United States Patent

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[54] **DOCUMENT-HANDLING APPARATUS**
5 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **271/4,** 271/89
[51] **Int. Cl.** **B65h 31/38**
[50] **Field of Search** 271/3, 4, 80, 86, 89

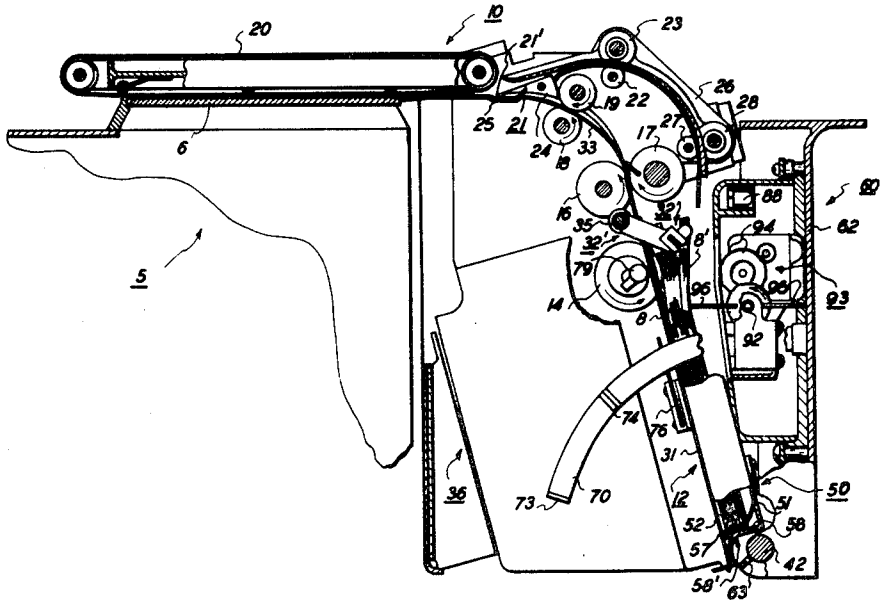
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ABSTRACT: A recirculating document-handling system in which documents are fed in seriatim from a supply to an operating station and returned to the supply for either recycling or removal. The system incorporates a tray to hold the document supply, a feeder for feeding one document at a time from the bottom of the supply to the operating station and back to the tray, a bail bar to maintain documents returning to the tray segregated from other documents awaiting feeding, at least until the supply of such other documents is used up; and a cover for the tray. The cover includes a rotatable wheel having one or more flexible paddles disposed to wipe against documents in the tray to settle documents returning to the tray against the bail bar, and drive means to turn the paddle wheel.



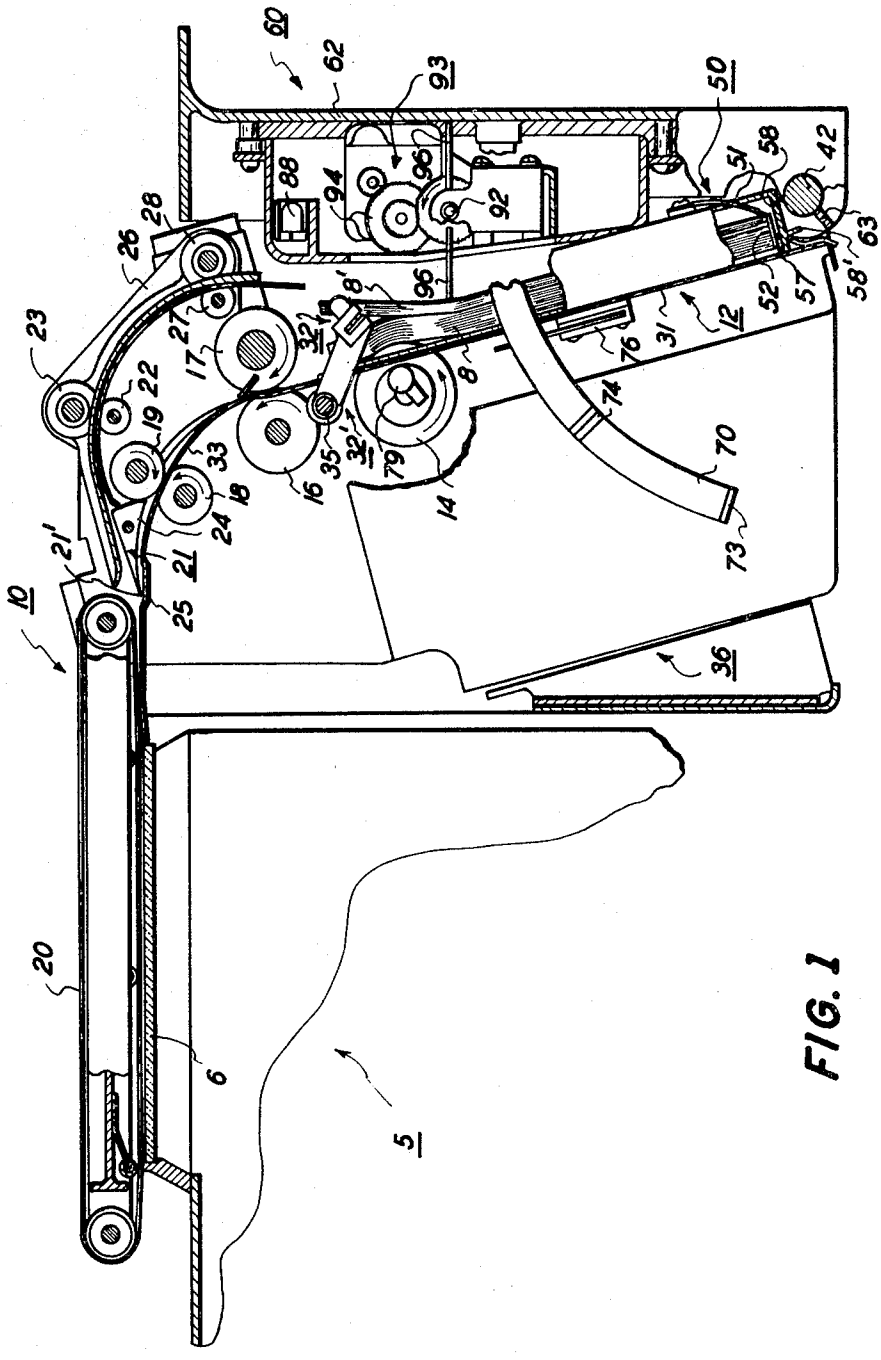


FIG. 1

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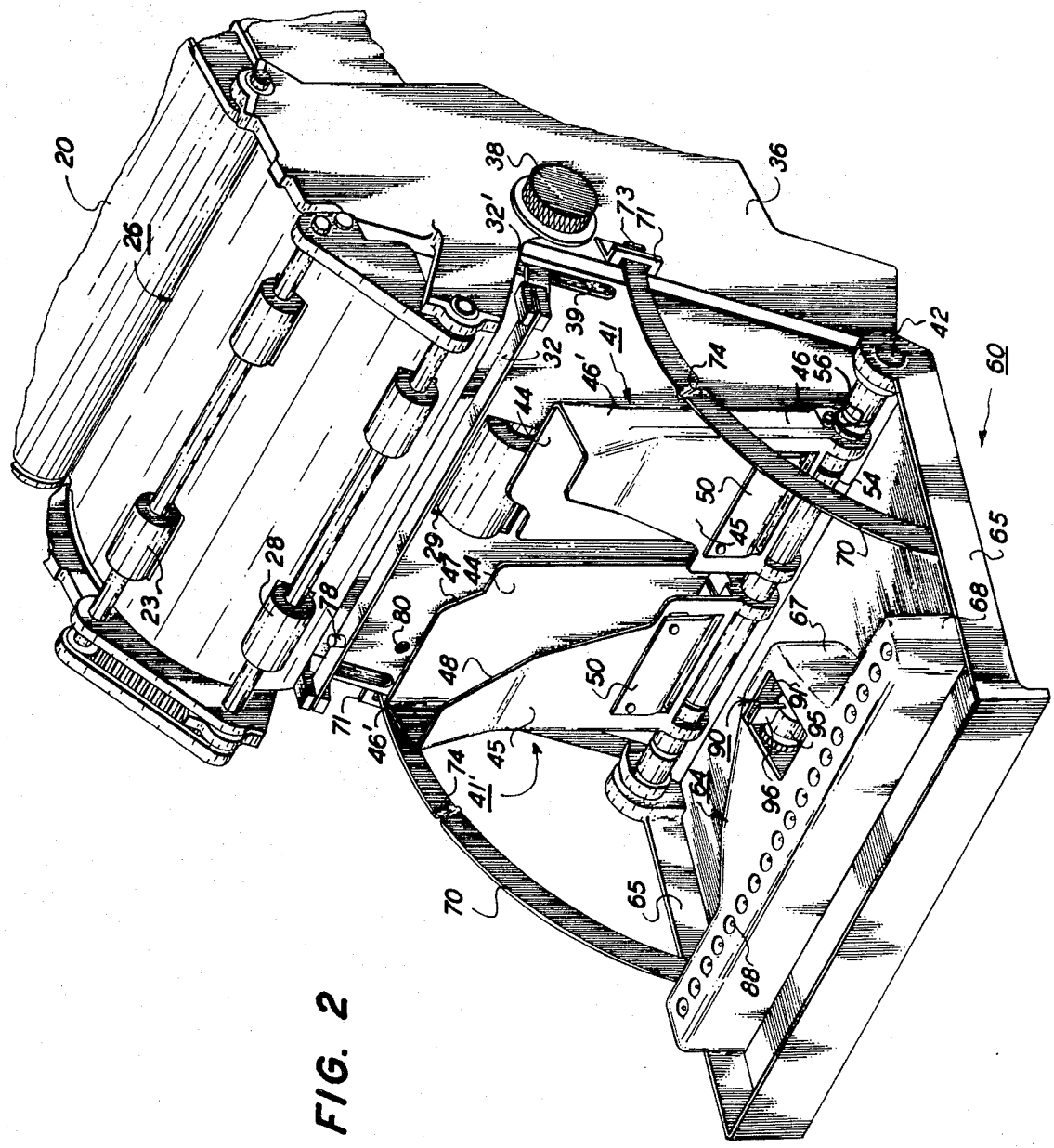

20
26
38
36
32'
73
71
39
41
42
60
32
46'
74
46
56
44
54
50
45
29
41'
44'
70
65
28
23
78
80
67
68
48
50
71
46'
74
41'
45
90
64
96
95
70
65
88

FIG. 2

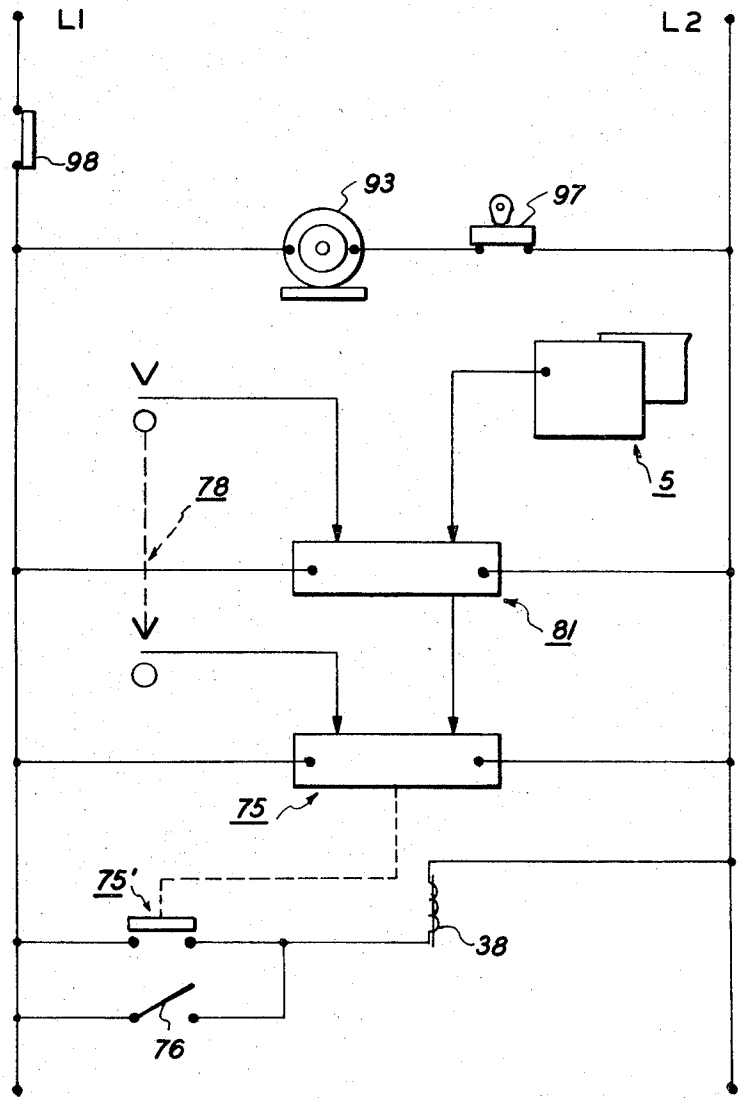


FIG. 3

DOCUMENT-HANDLING APPARATUS

This invention relates to a recirculating document-handling system, and more particularly, to a recirculating document-handling system incorporating a paddlelike wheel to settle the system document supply as the documents return to the supply following use.

As copying or reproduction machines obtain faster and faster operating speeds, the physical work imposed upon the user to keep the machine operating may increase rather than decrease as is intended. By modern standards, the user should no longer be required to constantly change items such as documents, papers, etc., that are being copied, or to gather or collate the copies generated by the machine. While in the latter instance, a collator can be provided to automatically sort the copies, the use of a collator can be avoided if the original documents are cycled past the copy station in correct order the requisite number of times. While this can be accomplished manually, it is desirable to do so automatically, thereby reducing the operator's work and utilizing to a fuller degree the high speed capabilities of modern copying machines. Unfortunately, designing apparatus to recirculate documents at high speed, at reasonable cost and with acceptable reliability is difficult, in no small part due to the propensity of the documents to rip or tear.

It is a principal object of the present invention to provide a new and improved recirculating document-handling system.

It is an object of the present invention to provide an improved document-handling apparatus incorporating a rotatable paddle wheel to assist in positioning documents in the apparatus document supply tray.

It is a further object of the present invention to provide a cover for the document supply tray of a recirculating document feeder carrying a rotatable paddle wheel therewithin positioned so that the paddle portions thereof wipe lightly against documents in the supply tray when the cover is closed and the feeder operative.

It is an object of the present invention to provide, in a recirculating document handler having means for maintaining returned documents separated from documents awaiting feeding, a paddle wheel arrangement designed to settle documents against the separating means.

It is an object of the present invention to provide a document supply tray with means to settle and align documents in the tray.

This invention relates to a recirculating document-handling system wherein documents are cycled in succession from a supply through the system and back to the supply for either recycling or removal, the combination comprising; tray means for holding the document supply; document feed means normally engageable with the bottommost one of the documents in the tray means to feed the documents one by one from the tray means through the system and back to the tray means; displaceable bail means interposable between the last document in the tray means awaiting feeding and documents returning to the tray means to prevent uncontrolled refeeding of returned documents by the feed means; means to reset the bail means and permit returned documents to be refed in the original order by the feed means; and a cover for the tray means, the cover including a paddle wheel, means rotatably supporting the paddle wheel on the cover such that, on rotation of the wheel, the paddle members thereof wipe against documents in the tray means to thereby settle documents returning to the tray means against the bail means, and drive means for rotating the paddle wheel.

Other objects and advantages of the present invention will be apparent from the ensuing description and drawings in which:

FIG. 1 is a schematic view partly in section of the recirculating document-handling system of the present invention;

FIG. 2 is an isometric view showing details of the document supply tray including the paddle wheel of the present invention; and

FIG. 3 is a schematic view of the control arrangement for the document-handling system of the present invention.

Referring to the drawings, there is shown the recirculating document-handling system, designated generally by the numeral **10**, of the present invention. For purposes of explanation, document-handling system **10** is shown with a document-copying or reproduction machine **5** such as an electrostatic-type copier having a transparent platen **6** on which each document to be copied is placed, and following copying, removed as understood by those skilled in the art.

The document-handling system **10** includes a supply tray **12** for holding the documents **8** being copied, and a primary document feed roll **14** adapted when rotated in the direction of the solid line arrow in FIG. **1** to advance the bottommost one of the documents **8** in tray **12** forward into the nip of document limiting rolls **16, 17**. Rolls **16, 17** cooperate to limit feed of documents by roll **14** to only one document at a time. As each document leaves rolls **16, 17**, it is carried forward by intermediate transport rolls **18, 19** underneath curved guide fingers **21** to platen transport **20** which carries the document into position on platen **6**.

On completion of the document-scanning or viewing cycle, transport **20** is reversed to carry the document backwards off platen **6**. Guide fingers **21**, the leading end **21'** of which normally rests in depressions **25** in curved base **33**, deflect the document upwardly as the document leaves platen **6** into the nip of first return transport rolls **22, 23**. Rolls **22, 23** feed the document between return transport rolls **27, 28** which discharge the document into tray **12**. As will appear, tray **12** not only holds documents awaiting feeding, but also serves to collect returning documents for either refeeding or removal.

To maintain the returning documents, which have been designated for convenience by the numeral **8'**, segregated from documents **8** awaiting feeding, and prevent premature or uncontrolled refeeding of returned documents **8'** by feed roll **14** following feed of the last original document **8**, a movable bail or separator bar **32** is provided. Bail bar **32**, when in position, extends across the upper portion of tray **12** substantially opposite feed roll **14**, to prevent the returning documents **8'** which rest thereon, from contacting feed roll **14** and being fed thereby. As will appear, bail bar **32** is moved out from under the returned documents **8'** when it is desired to recycle the returned documents **8'**.

A more detailed description of the construction and operation of limiting rolls **16, 17**, intermediate transport rolls **18, 19**, platen transport **20**, and return transport roll pairs **22, 23** and **27, 28** may be found in application. Ser. No. 782,790 filed Dec. 4, 1968 in the name of Anthony Howard, now U.S. Pat. No. 3,556,513.

Document tray **12** has a substantially flat, relatively steeply inclined base **31** supported by frame sides **36** suitably secured to copying machine **5**. The curved base **33** effects a juncture between base **31** of tray **12** and platen **6**, the latter normally being substantially horizontal. Suitable openings such as **29** are provided in bases **31** and **33** to accommodate the various feed rolls **14, 16** and **18**.

Guide fingers **21** are spaced above the curved base **33**, the lower side **24** of fingers **21** being suitably curved in matching relationship to base **33** therebelow. Fingers **21** cooperate with base **33** to turn or guide the upwardly moving documents onto platen **6**.

Bail bar **32** is supported on a cross-shaft **35** journaled in frame sides **36**. Tray base **31** is slotted at **39** to accommodate ends **32'** of bar **32**. Suitable means such as solenoid **38** may be provided for turning cross-shaft **35** and momentarily raising bar **32** out from below documents in supply tray **12** (to the position shown in FIG. **2**). This permits the documents to contact feed roll **14**. On subsequent deenergization of solenoid **38**, bar **32** falls back onto the topmost one of the documents thereunder (to the position shown in FIG. **1**).

Other arrangements for turning cross-shaft **35** to displace bar **32**, as for example, a clutch, may be contemplated. It may be further appreciated that suitable spring means may be provided to bias bail bar **32** downwardly to maintain documents **8** thereunder in operative contact with feed roll **14**.

As best seen in FIG. 2, tray 12 includes matching right- and left-hand receptacles 41, 41' respectively. Receptacles 41, 41' are arranged in facing relationship to one another and journaled at their lower ends on shaft 42. Shaft 42 is in turn journaled for rotation in frame sides 36 adjacent the bottom of tray base 31. As will appear, receptacles 41, 41' and shaft 42 are capable of limited rotational movement relative to one another.

Receptacles 41, 41', which are substantially U-shaped in cross section, each include a base 44, a top 45 spaced thereabove, and sides 46. The opposing edges of bases 44 are cut away at 47 to accommodate feed roll 14 while the edges of the receptacle tops 45 are beveled outwardly at 48 to facilitate handling of documents by the user particularly the loading and unloading thereof.

As best seen in FIG. 1 of the drawings, the lower end of each receptacle 41, 41' consists of a springlike part 50. Spring 50 includes a curved top segment 51 which flares into top 45 and a substantially flat bottom segment 52 which intersects the receptacle base 44.

A resilient material such as foam 57 is disposed behind spring segment 52 and the end 58 of receptacles 41, 41'. The curved spring segments 51 serve to slow or brake documents returning to tray 30 while the resilient backed bottom segment 52 serves to further absorb document velocity and to jog and align the lower edges of the returning documents with one another.

Sides 46 of receptacles 41, 41' are preferably flared outwardly at 46' adjacent the top thereof to provide a slightly enlarged entrance facilitating entry of returning documents into tray 12. The relatively narrower sides 46 therebelow aid in aligning the document side edges with one another.

Receptacles 41, 41' are arranged for lateral adjusting movement along shaft 42 toward and away from one another to accommodate various size documents. Suitable detent means, for example spring biased ball members (not shown), cooperate with recesses 54 in shaft 42 to maintain receptacles 41, 41' in adjusted position. Torsion springs 56 bias receptacles 41, 41' toward base 31 (in the counterclockwise direction as seen in FIG. 1), it being understood that contact between base 31 and the bottom of receptacles 41, 41' limits inward movement of receptacles 41, 41' toward base 31.

To guide returning documents into the tray 30 as well as prevent documents from falling out of tray 30, particularly when bail 32 is raised, a cover 60 is provided. Cover 60 is secured to shaft 42 to enable cover 60 to be opened for access to document tray 30 as when loading or unloading documents.

Cover 60 has an exterior wall 62, which may be suitably decorated, and inwardly projecting sides 65 integral therewith. A hollow housing 64 is suitably secured to the interior of wall 62 and within the confines of sides 65 thereof. As best seen in FIG. 2, housing 64 has a triangular lower portion 67 corresponding to the triangularlike area defined by the beveled edges 48 of the receptacles 41, 41' and a rectangular upper portion 68 corresponding in shape to the space above the entrance to receptacles 41, 41'. The depth of housing 64 is such that housing 64 is substantially flush the top 45 of receptacles 41, 41' when cover 60 is closed. In this manner, housing 64 serves as a guide in the space between transport rolls 27, 28 and the entrance to receptacles 41, 41' the as well as a closure for the space between receptacles 41, 41'.

Cover 60 has a pair of curved detents 70 on opposite sides thereof, detents 70 extending through slotted stop members 71 on the sides of frame 36. The ends 73 of detents 70 are turned at right angles and cooperate with stop members 71 to limit maximum opening movement of cover 60. Detents 70 include a dimpled segment 74 cooperable with stop members 71 to releasably limit opening of cover 60 to a partially opened position designed to permit the user to service the feeding apparatus 10 without disrupting the document order as will appear. To provide the requisite detent action, detents 70 are formed from a suitable spring material.

Referring particularly to FIG. 1, radially projecting tangs 63 are provided on shaft 42 opposite the lower end 58 of receptacles 41, 41'. Preferably, the receptacle ends 58 are provided with a protruding lug 58' opposite tangs 63. Tangs 63 are arranged so that, following predetermined opening of cover 60 with attendant rotation of shaft 42 in a clockwise direction, tangs 63 engage lugs 58' to thereafter move receptacles 41, 41' in the same opening direction in unison with cover 60 and against the bias of springs 56. Tangs 63 are disposed to engage lugs 58' whenever cover 60 is opened beyond the intermediate or service open position corresponding to the dimpled segments 74 in stop members 70.

To settle the returning documents 8' against bail bar 32, a paddle wheel 90 is supported in cutout 91 of cover housing 64 on shaft 92. Shaft 92 may be suitably journaled in the sides of cover housing 68. A drive motor 93 is supported within housing 68 of cover 60, the output shaft of motor 93 being drivingly connected to paddle wheel shaft 92 as by gears 94. Motor 93 serves to turn paddle wheel 90 in the direction in which returning documents 8' enter receptacles 41, 41' of tray 12 (the direction shown by the solid line arrow in FIG. 1).

Paddle wheel 90 comprises a suitable core element 95 secured to shaft 92 with a pair of outwardly projecting generally rectangular paddles 96. Paddles 96 are formed from a relatively flexible rubber or plastic material, for example neoprene, to prevent damage or marring of the documents. Paddle wheel 90 is dimensioned and supported so that normally only the top portions of paddles 96 brush or wipe lightly against the documents in tray 12 when cover 60 is closed. In this way, documents returning to tray 12 are settled against bail bar 32. At the same time, the wiping action effected by the rotating paddle wheel 90 aids in aligning the documents in tray 12 by urging the documents downwardly so that the document lower edges rest against bottom segment 52 of springs 50 which comprise the lower ends of document receptacles 41, 41'.

Referring to FIG. 3, paddle wheel drive motor 93 is connected through a suitable cover control switch 97 across a power source, represented by leads L_1, L_2. A suitable stop-start switch 98 is provided in leads L_1, L_2. Cover control switch 97 is suitably arranged for actuation in response to closure of cover 60, actuation of switch 97 serving to operate motor 93 and rotate paddle wheel 90. On opening of cover 60, switch 97 opens to interrupt the circuit to motor 93 and stop paddle wheel 90.

A suitable operating circuit 75 including switch 75' is provided for solenoid 38. A photocell 78 is supported on bail bar 32 to sense the presence of documents therebelow, the light source 79 for photocell 78 being supported underneath base 31. A suitable aperture 80 is provided in base 31 above light 79. As will appear, photocell 78 responds to feed of the last document from under bar 32 to trigger circuit 75 and momentarily actuate solenoid 38. Solenoid 38 raises bar 32 out from below any documents such as returned documents 8' resting thereon, bar 32 dropping back down onto the topmost document with deenergization of solenoid 38. At the same time, a signal from photocell 78 readies a suitable timer 81 for operation.

Timer 81 comprises any suitable circuit adapted, on a predetermined interval following triggering, to trigger circuit 75 and momentarily energize solenoid 38 to move bail bar 32 onto the topmost document as described heretofore. Copying machine 5 includes suitable circuitry adapted when copying of the last document is completed to start timer 81. Following a predetermined interval adequate for the last document to reach tray 30, timer 81 triggers circuit 75 to reset bar 32. Other circuitry of machine 5 may be arranged to trigger circuit 75 at startup of the copy cycle to assure that bail bar 32 is atop the topmost document in tray 30 at startup of the copying cycle.

To enable documents to be loaded or unloaded in tray 30 without interference by bar 32, a switch 76 is disposed on base 31 adjacent one of stop members 70. On opening of cover 60

to the document loading and unloading position, the terminal end 73 of the associated stop member 70 closes switch 76 to energize solenoid 38 and raise bar 32 out of the way.

To obviate buildup of static electricity on the documents, a suitable ion generator 88 is supported in the upper portion 68 of cover 60. Generator 88, which is connected to a suitable source of electrical energy (not shown), is arranged to ionize the air through which the documents returning to tray 12 pass to neutralize any static electric charges on the documents. It is understood that such static charges often occur simply from the moving of documents. By passing the documents through the space proximate generator 88, static electrical charges on the documents can be eliminated or substantially reduced.

Where it is desired to load or unload one or more documents, cover 60 is opened fully to the position determined by ends 73 of detents 70. As cover 60 moves past the intermediate position determined by dimpled segments 74 of detents 70, tangs 63 on shaft 42 engage lugs 58' to swing receptacles 41, 41' outwardly with cover 60. Preferably, the components of feeding apparatus 10 are arranged so that opening of cover 60 to a fully opened position moves the receptacles 41, 41' to a substantially vertical position as shown in FIG. 2 of the drawings to facilitate loading and unloading of documents. With opening of cover 60, switch 76 triggers solenoid 38 to hold bail bar 32 raised while switch 98 is opened to interrupt the circuit to motor 93 and stop paddle wheel 90.

Following loading of documents, cover 60 is closed. As tangs 63 turn in a counterclockwise direction with shaft 42, springs 56 swing receptacles 41, 41' downwardly about shaft 42 onto base 31 to bring the lowermost document in receptacles 41, 41' into contact with feed roll 14. With closure of cover 60, solenoid 38 is deenergized to permit bail bar 32 to drop back onto the topmost document 8 while switch 97 closes to start paddle wheel 90.

On startup of the machine 5, feed roll 14, document limiting rolls 16, 17, intermediate transport rolls 18, 19, and platen transport 20 operate to carry the lowermost document in tray 12 forward onto platen 6 where the document is copied. Thereafter, platen transport 20 is reversed to carry the document backwards off platen 6. Guide fingers 21 intercept the leaving document to route the document into the nip of first return transport rolls 22, 23 which, in cooperation with return guides 26 and second return transport rolls 27, 28, carry the document back to tray 30. It may be understood that while one document is being copied or returned to tray 12, rolls 14, 16, 17 and 18, 19 may be operated to bring the next document forward.

As each returning document 8 leaves rolls 27, 28, the cover guide 64 and the wiping action of the rotating paddle wheel 90 against the returning documents guide the documents into receptacles 41, 41' of tray 12 and against the bail bar 32. As the relatively rapidly moving documents enter receptacles 41, 41', the leading document edge first contacts curved spring segment 51 and is initially deaccelerated thereby. The subsequent engagement of the document with spring segment 52 brings the slowed document to a stop without damage or tearing of the document while the inherent resiliency of the segment 52 with the help of paddle wheel 90 serves to jog the returning documents into proper alignment for subsequent refeeding. Additionally, the wiping action of paddle wheel 90 serves to settle the returning documents in receptacles 41, 41' and against bail bar 32.

On feed of the last document 8 from under bar 32, the signal from photocell 78 momentarily triggers circuit 75 to actuate solenoid 38 and raise bar 32 out from below the stack of returned documents 8 then in tray 30. Bar 32 then drops back upon the topmost document. At the same time, the signal from photocell 78 readies timer 81 for operation.

On copying of the last document, a signal from the machine 5 triggers timer 81, and following a delay sufficient to enable the last document to be returned to tray 30, timer 81 again triggers circuit 75 to actuate solenoid 38 and raise bar 32 out from below the just returned last document and onto the top thereof. This places bail bar 32 in the correct position between the documents for the next succeeding cycle.

It is understood that the document-handling system 10 is recycled for as many additional document copies as are desired.

When the last copy cycle is completed, cover 60 may be fully opened as described heretofore and tray 12 unloaded. It is understood that opening of cover 60 actuates solenoid 38 to raise bail bar 32 out of the way while opening switch 97 to stop paddle wheel 90.

In the event of a system malfunction, as for example, a document jam, cover 60 may be partially opened to the position corresponding to dimpled segments 74 of detents 70. At this position, servicing may be done without the resetting of bail bar 32 and consequent disruption of the document copy order.

While the invention has been described with reference to the structure disclosed herein, it is not confined to the details set forth; but is intended to cover such modifications, or changes as may come within the scope of the following claims.

What is claimed is:

1. In a recirculating document-handling system wherein documents are cycled in succession from a supply through said system and back to said supply for either recycling or removal, the combination of:

tray means for holding the document supply,

document feed means normally engageable with the bottommost one of the documents in said tray means to feed documents one by one from said tray means through said system and back to said tray means;

displaceable bail means interposable between the last document in said tray means awaiting feeding and documents returning to said tray means to prevent uncontrolled recycling of said returned documents by said feed means;

means to reset said bail means and permit returned documents to be recycled in the original order by said feed means; and

a cover for said tray means, said cover including a paddle wheel having at least one flexible bladelike member projecting radially therefrom,

means rotatably supporting said paddle wheel on said cover such, that on rotation of said wheel, the paddle member wipes against documents in said tray means to thereby settle documents returning to said tray means against said bail means, and

means for rotating said paddle wheel.

2. The document-handling system according to claim 1 in which said paddle wheel has a pair of oppositely disposed bladelike members.

3. The document-handling system according to claim 1 in which said wheel rotating means comprises a motor supported on said cover, and drive means operatively coupling said motor with said paddle wheel.

4. The document-handling system according to claim 3 including means supporting said cover for movement between a cover raised position and a cover closed position, and control means for actuating said motor in response to disposition of said cover in said closed position.

5. The document-handling system according to claim 1 in which wheel rotating means is arranged to rotate said paddle wheel in the same direction as the direction with which said documents are returned to said tray means by said document feed means.

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