

Dec. 3, 1940.

A. M. ERNST ET AL

2,223,341

PHOTOGRAPHIC PRINTING MACHINE

Filed Nov. 17, 1938

2 Sheets-Sheet 1

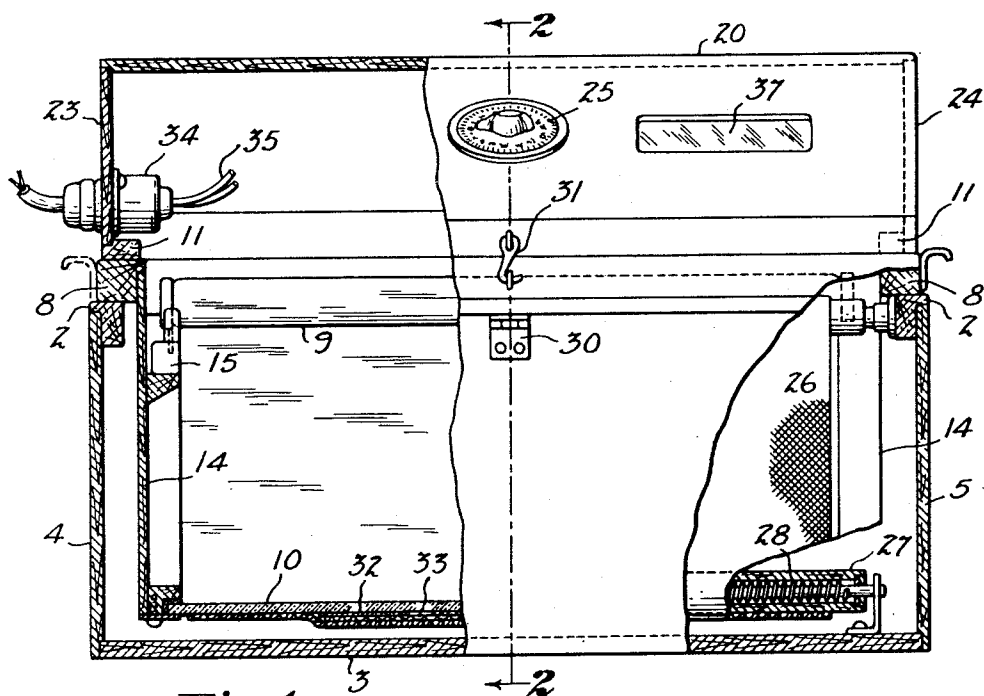


Fig. 1

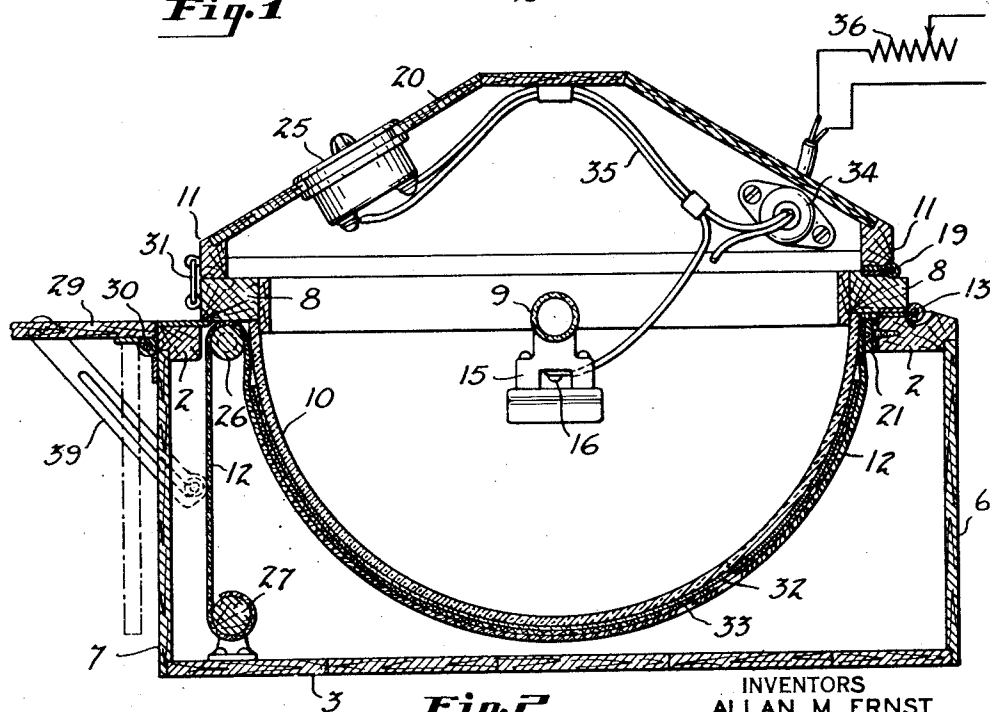


Fig. 2

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2 Sheets-Sheet 2

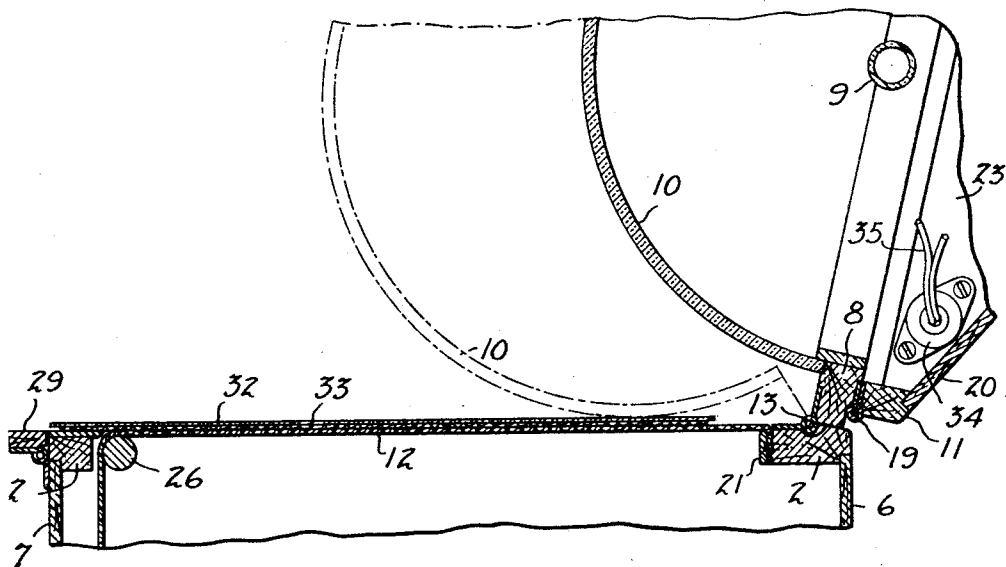


Fig. 3

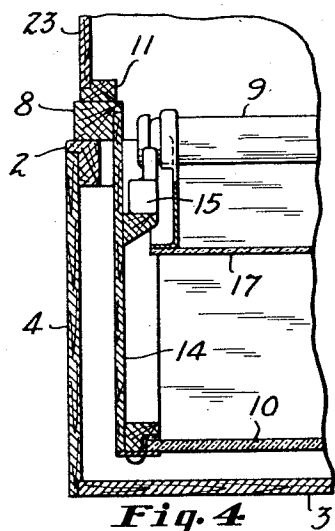


Fig. 4

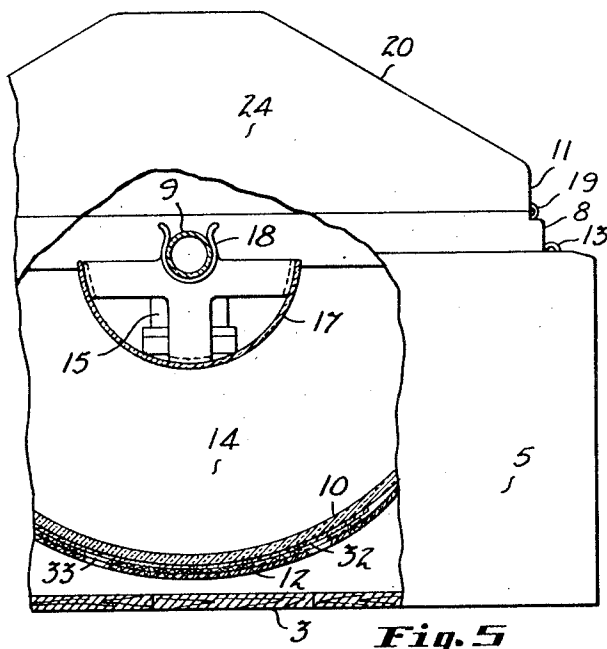


Fig. 5

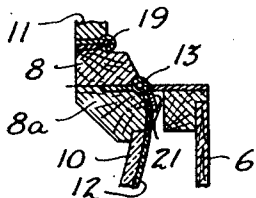


Fig. 6

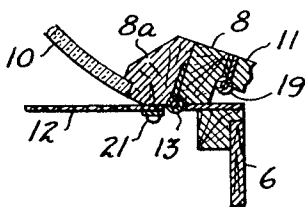


Fig. 7

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PHOTOGRAPHIC PRINTING MACHINE

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11 Claims. (Cl. 95—77.5)

This invention relates to machines for making photographic prints, and especially to a relatively inexpensive machine suitable for economically making prints or copies of all sorts of documents.

Ordinary printing machines where the material is interposed between plane surfaces are not generally satisfactory for making large prints because wrinkles frequently occur and it is very difficult to obtain uniform, satisfactory contact over large areas. The large power driven machines where the prints are held between a rotating cylinder and a conveyor belt, are relatively costly and consequently unavailable for many purposes.

It is, therefore, an object of this invention to provide photographic printing machines which provide uniform contact over large areas and which are suitable for economically making prints of all sizes.

It is another object of this invention to provide photographic printing machines wherein there is no tendency for slippage between the negative and printing paper.

It is a further object of this invention to provide photographic printing machines wherein the entire exposure area is substantially evenly lighted.

This invention is shown in the accompanying drawings in which similar characters of reference denote corresponding parts, in which:

Figure 1 is a front elevation of the device with parts broken away to show its internal construction;

Fig. 2 is a section on the line 2—2 of Fig. 1 and shows the form of the invention wherein the flexible work receiver is attached to a stationary element in the device;

Fig. 3 is an enlarged sectional view of a portion of the machine shown in Fig. 2, and shows the hinge construction and the method of applying work to the machine and the position occupied by the flexible work receiver in the open position;

Fig. 4 is a fragmentary sectional view of a portion of the machine and shows a method for attaching filters when these are desired;

Fig. 5 is a fragmentary end view with parts broken away;

Fig. 6 is a fragmentary section in the vicinity of the hinge portion of a modified form of the device, wherein the flexible work receiver is attached to a movable element of the device; and

Fig. 7 is a fragmentary section of the open machine in the vicinity of the hinges, and shows the method for attaching and the position occu-

pled by the flexible work receiver in the open position.

Referring more particularly to the drawings, the machine comprises a stationary frame 2 carrying the bottom 3, the ends 4 and 5, and the sides 6 and 7, a curved transparent member 10 which is fastened to the movable frame 8, an auxiliary frame 11, a flexible work receiver 12, and a light source 9.

The movable frame 8 is rotatably mounted on the stationary frame 2 by means of the hinge 13 which is parallel to an element of the surface of said transparent member and is preferably located near the edge of the curved member 10, an extension thereof as in Figs. 6 and 7, or at a slightly greater distance from the center of curvature as in Figs. 2 and 3. The curved, transparent member 10 is preferably a portion of a cylinder and it is fastened to the movable frame 8 by means of the end supports 14 which are preferably opaque and adapted to maintain a dust-tight seal around the edges of the curved, transparent member 10.

The light source 9 may be a series of bulbs, or it may be of the luminous tube type, supported at each end by the mounting brackets 15 which are fastened to the end supports 14 and are adapted to make electrical connection between the terminals 16 and the electrodes of the light source. The light source 9 is preferably mounted coaxially with the curved or cylindrical portion of the transparent member so as to be normally equidistant to all points of the surface of the member and thus provide a substantially uniform illumination over the printing area. Means, such as a ground glass, a filter, or a diffuser 17, may be provided for varying the intensity, diffusion, and character of the illumination applied to the printing surface. The filters may be mounted to be revolved about the light source 9 and may be conveniently secured by means of the clips 18 which are fastened to the ends of the filter 17 and are adapted to fit the light source 9 or suitable mountings.

The auxiliary frame 11 is fastened to the movable frame 8 by means of the hinge 19, and it is provided with a suitable top member or members 20, and ends 23 and 24 which are adapted to cooperate with each other and the frame 11 to form a cover for the movable frame 8 and prevent dust from settling on the inner curved surface of the transparent member 10. The top member 20 may carry a window 37 which may be used for observing the work material before or during the printing operation. The latch 31 may

be used for securing the auxiliary frame 11 to the movable frame 8. An automatic timing device 25 may be inserted in the cover 20 and connected with a light circuit so as to interrupt the current which flows between the connector 34 and the light source 9 over the wires 35 at a definite predetermined time. If desired a means, such as a variable resistance 36, may be provided to vary the voltage on the light source 9.

One of the features of the present invention is the flexible work receiver 12. A convenient form for such a receiver is shown in Fig. 2 in which one end of the flexible work receiver, which may be a sheet of canvas or fabric, is fastened to the frame 2 by any suitable securing means 21. It passes over the idler roll 26 and is maintained under tension by means of the tension roll 27 which contains a suitable coil spring 28 and is adapted at all times to take up any slack and maintain the flexible work receiver 12 taut. The roll 26 may be fastened to the frame 2 and preferably is located so as to maintain the surface of the flexible work receiver in the plane of the surface of the top of the frame 2 when the cover is in the open position as shown in Fig. 3. A work rest 29 may be provided and as shown in Fig. 2 is hinged to the frame 2 by means of the hinge 30. It may be held in operative position by a suitable brace 39 or it may hang in inoperative position.

In Figs. 6 and 7 is shown a modified form of securing the cover to the stationary frame member and attaching the work receiving device. In this form the portion 8 of the movable frame carries a framing bar 8a which is rabbeted to receive the edge of the transparent member 10. The flexible work receiver 12 is secured by any suitable means 21 to the bar 8a. The hinge 13 for the parts 8, 8a is so located that the axis of the hinge is substantially in the plane of or forms an element of the projected curved transparent member 10. When the cover is moved down from a position shown in Fig. 7 it will be seen that the transparent cylinder will quickly clamp the edges of the negative and sensitized sheet and firmly hold them while the cover is being lowered to printing position.

While the work receiving member has been shown as a flexible sheet secured at one end 50 and held by a tensioning roll at the other end, it is to be understood that various modifications may be made in which a transparent member of the cylindrical type and the flexible work receiver may be mounted or moved to tightly grasp and 55 hold the work material with uniform contact.

While the source of light is shown as a luminous tube extending substantially the length of the curved transparent member, it will be seen that a series of luminescent bulbs, preferably of the 60 inside frosted type, may be utilized in which case the incandescent filaments or bulbs should be disposed substantially along the axis of curvature of the cylindrical or partially cylindrical transparent member.

In the operation of the invention the frame 8 is raised to the upper position, whereupon the slack in the flexible work receiver 12 is taken up by the roll 27 and the portion of the flexible work receiver between the roll 26 and the point where 70 it is attached to the frame is held substantially in a horizontal position under considerable tension. A negative or original 32 to be printed and a sensitized sheet 33 of suitable size, are placed on the flat portion of the flexible work receiver 75 as illustrated in Fig. 3.

The movable frame 8 is then lowered, whereupon the curved surface of the transparent member 10 comes in contact with the negative and firmly holds the negative and sensitized sheet together between the member 10 and the flexible work receiver 12. During the closing action one edge of the work is first held or clamped between the curved member 10 and the flexible work receiver 12. Upon further closing movement of the cover there is a marked ironing action which smooths out any wrinkles that may be present in the work material. This smoothing or ironing action irons out the wrinkles and maintains uniform contact between the negative and the sensitized paper over the whole area, and is accentuated when the hinges for this transparent member are located away from the axis of the curved or cylindrical member.

If it is desired to modify the character or intensity of the light source 9 the variable resistance 36 is adjusted to the desired value and a suitable filter or diffuser 17 is interposed between the light source and the curved transparent member 10. The printer is then closed, whereupon the work material is held firmly between the flexible work receiver and the curved transparent member as shown in Figure 2. The timer 25 is then set at a predetermined value and the desired exposure time is automatically obtained. The material may then be removed and developed in the customary manner.

It may be seen that, while there is a relative bodily movement between the work receiver 12 and the curved transparent member 10, there is no tendency for slippage between the surface of the curved transparent member and the flexible work receiver. Thus there is no tendency for the negative 32 to slip with reference to the sensitized material 33 and prints with positive register are thus obtained. The substantially uniform lighting and perfect contact obtained with our invention eliminate the variation in density of the lines of the recorded image, and the uneven exposures frequently obtained when large prints are produced. When in the printing position the work receiver conforms to the curvature of the curved transparent member 10 and maintains perfect contact over the entire printing area. The pressure between the work receiver and the curved member may be varied by adjusting the tension of the spring 28 in the tension roll 27.

It has been found that this invention maintains substantially uniform contact over large or small areas and that large and small prints alike are produced with extreme accuracy and relative ease and economy. It is advantageous for use in large and small establishments alike and is adapted for making photographic prints in general including Vandykes, copies of all sorts of documents, and blueprints. It is also suitable for making curved offset printing plates and in their preparation a vacuum printing frame is unnecessary, due to the ironing effect and positive contact secured over the entire exposure area.

Although but two specific embodiments of the invention are herein shown and described, it is to be understood that numerous details may be altered or omitted without departing from the spirit of the invention as defined in the following claims.

What we claim is:

1. A photographic printer comprising a supporting structure, a pair of spaced supports carried by the structure, a flexible work receiver having a portion extending between the supports and

having fixed and movable ends, resilient means having connection with the movable end of the receiver to yieldingly hold the same and thereby maintain the portion of the receiver between the supports under tension in a normally flat plane position, a cylindrically curved light transmitting member having hinged means mounting the same on the structure for pivotal movement about an axis substantially at the fixed end of the work receiver and so that the convex side of said member is movable against said normally flat portion of the receiver to displace the latter to a curved printing position corresponding to the curvature of the light transmitting member, a light source, and means mounting the light source on the concave side of the curved member opposite the work receiver and for movement with the curved member to printing position.

2. A photographic printer comprising a supporting structure, a flexible work receiver, spaced means carried by the structure to support the work receiver, resilient means for tensioning a portion of the work receiver between the spaced supporting means to normally retain the surface of said portion in a substantially flat plane position, at least one end of said portion of the work receiver being yieldable to permit displacement of the receiver from said flat plane position, a curved light transmitting member having concave and convex sides, pivot means carried by the structure and mounting said member for rotative movement bodily relative to said work receiver about an axis substantially in said plane whereby the light transmitting member can be moved bodily to bring the convex side thereof against said portion of the work receiver and displace the latter, and a light source having means for supporting the same on the concave side of the light transmitting member.

3. A photographic printer comprising a curved light transmitting member having convex and concave sides, a light source and means for supporting the same on the concave side of the member, a deformable work receiver on the convex side of the curved member, means for resiliently supporting the work receiver with a portion of the surface thereof in a normally substantially flat plane position and which permits said portion to be deformed to a curved position, and means for supporting the light transmitting member for bodily movement against said normally flat surface portion of the work receiver to displace said portion of the work receiver.

4. A photographic printer comprising a yieldable work receiver, spaced supports, resilient means for holding a portion of the work receiver with the surface thereof tensioned between said supports in a normally substantially flat plane position and which permits said portion to be deformed to a curved position, a curved light transmitting member having convex and concave sides, means for supporting said member for bodily movement of the convex side thereof against said flat portion of the work receiver to displace the work receiver so that said surface portion thereof corresponds in curvature to the convex side of the light transmitting member, a light source, and means supporting said source on the concave side of the light transmitting member for bodily movement therewith.

5. A photographic printer comprising a curved light transmitting member having convex and concave sides, a light source and means for supporting the same on the concave side of the member, a flexible work receiver on the convex side of

the curved member, spaced means supporting a portion of the work receiver in a normally flat position, means for yieldingly retaining the flat portion of the receiver under tension between said spaced supporting means, and means mounting the curved member for bodily movement toward and away from the work receiver, the movement of the curved member toward the receiver being directed between said spaced supporting means to displace said portion of the receiver from its normally flat position.

6. A photographic printer comprising a curved light transmitting member having convex and concave sides, a light source and means for supporting the same on the concave side of the member, a flexible work receiver on the convex side of the curved member, spaced means supporting a portion of the work receiver in a normally flat position, means for yieldingly retaining the flat portion of the receiver under tension between said spaced supporting means, and pivot means for mounting the curved member for pivotal movement about an axis adjacent the surface of the curved member and toward and away from the work receiver, the pivotal movement of the curved member toward the receiver effecting a bodily movement of the curved member between said spaced supporting means to displace said portion of the receiver from its normally flat position.

7. A photographic printer comprising a light transmitting member having a substantially cylindrical surface, an elongated light source disposed substantially along the longitudinal axis of the light transmitting member and means supporting said source for movement with said member, a flexible work receiver having means associated therewith to maintain a portion of the same under tension and normally yieldably supported in a substantially flat plane position on the convex side of the light transmitting member, and means for supporting the curved member for bodily movement transverse to said plane of the work receiver to displace the flexible work receiver from its normally flat plane position to a curved position of which the flat position is a subtending chord.

8. A photographic printer comprising a flexible work receiver, spaced substantially parallel elements for supporting a portion of the work receiver in a normally flat plane position and which permits deformation of the receiver therebetween, a curved light transmitter member having concave and convex sides, means supporting the light transmitting member for pivotal movement about an axis adjacent the plane of the flat work receiver and near one of said elements so that the convex side of the light transmitting member is toward the work receiver and said member can be shifted bodily to move the convex side thereof into engagement with said portion of the work receiver to displace the latter from its flat plane position, and a light source having associated means for supporting the same on the concave side of the light transmitting member.

9. A photographic printer comprising a flexible work receiver, spaced substantially parallel elements for supporting a portion of the work receiver in a normally flat plane position and which permits deformation of the receiver therebetween, a curved light transmitting member having concave and convex sides, means supporting the light transmitting member for pivotal movement about an axis adjacent the plane of the flat work receiver and near one of said elements so that the

- convex side of the light transmitting member is toward the work receiver and said member can be shifted bodily to move the convex side thereof into engagement with said portion of the work receiver to displace the latter from its flat plane position, a light source disposed on the concave side of the light transmitting member, and means for supporting said source for pivotal movement about said axis.
10. A photographic printer comprising a supporting structure, a curved light transmitting member having concave and convex sides, a light source and means mounting the same on the concave side of said member, a flexible work receiver having one end fixed on the structure and having means associated therewith to tension the same to maintain a yieldable normally flat surface portion to receive the work to be printed, and means mounting said curved member on the structure for rotation about a pivot which is substantially at the fixed end of the work receiver to permit rotative movement of the convex side of the curved member against said surface portion of the work receiver, said pivot

being at a distance from the axis of curvature of the light transmitting member at least substantially equal to the radius of curvature of said member.

11. A photographic printing machine comprising a supporting structure, a light source, a flexible work receiver having a yieldable portion with fixed and movable ends, a curved light transmitting member concave on one side and convex on the other side, and means mounting the curved member on the structure for rotation into printing position about a pivot which is substantially at the fixed end of the work receiver to permit rotative movement of the convex side of the curved member against said portion of the work receiver, and resilient means at the movable end of the work receiver to maintain the same under tension and to normally yieldably hold the same in a substantially flat plane position from which the receiver is displaced by movement of the light transmitting member into printing position.

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