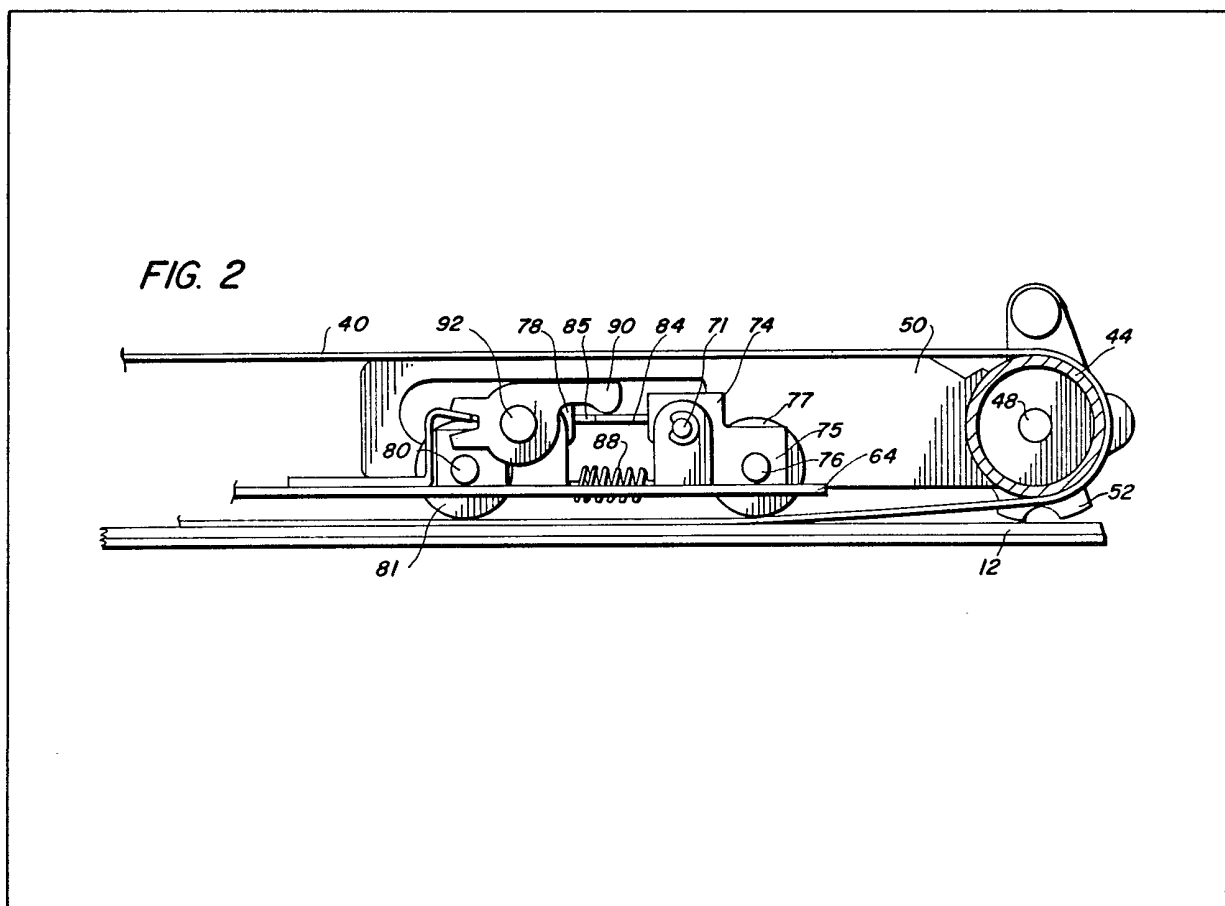


(21) Application No **7944304**
(22) Date of filing **21 Dec 1979**
(30) Priority data
(31) **3438U**
(32) **15 Jan 1979**
(33) **United States of America (US)**
(43) Application published
3 Sep 1980
(51) **INT CL³**
B65H 29/18 9/06
(52) Domestic classification
B8R 533 671 AR2
(56) Documents cited
None
(58) Field of search
B8R
(71) Applicant
Xerox Corporation, Xerox Square, Rochester, New York, United States of America
(72) Inventor
Ronald M. Nekula
(74) Agent
Nicholas J. Prior

(54) **Document handling apparatus**

(57) An automatic document handler having a tray for supporting documents to be copied for supplying to and removing documents from the platen (12) of a copying machine includes a register against which the document trailing edge is abutted through reversal of a platen transport. The platen transport comprises an endless belt conveyor (40) supported above the platen (12), with normal sag in the belt or its catenary allowing the belt to contact the platen to provide the driving force for moving a document across the platen. An anti-skewing pair of roller devices (77, 81) are provided to force the belt (40) down against a document and platen (12) to provide a greater force between the belt and the platen to assure positive driving of the document over the register for return of the document to the tray (14).



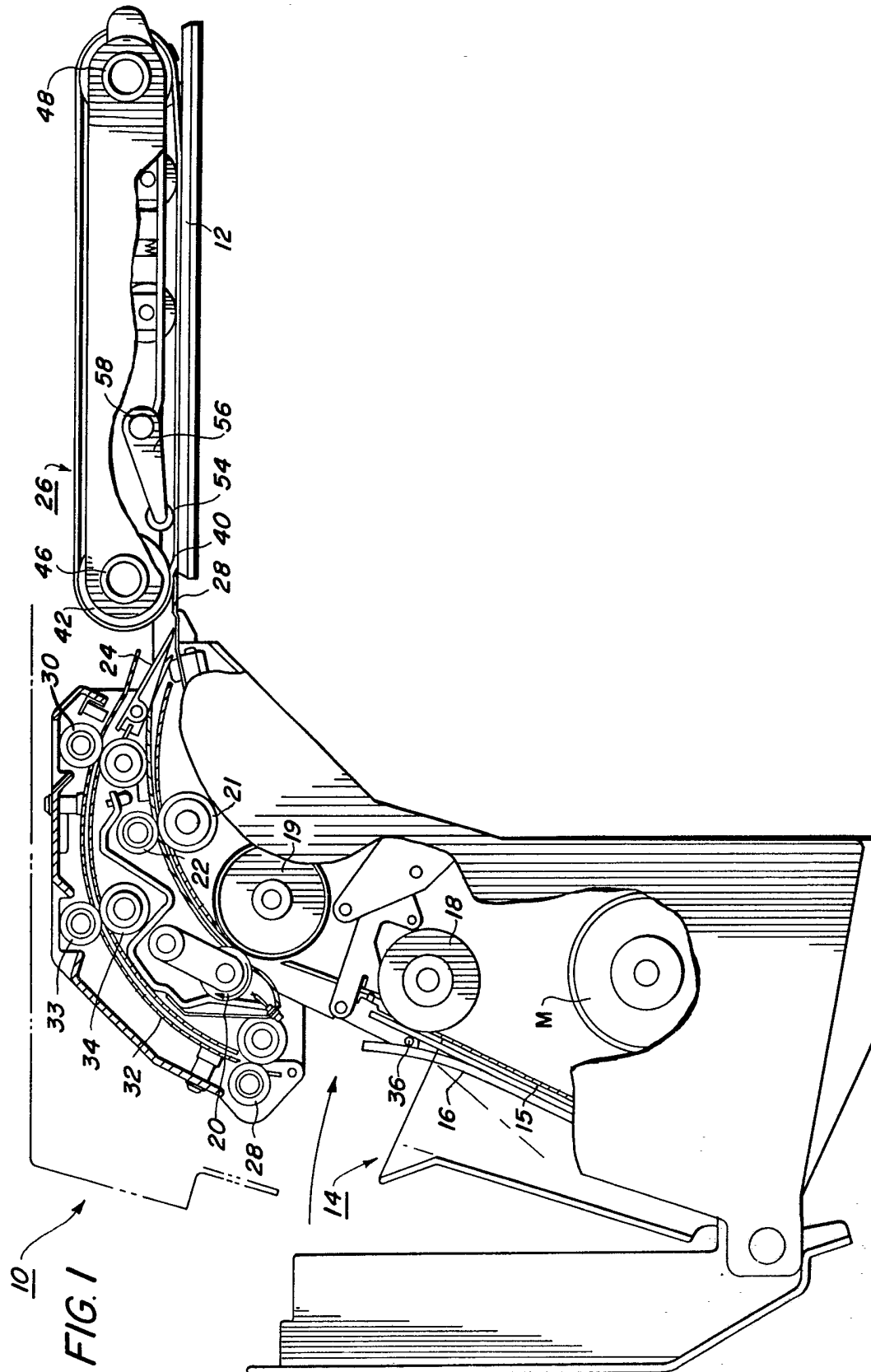


FIG. 2

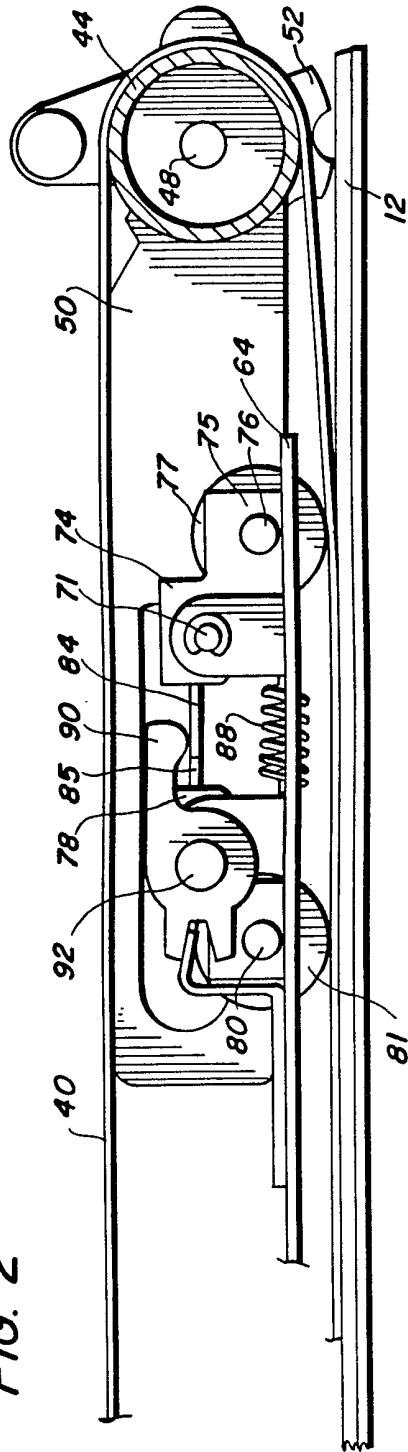


FIG. 3

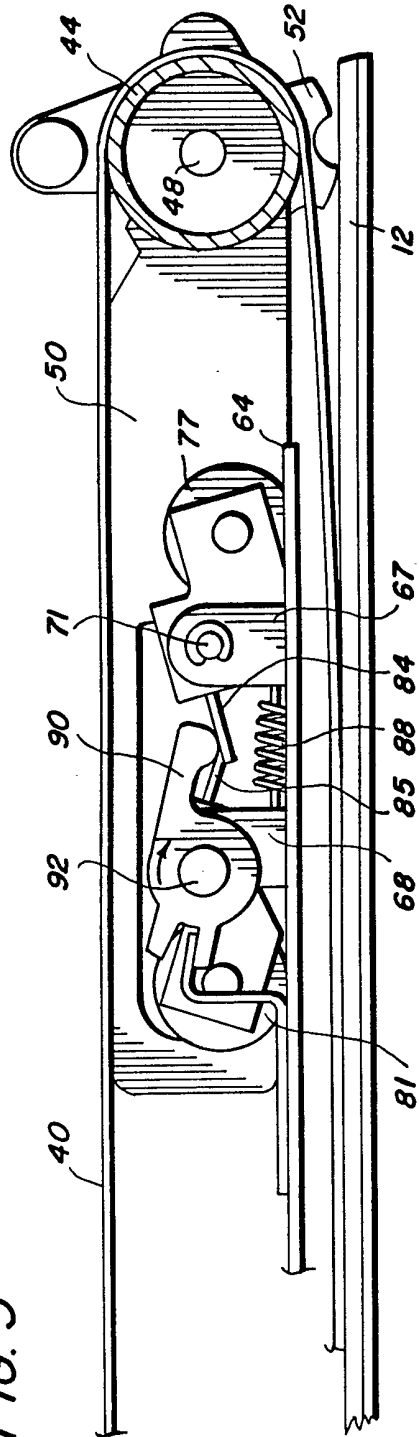
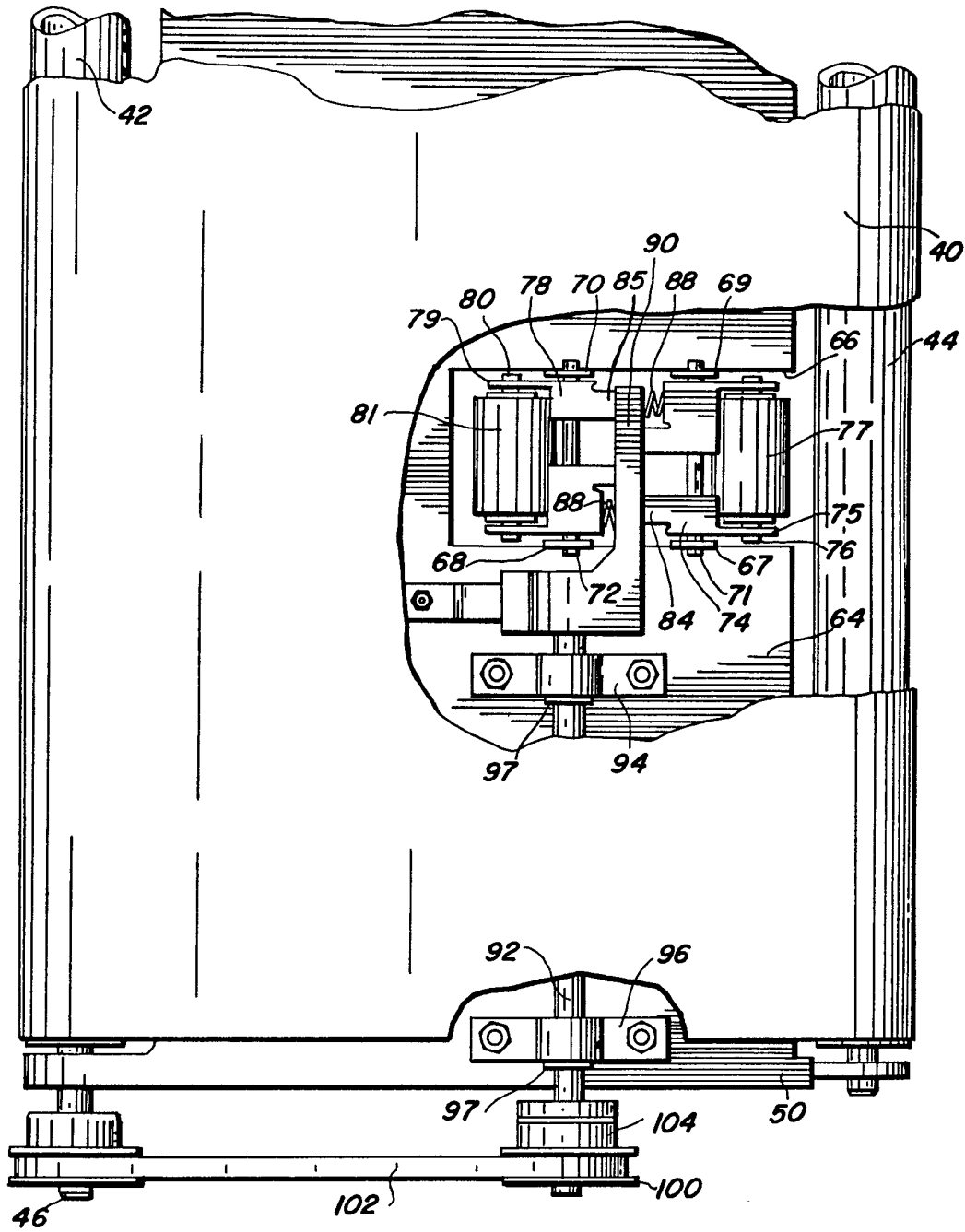


FIG. 4



SPECIFICATION

Document handling apparatus

5 With the advent of high speed copiers, such as xerographic reproduction machines, automatic document handlers are required to rapidly place and remove documents from the illumination platen of the copy machine to enable the machine to produce
 10 copies at its full potential. The document handler must first separate the document to be copied from a stack of others awaiting copying. Following this, the document must be brought into position on the platen, then registered for proper optical alignment and
 15 transported back to the stack to await its turn in another copying cycle.

To assure that the document is positively driven onto the platen of the copy machine and accurately registered, a substantial nip pressure is employed
 20 between the rolls or belts utilized to feed the document onto the platen. However, the document must always be handled with care to avoid tearing, creasing or other mutilation thereto. This, of course, is particularly true where the original is one of a kind.

25 In the U.S. patent No. 3,941,376, commonly assigned with the present invention, there is disclosed an automatic document feeder employing a platen belt which is spaced above the platen to minimize generation of static electricity. This spacing also reduces wear and tear on the platen belt and
 30 platen glass which would ordinarily be encountered if the belt were in contact with the platen glass along its entire length.

To provide for positive feeding of the document
 35 onto and off the platen, a spring biased roller is provided adjacent the registration edge to provide line contact between the platen belt and the platen. While this provides a dramatic improvement in the document handling capabilities of the document
 40 handler disclosed, the nip force beneath the biased roller between the belt and the platen glass may be sufficient to wrinkle or otherwise damage a lightweight document as the document is driven against the registration edge for location of the document on
 45 the platen prior to copying.

In U.S. patent No. 3,889,943 commonly assigned with the present invention, there is disclosed an automatic copying machine including a transport belt adapted for cooperation with the platen of the
 50 copy machine for moving documents onto and off of the platen. A register edge movable up into and down, out of the document path is adapted for movement into the document path after the document is placed on the platen, after which the platen
 55 belt is reversed to force the document against the registration edge for proper positioning of the document on the platen. Internal roller means are provided for supporting the transport belt therearound such that an operating run of the belt is
 60 stretched across the platen surface.

The roller means includes belt supporting rollers adjacent the side boundaries of the platen surface with the belt operating run extending therebetween across the platen surface. The belt rollers are rotatably supported in substantially parallel relationship

such that the outer surface of the portion of the belt wrapped about the rollers is spaced slightly above the plane of the platen surface. With this arrangement, the sag or catenary of the operating run of the
 70 belt rests upon the platen during transporting of a document. A pressure roller is disposed opposite the platen surface and registration edge for contact with the belt to force the portion of the belt riding thereagainst downwardly against the registration edge
 75 when the registration edge is in the "up" position to provide a driving force therebetween for feeding the document onto the platen.

Movement of the registration edge into the "down" position, causes the pressure roller to force
 80 the portion of the belt riding thereagainst downwardly into contact with the platen to provide a positive driving force for removing the documents from the platen. The driving force for moving the document against the register edge after it is placed on
 85 the platen is provided by the force generated between the belt and the platen glass due to the sag of the belt between the pressure roller and the rear support roller.

In addition to the above-referred to patents, other
 90 patents directed to the general subject matter of document handling relative to document exposure are U.S. patent No. 3,829,082 which discloses details for controlling movement of a register edge, and U.S. patent No. 3,874,651 which discloses specific
 95 details of the register edge per se. U.S. patent No. 3,944,209 which discloses the use of rollers for forcing a plurality of narrow document tracking belts into grooves during transporting of documents is not concerned with transporting documents across a
 100 platen. U.S. patent No. 4,023,791 discloses a plurality of front and rear rollers engaging cooperating document feed belts on a full-time basis as a necessary part of the document transport apparatus.

The present invention is an improvement to the
 105 document handling apparatus disclosed in the above-referred to patent, U.S. patent No. 3,889,943. The conveyor device which transports documents onto and across a platen for exposure is provided with anti-skew roller devices which are coordinated
 110 for use after registration of the document to aid in its return to a supply stack. The host machine logic is adapted to program use of the rollers so that a low drive force will be produced during registration and a high driving force for driving documents off the
 115 platen at high speeds.

It is, therefore, a principal object of the present invention to improve automatic document handling apparatus by eliminating time lags in moving a document off a platen preparatory to the time feeding of a succeeding document thereon.

It is another object of the invention to eliminate damage to documents in document handling apparatus having a transport belt arranged to move a document against a registration device at high
 125 speeds. Other objects and advantages will become apparent after reviewing the following description taken in conjunction with the accompanying drawings wherein:

Figure 5 is an elevational view in cross-section
 130 showing a document handler incorporating the

improved document anti-skew feature transport of the present invention in operative association with a document copying machine;

Figures 2 and 3 are partial, enlarged elevational views illustrating the anti-skew device of the present invention in two different positions of operation; and

Figure 4 is a partial plan view of the platen transport of the present invention with the anti-skew device actuating mechanism.

Referring to the drawings, there is shown a document handler designated generally by the numeral 10 incorporating the platen transport of the present invention. Document handler 10 may be used with any suitable document reproduction machine which has a platen 12 on which the document to be copied is placed. Document handling apparatus 10 includes a supply tray 14 for storing both documents 15 to be copied and documents 16 already copied. From tray 14, one document at a time is advanced from the bottom of supply 14 by an intermittently operated primary feed or separator roll 18 into the nip of retard roll pair 19, 20. The lower roll 19 is driven in a document feeding direction while the upper roll 20 is driven in the reverse or document reject direction through a suitable slip coupling which normally enables the lower roll 19 to override the reverse drive input to roll 20 and thereby turn roll 20 in the document feeding direction. However, if two or more documents enter the nip of roll pair 19, 20, the reduced friction between the overlapping documents reduces the frictional drive force between roll pair 19, 20, permitting the slip clutch to engage and drive roll 20 in the reverse, document rejecting direction.

The document emerging from retard roll pair 19, 20 passes into the nip of intermediate roll pair 21, 22 and from there underneath deflector plate 24 to platen transport generally indicated by the reference numeral 26. Transport 26, which comprises a belt-type conveyor, first carries the document forward onto platen 12 until the entire document is positioned thereon. Transport 26 is then reversed to bring the document trailing edge against a register 28. Register 28 locates the document in copying position following which a copy or copies are made by the reproduction or copying machine.

When copying is completed, the platen transport 26 is again started in reverse to move the document backwards off platen 12, register edge 28 being previously retracted for this purpose. The deflector 24, which was previously lowered, guides the returning document upwardly into the nip of return roll pair 30. The roll pair 30 moves the document along suitable return guides 32 through second and third return roll pairs 33, 34 respectively, and back into tray 14.

To maintain documents which have been designated for convenience by the numeral 16, segregated from documents 15 awaiting copying, and prevent inadvertent or premature refeeding of the returned documents 16 by the separator roll 18 following feed of the last one of the documents 15, a displaceable bail or separator bar 36 is provided. The bail bar 36 is disposed substantially opposite to and above the separator roll 14 to prevent documents resting thereon from contacting roll 18. The bail 36

may be reset onto the top of the documents in tray 14 when it is desired to refeed the documents to the copying machine. For a complete description of mechanisms suitable for moving the bail bar 36, register 28 and deflector 24, reference may be made to the aforementioned U.S. patent No. 3,941,376.

Referring particularly to Figures 2, 3, and 4 of the drawings, the platen transport 26 consists of an endless, flexible belt 40, the outer surface of which is light reflective. One such belt construction is disclosed in U.S. patent No. 3,482,676 to George E. Fackler. The platen belt 40 is stretched about drive and idler roll pair 42 and 44, respectively, with the rolls being arranged on opposite sides of platen 12 with the axis of roll 42 being above register 28 while that of roll 44 is above the far side of platen 12. Each of the rolls 42, 44 includes a shaft 46, 48 respectively and these are rotatably supported in sides 50 of the platen transport 26. The sides 50 each carry a downwardly depending adjusting member 52 adjacent idler roll 44 which contacts the platen 12 to provide the required spacing of the platen belt 40 above the surface of the platen. The dimension and mounting of the belt supporting roll pair 42, 44 and the adjustment of the member 52 is such that the sag or catenary of the operating run of the platen transport belt 40 therearound slightly touches the platen 12 as seen in Figure 3.

An internal pressure roll 54 (see Figure 1) is provided between the runs of the belt 40 and is movable into contact with the lower run adjacent the inlet to the platen to force the belt 40 against register 28 when the same is in the UP position. It should be noted that the pressure roll 54 does not force the belt 40 into contact with the platen adjacent register 28. The roll 54 is rotatably supported by arms 56 which in turn are pivotally carried from cross shaft 58 which is supported on the sides 50 of the transport. Suitable springs (not shown) force arms 56 and pressure roll 54 downwardly such that the roll 48 forces a line portion of the belt 40 into contact with the upper edge of register 28. As a result, a line-like portion of the platen transport belt normally rides against the edge of register 28 to provide a nip force therebetween for driving the documents onto the platen 12. By this arrangement a positive driving force is provided between the belt and the register edge to drive documents onto the platen while an absolute minimum force between the belt and the platen glass is provided to force the document against the registration edge when the platen belt is reversed for registering the document, thereby providing minimal wear and tear on the document to be copied. It will also be understood that upon movement of the transport belt 40 in the reverse direction to drive a document over the register 28 now in its lowered position, the roll 54 forces the belt into positive engagement with the lead edge of the document thereon to provide sufficient force between the platen belt and the document for positively driving the document off from the platen preparatory to the placement of the succeeding document.

This driving of the document off the platen by the transport belt 40 often produces skewing of the document since portions of the leading edge of a

document or a corner thereof, in this movement, often becomes momentarily in contact with the edge of the register 28, or various sections of the belt 40 may have more or less frictional engagement with the document. This skewing action more often is unpredictable in its directional path and its extent. A skew document will not correctly enter the various transport rolls 30, 33, 34 and guides of the document handling apparatus and will cause damage to documents. A skewed document may also become mistimed if there is also a hesitation in its movement off the platen. This effect could interfere with the succeeding timed document and may also impact timed jam detection sensors and circuits.

As shown in Figures 2, 3, and 4, a document transport belt 26 assembly is provided with a plurality of rollers positionable between the sides 50 thereof and the belt runs of the transport belt 40. Extending between the sides 50 is a horizontally disposed support plate 64 formed with a rectangular cutout portion 66. One edge of the plate 64 adjacent the opening 66 is formed with two upstanding ears 67, 68 while the opposite edge of the plate 64 in the opening 66 is formed likewise with upstanding ears 69, 70. The ears are arranged so that the ear 67 is in alignment with the ear 69 and the ear 68 is in alignment with ear 70. The ears 67, 69 and 68, 70 are formed with aligned openings for receiving shafts 71 and 72 respectively. The shaft 71 rotatably supports a bracket 74 having a pair of arms 75 extending at an angle therefrom in parallel and opposed. The arms 75 are formed with aligned openings for receiving a shaft 76 having a roller 77 secured thereto for rotation therewith within the openings formed in the arms. Similarly, the shaft 72 rotatably supports a bracket 78 which has extending therefrom arms 79 formed with aligned openings for rotatably receiving a shaft 80. The shaft 80 rotatably supports a roller 81 which is similar to the roller 77 both of the rollers being positioned in the opening 66 formed in the plate 64.

The bracket 74 is also formed with an actuating arm 84 which extends generally in an opposite direction from the arms 75 supporting the roller 77. Similarly, the bracket 78 is formed with an arm 85 which is positioned opposite the arms 79 for the roller 81. It will be obvious that upon downward movement of the actuating arms 84, 85 the brackets 74, 78 respectively will be rocked in opposite directions thereby producing lifting action of the rollers 77, 81 respectively. As shown in Figure 2, the rollers 77, 81 are arranged to contact the lower run of the belt 40 this normal action being provided by a pair of springs 88 having their ends connected to lower portions of the brackets 74, 78. The springs 88 normally bias the two rollers 77, 81 downwardly to force the lower belt run into engagement with a document on the platen 12 to increase the friction between the document and the platen.

Lifting of the two rollers 77, 81 in order to remove the pressure upon the lower run of the belt 40 is provided by an intermittently rockable actuator arm 90 mounted for rocking action by a drive shaft 92 journaled for rotation by means of brackets 94, 96 secured to the support plate 64. Suitable bearings 97 mounted in the brackets 94, 96 support the drive

shaft 92 for rotation relative to the transport assembly 26. Actuation of the member 90 downwardly as viewed in Figures 2 and 3 will cause simultaneous downward movement of the arms 84, 85 as shown in the position of Figure 3 relative to that shown in Figure 2. Rotation of the shaft 92 is produced by means of a pulley 100 mounted outwardly on the shaft 92 and a constantly driven belt 102 which is connected to the machine drive system by way of the belt 102 being connected to the constantly driven roller 42 for the platen transport. The roller 42 is suitably connected to the drive system for the document handling apparatus 10 which includes the motor M. Details of the drive system will not be described herein as it is adequately disclosed in the above-referred to U.S. patent No. 3,941,376. The constantly rotating pulley 100 is intermittently connected to the shaft 92 to rock the same by a solenoid operated clutch 104 which is normally energized to hold the rollers 77, 81 up and out of contact with the belt 40. When de-energized, the shaft 92 is not driven and the springs 88 will effect lowering of the rollers 77, 81 into engagement with the belt 40. The clutch 104 may be operated intermittently in timed sequence by the machine logic at the time when the rollers 77, 81 are to perform their function.

In the normal cycle of operation of the document handling apparatus wherein a document is transported upon the platen 12 by way of the transport belt 40, the rollers 77, 81 are in their upper positions as shown in Figure 3. This is arranged when the clutch 104 is energized to overcome the spring 88 force upon the brackets 74, 78. When the document is brought upon the platen, the belt 40 is reversed in order to move the belt into proper registration with the register edge 28 whereat the document is in position to be illuminated by the reproduction machine to effect reproduction thereof. After this illumination, the belt 40 will drive the document over the edge 28 in order to return the same into the document supply 16. Simultaneously with the initiation of moving the document over the registration edge 28, the clutch 104 is de-energized in order to permit the clockwise rotation of the member 90 as viewed in Figure 3. With the rollers 77, 81 providing force on the lower run of the belt 40 to increase the frictional drive characteristic to the belt, a document is positively driven across the register edge 28 thereby eliminating any prospect of skewing of the document due to engagement of the leading edge of the document with the edge 28 and/or the uneven frictional relationship between the belt operating run and the document due to the sag or catenary of the run.

From the foregoing it will be appreciated that the rollers 77, 81 at the precise time of operation provide a positive but light force to the document belt 40 in order to drive the same off the platen. The rollers 77, 81 are positioned in a line which is the center line for the document belt 40 and are spaced along this line of document travel so that skewing is eliminated at the precise instant of use. With the elimination of skew, and the prevention of slip or hesitation of movement of the document at this precise instant of use, high speed, timed movement of documents will be maintained. Document damage due to skewing is

eliminated and the timing sequence for machine operation will be maintained more efficiently.

While there is described a preferred embodiment of the invention, it should be understood that the invention is not limited thereto but may be otherwise embodied within the scope of the following claims.

CLAIMS

1. Document handling apparatus for moving documents into copying position on the platen of a reproduction machine having a flexible document transport belt disposed over the platen and arranged so the operating run of the belt is spaced slightly above the plane of the platen, a register edge adjacent the platen and means for driving the belt in one direction for transporting a document onto the platen and in the reverse direction to register the document for copying thereof and continued reverse direction to transport the document over the register edge and off the platen, and a plurality of rollers positioned above the operating run of the transport belt and arranged for contact with the run overlying a document and platen during the movement of the belt in the reverse direction for providing a frictional force between the belt and the document.
2. Document handling apparatus according to Claim 1 wherein two of the rollers are in alignment with the direction of movement of the operating run of the belt.
3. Document handling apparatus according to Claim 1 including means for intermittently moving said rollers into contact with the operating run.
4. Document handling apparatus according to Claim 3 wherein said means for moving said rollers into contact with the belt is actuable only when a document is to be transported over the register edge.
5. Document handling apparatus constructed, arranged and adapted to operate substantially as hereinbefore described with reference to the accompanying drawings.

Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd.,
Berwick-upon-Tweed, 1980.
Published at the Patent Office, 25 Southampton Buildings, London, WC2A 1AY,
from which copies may be obtained.