide a pair of parallel portions moving in opposite directions, as indicated by the arrows *a* and *b* in the drawing. Secured to the conveyor 10 at suitably spaced distances *D* from each other are a plurality of pickup devices 13 adapted to pick up and to sequentially feed the articles to be printed, such as plates 14 or the like, stacked or stored in a container 15, as shown in the example illustrated. According to a simple embodiment of the invention, the devices 13 may be in the form of pickup dogs or lugs extending at right angles to the conveyor 10, in such a manner as to engage and move the lowermost article 14 of the stack along a feeding path or platform 19 to the printing station or position.

The conveyer 10 may be continuously driven or operated at a desired translatable speed by the provision of any suitable drive or operating means, such as an electro-motor 16 driving the guide roller or gear 12 through a chain, belt or equivalent drive means 17, as shown schematically in the drawing.

The printing device proper comprises a further endless and continuously moving auxiliary conveyer 18 which, in the example shown with both the conveyers 10 and 18 or the driving axes being parallel to one another, has a total length equal to the spacing distances between the pickup devices 13 or articles 14, respectively, fed by the conveyer 10. The auxiliary conveyer 18 which may be passed over guide rollers or gears 20 and 21 similar to the conveyer 10, to provide parallel portions moving in opposite directions, as indicated by the arrows *c* and *d* in the drawing, is driven synchronously with or at the same translatable speed as the conveyer 10 by the provision of suitable motion transmitting or coupling means operably connecting it with the common drive or motor 16, such as in the form of a further chain or belt drive 22 connecting the rollers or gears 12 and 21, as shown by the example illustrated.

Linked to the auxiliary conveyer 18, preferably through a slidable slot and pin coupling is a printing frame 24 having stretched thereon the usual silk, metal or the like screen 25 which carries the stencil for the characters or design to be printed upon the articles 14, in a manner well known to those skilled in the art. The coupling between the conveyer 18 and the screen 25 or frame 24 comprises, in the example shown, a pin 26 secured to the conveyer 18 and arranged to slide within a vertical slot 27 in a connecting member 28 carrying or supporting the frame 24. As a consequence, the frame 24 will be operated to and maintained in a position close to and in operative printing relation with the articles 14 while moving in one direction, as indicated by the arrow *d*, and will be retracted or caused to move in the opposite direction, as indicated by the arrow *c* and shown by FIG. 2, the reciprocating movements of the frame or printing screen being synchronized with the conveyer 10 or the sequential feed movements of the articles 14 to be printed.

According to the construction of FIG. 1, the guide slot 27 is so designed such as to cause the screen 24 to be reciprocated in a single plane in cooperation with suitable guide means, as indicated schematically at 30 and 31 in the drawing. In operation, as one of the articles 14 reaches the starting point of the printing operation, as shown in the drawing, the screen 24 also assumes the proper position in registry with the article, whereupon both the article and screen move at the same translatable speed in the direction of the arrow *a* or without relative displacement between one another during a complete operating or printing cycle. The latter is further controlled by the provision and operation of a stationary squeegee 32 which may have the usual rubber or the like plate cooperating with the screen 25 for the purpose of working the printing color or pigment carried by the screen through its open meshes and unto the printing material, in a manner well known. There is shown for this purpose a mechanical coupling or operating member in the form of a bent leaf spring 33 having one end connected to the squeegee 32 and having its opposite end connected to an intermediate point of a lever arm 34 provided with a fixed pivot 35 at one end and having its opposite end engaging a cam 36 driven by the motor 16, if necessary, through suitable intermediate gearing. Furthermore, the construction of the squeegee-operating means or coupling is such that the squeegee engages the screen 24 at the exact instant of the starting or initiation of a printing operation, that is, when the article and screen are in proper register, as indicated by the position shown in the drawing, and that the squeegee is retracted to an inoperative position be-

tween successive printing cycles or return movements of the screen by the conveyer 18.

As an alternative to the mechanical control means for the squeegee 32 shown for illustration, the same may be operated to and from operative or printing position synchronously with the feeding of the articles or operation of the printing screen, in any other suitable manner, such as by means of a solenoid or electromagnetic actuator having an exciting circuit closed and opened by a microswitch or the like actuating device cooperating with the cam 26, or operated in any other suitable manner by the motor or common drive means of the device.

There is thus provided by the invention a screen stencil printing device of simple construction, wherein in spite of the continuous movement of both the printing screen and printing material, successive intermittent printing operations or cycles may be effected efficiently and reliably and at relatively high speed.

According to modification of the invention as shown by FIG. 2, the guide slot 27 in the coupling member 28 may be so designed or positioned relative to the conveyer 18 as to cause the screen 25 or frame 24 to be retracted or lifted from the articles 14 during its return or inoperative movement in the direction of arrow *c* such as to provide a free space or clearance *x* as shown in the drawing. For this purpose, the guides 30 and 31 are so constructed as to afford both a horizontal and vertical movement of the screen.

According to one constructional embodiment of the invention, especially suitable for the printing of flat articles such as plates, discs, etc., the conveyer 10 may be in the form of an endless chain passing over gears or sprocket wheels and having secured thereto the pickup lugs 13, as shown by FIG. 3. Alternatively, the conveyer may be fitted with suitable supports or platforms 38 adapted to receive and hold the articles to be printed which may be of any shape, as shown by FIG. 4. Furthermore, the conveyer may be in the form of a flexible belt provided upon its inside surface with teeth 40 in the manner of a rack guided and/or driven by gears or sprockets, in a manner well understood and shown by FIG. 5 of the drawings. The same applies to the construction of the auxiliary conveyer 18 carrying the printing frame 24.

Referring to FIG. 6, there is shown a modified screen stencil printing machine construction according to the invention which differs from FIG. 1 by the arrangement of the auxiliary conveyer 18 in a plane being at right angle to the plane of the main conveyer 10 feeding the articles to be printed. This construction makes it possible to employ two printing frames carried by the same conveyer, which, in turn, results in a reduction of the spacing distance *D* between the articles by one half compared with the construction of FIG. 1. As a consequence, the operating efficiency of the device may be increased by one hundred percent or more by the improved construction of this type.

More specifically, in FIG. 6 the guide rollers or gears 20 and 21 for the conveyer 18 are arranged to rotate about vertical axes with the roller 21 being shown driven synchronously with the conveyer 10 by the motor 16 through suitable coupling or transmission means, shown in the form of conical gearing 38 interposed between the drive belt or chain 22 and the roller 21. The conveyer may carry a pair of similar printing screen frames 24 and 24' equally spaced from one another and being advantageously additionally guided by the provision of further guide means indicated at 40, 41, 42 in the drawing. As pointed out hereinbefore, in a device of this type where the articles 14 to be printed and fed by the conveyer 10 are spaced by only one half of the distance *D* from each other, compared with the arrangement of FIG. 1, the speed of operation or efficiency of the device may be substantially increased, an advantage being of special importance in mass or quantity production operations.

In place of a single printing operation as described, the

device according to the invention may be used or modified in a simple manner for multiple printing, such as by the provision of a further auxiliary conveyer and printing screen following the screen 24 at a distance D from the latter in the direction of movement of the main conveyer 10, in such a manner as to insure an exact registry of the following screen with the article to be printed, provided further the second screen to be driven at the same trans-
latory speed as and synchronized with the screen 24. This may be achieved by a drive similar to the drive connecting the conveyer of the screen 24 with the common prime mover or motor 16.

In the foregoing the invention has been described in reference to a specific illustrative device. It will be evident, however, that variations and modifications, as well as the substitution or equivalent elements or parts for those shown herein for illustration, may be made without departing from the broader purview and spirit of the invention, as set forth in the appended claims. The specification and drawings are accordingly to be regarded in an illustrative rather than in a restrictive sense.

I claim:

1. In screen stenciling apparatus for printing flat articles, an elongated horizontal platform, a first endless moving carrier with guide and operating means therefor to provide a portion thereof adjacent and moving parallel to said platform, pickup and positioning means upon said carrier to locate and feed articles to be printed along said platform, a flat printing screen, a second endless carrier with guide and operating means therefor to provide a pair of spaced and parallel portions thereof moving in opposite directions adjacent and parallel to said platform, drive means to operate both said carriers continuously and at equal translatable speeds, a vertically slidable coupling connection between said screen and said second carrier, to effect periodic reciprocating and up-and-down movements of said screen, said positioning means being operably coordinated with said second carrier and screen such as to cause said screen to be lowered upon said platform and into printing position with said articles during its operative reciprocating half-cycles, and to cause said screen to be raised from said platform during its alternate inoperative reciprocating half-cycles, respectively.

2. In screen stenciling apparatus as claimed in claim 1, a support for said screen, said coupling connection being comprised of a pin secured to said second carrier and engaging a vertical slot in said support.

3. In screen stenciling apparatus as claimed in claim 1, a frame supporting said screen and having a vertical extension, said coupling means being comprised of a pin secured to said second carrier and engaging a vertical slot in said extension.

4. In screen stenciling apparatus as claimed in claim 3, said slot having a length such as to cause said screen to engage the articles upon said platform during its operative reciprocating half-cycles and to be retracted from said platform by a predetermined distance during its inoperative reciprocating half-cycles, respectively.

5. In screen stenciling apparatus as claimed in claim 1, a stationary squeegee and means to intermittently operate the same into operative engagement with and to retract it from said screen during and after a printing cycle, respectively, in synchronism with the screen operation.

6. In screen stenciling apparatus for printing flat articles, an elongated horizontal platform, a first endless moving carrier with guide and operating means therefor to provide a portion thereof adjacent and moving parallel to said platform, a plurality of pickup and positioning members upon said carrier spaced by a predetermined constant distance from each other, to locate and to successively feed articles to be printed along said platform, a flat printing screen, a second endless carrier with guide and operating means therefor to provide a pair of spaced parallel portions thereof moving in opposite directions adjacent and parallel to said platform, drive means to operate both said carriers continuously and at equal translatable speeds, a vertically slidable coupling connection between said screen and said second carrier, to effect periodic reciprocating and up-and-down movements of said screen, said predetermined spacing distance being equal to the length of said second carrier and said positioning members being operatively coordinated with said screen and second carrier such as to cause said screen to be intermittently lowered upon said platform and into printing engagement with said articles during its operative reciprocating half-cycles, and to cause said screen to be raised from said platform during its alternate inoperative reciprocating half-cycles, respectively.

7. In screen stenciling apparatus as claimed in claim 6, a frame supporting said screen having a vertical extension, said coupling connection being comprised of a slot and pin coupling connecting said extension with said second carrier, said slot having a length such as to cause said screen to engage the articles upon said platform during its operative reciprocating half-cycles and to be retracted by a predetermined distance from said platform during its inoperative reciprocating half-cycles, respectively.

8. In screen stenciling apparatus as claimed in claim 6, a stationary squeegee and means to intermittently operate the same into engagement with and to retract it from said screen during and after a printing cycle, respectively, in synchronism with the screen operation.

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