June 26, 1962 HISAKICHI ICHINOSE 3,040,657

INTERMEDIATE DRYING ARRANGEMENT FOR AUTOMATIC SCREEN PRINTING MACHINE

Filed April 8, 1960 3 Sheets-Sheet 1

Fig. 1

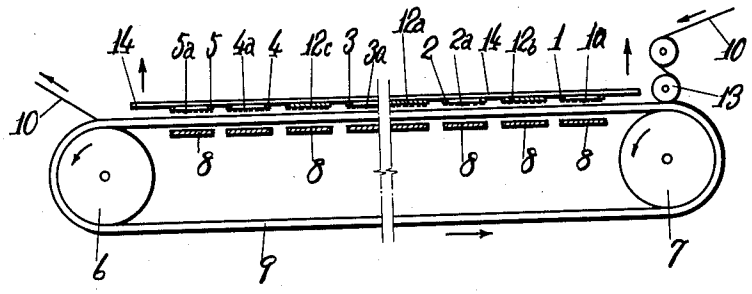
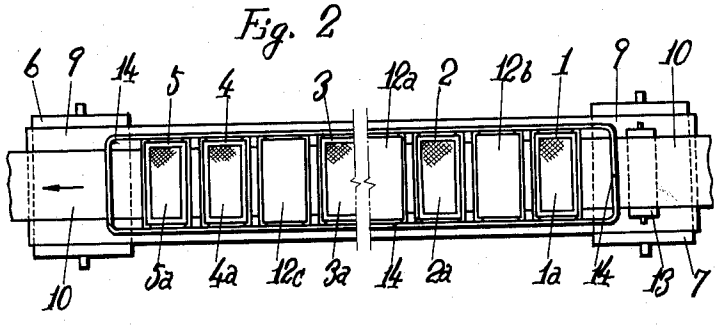


Fig. 2



HISAKICHI ICHINOSE
INVENTOR.

BY Wenderoth, Lind & Ponack
ATTORNEYS

June 26, 1962 HISAKICHI ICHINOSE 3,040,657

INTERMEDIATE DRYING ARRANGEMENT FOR AUTOMATIC SCREEN PRINTING MACHINE

Filed April 8, 1960 3 Sheets-Sheet 2

Fig. 3

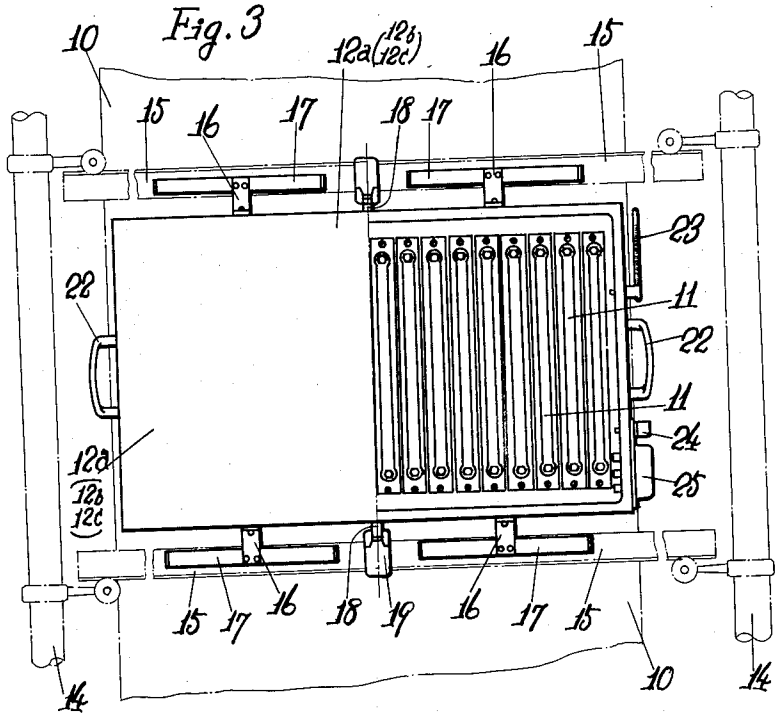
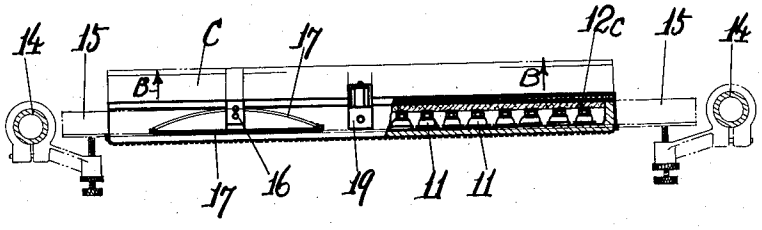


Fig. 4



HISAKICHI ICHINOSE
INVENTOR.

BY Wenderoth, Lind & Ponack
ATTORNEYS

June 26, 1962 HISAKICHI ICHINOSE 3,040,657

INTERMEDIATE DRYING ARRANGEMENT FOR AUTOMATIC SCREEN PRINTING MACHINE

Filed April 8, 1960 3 Sheets-Sheet 3

Fig. 5

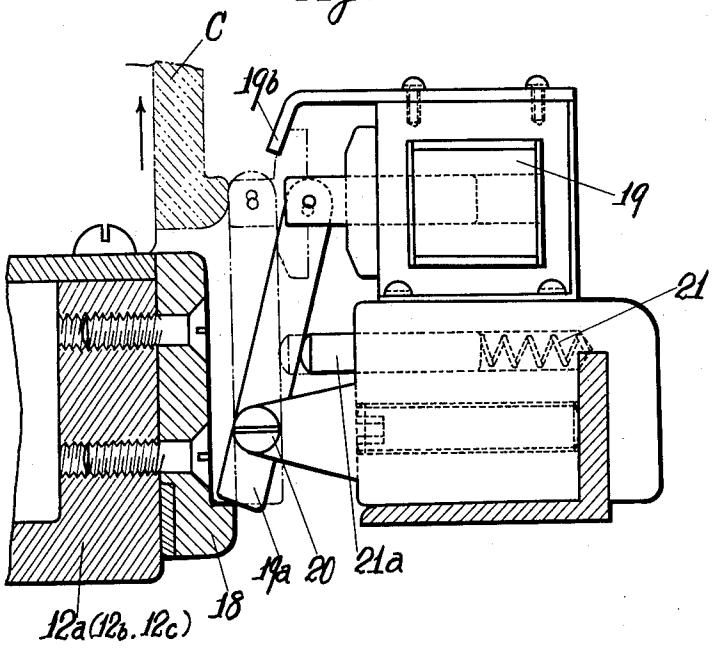
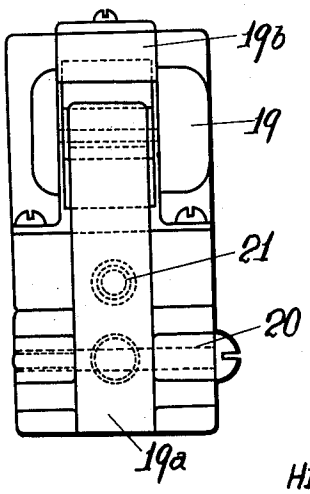


Fig. 6



HISAKICHI ICHINOSE
INVENTOR.

BY Wenderoth, Lind & Ponack
ATTORNEYS

United States Patent Office 3,040,657 Patented June 26, 1962

3,040,657

INTERMEDIATE DRYING ARRANGEMENT FOR AUTOMATIC SCREEN PRINTING MACHINE

Hisakichi Ichinose, 57 Sanbancho, Hyogo Prefecture, Koushien, Nishinomiya City, Japan

Filed Apr. 8, 1960, Ser. No. 20,858
Claims priority, application Japan Dec. 22, 1959
5 Claims. (Cl. 101—115)

This invention relates to drying means for automatic screen printing machines in which the drying means acts on the cloth being printed at points between the screens at times when the cloth is still and parts thereof are being printed.

The screen printing machines to which the present invention pertains have an endless belt which is advanced step by step, the belt carrying the cloth to be printed, the machine having screens which are lowered against the cloth when it has stopped after an advancing step.

The drying means of the present invention comprises heaters which are lowered onto the cloth after an advancing step at points between the points at which the screens are lowered onto the cloth, the heaters drying the color paste which has been placed on the cloth by a printing step at a position immediately preceding the position at which the heater comes down on the cloth. The heaters quickly evaporate the moisture in the color paste and dry it satisfactorily before the cloth is moved on to the next printing step. In this way, mixing of color paste, which occurs when wet printing paste is spread over paste which has not dried, is eliminated.

The invention further comprises means for automatically lifting the heaters from the cloth when the temperature rises too high or the heater has been applied to the cloth for too long a period of time. This prevents scorching when the apparatus does not function properly to move the cloth step by step or it is stopped for some reason.

As a result of the use of the present invention, screen printing can be carried out accurately and quickly, and complex and intricate patterns can be easily printed.

For a more complete understanding of this invention, reference is made to the following description and to the attached drawings, in which:

FIG. 1 is a schematic side elevation view of an automatic screen printing machine provided with an intermediate drying arrangement according to the invention;

FIG. 2 is a plan view of the machine of FIG. 1;

FIG. 3 is a plan view on a larger scale which illustrates one unit of the intermediate drying arrangement according to the invention;

FIG. 4 is a side elevation view of the arrangement of FIG. 3;

FIG. 5 is a side elevation view on a larger scale of a safety device for the intermediate drying arrangement; and

FIG. 6 is an elevation view of the device of FIG. 5 viewed from the direction indicated by the arrow A in FIG. 5.

In FIGS. 1 to 4 is shown the screen printing machine provided with the intermediate drying arrangement. A driving roller **6**, and an idler roller **7** have an endless belt **9** stretched between them. The cloth **10** to be printed lies along the upper run of the belt **9**, the cloth being fed around roller **13**. A mother frame **14** is vertically movable and has screens **1***a*, **2***a*, **3***a*, **4***a* and **5***a* mounted on the printing frames **1**, **2**, **3**, **4** and **5** respectively, the printing frames in turn mounted on the mother frame **14**. Parts **12***a*, **12***b* and **12***c* are the heaters for the drying arrangements, the number of which heaters may be varied depending on various conditions such as the numbers of colors to be used. The heaters are placed on the bars **15** mounted across the mother frame **14**. (See FIG. 3.)

Beds **8** are fixed under the upper run of the endless belt **9** opposed to the heaters and printing frames mentioned above being supported on the machine frame (not shown). To said heaters is connected some suitable source of heat such as gas, electricity, etc. In the embodiment shown in FIGS. 3 and 4, electricity is used for the source of heat. A number of coated heating wires **11**, **11**, **11** . . . are arranged inside the heaters **12***a*, **12***b* and **12***c*. Each heater is equipped with two handles **22**, **22**, a thermometer **23** for measuring the temperature of the heater, and a regulator **24** automatically controlling the temperature. Furthermore terminal **25** for said heating wires is attached to each heater.

When the mother frame **14** is lifted upwardly by a separate mechanism (not shown) in the direction indicated by the arrow in FIG. 1 and is temporarily suspended in the raised condition, the driving roller **6**, endless belt **9** and idler roller **7** are advanced by one pitch by another driving means (also not shown) so that the cloth **10** which is fed in steps to the endless belt **9** by roller **13** is also advanced together with the endless belt **9**. While the endless belt **9**, cloth **10**, driving roller **6**, idler roller **7** and roller **13** are temporarily stopped, the mother frame **14** is lowered and the printing of the cloth **10** on the endless belt **9** is accomplished through screens **1***a*, **2***a* . . . **4***a*, **5***a* by the sliding of squeegees (not shown) on said screens. In this case, since the heaters **12***a*, **12***b* and **12***c* are attached to the mother frame **14**, all the heaters are lowered with the mother frame **14** and their lower surfaces contact directly the color paste spread on the cloth **10** during the preceding step. (The positions of screens and heaters may be changed by replacing the screens with the heaters and vice versa.) The color paste printed on the cloth **10** may thus be fully dried by said heaters. The lower surfaces of said heaters which are used as heating surfaces are made either as a flat and smooth metallic surface, or as an uneven rough surface, e.g. machined by means of a knurling tool. Alternatively these surfaces can be made as wire nets or are provided with an insulating medium by applying a coating layer of a silicon solution on wire nets. The uneven surface or wire net forming a heating surface such as that described above is intended to prevent the outline of the design from being made indistinct because the color paste is pressed out of the printed pattern by the pressure of a flat surface, especially when the color paste is in a thick layer, and to facilitate the evaporation and escape of the moisture contained in the color paste through small spaces in the rough surface.

The invention further comprises a safety device to prevent the cloth and the endless belt from being scorched and damaged by overheating due to the heaters being held on the cloth when the belt is accidentally stopped during the printing, or by the residual heat left in the heaters even if the source of heat is interrupted during the suspension of the printing operation. This safety device is constructed as shown in FIGS. 3 and 4, with retainer segments **16**, **16**, . . . projecting at several points from the heaters **12***a*, **12***b* and **12***c*. On the lower end of these retainer segments are secured arched strip springs **17**, **17**, **17** respectively. These strip springs are mounted relative to the bars **15** so that the heaters **12***a*, **12***b* and **12***c* are constantly urged up in the direction shown by the arrow B in FIG. 4 due to resilience of these strip springs, and in the absence of a counterbalancing downwardly directed force are kept at the elevation shown by the chain line C. Therefore overheating of the cloth and the endless belt may satisfactorily be prevented. On the sides of the heaters, projecting pawls **18**, **18** are provided. Opposed to each of these pawls is a latch pawl **19***a* pivotally connected to an electromagnetic switch **19** and being freely rotatably mounted on a shaft **20**. This latch pawl **19***a*

is constantly being urged counterclockwise around shaft **20** by rod **21***a* which is urged against pawl **19***a* by spring **21**. Normally the electromagnetic switch is energized while the printing machine is running holding the pawl **19***a* in the position shown in full lines with the lower end engaged with pawl **18**. When the printing machine is stopped, this latch pawl **19***a* is disconnected from the pawl **18** by the thrust of rod **21***a* due to the stopping of the excitation of magnetic switch **19**. Electromagnetic switch **19** is placed in the circuit of the printing machine itself. At this time, latch pawl **19***a* is pushed into the position shown by chain lines in FIG. 5 the limit of this movement being controlled by stop **19***b*. Consequently, the heaters are moved upwardly to the elevation shown by the chain line C (see FIGS. 4 and 5), and the cloth is not heated.

In other words, the engagement of the pawls **18** with the latch pawls **19***a* is broken by the thrust of rod **21***a* when the excitation of the magnetic switch **19** is interrupted, and the heaters are moved upwardly by the thrust of springs **17**, when the operation of the printing machine is interrupted by accident. When operation starts again the electromagnetic switches are excited. The lower ends of latch pawls **19***a* are engaged with pawls **18**.

During the normal printing operation, the heaters always ascend and descend with the mother frame and dry the color paste on the cloth. When the mother frame is kept in a lowered position due to some accident, the heaters are moved upwards as described above in order to prevent overheating and scorching of cloth.

On the printing machine constructed in accordance with this invention as described above, the intermediate drying for the printed surface of the cloth may most effectively be accomplished during a short period of time with the most simple construction by direct utilization of the vertical movements of the mother frame and by the application of direct thermal conduction for drying, which is different from indirect thermal conduction such as radiation, convection or both of them. Moreover, on this printing machine, the satisfactory intermediate drying may be carried out at a high temperature without causing adhesion of the color paste to the surface of the heaters by using an isolating medium on the surface of the heaters.

Furthermore, in accordance with this invention, troubles such as adhesion of the cloth to the endless belt caused by the penetration of the water-soluble color paste through the cloth to its lower surface, conventionally unavoidable during the printing of thin fabrics, are removed and the troublesome procedures such as removal of the cloth agglutinated on the endless belt by the water-soluble color paste, can be fully eliminated. Moreover, the procedure for applying the under cloth such as cotton cloth on the back of the cloth to be printed when printing thin fabrics may also be eliminated. Because of these advantages, this invention makes possible an accurately and ingeniously printed cloth.

I claim:

1. In a screen printing machine having a driven roller, an idler roller, a belt around said rollers for supporting cloth to be printed, a mother frame vertically movable over said belt and having a plurality of screen printing frames thereon, and driving means for intermittently driving said belt and vertically reciprocating said mother frame, the improvement comprising a plurality of heaters mounted across the mother frame between the screen printing frames, said heaters each having a heated cloth contacting face on the bottom thereof on a level with the screens in the screen printing frames.

2. The improvement as claimed in claim 1 in which said heaters have a smooth cloth contacting face.

3. The improvement as claimed in claim 1 in which said heaters have a rough cloth contacting face.

4. In a screen printing machine having a driven roller, an idler roller, a belt around said rollers for supporting cloth to be printed, a mother frame vertically movable over said belt and having a plurality of screen printing frames thereon, and driving means for intermittently driving said belt and vertically reciprocating said mother frame, the improvement comprising a plurality of heaters mounted across the mother frame between the screen printing frames, said heaters each having a heated cloth contacting face on the bottom thereof on a level with the screens in the screen printing frames, and scorch preventing means on said heaters comprising at least one spring means on each heater extending below said cloth contacting face in the unstressed condition and urging said heaters up away from the belt when the mother frame is in the lowered position, and spring release means mounted on said mother frame and normally contacting said heater and holding the heater down against the action of the spring means thereon when the mother frame is in the lowered position, said spring release means being connected to the driving means and actuated to release the heater when the driving means fails to function.

5. The improvement as claimed in claim 4 in which said spring release means comprises an electromagnetically actuated solenoid, a pawl latch having the center pivotally mounted on the coil of the solenoid and having one end pivotally connected to the core of said solenoid, and spring means engaged with said pawl latch normally tending to pivot said latch around the pivotal mounting on the coil in the direction to move the other end away from the heater, and said heater having a pawl thereon with which said other end of said pawl latch is normally engaged, whereby when said coil is energized, said spring means is prevented from moving said pawl latch, and when said coil is deenergized when the driving means fails to function, said spring means pivots said pawl latch to move said other end away from the pawl on the heater, thereby freeing the heater.

References Cited in the file of this patent

UNITED STATES PATENTS

1,479,819	Kluever	Jan. 8, 1924
2,017,459	Howe	Oct. 15, 1935
2,157,638	Soubier	May 9, 1939
2,217,133	Overlack	Oct. 8, 1940
2,359,825	Campbell	Oct. 10, 1944