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3,137,230

AUTOMATIC SCREEN PRINTING MACHINE BY VACUUM METHOD

Filed Nov. 29, 1961

3 Sheets-Sheet 1

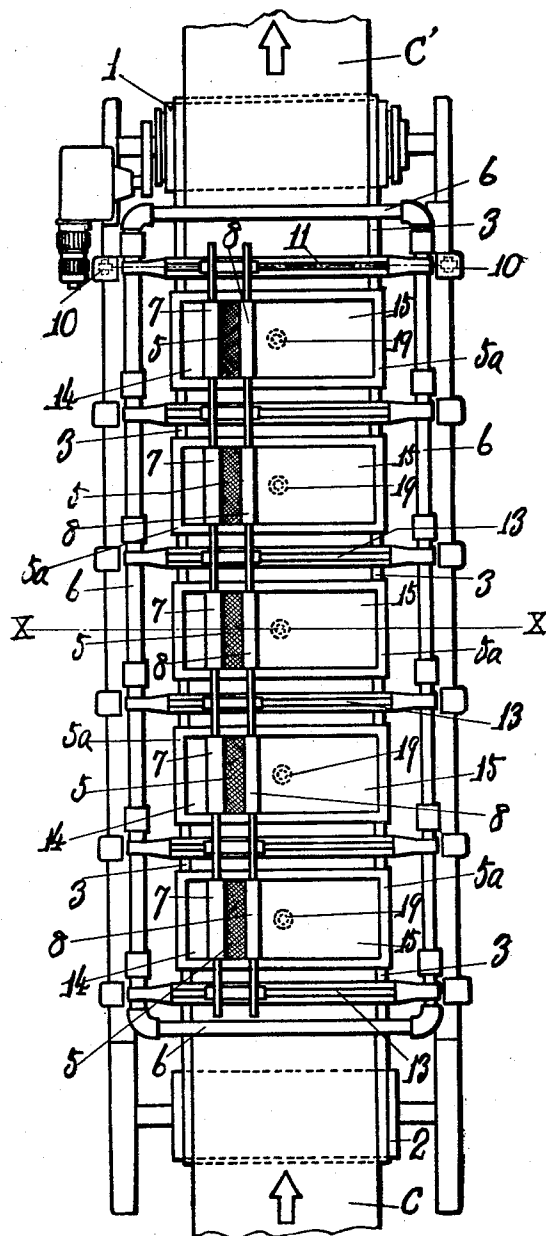


FIG. 1

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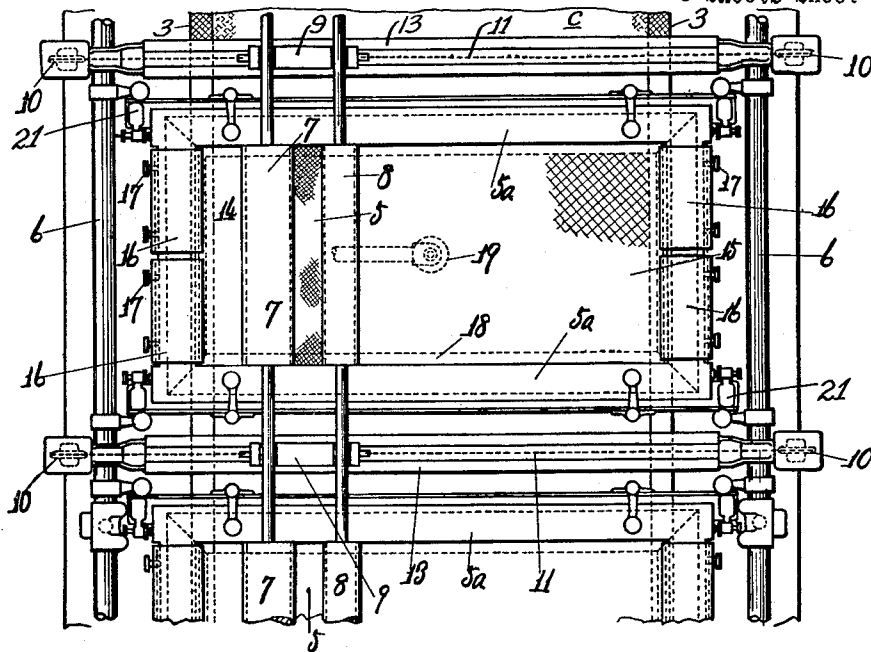


FIG. 4

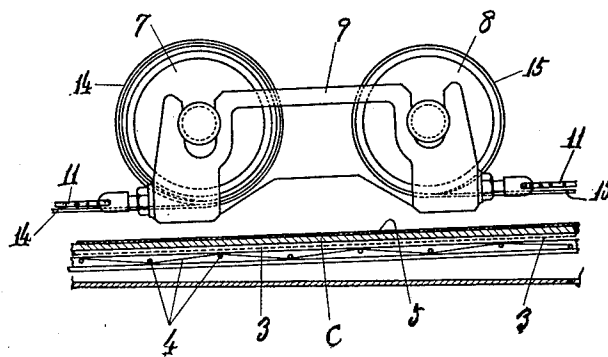


FIG. 5

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AUTOMATIC SCREEN PRINTING MACHINE BY VACUUM METHOD

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4 Claims. (Cl. 101-115)

This invention relates an automatic screen printing machine for screen printing while using a vacuum in which dyestuffs can sink into whole thickness of somewhat thick cloth such as a curtain or table-cloth as well as very thick cloth such as a carpet or a blanket, so that the same multi-colored pattern can be printed on the both sides of cloth to be printed. In the apparatus according to the invention, a plurality of vertically movable screens with the patterns to be printed are arranged above the endless belt which is stretched around driving and driven rolls. Dye is poured into each printer, which is composed of two rollers arranged in parallel, which go back and forth on the screen. During intermittent stoppage of the above endless belt, each screen descends and comes in contact with the cloth on the endless belt. By the movement of the rollers on the screens, and absorbing action of vacuum produced only in the area between two rollers of the printer, and covering the other parts of the screen, both sides of the cloth attached on the endless belt are printed, because dyestuff on the screen passes through the pattern of each screen, and finally sinks into the whole thickness of the cloth. After the printing action, each screen ascends and is separated from the cloth. During ascension of screens, the endless belt and the cloth are advanced through the required interval. During the stoppage of the endless belt, the printing action is performed as above mentioned. These actions are repeated alternately, and for this purpose the automatic screen printing machine is equipped with a small vacuum pump and can print the same pattern on the both sides of cloth at the same time clearly without any distortion of the pattern.

A detailed explanation of the invention will be given with reference to the accompanying drawings.

FIG. 1 is a plan view of a typical embodiment of a screen printing machine according to this invention equipped with 5 screens.

FIGS. 2 and 3 are parts of a cross-sectional view of the screen printing machine of FIG. 1 taken on X—X, the parts of the cross-sectional view being broken at line Y—Y.

FIG. 4 is an enlarged plan view of a part of the apparatus of FIG. 1.

FIG. 5 is a detailed view of the printer.

FIGS. 1 to 4 show the printing machine in which each printer is moved back and forth transversely to the length of an endless belt. In FIG. 1, a driving roll 1 and a driven roll 2 have an endless belt 3 stretched around them and the belt is advanced by a mechanism (not shown) attached to driving roll 1. The belt 3 is a wire-netting made of stainless steel or bronze by blanking or weaving, or a net made of synthetic resin fibers. C is a cloth to be printed which is attached to the belt 3 adjacent the driven roll 2 and separated adjacent the driving roll 1. C' is the printed cloth which is produced by the machine. Screens 5 are each mounted in a top frame 5a. Each screen is positioned above the belt 3. The number of the screens must be the same as that of the colors to be printed. (In the figures, the machine has five screens.) Each screen is stretched by the corresponding top frame 5a respectively. These top frames 5a are mounted on a vertically movable frame 6 by means of branch frames 21, and go up and down intermittently together with the

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frame 6. During descent of the screen frames, each screen comes in contact with the cloth C on the belt 3. The vertical motion of the frames 5a and 6 is performed by other mechanism (not shown in the figures). On each screen, a printer is carried. Under the above mentioned belt 3, a strong and rough network 4 (which is made of the same material as that of belt 3, lets dyestuff pass freely and supports the screens) is stretched, held and fixed by bottom frames 4a, which are the same size and in the same shape as the top screen frames 5a and which are mounted on supports 22 on main frame 23.

The printer is composed of two rollers 7, 8 as shown in the detailed FIG. 5. These rollers are spaced from each other at a sufficient mutual interval to store the required quantity of dyestuff between them. The rollers 7, 8 have a length substantially equal to the spacing of the side frames of the top screen frames 5a, and are mounted on shafts 9a which in turn are mounted in brackets 9, 9 which are connected to opposite ends of the endless chain 11. Brackets 9 run on cross members 13 mounted on vertically movable frame 6. The chain is stretched around the chainwheels 10, 10, 20, 20 which are arranged on both sides of the machine frame 23. One of the shafts 12 of the above chainwheels is connected to driving means which can be reversed regularly (using the usual reversing equipment which is not shown, however). Rotation of the driving wheels can reverse movement of the chain at the proper time, resulting in back and forth movement of the printer on the brackets 9 and 9. Sometimes, the chain 11 has means coupled thereto which always stretches the chain taut.

On the above mentioned rollers 7 and 8 of the printer, are wound belts 14 and 15 to cover approximately the whole surface of the screens. One end of each of these cover belts 14 and 15 is connected to the corresponding rollers 7 and 8 respectively, and are rolled up by these rollers respectively. The other ends of the cover belts are fixed to the end members of top screen frames 5a, 5a by the fittings 16, 16. These fittings are made from U-shaped bars as shown in FIGS. 2 and 3. The one ends of the fittings clamp the cover belts and the other ends are fixed by the setting screws 17 which enable the cover belts to be installed and taken off easily. The above cover belts are made of either thin leather or filled cloth (by painting) or celluloid or soft material such as vinyl chloride or polyethylene through which air cannot pass.

When these belts cover the top screen, air cannot be drawn through the top screen by vacuum acting under the surface of bottom screen 4 except between rollers 7 and 8. When the bracket 9 moves, for example, to the right from the position as shown in FIGS. 2 and 3, the cover belt 14 is unrolled by the roller 7, and the other cover belt 15 is rolled up on the roller 8, being continuously stripped off the surface of the screen. On the other hand, when the bracket 9 moves to the left from one end of the screen, the cover belt 14 is rolled up on the roller 7, and the belt 15 is unrolled from the roller 8. In this way, the vacuum draws air only through the small space between the rollers 7 and 8. On the other parts of screen covered by belts 14 and 15, the vacuum has no effect. Therefore, the printing can take place only in the said small space between the rollers 7 and 8, so that small force of the vacuum is sufficient to print such a small part of cloth limited by the interval of rollers 7 and 8. In the above-mentioned way, the dyestuff can be easily caused to flow completely through the cloth to the under surface of cloth through the screens due to the force of the vacuum acting on such a small space.

A shallow funnel shaped pan 18 is arranged under whole area of the bottom screen 4. The pan is connected to a pipe 19 which is in turn connected with a vacuum source composed of a vacuum pump, vacuum

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vessel or the like. The vacuum from the vacuum source acts in the pan 18 at all times or during a certain interval (for example, only during descent of the screen), and therefore draws the dyestuff stored between the rollers 7 and 8 down through the cloth. The dyestuff which has been drawn down through the bottom screen 4 is drawn through the pipe 19, and is returned to the printer through a cyclic system. Air in the pipe 19 is discharged through an outlet (not shown in the figure). When the rollers 7 and 8 come to the end of the screen, or are stopped at this position, no printing should take place, because printing may be done inaccurately. In order to prevent the screen from printing at this position before the rollers 7, 8 begin to move, either the margins of screens are covered, or no patterns are made on the margins of screens.

In operation, dyestuff is stored in each printer between the two rollers. The chains 11 are operated when the vertically movable frame 6 descends, that is, when the screens touch the cloth to be printed, and the printers move to the right or to the left and the vacuum acts only in the area between two rollers of each printer. Dyestuff penetrates through each screen and completely through the cloth to be printed, thus printing the same pattern on both sides of the cloth. While the vertically movable frame ascends, the printers return and the cloth to be printed, which is attached to the belt 3 advances by one pitch. When the vertically movable frame descends again, repetition of the above printing on the next new area of cloth becomes possible. Alternatively, the back and forth strokes of printer can take place at the same time the vertically movable frame descends. In the above-mentioned example, the printers move in a transverse direction to the cloth motion, but it is also possible to operate the printers in the same direction as the cloth motion.

The great advantage of this invention is that the required pattern can be printed on thick and wide cloth by a very small vacuum, because the vacuum acts only on the small gap between two rollers of each printer. This makes it possible to use vacuum equipment which is very small and the structure of the auxiliary elements is simple.

I claim:

1. A screen printing machine for printing a pattern which is the same on both sides of the cloth being printed, said machine comprising an intermittently driven porous endless cloth supporting belt for supporting the cloth to be printed, a vertically movable frame adjacent said cloth

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supporting belt periodically movable upwardly relative to the surface of said cloth supporting belt from a position in which said frame is on cloth on said supporting belt, and then downwardly, a plurality of top screen frames mounted on said frame at spaced intervals along said cloth supporting belt and above the surface of said cloth supporting belt, a printing screen in each frame, a printer for each screen movable across the screen from one edge to the other, each printer comprising a pair of rollers spaced from each other a short distance and each having a cover belt of air impervious material wound there-around with one end of each cover belt attached to a roller and the other attached to one of the edges of the screen between which the printer is movable, printer moving means to which said printers are attached for moving said printers back and forth across the screens while respectively winding and unwinding said cover belts, and a plurality of vacuum applying means immediately beneath said belt in fixed positions corresponding to the positions of said screen frames for applying a vacuum to areas beneath said cloth supporting belt corresponding to the areas of said screens.

2. A screen printing machine as claimed in claim 1 in which said vacuum applying means each comprises a bottom screen frame corresponding in size to a top screen frame, an air pervious bottom screen in said bottom screen frame, and vacuum pan attached to the edges of said bottom screen frame and extending downwardly from said bottom screen frame and being adapted to be connected to a source of vacuum.

3. A screen printing machine as claimed in claim 1 in which said printers are movable transversely to the direction in which said cloth supporting belt extends.

4. A screen printing machine as claimed in claim 3 in which said means for moving said printers comprise a pair of shafts on which said rollers are mounted, a bracket between each pair of top screen frames on which said shafts are mounted, a cross member corresponding to each bracket and on which said brackets run, said cross members being mounted on said vertically movable frame and extending in a direction transverse to the direction in which said cloth supporting belt extends, and driving means coupled to each bracket for moving said brackets back and forth along said cross members.

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