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(54) Improvements in and relating to document copiers.

(57) A portable photocopier comprises an elongate housing accommodating a roll (25) of sensitised paper (71) and a feed mechanism for feeding the paper (71) from the roll passed a corona wire (47) for electrostatically charging the paper (71) to a location for illuminating (13) the charged sheet in contact with a document to be copied and then to a device for applying toner (43) to the charged exposed paper and for fixing (41) the toner. The copier is traversed across the surface of the document to be copied by the movement of the paper.

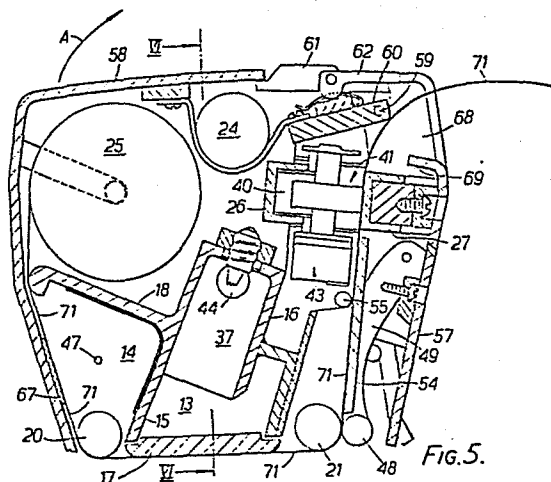


Fig. 5.

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Improvements in and relating to document copiersDESCRIPTIONField of Invention

This invention concerns document copiers and in particular a photocopying device for copying papers and documents.

Background to the Invention

Conventional photocopiers normally remain generally stationary while the document to be copied may itself remain stationary while it is optically scanned to produce an image of the text thereon or the document may be moved on the copier so as to provide for the necessary relative movement to achieve a scanning of the document.

Hitherto document copiers have, therefore, tended to be relatively large pieces of equipment at least as large in area as the largest document which is intended to be copied by the machine.

Since prior art photocopiers have normally been associated with office use, there has been no attempt to miniaturise the copier below a size slightly larger than the largest document which is to be copied by the copier.

It is an object of the present invention to provide a copier which whilst it can still be used in an office or similar environment is primarily intended to be of a portable nature and can be carried about the person

or in a brief case, to be used as and when required for copying items of text, letters, pages from books etc..

The concept behind the present invention is that the photocopier shall be taken to the document to be copied

5 rather than vice versa as has conventionally been the case.

Summary of the Invention

According to the broadest aspect of the present invention, a copier for producing a photocopy of a
10 document comprises a portable elongate housing containing:- a roll of sensitised paper, means for electrostatically charging the paper, means for illuminating the paper and forming an electrostatic image thereon, means for applying toner to the paper so as to
15 cause toner to adhere to those areas of the sensitised paper on which a charge remains after illumination and exposure to the document to be copied, and an exit from which a photocopy of a document will pass as it is exposed and developed, the housing further comprising
20 drive means to cause the paper to move relative to the housing and out through the exit, and further means for generating a high voltage electrical discharge and for causing the source of illumination to operate.

The charging and the illumination may be
25 synchronised with the movement of the paper so that a uniform charge pattern and related lumen exposure rate is achieved.

The invention lends itself to a hand-held photocopier unit which can be located over a document or book page or the like and can be guided thereover by hand so as to illuminate successive regions of the document and produce a photocopy thereof. Illumination may be continuous or intermittent and synchronised with movement of the photocopier across the document.

Alternatively, the invention may be fitted with a base plate to define an entry and exit gap through which a document bearing photocopyable material such as printing can pass for illumination and exposure to the sensitised paper. In this arrangement, the housing can remain static so that the only movement is of a document as it moves through the housing between the underside thereof above the base plate.

Drive for the paper and related facilities within the photocopier housing may be obtained by a friction drive from one or more rollers protruding below the underside of the housing which when the latter is advanced across a flat surface such as a table top or document cause rotation of appropriate members within the housing and produce relative movement of the sensitised paper and other facilities within the housing.

Alternatively, the device may be actively driven across the document to be copied by wheels or rollers or other tracking devices independently of the movement of the sensitised paper, the speed of the sensitised paper moving through the device being matched to the movement of the housing across the document.

The force necessary to advance the device across a document to be copied may be provided by the operator, for example through a hand crank or rotatable knob.

Alternatively, the power may be supplied by motors and batteries or even from a flying lead with or without transformer for connection to the electricity supply mains.

Where the device is used in a stationary mode with the base plate previously referred to, drive means would be required to feed the paper between the device and the base plate.

The invention is applicable to a so-called reflex copying arrangement in which a reverse image is first formed on a first photocopy which is then subsequently re-imaged by the same apparatus to form a second photocopy, the first one being discarded, and is also applicable to a single stage reflex copying process in which appropriate paper and toner are used so that a single stage of exposure and development is required to provide a correctly handed image without the need for a preliminary photocopy which then has to be discarded.

Alternatively, single stage photocopying process could be used in which an optical system which may include a lens or lens/mirror, fibre optic imaging system, a micro-lens array and erecting prism is employed
5 so as to produce a correctly handed image on the sensitised paper as the copier is traversed across the document.

Where the speed of travel of the photocopier relative to the document to be copied is not necessarily
10 constant, as in a hand propelled machine, the charging rate, illumination rate and toning rate may, with advantage, all be carefully matched to the speed of the machine travel in order to achieve a uniform copy. This can be done mechanically using gears and pulleys together
15 with electrical switching.

In one embodiment of the invention, the high voltage required to charge the photocopying paper is generated by a piezo-electric crystal and means is provided for repetitively stressing the crystal to
20 generate the high voltage needed to produce the charging voltage. In this arrangement, the stressing mechanism is linked mechanically to a drive mechanism for the photocopier so that irrespective of the speed of the photocopying device over the document to be copied, a
25 high tension pulse will always be applied to the corona wire or other charging device at a predetermined pitch relative to the linear movement over the document so that the sensitised paper is charged relatively uniformly.

The repetition rate at which the crystal is stressed and therefore the pitch at which the charging voltages occur is such that bands of charge along the sensitised paper join up to give a uniform overall
5 charge.

Alternatively, with a piezo-electric charging device, the sensitised paper may be charged to saturation in which case linking is not necessary.

Alternatively, the high voltage at a frequency
10 in the KHz range may be generated by a suitable electronic unit, or, where the copier is powered from a mains supply, a high voltage transformer may be used.

The width of the machine from front to back is governed by the space required to fit in the various
15 components such as a roll of paper, a charging device for applying high voltage to the paper, an illumination device such as a lamp and a toning station containing toner typically in the form of a finely divided powder or a liquid suspension.

20 Whilst charging of the sensitised paper will normally be effected before illumination, it may be preferred to employ simultaneously charging and illumination.

The means for causing the toner to adhere to the paper preferably comprises a roller that is traversed to and fro across the paper at right angles to the direction of movement of the paper through the machine. The roller
5 may be rotatably mounted upon a carriage that is guided for movement across the paper by guides that may include an arrangement for urging the roller against the paper to cause the toner to adhere to the paper.

Preferably, the carriage also supports a hopper
10 containing toner which is transferred to the paper by means of a magnetic transfer device.

Movement of the paper, after exposure, to the toner fixing roller may be controlled by an intermittently operating indexing mechanism, for example
15 a geneva wheel. Alternatively, the paper may be allowed to form a "loop" during the periods when the roller is traversing across the paper. Yet again, a swinging roller device may be employed to take up and release "slack" in the paper upstream of the roller. In a
20 further alternative, the paper may be advanced to the roller by an elastic roller drive for example a stretching belt drive.

The length of the machine, i.e. from left to right, is governed by the width of the sensitised paper
25 which is to be made available for copying on. In

addition, the length of the machine must accommodate such components as are required at each end for supporting the roll of paper and providing drive therefor. Typically the side regions of the apparatus also include the piezo electric crystal, the means for stressing the crystal and drive gear associated therewith.

It may be necessary to ensure that during copying light from the illuminating means does not enter other parts of the apparatus where the light might reach charged, sensitised paper before an electrostatic image is formed on the latter. To this end, according to a further subsidiary feature of the invention, the lower peripheral region of the apparatus, and particularly the periphery around the opening which defines the viewing window, includes a flexible light-proofing such as velvet covered foam plastic or a dense brush material or the like.

However, if the degree of illumination is sufficiently intense with respect to ambient light, light proofing against the ingress of ambient light is normally unnecessary unless very sensitive paper is used.

The present invention is essentially based on the concept that the photocopier shall be taken to the document to be copied and that small portions of the

document can be illuminated successively and viewed and exposed in succession so enabling the physical size of the photocopier to be reduced considerably as compared even with the so-called desk top copiers. Thus, a

5 photocopier constructed in accordance with the present invention will only view a small portion of an original document at any instant in time during the photocopying process or where the document actually passes through the apparatus, will only contain a small region of the
10 document within the apparatus at any instant in time during the photocopying process.

Introduction of Drawings

By way of example only, embodiments of the invention will now be described in greater detail with
15 reference to the accompanying drawings of which:

Fig. 1 is a perspective view of a first embodiment partly in diagrammatic form and with certain components removed and others shown cut-away,

20 Fig. 2 is a view from one end of the first embodiment with the end cap removed,

Fig. 3 is a view from the other end of the first embodiment with the end cap removed,

Fig. 4 is a section on line IV-IV of Fig. 2,

25 Fig. 5 is a section on a slightly enlarged scale on line V-V of Fig. 6,

Fig. 6 is a section on a slightly reduced scale on line VI-VI of Fig. 5,

Fig. 7 is a perspective view of the first embodiment at the commencement of a copying operation,

Fig. 8 is a perspective view of an attachment,

5 Fig. 9 is a perspective view of the first embodiment at the commencement of a copying operation involving use of the attachment, and,

Fig. 10 is a cross-section of a second embodiment of the invention. --

Detailed description of Drawings

Referring first to Figs. 1-6, the copier includes a generally elongate housing 10 formed from a main structural member 11 that extends between end walls 12. The member 11 incorporates an illumination chamber 13 and a charging chamber 14 that extend for the full length of the member.

The illumination chamber 13 is of inverted channel form with walls 15, 16 contoured at their lower (as seen in the drawings) ends to receive a transparent screen or window 17 releasably secured to the walls by means of spring clips 17a.

Extending forwardly from wall 15 in a substantially horizontal direction is a wall 18 that bounds the upper part of the charging chamber and whose extremity is downturned and separated from the lower end of the adjacent wall 15 by a gap 19.

Rotatably mounted between the end walls 12 across the lower edge of the gap 19 is a roller 20 that extends across from one end wall 12 to the other.

A second roller 21, also rotatably mounted
5 between the end walls 12, lies on the other side of the illumination chamber 13 from roller 20 as can be seen from Fig. 2. Roller 21 is carried by a shaft one end of which extends through the right-hand (as viewed in Fig. 1) end wall 12 and is rotatable by an electric drive
10 motor 22 via a suitable drive shown in Fig. 1 as a belt-driven gear train 23 which drives a pinion 21a fixed to the shaft.

The motor 22 is mounted upon the left-hand end wall 12 and is powered by batteries shown at 24 and
15 supported in a cradle located between the end walls 12.

As can be seen from Figs. 2, 3 and 5, the lower face of the transparent screen 17 viewed end-on lies approximately tangential to the rollers 20, 21 although the latter project very slightly beyond the lower face to
20 enable the copier to be advanced across a surface as will be described in more detail below.

The end walls 12 are also slotted at 12a to receive a shaft on which is mounted a roll, indicated schematically in Fig. 1 at 25, of sensitised paper of
25 which more detail is given below.

Supported by the end walls 12, is a toner applicator and fixing device comprising spaced channel-shaped rails 26, 27 between which a carriage 28 is traversed to and fro by the motor 22 via a drive including a thumb wheel 28a. At both ends, the rails pass through the end walls 12 which are cut away for this purpose and, on the remote side of the end walls, the rails 26, 27 are coupled together by pairs of levers of which only the pair at one end is shown in full in Fig. 1. That pair comprises right-angled levers 29, 30 pivoted at 31 to rail 27.

At their other ends, the levers are pivoted to an attachment 32 secured to the rail 26 on that side thereof remote from rail 27.

The levers of the other pair at the other ends of the rails 26, 27 are of somewhat different shape as is shown in Fig. 4 at 33. The levers 33 are pivotally attached to rail 27 at 34, the adjacent ends of the levers being coupled together by a transverse block 35 against which bears one end of a compression spring 36. The other end of spring 36 is supported by an adjustor 37 secured to the rail 26. The adjustor includes a threaded rod 38 along which a nut 39 is movable to control the degree of compression of the spring 36.

The arrangement is such that, assuming rail 27 to be fixed, rail 26 is biased by the spring 36 towards rail 27 and is also movable to a limited extent towards and away from the latter whilst maintaining a parallel position with respect thereto.

The carriage 28 is guided for movement along the channel of rail 26 by a guide means 40 (Figs. 2, 3 and 5) that traverses along the channel. Rotatably mounted upon the carriage 28 is a roller wheel 41 urged towards the flat face of rail 27 by rail 26 under the action of spring 36.

Also carried by the carriage 28 is a hopper 42 that may be removable from the carriage and a toner transfer device for transferring toner from the hopper to the paper after the latter has been charged and exposed as will be described in more detail below. The transfer device is shown in the drawings as block 43 (Figs. 2, 3 and 5) and consists of a multiple pole magnet assembly rotatably mounted within a cylindrical housing of brass, aluminium or any other non-magnetic material. Mounted adjacent the cylindrical housing is a doctor blade (not shown) whose operative edge lies very close to the surface of the housing and operates to adjust the depth of toner on the housing. The position of the doctor blade edge relative to the surface of the housing is adjustable to control the depth of toner.

The carriage 28 is driven from the motor 22 by, for example a belt drive, the carriage being shown at both limits of movement in Fig. 4 and are located outside the edges of the paper as will be described below.

5 More details of the carriage and the drive therefor are given in U.K. Patent Specification No. 82.22451. A further example of a traversing carriage system is found in U.S. Specification No. 4,305,330 although in this case the carrier does not incorporate a
10 toner hopper with a toner applicator.

 Also powered from battery 24 are electric bulbs 44 mounted as shown in an upper part of the wall 15 of the illumination chamber 13. The bulbs 44 are so spaced that in conjunction with reflectors 45 even illumination
15 of the screen 17 is obtained.

 On its outside face, the right-hand wall 12 supports an electronic EHT unit, shown schematically as block 46, that converts battery potential into a high potential suitable for charging the sensitised paper.
20 Stretched along the charging chamber 14 is a corona wire 47 joined to the EHT output of unit 46.

 Associated with roller 21 is a pinch roller 48 rotatably supported between arms 49 pivotally mounted upon respective ones of the end walls 12 on the inner
25 faces thereof and lockable to hold the roller 48 against

roller 21 by locking arms 50. The arms 50 are pivotally mounted at 51 on the respective outer faces of the adjacent end walls 12. Locking arms 50 each have locking slots 52 in which move studs 53 secured to respective
5 arms 49.

As can be seen from Fig. 5, there is a lateral wall 54 that extends across the device between the end walls 12 and below the rail 27. The wall 54 is aligned with the nip between rollers 21 and 48 and terminates
10 just above that nip.

A further nip roller 55 extends through end walls 12 between and is carried by the locking arms 50. In its operative position, roller 55 contacts wall 54 at the position shown in Fig. 5.

15 The end walls 12 have end covers 56 detachably secured to them. The upper portions of the end covers 56 are contoured to provide surfaces by which a user can hold the copier. Extending between end walls 12 is a side cover 57, the lower edge of which lies adjacent the
20 rollers 20 and 48. The side cover 57 is carried by the arms 49.

A cover 58 is hinged at 59 to a cross member 60 that extends between the end walls 12 as can be seen from Fig. 1 and which also carries the battery cradle referred
25 to above. The cover 58 extends forwardly from the hinge

over the top of the device between the end walls 12 and down over the front. Pivotal movement in the direction of arrow A, Fig. 5, gives access to the interior of the device to enable a user to insert a roll of paper, to
5 replace the battery and to thread the paper towards the rollers 21 and 48 as will be explained below.

Mounted externally upon the cover 58 is a control switch 61 that controls energisation of the motor 22 and the EHT unit 46, and a lock-off control 62 for the
10 switch 61.

When shut, as shown in Figs. 2, 3 and 5, the cover 58 is held closed by brackets 63 contoured to engage studs 64 mounted upon the outside faces of the end walls 12 as shown in Figs. 2 and 3.

15 When in its closed position, cover 58 pivots an earthing bracket 65 away from contact with a terminal 66 to which one end of the corona wire 47 is joined and which connects the wire with the EHT unit 46. When the cover 58 is opened, bracket 65 moves into contact with
20 the terminal 66 under the action of a spring (not shown) and this action earths the corona wire 47.

Mounted upon the inside face of the cover 58 is a charge bed 67 so positioned that when the cover is closed, the bed lies along the gap 19 as can be seen from
25 Fig. 5.

The copier also includes a light mask adjustable in position across the screen 17 to vary the effective width of the screen in the direction of movement of paper passed the screen. The mask consists of a strip 72 of
5 light impervious material that extends the full length of the illumination chamber 13 above the screen 17 and projects at each end through cut-away parts 73 of the end walls 12 where it is attached to the ends of arms 74 pivotally attached at 75 to the end walls. The arms 74
10 are approximately sector-shaped and one has teeth 75 formed at its outer end that mesh with a pinion 76 on the shaft 77 of an adjusting knob 78 by which a user can adjust the position of the strip 72 relatively to the screen 17.

15 The embodiment just described is sized for the copying of document of A4 width and below. The EHT unit 46 is capable of delivering to the corona wire 47 a current of from about 20-40 μ A at a potential of about 8Kv. The bulbs 36 are of $\frac{1}{2}$ watt rating. The motor 22 is
20 geared down by gear train 23 to rotate roller 21 at a speed sufficient to allow the device to advance across a surface at a speed of about 2 cm per second.

The copier described is also intended to provide a right-reading copy so sensitised that paper of the
25 right-reading reflex type is required. Paper of that

type is described in European Patent Specification No. 82.300091.4. Such paper comprises basically a substrate of a light-transmitting material coated on one face with a directly-applied layer of a photo-conductive material.

5 A further layer of an electrically-insulating material may be applied to the other face of the substrate.

The substrate may be that known under the Trade Name GLASSINE, a preferred type being the so-called bleached GLASSINE type 802.

10 The photo-conductive material may be zinc oxide.

Before using the copier, a user lifts the cover 58 and loads the copier with a roll of sensitised paper, the sensitised layer being on the inside face. He also ensures that a battery is in position and that the hopper

15 42 is loaded with toner. If the battery is fully charged, knob 78 is turned to bring the strip 72 into a position in which it masks window 17 to a maximum permitted extent.

The paper is then advanced from the roll passed

20 the gap 19, round the roller 20 and underneath the screen 17. The locking arms 50 are pivoted away from the copier so moving arms 49 and carrying the pinch roller 48 away from roller 21, and nip roller 55 away from the wall 54.

The paper can now be passed round roller 21, up across the inner face of wall 54, between the guide rails 26 and 27, care being taken to ensure that the carriage 28 is in one of its limit positions, and then through an exit 68 between the upper inturned edge 69 of wall 54 and the cover 58.

If a page from a book is to be copied, the user then places the copier over the opened book as indicated in Fig. 7, the page to be copied being referenced 70.

10 The copier is located with roller 20 against the bottom edge of page 70. The lock-off control 62 is then released, switch 61 is actuated to drive the motor, advancing the copier across the page 70 by contact between the latter and paper being advanced through the copier by the driven roller 21. The user has merely to
15 guide the copier as it advances over the page using the end covers 56 to hold the machine as shown in Fig. 7.

Copying is effected in the well known manner of electro-photographic copiers. Paper advancing over the charge bed 67 is charged by the corona wire 47 and then
20 exposed as the paper moves across screen 19. Toner is applied to the exposed paper and is fixed by the pressure of roller wheel 41 that is traversed to and fro across the paper.

When the copier has moved along the entire length of the page, the user allows the motor to continue to run for a few seconds to allow the copy to be completely expelled from the machine after which the copy
5 can be detached by pulling the paper by tearing it across the inturned edge 69 of the cover 48.

The path of the paper through the copier is shown at 71 in Fig. 5. In Fig. 7, the free edge of the paper is shown at 79. The copy moves outwardly during
10 copying as indicated by arrow B in Fig. 7.

It will be observed that the paper is advanced a constant rate up to nip roller 55 but thereafter is advanced intermittently at the end of each traverse of the carriage 28 across the paper. As has been explained
15 above, at its limits of movement the carriage 28 and therefore the roller wheel 41 is clear of the paper which is free to advance. As the roller wheel 41 moves back across the paper, the latter is gripped between the wheel 41 and the flat face of rail 27 and cannot move. During
20 the periods that the wheel 41 is in contact with the paper, a "loop" tends to build up upstream of nip roller 55 which feeds the paper forward when the wheel 41 is clear thereof at the end positions of the carriage 28.

When it is necessary to replenish the supply of toner in the hopper 42, the cover 58 is lifted and if the carriage is not in its left-hand limit position as shown in Fig. 1, the thumb wheel 28a is rotated to bring the
5 carriage into that position in which access to the toner allows a user to replenish the latter.

When it is desired to copy an original in sheet form, the sheet is laid on a flat surface and the copier is guided across it as set out above with reference to
10 Fig. 7.

Alternatively, the copier may be placed on a guide platen of the form shown in Fig. 8 and comprising a tray-like body 80 across the centre of which is positioned a pressure plate 81 faced with a smooth white
15 material, for example white silk. The dimensions of the plate 81 are substantially the same as those of the window 17. Along the sides of the plate 81 are rollers 82, 83, spaced apart by a distance corresponding to that between rollers 20 and 21. Adjacent roller 82, the side
20 wall of the body 80 is formed to provide an entry chute 84 whilst an exit gap 85 is formed in the opposite side wall adjacent roller 83. The upper face of the plate 81 is substantially tangential to the rollers 82, 83.

To use the platen, the copier is seated therein with the window 17 positioned directly above the plate 81 and rollers 20, 21 aligned, and in contact with rollers 82, 83 respectively. The plate is sized so that it is
5 necessary merely to place it on the platen as indicated in Fig. 9 with roller 20 adjacent chute 84 and it is then correctly positioned.

With the copier switched on, the original is pushed forward until its edge engages the paper moving
10 round roller 20 after which the original is drawn forward between the paper and the plate 81 and emerges from the exit gap 85 as indicated at 86 in Fig. 9. The copy 87 emerges from the copier through exit 68 and is detached as described above.

15 In a modified embodiment of the invention shown in schematic cross-section in Fig. 10, there is no internal roll of sensitised paper but sheets of the latter are fed into the copier at the commencement of a copying operation.

20 The copier shown in Fig. 10 has an external appearance and a construction that is similar to that of the copier described above with reference to Figs. 1-6. A transverse member 88 located between end walls 89 comprises an illumination chamber 90 and a charge chamber
25 91 through which extends a corona wire 92 energised from an EHT unit not shown powered by a battery 93.

The charge chamber 91 has an entry slot 94 giving access to the chamber and a forward feed roller 95 driven by a motor 96 powered from battery 93.

Across the lower end of the illumination chamber 90 is a screen or window 97 similar to screen 17 described above. On the other side of the screen 97 from roller 95 is another feed roller 98 adjacent which is an electrostatic pick-up device 99 followed by a second driven roller 100 with a co-operating nip roller 101. Aligned with roller 101 is a paper guide 102 of generally semi-cylindrical form which together with another semi-cylindrical paper guide 103 guides the exposed sensitised paper to a toner applicator and fixer unit 104 whose construction is similar to that described above and incorporates transverse guide rails 105, 106 along which a carriage 107 carrying a toner hopper, toner applicator and roller wheel traverses to and fro when driven by the motor 96. Toned paper leaving unit 104 passes between rollers 108, 109 to be discharged from the copier. Roller 108 is driven from motor 96 via an elastic drive (not shown) which enables the roller to remain stationary whilst the roller wheel is traversing across the paper to fix the toner.

The copier shown in Fig. 10 also includes a movable plate 109 similar to a strip described above.

The mode of use of the copier shown in Fig. 10 is generally similar to that of the copier described above. A sheet 110 of sensitised paper is fed in through entry slot 94 into the charge chamber where it passes
5 across a charge bed 111. The copier is then placed in position over an original to be copied with the feed roller 95 on the edge of the original. The motor 96 is then energised and the copier guided by the user as it traverses along the original. As the copier traverses
10 the original, the sheet 110 is drawn into the copier and is charged by corona wire 92 as it passes across the charge bed. The charged sheet is exposed as it passes with the original beneath screen 97 and is then the leading edge of the sheet and is separated from the
15 original by separator 99 to pass between rollers 100, 101 from which it is guided by guides 102 and 103 to the toner applicator and fixing unit 104 where toner is applied to the charged exposed sheet and fixed. The sheet then emerges from between rollers 108, 109.

20 The original continues in a straight path beneath roller 101 and a further roller 112 and emerges from the base of the machine.

It will be appreciated that some of the components described above may be replaced by equivalent
25 parts. For example, the carriage could be reciprocated

between the rails by fitting the carriage with one or more drive rollers whose axis or axes are inclined with respect to a rotatable driving rod that extends between the rails. Reversal of movement can be effected either
5 by reversing the direction of rotation of the driving rod or by altering the inclination of the roller or rollers.

Topping up of the toner hopper may be effected automatically from a main hopper fixed at one end of the rails and operating to transfer toner when the carriage
10 is in its limit position at that end. In this case, the user merely replenishes the main hopper periodically.

Other means of progressing the sensitised paper passed the toner unit may be employed. For example, an indexing geneva wheel drive may be included to advance
15 the paper positively when the carriage is in a limit position.

Alternatively, a swinging roller to allow looping of the paper and pay-out thereof may be used or an elastic drive, for example a stretching belt drive
20 that stretches while the paper is stationary and contracts to advance the paper at the appropriate time.

Charging potential may be obtained from one or more piezo-electric crystals instead of electronically as described above. Preferably, a pair of crystals is used
25 to produce a balanced assembly, one crystal being loaded

as the other is relieved. The crystals may be by cams driven by the drive motor 22 mentioned above, and a manual drive operated by the user may be adopted. In the latter case, the manual drive may also drive the rollers
5 that advance paper through the copier.

The crystals are loaded and relaxed in synchronism with the rate of movement of the copier to give uniform charging of the paper as it passes across the charging bed.

10 A suitable piezo-electric crystal unit is described in U.K. Patent Specification No. 82.23656.

The copier may operate by simultaneous charging and exposure of the paper by incorporating corona wire in the illumination chamber. That method may require a
15 conductive layer on the sensitised paper as is described above.

In another embodiment, the illumination chamber has a window at one end across which the charged paper is passed and on to which is focussed an image of the
20 respective part of the document to be copied. Focussing is achieved by a suitable optical system using, for example, a lens, a lens/mirror, fibre optic imaging systems, or a micro-lens array and erecting prisms.

In the embodiment shown in Fig. 10, the electro-static pick-up device may be replaced by a mechanical blade separator or by using sensitised paper with a slightly tacky leading edge and a mechanical
5 lifting device or deflector that coacts with the leading edge of the paper to separate it from the original.

Claims:

1. A copier for producing a copy of a document comprising a portable elongate housing, an arrangement for feeding sensitised paper passed means for
5 electrostatically charging the paper, means for illuminating the charged paper and forming an electrostatic image thereon, and means for applying toner to the charged, exposed paper and for fixing the toner after application, and an exit from which the paper
10 emerges after fixing of the toner.

2. A copier as claimed in claim 1 and further including means within the housing for supporting a roll of sensitised paper.

3. A copier as claimed in claim 2 in which the
15 housing also contains drive means for advancing paper from the roll and then passed the charging means, the illuminating means, the toner applying and fixing means to the exit.

4. A copier as claimed in claim 1 in which the
20 housing incorporates an entrance through which sensitised paper is fed to the feeding arrangement at the start of a copying operation.

5. A copier as claimed in claim 1, 2, 3 or 4 in which the copier is advanced across the surface of the
25 document to be copied by the sensitised paper as it is advanced by the feeding arrangement towards the exit.

6. A copier as claimed in any one of the preceding claims in which the illuminating means comprises an illuminating chamber having in one wall thereof an elongate window through which, in use, the
5 illuminating means illuminates a part of the document to be copied.

7. A copier as claimed in any one of the preceding claims and further comprising a guide platen for use in copying single sheet documents, the platen
10 comprising a receptacle for receiving the photocopier, the receptacle including a guide chute for directing the single sheet document to the copier at the commencement of a copying operation and an exit through which the document emerges as copying proceeds.

15 8. A copier as claimed in any one of the preceding claims in which the housing provides accommodation for an electric power unit to power the drive means.

9. A copier as claimed in claim 8 in which the
20 power unit comprises batteries and an electric motor and in which the batteries also power the illumination means.

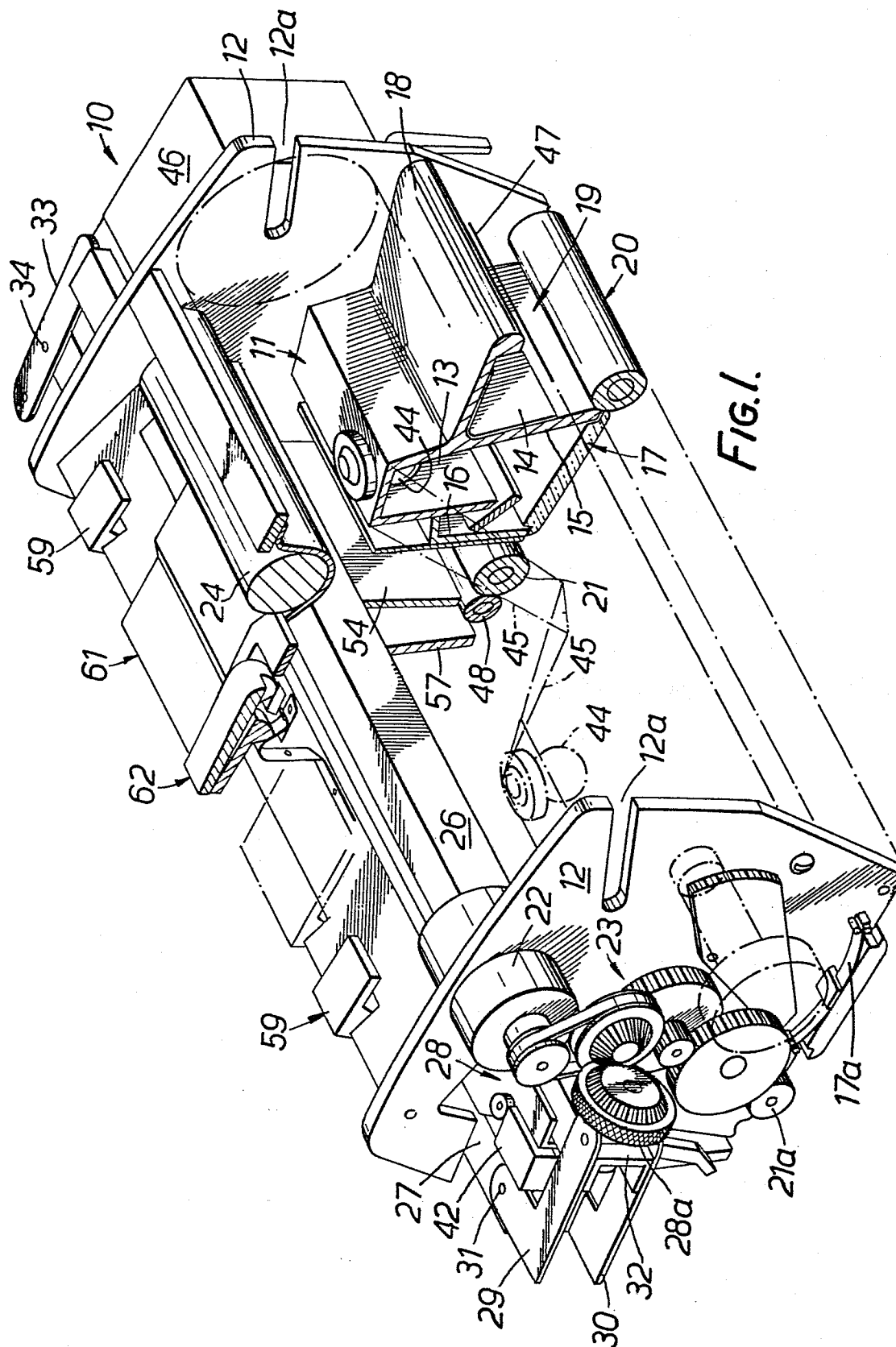
10. A copier as claimed in claim 9 in which the charging means comprises a corona wire charged by a high tension unit powered from the batteries.

11. A copier as claimed in any one of claims 1-8 in which the charging means comprises a corona wire charged from piezo-electric crystal means, and in which the drive means is powered by a hand-operated drive that
5 also actuates the piezo-electric crystal means.

12. A copier as claimed in claims 1-8 in which the charging means comprises a corona wire charged from piezo-electric crystal means, and in which the latter is actuated by the electric motor.

10 13. A copier as claimed in any one of the preceding claims in which the toner applying toner comprises a hopper, means for traversing the hopper across the paper and an arrangement for transferring toner from the hopper to the paper.

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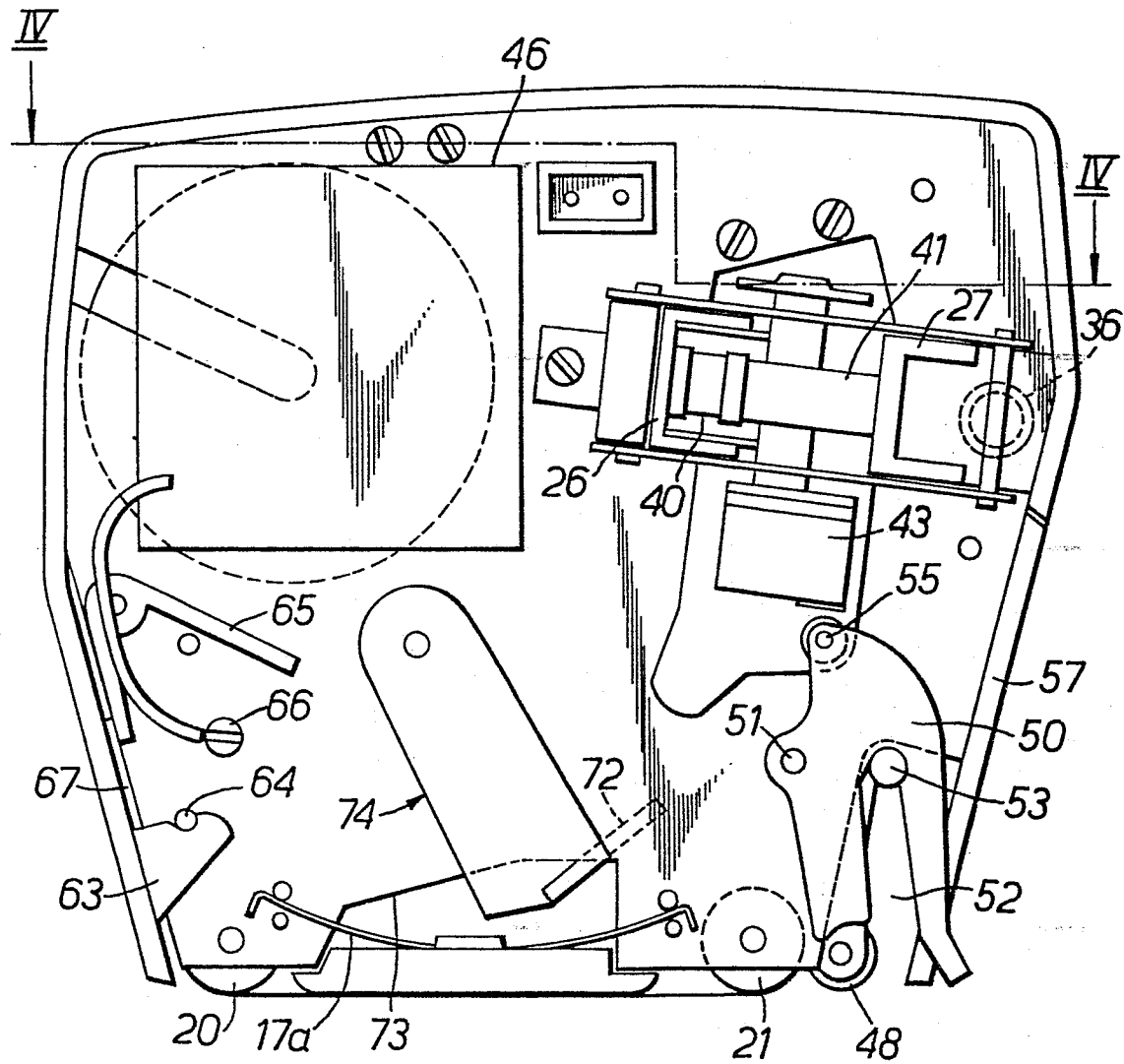


FIG. 2.

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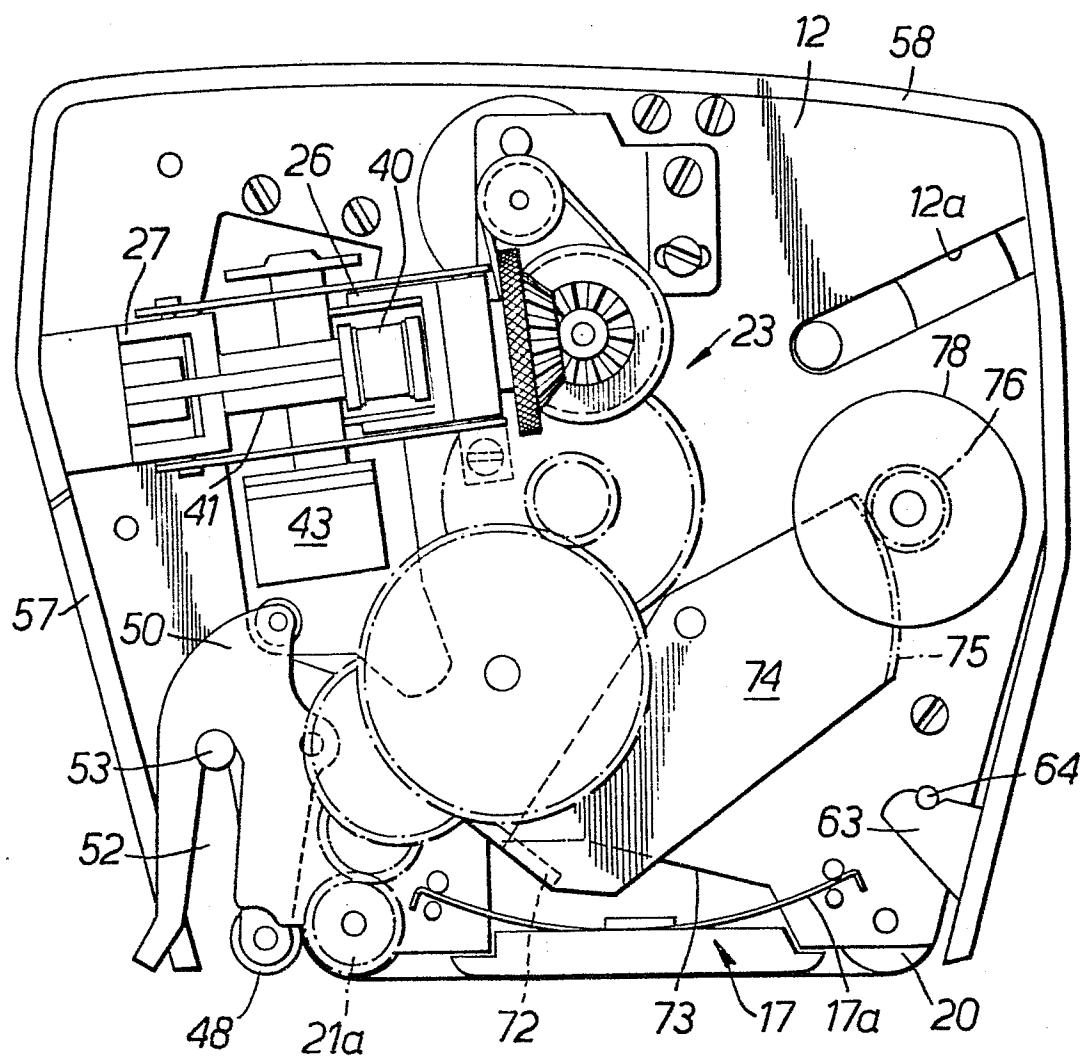


FIG. 3.

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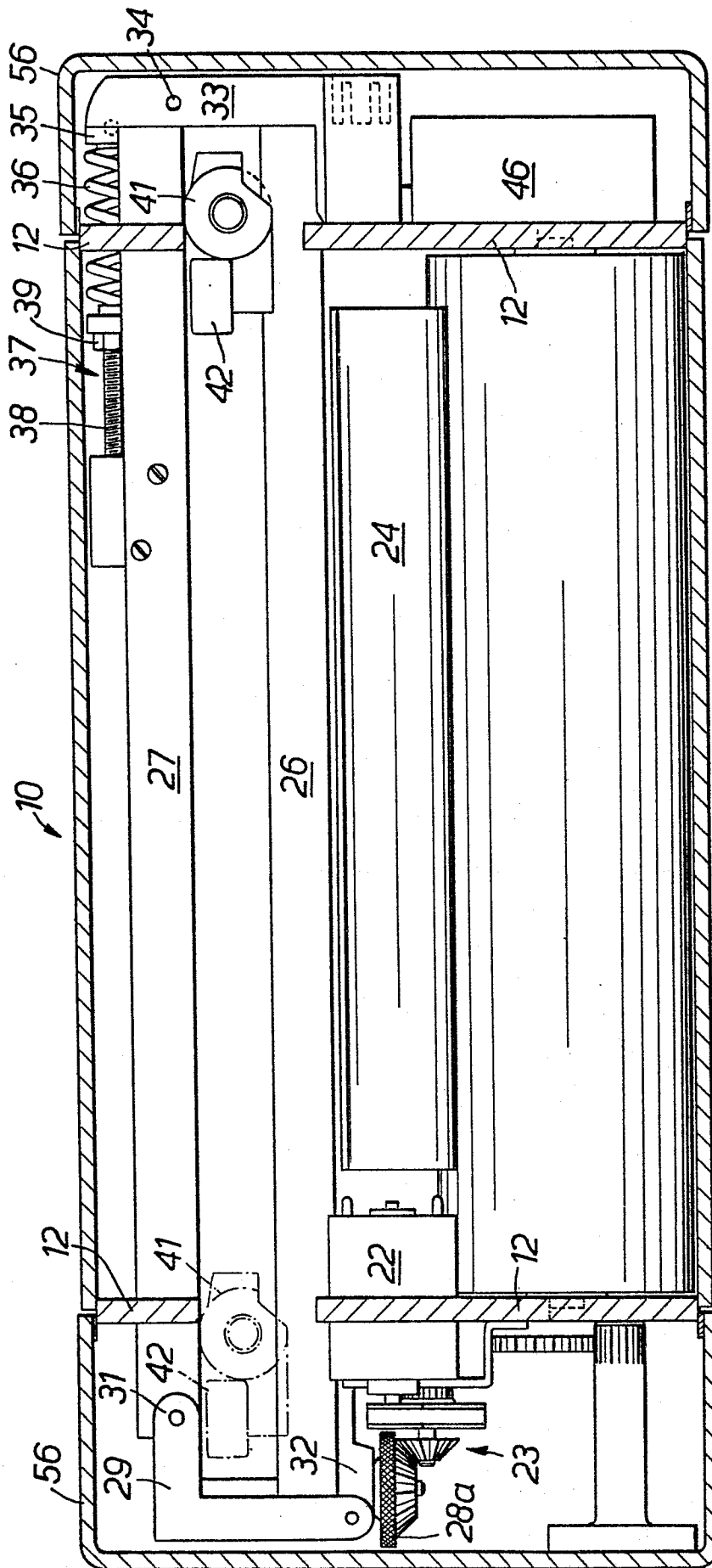
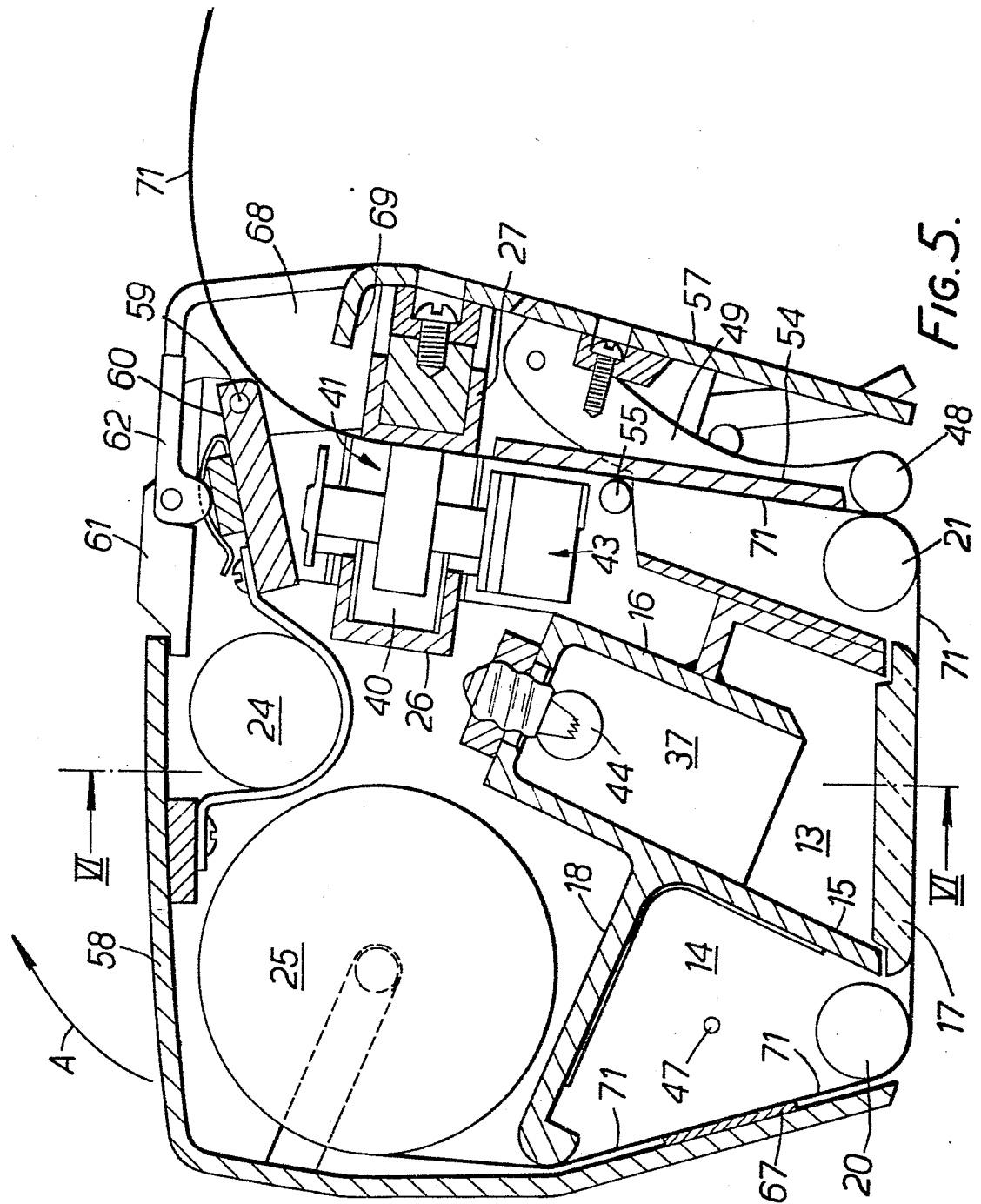
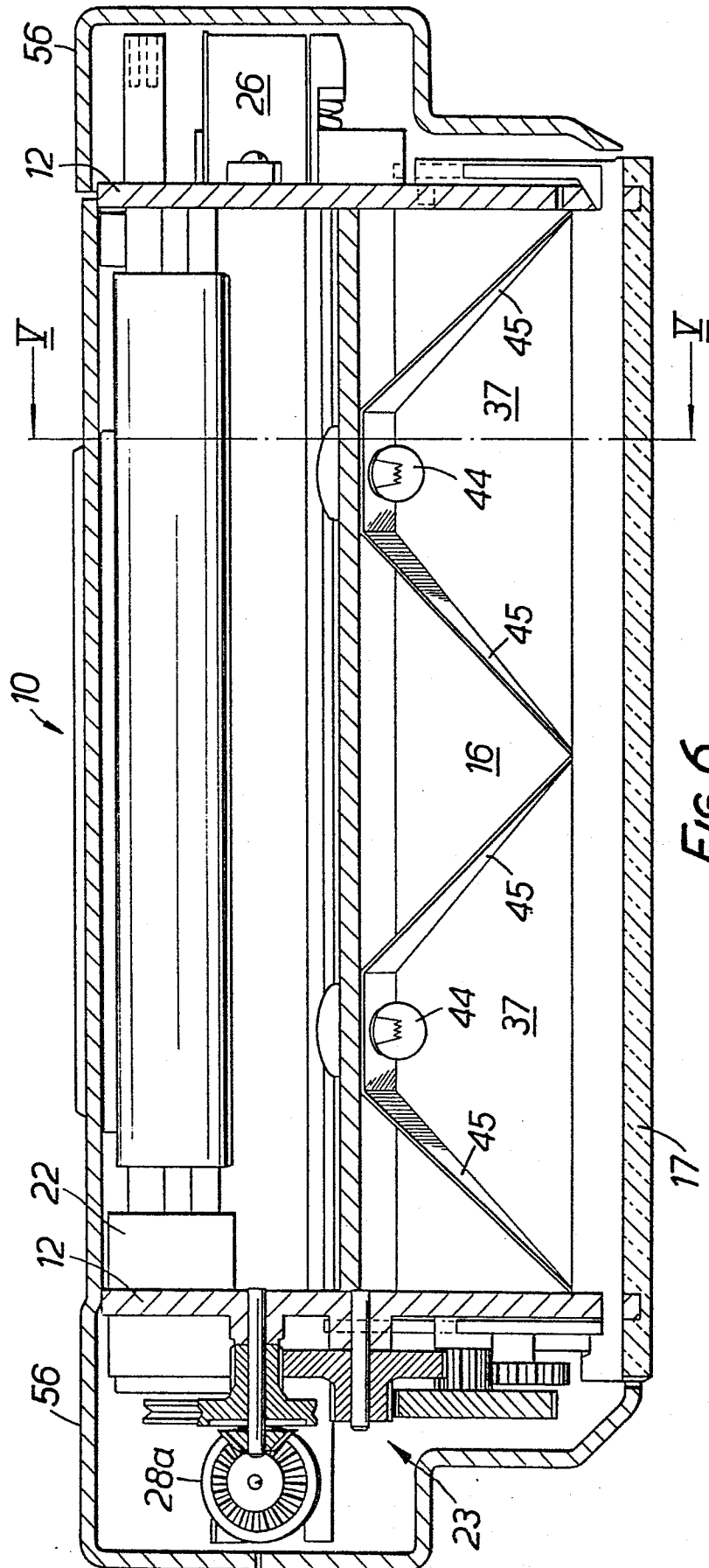


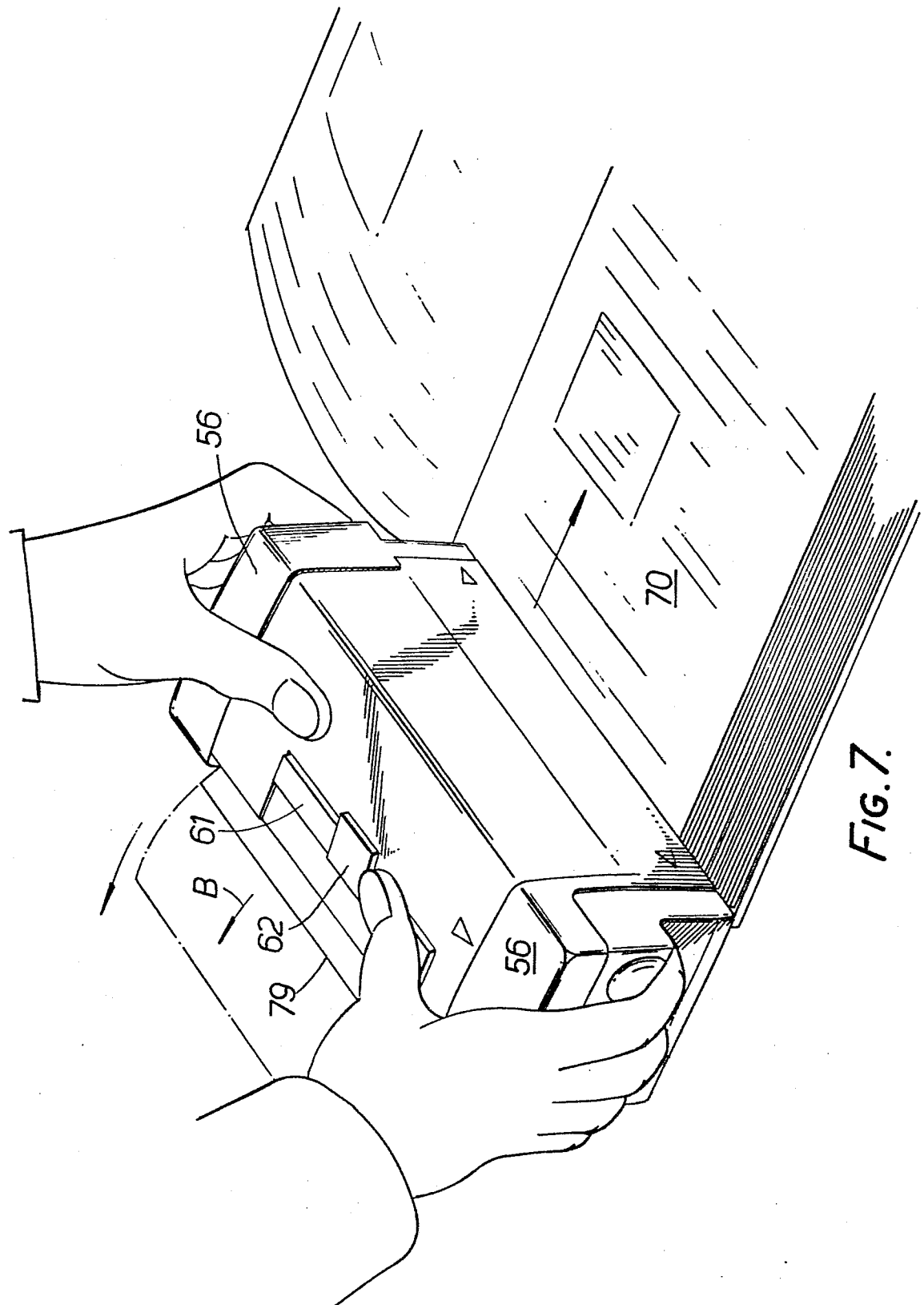
FIG. 4.

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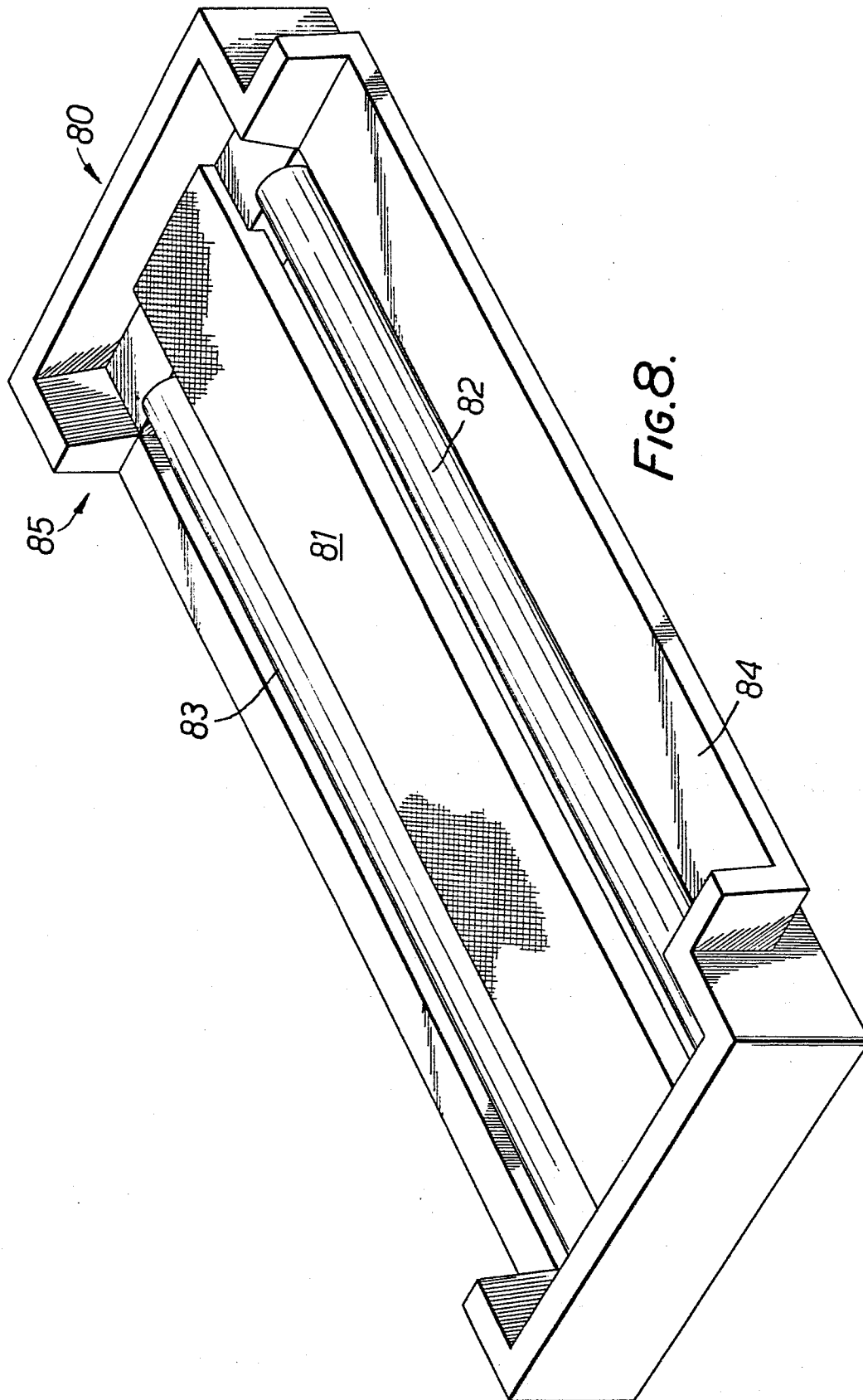


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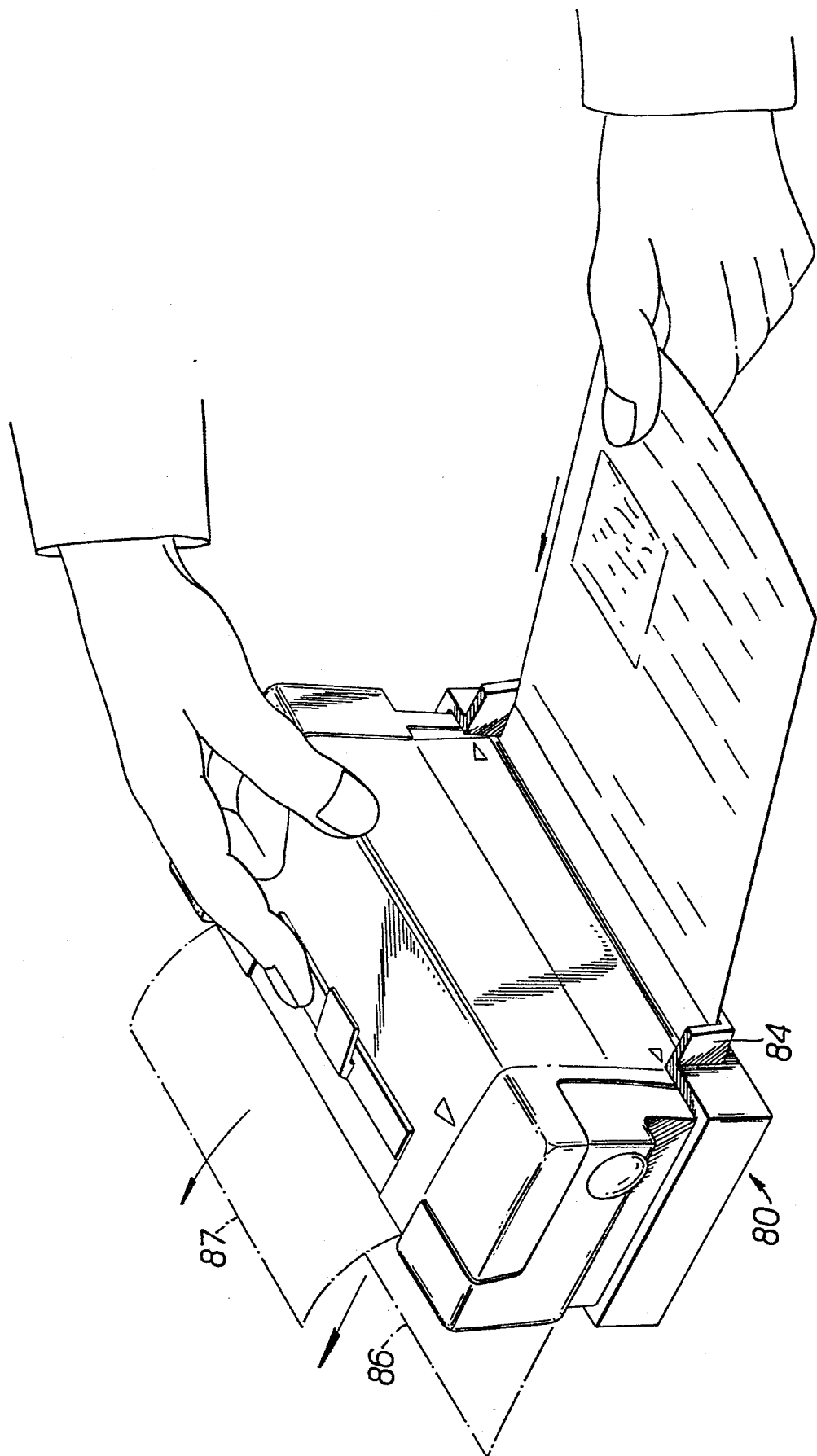


FIG. 9.

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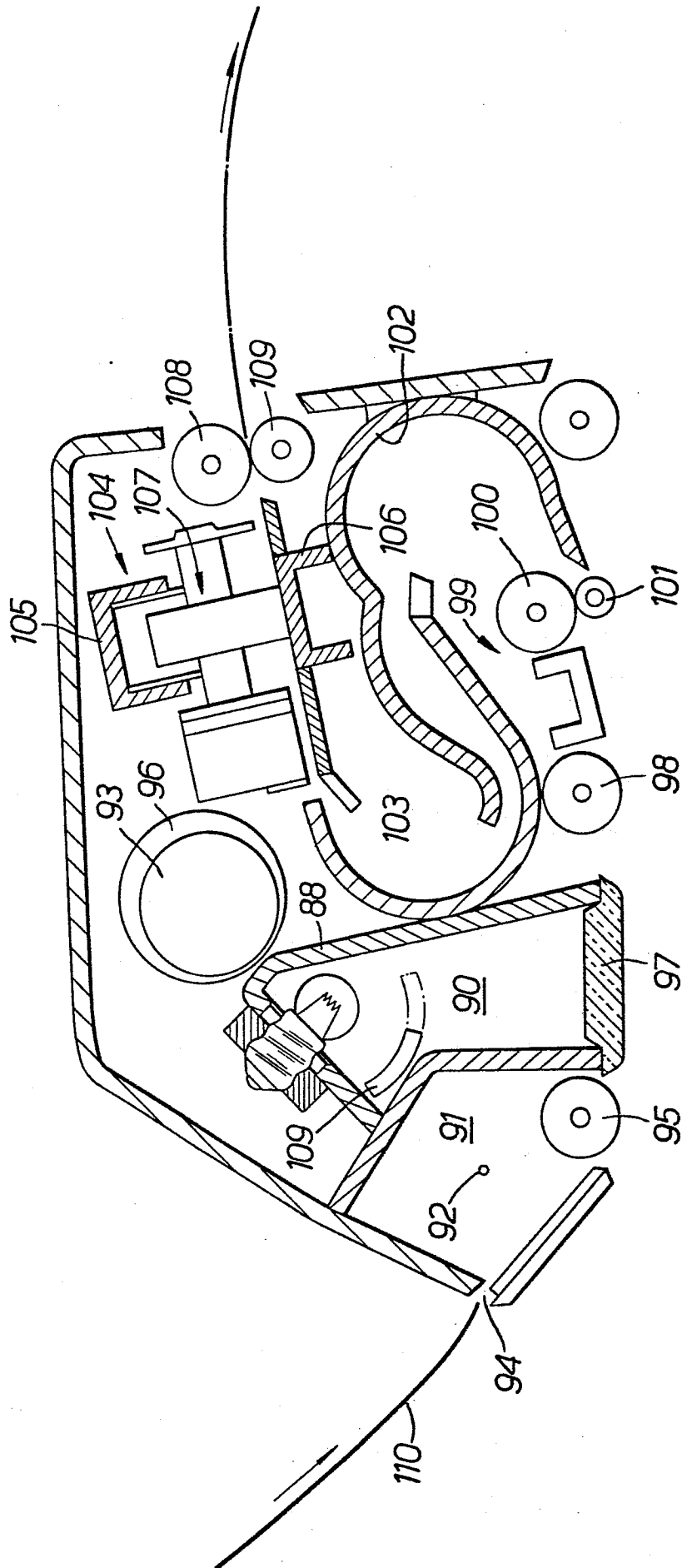


FIG. 10.



European Patent
Office

EUROPEAN SEARCH REPORT

0124660

Application number

EP 83 30 2400

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
Y	EP-A-0 056 313 (J.M. PAYNE) * Complete document *	1	G 03 G 15/22
Y	--- Patent Abstracts of Japan Vol. 5, no. 77, 21 May 1981 & JP-A-56-24379	1	
A	--- US-A-3 081 677 (W. LIMBERGER) * Figure 1 *		
A	--- DE-A-1 472 979 (KALLE) * Claim 1 *		
D,A	--- US-A-4 305 330 (M. OGIHARA) -----		
			TECHNICAL FIELDS SEARCHED (Int. Cl. 3)
			G 03 G 15/00
The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 03-11-1983	Examiner HOPPE H
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