May 19, 1936. D. A. SHIRAEFF ET AL 2,041,153

PHOTOGRAPHIC PRINTING MACHINE

Filed March 20, 1934

Fig. 1.

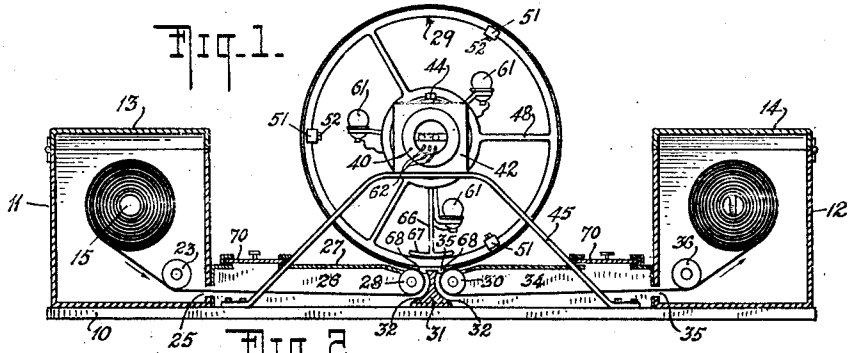


Fig. 2.

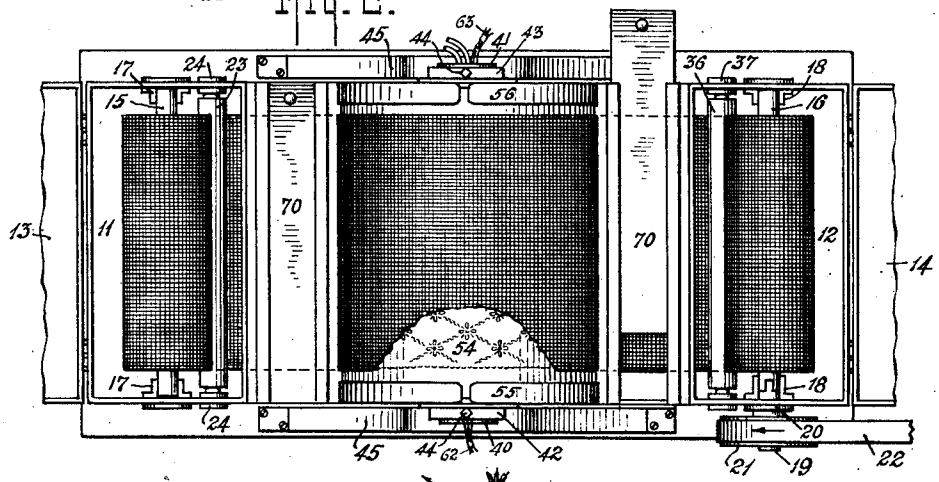
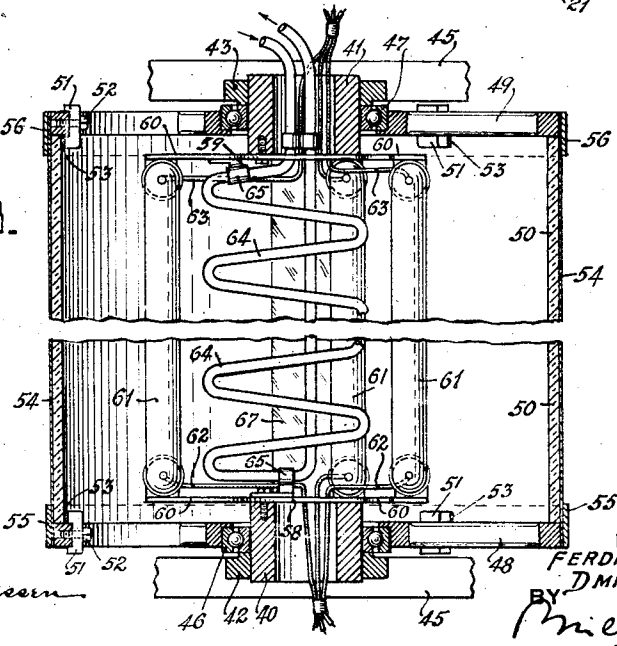


Fig. 3.



WITNESS

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Patented May 19, 1936 2,041,153

UNITED STATES PATENT OFFICE

2,041,153

PHOTOGRAPHIC-PRINTING MACHINE

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Application March 20, 1934, Serial No. 716,458

4 Claims. (Cl. 95—75)

The invention relates to a machine for producing pictures, designs, or the like, on a sensitized strip of material and has for its principal object to provide a machine that will photographically produce a continuous and uninterrupted design on long sheets or strips of light-sensitized material as such sheets or strips are run through the machine at a predetermined rate of feed so that entire rolls of such material can be made up at adequate speed. The invention is particularly applicable to the producing of pictures or designs within the texture of strips of fabric, paper, leather or other fibrous or porous material which have first been impregnated with diazo solutions according to the process described in our copending application Ser. No. 536,076, filed May 8, 1931.

In accordance with the embodiment of the invention herein shown and described, a hollow cylinder made of glass which is non-obstructive to the passage of actinic rays, is mounted so that it is freely rotatable about its central axis. The cylinder carries a photographically developed film containing the pattern that is to be imparted to the sensitized strip of material and the pattern on such film is so made that when it is in position on the hollow glass cylinder, its ends will meet to form a continuous, uniform design. Means are provided whereby the sensitized strip of material is continuously fed through the machine at a predetermined rate, each portion of such strip being held in contact with the photographic film for substantially one entire revolution of the glass cylinder. During its travel around the axis of the cylinder in contact with the photographic film, the sensitized material is exposed to light rays which emanate from a source positioned interiorly of the cylinder. The source of light should be such as to evenly distribute the light rays throughout the entire cylinder so as to give equal illumination to every part of the photographic film. Means are provided to prevent blurring of the design on the strip of sensitized material as the latter is fed into contact with and removed from the surface of the photographic film on the cylinder. A cooling unit is also provided in the interior of the hollow glass cylinder to keep the temperature in such cylinder from becoming excessive.

The invention may be better understood by referring to the following description taken in conjunction with the accompanying drawing in which Fig. 1 represents a side elevation, partly in section, of the complete machine; Fig. 2 is a plan view of the same with the covers of the end receptacles in open position, and Fig. 3 is an enlarged horizontal detailed section, in broken view, of the film carrying cylinder showing the means for rotatably supporting the same together with the interiorly mounted lighting and cooling arrangement.

Referring more particularly to Figs. 1 and 2 of the drawing, the reference character 10 designates the base of a machine made according to the invention, on each end of which there is mounted in any suitable manner a box-like compartment or receptacle 11, 12. The receptacles 11 and 12 are provided with hinged covers 13 and 14, respectively, which are kept in closed position while the machine is in operation to prevent light from entering the interior of the receptacles and affecting the light sensitive material. The light sensitive material is rolled on a roller or shaft 15 positioned in the receptacle 11 and is fed from there to a take-up roller or shaft 16 positioned in the receptacle 12. The rollers 15, 16 are rotatably supported in their respective receptacles by the sockets or bearings 17 and 18, respectively. The bearings 17 and 18 are fixedly mounted on the end walls of the receptacles and are U-shaped in construction so that the shafts may be readily placed in or lifted from position in the receptacles. The take-up roller 16 is keyed to a stud shaft 19 which is rotatably supported in a bearing 20 mounted on the forward end wall of the receptacle 12, as viewed in Fig. 2. A pully wheel 21 is fixedly mounted on the outer end of the shaft 19 and is connected to a motor (not shown) by means of the belt 22 whereby the take-up roller is driven at any suitable speed.

As the strip of sensitized material is unwound from the roller 15 it passes under a guide roller 23 rotatably supported by the bearings 24 which are suitably mounted on the end walls of the receptacle 11. The guide roller 23 is so positioned in the receptacle 11 that it guides the unwinding strip of sensitized material through an elongated aperture or slot 25 provided in the inner wall of the receptacle and adjacent the lower edge thereof. The slot 25 communicates with one end of an enclosed space 26 formed between the base 10 and a housing 27 mounted on such base. The housing 27 may be made of any suitable material such as sheet steel which has been stamped into the proper shape. A guide roller 28 is rotatably supported on the side walls of the housing 27 by bearings (not shown) and is positioned in said housing adjacent to one edge of an elongated aperture 35 provided in the top wall of the housing 27 and extending transversely of the length of said housing for

substantially its entire width. The upper portion of the peripheral surface of the guide roller 28 lies closely adjacent to the periphery of a hollow cylinder or drum, generally designated in Fig. 1 by the reference character 29 which is rotatably supported above the aperture 35, and beneath the bottom of which the guide roller 28 extends. Thus when the sensitized strip of material is fed around the guide roller 28 for substantially a half revolution thereof, it is placed in contact with the bottom portion of the peripheral surface of the cylinder 29 and is passed around the cylinder in a clockwise direction as viewed in Fig. 1, to a take-off guide roller 30 which extends in parallel relation to the roller 28 beneath the bottom of the cylinder 29 and adjacent to the opposite edge of the aperture 35. The rollers 28 and 30 are preferably positioned closely adjacent to each other beneath the cylinder 29 so that every portion of the strip of sensitized material is maintained in contact with a portion of the outer peripheral surface of the cylinder 29 for substantially one entire revolution of such cylinder. A wall 31 is mounted on the base 10 in between the rollers 28 and 30 so that its top edge is disposed substantially centrally of the aperture 35 and is provided with concave sides 32 in order that the strip of sensitized material may be more readily threaded around such rollers. The strip of sensitized material is fed from the take-off guide roller 30 which is rotatably supported on the side walls of the housing 27 by bearings (not shown), through an enclosed space 34 formed in the right-hand portion of the housing, as viewed in Fig. 1, to the take-up roller 16 in the receptacle 12. The receptacle 12 is provided with an elongated aperture or slot 35 on the lower portion of the inner wall thereof through which the strip of material passes on its way into such receptacle and a guide roller 36 to guide the strip of material through such slot. The guide roller 36 is rotatably supported on bearings 37 which are suitably mounted on the end walls of the receptacle 12.

The drum or cylinder 29 is hollow and is supported on hollow stub shafts 40 and 41 each of which are fixedly secured in any suitable manner in the mounting blocks 42 and 43, respectively, such as by set-screws 44. The blocks 42 and 43 are each supported by a frame member 45 which is rigidly secured in position on the base 10 by bolts. Mounted on the stub shafts 40 and 41 adjacent the inner sides of the mounting blocks 42 and 43, respectively, are the roller-bearing units 46 and 47 which rotatably support the spiders 48 and 49 respectively. A hollow cylinder 50 made of glass which is non-obstructive to the passage of actinic rays, is supported on the outer rims of the spiders 48 and 49 by means of the angular blocks 51. We have found that the types of glass known as "Uviol" glass or "Corex" are best suited for our purposes.

The outer periphery of the glass cylinder 50 is covered with a photographically developed film 54 containing the pattern that is to be imparted to the strip of light sensitive material. The pattern on the film is preferably so made that when the film is placed around the cylinder 50 its ends will meet to form a continuous uniform design. The photographically developed film 54 is secured to the outer periphery of the glass cylinder 50 by means of the split compression bands 55 and 56, each of which is placed around an outer edge of the film. The bands 55 and 56 are substantially wider than the outer rims of the spiders 48 and 49 so that they overlap a portion of the edges of the glass cylinder 50 and thus provide an added means for securing the cylinder in position on the spiders 48 and 49.

Positioned within the hollow cylinder 29 are two supporting plates 58 and 59, which are rigidly attached to the inner ends of the stub shafts 40 and 41 respectively, by bolts or any other suitable means. Each of said plates are centrally apertured so that access to the interior of the cylinder may be gained through the hollow stub shafts 40 and 41. The plates 58 and 59 are also each provided with a plurality of extensions or arms 60, the arms of each plate projecting outwardly in parallelism with the arms of the other plate. Suitably secured to the outer ends of each pair of parallel arms is a mercury vapor lamp 61 which extends longitudinally of the hollow cylinder in parallel relation with the axis thereof. The mercury lamps are each connected by wires 62 and 63 to a source of electrical energy (not shown). These wires pass through the apertures in the supporting plates 58 and 59 and through the hollow stub shafts 40 and 41 so as not to engage the spiders 48 and 49 revolvably mounted on said hollow shafts. The open ends of the cylinder may be provided with a hood (not shown) to prevent injury to the eyes of the operator from the direct rays of the mercury lamps 61.

A cooling pipe 64 is supported in the central longitudinal portion of the hollow cylinder by means of the brackets 65 which are suitably attached to the supporting plates 58 and 59. The pipe may be formed in any suitable manner so that the cooling fluid is retained in the cylinder for as long as is considered necessary and should preferably be made of glass so as not to cast a decided shadow on the surface of the glass cylinder 50. The cooling pipe 64 is suitably connected to an outside source of fluid supply (not shown), the inlet and outlet ends of the pipe preferably extending through one of the hollow shafts, in this case shaft 41, so that the glass cylinder 50 and bands 55 and 56 may be readily disassembled without disturbing the pipe. It is also within the contemplation of the invention to provide a fan at one end of the hollow cylinder to keep the temperature from becoming excessive therein.

A depending arm 66 is secured at its upper end in any suitable manner to each of the supporting plates 58 and 59 and extends vertically downward to a point closely adjacent to the inner periphery of the bottom portion of the glass cylinder 50. A shield 67 which extends longitudinally of the cylinder is suitable secured at each of its ends to the lower ends of the arms 66. The shield 67 preferably has the same arcuate curvature as the inner periphery of the glass cylinder 50 and is of sufficient width so that light from the mercury vapor lamp 61 is prevented from striking that portion of the film 54 which is not in actual contact with the strip of sensitized material. Due to this construction those portions 68 of the strip of sensitized material which are not in actual contact with the film 54 as they are being fed to or removed from the surface of the film by the rollers 28 and 30 respectively, are protected from the light rays of the lamps 61 while in this position, as shown in Fig. 1, thus preventing the design from becoming blurred. The lower surface of the shield is preferably blackened or otherwise treated so that it will not

reflect rays of light down on the portions 68 of the sensitized strip of material.

In the operation of the device, a photographically developed film 54 bearing the desired design or pattern to be produced on the strip of light-sensitive material is first secured in position on the outer surface of the glass cylinder 50 by placing such film on the surface of the cylinder in such manner that the ends of the pattern meet thus forming a continuous or endless design, and then placing the compression bands 56 in position over the edges of the film. A roll of fabric, paper, leather or other fibrous material whose surface has been rendered sensitive to light or which has been impregnated with diazo solutions according to the process described in our copending application Serial No. 536,076, filed May 8, 1931, is then placed in position in the receptacle 11. The sensitized strip of such roll is then threaded around the bottom of the roller 23, through the slotted aperture 25, through the enclosed space 26, around the roller 28 positioned under the glass cylinder 50, thence around the glass cylinder 50 in a clockwise direction, as viewed in Fig. 1, thence around the second roller 30 positioned under the glass cylinder 50, through the enclosed space 34, thence through the slotted aperture 35, around the roller 36 in the receptacle 12 and thence on to the take-up roller 16 in said receptacle to which it is suitably attached. The top wall of the housing 27 is provided on each side of the cylinder 29 with slide covers 70 which may be opened to facilitate the threading of the strip of sensitized material through the machine. The hinged receptacle covers 13 and 14 and the slide covers 70 of the housing 27 are immediately closed after the strip of sensitized material has been threaded through the machine to prevent light from reaching and affecting such strip as it passes through the machine. The mercury lamps 61 are then lighted so as to give an equal illumination to every part of the photographic film. The motor is then started and rotative motion is transmitted to the take-up roller 16 through the driving belt 22, pulley wheel 21 and stub shaft 19, causing such roller to turn in a counter-clockwise direction, as viewed in Fig. 1, and draw the strip of sensitized material forward through the machine. As the strip of light-sensitized material travels toward the take-up roller, it imparts rotary motion to the hollow cylinder 29 at the same surface speed. Due to the fact that the feed and take-off rollers 28 and 30, respectively, are positioned closely adjacent to each other, every portion of the sensitized strip of material remains in contact with a portion of the pattern on the film 54 for substantially one complete revolution of the cylinder 29 and during such time has printed on it by means of the light rays which pass through the glass cylinder 50 and the film 54, an impression of that portion of the design or pattern with which it is in contact. If the material is paper which has been light-sensitized on the surface thereof according to ordinary methods, the rate of feed of such material through the machine is relatively fast as such material does not require a long exposure. If on the other hand the material is fabric, paper, leather or other porous substance which has been impregnated with diazo solutions according to the process disclosed in our aforementioned copending application so that the design or pattern will be produced within the texture of the strip of material used as a permanent part of such material, the rate of feed at which such material is drawn through the device lies adjustably between five to sixty yards a minute according to the density of the photographic design. The sensitivity of the material so impregnated is such that with light photographic negatives exposure of one second for each portion of the sensitized material is sufficient, while for denser negatives exposure of something like twelve seconds may be necessary.

It is thus seen that the machine is adapted to print a continuous design or pattern on strips of light-sensitive material that require widely varying periods of exposure in order to properly impart the design or pattern to such material and that the machine is especially adaptable for printing at adequate speed those materials which have been impregnated with a light sensitive material requiring relatively long periods of exposure in order to satisfactorily obtain an impression of the design or pattern on such material. Furthermore, the simple, rugged construction of the machine and the ease and speed with which heavy rolls of sensitized paper, fabric, leather, etc. of varying widths can be inserted into the machine, printed, and removed therefrom, renders it particularly adaptable for large scale manufacturing purposes.

The invention has been described in connection with the use of a photographically developed film for printing the design or pattern on the strip of sensitized material. It is obvious, however, that a negative made of any transparent material suitable for the purposes of the invention may also be used. It is also within the purview of the invention to connect the motor directly to the cylinder 29 so that less tension is exerted on the strip of sensitized material. This construction is especially desirable in those cases where the strip of sensitized material used is very thin or flexible and might be unduly stretched when drawn through the machine by the take-up roller.

Other modifications, particularly in the form and arrangement of the casing and the mountings for the various parts will be evident to one skilled in the arts wherein the invention may be practiced, and it is intended that such apparatus should fall within the scope of our invention as defined by the appended claims.

What is claimed is:

1. A photographic printing machine adapted for producing a continuous and uninterrupted photographic impression on a travelling strip of sensitized material, comprising a hollow cylinder made of material which is non-obstructive to the passage of actinic rays; means for rotatably supporting said cylinder, a photographically developed film configured into cylindrical form about said rotatable cylinder and snugly engaging with the outer peripheral surface of the cylinder, an impression on said film forming an endless design of the cylindrical form of the film, guiding means for maintaining the travelling strip of sensitized material in contact with said film for substantially its entire circumference, stationary sources of light located within said rotatable cylinder and adapted to provide equal intensity of illumination at every portion of the interior surface of said film, said sources comprising a plurality of mercury vapor lamps extending longitudinally of said rotatable cylinder and spaced from the axial center thereof, means located within said rotatable cylinder and adapted to prevent light from said sources reaching that portion of the film which is not in actual

contact with the strip of sensitized material, a cooling unit for preventing the temperature in the rotatable cylinder from becoming excessive, said cooling unit being arranged axially of said cylinder and so constructed that it does not affect the intensity of illumination at any portion of the interior surface of the negative and means for drawing the strip of sensitized material over said rotatable cylinder.

2. A photographic printing machine adapted for producing a continuous and uninterrupted photographic impression on a travelling strip of sensitized material, comprising a hollow cylinder made of material which is non-obstructive to the passage of actinic rays, means for rotatably supporting said cylinder, a light-pervious material configured into cylindrical form positioned on the outer peripheral surface of said cylinder and provided with a continuous pattern, a pair of guides positioned closely adjacent to each other and to the outer surface of said light pervious pattern for maintaining the travelling strip of sensitized material in contact with said pattern for substantially its entire circumference, stationary sources of light located within said rotatable cylinder and adapted to provide equal intensity of illumination at every portion of the interior surface of the light-pervious pattern which is in contact with said cylinder, a stationary shield located within said cylinder and so positioned relative to the inner peripheral surface of the rotatable cylinder and said guides that substantially no light from said light source reaches those portions of the strip of sensitized material which are being drawn into and out of contact with the light-pervious pattern by said guides, said shield being non-reflective on the side that is adjacent to the inner peripheral surface of the rotatable cylinder so that indirect beams of light from said light source will not be reflected upon said portions of the sensitized material, a take-up roller for the strip of sensitized material and means associated with said take-up roller for drawing the strip of sensitized material continuously over said rotatable cylinder.

3. A photographic printing machine adapted for producing a continuous and uninterrupted photographic impression on a travelling strip of sensitized material, comprising a hollow cylinder made of material which is non-obstructive to the passage of actinic rays, a pair of hollow shafts fixedly mounted in a frame, means for rotatably supporting said cylinder on said shafts, a light-pervious material configured into cylindrical form positioned on the outer surface of said cylinder and provided with a continuous pattern, a pair of guide rollers positioned closely adjacent to the outer periphery of said light-pervious pattern for feeding said strip of sensitized material to and removing it from said pattern, said guide rollers being mounted closely adjacent to each other in parallel relation whereby the strip of sensitized material is maintained in contact with said light-pervious pattern for substantially its entire circumference, a plurality of mercury vapor lamps extending longitudinally of said rotatable cylinder and spaced from the axial center thereof, means for supporting said lamps on the inner ends of said shafts, a cooling unit arranged axially of said cylinder between said shafts and composed of material that is non-obstructive to the rays of light emanating from said source so that the intensity of illumination at any portion of the interior surface of the pattern is relatively unaffected, a stationary shield having an arcuately shaped outer surface located within said cylinder, the said outer surface thereof being so positioned with relation to the inner peripheral surface of said cylinder and the pair of guide rollers that substantially no light from said source reaches those portions of the strip of sensitized material which are being drawn into and out of contact with the light-pervious pattern by said guide rollers and means for drawing the strip of sensitized material over said rotatable cylinder.

4. A photographic printing machine adapted for producing a continuous and uninterrupted impression on a strip of sensitized material, comprising a darkened case having an elongated aperture, a hollow cylinder made of transparent material, means for rotatably supporting said cylinder exteriorly of the casing in such manner that the outer peripheral surface thereof is closely adjacent to said aperture, a light-pervious material configured into cylindrical form positioned on the outer surface of said cylinder and provided with a continuous pattern; means for rotatably supporting a reel of sensitized material in said casing, a take-up roller for said sensitized material, a guide roller located in said casing so that its peripheral surface is closely adjacent to one edge of said aperture and the outer peripheral surface of said light-pervious pattern and adapted to place the strip of sensitized material in contact with said pattern, a second guide roller located in said casing so that its peripheral surface is closely adjacent to the opposite edge of said aperture and the outer peripheral surface of said light-pervious pattern and adapted to draw the strip of sensitized material out of contact with said pattern, stationary sources of light located within said rotatable cylinder and adapted to provide equal intensity of illumination at every portion of the interior surface of the light-pervious pattern, a stationary shield located within said rotatable cylinder and so positioned relative to the inner periphery thereof and said guide rollers that substantially no light from said source reaches those portions of the strip of sensitized material which are being drawn into and out of contact with the pattern by said guide rollers and means associated with the take-up roller for drawing the strip of sensitized material over said rotatable cylinder.

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