United States Patent [19]

Slingsby et al.

[11] **3,776,119**

[45] **Dec. 4, 1973**

[54] **DIFFUSION TRANSFER PRINTING PLATE PROCESSOR**

[75] Inventors: **Thomas W. Slingsby,** Old Saybrook, Conn.; **Hugh C. Neville,** Barrington; **Karl A. Heise,** Warwick, both of R.I.

[73] Assignee: **Richmond Graphic Systems, Inc.**

[22] Filed: **June 22, 1972**

[21] Appl. No.: **265,146**

[52] **U.S. Cl.** ..... **95/89 A,** 95/14, 95/93

[51] **Int. Cl.** **G03d 3/00**

[58] **Field of Search** ..... 95/89 R, 94 R, 89 A, 95/89 L, 93, 14

[56] **References Cited**

UNITED STATES PATENTS

3,179,031	4/1965	Gordon	95/89 L X
3,334,564	8/1967	Kleinstra	95/89 R
3,277,808	10/1966	Frohock	95/89 R
3,112,685	12/1963	Fluke	95/89 L

FOREIGN PATENTS OR APPLICATIONS

1,148,139	5/1963	Germany	95/89 L

Primary Examiner—Richard L. Moses
Attorney—Stein & Orman

[57] **ABSTRACT**

A developing and processing machine used for processing diffusion transfer printing plates and the like comprising a casing in which is located a transport means which at least partially defines a path of travel for the positive plate wherein this path is specifically defined and configured to be substantially planar thereby preventing the bending or curving of the positive plate. A second path of travel is also defined within the casing through a tank portion designed to hold developer fluid within said casing. The transport means include a set of infeed rolls located at the entrance to the casing, an applicator means including two applicator roll assemblies at least one of which is arranged in intercommunicating relation between the tank portion and the positive plate, and exit rolls which may be disposed in cooperative relation with a wash means. A separating means in the form of a pivotally mounted deflector plate may also be mounted adjacent the infeed roll so as to separate the positive and negative members as they are channeled along their individual paths of travel. One or more of the applicator rolls may also be movably mounted in a direction substantially transverse to the path of travel of the positive member so as to allow said movable roll to be floatingly mounted thereon as the positive member passes through the casing.

15 Claims, 3 Drawing Figures

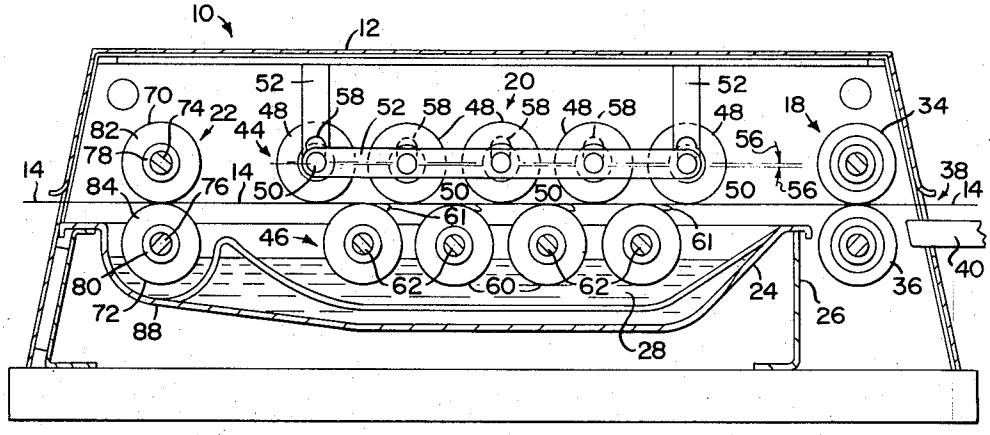
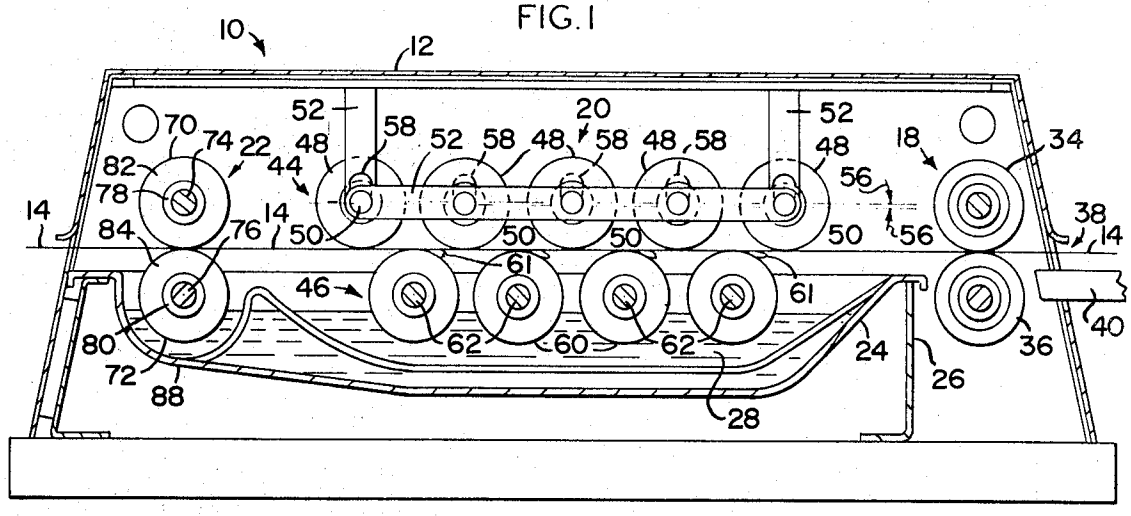


FIG. 1



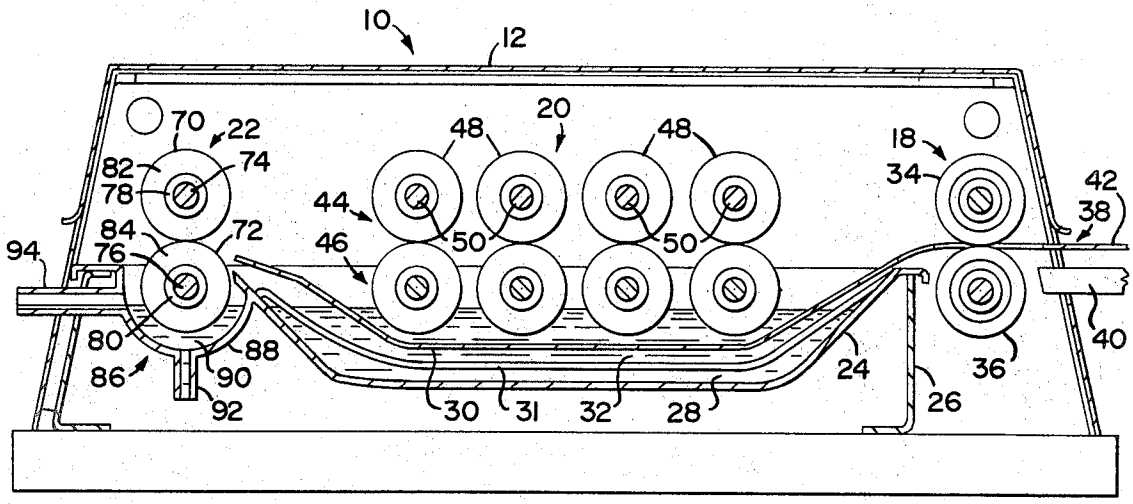


FIG. 2

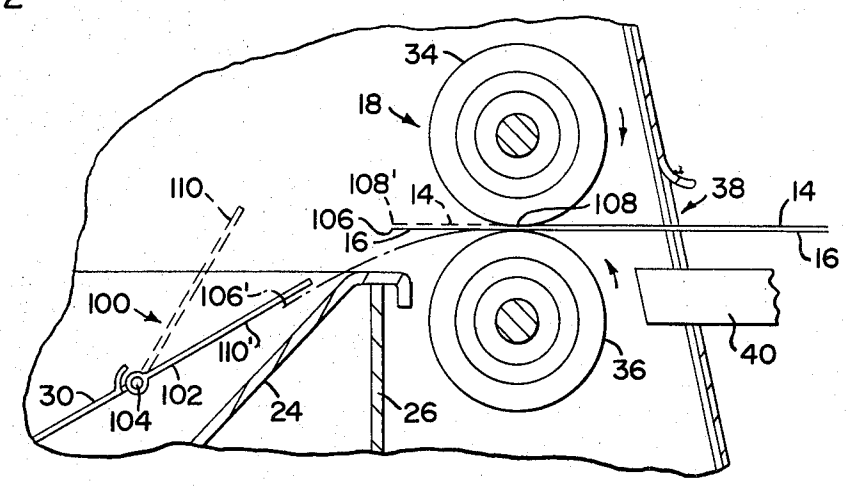


FIG. 3

DIFFUSION TRANSFER PRINTING PLATE PROCESSOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a diffusion transfer processing and developing machine of the type used to process a positive plate and a photographic negative arranged in predetermined orientation to one another as they simultaneously pass through the machine. Transport means which may comprise a plurality of rolls are specifically configured to define a substantially planar path of travel for the positive member thereby allowing it to have a dimensionally greater thickness which serves to increase its durability and operable life.

2. Description of the Prior Art

Processing machines of the diffusion transfer type have been known in the prior art and have been used commercially for many years. The vast majority of these prior art machines were designed to process short run, light duty plates having a relatively small dimensional thickness. Basically these prior art machine comprise a configuration wherein both a positive and negative plate are channeled through curved or non-planar feed paths in order to expose both of the plates to a developer fluid for a predetermined period of time.

Generally, the curved path type of diffusion transfer processing machines has been popularized apparently because this configuration represents a low cost means of accomplishing the proper transport of the diffusion transfer material through developing fluid which ensures the fact that both positive and negative sheets or plates are properly exposed to the developing fluid. Further support for the use of this type of processing machine is found in the fact that one of the most commercially popular processing machine in the prior art was simultaneously developed with the diffusion transfer process. This machine is of the type shown in U. S. Pat. No. 2,657,618 to Eisben.

The structure disclosed in the Eisben patent is directed to a machine capable of simultaneously processing both a positive and a negative sheet by submerging the sheets in a developer fluid as they are channeled through separate paths in the machine and eventually through a squeege roll arrangement where the positive and negative sheets are brought into forced registration. More specifically the Eisben machine includes a casing which has a liquid proof lower portion in which the developer fluid is maintained. The casing further includes four approximately parallel guiding plates each having a substantially arcuate or curved cross sectional configurations. These plates are disposed within the casing to pass through the develop fluid maintained in the casing and also each of the plates contain a plurality of holes which allowed the developer fluid to fill at least a portion of each of the channels defined by the plates. The positive and negative members are directed through separate channels and follow their arcuate configuration as they pass through the developer liquid and are exposed thereto.

During the early days of use of the diffusion transfer process, cost of processing was a prime consideration and the sophistication and application of the products and the process itself did not demand a more functionally exotic system.

However, as the diffusion transfer process and its applications became more popular it became apparent

that the design of prior art processing and developing machines would not fulfill the needs or requirements of the modern day photo copying industry. More particularly, the advantages of using a relatively stiff aluminum off-set printing plate which are presently available in thicknesses up to approximately 12 mils are great because of its long operable life and durability. However, it is evident that the processing of such a plate through prior art machines is impossible because of its thickness dimensions and resulting relative rigidity.

When processing a plate of this thickness bending, such as would occur when passing it through the arcuate path of travel of prior art processing machines, would render such plate useless. This is primarily due to the fact that such an aluminum plate has no "memory" and after bending could not be applied to a print drum. While some slight curvature or angular variation from a completely flat or planar path of travel is allowed such amount of bending or curvature must be directly related to the curvature of the drum on which it is applied.

Furthermore, in the use of offset printing plates positive emulsion material with which these plates are coated is extremely scratch prone and nay such scratch or imperfection appearing on the emulsion material shows up on most copy and especially half tones. It is readily seen that any bending of the positive plate could cause imperfection in the emulsion surface which would impair the quality of, or even ruin, the copy produced therefrom.

Accordingly, it is readily seen that there is a need in the photo copying industry for a diffusion transfer processing and developing machine capable of eliminating the above noted problems by being capable of processing plates having dimensional thickness as great as approximately 12 mils. This of course would require that the positive plate pass through the machine along a substantially planar or level path of travel while at the same time providing for sufficient contact between the positive emulsion material on the plate and the developer fluid and ultimately be forced into registered contact with the negative member.

SUMMARY OF THE INVENTION

This invention relates to a processing machine of the type designed to develop and process diffusion transfer printing plates and other scratch prone diffusion transfer materials. The machine includes a casing having a plate transport means mounted therein so as to at least partially define a path of travel of at least one of the positive and negative member which the machine is simultaneously processing.

A tank means designed and configured to have a developer fluid maintained therein is located in the lower portion of the casing in cooperative relation to both paths of travel of both the positive and negative members which will be described in detail hereinafter.

The transport means comprises an infeed means which include at least two infeed rolls arranged in opposed relation to one another such that their outer peripheral surfaces are directly engaged or alternately arranged a predetermined spaced distance from one another. The transport means further includes applicator means and exit means which are arranged in spaced relation to one another and to the infeed means in substantially successive position.

The applicator means comprises upper and lower applicator roll assemblies arranged in cooperative relation to one another so as to partially define, along with the infeed means and the exit means, a flat or substantially planar path of travel for the positive member as it passes through the machine. Each of the upper and lower assemblies comprises a plurality of assembly rolls. Each roll in each of the assemblies is positioned relative to the correspondingly positioned roll in the other assembly so as to partially define the first path of travel of the positive member to have a planar configuration between the roll assemblies. In addition, one or more of the applicator rolls in the upper assembly may be movably mounted so as to move in a substantially transverse direction to the first path of travel of the positive member. This allows any such applicator rolls so movably mounted to substantially float on the plate member as it passes between the upper and lower applicator assemblies. This insures that proper pressure is maintained on the plate so as to bear it against the rolls of the lower assembly while not distorting the design of planar configuration of the plate member to any harmful extent. Alternately, each of these applicator rolls on the upper assembly may be mounted on a carriage means which itself is movably mounted so as to move in a substantially transverse direction relative to the path of travel of the positive plate member. In this embodiment, the entire carriage and all of the rolls attached thereto serves to substantially float on the positive plate member as it passes between the applicator assemblies.

The applicator rolls of the lower assembly are, of course, rotatably connected to the casing and are specifically disposed in intercommunicating relation between the tank, and in direct contact with any developer fluid maintained therein, and the undersurface of the positive plate member as it passes through or along the first path of travel. By virtue of this disposition, the developer fluid may be transferred by virtue of it being carried on the outer peripheral surface of the applicator rolls on the lower assembly, to the undersurface of emulsion side of the plate member. As this developer fluid is carried by these rolls, a meniscus is formed contiguous to the area of contact between the applicator rolls and the lower surface or emulsion on the positive member. This particular arrangement serves to adequately apply a predetermined amount of fluid to the emulsion coating on the positive member and the extent or length of time this emulsion is in contact with the fluid depends upon the rate of travel of the transport means. Applicators conceivably could operate at speed different from feed rolls.

The exit means comprises at least two exit rolls arranged in opposed relation to one another. These rolls are ideally formed to have a hard core surrounded by a relatively elastic or pliable material. This formation of the exit rolls and their relation to one another allows them to serve as squeege pressure rolls and force the positive and negative members into direct registered engagement with one another while at the same time removing any excess fluid as it exits from the casing. These exit rolls could have their peripheral portion formed of material other than elastic or pliable material and still come within the intended scope of the present invention.

In one embodiment of the present invention, a wash fixing means may be mounted in direct cooperative relation to one of the rolls of the exit means such taht as this one roll rotates its peripheral portion passes through a washing or fixing fluid maintained in the washing means and is thereby transferred on to at least one of the members as it passes between the nip of the exit rolls and exits from the casing. Again, the squeege action formed by the exit rolls serves to remove or eliminate any excess fluid upon exiting of the plate member from the casing.

In describing the transport means, the subject invention has been disclosed utilizing a plurality of rolls in each of the infeed means, applicator means, and exit means. It is, of course, obvious that any applicable structure capable of performing the functions described above could be substituted for a roll or roll structures per se and still come within the intended scope of the present invention.

Yet another embodiment of the present invention includes the mounting of a separator means in cooperative relation to the exit means within the casing. This separator means may be in the form of a pivotally mounted deflector plate capable of being selectively moved between a separating and non-separating position. More specifically, as the positive and negative members enter the entrance to the casing, the lead edge of the positive member is staggered a predetermined distance behind the lead edge of the negative member. This staggering entrance is provided to accommodate the longer path of travel of the negative member as it is directed in a somewhat arcuate path directly through the tank portion of the casing and in direct exposure to the developer fluid. Accordingly, as the lead edge of the negative plate enters the exit means and passes beyond the nip of the exit rolls, the deflector plate is in its non-separating position. Upon a sufficient amount of the leading portion of the negative member being advanced into the casing, the negative plate is pivoted to its separating position wherein it engages the leading portion of the negative member and forces it downward into a specifically configured channel which defines the second path of travel reserved for the negative member. Since the positive member is staggered a predetermined distance from the leading edge of the negative member, the pivotal movement of the deflector plate does not interfere with the movement of the positive member as it passes along its first path of travel. There is no engagement, at any time, between the deflector plate and the positive member because of the disposition of the deflector plate and the location of the planar path of travel of the positive member.

This invention accordingly comprises the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereinafter set forth and the scope of the invention will be indicated in the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

For a fuller understanding of the nature and the objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings in which:

FIG. 1 is a sectional view showing the interior of the casing and the various structural elements of the transport means.

FIG. 2 is a sectional view showing another embodiment of the present invention taken through the casing

and showing its interior and the various structural features of a transport means.

FIG. 3 is a detailed sectional view showing yet another embodiment of the present invention.

Similar reference characters refer to similar parts throughout the several views of the drawings.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

As shown in FIGS. 1 and 2, the processing machine is generally indicated as 10 and comprises a casing 12 which is primarly designed to house the workings of the machine. More particularly, a transport means for transporting both the positive and negative members 14 and 16 respectively, is shown in the form of three groups of transport rolls.

More specifically, the transport means includes an infeed means generally indicated as 18, applicator means generally indicated as 20, and exit means generally indicated as 22. The specific structural details of the transport means will be discussed hereinafter.

The casing 12 further comprises a tank means 24 which may be mounted within the lower portion of casing 12 by a bracket or like connector 26. The tank 24 is specifically configured to hold a developer liquid 28 such that the tank 24 may be filled a sufficient degree to enclose a major portion of path defining members 30 and 31. These members are configured to define a channel or space 32 which serves as a path of travel for the negative member 16 which will also be described in greater detail hereinafter.

Turning now to the detail of the transport means, the infeed means 18 comprises at least two rolls, 34 and 36, arranged in opposed, cooperative relation to one another adjacent the entrance 38 of the casing. A support table or flange 40 may also be positioned adjacent this entrance 38 to facilitate loading of the positive and negative members into the casing. A divider plate 42 may also be positioned adjacent entrance 38 and in cooperative relation with the nip of rolls 34 and 36 to insure proper registration of the positive and negative members 14 and 16. It is important to note that the structural elements of the transport means are essentially arranged in a spaced relation to one another. This configuration specifically defines a substantially planar first path of travel along which positive member 14 is intended to travel. This is specifically shown in FIG. 1. Accordingly, the rolls 34 and 36 at least partially define a portion of this first path of travel of the positive member.

The applicator means 20 comprises an upper applicator roll assembly generally indicated as 44 and a lower applicator roll assembly generally indicated as 46. While the embodiments of the subject invention are described with relation to upper and lower roll assemblies, it is apparent that the scope of the present invention is intended to include any "opposed" roll assemblies whether or not they are specifically located one above the other as shown in FIGS. 1 and 2. FIGS. 1 and 2 further point out that, depending upon the particular embodiment utilized, the rolls of the upper assembly may be arranged in directly opposed relation to one another (FIG. 2) or alternately may be arranged in a somewhat offset, opposed relation to one another (FIG. 1). Regardless of the particular configuration of the applicator means utilized, the upper assembly includes a plurality of rolls 48, each rotatably mounted about a substantially centrally located axle 50 and having substantially the same diameter so as to at least partially define a planar first path of travel for the positive member 14. An additional structural feature found in the upper applicator roll assembly is the fact that at least one of the rolls may be mounted to move in a substantially normal direction to the first planar path of travel of positive member 14. Alternately, each of the rolls 48 may be mounted on carriage means 52 and the carriage means itself may be movably mounted so as to move in a substantially transverse direction to the planar first path of travel of positive member 14. If this occurs, all of the rolls 48 thereby are allowed to substantially "float" over the positive member 14. This allows a certain extent of variation in the path of member 14. This variation is a function of the thickness of the positive member and the weight of the floating roll assembly. For example, a four mil plate would flex to the limit of the normal travel of the roll or rolls while a 12 mill thickness plate would ride substantially straight, or on a planar path therethrough without bending unless the upper roll assembly was unusually heavy. The amount of variation of "float" of the upper roll assembly or alternately any such movably mounted roll is indicated by directional arrows 56. In order to accomplish this float, each of the axles 50 are mounted in elongated slots or housings 58.

The lower roll assembly 46 also comprises a plurality of applicator rolls 60 arranged in spaced relation to one another and each being mounted on a central axle 62. Preferably, each of the rolls 60 are rotatably mounted in fixed relation to one another and to the planar first path of travel of positive member 14. The relationship of the upper and lower roll assemblies, as shown in FIG. 1, allows this first path of travel to be defined between these roll assemblies such that the positive member 14 passing along this planar first path is in contact with both the rolls 48 and 60 of each roll assembly. The rolls 60 are further disposed so as to be partially submerged in the developer fluid 28 within tank 24. Accordingly, upon rotation of the roll 60 the fluid is transferred from tank 24 up to the undersurface or emulsion coating on positive member 14. As the member 14 passes along the planar first path and engages each of the rolls 60, a meniscus 61 which adequately coats this undersurface, is formed at the point of contact of each roll 60 and member 14. The amount of time the emulsion coating on plate member 14 is subjected to the fluid 28 depends on the rate of travel of the transport means and may be predetermined as desired. Because of the specific arrangement of each of the groups of rolls 18, 20 and 22, all of these groups are engaging the same plate member at the same time.

The exit means 22 may comprise at least two rollers 70 and 72 arranged in cooperative, opposed, engaging relation to one another. Each of these rollers mounted on a central hub or axle 74 and 76 respectively and the central core 78 and 80 respectively is formed from a hard material. The portion of each roll 82 and 84 surrounding the core is made from a elastic or flexible material so as to give rolls 70 and 72 the capability of providing a squeege action as both the positive and negative member pass therebetween. Alternately, the portions 82 and 84 may be formed from a relatively hard material and serve to register the positive and negative members together under pressure. Regardless of the specific configuration, these rolls are disposed relative

to one another to force the positive and negative members into pre-oriented registration such that the emulsion coating of each member are forced into direct contact with one another.

Another embodiment of the present invention is shown in FIG. 2 and comprises a wash means generally indicated as **86** including housing **88** designed to hold a wash or fixing liquid **90** and being fed from an inlet **92.** Roll **72** is so disposed relative to the wash liquid **90** and the roll **70** as to transfer the liquid **90** up the nip or point of contact between the roll **70** and **72** and the positive and negative members as they pass therebetween. The wash liquid **90** will be maintained substantially clean since it will be substantially continuous flowing into inlet **92** and exiting from outlet **94.** Again, the exit means **22** is arranged relative to applicator means **20** so as to at least partially define the planar first path of travel of the positive member **14.**

Turning to FIG. **3,** another embodiment of the present invention comprises a separating means generally indicated as **100.** This separating means includes a deflector plate **102** pivotally mounted at **104** to a point of the casing adjacent to the casing entrance **38** and more particularly the infeed means **18.** Since the path of travel of the negative member is defined through the developer liquid **28** by members **30** and **31,** it can be seen that this second path of travel of the negative member is greater than the planar first path of travel of the positive member. Accordingly the leading edge **106** of negative member **16** is placed into the end feed means **18** somewhat ahead of the leading edge **108** and of the positive member **14.** As both positive and negative members **14** and **16** respectively come under the control of rolls **34** and **36** and pass into the casing, the separator means **100** is activated to separate the plates from one another and more particularly direct negative member **16** downwardly into the second defined path of travel through space **32.** This is accomplished by selective manipulation of deflector plate **102** from a non-separating to a separating position indicated by broken lines **110** and solid lines **110'** respectively. This pivotal movement of plate **102** occurs when the leading edge **106** has reached the approximate point indicated by **106'** in broken lines while the leading edge **108'** has reached its corresponding position as indicated in broken lines. The specific dimension and location of deflector plate **102** and the relative positions of the leading edges **106** and **108** of the negative and positive members respectively allow the deflector plate **102** to engage the end of the negative member while not engaging at all the positive member. Accordingly, the positive member contines on in a straight through or substantially planar path through the applicator means **20** and out the exit means **22.** As is apparent the sheets again come into direct registration after both being exposed to the developer fluid **28** by the action of exit rolls **70** and **72.**

It will thus be seen that the objects made apparent from the preceding description, are efficiently attained and since certain changes may be made in the above article without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Now that the invention has been described,

What is claimed is:

1. A processing machine of the difusion transfer type, designed to process both a positive and a negative member, said machine comprising; a casing, transport means mounted within said casing, a tank portion formed in said casing and configured to hold a developer fluid, said transport means comprising a plurality of transport elements at least some of which are arranged in aligned, successively spaced relation to one another so as to define a substantially planar first path of travel through said casing, guide means mounted within said casing and defining a second path of travel, said guide means at least partially disposed in communicating relation to said tank, whereby said first and second paths of travel are in communicating relation to the developer fluid.

2. A processing machine as in claim **1** wherein said transport means comprises applicator means, said applicator means mounted within said casing to at least partially define said planar first path, said applicator means further disposed in intercommunicating relation between the positive member passing through said machine and said tank portion, whereby developer fluid within said tank is delivered to the positive member by said applicator means.

3. A processing machine as in claim **1** wherein said transport means comprises applicator means including cooperatively arranged applicator roll assemblies, said roll assemblies disposed relative to one another to at least partially define said planar first path.

4. A processing machine as in claim **3** wherein said applicator roll assemblies include an upper plurality of applicator rolls and a lower plurality of applicator rolls arranged in cooperating, substantially opposed relation to one another so as to at least partially define said substantially planar first path therebetween.

5. A processing machine as in claim **3** wherrein said applicator roll assemblies include an upper plurality of rolls and a lower plurality of applicator rolls, at least one of said upper plurality of rolls being mounted on said casing so as to be movable in a direction substantially normal to the planar first path of travel of the positive member, whereby passage of the positive member therethrough causes said one roll to float thereon.

6. A processing machine as in claim **3** wherein said applicator roll means includes an upper plurality of rolls and a lower plurality of rolls, said upper plurality of rolls secured to carriage means, said carriage means connected to said casing so as to be movable in a direction substantially normal to said planar first path of travel, whereby passage of the positive member therethrough causes at least some of said plurality of rolls to float thereon.

7. A processing machine as in claim **3** wherein said applicator roll assemblies include an upper plurality of applicator rolls and a lower plurality of applicator rolls, said lower plurality of rolls arranged in intercommunicating relation between the positive member passing through said machine and said tank portion, whereby developer fluid within said tank is delivered to the positive member by said applicator means.

8. A processing machine as in claim **7** wherein said lower plurality of rolls are disposed in partially sub-

merged relation to developer fluid within said tank and disposed to movably engage said positive member, the relative position between said lower rolls, developer fluid in said tank and said positive member serves to define a meniscus of fluid contiguous to each roll in contact with both the fluid and said postive member.

9. A processing machine as in claim **3** wherein said transport means further includes in feed means and exit means disposed in said casing in aligned successive relation to said applicator means so as to at least partially define said substantially planar first path.

10. A processing machine as in claim **9** wherein said infeed means comprises at least two infeed rolls arranged in cooperative, opposed relation to one another and positioned adjacent to the casing entrance utilized for at least one of said positive or negative members.

11. A processing machine as in claim **9** wherein said exit means comprises at least two exit rolls arranged in substantially opposed, cooperating relation to one another, said two exit rolls positioned relative to one another and said first and second paths as to force the positive and negative members into direct engagement with one another between said two exit rolls.

12. A processing machine as in claim **1** wherein the outer surface of each of said two exit rolls is formed from a pliable material, whereby said two exit rolls serve as squeege rolls to remove any excess fluid from said members.

13. A processing machine as in claim **12** further comprising wash means mounted on said casing adjacent said exit means, said wash means configured to contain wash liquid, said exit means arranged in intercommunicating relation between said wash means and at least one of said first or second paths of travel, whereby wash liquid is transferred from said wash means to at least one of said members.

14. A processing machine as in claim **1** further comprising separator means positioned adjacent the casing entrance, said separator means movably mounted on said casing so as to be movable into a member separating position.

15. A processing machine as in claim **14** wherein said separator means comprises a deflector plate pivotally mounted within said casing adjacent the casing entrance, said deflector plate selectively movable between a member separating and non-separating position, said plate further disposed within said casing so as to engage a predetermined portion of one of said members independent of engagement with the other of said members.

* * * * *