Feb. 16, 1960 W. C. CONNER 2,925,025

PHOTOCOPYING MACHINE

Filed Jan. 28, 1958 4 Sheets-Sheet 1

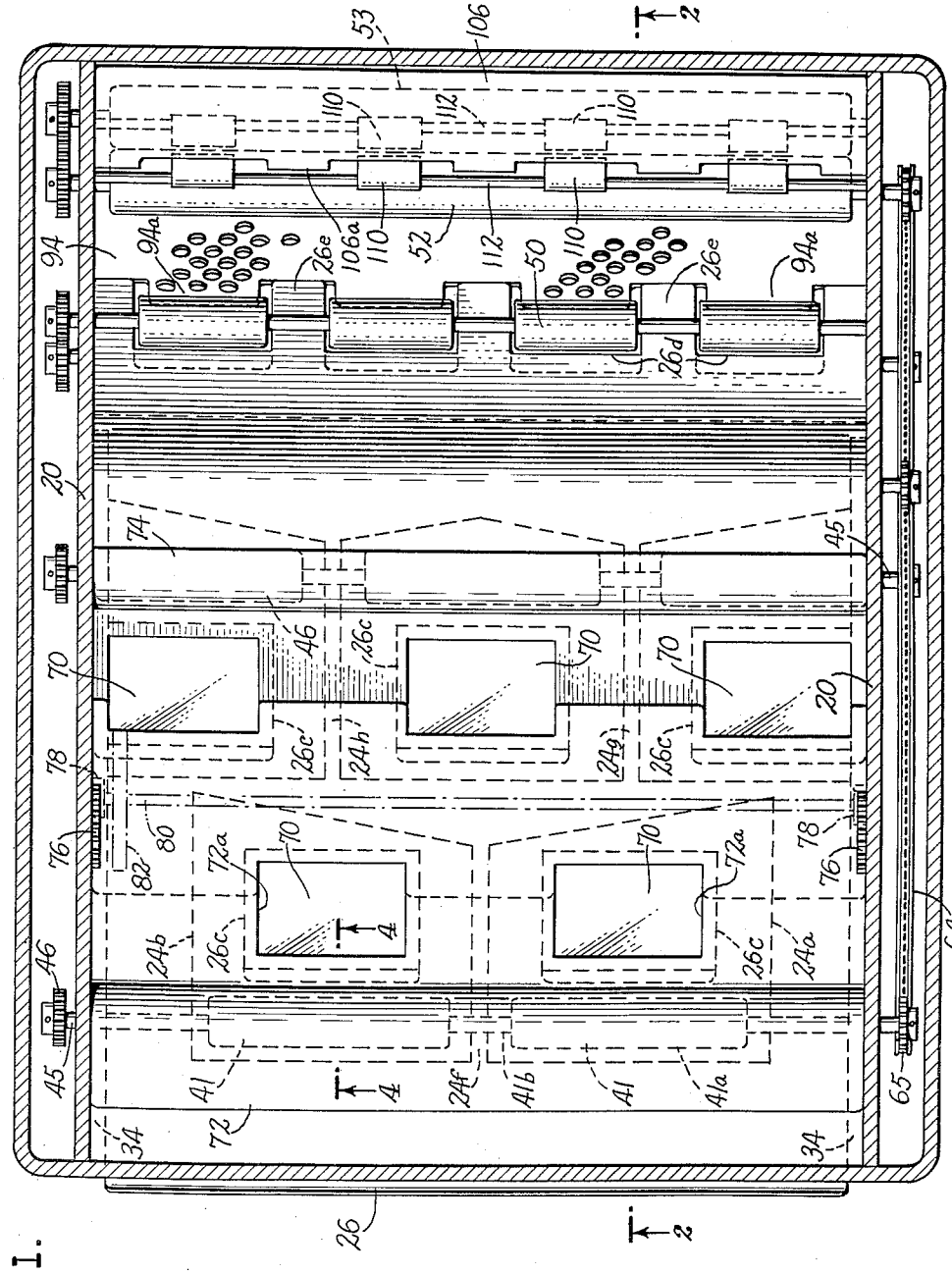



Fig. 1.

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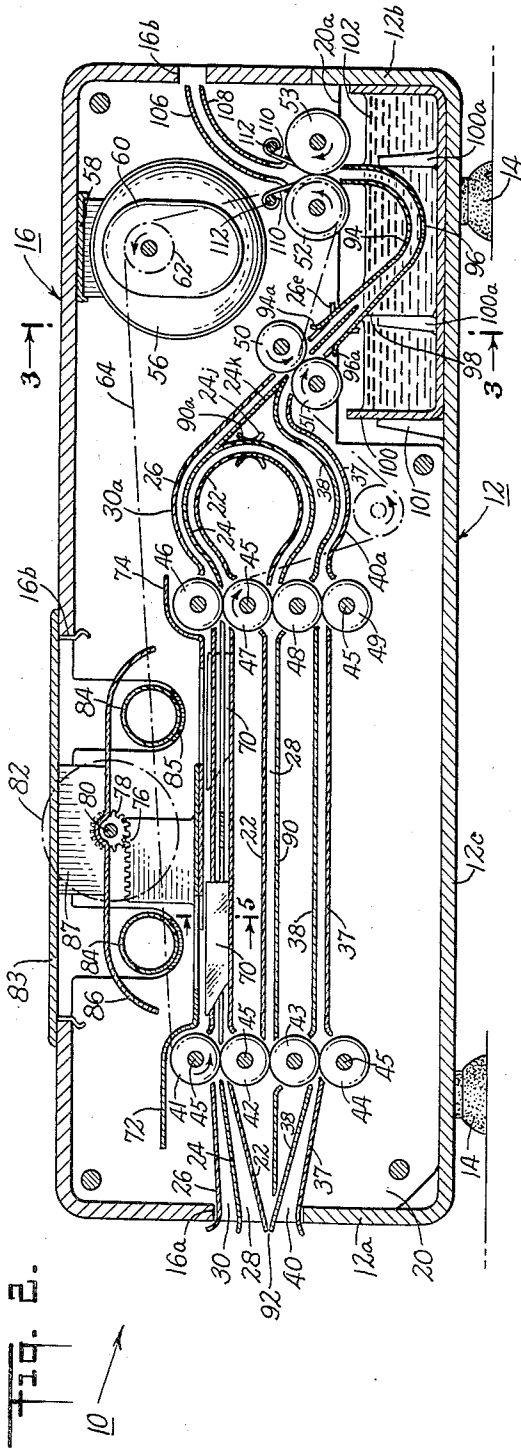


FIG. 2.

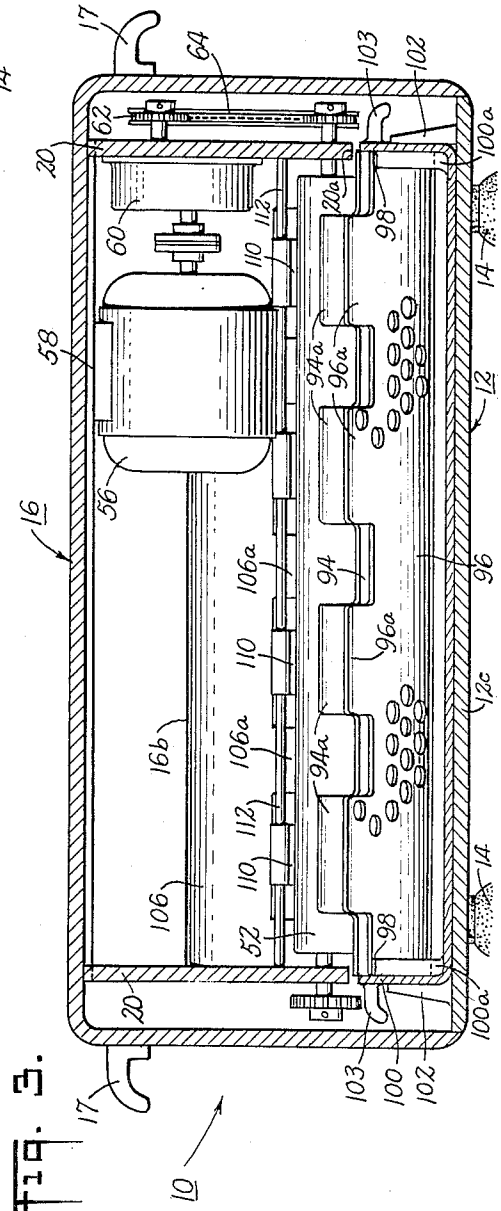


FIG. 3.

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Fig. 4.

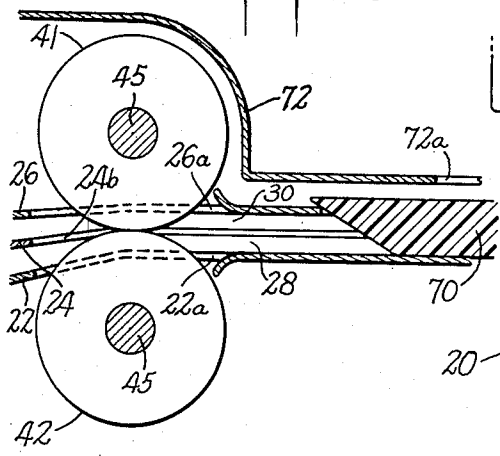



Fig. 5.

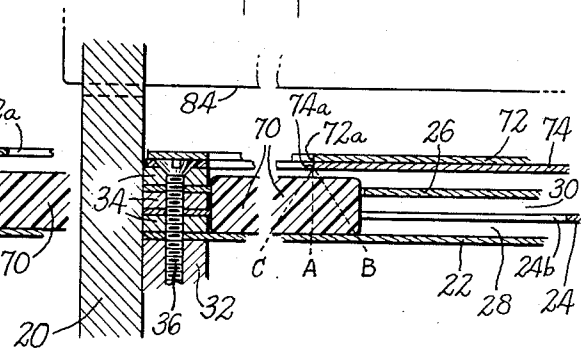
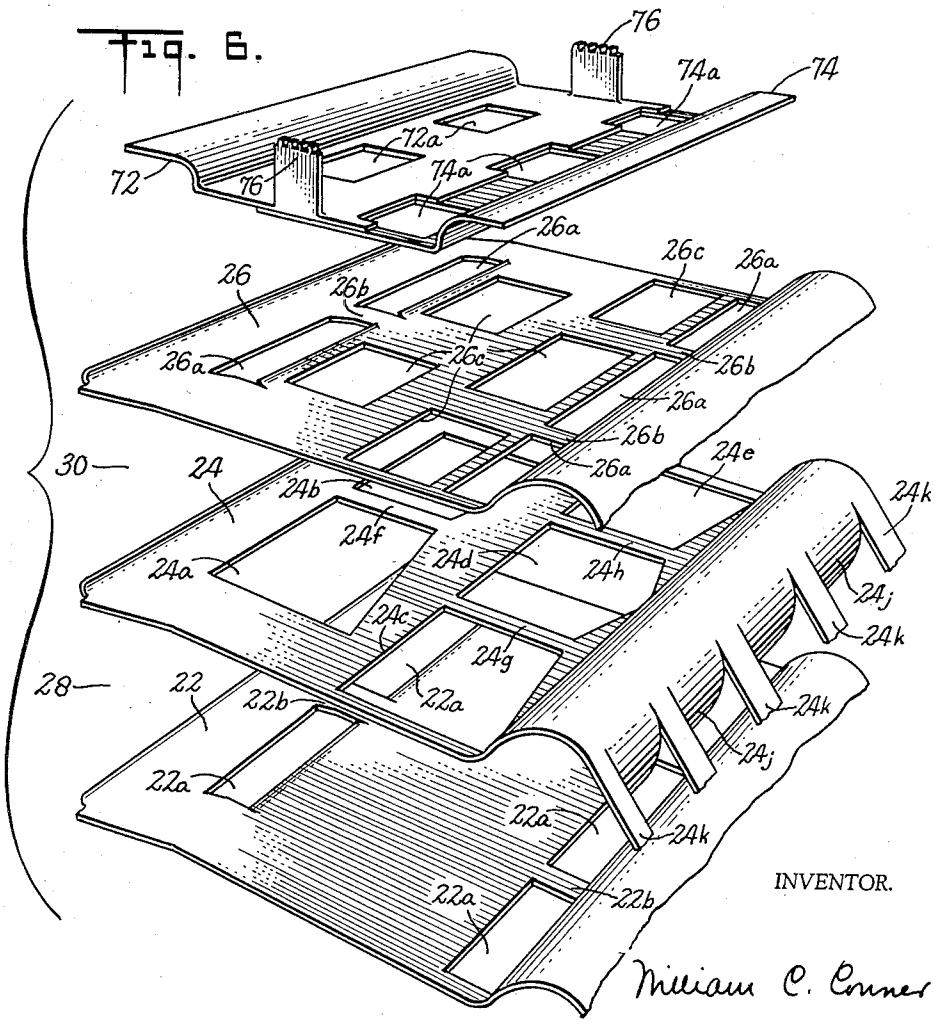



Fig. 6.




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Fig. 7.

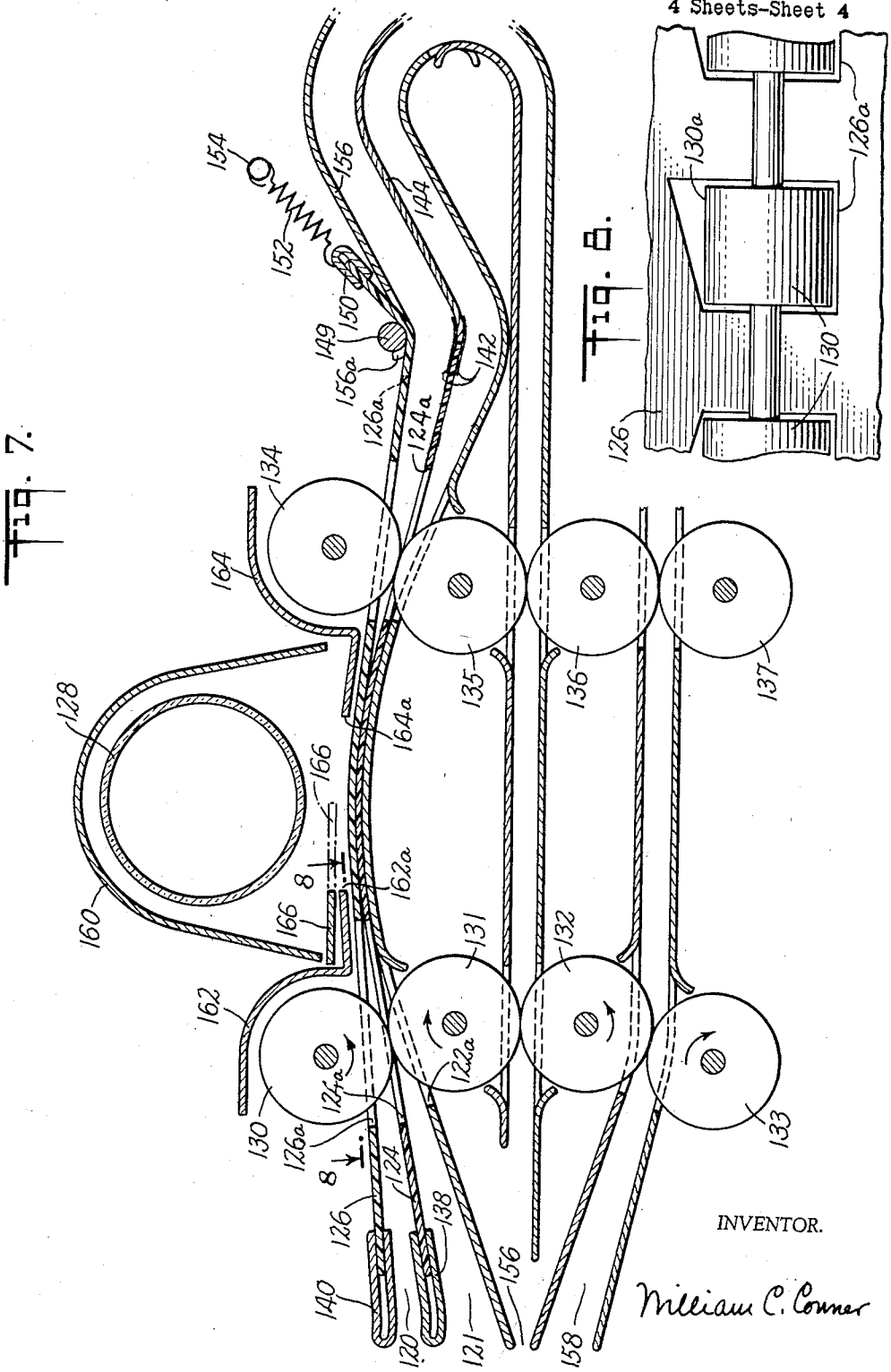



Fig. 8.




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United States Patent Office 2,925,025 Patented Feb. 16, 1960



2,925,025

# PHOTOCOPYING MACHINE

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Application January 28, 1958, Serial No. 711,723

15 Claims. (Cl. 95—75)

This invention relates to photocopying machines and more specifically to a novel type of photocopying machine in which both exposing and developing operations are performed in sequence in a single transit through the machine.

The photocopying process per se which is involved is disclosed more fully in French Patent No. 870,995 granted December 10, 1952 to I. G. Farbenindustrie A.G., and in U.S. Patent No. 2,352,014 granted June 20, 1944 to Andre Rott. In this process, the master sheet to be copied is placed with the "copy" side in face-to-face contact with the emulsion side of a photosensitive (silver halide) negative sheet, and light is directed through the back side of the negative sheet against the copy side of the master. The light reflected from the master against the emulsion side of the negative "exposes" the latter to form in its emulsion a latent image which is a page-reversed (i.e., "mirror") image. Then the master is separated from the negative and the negative and a positive sheet bearing a non-photosensitive emulsion are placed briefly in a developing solution; this develops the latent image on the negative, reducing the silver halide grains in the exposed areas of the film (corresponding to the light areas on the master) to metallic silver, leaving the unexposed portions of the negative (corresponding to the dark areas on the master) undeveloped. Then, while the two sheets are still imbibed with the developing solution, they are pressed together in intimate face-to-face contact, and the silver halide grains in the unexposed portions of the negative are dissolved from the photosensitive emulsion and diffused into the emulsion of the positive where a "fogging" agent reduces them to produce blackened areas corresponding to the dark areas on the original—a positive copy. The second "mirror" reversal produced by this transfer operation makes this positive copy page-correct—i.e. readable. In the operation of pressing the positive and negative sheets together, most of the liquid is expressed from them so that they are only slightly damp, and while still in this condition they may be readily peeled apart.

U.S. Patent No. 2,657,618 issued November 3, 1953 to Walter Eisbein discloses a developing apparatus for performing the developing steps of the aforementioned process. In this apparatus, the positive and negative sheets are conducted between guide elements down through a developing tank, an intermediate guide plate maintaining their separation at least until they have been wet by the developing liquid, and then upwardly between a pair of rollers, the nip of which is located above the level of the developing liquid. The rollers press the sheets together and wring out the excess developing solution and deliver the sheets pressed together out of the machine. This developing machine must be used in conjunction with a separate exposure apparatus, for example either a flat-bed exposure apparatus in which the master and negative sheets are held stationary while they are pressed together and light is directed through the back of the negative, or a rotary exposure apparatus in which



the master and negative sheets are fed around a drum during the exposure operation.

To make a single copy, it has been necessary to handle the sheets several times in succession: first the negative sheet has to be placed in face-to-face contact with the master sheet and these sheets inserted into the exposure apparatus for the exposure operation, which requires a period of the order of three to eight seconds. Upon completion of the exposure operation, the operator takes the negative and master sheets and separates them, laying the master to one side; then he places the negative and positive sheets into the developing machine. The movement of these sheets through the developing apparatus requires five to ten seconds. Then the sheets must be left in contact with each other for an additional period of fifteen to thirty seconds before they may be peeled apart. The entire operation including the exposure and developing steps thus requires on the order of a full minute. Since the operator is required to handle the papers several times during this interval, as a practical matter it is difficult for the operator to perform any other operations simultaneously; most of the operator's time is thus wasted in mere waiting. Therefore, even in volume production, it has not been possible for a single operator to produce copies at a rate much greater than one per minute.

The present invention provides for the first time a unitary machine in which both exposing and developing operations are performed in a single pass of the papers through the machine. The operator merely places the master, negative and positive sheets into the machine and all of the other operations are performed automatically in proper sequence, including exposure of the negative to the master, separation of the master from the negative, delivery of the master out of the machine, placing of the positive and negative sheets in proper registration into the developer portion of the machine, developing the negative and transferring of a reversed image to the positive sheet, and delivery of the positive and negative sheets out of the machine. In the use of such a machine, the operator, immediately after having fed one set of papers into the machine need not wait to perform any subsequent operations, but may immediately feed a second set of papers into the machine while the first set of papers is still in it. A typical speed of operation of the machine is such that the operator may feed in a set of papers every six to ten seconds, and a pair of operators working together, one feeding the papers into the machine and the other stripping apart the positives and negatives, may maintain a production rate of six to ten copies per minute over an indefinite period. These things are accomplished in a machine which is compact, portable, inexpensive and substantially trouble-free in operation, assuming instructions are followed within reasonable limits.

In general terms, the machine is provided with three inlet slots for feeding in the master, negative and original respectively, these slots leading to three separate guideways defined, for example, by metal or plastic guide elements. Power-driven feed elements, such as rollers, extend through feed openings through the guide elements and convey the sheets through the machine. All of the feed elements are coupled to a single drive so that they are driven in unison and feed the papers through the machine at uniform speeds. In the exposure portion of the machine there is a light source and the intermediate and guide members are provided with opposed exposure portions in illuminated relation to the light source to expose the negative sheet to the master across their entire width while keeping them separate across at least a portion of their width at all times. In one embodiment of the invention, there are successive exposure

areas in each of which there are discrete, transversely spaced exposure openings in the guide plates through which the master and the negative may be pressed together across only a portion of their width while being separated in the remaining portion of their width. The exposure openings in the several exposure areas are staggered transversely of the machine so that in traversing the exposure areas, the master and negative sheets are exposed to each other across their entire width, the exposure openings being so shaped and their proximate ends being so positioned relative to one another that the degree of exposure is uniform. In another embodiment, the exposure portion of the intermediate guide member is formed of very thin, transparent sheet material which permits a reflex exposure of the negative sheet to the master across their entire width simultaneously while keeping the sheets physically separated. In both embodiments, since the master and negative are never allowed to come together across their entire width at any instant, separational control of them is maintained and they may be completely separated and directed along different paths by bifurcation of the intermediate guide plate, with the master being conducted out of the machine.

During movement of the negative sheet through the exposure portion of the machine, the positive sheet is moving at the same speed over an equal distance and the two sheets are brought together at the input of the developing portion of the machine in proper registration. They are fed through separate guideways until they reach the surface of the developing liquid and they are conducted through the developing liquid to the nip of the pressure rollers, which press them together, express the surplus liquid from them and deliver them pressed together out of the machine. After 15 to 30 seconds, the positive and negative sheets are manually peeled apart.

In the accompanying drawings:

Figure 1 is a horizontal sectional view of an illustrative machine constituting a first embodiment of the present invention, with the positions of certain internally concealed parts being shown by broken lines.

Figure 2 is a vertical-longitudinal sectional view taken generally along the line 2—2 of Figure 1.

Figure 3 is a vertical-transverse sectional view taken generally along the line 3—3 of Figure 2.

Figure 4 is an enlarged fragmentary vertical sectional view taken on the line 4—4 of Figure 1.

Figure 5 is an enlarged fragmentary sectional view taken on the line 5—5 of Figure 2.

Figure 6 is an exploded perspective view of the three guide plates which define the two upper guideways, and of the adjustable masking plates which are superposed above them to illustrate their shape and relative positions.

Figure 7 is an enlarged fragmentary vertical-longitudinal sectional view of the exposure portion of an illustrative machine representing an alternative embodiment of this invention.

Figure 8 is a fragmentary horizontal-transverse sectional view taken generally along the line 8—8 of Figure 7.

As may be seen in Figures 1, 2, and 3, the first machine includes a casing generally designated 10 comprising a base portion 12 (Figures 2 and 3) provided with supporting feet 14, and a removable upper portion 16 which is supported on the base portion 12. As may be seen by comparing Figures 2 and 3, the base portion 12 has, at the front and rear ends of the machine, vertical flanges 12*a* and 12*b* projecting upwardly from the horizontal portion 12*c* across its entire width. There are no such upstanding flanges at the sides of the machine, where the sides of the removable upper portion 16 of the casing extend all the way down to the horizontal portion 12*c* of the base 12 and overlap the same. As best shown in Figure 3, handles 17 are provided at either side of the upper portion 16 to facilitate lifting it off of the base 12.



Most of the mechanism of the machine is supported in the removable upper portion 16 of the casing on a pair of side plates 20 (Figure 1). This mechanism includes an upper set of three guide plates—a lower guide plate 22, an intermediate guide plate 24 and an upper guide plate 26 (Figure 2) which are spaced apart to define between them lower and upper guideways 28 and 30, respectively. As may be seen in Figure 5, the lateral edges of these guide plates 22, 24 and 26 are supported on the side plates 20 by means of a supporting block 32 and screws 36, being spaced apart by spacer strips 34. A lower set of guide plates 37 and 38 (Figure 2) which are spaced apart to define a single guideway 40, are similarly supported. The front ends of all of the guide plates 22, 24 and 26, 37 and 38 extend through an opening 16*a* in the front wall of the upper portion 16 of the casing and are open to serve as slots through which the sheets are fed into the respective guidepaths 28, 30 and 40, the ends of the guide plates being flared, as shown in Figure 2, to increase the spacing between them and facilitate insertion of the leading edges of the sheets into the slots.

For feeding the papers along the guidepaths, four sets of rollers are provided. The first set comprises four identical rollers 41, 42, 43 and 44, formed of rubber, neoprene or other resilient material and fixed on shafts 45 which are rotatably journaled in the side frames 20 (Figure 1). These rollers are arranged parallel to one another in a single vertical row with the surfaces of adjacent rollers in tangential engagement. The second set also comprises four identical rollers 46, 47, 48 and 49 which are of the same diameter as the first set and are similarly supported. Each of the other two sets of rollers comprises only a single matched pair of rollers 50, 51 and 52, 53.

As may be seen in Figure 1, the shaft 45 of each of the rollers in the machine has fixed on its end projecting through the side plate 20 at one side of the machine, spur gear 46 whose pitch diameter is equal to the diameter of its respective roller so that the gears mesh to insure the uniform rotational speed of all of the rollers in each set, even when the frictional engagement between the surfaces of adjacent rollers is impaired by the passage of pairs of sheets between them.

All of the rollers in the machine are driven by an electric motor 56 which is mounted on a channel 58 extending between the side plates 20 in the upper rear portion of the machine. This motor, through a reduction gear 60, a sprocket 62 and a chain 64, whose path is indicated in dot-and-dash lines in Figure 2, engages a sprocket 65 (Figure 1) on the end of one of the shafts 45 in each set of rollers opposite to the end on which the gear 46 is mounted, to drive the rollers in the direction indicated by arrows in Figure 2. There is a uniform ratio between the number of teeth in the sprockets 62 and the diameters of their respective rollers, so that all of the rollers are driven in synchronism by the motor 60 at the same peripheral speed to feed the papers through the machine at a constant rate.

All of the guide plates are provided with feed openings to receive the rollers and permit the papers to be pressed between the rotating rollers and fed along the respective guideways. The pattern of openings in the guide plates in the exposure portion of the machine can best be understood by reference to Figure 6, which shows each of the individual guide plates, and to Figure 1 which illustrates their relative positions. As best shown in Figure 6, the lower guide plate 22 of the upper set is provided only with feed openings 22*a* large enough to admit the rollers 42 (Figure 2). The upper guide plate 26 is provided with similar feed openings 26*a* which are in opposition with the feed opening 22*a* in the lower guide 22. The intermediate guide sheets 24 are provided with considerably larger openings 24*a*, *b*, *c*, *d* and *e*, which, as best shown in Figure 1, are arranged

so that the rollers 41 and 42 are spaced a short distance from the front ends of the openings 24*a* and 24*b* while the rollers 46 and 47 are spaced a short distance from the rear ends of the openings 24*c*, *d*, and *e*. Each of the rollers is discontinuous, being cut down between the feed openings so as to permit the enlarged portions 41*a*, etc. of the rollers to extend down through the opposed openings in the three guide plates and engage the sheets while the reduced portions 41*b* etc. clear the intervening webs 24*f*, *g*, and *h* (Figures 1 and 6) of the intermediate guide plate 24, and corresponding webs 26*b* (Figure 6) in the upper guide plate 26 and 22*b* in the lower guide plate 22.

The negative sheet is inserted into the uppermost guideway 30 between the guide plates 24 and 26 of the upper set, the master is inserted into the guideway 28 between the guide plates 22 and 24 of the upper set and the positive is inserted into the guideway 40 between the guide plates 37 and 38 of the lower set. These sheets are inserted with their leading edges in registration and perpendicular to their direction of movement through the machine, and with the sheets approximately centered laterally in the input slots. The papers are pushed manually through the guideways to the point where their leading edges reach the respective pairs of rollers 41, 42 and 43, 44 of the first set of rollers. The upper and lower sets of guide plates are symmetrically arranged so that the distance from their input ends to the nips of the first set of rollers are equal. Thus, the leading edges of the master and negative reach the nip of the rollers 41 and 42 simultaneously with the arrival of the leading edge of the positive sheet at the nip of the rollers 43 and 44. These continuously rotating rollers thereupon engage the sheets and feed them along their respective guideways.

The enlarged openings 24*a–e* (Figure 6) in the intermediate guide plate 24 permit the negative and master sheets to come together over substantial portions of their width, while the webs 24*f*, *g* and *h* keep them apart in other portions. The upper guide plate 26 is additionally provided with exposure openings 26*c* which are opposite the central portions of the enlarged openings 24*a–e* in the intermediate guide, and in each of these openings 26*c* is received a rectangular presser block 70 (see particularly Figures 4 and 5).

When no sheets are being fed through the machine, as shown in Figure 4, the presser blocks 70 are supported on the lower guide sheet 22. As sheets are fed past the exposure areas, their leading edges engage the front edges of the blocks 70 which, as best shown in Figure 4, are bevelled at a considerable angle so that the sheets will cam up the front edges of the presser blocks 70 and pass beneath them. The presser blocks 70 are only slightly smaller in size than the exposure openings 26*c* in the upper guide plate 26 so that the upper guide plate maintains them in proper lateral position. The weight of the presser blocks 70 presses the negative and master sheets into intimate surface contact with one another throughout substantially the entire area of the presser blocks. The presser blocks are formed of transparent or translucent glass or plastic, so that light may be transmitted through them to expose the negative sheets to the master as they pass beneath.

As best shown in Figure 6, positioned above the upper guide 26 and the presser blocks 70 are a pair of relatively adjustable masking plates 72 and 74. These two masking plates are provided with apertures 72*a* and 74*a* respectively which are slightly smaller than and are centered over the presser blocks 70. As shown in Figure 5, the lower masking plate 74 is supported at its edges on the uppermost spacer strip 34, and is fixed in position by the recessed-head screws 36. The upper masking plate 72 lies flat on the lower plate 74 and is slidable forwardly and rearwardly of the machine to permit adjustment of the size of the exposure apertures. Movement of the upper masking plate 72 in this manner is accomplished by means of racks 76 which project upwardly from its opposite ends and which are engaged by pinions 78 (Figure 1) fixed on a shaft 80 rotated by means of a knurled wheel 82 which projects through a slot in a cover plate 83 at the top of the machine. Even at the widest aperture setting, the masks 72 and 74 overlap the edges of the presser blocks 70 at all four sides so that the exposure is not affected by edge refraction.

As a light source, a pair of fluorescent bulbs 84 are provided, these bulbs extending transversely of the machine and being supported at their ends by sockets 85 secured to the side plates 20. A reflector 86 extends above the fluorescent bulbs 84 to reflect all of the light emitted thereby downwardly toward the exposure areas. This reflector 86 is attached to the cover plate 83 by spacing brackets 87 and is removed through an opening 16*b* in the upper portion 16 of the casing 10 when the cover plate is lifted. This permits ready access to the fluorescent bulbs 84 to replace a defective bulb.

The effective exposure areas with the apertures at their widest setting may be seen in full lines in Figure 1, in which the aperture areas are designated 72*a* and 74*a* respectively. The five apertures are divided into two sets, the first set comprising the two apertures 72*a* and the second set comprising the three apertures 74*a*, these two sets being respectively centered beneath the fluorescent bulbs 84. The apertures in each set are discrete and transversely spaced, with the apertures 72*a* in the first set being transversely staggered relative to the apertures 74*a* in the second set, and with the proximate ends of the adjacent apertures of the two sets in approximate longitudinal alignment.

As the negative and master sheets move past the two exposure areas, the portions of the width of the two sheets opposite the first set of apertures 72*a* are exposed. Then as the sheets pass the second exposure area, the remaining portions of the two sheets are exposed.

As many be seen in Figure 5, because of the spacing of the masking plates 72 and 74 from the lower guide plate 22 against which the two negative and master sheets are pressed during exposure, the edges of exposed areas are not sharply defined. Thus the exposure is not abruptly terminated at the point A directly beneath the longitudinal edge of the aperture 72*a*, but instead there is a diminishing degree of exposure all the way over to the point B, some distance behind the edge of the aperture. This is due to the fact that the fluorescent bulbs 84 extend across the entire width of the machine and radiate light not only vertically but also obliquely and horizontally. Moreover, the exposure does reach its maximum at point A, because the masking plate cuts off therefrom light rays from portions of the bulb to the right, as viewed in Figure 5, of the edge of the aperture 72*a*. Thus, the intensity of illumination gradually increases in more or less linear fashion from the minimum at point B to the maximum at point C.

The two exposure areas each have these twilight zones at each longitudinal edge of each aperture, and each twilight zone is longitudinally aligned with another zone in the other exposure area, in which the relative positions of the maximum and minimum exposure points are reversed, due to the staggering of the apertures. Thus, any point on the negative and master sheets which passes near the minimum exposure point B in one exposure area will pass near the maximum exposure point C in the other exposure area. Therefore, assuming these sheets move through the exposure areas in a perfectly straight line, any point which passes through twilight zones in the two exposure areas will receive a total exposure which is substantially equal to that which it would receive if it passed through the center of an aperture in one of the two exposure areas. This avoids any possibility that a minute laterial creepage of the two sheets in passing from one exposure area to the other might cause a particular portion of the film to be either totally unexposed or doubly ex-

posed. With the arrangement described, the maximum anticipated creepage might, for example, produce an exposure 10% above or below the optimum, but this is well within the exposure latitude of the photosensitive emulsion on the negative sheet.

A similar result can be achieved by complementarily tapering the ends of the exposure areas and overlapping them in such geometric relation that in passing straight through the overlapping tapered end portions of a pair of apertures in the respective exposure areas, the negative and master are exposed over a total longitudinal distance equal to the maximum longitudinal dimension of each of the apertures.

From the foregoing description it will be appreciated that in passing through the exposure areas, the negative sheet is uniformly exposed to the master across their entire width, although separational control of the two sheets is maintained. That is to say, the sheets are separated by the intermediate guide plate 24 across at least a portion of their width at all times, the points of separation being shifted from one exposure area to the next.

As may be seen in Figures 1 and 6, the rear edge of each of the openings 24*a* to 24*e*, inclusive, in the intermediate guide 24 is inclined at an angle relative to a line perpendicular to the path of the sheets. This is to insure that the leading edges of the moving sheets cannot come into abutment with an edge of the opening which is perpendicular to their direction of movement—i.e., parallel to their leading edges—which might cause the leading edge to snag and perhaps to jam the machine.

For the purposes of illustration, assume that the negative sheet, which rides on top of the intermediate guide plate 24, is curled downwardly at one of its leading corners; assume further that the paper is inserted slightly crooked, so that the downwardly curled corner is ahead of the rest of the leading edge. During passage of the sheet through the exposure portion of the machine, the path of this downwardly curled edge would cross the rear edge of one of the openings in the intermediate guide plate 24. If this edge of the opening were perpendicular to the path of the paper, the downwardly curled corner of the negative sheet would be apt to pass beneath rather than above it, up to the point where the leading edge of the sheet would come into direct abutment with the rear edge of the opening. This would cause the paper to buckle and possibly tear or crumple or even jam in the machine, which might render it necessary to at least partially disassemble the machine in order to remove the paper. To avoid this possibility, the rear edges of the openings in the intermediate guide 24 are inclined, as shown in Figures 1 and 6, away from the webs 24*f*, *g* and *h* by which the sheet is supported between the openings 24*a*—*e*. When the sheet reaches the rear edges of the openings, the width of the supporting surface is gradually increased, camming upwardly the leading edge of the sheet until the entire leading edge, including any downwardly curled corner, rests on top of the intermediate guide plate 24.

As shown in Figures 2 and 6, the rear edges of the feed openings 22*a* and 26*a* in the lower and upper guide members 22 and 26 respectively are flared outwardly to "funnel" the leading edges of the sheets into the guide paths and prevent snagging of the sheets.

It will be understood that the transverse dimension of the sheets fed into the machine must be at least as great as the width of the openings 24*a*—*e* in the intermediate guide plate 24, so that the sheets cannot pass through the openings and get into the wrong guide path, and that the sheets should be at least as long as the greatest spacing between adjacent sets of rollers, so that they may be fed from one set of rollers to the next. Moreover, for most reliable handling of narrow sheets, the sheets should be placed into the machine as near the center of the input slots as possible to insure that their lateral edges will overlap the webs 24*g* and 24*h* at either side of the center openings 24*d* in the second exposure area, and eliminate the possibility that one of their leading corners might engage a portion of the rear edge of this opening which was inclined in the wrong direction to achieve the camming action previously described.

After the sheets have passed the exposure areas, there are no more openings in the intermediate guide plate and the separation of the negative and master sheets becomes complete.

As best shown in Figure 2, the lower guide plate 22 is bent around a generally cylindrical curve and the intermediate guide plate 24 and upper guide plate 26 follow it for some distance to a point where the intermediate guide plate 24 is divided, as best shown in Figure 6, into alternately arranged fingers 24*j* and 24*k*. The fingers 24*j* are bent down, following the contour of the lower guide plate 22, and overlap the generally coplanar interdigitated fingers 90*a* of an intermediate guide extension plate 90. The lower guide 22 continues on around through a net angle of 180° and extends back toward the front of the machine, with the extension plate 90 closely following the contour to form an effective continuation of the lower guideway 28. This causes the master sheet to reverse its course, passing first between the rollers 47 and 48 and the rollers 42 and 43, which extend through feed openings in the two plates. As indicated by the arrows in Figure 2, these rollers rotate in such direction as to feed the paper back toward the front of the machine. The guide plates 22 and 90 conduct the master sheet through a narrow outlet slit 92 between the upper and lower sets of guide plates, the opposed surfaces of the innermost guide plates 22 and 38 of the upper and lower sets being inclined toward one another to "funnel" the master sheet through the narrow slit 92. The fact that the outlet slit 92 is very narrow prevents accidental insertion therein of one of the sheets being fed into the machine through the input slots above and below. Thus, the master sheet, after being exposed to and then separated from the negative sheet, is conducted out of the front of the machine.

While the negative sheet is passing through the exposure portion of the machine and is being exposed to the master sheet, the positive sheet will have been conveyed along the guideway 40, through a path of exactly the same distance, being driven by the rollers 43 and 44 and the rollers 48 and 49, which rotate in such direction to feed the paper to the rear of the machine. This path also includes an offset portion 40*a* of the same shape and dimensions as the hump 30*a* where the upper guideway bends around the cylindrical curve in the lower guideway 28. Thus the leading edges of the negative and positive sheets arrive simultaneously between the rollers 50 and 51. As may be seen in Figure 1, the rollers 50 and 51 are provided with alternate sections of enlarged and reduced diameter, the enlarged sections, such as 50*a* (Figure 1) projecting into notches 26*d*, etc. cut in the ends of all three guide members 26, 24 and 37, with the fingers 26*e*, etc. between these notches extending between the enlarged portions 50*a* of the rollers to guide the negative and positive sheets while maintaining their separation. These fingers 26*e*, etc. overlap fingers 94*a* and 96*a* of a pair of upper and lower guide plates 94 and 96 (Figure 2) which are supported in the developing tank 100 between end plates 98 slidably received between guide bosses 100*a* at the inner faces of the end walls of the tank. This arrangement permits the guide plates 94 and 96 to be lifted out of the tank 100 for cleaning and to be readily replaced into proper position.

As shown in Figure 2, the front or input ends of the fingers 94*a* and 96*a* are flared outwardly, to insure that they will gather the leading edges of the sheets and direct them between the guide plates 94 and 96. The fingers 24*k* (best shown in Figure 6) at the rear end of the lower guide 24 terminate just short of the surface of the liquid 102 (as may be seen in Figure 2) in the de-

veloper tank **100** to maintain the separation of the negative and positive sheets at least until they have reached the surface of the liquid and have been moistened by it. In certain types of machines it may be necessary to provide an intermediate guide plate between the upper and lower guide plates **94** and **96** to separate the positive and negative sheets through some or all of their passage through the tank **100**. Such an intermediate guide plate could be provided at its input end with fingers which interdigitate in coplanar relation with the fingers **24***k* of the intermediate guide plate **24**, preferably with the output ends of the fingers **24***k* being flared in thickness so as to direct the positive and negative sheets toward the upper and lower guide plates **94** and **96** and insure that the leading edges of these sheets will not strike the input ends of the fingers of the intermediate guide plate, even though they may be slightly misaligned relative to the fingers **24***k*.

As best shown in Figure 3, the end walls of the tank **100** extend beneath the end plates **20** of the machine the end plates being provided with cut outs **20***a* (Figure 2) to receive the end portions of the tank.

The tank **100** rests on the horizontal portion **12***c* of the base **12**, being removably held in proper lateral position therein between the rear flange **12***b* of the base **12**, an upstanding guide flange **101** at its forward side and similar flanges **102** (Figure 2) at each end. Thus, when the upper portion of the casing is removed, the tank **100** is exposed and may be lifted by means of handles **103** (Figure 3) which are provided at either end. The tank may then be carried to a sink for emptying and cleaning.

The guide plates **94** and **96** conduct the positive and negative sheet between the pressure rollers **52** and **53**, which press them together to effect the transfer of the image from the negative to the positive sheets, to express the surplus moisture therefrom, and to deliver the sheets out of the machine between a pair of guide plates **106** and **108** and through a slot **16***b* in the upper portion **16** of the casing. As may be seen in Figure 1, these guide plates **106** and **108** are provided at their input ends with fingers, such as **106***a*, which are interdigitated with stripper fingers **110** (Figures 1 and 2) which are mounted on shafts **112** extending between the end plates **20**. The stripper fingers **110** are formed of spring material and are resiliently urged into frictional engagement with the surfaces of the rollers to peel away from the rollers any sheets which tend to stick thereto. The input ends of the fingers **106***a*, etc. on the guide plates **106** and **108** are flared outwardly to gather in the sheets and insure that they will pass between the guide plates and be conducted out of the machine by the rollers **52** and **53**.

In Figure 7 the exposure portion of a machine constituting an alternative embodiment of the present invention is shown in cross section; the remaining portions of this machine may be identical with the corresponding portions of the machine illustrated in Figures 1–6 and therefore the showing of these portions of the machine is not repeated.

In the exposure portion of the machine shown in Figure 7, there are two guide paths **120** and **121** defined by guide members **122**, **124** and **126**. The lower guide member **122** may be formed of metal and is upwardly bowed or curved with the highest portion of this curve being located beneath the single fluorescent bulb **128** and approximately midway between two sets of rollers **130**, **131**, **132**, **133** and **134**, **135**, **136**, **137**. The intermediate guide member **124** and the upper guide member **126** are formed of flexible transparent sheet material such as cellulose acetate sheet and the intermediate guide member **124** at least is formed of a very thin material, for example having a thickness of the order of from .001 to .010 inch. The input ends of the intermediate and upper guide members **124** and **126** are supported by metal clamping strips **138** and **140** which extend between and are supported by the side plates of the machine.

The rear edge of the intermediate guide member **124** extends adjacent the forward edge of an intermediate guide extension plate **144** which extends between and is supported by the side plates, the two guide members being attached to one another above and below by extremely thin plastic strips **146** which extend along the full length of the guide members and are secured thereto by adhesive or by heat sealing. For example, these stops may be formed of pressure-sensitive adhesive tape. Their extreme thinness prevents snagging of the leading edges of the sheets.

The upper guide member **126** extends beneath a rod **149** which extends transversely of the machine between the side plates and is bent around the rod so that its rear end projects upwardly at a slight angle. The rear edge of the upper guide member **126** is reinforced by a metal clamping strip **150** which is provided with openings through which are hooked the forward ends of helical tension springs **152** whose opposite ends are hooked around stubs **154**, to maintain the upper guide member under slight tension. The upper guide member **126** is provided with transversely spaced openings **126***a* through which project fingers **156***a* on the forward end of the upper guide extension plate **156** the forward ends of these fingers **156***a* being flared outwardly around the rod **149** to gather in the leading edges of the negative sheets and direct them along the guide path **120**.

All of the guide members **122**, **124** and **126** are respectively provided with feed openings **122***a*, **124***a* and **126***b* through which the feed rollers **130**, **131** and **134**, **135** project into mutual engagement.

The input and output ends of the guide members **124** and **126** are located below the highest point of the curve in the lower guide member **122**. Thus, the tension imposed on the upper guide member causes central portions of these two guide members to bear against and follow the contour of the lower guide member **122** throughout the exposure area directly beneath the fluorescent bulb **128**. However, the spacing of the ends of the intermediate and upper guide members **124** and **126** from the adjacent portions of the lower guide member **122** causes these guide members to diverge from each other at either side of this exposure area.

Thus, as the negative and master sheets are inserted into the input ends of the respective guide paths **120** and **121**, they are guided between the upper pair of rollers **130** and **131** of the first set and are pressed together and fed along the guide paths which become progressively narrower as the papers approach the exposure area. The leading edges of the papers wedge apart the guide members in the exposure area, with the springs **152** yielding to permit any slight longitudinal movement of the intermediate and upper guide members **124** and **126** necessary to accommodate such vertical separation of the guide members by the sheets.

During the passage of the negative and master sheets through the exposure area, the intermediate and upper guide members press them smoothly around the contour of the lower guide member **122** and bring the photosensitive layer of the negative and the copy side of the master into intimate areal engagement with opposite faces of the intermediate guide member **124**. Since the intermediate guide member is very thin, the amount of parallax or diffusion which results is negligible, and it is possible to make an accurate reflex exposure of the negative to the master through the intermediate guide member.

As may be seen in Figure 8, the rear edges of the feed openings **122***a*, **124***a* and **126***b* in the guide members **122**, **124** and **126** are inclined in a direction outwardly

from the center of the machine and forwardly in the direction of movement of the sheets through the machine to prevent snagging of the leading edges or corners of the sheets. The rollers 130–137 inclusive are interrupted, their enlarged portions 130*a* etc. (Figure 8) being relatively short, with the feed openings being correspondingly short so that the inclination of the rear edges of the feed openings may be made comparatively steep without extending over a substantial distance lengthwise of the machine. This steepening of the rear edges of the openings in the intermediate guide member makes these edges function even more efficiently in properly separating the sheets and virtually eliminates any possibility that the sheets could inadvertently be placed in the machine so misaligned that their leading edges were parallel to the rear edges of the openings.

From the foregoing description, it will be apparent that in the single exposure area beneath the fluorescent bulb 128, the negative sheet is exposed to the master across the entire width of the sheets simultaneously, while the intermediate guide member 124 maintains their physical separation. Thus, after the sheets have passed the exposure area the master may be returned through an opening 156 in the front of the machine while the negative sheet is passed to the developing-transferring portion. It arrives there in registration with the positive sheet which has been inserted through an opening 158 in the front of the machine, the two sheets being inserted simultaneously and moving through paths of the same overall length at equal speeds.

A reflector 160 which extends around the top and sides of the fluorescent bulb 128 serves to direct all of the light radiated thereby downwardly toward the exposure portions of the guide paths. Light shields 162 and 164 which extend between and are supported by the side plates of the machine serve to mask all of the upper guide member 126 beneath the lamp except a short portion between the ends 162*a* and 164*a* of the shields, the guide members 124 and 126 lie flush against the contours of the lower guide member 122, to insure proper exposure of the negative to the master throughout this area. A diaphragm plate 166 is mounted above the inner horizontal portion of the shield 122 and as shown in broken lines is movable to mask varying amounts of the exposure area and vary the degree of exposure.

The machine shown in Figures 7 and 8 has the advantage that since there is only one exposure area the spacing between the two sets of rollers 130—133 and 134—137 is quite short. This not only reduces the overall length of the machine, but makes it possible for the machine to handle sheets of shorter length. Moreover, since the largest openings in the guide members 122, 124 and 126 are very narrow as compared to the exposure openings of the machine shown in Figure 1–6, the machine of Figures 7 and 8 can handle much narrower sheets. For the reasons pointed out above, there is also greater margin for error on the part of the operator in inserting the sheets into the machine. Moreover, since there is only one fluorescent bulb and one exposure area, there is never any problem with respect to matching fluorescent bulbs or of varying the relative sizes of exposure apertures in two separate exposure areas to compensate for difference in actinic light output of the two fluorescent bulbs employed in the respective exposure areas.

From the foregoing description, it will be seen that the present invention provides a photocopying machine which is adapted to receive master, negative and positive sheets which are inserted simultaneously and in registration at one end of the machine, expose the negative to the master across their entire width while maintaining separational control of them, then separate the negative and the master, deliver the master out of the machine adjacent the point where it was inserted, deliver the negative and the positive registration to the developing apparatus in which they are maintained separate until they have been wet by the developing liquid and then are pressed together with the excess fluid being wrung out of them, and then are delivered out of the machine, ready to be stripped apart to produce a readable positive photoprint. All of this is accomplished in a machine which is compact, inexpensive and practical in construction and operation.

It will thus be appreciated that the aforementioned as well as other desirable objects have been achieved. However, the particular embodiments of the invention which are shown in the accompanying drawings and described in the foregoing specification are intended as merely illustrative of the principles of the invention rather than as restrictive of the scope thereof. For example, in the first embodiment shown in Figures 1–6, the particular shape, number and arrangement of the exposure openings are subject to almost infinite variation, provided the aforementioned precautions, such as sheet separation and uniform exposure are observed. Additionally, the portion of the intermediate guide element 24 within the exposure areas, instead of being formed of a rigid, self-supporting material such as sheet metal or plastic, could be formed of flexible material such as a thin sheet metal or strong plastic sheet material. It would thus sag by its own weight and lie normally against the lower guide plate 22, but be cammed up by the leading edge of the master sheet to permit the master sheet to pass between it and the lower guide plate. This would have the advantage of allowing the negative sheet to lie much closer to the master, even in the areas where they were separated by the webs of the intermediate sheet, to alleviate the problem of pressing them into intimate areal contact through the exposure openings in the intermediate guide sheet, in both embodiments disclosed. Moreover, other types of paper feeding elements may be substituted for those actually shown. It thus should be emphasized that the coverage of this patent is limited only by the appended claims and not to the specific illustrative apparatus which is disclosed.

I claim:

1. In a photocopying machine of the type having developing-transferring means adapted to receive negative and positive sheets separately, moisten at least one of said sheets with developer liquid and press them together, the combination therewith of exposure means comprising three guide members superposed in face-to-face relation to define two generally parallel guide paths for respectively guiding a master sheet and a photosensitive negative sheet, opposed feed openings in all three of said guide members, movable power driven feed members extending through the feed openings in the inner and outer guide members for pressing said two sheets together through the opening in said intermediate guide member and feeding the same along said guide paths at equal speeds, a light source, opposed light-transmitting exposure portions in the intermediate guide member and one of the outer guide members in illuminated relation to said light source, for exposing said negative sheet to said master sheet across their entire width, with said intermediate guide member maintaining the separation of said sheets along at least a portion of their width during their entire movement along said parallel guide paths, master conveyor means for receiving the master sheet from one of said guide paths and conducting it out of said machine, negative conveyor means for receiving the exposed negative from the other of said guide paths and conducting it to said developing-transferring means, and positive conveyor means for conducting a positive sheet separately to said developing-transferring means.

2. In a photocopying machine of the type having developing-transferring means adapted to receive negative and positive sheets separately, moisten at least one of said sheets with developer liquid and press them together, the combination therewith of exposure means comprising a set of three guide members superposed in face-to-face

relation to define two generally parallel guide paths for respectively conveying master and negative sheets, a light source, opposed light-transmitting portions in said intermediate guide member and said outer guide member in illuminated relation to said light source for exposing said negative sheet to said master sheet across their entire width, with said intermediate guide member maintaining the separation of said sheets across at least a portion of their width during their entire movement along said parallel guide path, guide elements for conducting the master sheet from one of the aforesaid guide paths out of said machine, negative guide members defining a guide path for conducting the exposed negative from the other of said guide paths to said developing-transferring means, and positive guide members defining a guide path for conducting a positive sheet separately to said developing-transferring means, feed openings in all of said guide members, movable feed elements projecting through said feed openings to engage the sheets therein and feed them along said guide paths, a single motor for driving all of said feed elements to cause them to feed said sheets at equal speeds, the input ends of said set of three guide members and said positive guide members having their input ends located adjacent to one another and the guide paths of the negative and positive sheets being of the same overall length, whereby when all three sheets are inserted simultaneously into the respective input ends of said guide paths in registration, the negative and positive sheets will reach said developing-transferring means in approximate registration.

3. A machine as claimed in claim 2 in which said negative guide members are shaped to define a guide path which makes a 180° turn and leads to a narrow space between the input ends of said dual conveyor means and said positive conveyor means.

4. In a photocopying machine of the type having developing-transferring means adapted to receive negative and positive sheets separately, moisten at least one of said sheets with developer liquid and press them together, the combination therewith of exposure means comprising dual conveyor means for respectively conveying master and negative sheets in separate guide paths, said dual conveyor means including an intermediate guide member separating said guide paths and an outer guide member defining the other side of one of said guide paths, and power driven movable feed means acting upon said sheets to feed them along said guide paths, a light source, opposed exposure openings in said intermediate guide member and said outer guide member in illuminated relation to said light source, said openings including portions in different areas along said guide paths, the openings in each of said areas being discrete and transversely spaced and the openings in the several areas being transversely staggered relative to one another, whereby in traversing said areas said photosensitive sheet and said master sheet are exposed across their entire width, with said inner guide member maintaining the separation of said sheets in the spaces between said openings in each of said areas, master conveyor means for receiving the master sheet from one of said guide paths and conducting it out of said machine, negative conveyor means for receiving the exposed negative from the other of said guide channels and conducting it to said developing-transferring means, and positive conveyor means for conducting a positive sheet separately to said developing-transferring means in a transit time equal to the total transit time of said negative sheet.

5. In a photocopying machine of the type having developing-transfering means adapted to receive negative and positive sheets separately, moisten at least one of said sheets with developer liquid and press them together, the combination therewith of exposure means comprising three guide members superposed in face-to-face relation and spaced apart to define two generally parallel guide paths for respectively guiding master and photosensitive sheets, opposed feed openings in all three of said guide members, movable power driven feed members extending through the feed openings in the inner and outer guide members for pressing said two sheets together through the opening in said intermediate guide member and feeding the same along said guide paths at equal speeds, a light source, opposed exposure openings in the intermediate guide member and one of the outer guide members in illuminated relation to said light source, said openings including portions in different areas along said guide paths, the openings in each of said areas being discrete and transversely spaced and the openings in the several areas being transversely staggered relative to one another, whereby in traversing said areas said photosensitive sheet and said master sheet are exposed across their entire width, with said inner guide member maintaining the separation of said sheets in the spaces between said openings in each of said areas, master conveyor means for receiving the master sheet from one of said guide paths and conducting it out of said machine, negative conveyor means for receiving the exposed negative from the other of said guide paths and conducting it to said developing-transferring means, and positive conveyor means for conducting a positive sheet separately to said developing-transferring means in a transit time equal to the total transit time of said negative sheet.

6. In a photocopying machine of the type having developing-transferring means adapted to receive negative and positive sheets separately, moisten at least one of said sheets with developer liquid and press them together, the combination therewith of exposure means comprising three guide members superposed in face-to-face relation and spaced apart to define two generally parallel guide paths for respectively guiding master and photosensitive sheets, opposed feed openings in all three of said guide members, movable power driven feed members extending through the feed openings in the inner and outer guide members for pressing said two sheets together through the feed opening in said intermediate guide member and feeding the same along said guide paths at equal speeds, a light source, opposed exposure openings in the intermediate guide member and one of the outer guide members in illuminated relation to said light source, said exposure openings including a first set of discrete openings spaced apart across the width of said guide paths and a second set of discrete openings having the same longitudinal dimension and spaced from said first set along said guide paths and arranged to occupy positions corresponding to the spaces between the openings of said first set, whereby in traversing said exposure openings, the entire width of said sheets is exposed at least through a distance equal to the longitudinal dimension of said sets of openings, with said inner guide member maintaining the separation of said sheets in the spaces between the openings in each of said sets, master conveyor means for receiving the master sheet from one of said guide paths and conducting it out of said machine, negative conveyor means for receiving the exposed negative from the other of said guide paths and conducting it to said developing-transferring means, and positive conveyor means for conducting a positive sheet separately to said developing-transferring means in a transit time equal to the total transit time of said negative sheet.

7. In a photocopying machine of the type having developing-transferring means adapted to receive negative and positive sheets separately, moisten at least one of said sheets with developer liquid and press them together, the combination therewith of exposure means comprising three guide members superposed in face-to-face relation and spaced apart to define two generally parallel guide paths for respectively guiding master and photosensitive sheets, opposed feed openings in all three of said guide members, movable power driven feed members extending through the feed openings in the inner and outer guide members for pressing said two sheets together

through the opening in said intermediate guide member and feeding the same along said guide paths at equal speeds, a light source, opposed exposure openings in the intermediate guide member and one of the outer guide members in illuminated relation to said light source, said openings including portions in different areas along said guide paths, the openings in each of said areas being discrete and transversely spaced and the openings in the several areas being transversely staggered relative to one another, whereby in traversing said areas said photosensitive sheet and said master sheet are exposed across their entire width, with said inner guide member maintaining the separation of said sheets in the spaces between said openings in each of said areas, presser elements yieldably engaging at least one of said sheets at said exposure openings to press said sheets into areal face-to-face contact, master conveyor means for receiving the master sheet from one of said guide paths and conducting it out of said machine, negative conveyor means for receiving the exposed negative from the other of said guide paths and conducting it to said developing-transferring means, and positive conveyor means for conducting a positive sheet separately to said developing-transferring means in a transit time equal to the total time of said negative sheet.

8. In a photocopying machine of the type having developing-transferring means adapted to receive negative and positive sheets separately, moisten at least one of said sheets with developer liquid and press them together, the combination therewith of exposure means comprising three generally horizontally extending guide members superposed in face-to-face relation and spaced apart to define two generally parallel guide paths for respectively guiding master and photosensitive sheets, opposed feed openings in all three of said guide members, movable power driven feed members extending through the feed openings in the inner and outer guide members for pressing said two sheets together through the feed openings in said intermediate guide member and feeding the same along said guide paths at equal speeds, a light source, opposed exposure openings in the intermediate and upper guide members said openings including portions in different areas along said guide paths, the openings in each of said areas being discrete and transversely spaced and the openings in the several areas being transversely staggered relative to one another, whereby in traversing said areas said photosensitive sheet and said master sheet are exposed across their entire width, with said inner guide member maintaining the separation of said sheets in the spaces between said openings in each of said areas, translucent presser blocks respectively received within said exposure openings with their weight normally supported on the lower guide member, but having beveled front surfaces to cause them to be cammed up by the leading edges of said sheets and permit said sheets to pass beneath said presser blocks and be pressed by them into intimate areal contact, master conveyor means for receiving the master sheet from one of said guide paths and conducting it out of said machine, negative conveyor means for receiving the exposed negative from the other of said guide paths and conducting it to said developing-transferring means and positive conveyor means for conducting a positive sheet separately to said developing-transferring means in a transit time equal to the total transit time of said negative sheet.

9. In a photocopying machine of the type having developing-transferring means adapted to receive negative and positive sheets separately, moisten at least one of said sheets with developer liquid and press them together, the combination therewith of exposure means comprising three guide members superposed in face-to-face relation and spaced apart to define two generally parallel guide paths for respectively guiding master and photosensitive sheets, opposed feed openings in all three of said guide members, movable power driven feed members extending through the feed openings in the inner and outer guide members for pressing said two sheets together through the opening in said intermediate guide member and feeding the same along said guide paths at equal speeds, a light source, opposed exposure openings in the intermediate and upper guide members, the exposure openings in said intermediate guide member extending beyond those in said upper guide member, said openings including portions in different areas along said guide paths, the openings in each of said areas being discrete and transversely spaced and the openings in the several areas being transversely staggered relative to one another, whereby in traversing said areas said photosensitive sheet and said master sheet are exposed across their entire width, with said inner guide member maintaining the separation of said sheets in the spaces between said openings in each of said areas, translucent presser blocks of approximately the same size as the exposure openings in said upper guide member respectively received in said exposure openings with their weight normally supported on the lower guide member, but having beveled front surfaces to cause them to be cammed up by the leading edges of said sheets and permit said sheets to pass beneath said presser blocks and be pressed by them into intimate areal contact, a mask overlying said upper guide having apertures smaller than presser blocks and arranged to overlap and mask the edges of said presser blocks at all sides, master conveyor means for receiving the master sheet from one of said guide paths and conducting it out of said machine, negative conveyor means for receiving the exposed negative from the other of said guide paths and conducting it to said developing-transferring means, and positive conveyor means for conducting a positive sheet separately to said developing-transferring means in a transit time equal to the total transit time of said negative sheet.

10. In a photocopying machine of the type having developing-transferring means adapted to receive negative and positive sheets separately, moisten at least one of said sheets with developer liquid and press them together, the combination therewith of exposure means comprising three guide members superposed in face-to-face relation and spaced apart to define two generally parallel guide paths for respectively guiding master and photosensitive sheets, opposed feed openings in all three of said guide members, movable power driven feed members extending through the feed openings in the inner and outer guide members for pressing said two sheets together through the opening in said intermediate guide member and feeding the same along said guide paths at equal speeds, a light source, opposed exposure openings in the intermediate and upper guide members, the exposure openings in said intermediate guide member extending beyond those in said upper guide member, said openings including portions in different areas along said guide paths, the openings in each of said areas being discrete and transversely spaced and the openings in the several areas being transversely staggered relative to one another, whereby in traversing said areas said photosensitive sheet and said master sheet are exposed across their entire width, with said inner guide member maintaining the separation of said sheets in the spaces between said openings in each of said areas, translucent presser blocks of approximately the same size as the exposure openings in said upper guide member respectively received in said exposure openings with their weight normally supported on the lower guide member, but having beveled front surfaces to cause them to be cammed up by the leading edges of said sheets and permit said sheets to pass beneath said presser blocks and be pressed by them into intimate areal contact, a mask overlying said upper guide having rectangular apertures smaller than presser blocks and arranged to overlap and mask the edges of said presser blocks at all sides, the proximate edges of the adjacent apertures in said mask being in substantial longitudinal

alignment, master conveyor means for receiving the master sheet from one of said guide paths and conducting it out of said machine, negative conveyor means for receiving the exposed negative from the other of said guide paths and conducting it to said developing-transferring means, and positive conveyor means for conducting a positive sheet separately to said developing-transferring means in a transit time equal to the total transit time of said negative sheet.

11. In a photocopying machine of the type having developing-transferring means adapted to receive negative and positive sheets separately, moisten at least one of said sheets with developer liquid and press them together, the combination therewith of exposure means comprising three guide members superposed in face-to-face relation and spaced apart to define two generally parallel guide paths for respectively guiding master and photosensitive sheets, opposed feed openings in all three of said guide members, movable power driven feed members extending through the feed openings in the inner and outer guide members for pressing said two sheets together through the opening in said intermediate guide member and feeding the same along said guide paths at equal speeds, a light source, opposed exposure openings in the intermediate and upper guide members, the exposure openings in said intermediate guide member extending beyond those in said upper guide member, said openings including portions in different areas along said guide paths, the openings in each of said areas being discrete and transversely spaced and the openings in the several areas being transversely staggered relative to one another, whereby in traversing said areas said photosensitive sheet and said master sheet are exposed across their entire width, with said inner guide member maintaining the separation of said sheets in the spaces between said openings in each of said areas, translucent presser blocks of approximately the same size as the exposure openings in said upper guide member respectively received in said exposure openings with their weight normally supported on the lower guide member, but having beveled front surfaces to cause them to be cammed up by the leading edges of said sheets and permit said sheets to pass beneath said presser blocks and be pressed by them into intimate areal contact, a set of superposed masking members overlying said upper guide having apertures smaller than presser blocks and arranged to overlap and mask the edges of said presser blocks at all sides, said masking members being longitudinally movable relative to one another to vary the longitudinal dimension of said apertures and thereby control the degree of exposure of said negative sheet, master conveyor means for receiving the master sheet from one of said guide paths and conducting it out of said machine, negative conveyor means for receiving the exposed negative from the other of said guide paths and conducting it to said developing-transferring means in a transit time equal to the total transit time of said negative sheet.

12. In a photocopying machine of the type having developing-transferring means adapted to receive negative and positive sheets separately, moisten at least one of said sheets with developer liquid and press them together, the combination therewith of exposure means comprising dual conveyor means for respectively conveying master and negative sheets in separate guide paths, said dual conveyor means including an intermediate guide member separating said guide paths and an outer guide member defining the other side of one of said guide paths, and power driven movable feed means acting upon said sheets to feed them along said guide paths, a light source, opposed exposure openings in said intermediate guide member and said outer guide member in illuminated relation to said light source, said openings including portions in different areas along said guide paths, the openings in each of said areas being discrete and transversely spaced and the openings in the several areas being transversely staggered relative to one another, whereby in traversing said areas said photosensitive sheet and said master sheet are exposed across their entire width, with said inner guide member maintaining the separation of said sheets in the spaces between said openings in each of said areas, and the rear edges of the openings in said intermediate guide member being inclined away from the webs which separate said openings, whereby, in the direction of movement of said sheets, the separating webs are progressively widened and the openings correspondingly narrowed, master conveyor means for receiving the master sheet from one of said guide paths and conducting it out of said machine, negative conveyor means for receiving the exposed negative from the other of said guide paths and conducting it to said developing-transferring means, and positive conveyor means for conducting a positive sheet separately to said developing-transferring means in a transit time equal to the total transit time of said negative sheet.

13. In a photocopying machine of the type having developing-transferring means adapted to receive negative and positive sheets separately, moisten at least one of said sheets with developer liquid and press them together, the combination therewith of exposure means comprising three guide members superposed in face-to-face relation to define two generally parallel guide paths for respectively guiding master and photosensitive sheets, opposed feed openings in all three of said guide members, movable power driven feed members extending through the feed openings in the inner and outer guide members for pressing said two sheets together through the opening in said intermediate guide member and feeding the same along said guide paths at equal speeds, a light source, opposed exposure portions in the intermediate guide member and one of said outer guide members in illuminated relation to said light source, said exposure portions being formed of translucent sheet material with the exposure portion of at least said intermediate sheet being formed of a very thin transparent material, and said exposure portions extending across the full width of said sheets, means yieldably urging said exposure portions toward the other guide member to cause said negative and master sheets intimately to engage opposite faces of said intermediate guide member, master conveyor means for receiving the master sheet from one of said guide paths and conducting it out of said machine, negative conveyor means for receiving the exposed negative from the other of said guide paths and conducting it to said developing-transferring means, and positive conveyor means for conducting a positive sheet separately to said developing-transferring means.

14. In a photocopying machine of the type having developing-transferring means adapted to receive negative and positive sheets separately, moisten at least one of said sheets with developer liquid and press them together, the combination therewith of exposure means comprising three guide members superposed in face-to-face relation to define two generally parallel guide paths for respectively guiding master and photosensitive sheets, opposed feed openings in all three of said guide members, movable power driven feed members extending through the feed openings in the inner and outer guide members for pressing said two sheets together through the opening in said intermediate guide member and feeding the same along said guide paths at equal speeds, a light source, a convex curve in the lower one of said guide members opposite said light source, opposed exposure portions in the intermediate and upper guide members adjacent said curve, extending the full width of said sheets the exposure portion of the upper guide member being formed of flexible, translucent material, and the exposure portion of the intermediate guide member being formed of thin, flexible, transparent material, the exposure portions extending around said curve and fanning out at at least the input side thereof and being separable

to permit said sheets to wedge them apart and enter between them, master conveyor means for receiving the master sheet from one of said guide paths and conducting it out of said machine, negative conveyor means for receiving the exposed negative from the other of said guide paths and conducting it to said developing-transferring means, and positive conveyor means for conducting a positive sheet separately to said developing-transferring means.

15. In a photocopying machine of the type having developing-transferring means adapted to receive negative and positive sheets separately, moisten at least one of said sheets with developer liquid and press them together, the combination therewith of exposure means comprising three guide members superposed in face-to-face relation to define two generally parallel guide paths for respectively guiding master and photosensitive sheets, opposed feed openings in all three of said guide members, movable power driven feed members extending through the feed openings in the inner and outer guide members for pressing said two sheets together through the opening in said intermediate guide member and feeding the same along said guide paths at equal speeds, the rear edges of the said feed openings in said intermediate guide member being inclined in a direction outwardly from the centerline of said machine in the direction of movement of said sheets, a light source, opposed



exposure portions in the intermediate guide member and one of said outer guide members in illuminated relation to said light source, said exposure portions being formed of translucent sheet material with the exposure portion of at least said intermediate sheet being formed of a very thin transparent material, and said exposure portions extending across the full width of said sheets, means yieldably urging said exposure portions toward the other guide member to cause said negative and master sheets intimately to engage opposite faces of said intermediate guide member, master conveyor means for receiving the master sheet from one of said guide paths and conducting it out of said machine, negative conveyor means for receiving the exposed negative from the other of said guide paths and conducting it to said developing-transferring means, and positive conveyor means for conducting a positive sheet separately to said developing-transferring means.

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