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(12) # EUROPEAN PATENT APPLICATION

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(54) **A stencil printing machine having a curved printing table.**

(57) A stencil printing machine having a curved printing table in which the printing table (1) is so arranged as to rotate about a rotating shaft (2) and has a to-and-fro motion imparted to it by a drive organ (3). A stencil (5) fastened in a frame (4) is so arranged as to follow the motion of the printing table (1), whereby it is displaced in relation to the scraper and ink charging devices (14, 15). These are in a stationary relationship to a frame forming part of the stencil printing machine. The material to be printed (6) is capable of being fed between the stencil (5) and the printing table (1). The printing table (1) has a printing surface which occupies rather less than 170° of the surface of a complete cylinder, and the radius of curvature of the cylindrical surface of the printing table is within the range of 400 - 500 mm, thereby providing both a suitable clearance angle (a) and a suitable delivery angle (b). Also provided are organs which ensure that the printing speed remains constant or essentially constant.

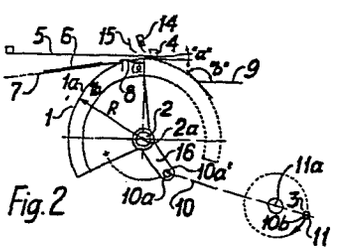

Fig.2

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TITLE OF THE INVENTION: A stencil printing machine having a curved printing table.

TECHNICAL FIELD.

The present invention relates to a stencil printing machine and in particular to the type of stencil printing machine having a curved printing table.

The printing table is so arranged as to rotate about a rotating shaft and has its motion imparted via a drive organ. A stencil fixed in a frame is so arranged as to follow the motion of the printing table, whereby it is displaced in relation to scraper and ink charging devices which form part of the stencil printing machine. The scraper and ink charging devices are in a stationary relationship to a frame forming part of the stencil printing machine. The material to be printed is capable of being fed between the stencil and the printing table.

DESCRIPTION OF THE PRIOR ART.

Previously disclosed are a number of stencil printing machines, and amongst the types of machine which may be regarded as resembling the present invention are those in which the printing table is in the form of a cylindrical surface or part of a cylindrical surface, usually half of a cylindrical surface.

By way of an example of the prior art, reference may be made to the stencil printing machine illustrated and described in US Patent 3 915 088. The stencil printing machine described in said Patent has a printing table in the form of the entire surface of a cylinder.

As a further example of the prior art, reference may be made to the stencil printing machine illustrated and described in German Patent Application 1 038 067. The stencil printing machine described in said Patent Application has a printing table in the form of one half of the surface of a cylinder.

DESCRIPTION OF THE PRESENT INVENTION

TECHNICAL PROBLEM

It is usual to select a radius of curvature such that the length of the printing surface (length of the arc) corresponds to the length of the longest material which is to be printed.

The practical result of this is for a radius of curvature of less than 300 mm to be selected.

Where a stencil printing machine of the aforementioned type is operated at high speed, it has been found on the one hand that the mass effect is considerable, resulting in heavy vibrations, and on the other hand that the print quality is unacceptable due to the ink running.

A particular technical problem is encountered in designing a stencil printing machine with a curved printing table in which printing speeds as high as 3 000 to 5 000 impressions per hour will produce acceptable print.

A particular technical problem is also encountered in providing suitable conditions for maintaining a constant printing speed at high printing speeds.

CONSIDERATIONS UNDERLYING THE PRESENT INVENTION.

In the case of stencil printing machines of the aforementioned type, i.e. with a curved printing table, a number of different considerations must be taken into account in order to provide a high printing speed which is unaffected to all intents and purposes by the stiffness of the material and the viscosity of the ink.

Apart from the fact that a high printing speed usually requires steps to be taken to reduce the weight of the component parts at the same time as the component parts must satisfy high standards in respect of their strength, practical assessments have shown that the clearance angle, i.e. the angle between the stencil and the material to be printed must lie within predetermined values at the same time as the delivery angle, i.e. the angle between the delivery surface or the delivery track and the material must lie within a precisely defined range of values.

It has been found that a large clearance angle, which will usually occur if the curved printing table has a radius of less than 300 mm, will impose restrictions due to the fact that such a clearance angle will to all intents and purposes only permit the printing of thin material.

Poor print quality has been found to result from an excessively small clearance angle.

As far as the delivery angle is concerned, it has been found that this angle must lie within close tolerances because an excessively large angle and an excessively small angle will both result in poor delivery. As a general rule, the stiffer the material the greater must be the delivery angle.

On the basis of the above considerations, the present invention seeks to propose a stencil printing machine of such a nature as to offer a high print speed,

i.e. of the order of 3 000 to 5 000 impressions per hour, largely irrespective of the stiffness of the material and the viscosity of the print without impairing print quality.

Print quality is also dependent on a constant or essentially constant printing speed.

SOLUTION.

The present invention proposes a stencil printing machine having a curved printing table such that the printing table is so arranged as to be capable of being rotated about a rotating shaft by a drive organ and with a stencil fastened in a frame being so arranged as to follow the motion of the printing table, thereby being displaced in relation to scraper and ink charging devices, which are in a stationary relationship to a frame forming part of the stencil printing machine. The material to be printed is capable of being fed between the stencil and the printing table.

In a stencil printing machine of this kind, the present invention offers the possibility of designing the printing table to have a printing surface forming part of the surface of a cylinder, preferably less than 170° of the surface of a complete cylinder, at the same time providing a constant printing speed.

This offers the advantage of a printing table which is an extremely light and yet dimensionally stable structure, especially if it is manufactured from an aluminium material.

In order to permit the aforementioned different limit values for the clearance angle and the delivery angle to be observed, the present invention offers the possibility of selecting a radius of curvature within the range of 400 - 500 mm for the cylindrical surface of the printing table.

It has been found to be particularly appropriate from the production engineering point of view to manufacture a completely cylindrical surface, which is subsequently divided up into three equally large parts, each of which is then incorporated in its own stencil printing machine, with the result that the cylindrical surface will occupy no more than 120° of the surface of a complete cylinder.

In order to be able to reduce the weight of the printing table it is recommended, apart from selecting aluminium or an aluminium alloy as the material from which it is produced, that the printing surface should be in the form of an outer sleeve, usually sheet steel of 0.8 mm in thickness, beneath which are arranged a number of strengthening elements which may be in the form of low-pressure chambers.

In order to achieve a constant or at least essentially constant speed for the printing table during the actual printing phase, which will contribute to even printing and high print quality, the present invention offers the possibility of imparting motion to the printing table via a rod connected to a shaft rotating in a circular path.

By selecting a certain relative position for the points of attachment of the rod it is possible to cause the speed of movement of the printing table during the printing phase to resemble a curve with an initial increase in speed (not printing), a constant or essentially constant speed (printing) and a final reduction in speed (not printing). It is also possible to select a reciprocating motion for the printing table such that this is characterized by an initial high speed and a final low speed. The latter is particularly important when the machine is operated at a high printing speed, since the low speed at that point provides sufficient time for the registration of the material and

for the engagement, if required, of the material in the gripping organs.

ADVANTAGES

The advantages of a stencil printing machine of the type described above are associated principally with the ability to choose the printing speed and with the possibility of achieving a printing speed of the order of 3 000 - 5 000 impressions per hour in conjunction with excellent print quality which is essentially unaffected by the stiffness of the material and the viscosity of the ink.

What may be regarded as the principal characteristic features of a stencil printing machine having a curved printing table in accordance with the present invention are indicated in the first characterizing section of the following Patent Claim.

DESCRIPTION OF THE DRAWINGS

A preferred embodiment exhibiting the characteristic features of the present invention will now be described in greater detail with reference to the attached drawing, in which

Fig. 1 shows a perspective view of a stencil printing machine;

Fig. 2 shows the basic principle of the curved printing table in accordance with the present invention and its operation;

Fig. 3 shows a section through the printing table; and

Fig. 4 shows the speed of the printing table during the printing phase and during the return phase.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Fig. 1 shows a perspective view of a stencil printing machine having a curved printing table in accordance with the present invention in which the printing table is so arranged as to rotate about a rotating shaft.

The printing table 1 and its point of attachment which is capable of rotating about a rotating shaft 2 are illustrated in detail in the drawing in Fig. 2 showing the basic principle. The printing table 1 may be imparted with a reciprocating rotary motion by the to-and-fro motion of a drive organ 3 . A stencil 5 fixed in a frame 4 is so arranged as to follow the motion of the printing table 1 and is thereby displaced in relation to the scraper and ink charging devices, which are in a stationary relationship to a frame forming part of the stencil printing machine.

The printing table 1 and its point of attachment which is capable of rotating about a rotating shaft 2 are illustrated in detail in the drawing in Fig. 2 showing the basic principle. The printing table 1 may be imparted with a reciprocating rotary motion by the to-and-fro motion of a drive organ 3 . A stencil 5 fixed in a frame 4 is so arranged as to follow the motion of the printing table 1 and is thereby displaced in relation to the scraper and ink charging devices, which are in a stationary relationship to a frame forming part of the stencil printing machine.

The frame has been given the reference designation 13 whilst the scraper device has been given the reference designation 14 and the ink charging device the reference designation 15 .

The material to be printed 6 is capable of being fed between the stencil 5 and the printing table 1 .

The printing table has a printing surface occupying rather less than half and preferably less than 170° of the surface of a complete cylinder. The example of the preferred embodiment shows the cylindrical surface to occupy no more than 120° of a complete cylinder. It should be pointed out in this connection that the cylindrical surface should not occupy less than 45° of the surface of the complete cylinder.

In order to provide both a suitable clearance angle "a" and a suitable delivery angle "b" , the present invention proposes that the radius of curvature should be selected within the range 400 - 500 mm . The radius of curvature has been given the reference designation R in Fig. 2.

The printing surface 1a of the printing table 1 is in the form of an outer sleeve beneath which are arranged preferably hollow strengthening elements 1b . The strengthening element may best consist of a low-pressure chamber. The outer sleeve consists of an 0.8 mm steel sheet attached to a perforated strengthening element with a thickness of between 25 and 50 mm . Two end-plates made of aluminium are attached to the printing table.

Fig. 3 shows the printing surface of the printing table to consist partly of said outer sleeve 1a together with a number of adjacent segments incorporating low-pressure chambers , each low-pressure chamber being capable of being connected to a source of low pressure, with small holes 1a' being arranged between the cavity 1b of the hollow profile and the printing surface 1a enabling the material to be held in position against the printing surface if this should be considered necessary. The cavities of the low-pressure chambers are connected to a valve (not shown in the Figures) which may be

controlled so as to connect the low pressure only to a certain number of the cavities of the hollow profile, although it is also possible to cause the valve to connect all the low-pressure chambers to the source of low pressure immediately before the gripping organ 8 releases its hold on the material.

The motion of the printing table 1 is controlled by a rod 10 , of which one end 10a is attached to the printing table in such a way that it is free to rotate and of which the other end 10b is attached to a shaft 11 rotating in a circular path in such a way that it is free to rotate. The speed of rotation may be varied by a previously disclosed method, and may be set for even speed and/or acceleration for a single revolution or for variable speed and/or acceleration for a single revolution.

In this way the possibility is provided of imparting a constant or at least essentially constant speed to the printing table during the printing phase, i.e. as it rotates from the position indicated by the solid line in Fig. 2 to the position indicated by the dotted line in Fig. 2.

The points of attachment 10a and 10b of the rod 10 are positioned in such a way that the speed of movement of the printing table during the printing phase resembles a curve with an initial increase in speed (not printing), a constant or essentially constant speed (printing) and a final reduction in speed (not printing), whilst the speed of the reciprocating motion of the printing table 1 is characterized by its initial high speed and its final low speed. This is illustrated best in Fig. 4. Particular attention should be paid to the fact that, during the final low-speed phase, registration of the material and the engagement of the material in any gripping organs may take place, which is a contributory factor to the ability of the stencil printing machine to print at a considerable speed.

One further advantage of a stencil printing machine in accordance with the present invention is that the space below the rotating shaft 2 may be used to accommodate other component parts of the stencil printing machine.

The variation in the speed of the printing table referred to above is dependent partly on the position of the rotating shaft 11a in relation to the rotating shaft 2 , and partly on the distance between the centre-line 2a of the rotating shaft 2 and the point of attachment 10a' of the rod. This distance may differ to a certain extent from the distance between the rotating shaft 11a and the rotating shaft 11 . One other factor which is significant to the regulation of the speed of the printing table is whether the rotating shaft 11a is in a higher or lower position.

A bold line is used in Fig. 4 to indicate the speed of the printing table, and the actual printing should be arranged to take place between the angular values "35" and "145" , when the speed is essentially constant. It is also possible with the help of control devices to vary the speed of the shaft 11 immediately prior to this period, thereby achieving a more constant speed during the printing phase than that illustrated in the Figure.

The right-hand half of the curve should actually be placed beneath the abscissa, although it is shown above the abscissa here in the interests of clarity. The high speed in the initial return phase and the falling speed towards the end may both be appreciated here, during which period the registration of a new sheet of material may occur. Registration may best take place between the angular values 260 - 350° . Thus the embodiment of the present invention as described exhibits a curved printing table in which the cylindrical surface occupies rather less than 120° of the surface of a complete

cylinder. The printing table 1 is so arranged as to rotate in order to produce a reciprocating motion about a rotating shaft 2 . The printing table is driven by a drive organ 3 , which itself is so arranged as to produce the reciprocating motion of a rod 10 . A stencil 5 fixed in a frame operates in conjunction with the motion of the printing table via connecting organs not shown in the Figure,for example a rack and pinion, and is thereby imparted with displacement in relation to the scraper and ink charging devices which are in a stationary relationship. The material to be printed may best be transported by a material feed conveyor 7 to the printing table so that it may be brought into contact with gripping organs 8 incorporated in the printing table. These gripping organs take hold of the leading edge of the material, and the motion of the printing table causes the material to pass over the contact point or contact line of the scraper with the stencil and the printing table, whereupon the gripping organs 8 release their hold on the material in order to feed a sheet of material which has been printed to a material delivery conveyor 9 .

The angular values indicated in Fig. 4 relate to the rotation of the shaft 11 about its centre of rotation 11a.

The thin line shown in Fig. 4 indicates the speed curve for a rather larger format.

In the event of the material for printing being selected such that low pressure must be applied to the printing table, then this may take place immediately before the gripping organs release the material, which occurs after the start of the printing phase. The low pressure must cease to be applied when the material is to be fed onto the material delivery conveyor 9 .

The present invention is not, of course, restricted

to the preferred embodiment indicated above by way of an example, but may undergo modifications within the scope of the following Patent Claims.

In the description the expression "clearance angle" has been used and this expression is identical to "peel-of" angle. The expression "scraper and ink charging device" is identical to "squeegee and flood coater device".

PATENT CLAIMS.

1. A stencil printing machine having a curved printing table, in which the printing table (1) is so arranged as to rotate about a rotating shaft (2) by means of a drive organ (3), in addition to which a stencil (5) fastened in a frame (4) is so arranged as to follow the motion of the printing table (1) whereby it is displaced in relation to the scraper and ink charging devices, which are in stationary relationship to a frame forming part of the stencil printing machine and in which the material to be printed (6) is capable of being fed between the stencil and the printing table, c h a r a c t e r i z e d in that the motion of the printing table is controlled by a rod (10), of which one end (10a) is attached to the printing table in such a way that it is free to rotate and of which the other end (10b) is attached to a shaft (11) which is able to rotate along a certain path in such a way that it is free to rotate, whereby the speed of the printing table during the printing operation can be imparted with a constant or at least essentially constant velocity.

2. A stencil printing machine in accordance with Patent Claim 1, c h a r a c t e r i z e d in that the cylindrical surface of the printing table has a radius of curvature within the range 400 - 500 mm.

3. A stencil printing machine in accordance with Patent Claim 1, c h a r a c t e r i z e d in that the cylindrical surface occupies no more than 120° of the surface of a complete cylinder.

4. A stencil printing machine in accordance with Patent Claim 1, c h a r a c t e r i z e d in that the cylindrical surface occupies at least 45° of the surface of a complete cylinder.

5. A stencil printing machine in accordance with Patent Claim 1, c h a r a c t e r i z e d in that the printing surface of the printing table is in the form of an outer sleeve beneath which is arranged a strengthening element.

6. A stencil printing machine in accordance with Patent Claim 5, c h a r a c t e r i z e d in that the printing surface is in the form of a number of adjacent low-pressure segments, each of which may be connected to a source of low pressure, with small holes being arranged between the cavity of the segment and the printing surface for the purpose of holding the material in position.

7. A stencil printing machine in accordance with Patent Claim 4, c h a r a c t e r i z e d in that a valve is controlled so as to connect low pressure to a number of cavities only.

8. A stencil printing machine in accordance with Patent Claim 1, c h a r a c t e r i z e d in that the points of attachment (10a and 10b) of the rod (10) are so arranged that the speed of movement of the printing table during the printing operation resembles a curve with an initial increase in speed (not printing), a constant or essentially constant speed (printing) and a final reduction in speed (not printing), whilst the reciprocating motion of the printing table is characterized by its initial high speed and its final low speed.

9. A stencil printing machine in accordance with Patent Claim 1, c h a r a c t e r i z e d in that the registration of the material and the engagement of the material in any gripping organs (8) take place during the final low-speed phase.

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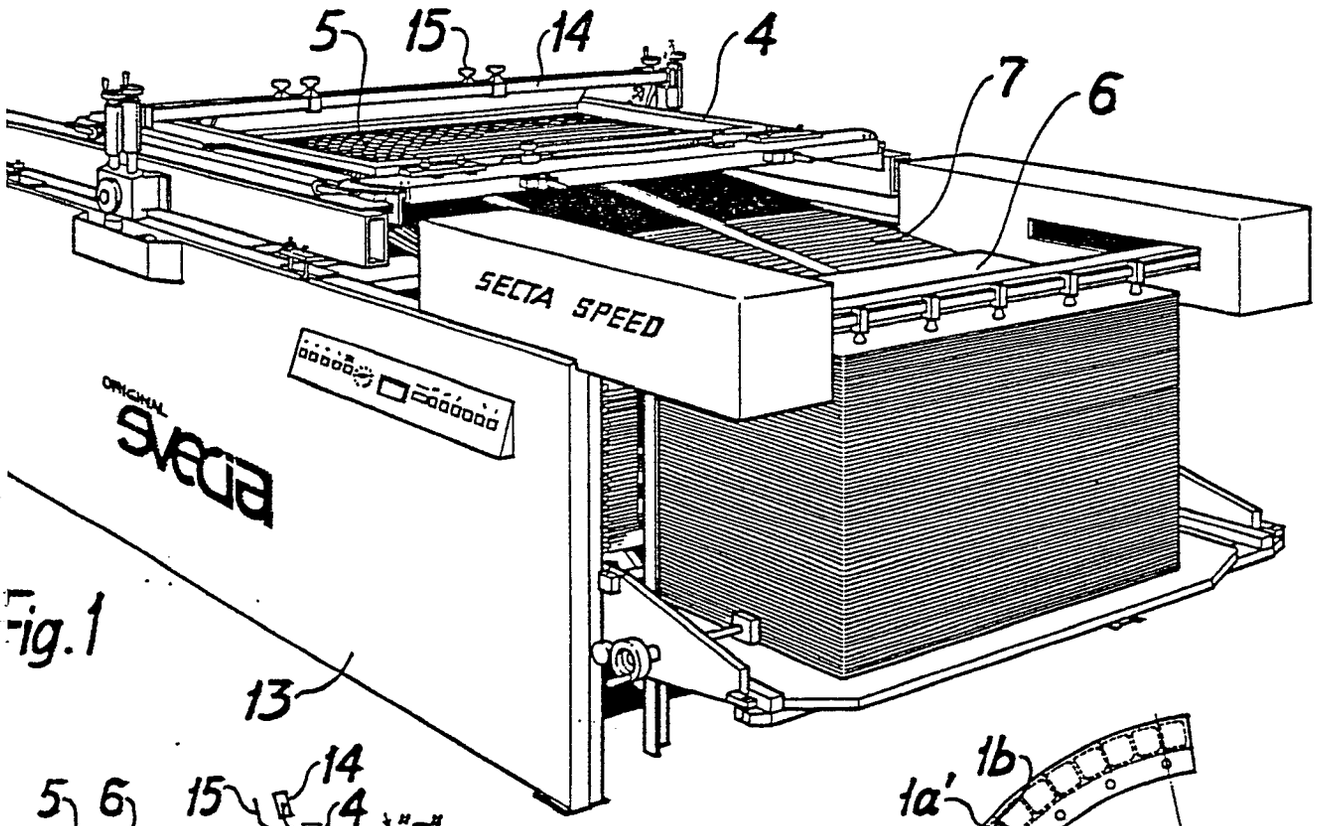

Fig.1

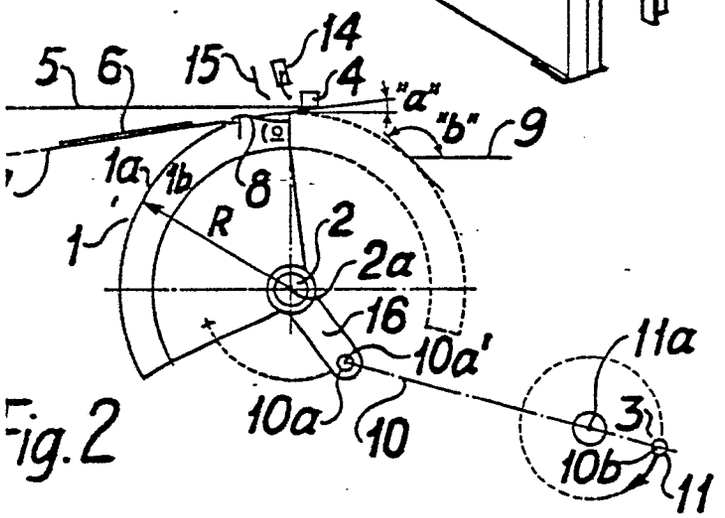

Fig.2

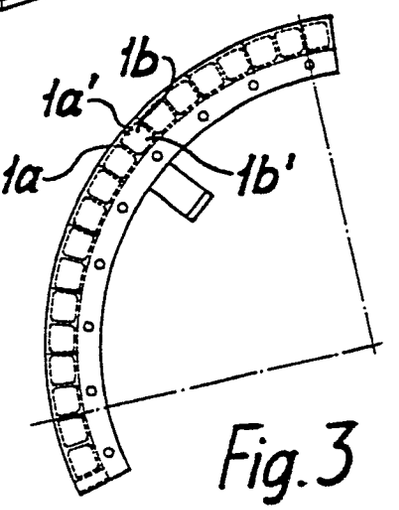

Fig.3

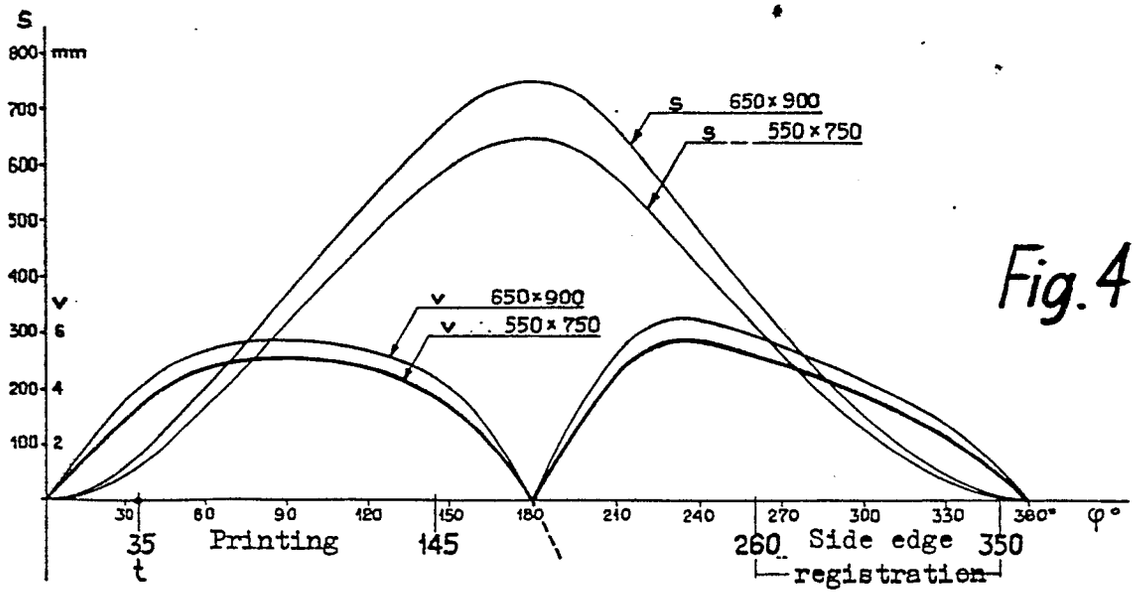

Fig.4

European Patent Office

EUROPEAN SEARCH REPORT

0075640
Application number

EP 81 85 0169

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. ³)
A	US-A-1 742 249 (HAMLIN) *Page 1, line 67 to page 2, line 30; figure 2*	1	B 41 F 15/08
A	US-A-2 606 492 (BLACK) *Column 5, lines 29-55; figures*	5,6,7	
A	US-A-2 950 673 (McCORMICK) *Column 4, lines 3-33; figure 1*	8	
A	US-A-3 229 627 (POLLITT)		
A	DE-A-2 016 377 (FRANKENTHAL)		

TECHNICAL FIELDS SEARCHED (Int. Cl. ³)

B 41 F
F 16 H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	03-05-1982	LONCKE J.W.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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