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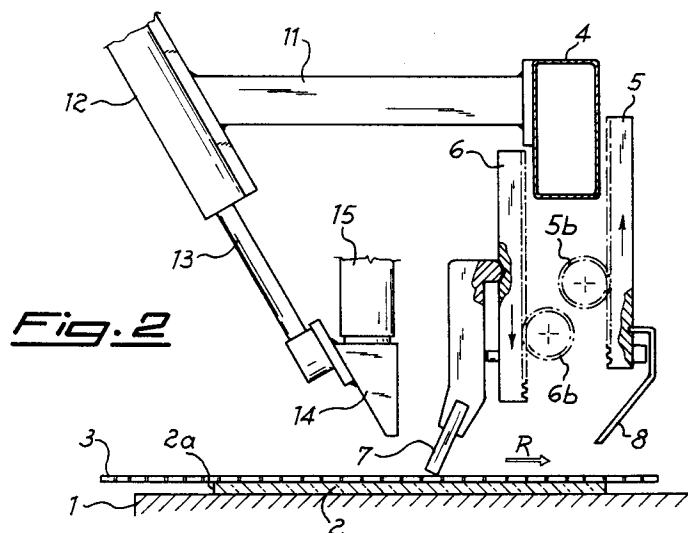
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I-20123 Milano (IT)(54) **Silk-screen printing machine with automatic suction device for the removal of ink residue.**

(57) A machine for the silk-screen printing of flat sheets of glass or the like comprising a supporting structure (1) capable of moving parallel to the printing plane of a frame (3) and equipped with a spreading squeegee (8) and a printing doctor (7), both capable of moving in a direction perpendicular to the plane of frame (3) and independently of one another, comprising a device with automatic action for the removal of ink residue from such screen frame (3) and consisting of at least one suction unit (10) ca-

pable of moving in a perpendicular direction with respect to such screen frame (3) simultaneously with such spreading squeegee (8), suction nozzle (14) of such unit being connected to a suction header (15) and positioned between such doctor (7) and squeegee (8), according to the direction of travel thereof, so as to make possible the continuous suction of the ink residue and of any impurities liable to clog the screen during any spreading movement.

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The object of this invention is a silk-screen printing machine equipped with an automatic suction device for the complete removal of ink residue from the screen frame used in the printing of flat sheets such as sheets of glass, paper, fabric and the like.

As is known, the so-called silk-screen process uses for the creation of images, lettering, patterns and the like on flat sheets of glass, paper and the like the transfer of inks whether black or coloured, which are spread on a mesh (screen) frame in which such mesh has openings for the passage of the ink arranged in such a way as to match the pattern or image to be printed on the flat sheet, placed in contact with a fixed supporting surface.

More particularly, the current silk-screen printing machines used to print flat media (sheets of glass or of another material, sheets of paper and the like) provide a fixed supporting structure with a flat surface on which is placed in a stable manner the medium to be printed and, above the latter, a perforated frame, normally termed the "screen or printing frame". Above such screen frame is positioned a structure capable of being moved, parallel to the plane of the sheet to be printed, from one end of the frame to the opposite end and vice versa. Such structure carries an initial support, in the form of an arm, to the lower end of which is secured a squeegee used to spread the ink on the underlying frame, and a second supporting arm having at its lower end a doctor intended to force the ink, previously spread by the squeegee on the screen, through the latter so as to print the underlying sheet.

The supports or arms of the spreading squeegee and of the doctor are capable of being moved in opposition to one another according to a direction perpendicular to the printing plane and in both senses, in order to make possible an initial outward stroke parallel to the printing plane with the squeegee lowered into contact with the screen and the doctor raised, and a second return stroke with the squeegee raised and the doctor lowered, by which means printing is achieved. The use of such known silk-screen printing machines poses in practice a number of serious disadvantages, especially in the printing of peripheral strips of sheets of glass, for which special arrangements are required in order to carry out printing in a fully correct manner. Moreover, such type of printing requires that the surface of the screen whose perimeter determines the printing of the edge strip shall be smaller than the surface of the sheet of glass to be printed; in other words the area of the sheet of glass should always be smaller than the area of the screen so as to leave an empty strip between the part to which ink is applied and the corner of the sheet.

Such need is brought about by the fact that the possible area of screen exceeding the sheet to be printed would retain between the actual screen holes the ink spread by the squeegee but not deposited by the doctor due to the absence, in the surplus area, of the underlying sheet to be printed, causing in time the build-up of ink and the running thereof with the consequent need to shut down the machine for frame cleaning operations.

Such disadvantage is even more serious when considering that such printing machines are normally included in continuous production lines which would be shut down as a result of having to shut down the individual printing station.

Such disadvantage furthermore makes compulsory the correct and accurate centring of the sheet with respect to the screen, even when printing a simple peripheral edge, since a minor misalignment would shift the frame outside the perimeter to be printed, thus causing once again the above-mentioned problems.

There is therefore posed the problem of providing a machine for the silk-screen printing of flat sheets which will make possible the printing of surfaces to the very edge, and therefore of an area smaller than the area of the mesh screen for the passage of the ink. More particularly, there is posed the problem of providing a machine equipped with devices capable of avoiding the build-up of ink in those zones of the screen in which the underlying sheet to be printed is not present.

A further disadvantage typical of silk-screen printing machines is constituted by the ready clogging of the screen mesh due to impurities present in the ink and/or deposited on the said screen.

Such technical problem is resolved according to the invention by a machine for the silk-screen printing of flat sheets of glass or the like comprising a supporting structure (1) capable of moving parallel to the printing plane of a frame and equipped with a spreading squeegee and a printing doctor, both capable of moving in a direction perpendicular to the plane of the frame and independently of one another, comprising a device with automatic action for the removal of ink residue from such screen frame and consisting of at least one suction unit integrally secured to such movable structure and capable of moving in a perpendicular direction with respect to such screen frame simultaneously with such spreading squeegee, the suction nozzle of such unit being connected to a suction header and positioned between such doctor and squeegee, according to the direction of travel thereof, so as to make possible the continuous suction of the ink residue and of any impurities liable to clog the screen during any spreading movement, the stroke of such suction unit being

set to a length at least equal to the longitudinal dimension of the frame for the removal of any ink residue should the sheet be smaller in size than the frame.

According to the invention, provision is also made for such device to be capable of being raised and lowered from/to the frame by means of a rod guided by a slide or the like, operated by pneumatic or like means, such rod and such slide being preferably tilted with respect to the plane vertical to the printing plane.

Furthermore, in the machine according to the invention such screen frame is larger in size than the flat sheet to be printed.

In a convenient method of implementation the machine according to the invention provides for the suction nozzle of such suction unit to have transverse dimensions at least equal to the width of the screen frame. Further features and advantages of this invention will become more clearly apparent from the following description of one of its possible forms of implementation, given only by way of information and without restriction, and made with reference to the attached set of drawings which shows:

- In figure 1 : a diagrammatic cross-section of the machine according to the invention with the suction device in the cycle start-up phase, and
- In figure 2 : a cross-section like that of fig. 1 during the phase of deposition of the ink on the sheet of glass or the like.

With reference to the above-mentioned figures, the machine according to the invention comprises a silk-screen printing machine of known type with which is associated a suction device with the aim of being able to print in particular sheets of glass with a perfectly treated edge, without necessitating accurate centring between the impression of the screen and the underlying sheet of glass.

More precisely, such silk-screen printing machine comprises a fixed base plane 1, on which is positioned a sheet of glass 2 to be printed, and a screen 3 capable of being placed in contact with the upper surface of the sheet to be printed, on which is arranged in a known manner an impression to be printed over the whole or part of the surface of the sheet 2.

Such machine furthermore comprises a structure 4, located above printing frame 3, which is capable of being moved in two senses parallel to screen frame 3, which structure supports two arms 5 and 6 capable of moving in two senses in a direction perpendicular to the printing plane and independently of one another, via appropriate racks 5a and 6a respectively, operated by appropriate pinions or gearwheels 5b and 6b.

To arm 5 is secured a bent squeegee 8 intended to spread the ink on screen 3 after being lowered into contact with the latter and providing, during an initial movement, the outward stroke of structure 4 (arrow A in fig. 1).

To vertically moving arm 6 is instead secured a shaped component 7 constituting the printing doctor after being lowered into contact with the screen and providing, during a second movement, the return stroke of structure 4 (arrow R in fig. 2).

The suction device according to the invention, generally marked 10 in the figures, is comprised of a supporting arm 11 substantially parallel to the printing plane and made integral, via its end, with such movable structure 4.

At its opposite end arm 11 carries a body 12 tilted with respect to the vertical and having inside a pneumatic slide (or double-acting piston) to which is made integral a rectilinear arm 13 which is therefore capable of moving from and to screen frame 3 in order to place a suction nozzle 14 integral therewith against the said screen; such nozzle 14 is connected to a collecting pipe 15 carrying within it, in a removable manner, in interchangeable filter not shown in the figures. The arrangement of the various parts is such that doctor 7 always remains interposed, in the direction of travel, between suction nozzle 14 and spreading squeegee 8.

The device described above is furthermore equipped with means of control with programmed action capable of bringing about its lowering and raising strokes simultaneously with those of spreading squeegee 8 and independently of the means of lowering and/or raising of doctor 7. Furthermore, because the function of suction unit 10 is that of removing the ink residue which, after each printing stroke, remains on the mesh of frame 3 exceeding the surface of underlying sheet 2 to be printed, as well as the impurities or the like present on the frame, the presence of such filter within suction duct 15 makes possible the continuous retention thereof avoiding discharge to the atmosphere.

Having stated the foregoing, in order to print the flat surface of a flat sheet of glass 2, after having applied or obtained in a known manner the impression of the pattern to be printed on screen frame 3 which, in this case, may have larger dimensions than those of the surface of the sheet of glass, there is brought about the simultaneous lowering of squeegee 8 and suction unit 14 in order to position them substantially in contact with the underlying screen frame.

The suction unit/squeegee assembly is then made to move over the screen frame to enable suction nozzle 14 to clean the surface of the screen while squeegee 8 spreads the ink. The

movement is stopped after squeegee 8 has overshoot end 2a of sheet 2 so as to overshoot with certainty the peripheral edge of the sheet to be printed.

Upon completion of spreading, suction unit 10-14 and squeegee 8 are raised and printing doctor 7 is lowered onto the screen and made to move over the latter in the opposite direction to that of movement of squeegee 8 (fig. 2).

Upon completion of spreading, there will remain outside the peripheral edge of sheet 2 ink residue which will be removed by suction by nozzle 14 either during a subsequent spreading operation or when the said suction nozzle is moved over the screen frame.

The presence of such suction device combined with such spreading squeegee makes it possible in practice to spread the ink beyond the periphery of the sheet and thus reliably print the peripheral edge thereof.

Furthermore, the possibility of extending the ink beyond the effective dimensions of the sheet provides the advantage of obtaining perfect printing of the edge thereof even if the sheet is not perfectly centred on the impression to be printed.

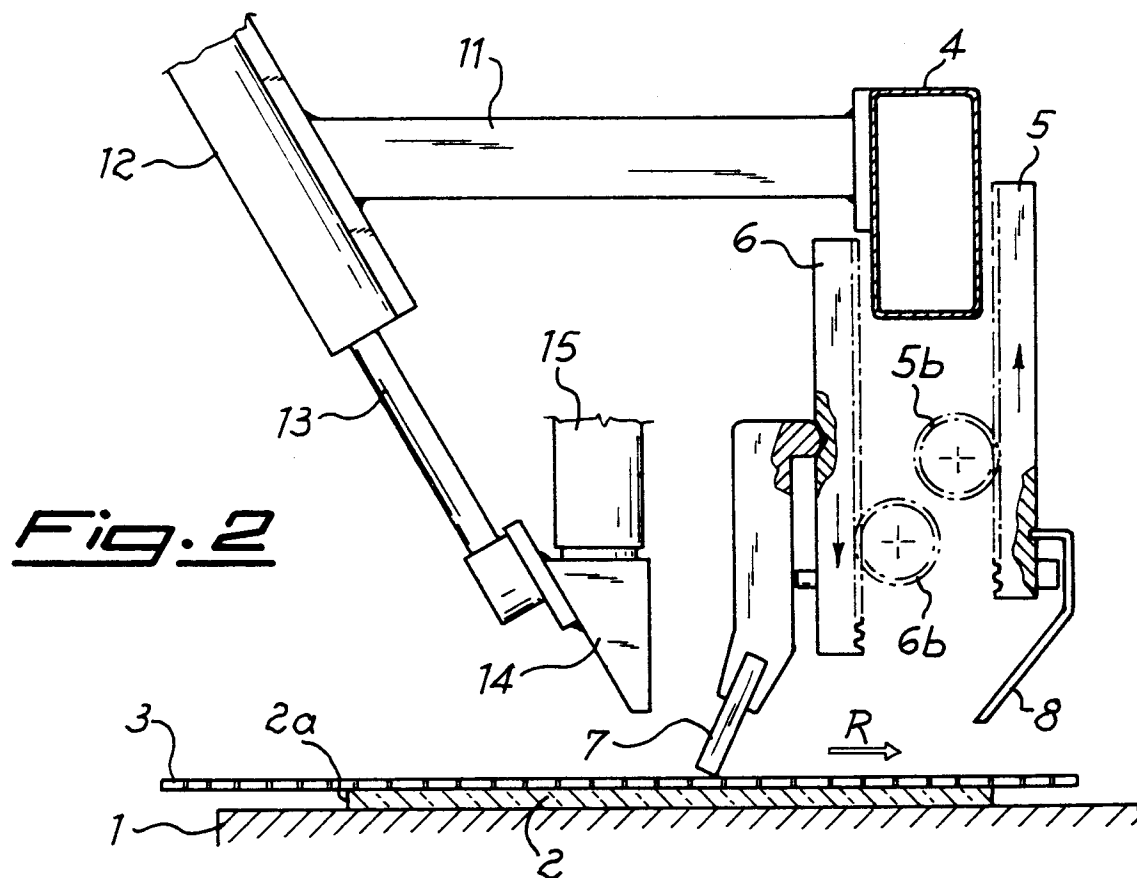
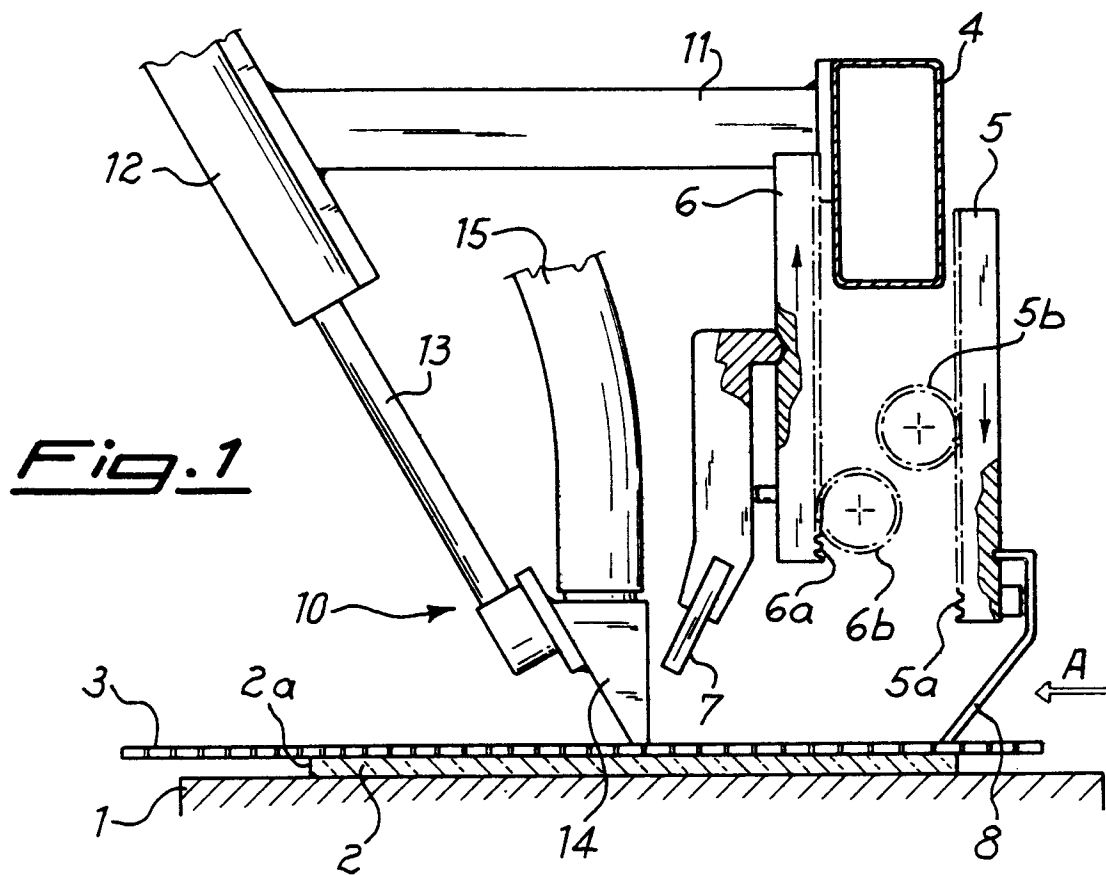
Lastly, it is clear that to the invention described above, according to one of its possible methods of implementation, there may be applied structurally and functionally equivalent modifications and variants without departure from the scope of protection of the said invention. Moreover, such suction device may be applied to any silk-screen printing machine of known type without necessitating special and/or expensive structural and functional modifications thereto.

Claims

1. A machine for the silk-screen printing of flat sheets of glass or the like comprising a supporting structure (1) capable of moving parallel to the printing plane of a frame (3) end equipped with a spreading squeegee (8) and a printing doctor (7), both capable of moving in a direction perpendicular to the plane of frame (3) and independently of one another, characterized in that it comprises a device with automatic action for the removal of ink residue from such screen frame (3) and consisting of at least one suction unit (10) integrally secured to such movable structure (4) and capable of moving in a perpendicular direction with respect to such screen frame (3) simultaneously with such spreading squeegee (8), suction nozzle (14) of such unit being connected to a suction header (15) and positioned between such doctor (7) and squeegee (8), according to the direction of travel thereof, so as to make

possible the continuous suction of the ink residue and of any impurities liable to clog the screen during any spreading movement, the stroke of such suction unit being set to a length at least equal to the longitudinal dimension of frame (3) for the removal of any ink residue should the sheet be smaller in size than the frame.

2. A machine according to claim 1, characterized in that such device is capable of being raised and lowered from/to the frame by means of a rod (13) guided by a slide or the like (12), operated by pneumatic or like means, such rod (13) and such slide (12) being preferably tilted with respect to the plane vertical to the printing plane.
3. A machine according to claim 1, characterized in that inside such suction duct (15) is provided a removable and/or replaceable filter element capable of retaining any surplus ink and any impurities present in the ink and/or on screen frame (3).
4. A machine according to claim 1, characterized in that such screen frame (3) has larger dimensions than those of the flat sheet (2) to be printed.
5. A machine according to claim 1, characterized in that suction nozzle (14) of such suction device (10) has a transverse dimension at least equal to the width of screen frame (3).





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EUROPEAN SEARCH REPORT

Application Number
EP 94 20 2586

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	FR-A-2 517 254 (PPG INDUSTRIES) * the whole document *	1-5	B41F35/00 B41F15/08
Y	FR-A-736 897 (BRUSCHWEILER) * the whole document *	1-5	
Y	US-A-5 197 384 (YAWATA ET AL.) * column 6, line 27 - line 46; figure 14 *	3	
A	EP-A-0 511 883 (SAINT-GOBAIN VITRAGE INTERNATIONAL) * the whole document *	1-5	
A	US-A-3 302 564 (E. WILFORD) * the whole document *	1-5	
A	EP-A-0 152 156 (TOSHIN KOGYO CO. LTD.) * the whole document *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B41F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 21 November 1994	Examiner Meulemans, J-P
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			