

Dec. 3, 1963

J. M. FLUKE

3,112,685

IMAGE TRANSFER APPARATUS

Filed June 12, 1961

2 Sheets-Sheet 1

Fig. 1

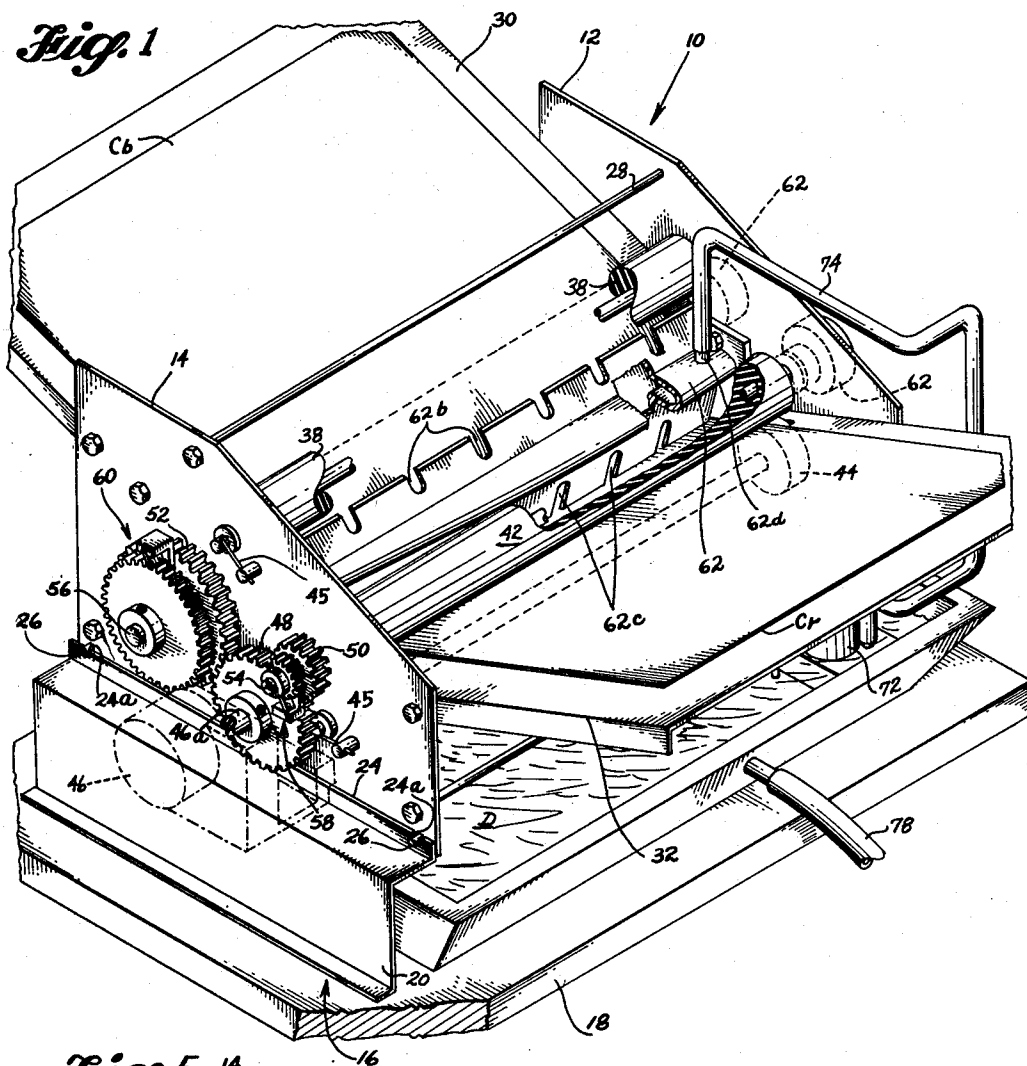
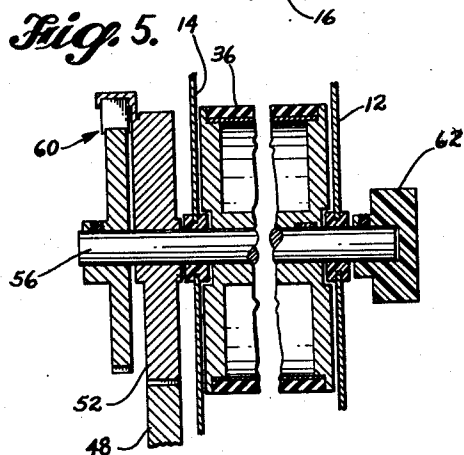


Fig. 5.



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2 Sheets-Sheet 2

Fig. 4.

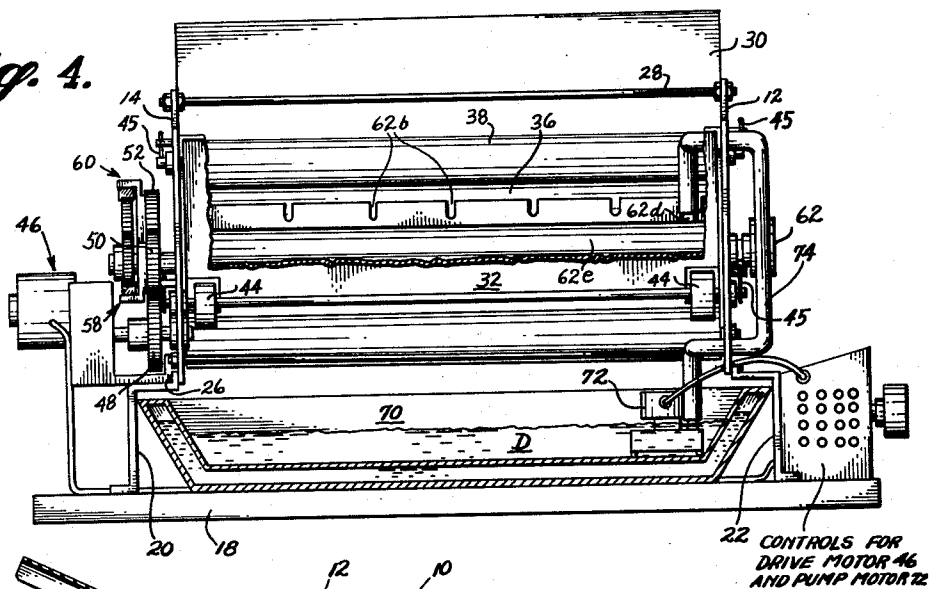


Fig. 2.

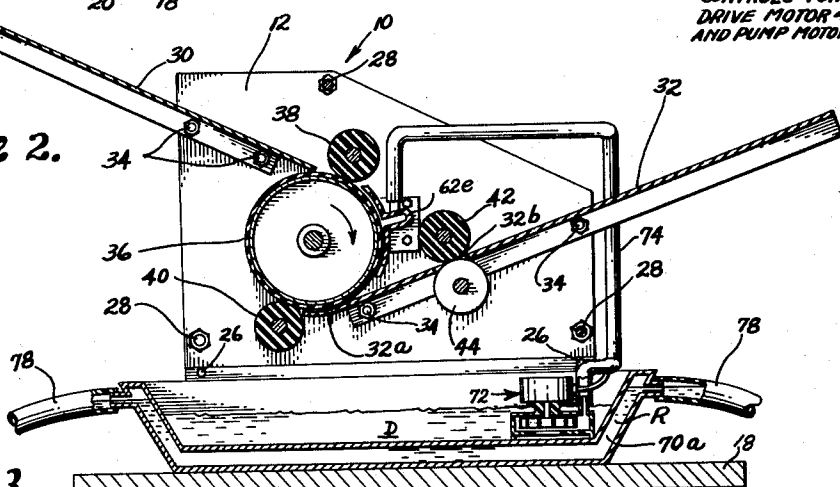
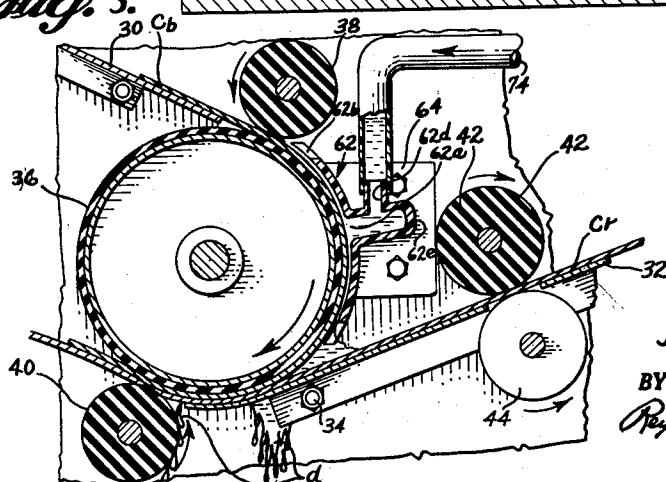


Fig. 3.



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IMAGE TRANSFER APPARATUS

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This invention relates to improvements in apparatus for transferring photographic and other images from one carrier to another involving the progressive mutual superpositioning of the carriers and the application of developer liquid activating the respective coatings on the image-bearing carrier and on the carrier to receive the image. The invention is herein illustratively described by reference to its presently preferred embodiment as applied to the transfer of photographic images from coated paper carriers to coated aluminum sheet carriers for use in photo-offset printing systems; however, it will be recognized that certain modifications and changes therein with respect to details and with respect to applications may be made without departing from the underlying essentials comprising the features of the invention.

In previous devices for effecting image transfers between carriers, difficulty was experienced in achieving precise uniformity in the degree of wetting and activation of the carrier coatings by the developer liquid while moving the carriers at a continuous and rapid rate into progressive mutually superposed relationship in passing through the apparatus. Also, the previous arrangements of carrier feeds and guides together with the means, usually an immersion bath container for the developer liquid, made visual inspection of the cooperating carriers for determination of relative positioning most difficult.

A broad object of this invention is to overcome these difficulties and more specifically to provide a compact, efficient and economical apparatus to this end.

Still another object is an improved image transfer apparatus incorporating feed and guide elements arranged for compactness and for easy determination and adjustment of relative positioning of the carriers.

A further object is apparatus which incorporates in combination therein an improved means for spreading developer liquid while guiding a carrier, and more specifically which is capable of spreading and flowing developer liquid uniformly over the coated surface of one carrier under pressure which insures uniform wetting and activation of its photographic coating despite variations or spottiness in its acceptance of such liquid, while also providing related arrangements for achieving uniform wetting of the other carrier with the developer liquid.

In accordance with this invention as herein disclosed, one carrier, preferably the image-bearing carrier since it is usually the more critical of the two carriers as to coating activation, is fed tangentially to the upper periphery of a driven guide roller to advance through the guide space between the roller and a conformably curved guide shoe which serves also as a developer applicator to which developer liquid under pressure is supplied by a recirculation pump so as to insure uniform spreading and flow of developer liquid over the carrier surface. Liquid pressure also increases feed traction of the guide roller on the carrier. The second carrier, in the example comprising the image-receiving carrier or coated aluminum sheet, is fed to the lower periphery of the guide roller with the direction of rotation thereof at a location directly beneath the applicator shoe, so that excess developer liquid which runs down from the shoe onto the second carrier as it converges with the first carrier rounding the guide roller, puddles there and supplements the wetting of the carrier coatings. The two then mutually superposed carriers uniformly wetted at their interface pass between the guide

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roller and a squeegee roller pressing against it. A liquid receiver beneath the cooperating rollers and shoe catches the run-off and holds it for the recirculation pump. Preferably the second feed comprises a driven roller also which is driven by the same power means as that driving the guide roller, through separate power transfer over-running clutches permitting independent manual speed-up or advance rotation of either such roller in order to advance the leading edge of either carrier relative to the other carrier as they approach convergence, and thereby permit positionally indexing the two carriers relatively.

These arrangements, particularly the preferred embodiment wherein the most desirable features of the invention are combined for the illustrative application, provide a precision, economical, rapid production, compact, easily operated and highly reliable machine according to the foregoing objectives.

These and other features, objects and advantages of the invention will become more fully evident from the following description thereof by reference to the accompanying drawings.

FIGURE 1 is a perspective view of the illustrative embodiment with parts broken away to show details of construction.

FIGURE 2 is a longitudinal sectional view of the apparatus.

FIGURE 3 is an enlarged longitudinal sectional view as in FIGURE 2, with the parts in operation.

FIGURE 4 is an end view of the apparatus with parts broken away in section to show construction.

FIGURE 5 is an enlarged sectional detail of the driven guide roller mechanism as viewed in a longitudinal sectional plane.

Referring to the drawings, a readily removable upper assembly 10 comprises the frame side plates 12 and 14 which are interconnected by and carry various other parts. The upper assembly 10 rests on a lower assembly 16 comprising the pedestal or base 18 having upstanding side brackets 20 and 22 thereon provided with horizontally extending upright flanges 24 notched at 24a to receive locating pins 26 carried by the respective upper assembly plates 12 and 14.

Horizontal tie rods 28 maintain the side plates 12 and 14 in vertically disposed parallel relationship, as do the oppositely inclined feed pans or aprons 30 and 32, respectively, which at their opposite side edges are bolted to the respective plates, as indicated at 34. The feed apron 30, located generally above the feed apron 32, has its lower horizontal edge portion terminate just above and in tangential relationship to the driven guide roller 36 in order to feed carrier sheets tangentially between said roller and a cooperating presser roller 38 journaled for idling in the upper assembly frame. The lower edge portion of the second and oppositely inclined feed chute 32 is tangentially directed against the lower periphery of the driven guide roller 36 and has a curved lower edge portion 32a which extends conformably about the lower edge of the guide roller through a short arc beyond the point of tangency to lead the mutually superposed carriers between such roller and a second presser roller 40, also an idler, bearing upwardly against the lower periphery of the driven guide roller 36. Preferably the feeding of carriers on apron 30 to the guide roller is accomplished initially by sliding the carriers down the apron into the nip of rollers 38 and 36, from which point the carrier is advanced by frictional contact with the driven guide roller 36. Carriers advanced along feed apron 32, however, are preferably fed positively to the guide roller 36 by means of a driven roller 42 cooperating with a presser roller 44 through a slot or slots 32b in the guide apron 32.

Each of the respective presser rollers 38, 40 and 42 are

spring urged against their respective cooperating rollers by suitable mounting arrangements permitting some sliding movement of their support journals in a direction toward and from the respective cooperating rollers, and by springs 45 which urge them against the latter.

Also part of the upper assembly 10 is a power means preferably comprising the gear-head motor 46 mounted on frame plate 14 and having an output shaft 46a upon which the spur gear 48 is fixed. This spur gear meshes with similar gears 50 and 52 which idle on one end of the respective support shafts 54 and 56 of driven rollers 42 and 36. The ratios of gear 48 to gear 50 and of gear 48 to gear 52 are such that the driven rollers have the same peripheral speed when driven by these gears through separate power transfer means comprising the overrunning clutches 58 and 60, respectively. The latter are part of a carrier indexing arrangement. Each of these overrunning clutches comprises a toothed member, such as a gear serving as a ratchet wheel fixed on the associated support shaft 54 or 56, and a spring-kept pawl mounted on the associated idle gear to engage the ratchet wheel. These clutches represent one of various suitable types of overrunning clutch devices which can be used for the purpose. To complete the indexing arrangement, a manual turn knob 62 mounted on each of the roller support shafts 54 and 56, preferably at the end opposite from the gearing, permits independent manual advancement rotation of each roller for indexing adjustment of the individual carriers being fed to the apparatus, without necessity for disengaging gears.

An additional and vitally important element of the upper assembly comprises the carrier guide and developer applicator shoe 62 which is positioned adjacent the side periphery of driven guide roller 36 by end mounts 64 secured to the side plates 12 and 14, respectively. This guide shoe 62 is arcuately curved conformably to the peripheral curvature of the guide roller 36 and is spaced outwardly therefrom by a slight distance affording clearance for passage of an image-bearing carrier *Cb* therebetween after its emergence from between the rollers 36 and 38, plus a sufficient clearance over and above the thickness of the coated carrier *Cb* to permit free flow of a film of developer liquid through this interface region as it is introduced therein under pressure. Preferably the developer is introduced through an opening 62a formed in the shoe, which extends the length of the guide shoe at a location intermediate its upper and lower edges as shown. The surface of roller 36 supports the flexible carrier sheet against the liquid pressure. Pressure of liquid developer against the carrier further increases its frictional feed contact pressure with the guide roller 36 so as to increase the positive feed imparted to the carrier. The upper edge of the guide shoe 62 extends nearly to the pressure roller 38 and serves to catch the leading edge of a carrier *Cb* as it emerges from between the rollers 36 and 38. This upper edge has notches 62b at intervals along its length through which pressurized developer liquid escapes or is depressured so that it cannot spurt up against the roller 38. It is desired to keep this roller dry as possible so as to avoid predeveloping the carrier coating. The lower edge of shoe 62 is also provided with notches 62c at locations along its length, but for a somewhat different purpose. This purpose is to permit increased flow and run-off of pressurized developer liquid through the space between the shoe and the drive roll 36, which flow would otherwise be limited due to the flow resistance entailed in the downward arcuate extent of shoe 62 serving to guide the carrier *Cb* into convergence with carrier *Cr* from feed guide 32.

Thus, pressurized developer liquid forced from opening 62a into and through the space between the carrier *Cb* and the guide shoe spills down into the reentrant space just mentioned where it puddles and is temporarily retained as a means to supplementally wet the image-receiving carrier *Cr* and to wet carrier *Cb*. Excess developer liquid, barred by the squeeze roller 40 from removal with the

departing carriers, runs out of the sides at the interface between the mutually superposed carriers.

This excess liquid running down from the upper assembly is caught in a receiver tray 70 placed on the base 18 between the side members 20 and 22. This receiver tray serves as a reservoir for developer liquid *D*. A motor-driven pump 72 mounted in this receiver tray draws from the reservoir and forces developer liquid through the tube 74 to the inlet 62d of a distribution channel formation 62e formed, in communication with the opening 62a, on the back side of the arcuate shoe 62. The inlet 62d is conveniently located at one end of the guide shoe 62 near the side of the apparatus at which the pump 72 is stationed. From this inlet location the guide shoe distribution channel 62e decreases progressively in cross section toward its opposite end so as to insure substantially uniform rate of discharge of developer liquid from the channel 62e through the opening 62a along its length despite pressure drop along such length.

Preferably temperature control of the developer liquid in the supply tray 70 is provided by suitable means comprising, for example, a hollow-wall tray construction affording a heat exchange chamber 70a through which temperature controlled liquid *R* may be circulated by means of outside conduits 78 extending to and from a source of such liquid (not shown).

In operation of the apparatus, an image-bearing carrier sheet *Cb* is placed on the apron 30 and an image-receiving carrier sheet *Cr* is placed on the apron 32, usually with the motor 36 deenergized. Pump 72 is in operation to circulate liquid developer through the tube 74 and the interface region between arcuate applicator-guide shoe 62 and the adjacent peripheral side of roller 36. Now, the rollers 38 and 42 are individually turned manually in order to advance the respective carriers into appropriate superposed registry as they converge in the reentrant region beneath the lower periphery of the guide roller 36. Thereupon the guide roller 36, and with it the driven roller 42, is placed in operation by energizing the drive motor 46 in order to continue the progressive advance of the now superposed carriers. As the carriers emerge from the space between the guide 32a and roller 36 they are squeezed under pressure exerted against the latter by the presser roller 40 so that they emerge and depart in a semi-dry state. If desired, the motor 46 may be left in continuous operation along with the pump motor 72, and with a small amount of practice an operator may accomplish the correct registry of carriers through superimposing any necessary increments of feed motion to one sheet or the other by simply turning the appropriate manual turn knob of roller 36 or roller 42, as permitted by the respective overrunning clutches described. In order to permit visual inspection of the relative positioning of the sheets, the applicator-guide shoe 62 is preferably made of a transparent material so that the leading edge of carrier sheet *Cb* may be observed as it approaches convergence with the leading edge of carrier sheet *Cr*. The arrangement of rollers and applicator shoe permit ready observation of the manner in which the carrier sheets meet.

These and other aspects of the invention will be recognized by those skilled in the art on the basis of the foregoing disclosure of the presently preferred embodiment, which persons will also recognize that the invention is not necessarily confined to the illustrative details of construction and application, except within the fair intended meanings of the claims which follow.

I claim as my invention:

1. Image transfer apparatus comprising means to advance an image-bearing carrier and an image-receiving carrier edgewise into progressive superposed contact one with the other along respective paths which converge together, said means including a guide surface on which one carrier is guided in approaching such convergence with the other carrier, the guide surface being contacted

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by that face of said one carrier which is opposite that contacted by the other carrier, developer liquid applicator shoe means disposed closely adjacent said guide surface and conforming substantially in shape to and parallel with said guide surface to form a narrow passage therebetween and through which said one carrier is moved, with said passage being only slightly thicker than said one carrier, said applicator shoe means having an opening therein communicating with said passage at an intermediate location along the extent of said guide shoe in the direction of carrier movement through the passage, and pump means connected to said opening to force developer liquid into said passage under pressure and thereby create a pressurized film of liquid which inherently, by reason of the pressure and the confinement between said one carrier and said shoe means, spreads out and flows over the carrier therein.

2. Image transfer apparatus comprising means to advance an image-bearing carrier and an image-receiving carrier edgewise into progressive superposed contact one with the other along respective paths which converge together, said means including a convexly curved guide surface around which one carrier is guided in approaching such convergence with the other carrier, the guide surface being contacted by that face of said one carrier which is opposite that contacted by the other carrier, developer liquid applicator means having a concavely curved guide face extending parallel to and along said guide surface in closely spaced relationship forming an intervening passage for said one carrier slightly thicker than the carrier itself, and means including said applicator means, accumulator means to receive the overflow therefrom and a pump to deliver the accumulated developer liquid to said passage under pressure causing spreading and flow of the liquid uniformly through the interface between the applicator and said one carrier, thereby to wet the latter carrier and thereby also the other carrier as the two carriers come together, said applicator means comprising a curved guide shoe which is apertured to pass developer liquid to such passage at a location intermediate its relatively leading and trailing edges.

3. The image transfer apparatus defined in claim 2, wherein the guide shoe comprises a curved plate-like member having an elongated groove extending in its guide face, across the breadth of the passage transverse to the direction of carrier movement, said groove comprising the aperturing through which developer liquid flows to the passage.

4. The image transfer apparatus defined in claim 3, comprising a horizontally disposed revolving roller providing said guide surface, a first feed for advancing said one carrier into tangential relationship with the upper periphery of the revolving roller in the direction of motion of such upper periphery, and a second feed for advancing the other carrier into tangential relationship with a point on the lower periphery of the revolving roller in the direction of motion of such lower periphery, the guide shoe being positioned adjacent the revolving roller in the path of said one carrier ahead of the infeed point of the second carrier, whereby developer liquid from the shoe runs from said passage down onto said other carrier as it approaches the revolving roller.

5. The image transfer apparatus defined in claim 4, wherein the lower and upper edge portions of the shoe have a succession of openings formed therein along the length thereof.

6. The image transfer apparatus defined in claim 5, and a presser roller operatively associated with the revolving roller at the latter's upper periphery to

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rollers, at least one of said drive means including a uni-directional coupling permitting separate turning of one of the revolving rollers independently of the other in the direction of driven rotation, and thereby permitting indexing of one carrier relative to the other.

7. Image transfer apparatus comprising means to advance an image-bearing carrier and an image-receiving carrier edgewise into progressive superposed contact one with the other along respective paths which converge together, said means including a horizontal revolving roller around a side portion of which one carrier is guided in approaching convergence with the other carrier, and means including a pump and a distributor of developer liquid mounted adjacent said roller side portion and conforming substantially in shape to and parallel with the periphery of the roller so as to form an interface region therebetween for confinement of a layer of developer liquid spread out on the carrier, said distributor thereby being operable under pressure from said pump to spread developer liquid on the exposed face of said one carrier as it advances around said side portion, the first-mentioned means including a first feed for advancing said one carrier into tangential relationship with the upper periphery of the revolving roller in the direction of motion of such upper periphery, and a second feed for advancing the other carrier into tangential relationship with a point on the lower periphery of the revolving roller in the direction of motion of such lower periphery.

8. Image transfer apparatus comprising means to advance an image-bearing carrier and an image-receiving carrier edgewise into progressive superposed contact one with the other along respective paths which converge together, said means including a horizontal revolving roller around a side surface of which one carrier is guided in approaching convergence with the other carrier, and further including a guide surface for the other carrier, and means including a pump and an arcuately curved distributor shoe conformed to and spaced a short distance from one of said surfaces to define a passageway therebetween for the individual carrier which is guided by the last-mentioned one of said surfaces and for a layer of developer liquid spread on said individual carrier, and operable under pressure from said pump to spread developer liquid on the exposed face of said individual carrier as it advances through said passageway, the first-mentioned means including a first feed for advancing said one carrier into tangential relationship with the upper periphery of the revolving roller in the direction of motion of such upper periphery, and a second feed for advancing the other carrier into tangential relationship with a point on the lower periphery of the revolving roller in the direction of motion of such lower periphery.

9. Image transfer apparatus comprising means to advance an image-bearing carrier and an image-receiving carrier edgewise into progressive superposed contact one with the other along respective paths which converge together, said means including a horizontal revolving roller around a side surface of which one carrier is guided in approaching convergence with the other carrier, and further including a guide surface for the other carrier, and means including a pump and a distributor shoe spaced a short distance from one of said surfaces to define a passageway therebetween for the individual carrier which is guided by the last-mentioned one of said surfaces and operable under pressure from said pump to spread developer liquid on the exposed face of said individual carrier as it advances through said passageway, the first-mentioned means including a first feed for

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periphery to squeeze said one carrier therebetween for advancement by driven rotation of the revolving roller, a second revolving roller operatively associated with the second feed, drive means drivingly interconnecting the revolving rollers to rotate at the same peripheral speed, a power source, and drive means drivingly connecting said power source to one of the revolving rollers, at least one of said drive means including a unidirectional coupling permitting separate turning of one of the revolving rollers independently of the other in the direction of driven rotation, and thereby permitting indexing of one carrier relative to the other.

10. The apparatus defined in claim 9, wherein the first and second feeds comprise tables which slope downwardly to the revolving roller in respectively opposite senses.

11. Image transfer apparatus operable to advance an image carrier and an image-receiving carrier into mutually superposed relationship while applying developer liquid to their interface surfaces, comprising a guide roller mounted to rotate on a horizontal axis, first and second presser rollers operatively associated with the upper and lower periphery respectively of the guide roller, power means to rotate the guide roller in one direction, a first feed to advance one carrier tangentially between the first presser roller and guide roller with rotation of the latter, an arcuately curved guide shoe operatively associated with the side periphery of the guide roller to pass said one carrier therebetween as it emerges from between the guide roller and first presser roller, a second feed to advance the other carrier tangentially between the second presser roller and guide roller with rotation of the latter, including guide means converging with the guide roller beneath said guide shoe, whereby the two carriers are advanced convergently

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into superposed relationship and guided to the second presser roller, and means operatively associated with the guide shoe to force developer liquid under pressure through the space between the shoe and the first carrier sufficient to run down onto the second carrier as it converges with the first carrier, including a receiver for excess developer liquid running from the carriers and a pump drawing from the receiver to recirculate such excess developer liquid to the guide shoe.

12. The apparatus defined in claim 11, wherein the second feed includes cooperating feed roller means one of which is driven, and separate power transfer means from the power means to the driven feed roller means and to the guide roller, each including a unidirectional clutch means permitting independent manual rotation of the driven feed roller means or guide roller selectively to advance either carrier's leading edge toward convergence with the other carrier.

13. The apparatus defined in claim 11, wherein the guide shoe comprises a curved plate having notched upper and lower edges, and a developer liquid feed channel extending generally horizontally across said plate intermediate said edges and in direct communication with the space between the shoe and the guide roller.

14. The apparatus defined in claim 13, wherein the feed channel's transverse cross section increases progressively to an entry point and the pump is connected to the channel at such entry point.

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