Dec. 17, 1968 R. RALSTON 3,416,863

DOCUMENT AND COPY SEPARATING SYSTEM

Filed May 11, 1966 2 Sheets-Sheet 1

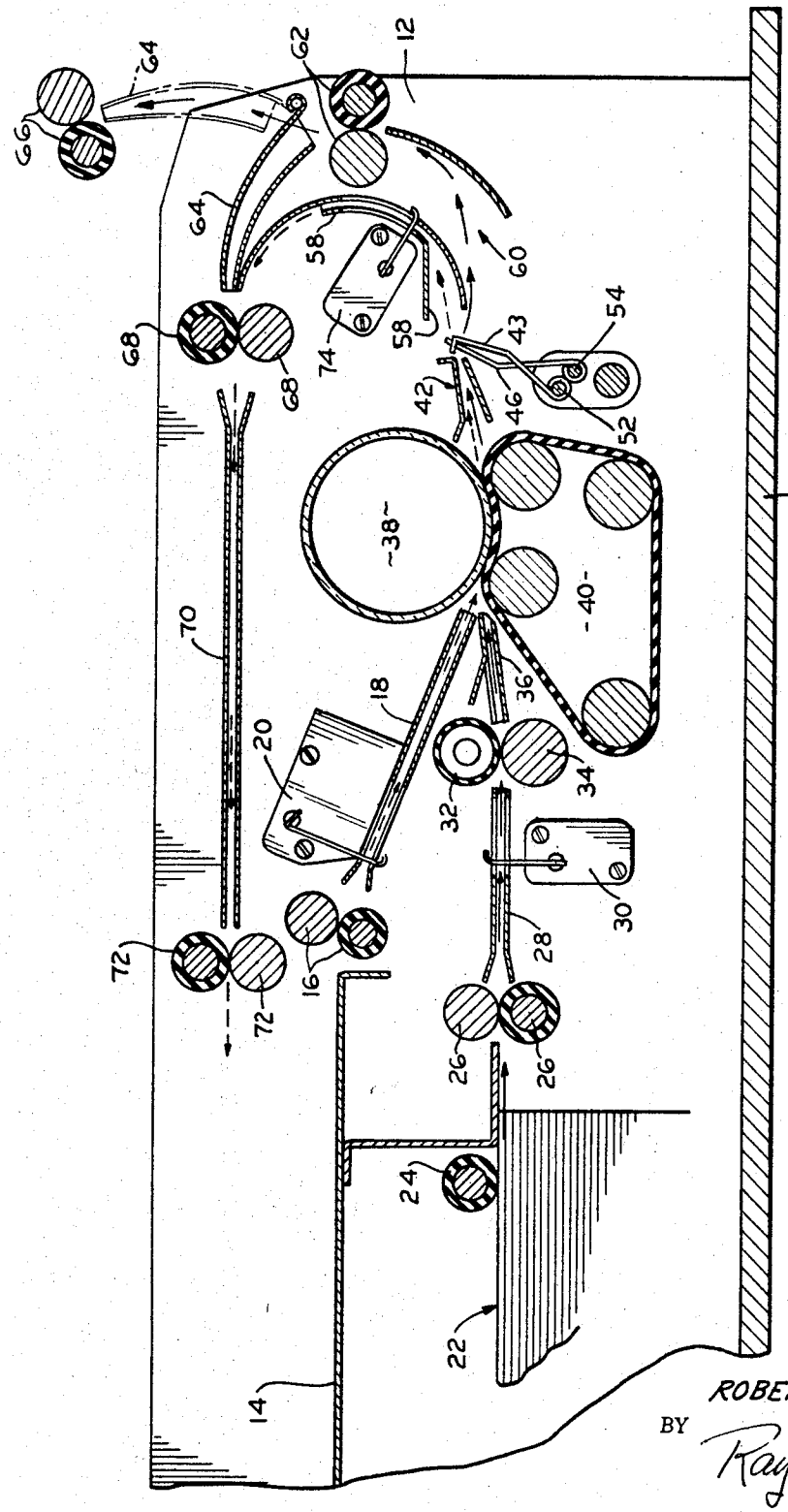


Fig. 1.

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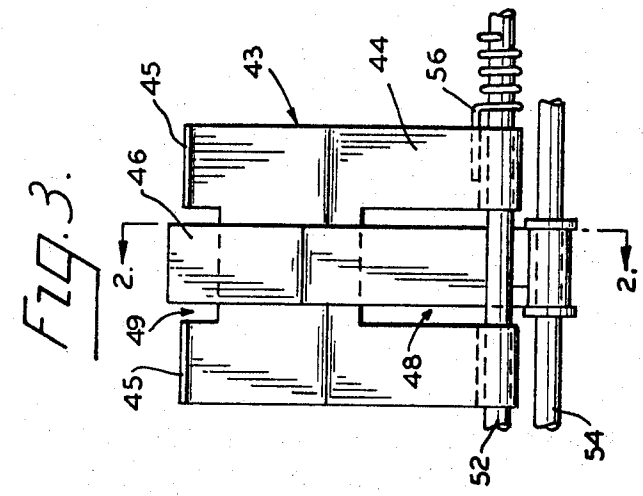


Fig. 3.

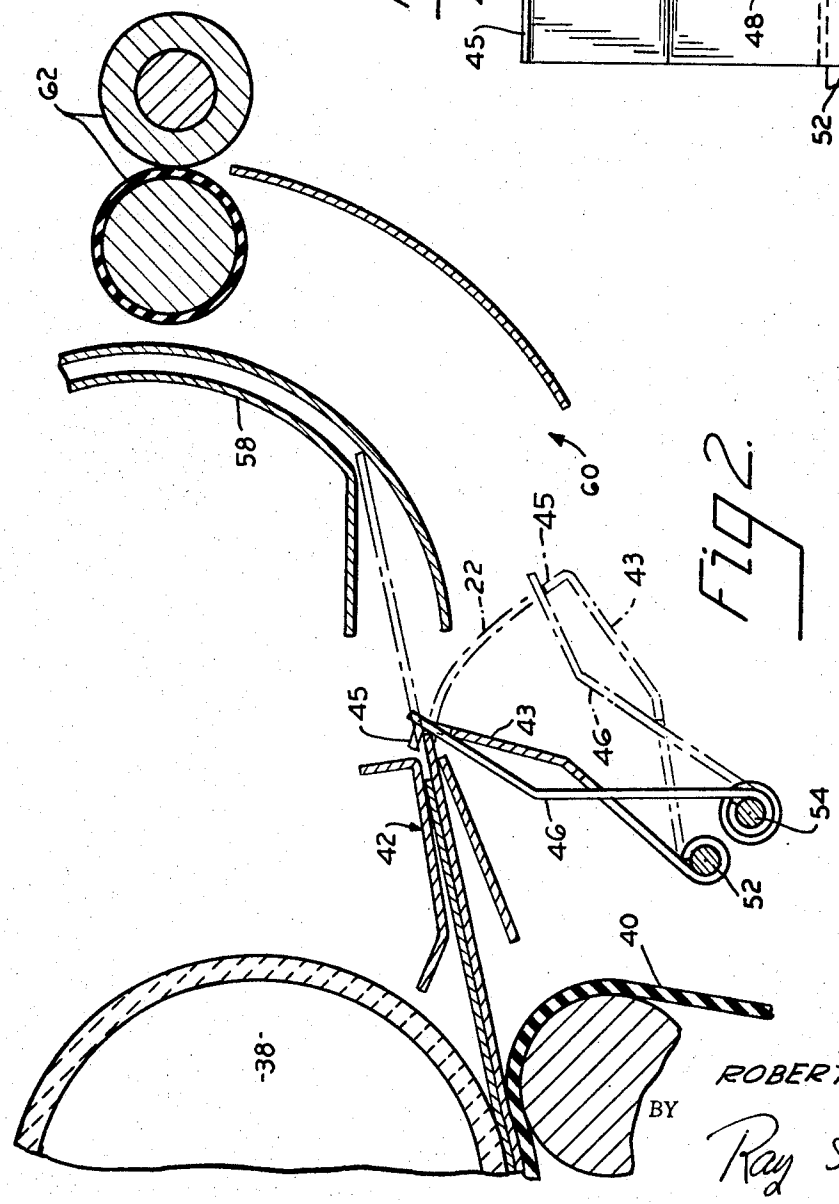


Fig 2.

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DOCUMENT AND COPY SEPARATING SYSTEM

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4 Claims. (Cl. 355—110)

BACKGROUND OF INVENTION

This invention relates to copying machines and to master imaging machines of the contact printing type and, more particularly, concerns means for controlling and sensing the movement and relationship of copy paper or master with the original matter to be copied, permitting interruption of the copying or master making process when an irregular condition arises.

For convenience, the description hereinafter is couched in terms of imaging masters from which additional copies may be printed by the lithographic process, but it will be understood that the making of ordinary photocopies is also contemplated whenever the comments are pertinent thereto.

Contact printing, in the sense herein used concerning business machines, involves a well-known technique of exposing a light-sensitive sheet through the subject matter to be copied, which is commonly referred to in the art as an "original," producing a latent image thereon and subsequently developing the image for use as a copy or as a master in conjunction with other reproduction processes.

A wide variety of materials may be used as copy sheets or masters, it being a primary requirement that they possess light sensitivity. In perfecting the image on a master, it is necessary to develop and fix the latent image or otherwise treat the master in accordance with the intended end use. In describing this invention, reference will be made to an electrophotographic master, which may be imaged by well-known electrostatic techniques. Imaging apparatus which handles electrophotographic masters includes development operations which apply either dry or liquid developer, the former usually followed by a high temperature fixing step. In the circumstances where the master is to be employed as a lithographic master, the electrophotographic sheet must also be treated with a conversion solution to give it the proper differential receptivity to ink and moisture.

It is a requirement of master imaging apparatus of the contact type that the original document be committed into the machine in order to effect a contact pressure. Contemporary apparatus of this general type requires manual collating of the original and master into an assemblage to assure proper placement of the sheets, and then hand feeding the assemblage into the machine. After exposure, the assemblage is manually intercepted, the original removed, and the master then manually fed into a machine for development. This procedure is time consuming and inefficient, although it assures proper placement of the sheets for exposure and also avoids the possibility of the original being carried through to the development step where it could possibly be damaged.

The prior art has many devices which conduct an original document and a copy sheet through a copy process, but the process is such that if the sheets are not separated there will be no harm done to the original. Those processes which use development harmful to the original do the processing in a separate step. This invention is novel in that it is directed to the concept of machine separation in a process that could be harmful to the original if processed with the copy sheet. Hence, no particular prior art is known which definitely relates to the invention as set forth in this description.

Object of the invention although very reliable, are subject to failure and that a back-up system for assuring the safety of an original document committed to a machine is required. The invention is based upon the concept that it is better to by-pass all material passing through the machine, than to have the original document destroyed by inadvertent passing along with the copy for processing.

Accordingly, it is an object of this invention that master imaging machine process the master and the original through the exposure of the master, and send the master through a guide path to a finishing operation without human intervention.

It is a further object and feature of such automatic imaging machine of this invention that the original be protected from accidently going through the developing step by being separated from the master after contact exposure has been completed.

Master imaging machines can be used as an integral part of more complex equipment, in which case the perfected master is utilized to duplicate a number of copies such as, for example, by lithographic means. The master sheet is mechanically transferred to and used by mechanism which will make use of it in this way.

Whenever this master is used in a device wherein the master is forwarded by the imaging machine to the duplicator without human intervention and multiple copies are produced from the master, then the master with an incomplete image or improperly located image should be diverted from the imaging apparatus to prevent the possibility of duplicating a large number of defective copies.

It is a primary object of this invention to provide an improved automatic master imaging machine capable of recognizing an irregular condition during imaging that results in a defective master or which could damage the original document, and of interrupting the imaging process to prevent damaging the original or production and forwarding of a defective master.

It is a further object of this invention to provide an improved imaging machine that will reject the assemblage of master and original in the event the original is not separated from the master after exposure.

It is yet a further object of this invention to provide an improved imaging machine that will reject the master if it has been improperly positioned on the original during exposure.

Briefly, in accordance with these and other objects of the invention, a contact printing apparatus involving the preferred embodiment of the present invention will comprise an arrangement of driving rollers and guide elements for moving and guiding the original sheet and the master sheet into the apparatus along an original path and a master path in predetermined relationship with one another. The apparatus includes an entryway for the original document, and a master feed assembly which feeds unexposed masters from a supply stack in response to the insertion of an original document into the entryway. An original document inserted into the machine engages a sheet sensing switch in a control circuit for apparatus which feeds a master sheet slightly in advance of the original in order to facilitate the later separation of the sheets.

The machine includes additional guide elements and rollers merging the two separate paths to a common delivery path which brings the original into superposed position on the unexposed master for delivery through the exposure station as an assemblage. Separating means are provided for separating the exposed master from the original document as the assemblage emerges from the exposure means, and for guiding the separated sheets along separate paths. The path into which the original is guided causes it to exit from the machine to a receiving station. The path for the master is provided with an ejection as-

sembly to side-track the assemblage should it pass the separation station without being properly separated.

As the description of the prefered embodiment of the invention proceeds, it will be seen that a detecting and diverting means is provided for ascertaining the presence of an original sheet in the original sheet path leading to a safe recovery and by-passing a path through the processing station. In the event that there is no sheet in the original sheet path, indicating that the original sheet is safe, then the diverting means directs all copies back to the operator and by-passes the path to the processing station. This invention operates on the principle that two paths are provided, one for the original document which is submitted for copying, and one for the exposed copy made in the machine. The separator is intended to separate the original and the copy into the respective paths. Should the separator fail, then there are two possibilities:

(1) Both copies will go in the original path and be ejected from the machine. In this event, no harm is done except a waste of one piece of copy material;

(2) Both copies will go into the copy path and ostensibly be directed to a processing station. In this latter event, this invention contemplates a diverting means in the copy path which by-passes the process, and is made inoperative only if the copy path detecting means senses the presence of the original or the original and the copy in the original path.

In accordance with these and other objects which will become apparent hereinafter, the best mode contemplated for the present invention is disclosed in the accompanying drawings.

THE ILLUSTRATED EMBODIMENT OF THE INVENTION

FIGURE 1 is a diagrammatic section elevation illustrating the machine of this invention;

FIGURE 2 is a detailed elevation of the sheet separator assembly drawn to a larger scale than FIGURE 1, together with the entrance way to the two sheet paths; and

FIGURE 3 is an elevation view of the actual sheet separator shown in side view in FIGURES 1 and 2.

The drawings set forth details of a working embodiment of the invention to the degree necessary to teach its construction, operation, and result. A base **10** of the machine supports vertically extending framework and housing members, such as the sidewall **12**. A table surface **14** at the front of the machine is provided for operator convenience. Here an original document may be placed in position for easy insertion into a pair of drive rollers **16**. The drawings do not set forth an electrical wiring diagram, because such diagram is obvious to a mechanic skilled in the art. It will be understood that power is supplied to drive the various electrical components to which referenec is made, including the drive rollers **16**.

The drive rollers **16** take the original document and drive it into a guide **18**. As the document enters the guide **18**, it is caused to abut the actuation arm of switch **20**.

Whenever a document and copy sheet are coordinated manually, they may be positioned one before the other, or in exact alignment, according to the desire of the operator. Usually, if separation is not to be accomplished, an exact alignment is acceptable. The separation device shown in the preferred embodiment of this invention requires the copy master to be slightly advanced with respect to the orignal document to be copied. Hence, the switch **20** is operative to bring the drive rollers **16** to an abrupt halt, such as by opening a clutch device which drives the rollers. This stopping action will position the original document with respect to the actuating arm of the switch **20**. The position will be accurately ascertainable. Then, it becomes necessary to place a copy sheet into a related position and advance the two sheets into engagement.

One type of copy material which is quite readily handled in the equipment illustrated is a master for use with a lithographic printing system after it has been processed. Such material is preferably kept in subdued lighting when not actually used, because it is photosensitive. A stack of such photosensitive material is shown placed in the body of the device under cover of the table **14**. The sheets of this stack will be refered to as a sheet **22**, or collectively as stack **22**.

The switch **20** is in a circuit which controls a drive device operating a feed roller **24**. Roller **24** is similar in most respects to the paper feed rollers found in offset printing machines. Thus, activation of the roller **24** will cause the top sheet **22** of the stack to advance into a mated pair of drive rollers **26**. Rollers **26** pick up the copy sheet and advance it into a guide **28**. A switch **30** located with its actuation arm across the path established by guide **28**, will be actuated by the edge of the sheet **22** as it comes through the guide **28**. Actuation of switch **30** will be established whenever the forward edge of the copy sheet reaches a precise location in the guide **28**. Thus, the location of the forward edge of the copy sheet in guide **28** with respect to location of the forward edge of the original document in guide **18** is readily established. Therefore, the circuit is provided such that actuation of the switch **30** will reactivate the drive rollers **16**, and advance the original document along with the advance of the copy sheet. The location of the switches is provided with respect to one another such that the speed of the drive rollers **16** and **26** will advance the original and copy sheets respectively to cause them to meet with the copy sheet slightly in advance of the original sheet to be copied.

The copy sheet, after passing switch **30**, is caused to enter between an electrostatic device **32** and drive roller **34**. An electrical charge is placed upon the surface of the sheet **22** by device **32** in the known manner for electrostatic image development. The sheet is directed from the roller **34** into a guide **36**. The guide **36** and the guide **18** direct the respective sheets to meet and advance in superposed relationship, and if the switches **20** and **30** are properly located, the copy sheet will arrive first and hence be a slight distance forward of the original sheet.

An exposure device **38**, preferably a high intensity light emitting device, is provided to expose the superposed sheet couple, and cause a discharge of the copy sheet everywhere except under the indicia on the original document, and to the extent of the shading of that indicia. This is a well known imaging phenomenon. A belt drive system **40** employing an endless belt and several drive rollers is used to cause the superposed sheets to move along the surface of the exposure device **38** in tight contact for such exposure purposes.

A guide **42** is located at the discharge side of the exposure device **38**, and causes the superposed sheets to advance to a separator **43**. Separator **43** is designed and configured to take hold of the advanced end of the copy sheet and pull it away from the original document. Then, such separation is used to cause the two sheets to enter two separate paths for further processing.

Reference to the FIGURE 3 illustrates the separator device **43** in more detail. A swinging hook arm **44** acts as a passive diverter. Hook ends **45** are positioned to trap the end of a sheet ejected from guide **42**. Arm **44** will be pushed by the sheet, and pivot about its center as it swings, pulling the trapped end of the sheet along in a curved path.

A stripping arm **46** operates in conjunction with the separator arm to sweep outwardly toward the ends of the hooks **45** and push the trapped copy sheet off of the separator arm at the proper location.

The separator arm has an H configuration created by a slot **48** and an opposed slot **49**. The arm **44** is mounted for swinging movement by means of a rod axis **52**, and the stripping arm **46** is mounted by a rod **54**. The axis **52** and **54** are located, as shown in FIGURES 1 and 2, in such a manner that swinging movement under drive of a projecting sheet will cause the stripping arm to ride over

the bridging portion of the H shaped configuration of arm **46**. This pivot action during swing acts to sweep the end of arm **46** outwardly with respect to the hook end **45**. Thus, any sheet of paper which may be located in the hook of the arm **44**, although it will have no self tendency to separate, will be pushed out of engagement by this pivoting, stripping action.

A torsion spring **56** on the rod axis **52** urges the combination of arm and separator to move up against the discharge end of the guide **42**, and the drive of the superposed sheets coming through the guide **42** causes the drive swing of the separator **43** from the rest position to the actuated position as shown in the dotted outlines in FIGURE 2. The master sheet **22**, when grasped by the separator device and pulled downwardly as the separator swings about its axis, will be caused to form an arc. At some place prior to the end of the swing of separator **43**, sheet **22** will lose its holding contact with the hook end **45**. It will then tend to snap upwardly because of its bent condition artificially induced by the swinging action of the separator.

The inherent stiffness of paper is also employed as a means to cause the original document to hold in its path of projection through the guide **42**. Note that the path of the superposed sheets through the exposure station between the device **38** and the belt **40** is a curved path induced by the nature of the endless belt and curved surface. Such curvature tends to cause the superposed sheets to advance upwardly through the guide **42**. This upward tendency will hold the original document against drooping whenever the copy sheet is grasped in the hook ends and pulled downwardly. Two relative paths are thus created, as suggested by the dotted arrows in FIGURE 1 representative of the original document, and the solid arrows representative of the copy sheet.

A guide **58** is placed to accept the projecting original sheet and to guide the original sheet around a curved path and back toward the direction in which it was originally inserted into the machine.

A guide **60**, which is a somewhat curved sheet, forms an impingement surface to intercept the extension of the copy sheet, and cause a deflection of the copy sheet into a pair of drive rollers **62**. At the discharge of rollers **62** is a swingable diverter guide member **64**, which is somewhat similar to a track switch in function. Diverter guide **64** has a normal path position as shown in full lines in the FIGURE 1. Hence, any copy sheet which passes through the drive rollers **62** and into the diverter guide **64**, will be caused to return in the direction of table **14**.

If the diverter **64** is moved into the position shown in phantom outline, however, then the copy sheet is caused to move to a pair of drive rollers **66**. From there the sheet is caused to move into another piece of apparatus which is not shown, but which ostensibly will process the copy sheet in some manner which would normally be deleterious to the original document. Hence, entrance into rollers **66** is to be avoided by the original document.

This invention provides a means to select the position of the diverter **64** in order to present the guide extension in the phantom outline position only whenever the original document is clearly secure in its own path **58**.

Drive rollers **68** are placed in position to receive a sheet from either the original path produced by the guide **58**, or the copy path as dictated by the full line position of the diverter **64**. Any sheet, or sheets, reaching the drive rollers **68** is caused to enter into a guide **70** and to a pair of discharge drive rolls **72**, where the sheet is delivered back out to the operator.

A switch detector **74** is located with its actuation arm in position to detect the presence of any sheet material in the path created by guide **58**. A circuit, which is not illustrated, is controlled by the guide **74** such that if the actuator of the switch is in the presence of a sheet of material, then and only then the diverter **64** will be moved to the phantom outline position as shown in FIGURE 1. Hence, if the separator **43** operates as it should, and an original and copy sheet are moved from the guide **42** and properly separated, then the original document will signal via the switch **74** that it has arrived safely and the diverting guide **64** will move to permit the copy sheet to pass into the rollers **66** and go for further processing.

In the event that the separator does not operate properly, and both of the sheets are caused to move into the copy sheet path and into the rollers **62**, then there will be no sensing by the switch **74** and diverter **64** will remain in the full line position as shown. Both the copy and the original will then be driven by the rolls **68** through the guide **70** to the exterior of the machine without being processed.

Finally, if by any chance the copy sheet drops free of the separator **43** prematurely, or for any other reason, both the copy and the original sheets pass into the guide **58**, the signal detector **74** will indicate the presence of sheet material in the guide **58**, and the diverter **64** will operate to permit a copy sheet to be further processed, but this action will be a harmless movement because, in fact, there is no copy sheet available in the path **60**.

Whereas the present invention has been shown and described herein what is conceived to be the best mode contemplated, it is recognized that departures may be made therefrom within the scope of the invention which is, therefore, not to be limited to the details disclosed herein, but is to be afforded the full scope of the invention as hereinafter claimed.

I claim:

1. In a master imaging apparatus of the contact printing type for imaging a light-sensitive copy sheet through an original sheet comprising:

exposure means;

a copy sheet treating station;

a receiving station;

means for guiding said original and copy sheet in superposed relation into a common path adjacent said exposure means;

separating means for parting said sheets as they leave said exposure means;

path means for directing said sheets after separation to respective separate stations, said sheets assuming a predetermined excursional relationship with one another;

detecting means disposed in said path means for sensing the establishment of said predetermined relationship; and

ejection means operative responsively to said detecting means when said predetermined relationship is not established directing said copy sheet and said original to said receiving station.

2. In a machine as defined in claim **1**, said path means composed of a first guide means from said sheet separator constituting a conveyor path to a first route, a second guide means from said sheet separator constituting a conveyor path to a second route;

said ejection means located in said second guide means and having an active condition for deflecting sheet material out of said second guide means, and having a non-active condition; and

control means operative in response to said detecting means for holding said ejection means non-active only when said detecting means is in the presence of sheet material in said first guide means.

3. A copying machine of the contact printing type for imaging a light sensitive copy sheet from an original sheet, comprising:

exposure means;

means for guiding an original and a copy sheet in superposed relationship into a common path passing adjacent said exposure means;

separating means for parting said sheets as they leave said exposure means;

guide means for directing said copy sheet after separa-

tion into a copy sheet path leading from said separating means to said treating means;

guide means for directing said original sheet after separation into an original sheet path leading from said separating means in a diversion route with respect to said treating means; and

detecting and diverting means for directing any sheet in said copy sheet path into a by-pass with respect to said treating means in the absence of a sheet in said original sheet path.

4. A copying machine of the contact printing type for imaging a light sensitive copy sheet from an original sheet, comprising;

exposure means;

means for guiding an original and a copy sheet in superposed relationship into a common path passing adjacent said exposure means;

separating means for parting said sheets as they leave said exposure means;

guide means for directing said copy sheet after separation into a copy sheet path leading from said separating means to said treating means;

a by-pass from said copy sheet path, and a deflector means having a first position for diverting sheets from said copy sheet path to said by-pass and a second position coordinated with said path to said treating means;

guide means for directing said original sheet after separation into an original sheet path leading from said separating means in a diversion route with respect to said treating means;

detecting means for ascertaining the presence of an original sheet in said original sheet path; and

means operative in response to said detecting means for holding said deflector means in said second position only when said detector means is in the presence of sheet material.

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U.S. Cl. X.R.

271—64; 355—106