

[54] **ELECTROSTATIC APPARATUS**

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[51] Int. Cl. **G03g 15/00**

[58] Field of Search..... **355/3, 8, 11, 14,**
355/15, 17, 12, 16; 118/637

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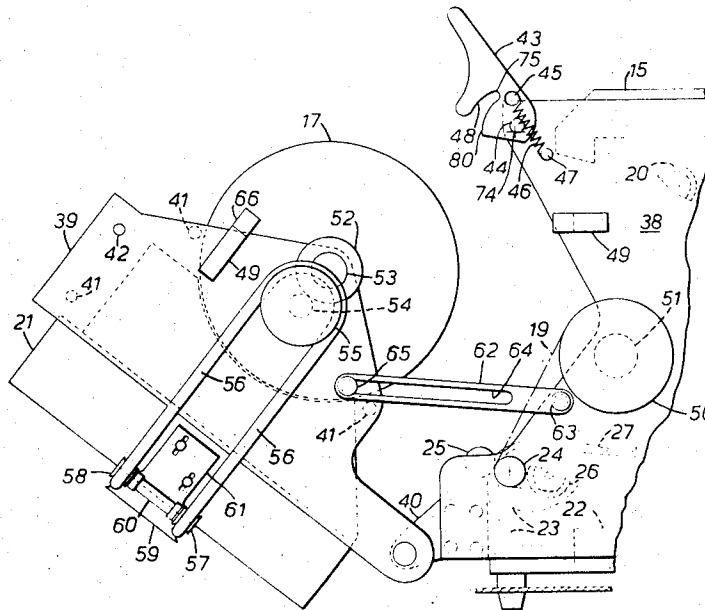
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[57] **ABSTRACT**

In copying apparatus comprising a drum provided with a photo-conductive surface, copy paper feed means for feeding paper to the drum and drive means for driving the drum surface and the copy paper at the same speed, the drum is carried on first support means the copy paper feed means are carried on second support means, and the two support means are moveable into and out of register, so that main drive means on the said second support means, arranged to drive the copy paper feed means, engage or disengage driven means arranged to drive the said drum without the said main drive means needing to be disengaged.

12 Claims, 4 Drawing Figures



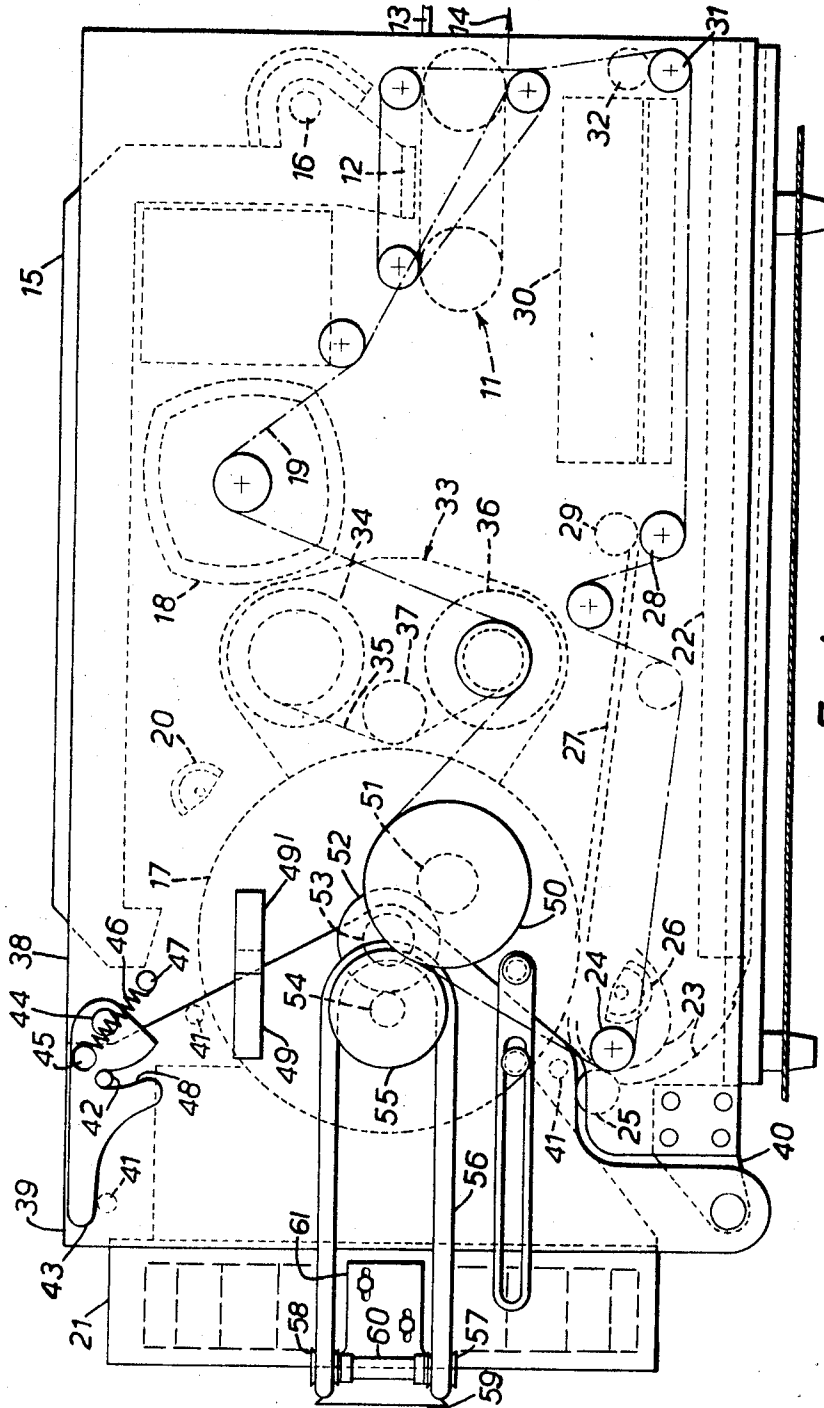


FIG. 1.

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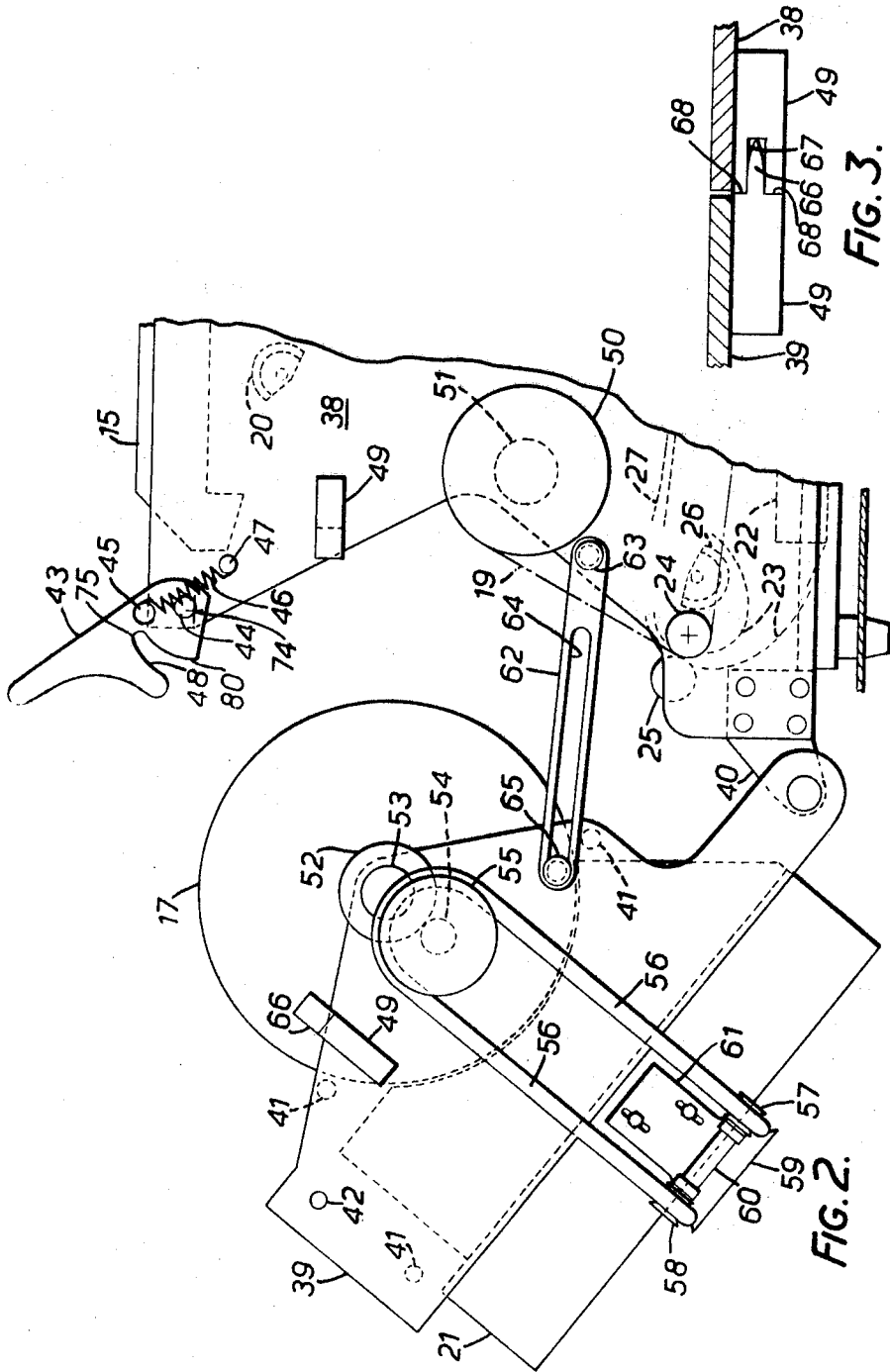


FIG. 2.

FIG. 3.

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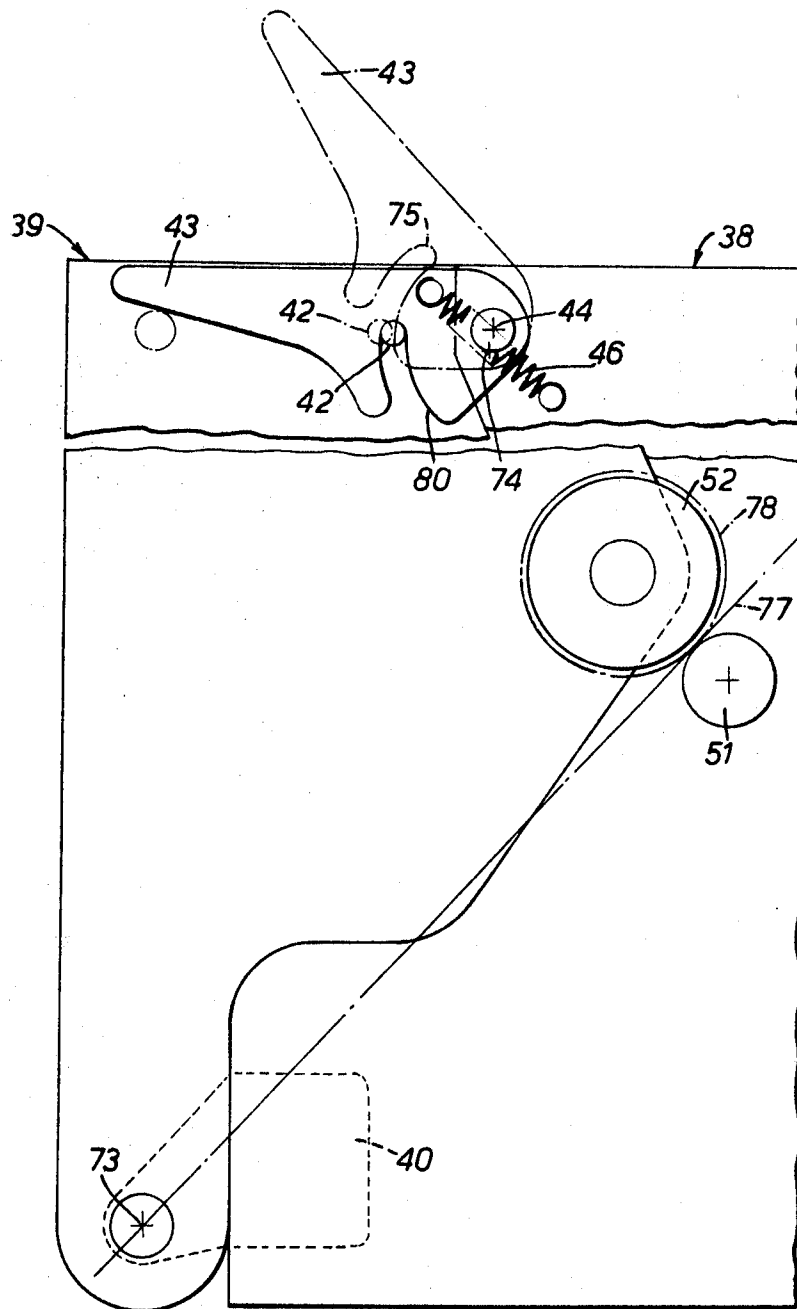


FIG. 4

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ELECTROSTATIC APPARATUS

The present invention relates to copying or electrostatic apparatus, and more particularly to apparatus of the xerographic type in which an electrostatic image is formed and developed on a photo-sensitive surface and is then transferred to a sheet of paper or the like and fused or otherwise made permanent thereon.

It is an object of the invention to provide apparatus of this type having improved access to internal regions of the apparatus.

According to the present invention copying apparatus for example electrostatic copying apparatus comprises a first surface adapted to carry a transferable and developable image of the data to be copied, for example a drum provided with a photo-sensitive e.g. photo-conductive surface, first means for feeding copy material e.g. paper to the said first surface, for example rollers adapted to engage the paper surface and guides to guide the paper into contact with the first surface, and optionally second means for producing a transferable and developable image of the data to be copied on the said first surface for example an optical scanning and image transfer system, means for forming an electrostatic replica of the optical image on the said first surface, and means for developing the electrostatic replica into a transferable form and also optionally third means for causing the copy material to acquire a developed image of the data to be copied for example means for transferring the image from the first surface to the copy material to produce a visible replica of the original data, and drive means for driving the first surface and the copy material at the same speed, the said first surface being carried on first support means for example a pair of side frames between which the said first surface is moveably mounted, the said first means being carried on second support means, for example a pair of side frames between which the said second means are mounted for movement in the same sense as the said first surface, the two support means being moveable into and out of register, for example by being pivoted to one another, for example adjacent their bottom edge, so that one can be swung down and away from the other, whereby main drive means on one of said support means preferably said second support means, arranged to drive either said first surface or said first means, preferably said first means, engage or disengage driven means arranged to drive said first means or said first surface respectively, preferably said first surface, without the said main drive means needing to be disengaged.

The first surface, for example a drum may be provided with a photo-conductive surface in accordance with the known art as for example amorphous vitreous selenium alone or in admixture with sensitizers such as tellurium or arsenic trisulphide, or alloys of sulphur and selenium as disclosed in British Patent Specification No. 1,091,862 or compounds of cadmium such as cadmium sulphide or cadmium selenium sulphide (which may be activated) or organic photoconductors or photoconductors dispersed in insulating binders, or photoconductors prepared with insulating overlayers.

The optical scanning means may comprise a system in which the original bearing the data to be copied is fed past a scanning station and then out of the machine which is preferred since it simplifies the image transfer system which need have no moving parts, or it may

comprise a system in which the original remains stationary and the illuminating scanning system is moved past it. The means for forming an electrostatic replica of the optical image on the photo-conductive surface may comprise a corona discharge wire arranged to impart an electrostatic charge evenly across the surface of the drum just before it is illuminated. When the drum rotates under the output end of the optical image transfer system the electrostatic charge is partly discharged in those areas where the original carried no data and is retained in those areas corresponding to the data. This electrostatic replica or latent image could however be produced by many other techniques but this one is preferred for its simplicity.

The electrostatic replica is preferably now developed into a transferable form, however it could be transferred direct to the copy material and developed on the copy material as is known. The means for developing the electrostatic replica to transferable form preferably comprises a toner-carrier mixture cascade developer though other developers such as the known cloud developers could be used. Preferably the developer means are carried on the same support means as the first surface i.e. desirably on the first support means.

The developer means may have a drive input member and may be mounted on the same support means as the said first surface or drum and the driven means arranged to drive the said first surface or drum may be arranged to also drive the said drive input member of the developer. Cascade developers having elevator systems for retaining the cascade mixture from the lower region of the drum back to an upper region are preferred. The driven means used to drive the first surface or drum can conveniently also be arranged to drive the elevator of the cascade developer. Thus the developer means are preferably a cascade developer having an elevator which is adjustably mounted on the said support means and driven from the said driven means by a flexible belt drive.

When a developer has been used to convert the electrostatic replica to a transferable replica the third means may transfer the replica, for example of charged pigmented fusible polymer particles, to the copy paper by means of a corona discharge wire or by other suitable means.

The support means may be arranged to be movable into and out of register by being pivoted to one another as mentioned above; the main drive means and the driven means preferably comprise interengaging wheels, for example meshing toothed gear wheels. In order to facilitate easy disengagement and re-engagement it is preferred that the common tangent of the gear wheels or other drive and driven means should pass through the axis of the said pivot. Desirably also the axis of both drive means and driven means are parallel to the said pivot axis, though other arrangements facilitating meshing or engagement of the drive and driven means could be used.

It is desirable that the initial movement out of register when the drive means and driven means will be disengaging and also the final movement into register when they are re-engaging should be carefully controlled and arranged to occur at a relatively slow rate so that damage to the two parts such as chipping of gear teeth is avoided. Interengageable means, preferably having a lever action, are thus provided on the first and second support means preferably at a position remote from the

pivot, whereby disengagement of the said means slowly moves the two supports out of register over a short distance, for example of the order of, or slightly greater than, the dimensions of the inter-engaging portions of the main drive means and driven means, such that the main drive means and driven means are disengaged and conversely the main drive means and driven means can only be brought into full engagement by reengagement of the said interengageable means.

The interengageable means may comprise a pin on one of the support means, preferably the first, and a lever pivoted on the other preferably the second support means. The lever has a slot in it for engagement with the pin, whereby disengagement forces the pin away from the pivot axis of the lever and engagement forces the pin and thus the support towards the pivot axis of the lever and thus towards the support on which it is mounted. The slot is preferably curved about an axis nearer to the pivot between the first and second support means than is the axis of the pivot of the lever, and is so positioned and dimensioned that when the pin is at the inner end of the slot the main drive means and the driven means are correctly and fully engaged.

The first and second support means are preferably linked by stop means arranged to limit the extent to which the first and second support means can move out of register or pivot apart. Desirably they are also provided with resistance means e.g. frictional resistance means, arranged to limit the rate at which the support means can move into and preferably also out of register.

The support means are preferably also provided with guide means for example of blade pin or tongue and slot form arranged to ensure that the final movement into register is correctly aligned whereby correct engagement of the main drive means and the driven means is assisted.

The invention can be put into practice in various ways and one specific embodiment will be described to illustrate the invention with reference to the accompanying diagrammatic drawings in which:

FIG. 1 is a side view of a xerographic document-copying machine embodying the invention, with its outer skin or cover removed,

FIG. 2 is a fragmentary view similar to that of FIG. 1 but showing part of the machine in an opened position giving access to the interior,

FIG. 3 is a plan view of a detail mounted on side plates of the machine, and

FIG. 4 is a simplified partial side view of the drum end of the machine.

The document-copying machine shown in FIG. 1 is generally of known kind. It comprises transport means 11 for conveying under a viewing window 12 a document which is to be copied and is presented to it endwise over a feed-in platform 13 at the front of the machine, by an operator to whom the document is returned, by the transport means 11, as indicated by an arrow 14. The window 12 is at the objective end of an optical system 15. This includes a lamp 16 for illuminating the part of the document under the window 12 and results in the formation of an optical image of that part of the document which is illuminated on part of the peripheral surface of a rotatable drum 17. The surface of the drum is constituted by a thin layer of a material, such as an amorphous vitreous selenium-sulphur composition, which is photo-conductive inasmuch as

its resistivity, though always very high, is higher in darkness than under illumination. A main drive motor 18 of the machine, via a main drive chain 19, drives the document transport means 11 and the drum 17 (as described in greater detail below) at appropriate relative speeds so that the moving image of the moving document being copied moves at the same speed as the drum surface on which it is being projected. Each part of the drum surface, which rotates counter-clockwise in FIG. 1, passes under a corona-discharge device 20 which applies a uniform electrostatic charge to the drum surface before this is exposed to the optical image. An electrostatic latent image is formed by partial discharge under illumination by the optical image and this latent image is developed by means of a developer unit 21 which cascades a carrier-plus-toner mixture over the image-carrying drum surface. Toner particles in the mixture are removed from this mixture as they are electrically attracted to and adhere to the charged parts of the drum surface. A paper tray 22 containing a stack of paper is provided in the lower part of the machine, and means 71 (not indicated in FIG. 1) are provided for advancing one sheet at a time from the top of this stack through a paper guide 23 and paper-feed rollers 24 and 25 into tangential contact with the drum 17. Control circuitry (not shown) of the machine is such that each sheet is advanced so that its leading edge contacts the drum surface in register with the leading edge of a developed image thereon, and a second corona-discharge device 26 causes the toner of the developed image to transfer from the drum surface and adhere, still in the pattern of the image, on the sheet of paper as this advances at equal speed with the drum surface. The sheet of paper, with the image transferred to it, is stripped from the drum surface by stripping and guiding means 27 which guide the sheet to feed rollers 28 and 29 which advance the sheet through a heater unit 30 in which the toner is heated and fused onto the sheet to provide a permanent image. The finished copy then passes between a final pair of rollers 31 and 32 which feed it out from the machine.

The drum surface, after the paper sheet has been stripped from it, passes a cleaning unit 33 comprising a spool 34 loaded with a web of cleaning material 35 such as suitably impregnated paper tissue, a take up spool 36 which is driven to wind up the cleaning web material which has been used, and a pressure roller 37 which, during cleaning, presses the web 35 against the drum to remove any residual toner therefrom and is driven, by means (not shown), to slowly advance the web 35 and thereby continually present a clean part of the web to the drum surface.

The various above-mentioned parts of the machine are mounted between two side plates and, as described above, the machine is of known kind. Such machines operate very satisfactorily, but on rare occasions, inevitably, a faulty operation occurs such as a sheet of paper being incorrectly fed to or from the drum and becoming jammed within the machine. In known machines of this kind, access for the removal of a jammed sheet of paper may be difficult; but in the illustrated machine means is provided, according to the invention, whereby access is greatly facilitated.

To this end, each of the side plates of the machine is divided into two parts 38 and 39 which are hingedly connected to one another. In the illustrated embodiment, each part 38 has mounted on it a bracket 40 on

which the other part 39 is pivotally mounted. The parts 39 are secured to one another by three transverse tie bars 41, and on and between them are mounted the drum 17 and the developer unit 21, the remaining parts of the machine being mounted on and between the main parts 38 of the side plates.

Each side plate part 39 has rigidly mounted on it a projecting pin 42, and is normally locked in correct relation to the corresponding side-plate part 38 by means of a respective one of two locking handles 43 mounted on respective ends of a shaft 44 which extends through both side plate parts 38 and is rotatable therein. One or each of the handles 43 is provided with a spring post 45 having mounted thereon one end of a tension spring 46 whose other end is mounted on a spring post 47 on the respective side-plate part 38. Each handle 43 is formed with a slot 48 for engagement with the respective pin 42, and preferably each slot 48 is a circular arc about a center 74 (see FIG. 4) located below the axis of the shaft 44. Thus, when the handles are raised (against the tension of the springs 46 until these pass over dead-center with respect to the shaft 44), the side-plate parts 39 are positively moved away from the parts 38 by the pressure of the wall of the slot 48 bearing against the pin 42. The parts 38 and 39 may be such that, in the locked position as shown in FIG. 1, they are mating edgewise fit with one another; or they may be slightly spaced from one another even when locked; but in either case they preferably have mounted on them mating pieces 49 and 49' which ensure correct relative location of the parts 38 and 39 when locked.

The side-plate part 38 of the machine, on the side of the machine at which the main drive chain 19 is provided, has freely rotatably mounted upon it a chain wheel 50 round which the chain 19 passes, and integral with the chain wheel 50 is a toothed gear 51. When the side-plate parts 38 and 39 are locked in position, the toothed gear 51 is in meshing engagement with a toothed gear 52 carried by a shaft 53, mounted rotatably in the other side-plate parts 39. This shaft 53 also carries the drum 17. The drum 17 and the gear 52 are both non-rotatably mounted on the shaft 53. The gear 52 also meshes with a gear 54 which is integral with a belt drive wheel 55 and rotatably mounted therewith on one of the side-plate parts 39. A belt 56 passes round the belt drive wheel 55 and also passes over guide pulleys 57 and 58 which rotate about a vertical axis and round a pulley 59 which rotates about a horizontal axis aligned along the length of the machine. The pulley 59 drives a rotary elevator of the developer unit 21. The pulleys 57 and 58 idle on a shaft 60 carried by a bracket 61 which is adjustably mounted on the developer unit 21 to allow the belt 56 to be fitted and properly tensioned.

It will be seen that, when the side-plate parts 39 are in their locked position as shown in FIG. 1, the main drive chain 19, passing over the chain wheel 50, provides drive both for the drum 17 and for the rotary elevator (72) of the developer unit 21 which returns to an upper hopper the developer mixture which has been cascaded over the drum. When the handles 43 are raised as shown in FIG. 2, the side-plate parts 39 may be pivoted away from the side plate parts 38, as is also shown in FIG. 2. The extent of pivoting allowed is controlled by stop bars 62 each pivotally mounted at one end on a stud 63 on the respective side-plate part 38 and each having a slot 64 in which is engaged a respec-

tive stud 65 mounted on the respective side-plate 39. The studs 65 may, if desired, be provided with spring-urged friction washers bearing on the stop bars 62 thus assisting in controlling the pivoting movement of the side-plate parts 39. The toothed gears 51 and 52 are so arranged that when they are in mesh their common tangent 77 passes through the pivotal axis 73 provided by the bracket 40, whereby these two gears are moving directly away from and towards one another as they disengage and engage during pivotal movement of the side-plate parts 39. (FIG. 1 is not entirely accurate in this respect and is only to be taken as a diagrammatic general representation. FIG. 4 shows this feature more accurately).

FIG. 4, it will be appreciated, is a composite view which has been much simplified by removal of components not relevant to the final meshing of the gear wheels 51 and 52. It shows the parts 38 and 39 fully in register but the pin 42 and the lever 43 both fully engaged (in full lines) and just before disengagement on opening (in chain lines).

It will also be appreciated from FIG. 4 that the position shown in chain lines of the pin 42 and the lever 43 is also the position just prior to reengagement. Because the lever 43 cannot swing up any further than is shown it also acts as a stop or abutment surface 80 to prevent the parts 38 and 39 and the gears 51 and 52 moving into register except under the action of the lever 43 engaging the pin 42.

The curve of the slot 48 is such that the pin 42 is moved on disengagement a distance slightly longer than the length of the teeth 78 on the gear wheel 52. When the pin 42 is re-engaged the wall of the slot 48 pushes the pin from the dotted position to the full position which it occupies when located fully at the end 78 of the slot 48 and this gently and positively engages the teeth of the gears 52 and 51.

It will be seen from FIG. 2 that with the side-plate parts 39 pivoted away, the developer unit 21 and drum 17 are displaced so as to give access, past the drum, to the paper feed region around the feed rollers 24 and 25, the feed guide 23, and the adjacent end of the feed guide 27, whereby any paper jam in this region may be readily cleared without actually dismantling the developer unit 21 and drum 17 to give access. Equally, when the drum 17 requires to be replaced by another as is occasionally necessary, this can be done without first dismantling the developer unit 21. It is necessary only to unlock the shaft 53 from the drum 17 and gear 53 and withdraw it axially after which the drum 17 can be lifted out vertically and another drum fitted by the reverse procedure.

It will be appreciated also that, with the side-parts 39 pivoted away as shown in FIG. 2, the drum 17 is well spaced from the pressure roller 37 and the cleaning web 35 which passes thereover. The machine may be such that replacement of a used cleaning web by a fresh one is affected by withdrawing the spools 34 and 36 in their axial direction, through an aperture provided for the purpose in that one of the side-plate parts 38 which does not have the main drive chain 19 adjacent to it, (the back face in FIG. 1). A fresh pair of spools with the fresh cleaning web extending between them is then inserted. This involves movement of the cleaning web along the pressure roller 37 and more particularly the edgewise insertion of the fresh cleaning web over the pressure roller 37. This is facilitated if the drum 17 is

first moved into its position shown in FIG. 2, since a generous loop of the cleaning web can then be allowed in order to clear the pressure roller easily, without fear that it might foul on the drum.

As shown in FIG. 3 each piece 49 has a projecting tongue 66, which enters a slot 67 of the corresponding mating piece 49' and shoulders 68 which when the side-plate parts 39 are locked in position about the end of the piece 49' on each side of its slot 68. The tongue 66 is preferably slightly tapered at its free end, to facilitate entry into the slot 68 and ensure alignment of the side-plate parts 38 and 39, and the abutting action of the shoulders 69 defines the position of the drum 17 in the locked position of the side-plates parts 39.

What we claim as our invention and desire to secure by Letters Patent is:

1. Copying apparatus comprising a pair of side frames each comprising first and second parts, said two first parts being connected to form first support means and said two second parts being connected to form second support means,

a first surface adapted to carry a transferable and developable image of the data to be copied,
first means for feeding copy material to said first surface,

drive means for driving said first surface and the copy material at the same speed, in which said first surface is carried on said first support means,
said first means are carried on said second support means and

said two support means are hingedly interconnected so as to be movable into and out of register, and are so hinged about an axis adjacent their bottom edges that one can be hinged down and away from the other,

and main drive means provided on one of said support means,

drivingly engaging driver means connected with one of said first surface and said first means which is carried on the support means which carries said drive means, said main drive means being arranged to engage and disengage said driven means connected with the other of said first surface and said first means without said main drive means needing to be disengaged from said one of said first surface and said first means which is carried on the support means which carries said drive means.

2. Copy apparatus as claimed in claim 1 in which the first and second support means are linked by stop means arranged to limit the extent to which the first and second support means can move out of register.

3. Copying apparatus as claimed in claim 1 in which the first and second support means are linked by resistance means arranged to limit the rate at which the support means can move into and out of register.

4. Copying apparatus as claimed in claim 1 in which the first and second support means are provided with guide means arranged to ensure that the final movement into register is correctly aligned whereby correct engagement of the main drive means and the driven means is assisted.

5. Copying apparatus comprising a pair of side frames each comprising first and second parts, said two first parts being connected to form first support means and said two second parts being connected to form second support means,

a first surface adapted to carry a transferable and developable image of the data to be copied,
first means for feeding copy material to said first surface,

an optical scanning and image transfer system for producing a transferable and developable image of the data to be copied on said first surface, without said data having to contact said first surface,

third means for causing the copy material to acquire a developed image of the data to be copied and drive means for driving said first surface and the copy material at the same speed, in which said first surface is carried on said first support means

said first means are carried on said second support means and

said two support means are movable into and out of register,

and main drive means provided on said second support means drivingly engaging driven means connected with said first means, said main drive means being arranged to engage and disengage driven means on said first support means, said driven means being connected with said first surface without said main drive means needing to be disengaged from said first means.

6. Copying apparatus as claimed in claim 5, further provided with interengageable means on said first and second support means whereby disengagement of the said interengageable means moves said two support means out of register over a short distance such that said main drive means and said driven means are disengaged and said main drive means and said driven means can only be brought into full engagement by reengagement of said interengageable means, said interengageable means comprising a pin on one of said support means and a lever pivoted on the other of said support means, said lever having a slot therein for engagement with said pin whereby disengagement forces said pin away from the pivot axis of said lever and reengagement forces said pin and thus its associated support towards the pivot axis of said lever and thus towards the support on which said lever is mounted.

7. Copying apparatus as claimed in claim 6 in which the slot is curved about an axis nearer to the pivot between the first and second support means than is the pivot axis of the lever and is so positioned and dimensioned that when the pin is at the inner end of the slot and the main drive means and the driven means are correctly and fully engaged.

8. Copying apparatus as claimed in claim 5 in which developer means having a drive in put member are mounted on the same support means as said first surface and the driven means arranged to drive said first surface are arranged also to drive said drive in put member of the developer.

9. Copying apparatus as claimed in claim 8 in which the developer means are a cascade developer having an elevator which is adjustably mounted on said support means and driven from said driven means by a flexible belt drive.

10. Copying apparatus as claimed in claim 5 in which said two connected support means are movable into and out of register by being hinged to one another.

11. Copying apparatus as claimed in claim 10 in which said support means are hinged about an axis ad-

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adjacent their bottom edge so that one can be hinged down and away from the other.

12. Copying apparatus as claimed in claim 10 in which the main drive means and the driven means comprise interengaging wheels and are so arranged on their

respective support means that when in driving relationship their common tangent passes through the axis on which the support means are pivoted.

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