

Sept. 24, 1946.

G. L. HASSLER

2,408,310

MECHANISM FOR CONTACT PRINTING

Filed Jan. 4, 1944

2 Sheets-Sheet 1

Fig. 1,

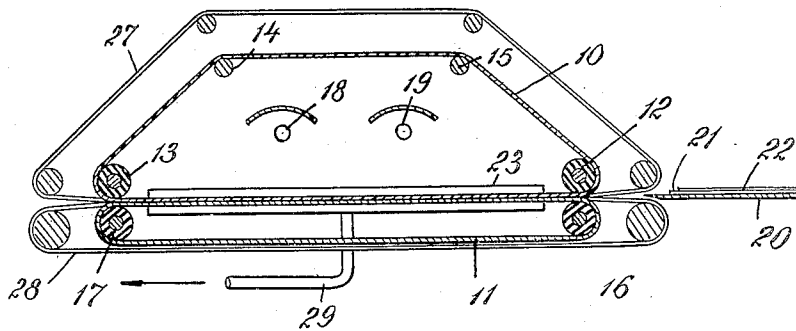


Fig. 2,

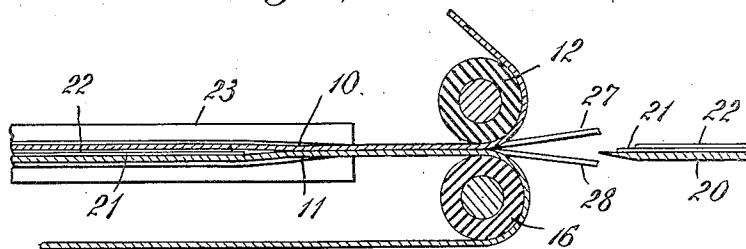


Fig. 3,

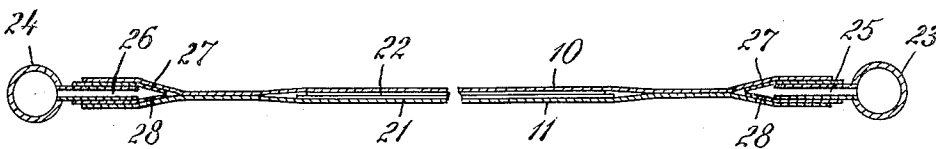
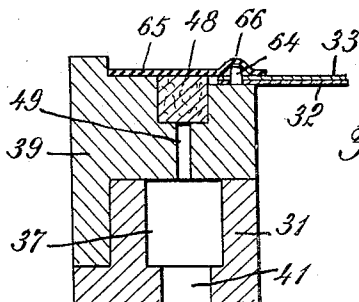


Fig. 9,

INVENTOR
Gerald L. Hassler
BY
Henry W. Engle
ATTORNEY

Sept. 24, 1946.

G. L. HASSLER

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2 Sheets-Sheet 2

Fig. 4,

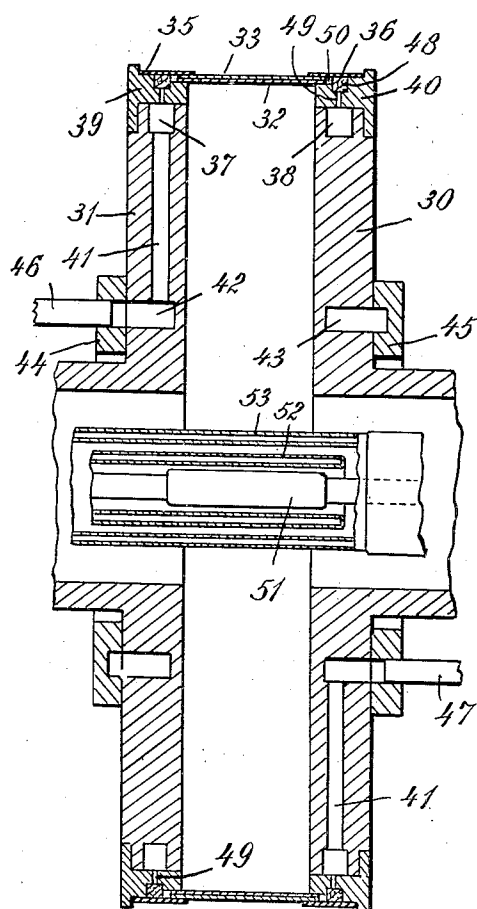


Fig. 5,

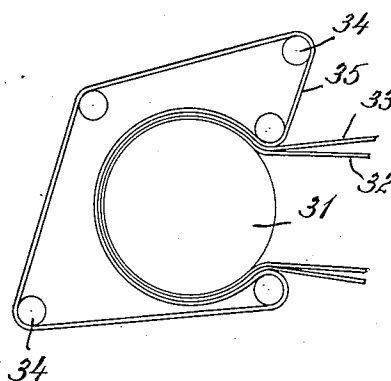


Fig. 7,

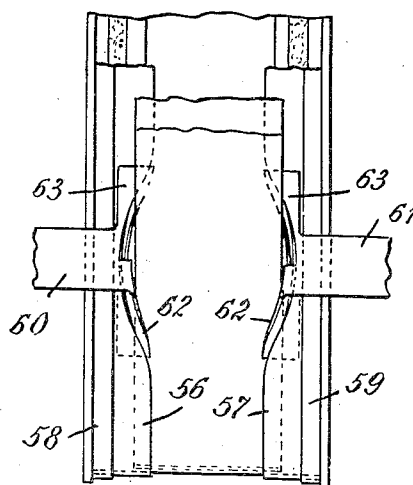


Fig. 6,

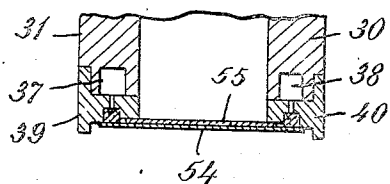
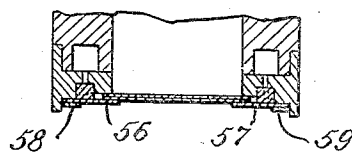


Fig. 8,



INVENTOR
Gerald L. Hassler
BY
J. M. Coughlin
ATTORNEY

UNITED STATES PATENT OFFICE

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MECHANISM FOR CONTACT PRINTING

Gerald L. Hassler, Binghamton, N. Y., assignor to
General Aniline & Film Corporation, New York,
N. Y., a corporation of Delaware

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6 Claims. (Cl. 95—73)

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This invention relates to a mechanism for maintaining contact and registry between an original and sensitized printing material during contact printing. More specifically, the invention has to do with maintaining such contact and registry by extracting air from between the original and printing material so that atmospheric pressure may be brought to bear in maintaining them in intimate contact and in preventing distortion of or relative movement between the two while they are exposed to a source of light.

In printing from an original, as in photographic and in similar work, pressure has been applied externally for the same general purpose and a vacuum has been employed by connecting a vacuum line to a printing frame, the latter system being used for holding both the original and printing material flat against a surface within the printing frame. No one of the systems heretofore used makes it possible to assure registry and satisfactory contact between the material and the original being printed by a vacuum and while they are being advanced, for example, during printing from movie negatives or positives.

In overcoming certain outstanding difficulties in this art, the mechanism herein described makes it possible to apply vacuum to printing material and the original which is to be printed as they are moving either continuously or intermittently. It is also one of the objects of this invention to maintain registry and contact between the materials by applying vacuum at the edge of the material, and therefore, more effectively withdrawing the air from between the elements in contact without subjecting them to unnecessary pressure and while allowing them to remain at rest or to advance in perfectly flattened condition.

In printing from movie negatives or when working from positives of that type, the material is rapidly advanced and yet is maintained in perfect contact and registry so that the printed film will be more nearly an exact duplication of the original than would otherwise be possible. The present system and the mechanisms here disclosed do not depend at all on the structural strength or rigidity of the film or printing material and are not subjected to harsh treatment such as would tend to destroy their surface structure or otherwise damage them rendering them less satisfactory for subsequent printing or projection.

According to the invention, plates or sheet films or other originals are printed by introducing them in superimposed relationship between a contacting pair of belts, these belts being wider than the original or printing material and pass-

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ing over rollers or other guiding means. At least one of these belts is to be suitably transparent so that light may be passed therethrough for illuminating the original and light-sensitive material. At that part of the cycle within which the material is subjected to the printing light, a vacuum is applied to the space between the belts by connections through hollow blades, one at either side of the mechanism. The simplest form of the invention would involve only that mechanism just described in a general way, however, it is preferable that an additional seal for the vacuum, that is, a seal capable of excluding the outside atmospheric pressure from entering between the belt structures, be provided. To that end, bands or strips of relatively flexible material may be guided in such a manner as to form an additional covering at the edges of the belts above mentioned. It is also contemplated that other strip material or bands may be used to reinforce and support the edges of the belts as they pass over the blades; these are also of superior friction characteristics.

For printing continuous strips such as movie films and the like, a rotary mechanism is preferably used and the light-sensitive material and original are introduced at one point along the circumference of this rotary mechanism, and in their travel, are subjected to light rays for exposing the light-sensitive material. The film or original and light-sensitive material are maintained in registry and in contact as they pass through the exposure zone in this printer by extracting air from between them, said air being extracted at the edges which are sealed against atmospheric pressure by a system of bands or strips there being different modifications of this sealing means all of which will be described in detail as the disclosure progresses. A vacuum is provided at the edges of the original and light-sensitive material by suitably coring out portions of the rotating printing mechanism and connecting the same through to a source of vacuum. Connections such as glands are used and make it possible to maintain the vacuum even though the printer is rotating and the source of vacuum to which it is connected is relatively stationary.

It is to be understood that the invention applies to printing all types of light-sensitive material such as photographic films, either negatives or positives, and to printing tracings or other printed matter on light-sensitive material such as blueprint paper or those papers treated with diazo-type dyes. The material to be printed may be of any size and, of course, the mechanism for the

purpose is to be built in appropriate dimensions for that class of work for which it is intended. Throughout the disclosure and claims, when reference is made to an original and to printing material or light-sensitive material, it is to be understood that the disclosure and scope of the invention are not limited to any particular material of this sort, but include all materials used in processes wherein an image from an original is to be printed.

Having now generally described the invention and that field in the art of reproduction to which it applies, preferred embodiments thereof will be described in detail by reference to the attached figures of drawings in which:

Fig. 1 is an elevation showing somewhat diagrammatically a simple form of the invention.

Fig. 2 is a sectional view taken at one end of Fig. 1 and showing details of the various belts, and the manner in which an original and the sensitized material are retained and advanced by those belts.

Fig. 3 is a transverse section through Fig. 1 showing the construction of the various belts and strips and the manner in which air is extracted through the vacuum blades.

Fig. 4 is a transverse section through a rotary printer to which the invention has been applied.

Fig. 5 is a diagrammatic view illustrating the path of travel of the original and the light-sensitive material through the printer of Fig. 4.

Fig. 6 is a sectional view showing in detail a modified form of the invention as applied to a circular printer.

Figs. 7 and 8 are an elevation and section, respectively, showing another modification as applied to the circular type printer and in which a seal at the edges of the film and printing material is lifted for entrance into and withdrawal from the printer of the feeding material.

Fig. 9 is an enlarged detail view of a means for covering or sealing the openings through which the teeth project.

Now referring to Fig. 1, a pair of belts indicated at 10 and 11 are specifically to be referred to as clamping belts. These are passed about the rollers 12, 13, 14, and 15 for belt 10, and rollers 16 and 17 for the lower belt 11. Each of these is impervious and considerably wider than the widest material to be clamped or held thereby, and it is essential that at least one of the belts, that facing lights 18 and 19, be suitably transparent so that the rays from those lights may pass through the belt and through the original to act on the sensitized surface of the printing material.

A table or platform 20 at the front of the machine serves to locate or place each strip or sheet of printing material 21 and the original 22 which may be a photographic plate, sheet film, tracing or any other material adapted to be reproduced by any one of the known light-printing processes.

These elements are shown to a slightly larger scale in Fig. 2, and in that figure, a sheet of film and printing paper have been inserted and are clamped between the adjacent faces of the upper belt 10 and the lower belt 11. Of course, the lower belt need not be transparent and may be of any material suitable for the purpose. These belts, especially that through which light is passed, should be of material not easily damaged or scratched and in which there are no inherent blemishes which might be printed through and recorded upon the sensitized material.

The rollers, especially rollers 12, 13, 16, and 17, are preferably similar to wringer rollers and have steel centers with soft rubber bonded thereto. The rubber will allow a certain amount of pressure to be inserted between the pairs of rollers 12-16 and 13-17 so as to effect a seal against entry of atmospheric pressure, but will allow insertion of the original and material to be printed since the rubber may be deflected for that purpose. It is to be understood that adjustments are to be provided, although not shown, for the purpose of maintaining the various belts tensioned and also for determining the proper amount of pressure between pairs of rollers 12-16 and 13-17.

Extending between the pairs of rollers at the opposite ends of the belts 10 and 11 are the tubes 23 and 24, one at either side, and projecting inwardly to engage between the belts 10 and 11 are the blades 25 and 26. These blades are soldered or welded or otherwise formed as a permanently connected part of the tubes, extending from a slit lengthwise in those tubes. The external surfaces of the blades are highly polished and offer little resistance to the passing of the belts or tapes along their length. The ends of the blades are tapered to assist in smooth action and improve the vacuum seal.

Friction strips 27 and 28, relatively thin and of a material more suited to stand the wear of continued sliding along the blades may be used. They also improve the air seal between the surface of the blades and the sealing belts. The strips are guided by pulleys which are preferably flanged so as to maintain the strips in proper alignment with the edges of the clamping belts. Of course, there are a pair of strips 27 and 28 at each side of the machine.

If desired, special sealing strips may be employed, these being relatively soft and impervious strips guided by suitable pulleys in a manner similar to the friction strips just described, these sealing strips being guided along the outer edges of the clamping belts thereby to increase the tendency of the moving belt and strip mechanism to resist entry of atmospheric pressure.

While it has not been illustrated, a support may be provided beneath the travelling belt 11 so as to prevent any sagging of that belt, although it is not likely that such a support would be needed except in larger machines adapted to handle relatively heavy materials and in which the belts themselves would be of considerable weight.

Each of the tubes 23 and 24 is connected through a line 29 to some suitable vacuum system such as a shop vacuum line or to a pump expressly provided for the purpose.

One pair of the rollers, for example, rollers 12 and 16, is to be driven from a suitable source of power. It is necessary to drive only one of these rollers, the other being geared to that one. Of course, the strips need not be driven independently since they will be carried along with the clamping belts, the friction between the strips and the belts being considerably greater than the friction between the strips and the polished blades.

In operation, light-sensitive material and an original are fed into the machine by superimposing the original properly over the light-sensitive material on the table 20 and then manually sliding them along until they are engaged by the belts 10 and 11 whereupon they will be drawn into the machine. The vacuum which is continuously existent within the tubes 23 and 24 withdraws

air from between the clamping belts and will also withdraw any entrapped air between the original and light-sensitive material. The atmospheric pressure outside the clamping belts causes them to be tightly compressed and will also flatten and press the original and light-sensitive material into perfectly contacting and permanently registering relationship. The exposure to the source of light takes place while the materials are flat, while they are in complete surface contact, and the effect of the atmospheric pressure on the belts, and, incidentally, through to the materials being printed and from which the image is printed, prevents any relative motion between them such as might cause the printing of a distorted image or one not as clear and precise in its detail as that on the original.

As the printing material and originals are discharged at the opposite side of the device, the printing material may be developed out in any one of the known ways, the developing and fixing or other subsequent treatment of the sensitive material depending upon that class of materials employed and the various processes applicable thereto.

Now referring to Figs. 4 and 5, a rotary-type printer will be described, this printer being adapted to handle movie films or any other type of printing material which may be fed in long strips and, therefore, more or less continuously. The printer consists of two discs or wheels 30 and 31. These wheels are separately mounted and are rotatable on a common axis. While the wheels may be rotated by power applied thereto, it is preferable that they be driven by the film itself, which will be advanced by some other means of power (not shown). It is to be understood that where movie film is to be treated, the wheels will be provided with teeth although such teeth have not been shown in these figures due to the relatively small scale and for purposes of simplifying the illustration. Such teeth are common in the art, and it is well understood that they engage series of openings or perforations at the edges of films of this type.

In the diagrammatic view of Fig. 5, an original 32 is being fed into the printer, and since the source of light is at the center, the sensitized material to be printed and indicated by numeral 33 is at the outer side of the original. Series of rollers or pulleys 34 guide bands or strips 35 and 36 which are for the purpose of sealing the edge of the material and other points against entry of atmospheric pressure. These bands or strips are of flexible, relatively soft and impervious material and are carried around by their frictional contact with the outer rims of the wheels 30 and 31.

These outer rims are separate from the main parts of the printer discs or wheels, and are so constructed mainly for purposes of design and ease of manufacture so as to form two annular chambers 37 and 38 which will be closed by the tightly fitting rims 39 and 40. These chambers are connected by a plurality of radial openings such as 41 to other annular cored spaces 42 and 43. Each of these latter cored openings communicates with a vacuum line through glands 44 at one side and 45 at the other, said glands serving to connect the moving printer mechanism through to some sort of stationary vacuum line or pump. Tubes 46 and 47 run from the glands to the source of vacuum which need not be shown or described in detail here.

Each of the rims 39 and 40 is similar, and it

will be noted that porous material such as hard felt has been packed in an annular space extending around the periphery of each rim. This felt 48 serves to allow the air between the original and printing material to be extracted, yet will prevent rapid leakage and destruction of the vacuum in the event a seal is broken at any point, that being something which happens between the point of entry of the material and its point of exit. That part of the printer circumference through which the sealing tapes do not cover the felt packing 48 is not of great extent, and there is not sufficient leakage there to lower the vacuum appreciably. However, pressure plates (not shown) may be applied throughout that arc thereby to lessen the effect of leakage.

A series of small radial holes 49 connects the chamber 38 with the space in which the porous material is packed and then the relatively small space 50 leads through to the film. This construction, as before stated, is duplicated at the opposite side.

At the center of the structure a high pressure, mercury vapor lamp 51 serves to illuminate the original and printing material, this lamp being supported by connections externally of the wheel hubs and having water-cooling chambers 52 and 53. Of course, other lighting means may be employed.

In operation, vacuum is maintained at a desirable pressure and the film or other original and printing material is fed to the machine being engaged by the sprocket teeth and also by the sealing tapes or bands 35 and 36. The vacuum withdraws air from between the material and thereby causes both the original and the printing material to be pressed together in perfect contact since atmospheric pressure within the printer and without are equalized. There is no tendency for the original or the light-sensitive material to move relatively, and therefore perfect registration makes it certain that the printed image will contain all the detail and definition of the original and will not be distorted with respect thereto.

In Fig. 6 a modification is shown in which the light-sensitive material 54 is considerably wider than the original 55. Where that is true, it is not essential that sealing tapes be employed since the added width of the printing material allows it to cover the felt or other porous material through which air is extracted and thereby to exclude the atmospheric pressure from without. The mechanism of Fig. 6 is otherwise similar to that just described with respect to Figs. 4 and 5.

Now referring to Figs. 7 and 8, a modification of the rotary-type printer will be described in which the seal at the edges is not obtained by driven strips or tapes such as tapes 35 previously described. In this modification sealing tapes are stretched about the rims of the printer wheels and are tightly drawn against each rim, enclosing the porous or pervious felt strips and engaging the outer edges of the film or other printing material. At the points of entry and exit for the film, these tapes are lifted or folded upwardly so as to allow those functions to take place.

The printing mechanism is generally the same as that of Fig. 4 except for the strips or tapes 56 and 57 which are preferably of some elastic material such as rubber. They are tightly drawn about the rims of the printer wheels and are held in place by tension rings 58 and 59. For the purpose of lifting or folding these tapes upwardly and outwardly so as to insert or allow

the film to be discharged, special devices are employed, those being indicated at 60 and 61. They are identical only oppositely disposed and are so constructed they slowly raise and turn the edge of the tape upwardly and outwardly throughout an angle of about 90° and thereafter force that tape back downwardly. The projection 62 is shown raising tape 56 which, at about the center line, will be folded back and standing at about 90° from the plane of the entering film or other printing material. The effect is that at the point of greatest deflection for the tapes, there is provided an opening amply wide for the printing material to be inserted or for it to be discharged. The opposite projection of the tape lifter 60, that at 63, quickly turns the tape down into its original position.

It can be seen that in this modification the seal over the film and also over the porous material is continuous except for that short distance in which the lifting mechanism functions to fold the tapes outwardly. For that reason, it is not necessary to provide any special provision for maintaining vacuum over that arc through which none of the material being treated is in contact with the printing machine.

While the sprocket teeth usually on printers or other mechanisms through which movie film or other perforated material is advanced have not been shown here, it is contemplated that such teeth are to be employed and Fig. 9 illustrates the manner in which sealing tapes are constructed for accommodating the teeth which normally project beyond the outer surface of the film or printing material.

These strips may be cast or molded from flexible, preferably elastic material, such as Saran, Lucite or rubber having sufficient thickness of the molded tooth receiving cups to withstand the applied vacuum. In Fig. 9, one rim of the printer of Fig. 4 is shown to a larger scale, the rim here being more completely depicted since one of the sprocket teeth 64 is evident. These teeth are of standard size and shape for the film, all as is known to those skilled in this art. A sealing strip or tape 65 having spaced tooth receiving cups or sockets 66 is to be used where there are sprocket teeth. As an alternate construction, and one which will be found easier and cheaper to manufacture, the cups may be replaced by continuous channels.

The invention has been described by reference to preferred embodiments thereof which are merely illustrative and are not to be interpreted as limiting thereon. Other modifications and variations in details will be apparent to those skilled in the art, and it is obvious that there are other uses for this mechanism beyond those specifically mentioned here. The invention is defined in the appended claims.

I claim:

1. Mechanism for contact printing including in combination, a rotary printing device including wheels rotatable about a common axis, a printing light, a rim for each said wheel adapted to guide an original and sensitized printing material at its edges only during a continuous printing operation, chambers within said wheels and connections to a source of vacuum, sealing strips, one for each rim, rotatable with the wheels and means including a plurality of rollers for guiding said sealing strips, connecting passages from the vacuum chambers in said wheels to the edges of the original and material to be printed, including radially disposed openings leading to an an-

nular space, said annular space being filled with porous material.

2. In a device for printing light-sensitive material, the combination of a source of light, means for conveying an original and light-sensitive material in substantially continuous lengths past said source of light, said means comprising rotary members having flanges adapted to receive and to guide the original and sensitive material at their edges only, means for sealing the edges of the original and sensitive material including tapes one at either edge of the material cooperating with the said flanges, and means for extracting air from between the original and sensitive material including a vacuum line, means for operatively connecting said vacuum line to a duct within said rotary members, a channel in the rotary members adjacent the edges of the original and sensitive material and connecting passages leading from the duct to the channel.

3. In a device for printing light-sensitive material, a light source, rotary members having a common center of rotation and being spaced apart a predetermined distance depending upon the width of the material to be printed, rims on said rotary members adapted to receive the material to be printed including an original and light-sensitive material, sealing means including tapes, one at either edge of the material and guiding means to maintain said tapes in operative relation to the rotary member rims and in contact with the printing material, said tapes being provided with means for moving them in a direction to allow entry of the original and sensitive material and also for discharge of that material after exposure, a vacuum line leading to each rotary member, a duct in said member and a gland operably associated with each duct, passages leading from said duct outwardly to the rims of the rotary members and an annular space at each rim adjacent the edges of the material to be printed, thereby to connect the vacuum through to the said material for extracting air from between the original and sensitive material to assure contact and registry during exposure.

4. Mechanism for contact printing including in combination a rotary printing device including members rotatable about a common axis, a printing light, a rim for each said rotatable member adapted to guide an original and sensitized printing material at its edges only during a continuous printing operation, chambers withing at least one of said members and connections to a source of vacuum, sealing strips, one for each rim, rotatable with the members and means including a plurality of rollers for guiding said sealing strips, connecting passages from said vacuum chambers in the members to the edges of the original and material to be printed including a space filled with porous material.

5. In a device for printing light sensitive material, the combination of a light source, conveying means including flexible tapes for permitting the simultaneous introduction to and for conveying a substantially continuous series of originals and light sensitive material past the light source for effecting exposure of the light sensitive material, said conveying means being effective, after exposure of the light sensitive material, to discharge both that material and the original from the device, means including the said flexible tapes for sealing the lateral edges of both original and light sensitive material as they pass the light source, said sealing means being effective to seal

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the said original and light sensitive material by contact at the lateral edges only thereof, and means for extracting air from between the original and light sensitive material including a chamber at each side of the device and conduits leading therefrom to a vacuum source, the said chambers extending in the direction of travel of the original and light sensitive material and being closely adjacent thereto, and said tapes overlapping both the original and light sensitive material and the chambers.

6. In a device for printing light sensitive material, the combination of a source of light, means for conveying an original and light sensitive material in substantially continuous lengths past said source of light, said means comprising mov-

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able members having surfaces for receiving and guiding the original and light sensitive material at their edges only, means for sealing the edges of the original and sensitive material, including tapes one at either edge of the material cooperating with the said guiding surface, and means for extracting air from between the original and sensitive material including a vacuum line, a duct and means for operatively connecting said vacuum line to said duct, a channel adjacent the movable members and the edges of the original and sensitive material, said tapes overlapping both the channel and the sensitive material, and a connecting passage leading from the duct to the channel.

GERALD L. HASSLER.