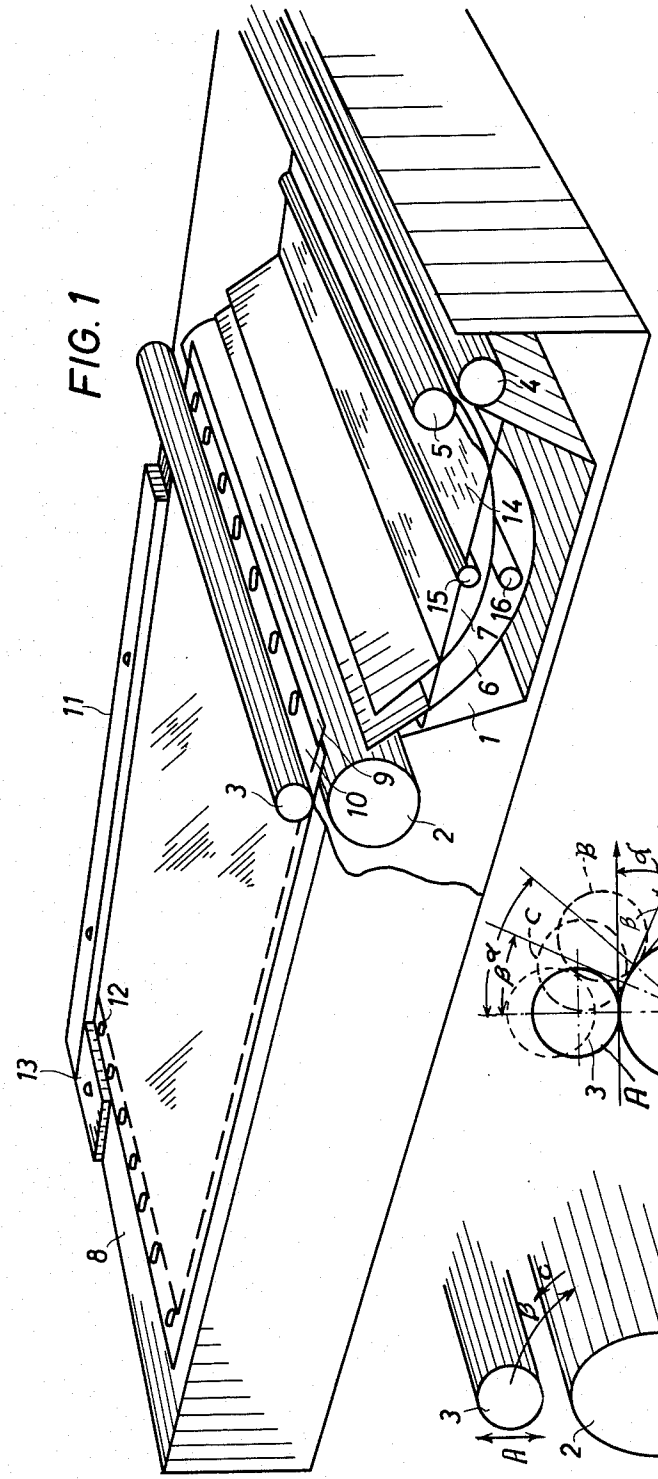
June 28, 1966 M. H. DE BELDER 3,257,927

APPARATUS FOR USE IN DIFFUSION TRANSFER COPYING

Filed May 22, 1963 2 Sheets-Sheet 1

FIG. 1



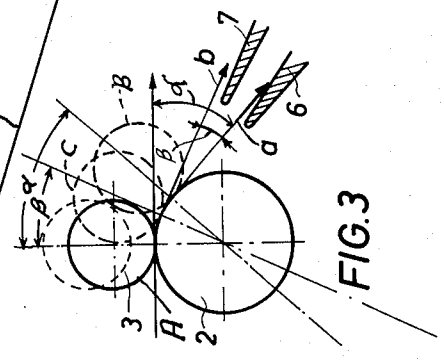


FIG.3

FIG.2

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APPARATUS FOR USE IN DIFFUSION TRANSFER COPYING

Filed May 22, 1963 2 Sheets-Sheet 2

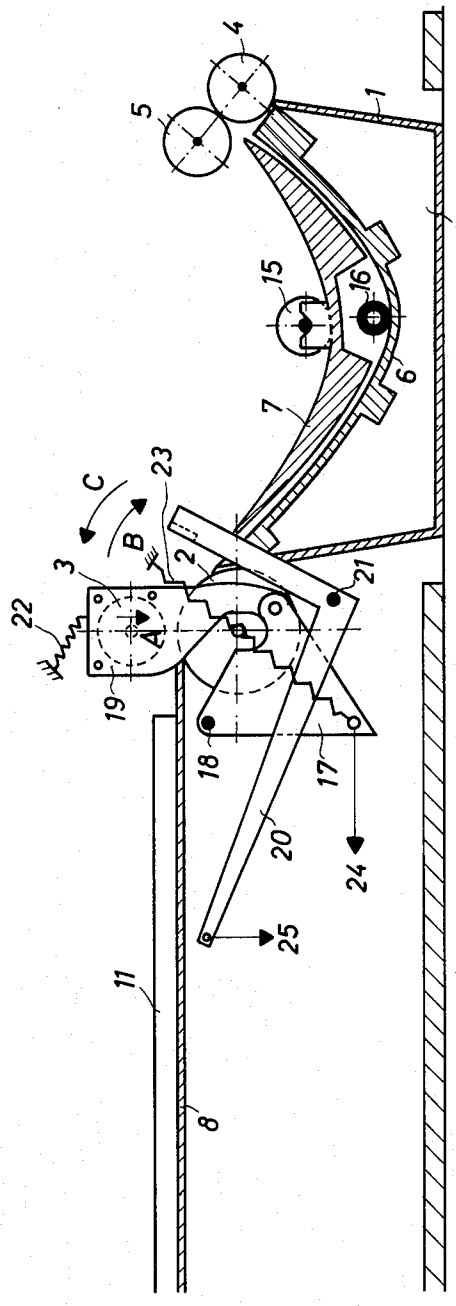


FIG. 4

United States Patent Office 3,257,927 Patented June 28, 1966

3,257,927

APPARATUS FOR USE IN DIFFUSION TRANSFER COPYING

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Claims priority, application Belgium, May 29, 1962, 41,702, Patent 618,238
7 Claims. (Cl. 95—89)

The present invention relates to apparatus for use in copying by the silver complex diffusion transfer process.

In the performance of the silver complex diffusion transfer process, an image-wise exposed light-sensitive sheet, normally a sheet comprising a silver halide emulsion layer, hereinafter called "light-sensitive sheet" is treated with a liquid to bring about development of the latent image and is pressed against a sheet material (hereafter called "receiving sheet") into which complexed silver halide diffuses from the light-sensitive material and is transformed to form an image of the printed text or other matter which is being copied.

If an exact predetermined position of the image on the receiving sheet is required, it is necessary to ensure a correct predetermined relative location of the light-sensitive and receiving sheets during the diffusion transfer, and the subject of the present invention is apparatus having means for facilitating such correct relative positioning of the sheets. The invention is particularly although not exclusively concerned with the performance of the diffusion transfer process using a receiving sheet which comprises a metal support, e.g. a sheet of aluminum foil and which can subsequently be used in offset printing.

Apparatus for use in carrying out the diffusion transfer process, having means for positioning the light-sensitive sheet with respect to the receiving sheet are described, among others in the German patent specification 1,102,558 and in the co-pending United States patent application Serial No. 215,677, now Patent No. 3,186,325, which both describe an apparatus comprising a pair of entrance rollers being movable from an open position, permitting the sheets to pass freely between said entrance rollers to removable stops, into a closed position for gripping the sheets. Consequently the registering of the sheets occurs by the abutment of their leading edges against the removable stops.

If sheets of different lengths are used, the center of one sheet having to coincide with the center of the other sheet, said apparatus cannot be used since registration relies on the alignment of the two leading edges of the sheets.

In general, the apparatus of this invention is adapted to effect the separation of any two sheets of sheet material that is sufficiently stiff to resist bending under its own weight, where such sheets are oriented in superposed relation with the leading edge of one projecting forwardly of the leading edge of the other. Preferably, the apparatus includes edge-contacting means for assisting in bringing the sheets into proper relation. Basically, the present apparatus comprises a fixed-guide member to which the oriented sheets are to be delivered with one sheet passing on one side and the other sheet passing on the other side and a differential sheet-deflection device. This device in its simplest form includes a curved surface arranged at a fixed locus adjacent the guide member, such surface being uniformly curved along its length corresponding to the direction of delivery of the sheets. The direction in which the sheet curves away from a plane passing through its upstream edge must be coordinated with the orientation of the sheets so that the sheet with the leading edge is situated in the same direction relating to the other sheet. Moreover, the length of the surface must be sufficient that

two imaginary planes can be passed tangentially to the surface in such manner that one plane extends on one side of the guide member and the other plane on the other side of the guide member. Cooperating with the curved surface is a hold-down bar extending parallel to the surface for pressing the sheets against the surface. The bar is mounted for bodily swinging member relative to the axis of curvature of the surface along a generally concentric path. The forward limit of this path approximately coincides with the radius of the surface containing the line of tangency of the one plane passing on the one side of the guide member corresponding to the direction of curvature of the surface. The rear path limit is spaced from the forward limit at least as far as necessary to coincide with the radius of the surface containing the line of tangency of the other plane. The oriented sheets are delivered to the surface in any desired way, e.g., by hand, and after both leading edges have passed between the bar and surface, the bar is swung to the forward limit of its path, causing the sheets to advance along a path passing on the one side of the guide member, and held at such limit until the projecting leading edge of the one sheet has advanced beneath the member. Then, the bar is swung rearwardly until it is in a position with its axis approximately coinciding with the surface radius containing the line of tangency of the other plane, so that the sheets now emerge from between the bar and surface along a path passing on the other side of the guide member. However, only the sheet with the trailing leading edge is free to follow the latter path as the edge of the leading edge is already caught under the member. Thus, as the sheets continue to advance, each passes on the corresponding side of the member until completely separated.

Preferably, the curved surface is the periphery of a rotatably supported cylinder and the hold-down bar is a similarly supported cylinder and at least one of the two cylinders is driven to positively feed the sheets to the guide member. The present apparatus lends itself especially well for use in carrying out the developing step of the diffusion transfer process in which case the guide member forms part of any array of guide plates directing the separated sheets through a bath of processing liquid.

With reference to the accompanying drawings, the characterizing features of the present invention are now described by way of example.

FIG. 1 is a schematic perspective view, partly broken away, of one apparatus according to the present invention.

FIG. 2 represents the movements of the removable entrance roller.

FIG. 3 shows the several positions of the entrance rollers in relation to the paths of travel of both supports.

FIG. 4 is a cross-section of an apparatus as represented in FIG. 1, the entrance roller pair of which is controlled by solenoids.

In FIG. 1 the apparatus shown is especially designed for producing aluminum printing plates according to the silver complex diffusion transfer process. Thus, it comprises a developing tank **1** containing a developing liquid **14**, a pair of relatively removable entrance rollers **2**, **3**, a pair of outlet rollers **4**, **5**, two guide plates **6**, **7** and a flat table member **8** in advance of the entrance rollers. The roller **2** has the same peripheral speed as the rollers **4** and **5** while the roller **3** is free rotating.

The guide plates guide a light-sensitive sheet **9** and an image receiving aluminum sheet **10**, respectively, through the apparatus.

The flat table member **8** is provided with a side guide member **11** and two step-shaped prominent parts **12** and **13** for positioning the light-sensitive sheet **9**, and the image receiving aluminum sheet **10**, respectively.

The system for differentially deflecting the two sheets while pressed together in order to guide them separately

along the guide plates, comprises the pair of rollers **2**, **3** and the mechanism for operating the roller **3**.

The rollers **2**, **3** are so mounted as to be capable of a relative vertical movement, indicated by the arrow A in FIG. 2, permitting them to be separated for the introduction of the sheets and then brought together to sheet-feeding position. In addition, roller **3**, while in sheet-feeding position, is arranged for bodily translation about the axis of roller **2** in a forwardly (clockwise) and then in a backwardly (counterclockwise) direction, indicated by arrows B and C, respectively, through predetermined arcs as necessary to differentially deflect the leading edges of the sheets into separate guide paths. The positions of the rollers corresponding to the above movements are shown in solid and dotted lines with the same alphabetical designations.

Two light pressure rollers **15** and **16** located in the developing tank **1** are freely resting on the guide plates and make the sheets follow reproducible paths through the developing tank.

The operation of the present apparatus will now be described in detail.

The image-wise exposed light-sensitive sheet **9** is introduced, with its emulsion side facing upwardly, between the opened entrance rollers **2**, **3** and then slipped backwardly until its rear edge abuts against the step-shaped prominent part **12**. Then, the left hand side edge of the light-sensitive sheet is pressed against the guide side member **11**.

The aluminum sheet **10**, which at its front and back sides is provided with a number of perforations, is similarly passed between the still open entrance rollers and laid upon the light-sensitive sheet, in such a position that its rear end rests against the step-shaped prominent part **13**, and its left hand side rests against the side guide member **11**.

The distance between the front sides of both step-shaped prominent parts is adjusted in such a way that the leading edge of the light-sensitive sheet is positioned at about 1 cm. behind the leading edge of the aluminum sheet.

Then the entrance rollers are closed (movement A). The rollers press both sheets together and convey them to the developing tank **1**. Immediately after the rollers close, movement B is initiated with the movable roller **3**, whereby it swings bodily through the angle α around the roller **2**, so that both sheets are deflected downwardly.

Both sheets are now moving along the path indicated by the arrow α (see FIG. 3). After the projecting edge of the lower light-sensitive sheet **9** has passed the front edge of the guide plate **7**, the roller **3** partially returns, swinging backwardly through the angle β (movement C), whereby the sheets are directed along the path *b*. However, since the leading edge of sheet **9** is already engaged between guides **6** and **7**, that sheet can only continue to move under the guide plate **7**. On the other hand, the aluminum sheet **10**, which is clear of guide **7**, can follow the new path *b* so that it will pass above the guide plate **7**.

When moving through the developing tank both sheets are pressed against the guide plates by the free turning rollers **15**, **16**, so that each of the sheets follow a reproducible path of travel.

When both sheets have been guided through the developing tank, they are gripped between the pair of driven outlet rollers **4** and **5**. These rollers press both sheets together whereby the superfluous developing liquid is removed. After a few movements the sheets are separated from each other, leaving a positive print on the aluminum sheet. Next, this sheet is treated with an appropriate lithographic composition whereupon it is ready for attachment onto the pressing roller of an aluminum offset printing press.

For assuring particularly good reproducibility, the angle α must be chosen in such a way as to permit the guiding of the light-sensitive sheet **9** in a rectilinear path along the underside of the guide plate **7**, and the angle β must be taken in such a way so as to permit the guiding of the aluminum sheet **10** in a rectilinear path over the upper side of the guide plate **7**.

With the apparatus just described, the deviation in parallelism measured on the coinciding longitudinal sides of both sheets is smaller than 0.4 mm.

For realizing the movements A, B and C of roller **3**, various mechanical constructions can be considered which can either be manually operated or automatically controlled. These mechanical constructions do not form part of the present invention.

With reference to FIG. 4 one automatic arrangement for controlling roller **3** will now be explained.

After correct registration of both sheets relative to each other on the table member as previously explained, the motor driving the roller **2** is switched on to operate. At the same time a first solenoid (indicated by the arrow of force **24**) is excited and a timing device (not shown in the drawings) is started which, after a given period of time, controls the excitation of a second solenoid (indicated by the arrow of force **25**). The triangular-shaped supporting plates **17** are rocked around point **18** in the direction of the arrow **24**, so that the floating arms **19** carrying the free rotating roller **3** are dropped in the direction indicated by the arrow A until the roller **3** occupies position A and presses the sheets against the roller **2**. At that moment the free rotating roller **3** is displaced bodily in clock-wise direction by the driven roller **2** until the arms **19** abut against the levers **20** and roller **3** is in position B. In this position the light-sensitive sheet will be directed between the guide plates **6** and **7**.

The timing device is so set in advance that, as soon as the front edge of the light-sensitive sheet has passed under the guide plate **7**, a second solenoid is excited drawing down the left hand part of the lever **20**, so that said lever, which is pivotally mounted in the point **21**, turns in counter-clockwise direction, whereby the arms **19** and consequently the roller **3** retracts about halfway (movement C) to position C so that the aluminum sheet will be directed above the guide plate **7**. When the sheets have left the apparatus, the current to the solenoids is cut off and the rollers **2** and **3** are restored in their initial open position under the influence of the springs **22** and **23**.

It is evident that the foregoing example illustrates but one specific embodiment of apparatus according to the present invention.

The invention can, among others, also be applied to apparatus for producing prints according to an electrophotographic or electrothermographic method, wherein the entrance rollers con be separately mounted, connected to an electric potential, they can be heated, etc. Furthermore, the apparatus according to the present invention can also be applied in the exposure system of automatic copying devices, where a light-sensitive sheet, after its exposure in contact with an original, has to be separated from said original.

I claim:

1. In an apparatus for use in copying by the silver complex diffusion transfer process comprising guide means for guiding an assembly of a light-sensitive sheet and a receiving sheet along two predetermined separate paths through a tank holding processing liquid, sheet-driving means comprising rotary members located at the entry end of the tank for introducing the sheets in superposed relationship into the tank, and means for pressing the said light-sensitive sheet and the said receiving sheet together at the exit end of the said tank, wherein the sheets are oriented in superposed relationship with the leading edge of one projecting forwardly of the leading edge of the other, in combination, an improved delivery mechanism comprising a fixed arcuate surface onto which said assembly is moved along a normal path,

said surface curving generally longitudinally of said assembly to that side of said path corresponding to the side of the assembly occupied by the sheet with the projecting leading edge, said surface being arranged adjacent the edge of said guide plate with its generatrix in spaced generally parallel relationship to the plate edge, the longitudinal extent of such surface being sufficient to include loci for two tangential planes, that plane containing the locus nearest the plate edge passing below and the other passing above said plate; a sheet hold-down bar cooperating with said surface to hold the sheets therebetween, said bar having its axis extending generally parallel to the guide plate edge and being mounted for pivotal movement generally about the axis of said surface; and means for pivoting said hold-down bar first to said near locus to direct said sheets along said first plane and then after said projecting leading edge of said first sheet has passed under the edge of said surface but prior to the passage of said other sheet edge thereof for retracting said bar to said second locus to direct said other sheet along said second plane.

2. The apparatus of claim 1 wherein said arcuate surface is the periphery of a driven roller and said hold-down bar is a freely rotatable roller, said rollers thereby serving to advance said sheets.

3. An apparatus according to claim 2, wherein said driven roller is stationarily mounted, and said freely-rotatable roller is mounted so as to move from a position spaced from the periphery of the driven roller to a position wherein said roller is pressed against the periphery of the driven roller, to hold the sheets therebetween.

4. The apparatus of claim 1 wherein one of said sheets is an exposed light-sensitive sheet and the other is an image-receiving sheet for a silver complex diffusion transfer process and said guide plate forms part of guide means for directing said sheets in separate predetermined paths through a tank containing processing liquid for said process.

5. An apparatus according to claim 4, wherein the guide means consist of plates which are curved in the direction of sheet travel, and which each are provided with at least one roller, fitted in a free rotating way, for making the guided sheets follow a reproducible path along the inner curved side of the said plates.

6. The apparatus of claim 1 including a sheet dressing table directly in advance of said arcuate surface, said table having longitudinal step means for engaging the sheet edges at one end to effect said orientation and lateral stop means for engaging the sheet edges at one side to effect lateral alignment thereof.

7. In a method for copying by the silver complex diffusion transfer process by the steps comprising the steps of guiding by means of guide means a light-sensitive sheet and a receiving sheet through a bath of processing liquid, said guide means including a fixed guide plate on one side of which passes one of said sheets and on the other side of which passes the other of said sheets, whereby said sheets are separated while within said bath, and pressing said sheets together upon emergence from said bath into superimposed contacting relationship, an improved mode of delivering said sheet to said guide means which comprises the steps of orienting said sheets with the leading edge of one projecting slightly forwardly of the leading edge of the other; feeding said sheets along a normal path extending to one side of said fixed guide plate with said sheet having the projecting edge nearer the plate; just prior to said leading edge reaching said plate, temporarily applying to said sheets a force deflecting them from said normal path to a path extending on the other side of said plate until the projecting sheet edge has passed the plate edge on said other side; and thereafter but before the leading edge of said other sheet passes on said other side, relieving said force to cause said other sheet edge to pass on the first side of the plate.

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