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 [33] **Germany**
 [31] **S109612**
 Continuation-in-part of application Ser. No.
 723,678, Apr. 24, 1968, now abandoned.

[56]

References Cited

UNITED STATES PATENTS

2,498,917	2/1950	Gattuso	101/124
2,917,997	12/1959	Black	101/126
3,078,792	2/1963	Kerstan	101/126
3,109,365	11/1963	Karlyn	101/124
3,199,449	8/1965	Jaff et al.	101/129
3,252,411	5/1966	Black	101/124

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[54] **SCREEN PRINTING MACHINE EMPLOYING A
 RECIPROCATING PRINTING AND FEED PLATE**
 10 Claims, 26 Drawing Figs.

[52] U.S. Cl. 101/124
 [51] Int. Cl. B411 27/06
 [50] Field of Search 101/124,
 126, 114, 129

ABSTRACT: A screen printing machine has a reciprocating printing and feed plate and retractable stops combined and cooperating with said plate so that the material to be printed moves forward over the plate in a stepwise manner. The screen is mounted over this plate and reciprocates with it so that the material passes under the screen. While it is under the screen a relatively stationary printing squeegee is lowered into its operative position and printing is thereby effected.

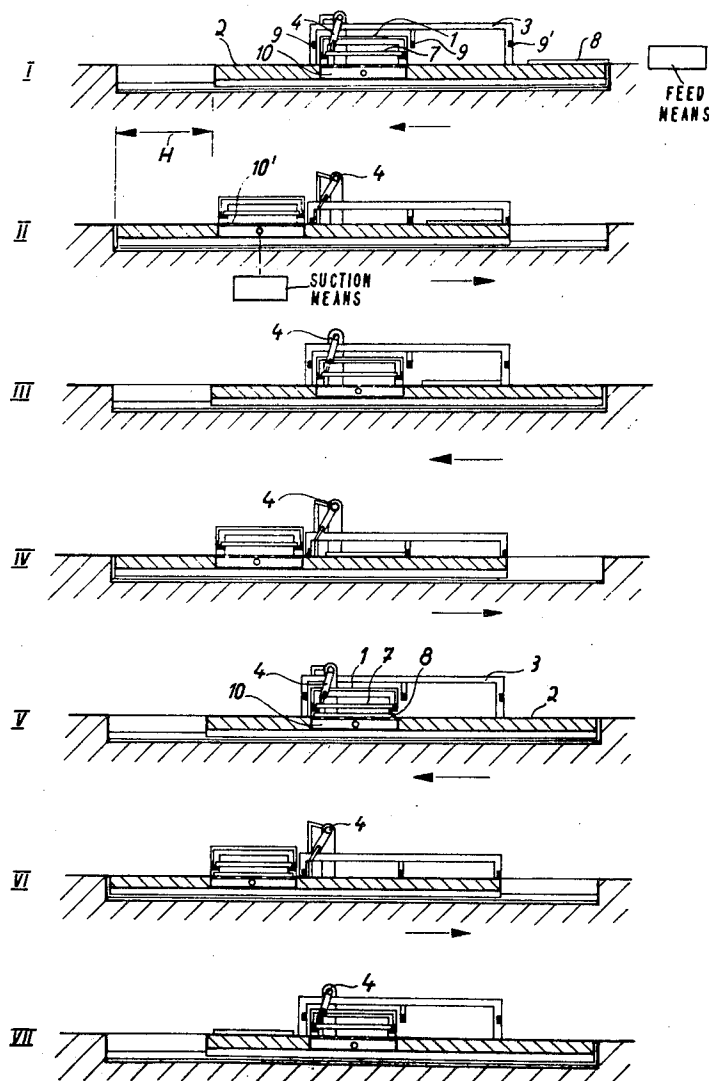
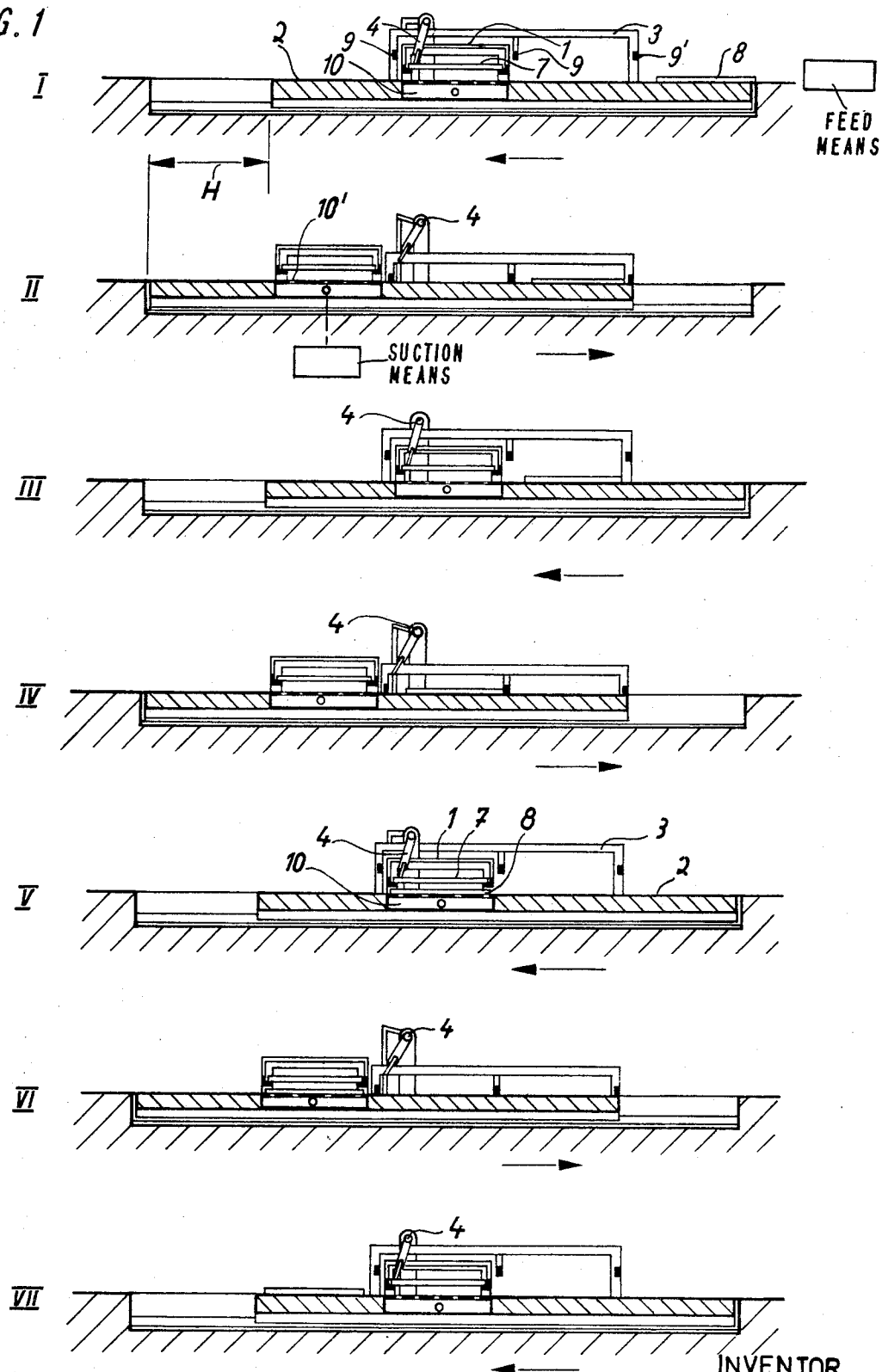
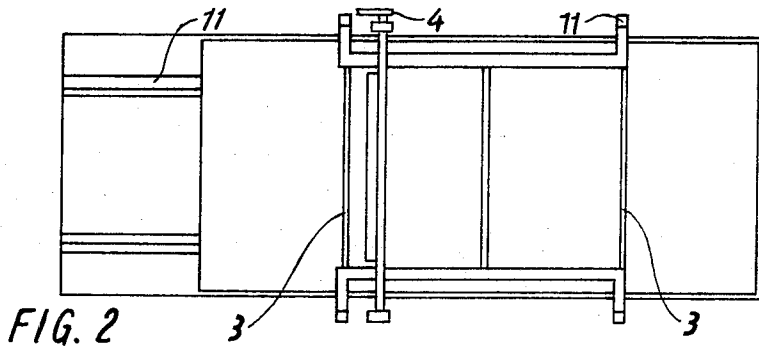
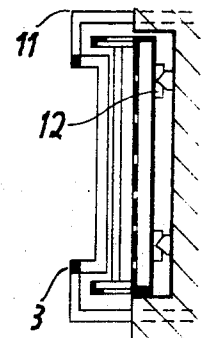
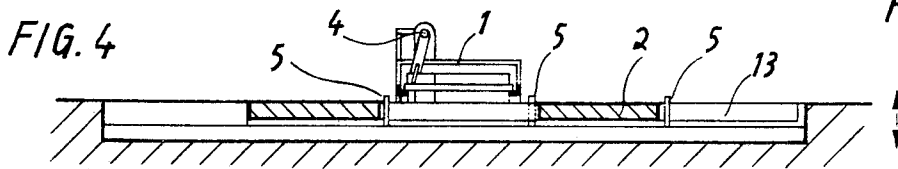
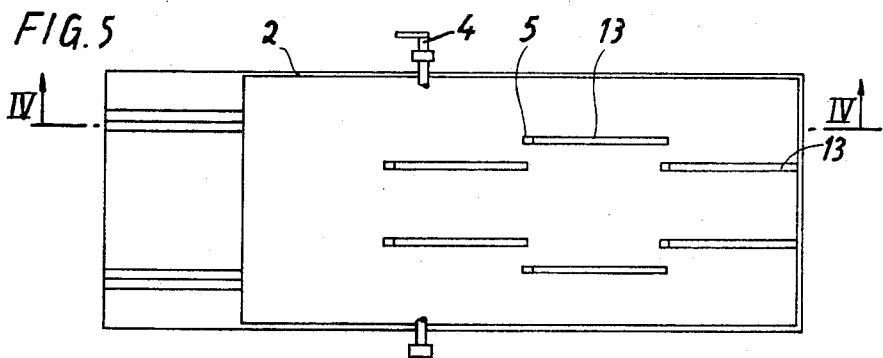
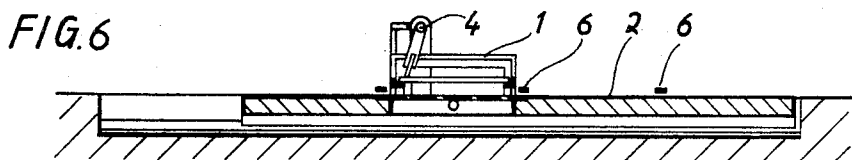
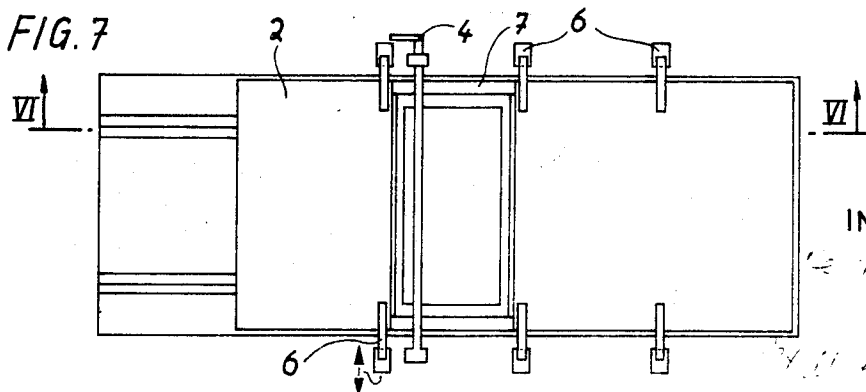


FIG. 1



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FIG. 8

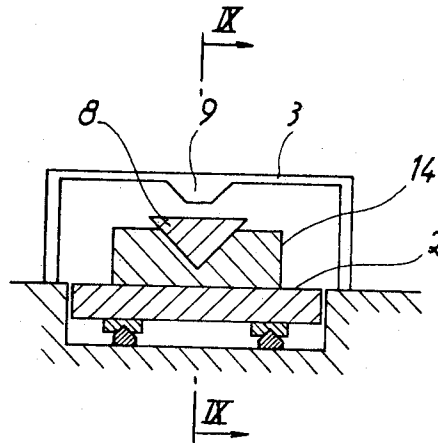


FIG. 9

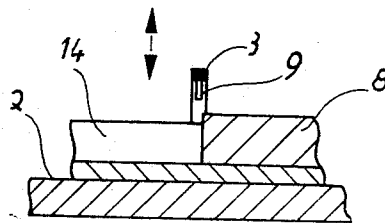


FIG. 10

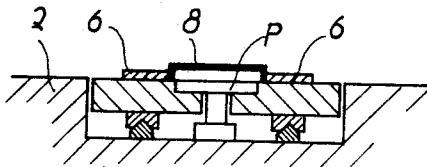
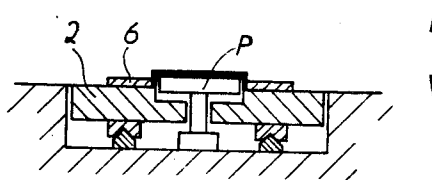


FIG. 11



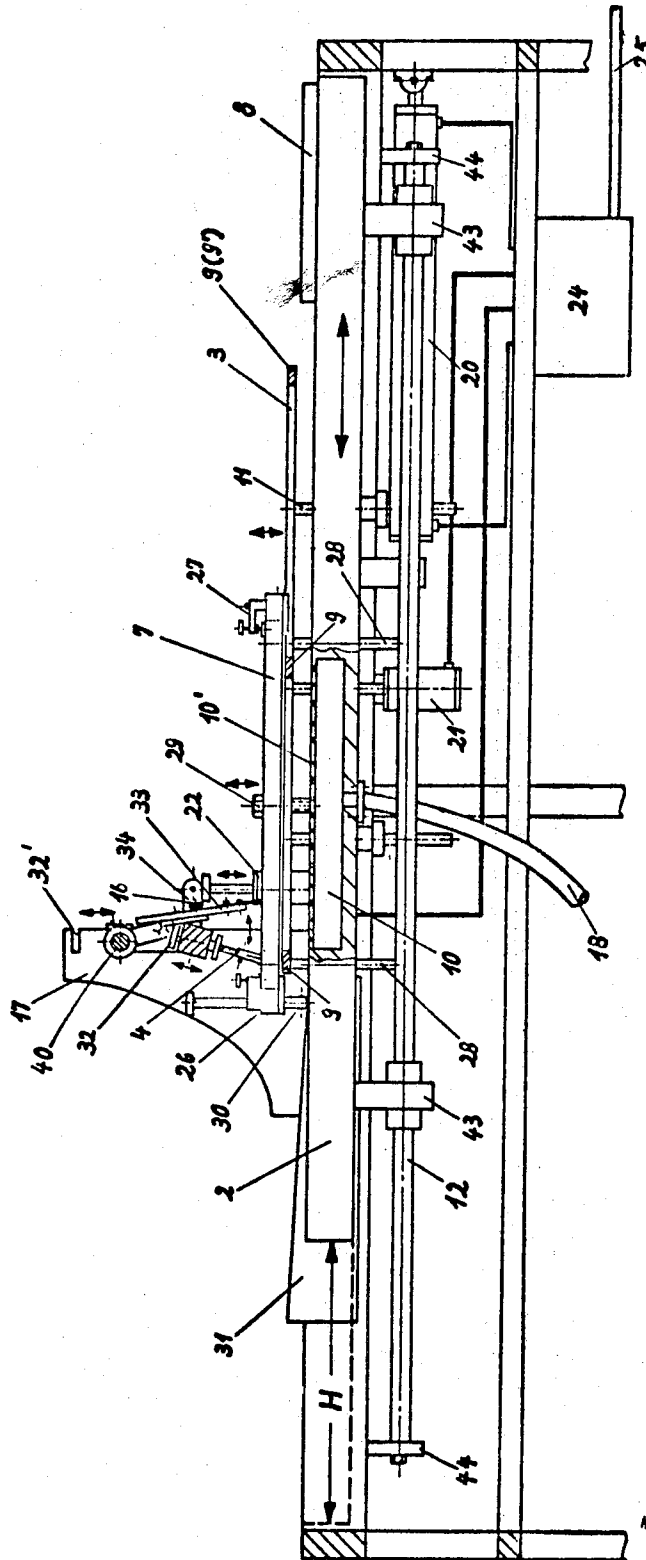
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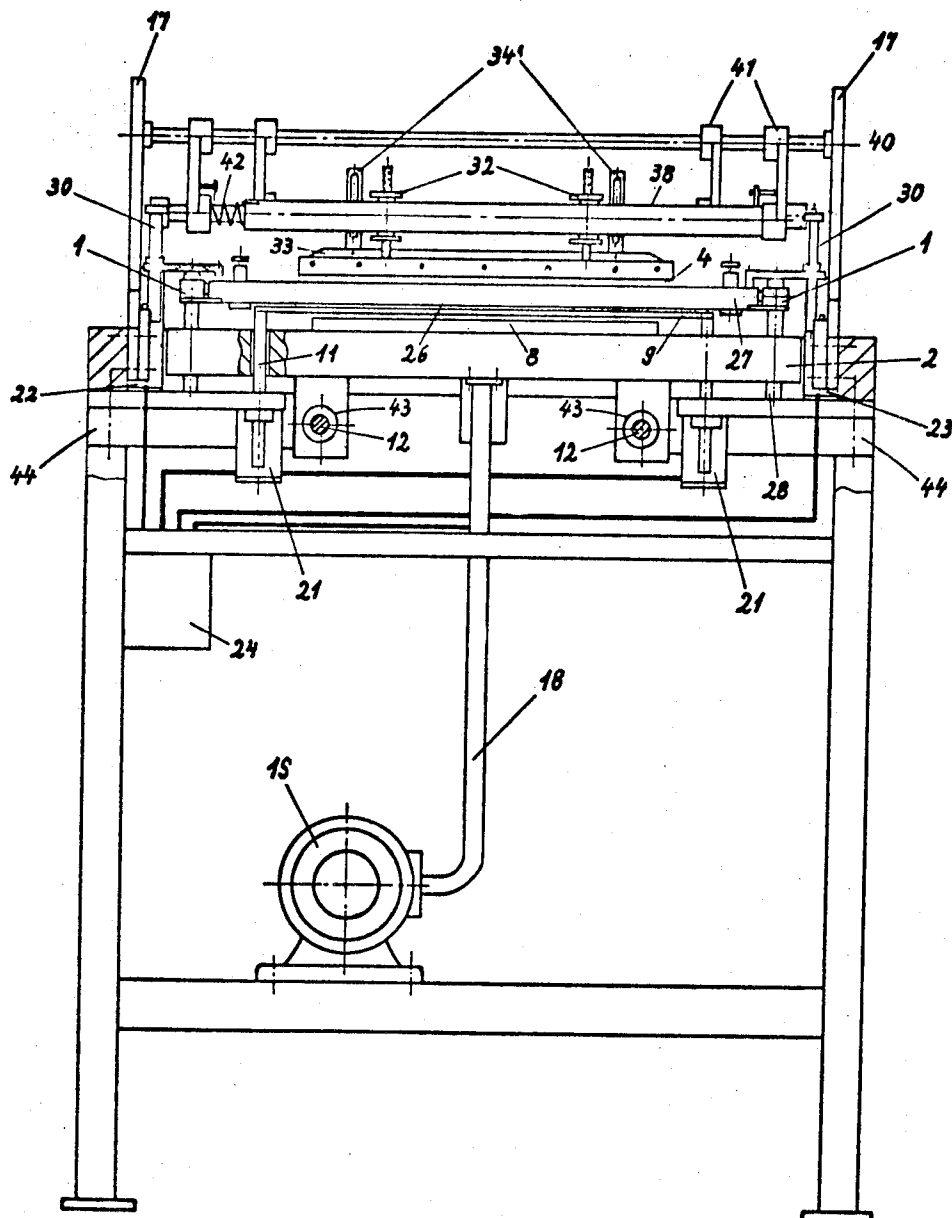
FIG. 12



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FIG. 13

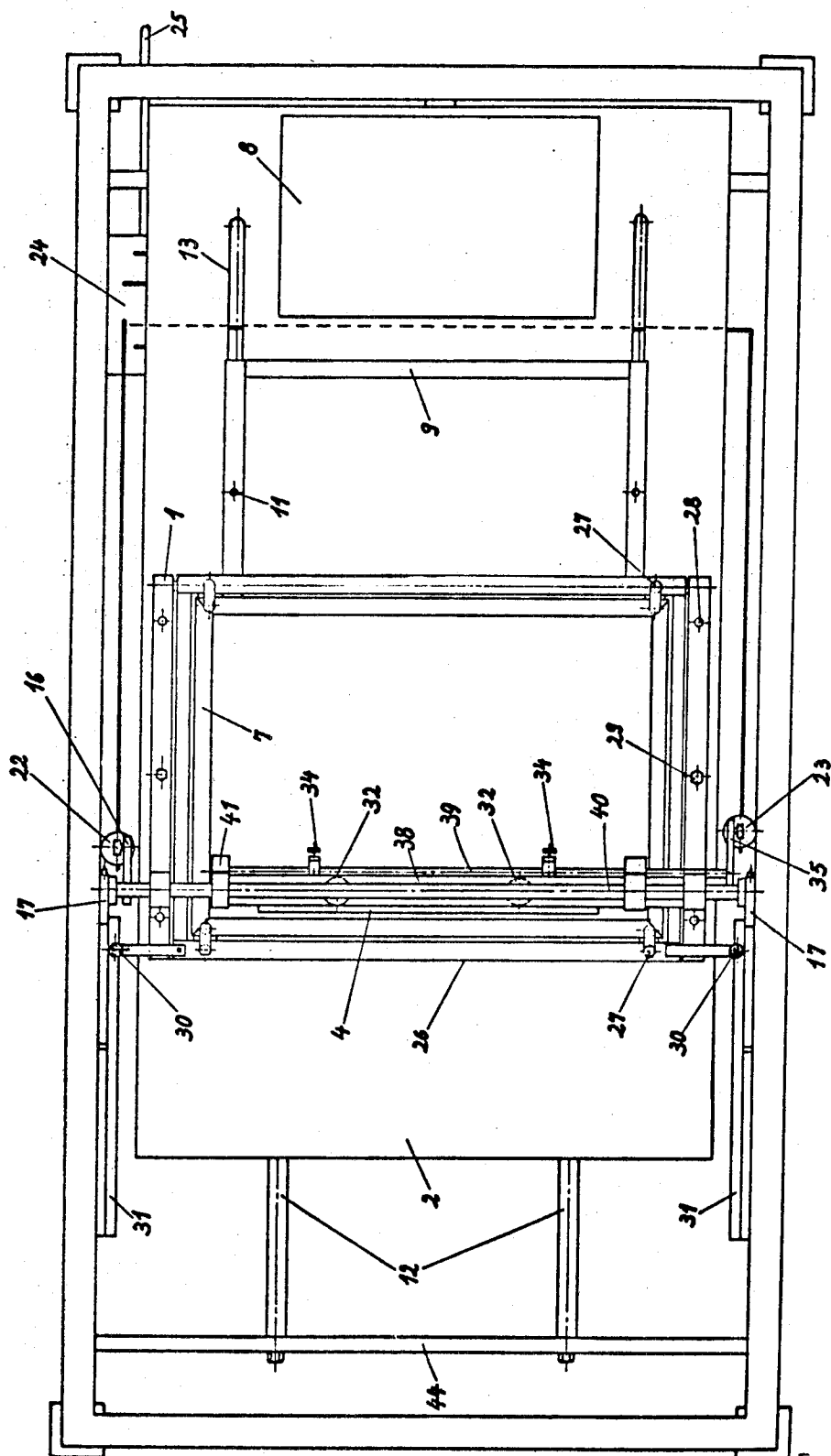


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FIG. 14



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FIG. 15

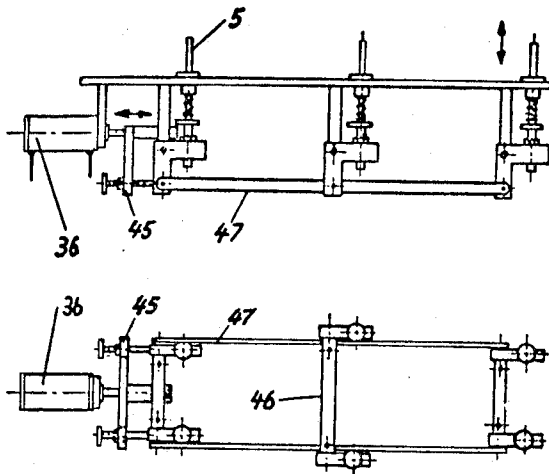


FIG. 17

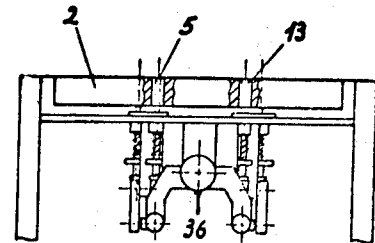


FIG. 16

FIG. 18

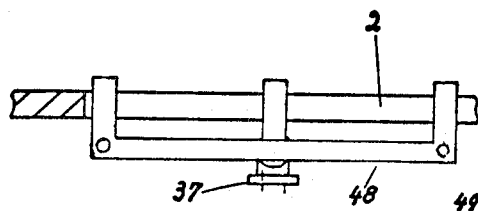


FIG. 19

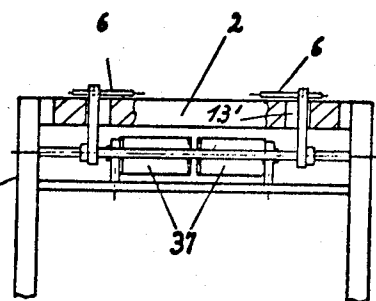
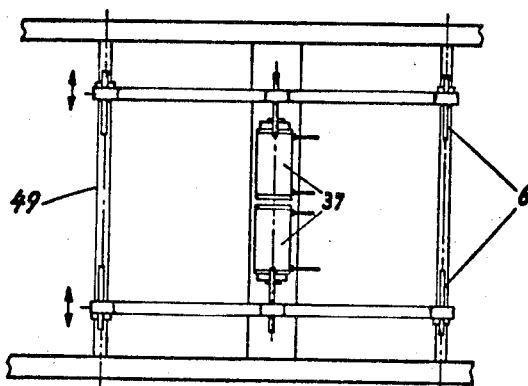


FIG. 20

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SCREEN PRINTING MACHINE EMPLOYING A RECIPROCATING PRINTING AND FEED PLATE

CROSS REFERENCE TO RELATED APPLICATION

This is a continuation-in-part of my earlier application, Ser. No. 723,678, now abandoned, filed on Apr. 24, 1968 and entitled "Screen Printing Machine."

BACKGROUND OF THE INVENTION

This invention relates to screen printing.

It is the nature of the screen printing process, as for no other printing process, that it can be used for a particularly wide range of different materials. The types of machine employed therefore make allowances for this fact.

However, these known machines have various drawbacks. In certain cases only a small hourly output can be obtained since the individual operations have to take place in succession. In others, in which the material being printed is taken off by grippers which secure it, the three processes of feeding (laying on), printing and removal (taking off) may be carried out simultaneously, which is an advantage. However, the disadvantage of this type is the absolute necessity of a gripper margin on the material being printed on, a disadvantage which is particularly serious if valuable material is being processed; apart from this an additional operation has to be carried out to cut off the gripper margin and this is particularly inefficient if the material has to be cut separately and not as part of the cycle. The latter type of machines cannot print on specially thick material (as it cannot be grasped by the gripper) or irregular molded shapes with parallel surfaces.

SUMMARY OF THE INVENTION

It is an object of the invention to provide a screen printing machine which is free from the aforementioned disadvantages.

A further object of the invention is to provide such a machine which can be used for printing on a wide variety of materials, has a high output and requires no gripper margin on the material to be printed.

In pursuance of these objects, and others which will become apparent hereafter, a machine according to one embodiment of my invention comprises, briefly stated, elongated baseplate means having an upper surface and being reciprocable longitudinally in predetermined directions and in working strokes of predetermined length, so that material to be printed and which is located on the surface tends to share such strokes, screen means mounted above the baseplate means for movement toward and away from an upper surface of the same, clamping means associated with the screen means for intermittently clamping the latter against the baseplate means, mounting means mounting the screen means and the clamping means on the baseplate means for reciprocation with the same, and blocking means operatively associated with the baseplate means for blocking material on the surface at the end of the respective working stroke from sharing with the baseplate means the subsequent return stroke, whereby the material advances stepwise over the upper surface in one of the predetermined directions.

The clamping means may be mounted, e.g., in supporting sidewalls and reciprocated by any type of drive, in uniformly long strokes. If printing material is fed to the apparatus when the combined baseplate is in its starting position, the material will be carried forward the length of one stroke on the forward movement. That is to say, the stroke must be long enough to make the material pass beyond the blocking means which may be in form of a bridge which is stationary with respect to the direction of reciprocation. When the material has passed through, the bridge is lowered and acts as a barrier for the material, when the baseplate carries out the return stroke. In this way the material can be conveyed forward through two or more stations. When it is below the screen which is fixed in the clamping means, and the baseplate moves forward, the material is printed by a stationary squeegee which is stationary with

reference to the direction of reciprocation and is controlled, e.g., by a cam and is lowered at the desired moment to move over the screen and thereby effect the printing. After the printing process the material is removed on the same advancing principle.

Printing material of any thickness can obviously be treated in this way, provided that the clamping means for the screen, the bridges and the squeegee are made suitably adjustable in height. Instead of the stationary bridges, pins which can be raised and lowered, may be used, if the combined printing base contains longitudinal slots through which the pins may project or withdraw. The pins must then be controlled by suitable means so that on the forward movement of the combined baseplate they are retracted beneath the surface thereof, whereas on the backward movement they project above the surface of the baseplate and thus prevent the printing material from moving back with the plate.

Instead of bridges or pins, it is possible to operate with lateral blocking arms, which are then always drawn apart to left and right far enough from the center to let the printing material lying on the baseplate pass on the forward stroke, and moved together far enough toward the center of the baseplate on the backward stroke of the latter to prevent the material from returning. Depending on requirements, the use of bridges, pins and lateral blocking arms may of course be combined to form a barrier at the various stations.

Any slipping between the baseplate and the printing material may be prevented e.g. by a vacuum in a perforated baseplate and by suction; in this way the material is securely maintained at the various stations. Instead of vacuum, mechanical securing means or magnets mounted on the baseplate may be employed where the nature of the printing material so permits.

The bridges, lateral arms and pins described above are provided to hold back the printing material when the baseplate carries out the return stroke, and the advantage of the invention resides chiefly in the fact that by their use a wide variety of materials can be advanced and printed. For example, plastic parts, plastic folders, ash trays, saw blades, tiles, rectangular bottles and many other materials may be advanced and printed with the same ease as sheets. Even parts without any parallel surfaces may be printed, provided that a guide of e.g. prismatic cross section is mounted on the baseplate.

It is also possible to equip the printing station so that a pickup implement receives the material. If thin plastic lids are taken as an example of the material, these may be received at the printing station by a plunger which may be controlled so that it acts as a support when raised for the printing process and is lowered into general plane of the baseplate when the printing material is moved on.

In known specialized machines operating on the line-production principle, the printing material is pushed by pins coupled to the clamping means for the screen. The material is pushed along the stationary plate of the printing table during the printing process. This has the disadvantage that only completely rigid material can be printed on such a machine. Moreover, the material itself, which is squeezed onto the plate by the pressure of the squeegee, must be insensitive to the friction thereby created, as it would otherwise be scratched underneath.

With the machine according to the invention, on the other hand, the printing material which may be hard or soft, lies on the advancing baseplate during the printing process and so cannot be damaged by friction. This advantage considerably widens the range of material which can be printed on the machine.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 shows various stages I to VII in the operation of a screen printing machine according to the invention;
 FIG. 2 shows the machine of FIG. 1 in plan view;
 FIG. 3 shows the machines of FIG. 1 in side view;
 FIG. 4 is a longitudinal section on line IV-IV of FIG. 5;
 FIG. 5 is a plan view of the embodiment of FIG. 4;
 FIG. 6 is a longitudinal section on line VI-VI of FIG. 7;
 FIG. 7 is a plan view of the embodiment of FIG. 6;
 FIG. 8 is a cross section through another embodiment;
 FIG. 9 is a fragmentary section on line IX-IX of FIG. 8;
 FIG. 10 shows yet another embodiment in sections and in one position;
 FIG. 11 shows the embodiment of FIG. 10 in another position;
 FIG. 12 is a side elevational view of an actual embodiment of an apparatus according to the invention;
 FIG. 13 is an end view of the apparatus in FIG. 12;
 FIG. 14 is a top plan view of FIG. 12;
 FIG. 15 is a side elevational detail view of the blocking means used in the embodiment of FIGS. 12-14;
 FIG. 16 is a top view of FIG. 15;
 FIG. 17 is an end elevation of FIG. 15 looking toward the right;
 FIG. 18 is an end elevational view illustrating further details of the blocking means;
 FIG. 19 is a side view of FIG. 18; and
 FIG. 20 is a top plan view of FIG. 19.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIGS. 1-3 a clamping means 1 for a printing screen 7 is rigidly connected to a baseplate 2 and mounted for longitudinal movement in a table. The baseplate 2 is moved to and fro by a drive of any type, in uniformly long strokes H. In position I the combined baseplate 2 is in its starting position, with printing material 8 thereon which is supplied by known feed means diagrammatically illustrated, this material being brought into position II on being moved forward the length of the stroke H. The length of this stroke is such that the material 8 passes through under a stationary bridge 3 fixed to the frame, after which the bridge is lowered by conventional means and acts as a barrier for the printing material when the baseplate 2 carries out the return stroke H. In this way the material 8 is transported forward through other positions. Between each of the positions I-VII there is a forward or return stroke in the direction of the arrow.

The bridge 3 is twice the length of the stroke and has three barriers 9, 9'. In position II the barrier 9' holds back the material 8. In position V the material 8 is below the printing screen 7, which is fixed in the clamping means 1. When the baseplate 2 moves forward, the material 8 is printed by a stationary squeegee 4 which is controlled in known manner, e.g. by a cam and is lowered for printing at the desired time. Any slipping between the baseplate 2 and the material 8 is avoided by providing a suction in a chamber 10 and perforation 10' in the baseplate 2, the material being secured in the various stations by suction produced by the diagrammatically illustrated suction means (FIG. 1/II).

After the printing process, position VII is reached by the same principle of advance and the material 8 is removed. In order that material 8 of different thicknesses can be processed, the clamping means 1 for the screen, the bridge 3 and the squeegee 4 are mounted for vertical adjustment in known manner.

As shown in FIGS. 2 and 3, the ends of the longitudinal sides of the bridge 3 are provided with angled portions 11 which terminate and are positioned in the table. The baseplate 2 is let into the table and slides therein on rails 12.

In FIGS. 4 and 5, instead of having the stationary bridge 3, lengthwise slots 13 are provided in the reciprocating base 2; these slots cooperate with pins 5 which can be lowered and which are fixed to the frame. The pins 5 are controlled by an arrangement (not shown) and are lowered beneath the surface

of the baseplate 2 on the forward movement of the latter. On the backward movement of the plate 2 the pins 5 project beyond its surface and prevent the printing material 8 from running back with the plate. Pairs of slots 13 and pins 5 are offset from one another for each length of stroke H and are staggered (see FIG. 5).

In FIGS. 6 and 7 lateral blocking arms 6 are provided instead of the pins 5 which can be lowered; the arms 6 can always be drawn far enough apart from the middle to center the printing material 8 lying on the baseplate 2 and let pass on the forward movement; on the backward movement of the baseplate 2 they are moved far enough together toward the middle of the baseplate in at least substantial parallelism with the plane of the upper surface thereof to prevent the material 8 from returning. The barrier 9, pins 5 and arms 6 hold back the material 8 when the baseplate 2 carries out the return stroke, and have the advantage of enabling many different types of material to pass through and be printed. Thus, instead of the sheets illustrated they will also let through e.g. plastic parts, plastic folders, ash trays, saw blades, tiles, rectangular bottles and parts with no parallel surfaces.

In FIGS. 8 and 9 the material 8 is to be printed in prismatic cross section and a guide 14 for it is mounted on the baseplate 2. The bridge 3 is provided with a barrier 9 which, when lowered, cooperates with the material 8 in the manner described earlier.

In FIGS. 10 and 11 the printing station is equipped so that the material 8 is received by a pickup implement. Thin lids are shown as an example of the material 8; at the printing station these are picked up by the plunger P, which, when it is raised for the printing presses, acts as a support and which, when the material 8 is advanced, is lowered into the plane of the baseplate 2.

FIGS. 12-20 show actual embodiments of the invention, by contrast to the diagrammatic illustrations in FIGS. 1-11.

The apparatus illustrated in FIGS. 12-15, wherein the elements have the same reference numerals as their counterparts in the preceding FIGS. insofar as possible, shows a screen 7 whose distance or height with respect to the base 2 may be adjusted; this is evident from FIG. 13. Clamping means 1 serves to hold screen 7 in the associated frame 26 and in the manner known to those skilled in the art.

It will be appreciated that the possibility of adjusting the distance of screen 7 from the base 2 makes it feasible to utilize the apparatus with a great variety of different printing materials—i.e., materials to be printed—of diverse thickness and configuration.

The clamping means comprises two portions, one of which is movable whereas the other is rigid with the base 2 and therefore movable with the latter without play. The squeegee is stationary and the printing frame 26 moves with reference to it. Blocking members 9 cooperate with bridge 3, and pins 5 with slots 13 and plate 2.

The clamping device 1 comprises two elements rigid with base 2 and carrying the frame 26 for the screen 7 in the illustrated manner. The frame, and thereby the screen, are tiltably mounted with the tilting axis located at one end of frame 26. At the opposite end there are provided on the frame two arms with adjusting spindles 30; these are arranged to move onto inclines 31 which are stationary, so that the frame 26 is lifted when this occurs. Four grippers 27 secure the screen 7 to the frame 26. Four bolts, and other, nonillustrated securing means secure the clamping device 1 to the base 2.

The height adjustment to accommodate thicknesses in the printing material, as mentioned before, is effected by means of screws 29 which permit adjustment of elements 1, 7, 26 and 30 as a unit with reference to the base 2.

Squeezes 4 and 33 are tiltable in the sense indicated by the associated arrow; rough adjustments in the height of squeegee 4 are effected by virtue of the presence of recess 32' of the members 17, while fine adjustments are carried out via a spindle 32. Two screws 34 permit adjustment of the position of squeegee 33.

As shown, one end of a lever 16 is connected to a rod 38 while the other end is associated with a drive cylinder 22. Similarly, one end of a lever 35 is connected to a rod 39 while its other end is connected with drive cylinder 23. A further cylinder 21 serves to effect moving of the bridge 9 with the aid of portions 11 which are guided in slots 13 of baseplate 2. Cylinder 20 provides motive power for the latter. Valves for the various cylinders are not separately illustrated; they are located in housing 24 and connected via a conduit 25 which communicates with a compressor. Hose 18 movably connects chamber 10 with a stationary vacuum pump.

Both of the squeegees 4 and 33 are tiltably mounted on arms 41 having axis 40 and connected by a spring 42. Squeegee 33 is adjustable by tilting about rod 39 through arms and cooperating longitudinal slots 34'. It is connected by spring 42 with the left-hand outer arm 41 (FIG. 13). Spring 42 is a torsion spring connected to rod 39 and to a projection of the arms 41 in question. A similar connection exists between the left-hand inner arm 41 and the rod 39 about which element 33 turns. The right-hand arm 41 serves as an abutment. Rods 12 act as guides for baseplate 2 and are connected to the baseplate 2 by loops 43, and with the frame 26 by the arms 44. Cylinders 20-23 are stationary. The springs urge elements 4 and 33 against the associated left-hand arms 41 and the elements are fitted from this operating position, and lifted off by the levers 16 and 25, respectively so that the elements then both extend in the same direction. The somewhat different showing in FIG. 13 has been chosen to preserve clarity of illustration. Slots 34' extend along two other arms which are transversely secured to element 33. Abutments on rod 39 are associated with screws 34.

In FIGS. 15-17 in which like reference numerals again identify like elements, a cylinder 36 is seen to be connected with spring-loaded pins 5 via lever 45, pairs of members 46 and rods 47. Cylinder 36 is stationary. This embodiment thus shows in detail what has been described with reference to the diagrammatic illustration in FIGS. 4 and 5.

FIGS. 17-20 show the use of two stationary cylinders 37 which are associated with the arms 6 and the members 48. The latter are mounted on rods 49 shiftable in transverse slots 13', with the rods being stationarily secured to the machine frame. In this embodiment the members 48 replace the pins 5 and correspond to the lateral blocking arms 6 of FIGS. 6 and 7, with their movement between blocking and unblocking positions being enabled and guided by the presence of the slots 13'.

As already mentioned, the drawings only show examples of the invention; the invention is not restricted to these, and other embodiments and applications are possible. It is, however, essential for the baseplate to be rigidly connected to the clamping means for the screen and to participate in the entire forward and backward strokes, whatever particular embodiment may be chosen.

While the invention has been illustrated and described as embodied in a screen printing machine, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the

meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims.

I claim:

1. In a screen printing machine, in combination, baseplate means having an upper surface and being reciprocable longitudinally in predetermined directions in alternate working and return strokes of predetermined length, so that material to be printed and which may be located on said surface moves with said baseplate means; screen means mounted above said baseplate means for movement toward and away from the upper surface of the same; blocking means associated with said baseplate means and operative during the respective return strokes of the same for blocking material on said surface from moving with said baseplate means, whereby such material advances stepwise over said upper surface and beneath said screen means in one of said predetermined directions; clamping means cooperating with said screen means for clamping the same against said baseplate means when material to be printed is located beneath said screen means; and squeegee means mounted for engagement with said screen means in response to operation of said clamping means to thereby effect printing of material located beneath said screen means.

2. In a machine as defined in claim 1, said blocking means comprising barrier means mounted for displacement in direction normal to said upper surface.

3. In a machine as defined in claim 1, said blocking means comprising barrier means mounted for displacement in at least substantial parallelism with the plane of said upper surface.

4. In a machine as defined in claim 1, said blocking means comprising three cooperating barrier elements arranged spaced from one another in longitudinal direction of said baseplate means and being movable in unison with one another relative to said upper surface between a blocking position which they assume during the respective return strokes, and an unblocking position which they assume during the respective working strokes.

5. In a machine as defined in claim 1, wherein said upper surface is provided with a plurality of slots extending longitudinally thereof; and wherein said blocking means comprises a plurality of projections each registering from below said baseplate means with one of said slots and being movable between a working position in which it is partly located in the associated slot and partly extends upwardly of said upper surface, and a retracted position in which it is entirely withdrawn into the associated slot.

6. In a machine as defined in claim 1; and support means associated with said baseplate means and operative for supporting material to be printed on said baseplate means in a predetermined position.

7. In a machine as defined in claim 1, said baseplate means having opposite lateral sides, and said blocking means comprising blocking members located at said opposite lateral sides of said baseplate means and being movable towards one another transversely of said predetermined directions.

8. In a machine as defined in claim 1; and further comprising guide means for material to be printed and operative so as to guide such material during the advancement thereof.

9. In a machine as defined in claim 8, said guide means being mounted on said baseplate means.

10. In a machine as defined in claim 8, wherein said guide means comprises a guide element of substantially prismatic cross-sectional configuration.