

May 8, 1945.

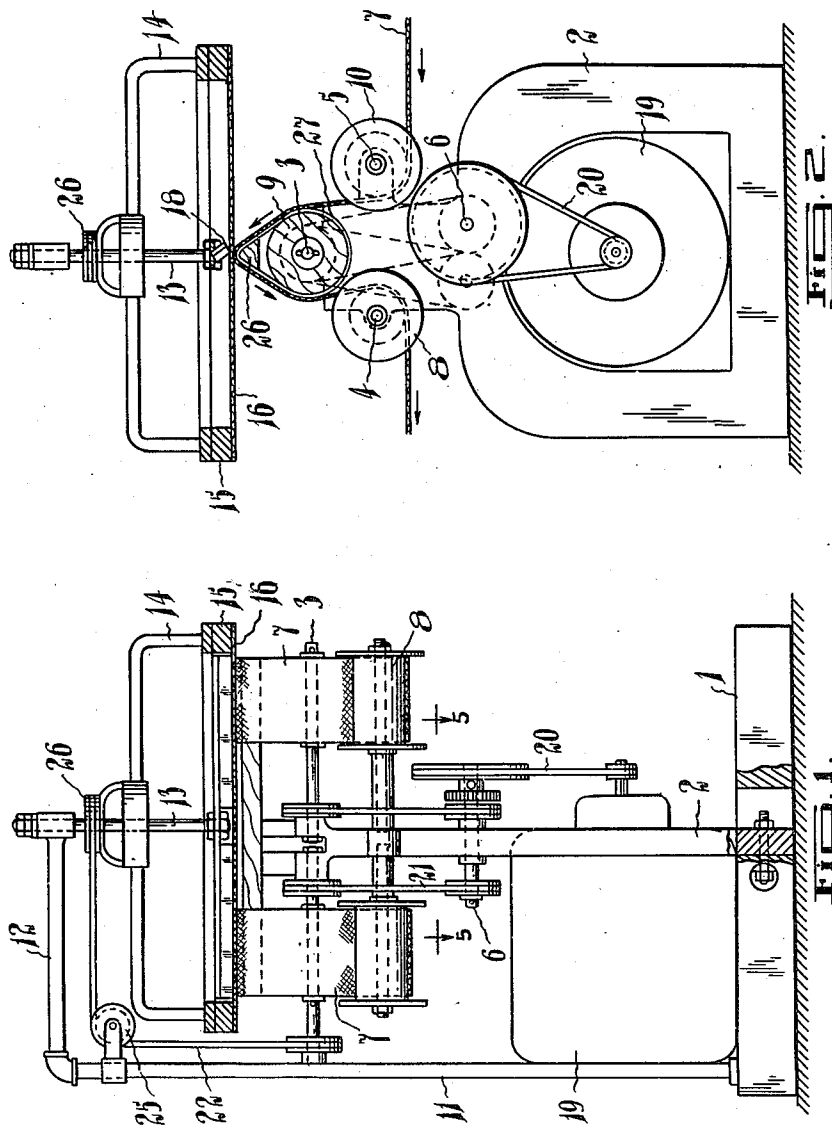
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2,375,237

APPARATUS FOR PRINTING LENGTHS OF MATERIAL

Filed June 28, 1943

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

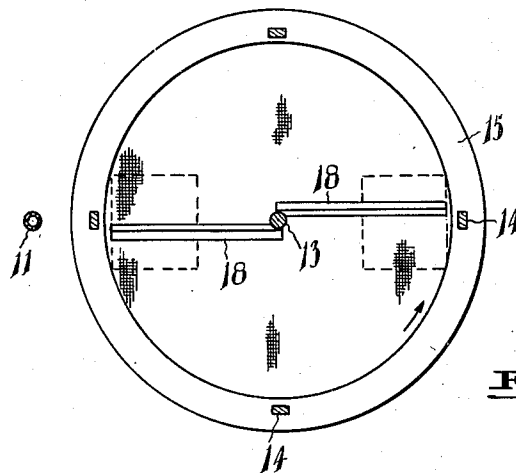


FIG. 3.

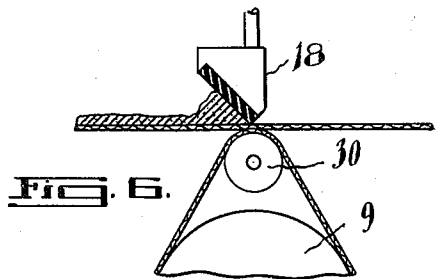


FIG. 6.

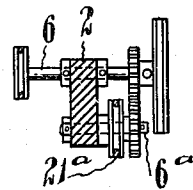


FIG. 5.

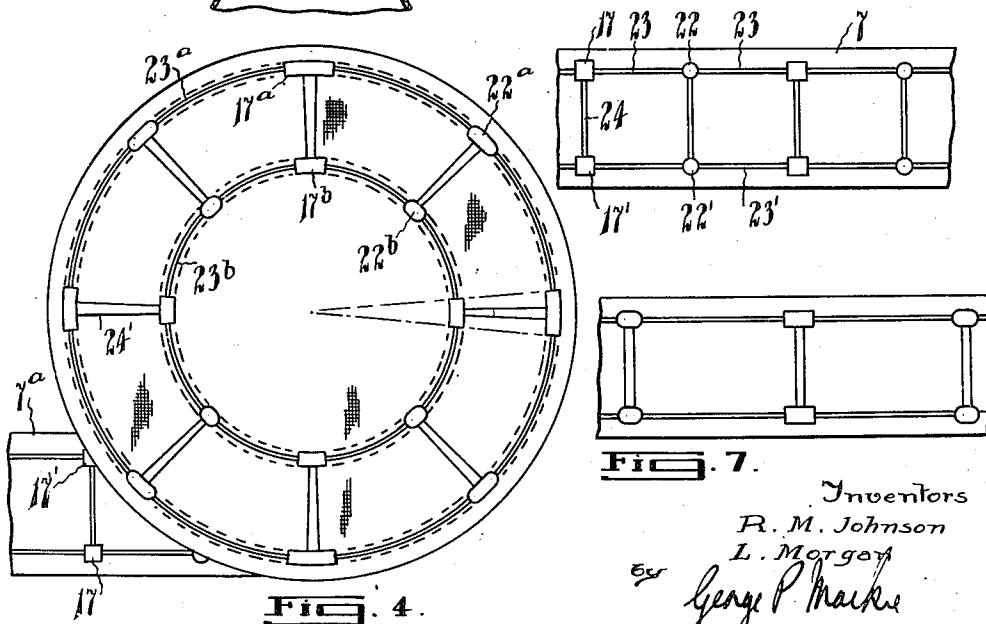


FIG. 4.

FIG. 7.

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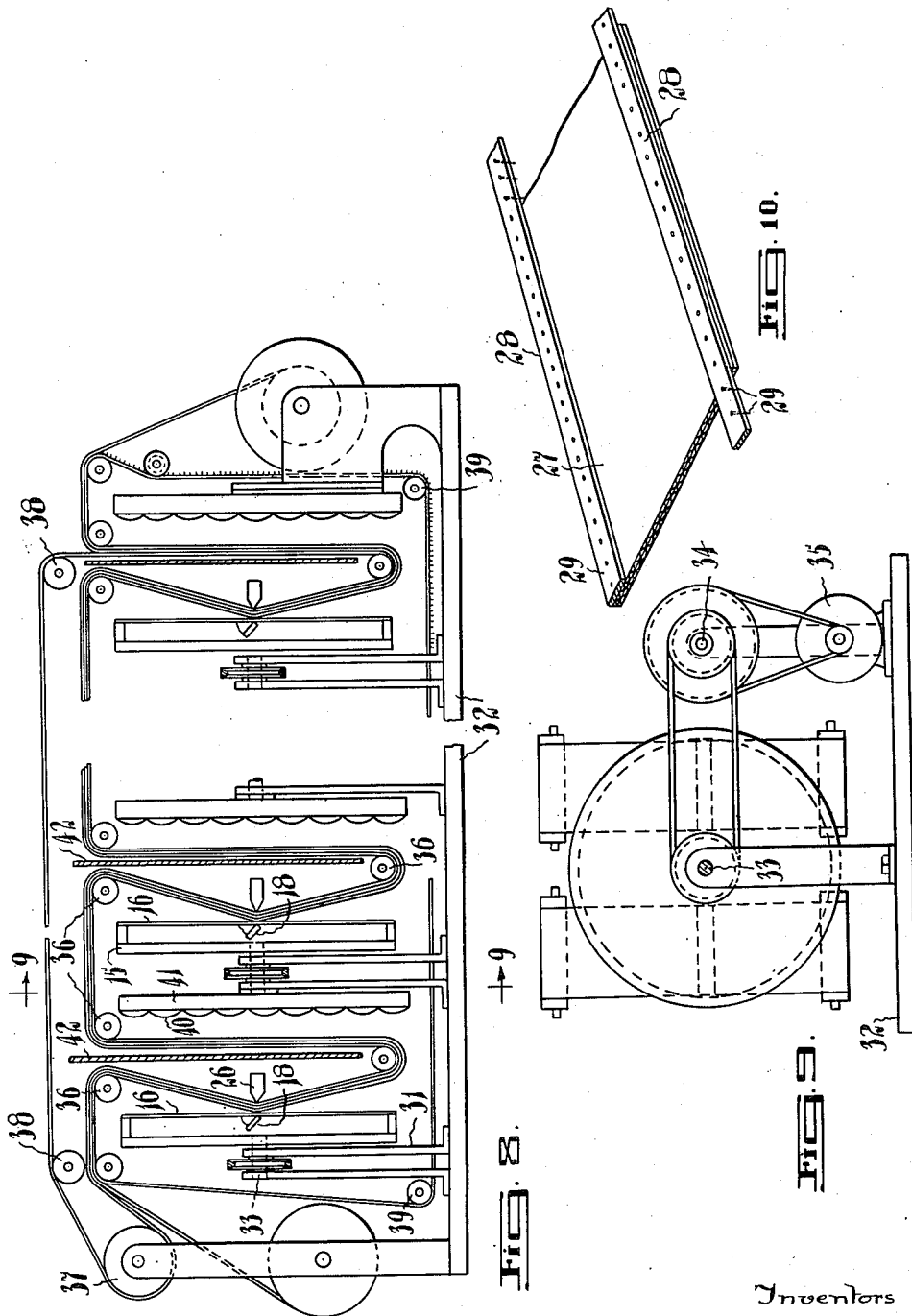
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APPARATUS FOR PRINTING LENGTHS OF MATERIAL

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3 Sheets-Sheet 3



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APPARATUS FOR PRINTING LENGTHS OF MATERIAL

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Application June 28, 1943, Serial No. 492,594

4 Claims. (Cl. 101-114)

This invention relates to the printing of long lengths of material, such as paper or cloth, with a repeat pattern. This has previously been done by passing the web of material over a stiff roll or drum having the desired pattern engraved, etched, or otherwise formed thereon.

It has been recognized for some time that finer printing is obtained when the "screen" process is used. This screen process employs a stencil comprising a piece of fabric of suitable size, having certain portions of its surface permeable to ink, dye, or color, and certain other portions of its surface treated to render them impermeable to ink, dye, or color, said permeable and impermeable portions being arranged relative to one another to form any desired pattern.

It has been found impracticable to employ such a screen by mounting it on a printing roll or drum, due to the difficulty in maintaining the screen in place with its surface following the desired arc or periphery of the drum surface, and on account of the difficulty in feeding the ink or color to the interior of such a roll or drum and forcing it through the screen stencil. Further in using a drum, the ends of the screen must be joined and the joint thus formed interferes with the printing process.

The object of our invention therefore is to devise suitable apparatus which will enable the screen process to be used in a practical manner for applying a repeat pattern to long lengths of material.

We attain our object by mounting the stencil screen in the flat on a printing head, the screen stencil being secured sufficiently taut so as to remain flat while the ink or color is forced through the permeable or pattern portions of its surface, and by causing the material to be printed to travel in a line crossing but spaced from the screen stencil at one side of the axis of the printing head, said material being caused to first approach the screen stencil, contact said stencil only on a narrow line extending radially of the printing head to enable printing to be effected and then to immediately recede from the printing head after printing has been effected.

We attain our object by means of the constructions hereinafter described and illustrated in the accompanying drawings in which:

Fig. 1 is a side elevation, partly in section, of the printing apparatus;

Fig. 2 a front view of the same;

Fig. 3 a plan view of the stencil carrying disk with its ink distributing means;

Fig. 4 a plan view of the under side of the disk showing a specimen stencil and a strip of printed material;

Fig. 5 a detail plan view of part of the driving mechanism;

Fig. 6 a detail vertical section showing a modified form of printing surface;

Fig. 7 a plan view of another pattern formed with the stencil shown in Fig. 4;

Fig. 8 a side elevation, partly diagrammatic, showing an arrangement for printing a multiplicity of colors;

Fig. 9 a section on the line 9-9 in Fig. 8; and

Fig. 10 a perspective view of the fabric with its supporting web and belts, all being shown in the flat condition.

In the drawings like numerals of reference indicate corresponding parts in the different figures.

Referring to Figs. 1 and 2, 1 indicates a base. Extending upwardly from the base is a frame 2 in which are journaled horizontal shafts 3, 4, 5 and 6. 7 indicates a strip of material to be printed. This strip passes around a roll 8 on the shaft 4, over a roll 9 on the shaft 3, then over a wedge-shaped member 26, the edge of which is slightly flattened or truncated, then back over the other side of the roll 9, and then around a roll 10 on the shaft 5, from which it is then led off to any convenient drying and reeling apparatus, not shown. The member 10 will be rigidly supported by the frame 2.

Printing is effected as the strip passes over the flattened edge of the member 9.

To prevent distortion of the fabric, which is often of very fine texture, during printing, we provide a supporting web 27 running over the roll 9 and member 10 and drive belts 28, which not only support the sides of the web 27, but are provided with prongs 29, which project not only through the supporting web but also through the material being printed, said prongs not only helping to hold the material straight during printing, but assisting in the positive drive of the latter over the printing surface. A detail of the belts and webbing is shown in Fig. 10.

Extending upwardly from the base 1 is a post 11 provided at its upper end with a lateral arm 12, in which is journaled a stationary vertical shaft 13. On this shaft is rotatably mounted a downwardly facing printing head, which comprises a frame 14 and an open ring 15. Across

the opening of this ring is secured the screen stencil 16. The ink is placed above the back of the stencil screen and forced through the pattern or permeable openings of the screen by a stationary distributor or squeegee 18 supported from the lower end of the shaft 13, immediately above the member 26.

It will be noticed from Fig. 3 that the printing head is arranged relative to the member 9 so that the top of the latter occupies a position radially of the under side of the stencil, and the distributor occupies a similar position relative to the upper side of the stencil, so that, as the printing rotates, the ink is squeezed through the stencil screen on to the strip of material as the latter passes over the member 9.

The strip of material at the printing position travels across the under face of the printing head at one side of the axis of the latter. It will be seen therefore that while the full width of the strip travels at a uniform speed as it passes the printing position, the stencil travels at a progressively greater speed from the axis of the head to its periphery, and consequently while, for example, that portion of the stencil nearer the axis may travel at the same speed as the material, the portion of the stencil nearer the periphery will naturally travel faster than the material. Conversely, if the part of the stencil near the periphery travels at the same speed as the material the part nearer the axis will travel slower than the material.

This means that there is a relative movement or slippage of at least certain parts of the stencil as it passes over the printing position. It is very important therefore that the time of contact between the stencil and the material be quite short and that the printed material move out of contact with the stencil as quickly as possible after printing, and this is the reason for employing the wedge shaped member with its flattened end forming the narrow printing surface.

Due to the unequal speed of travel of the parts of the stencil, it will be apparent that a special arrangement of the pattern in the stencil is necessary.

In Fig. 4 the printed design is shown as consisting of a series of small squares 17-17' and circles 22-22' connected by straight longitudinal lines 23-23' and transverse lines 24. The outer openings, or rather the permeable portions 17^a of the stencil which print the squares 17 must necessarily be longer than the inner openings 17^b which print the squares 17', while similarly the outer openings 22^a which print the circles 22 must necessarily be longer than the inner openings 22^b, in order to obtain printed reproductions of the same size in both rows. It will also be noted that the lines 23-23' are formed respectively by arc-shaped lines 23^a 23^b on the stencil, the curvatures of which are concentric of the printing head. It will be particularly noted that the stencil lines 24' which form the printed lines 24, are of gradually increasing width in a direction away from the axis of the printing head.

It will also be noted that the innermost sides of the stencil openings are concaved, while the outermost sides are convex, each being formed on circles concentric with the printing head.

It will be apparent that the increase in length of the pattern openings of the stencil is in direct ratio to the distance of said openings from the axis on which the head rotates. To put it

another way, the portion of the pattern between two parallel lines extending transversely of the finished print, will on the stencil, while occupying the same relative position be deformed to occupy the space between two radii, and further will be curved on an arc of which the axis of the printing head is the center.

The various parts of the apparatus may be driven in various ways, of which the following is only a specimen. 19 is an electric motor, which by means of a belt 20 drives the shaft 6, from which in turn the rollers 3 are driven. It will be seen that through the belts 28 and web 27, the material is positively driven past the printing position to ensure the proper application of the pattern or design on said material.

A belt 22 is mounted on a pulley on the shaft 3, passes over pulleys 25 supported by a bracket on the post 11, and passes around a pulley 26, rotatable on the shaft 13 and from which is supported the frame 14 of the printing head. If desired the shafts 4 and 5 may also be positively driven.

To obtain the square and round dots shown on the material in Fig. 4, the printing head will run slightly faster over the printing line than the material being printed. Variations in the printed design could readily be obtained by varying the rates of speed. For example oblongs and ovals having their greatest dimension longitudinally of the material could be readily obtained by slowing down the speed of the printing head relative to the travel of the material, an example of which is shown in Fig. 7, and the length of said oblongs and ovals could be varied as desired without change in the pattern and only a change of the relative speeds.

It will be seen that we have devised an arrangement which will permit of long lengths of material being printed with the screen process.

It will be apparent that the same stencil may be used to print two strips at one time by running a second strip 7a across the stencil at the other side of the axis of the printing head as indicated at the left hand side of Fig. 4. Duplicate rolls 9a, 8a and 10a will be provided. These rolls must rotate, however, to feed the material 7a in the direction to the material 7 and in Fig. 5 is shown a second shaft 6^a driven by gears from the shaft 6, which shaft 6a has a pulley thereon which drives a pulley on the shaft 3a by a belt 21a.

In Fig. 6 is shown a modified form of printing surface, which comprises a small roller 30, located above the roll 9 and immediately below the stencil. This roll is arranged with its axis extending in alinement with one of the radii of the rotating stencil.

The screen stencil may be formed in any desired manner, as for example, the pattern could be cut in a thin sheet material impervious to dyes, inks or colors, which may be softened by heat, for example, the product known under the trade name "Profilm" and this could be integrally united with the screen by heating the sheet material while pressing it into the screen, and then allowing the material to cool.

In Fig. 10 is shown more or less diagrammatically an apparatus for applying a plurality of separate colors to the material.

In this apparatus a plurality of supports 31 extend upwardly from a base 32 and in each support is journaled a short horizontal shaft 33. On one end of each shaft is mounted a stencil-carrying head 15, with each of which co-

operates a wedge-shaped member 26 over which the material passes during printing. Cooperating with each stencil 16 is a squeegee or scraper 18 supported from the adjacent support 31. These shafts 33 are driven by means of pulleys and belting from a common shaft 34 driven from a motor 35.

The material being printed is caused to travel over a series of rollers 36, which are arranged to cause the material to contact each stencil 16 in the series, each stencil applying a different color to the material. To ensure positive drive of the material and also to prevent distortion, an endless web also rides over the rollers 36 as well as over a driven roll 37 and idler rolls 38. Spiked belts similar to those shown in Fig. 10 pass over the ends of the rolls 36, and over rolls 39. Sufficient of these rolls will be positively driven to ensure the proper travel of the material past the various printing positions.

It is desirable that each application of ink or color be quickly dried after application so that it will not be marred by application of the next color, and we therefore support on each support 31 a suitable drying means, which may, for example, be infrared bulbs 40 carried on a suitable base 41, or ordinary electric resistance wiring. To prevent the drying of the ink or color on the stencil by the drying apparatus, guards 42 are interposed between the material passing over the stencil and the material passing in front of the drying apparatus. Fig. 8, being more or less diagrammatic, the supporting frame for the wedge-shaped printing members and the various rolls is not shown. It will be understood that in the multiple printing apparatus, the squeegee and cooperating printing surfaces are arranged radially of the stencil heads in the same manner as in the single form as shown in Fig. 3.

What we claim as our invention is:

1. In apparatus for printing lengths of material, a printing head having a stencil thereon for printing repeat designs, means for rotating said head on an axis at right angles to the face of the stencil; means for contacting said material with the stencil at one side of the axis on a line transversely of the material and substantially radially of the stencil; and means for contacting a second lot of material with said stencil at the opposite side of the axis on a line transversely of the second material and substantially radially of the stencil.

2. In apparatus for printing lengths of material, a disk-shaped printing head; means for rotating said head on an axis at right angles to the face of the head, said head having a stencil thereon for printing repeat designs, said design being arranged in a circle about the axis of the head; means for feeding the material across the face of the head at one side of the axis and on a line at right angles to radial line of the stencil; and means for contacting the material with said stencil only on said radial line, the design openings in the stencil and the spaces between them being progressively larger relative to the size of the finished print in a direction from the axis to the periphery of the stencil.

3. A printing stencil for printing repeat designs on a strip of material and adapted for continuous rotation on an axis at right angles to its face, the design on said stencil being arranged in a circle about the axis, the openings for producing the printed design and the spaces between them being progressively greater in length relative to the printed design from the axis to the periphery of the stencil the increase in the size of the design on the stencil on circles of which said axis is the center being proportionate to the distance between two corresponding radii of said circles.

4. In apparatus for printing lengths of material, a printing stencil for printing repeat designs on a strip of material and adapted for continuous rotation on an axis at right angles to its face, the design on said stencil being arranged in a circle about the axis, the openings for producing the printed design and the spaces between them being progressively greater in length relative to the printed design from the axis to the periphery of the stencil, the increase in the size of the design on the stencil on circles of which said axis is the center being proportionate to the distance between two corresponding radii of said circles; and means for feeding the material across the face of the stencil at one side of the axis on a line at right angles to a radial line of the stencil; and means for contacting the material with said stencil only on said radial line.

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