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54 **Paper sheet deflecting system for sorter mechanism.**

57 Paper sheet deflecting system for a continuous paper sorting machine having a receiver 14 which is comprised of at least two columns of inclined side-by-side stacks of paper storage bins 15 with entrances for receiving paper sheets from a reversible feeder conveyor 28. The receiver 14 is mounted on track means 16 for lateral movement relative to its feeder mechanism 10, such that the bin entrances move past the feeder 10 and present a particular bin address to a particular deflector and deflector guide position. The paper sheets can be deflected off the feeder conveyor 28 to a predetermined bin address whether they are moving down the conveyor 28, from the top or up the conveyor 28 from the bottom.

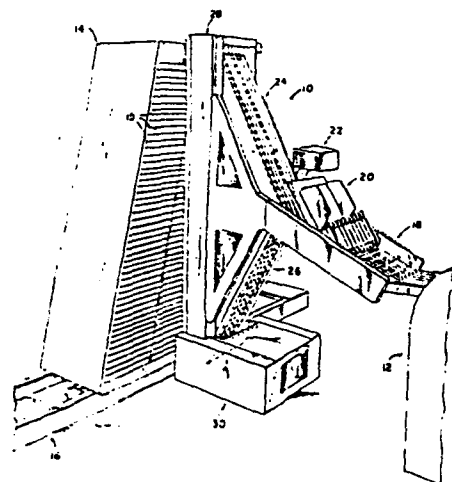


FIG. 1

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PAPER SHEET DEFLECTING SYSTEM FOR SORTER
MECHANISM

This invention relates to sheet distributing or sorting devices and more particularly to a receiver and feeder apparatus which can continuously receive and sort large numbers of multi-paged documents as
5 copies of a page proceed from a reproducing device such as a printer or copy making machine. This application references our copending European Patent Application No. 79300624.8 filed on even date herewith for "Continuous Sorter Machine" and corresponding
10 to U.S. Patent Application Serial No. 897,272 dated 17th April 1978.

Prior art paper distributors, sorters and/or collators have encountered many problems. One is that the rapid advances in copy producing machine
15 and press machine speeds have made increased demands

on sorters. In order for the maximum production capability of a printing or copy making machine to be utilized, it is necessary that the sorter have the capacity to receive the printer or copy machine output without loss of press or copy making machine time. Large capacity sorting machines have been introduced to the market place but they are not continuous. For instance, in some sorters after a vertical column of trays or bins has been filled, it is necessary to stop the press and shift that filled column away from the feeder and then move an empty column into position. Thus there is lost a significant amount of press or copy machine production time. Additionally, time is lost if the bins have to be unloaded on line.

A continuous sorter places unusual demands on both the feeder and receiver sections. The machine must continuously accept paper copies from the reproduction device and handle them in such a way as to avoid interruptions when a column of bins is filled and feeding must shift to a new column. While smaller collators or sorters are mainly intended for the office market as a necessary adjunct to office copying machinery, larger sorters are more intended for the high volume commercial market and for large in-plant reproduction centers, commercial houses and printing departments. These higher volume paper handling installations may be turning out catalogs, maintenance manuals, instruction books, brochures, sales material and perhaps other items such as reports, bid specifications and other large quantity, multi-page publications. Those skilled in the art will appreciate the savings in labor, time and expense if the reproduction capacity of a particular printing or copying center can be sorted at a rate which is consistent with the copy making capability.

Among the prior art references which may be considered with respect to the features of this invention are the following: United States Patent Nos. 3,420,517; 3,273,882; 3,356,362; 3,848,867; 3,937,459; 3,938,801; 3,740,050; 3,944,217; and 3,963,235. The devices covered by the above patents do not disclose the structure of this invention.

~~Summary of the Invention~~

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A continuous paper sorting machine in which the receiver with the bins is designed generally in accordance with the teachings of U. S. Patent No. 3,938,801 which describes side-by-side stacks of inclined columns of paper receiving bins or shelves. The receiver is moved laterally with respect to a generally upright feeding device, in which the feeder presents a generally vertical feed conveyor with deflectors and guides for intercepting sheets moving up or down the conveyor and directing them into bins in the receiver as the receiver moves a given bin in a column past a given deflector position. The feeder of this invention utilizes a reversible feeder belt conveyor so that sheets may be fed to a given bin address moving either up or down the reversible conveyor. The paper sheet deflecting system of this invention incorporates deflectors which deflect paper sheets off the conveyor in either direction of travel. Deflector guides are incorporated with the deflectors to control the sheets as they are directed off the conveyor and toward a particular bin address. Two deflectors are used for a single bin address in the receiver because of the reversibility of the feeder conveyor. Which deflector is used depends upon the direction of travel of the paper sheet on the conveyor.

Accordingly, it is among the features, objects and advantages of the invention to provide a paper sorting machine deflecting system for a continuous sorter which

is uniquely designed and intended for maximizing the production of a commercial printing, reproducing, duplicating or copying center. The invention is a unique system for intercepting sheets off a reversible conveyor and directing them into a desired bin address. The invention is particularly suited for use in printing shops or reproduction centers for such things as multi-page brochures, catalogs, books and other items which must be produced in large numbers. The system is capable of handling sheets at the high speeds of present day advanced copying, printing and duplicating machinery. The system is uniquely simple and inexpensive for continuously filling a large number of bins.

Brief Description of Drawings

Figure 1 is a perspective view showing generally the general arrangement and organization of the sorter including the receiver and feeder mechanism.

Figure 2 is a partial cross-section view in elevation showing details of construction of the feeder;

Figure 3 is an enlarged partial cross-section view in elevation showing in greater detail the construction features of the invention;

Figure 4 is a partial view in perspective showing additional details of the deflector; and

Figure 5 is a cross-section view in plan along the line 5-5 of Figure 2 showing additional details of the system.

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Referring now to the drawings and particularly Figures 1 and 2, it will be seen that the deflector system of this invention is located at the interface between a feeder, generally identified by the number 10, and a receiver generally identified by the number 14. A duplicator or press device generally designated by the number 12 delivers copies to the feeder 10 for transport of those copies to the receiver 14 and bins 15. The receiver moves laterally on track structure 16. Feeder 10 includes infeed conveyor section 18, a proof tray assembly 20 and a control panel 22. The infeed conveyor feeds either to an upwardly angled intermediate conveyor 24 or a downwardly angled intermediate conveyor 26. A tower section generally designated by the number 28 supports a vertically disposed reversible feeder conveyor, bin deflectors and guides to be described more in detail hereinafter. The tower section 28 is supported on a base section 30 shown in generally outlined form in Figure 1.

Referring now to Figure 2, it will be seen that the tower section 28 includes the upper end of upwardly angled intermediate conveyor 24 and includes large diameter belt pulleys 40 mounted on shaft 42. A series of equally spaced guide plates 44 with a radius 46 are provided to enable sheets of paper to move around the end of the conveyor. Several spring loaded retainer pulleys 48 and 50 for contacting 2 or more belts are provided for positive engagement of the sheets as they traverse around the end of the

conveyor on belts 41. It will be seen that the lower end of lower intermediate conveyor 26 has a similar structure and feeds in similar fashion to the lower end of the feeder conveyor now to be described.

The feeder conveyor comprises a series of lower belt pulleys 60 mounted on a drive shaft 62 in close proximity to the lower rollers of the downwardly inclined intermediate conveyor 26, for receiving sheets of paper as they come around the lower end and onto the feeder conveyor. At the upper end of the feeder conveyor are a series of pulleys 64 mounted on shaft 66. A series of continuous belts 68 are received on the pulleys 60 and 64.

It will be seen by reference to Figure 5 that the tower is composed of side frame members 70 and 72 having interior support frame members 74 and 76. Deflector support strips 78 on one side and 80 on the other side extend from top to bottom of the feeder conveyor frame and include a series of triangular vertically spaced apart openings 82 for supporting the two-way deflectors generally designated by the number 90.

The deflectors 90 are elongate members of light aluminum sheet having a front surface 92 and at approximately 90⁰ or at a right angle thereto a backwardly extending top surface 94. At each end of the deflector is an extension portion 96 with a mounting tab piece 98 located at the outermost lower part of the extension section 96. The tabs 98 mount in the triangular openings 82 in the side mounting pieces 78. It can be seen that the deflectors are formed with a series of cutout sections 102 which are formed in the face wall 92 and the top wall 94. Diagonal

portions 104 extend from the lower part of the face wall 92 to the rear part of the upper wall 94 within the cutout sections 102 or may be eliminated altogether. The openings 102 are formed in the deflector to provide clearance for the belts 68 when the deflector is moved out to its paper intercept position. A rear wall 106 extends from the lower part of the front face wall 92 generally rearwardly along substantially the entire length of the deflector to provide a strengthening continuous wall section for the deflector. A rearwardly and downwardly angling top connector wall 108 also extends from the rear part of top wall 94 for the same strengthening features. At one end section 96 of the deflector is a depending actuator leg 110 which as can be seen is connected to one end of a compression spring 112. The deflector is biased by the spring 112 into its retracted mode by pushing against the leg 110 to rotate the deflector rearwardly. Each spring 112 connects to the core member of a solenoid 114 so that when the solenoid is actuated the spring 112 is compressed to pull tab 110 in to force the deflectors to rotate outwardly into the position shown best by the second deflector in Figure 3.

A deflector guide frame consisting of side frame members 120 and 122 as best seen in Figure 5 is formed to pivot as around hinges 123 to allow access to the conveyor belts and deflectors in the event of a paper jam. Extending between the frame members 120 and 122 are a series of fifty Y-shaped deflector guides 124 having horizontal section 126 terminating at an outer end 128 and also having

upwardly angled leg 130 and downwardly angled leg 132. It will be noted that the deflector guides are positioned in such a way that the upper leg 130 is spaced a predetermined distance directly below the lower leg 132 of the deflector guide next above. It can be seen that a deflector 90 in its actuated position pivots outwardly in such a way that the front and top faces 92 and 94 of the deflector are at approximately 45° angles to the conveyor belts 68. The horizontal section 126 of the deflector guides can also be seen to be located approximately midway of the opening between the bottom of one bin 15 and the top of the entrance wall tray or bin 15 next below. The outer end 128 of the horizontal section of the deflector guide is located in close proximity to the plane of the entrance walls of the bins and are as close as can be without interfering with the passage of the receiver 14 as it moves by the feeder conveyor. A roller 140 at the top and another roller 142 at the bottom of the tower as seen in Figure 2 restrain the receiver from coming any closer than the spacing allowed for by the rollers 140 and 142. An opening 129 is provided through the entire stack of deflector guides 124 to accommodate an unobstructed photo-electric beam to sense the leading and trailing edges of paper as they are handled by the sorter.

Receiver 14 has fifty functioning bins 15 as seen in Figures 2 and 3. The top bin 17 is a non-functioning bin because it will be observed that the top most deflector guide 124 is located below the nonfunctioning bin 17 and above the topmost of the fifty functioning bins 15.

By reference to Figure 3, it will be seen that a sheet of paper coming down the conveyor is directed into bin B1 by the topmost deflector 90 being energized into its deflect or intercept position. The topmost deflector guide 124 is used on its upper surface for the guiding. In order to direct a sheet of paper into bin B1 coming up the conveyor it is necessary that the next lower deflector 90 be actuated and the lower surface of the topmost deflector guide is utilized. The sorter control system is programmed so that the paper deflector is actuated in order that a specific bin receive a paper sheet. Because it takes two deflectors to service one bin, it will be appreciated that the conveyor requires 51 deflectors with 50 deflector guides 124 to service 50 functioning bins 15. By referring to the deflectors and particularly the actuated deflector it is understood that it services two bins 15 depending on the direction of travel of the paper sheets.

Operation of the feeder and receiver is continuous and is best described as follows. A first or page "1" master is inserted in the press or duplicator. Several copies are first directed

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to the proof tray and then the sorting job begins. Odd numbered pages coming out of the press are directed to lower intermediate conveyor 26 and up the feeder conveyor to the top bin.

- 5 Sheets will be fed up the conveyor 68 and deflected to the desired bin address by a deflector and the lower surface of a Y-shaped deflector. The receiver moves a discrete distance from left to right and presents the next bin
- 10 address until all 50 bins in a column have been filled. If the sorting job extends to

the next column copies continue to be fed to the feeder conveyor 68 via lower intermediate conveyor 26 and up the feeder conveyor to the topmost bin in the second column. The topmost bin of the second column is offset from the lowermost bin of the first column by the same increment of distance as the bins are offset from each other in each column. Assuming that two complete columns of bins are being used for a sorting job the feeder continues to feed around the lower intermediate conveyor until all fifty bins in the second column are also filled. By the time the bottommost bin the second column has received its copy of page 1 from the press, copies of the page 2 master are already proceeding up the upper intermediate conveyor 24. The feeder belts 68 are reversed to bring the first sheet from the top to the bottom of the feeder conveyor and filling of the bins with copies of page 2 begins with the lowermost bins in column two where the first page sorting job ended. Thus the feeding of bins is continuous not only from bin to bin but from column to column. Also, it can be appreciated that odd numbered pages from the duplicator are fed from the bottom up while the receiver indexes from left to right and even numbered pages are fed from the top down while the receiver moves from right to left. Obviously, also, two adjacent deflectors are needed for a single bin add-

ress. When coming down the conveyor sheets are deflected by the top one of two adjacent deflectors and directed against the top surface of a deflector guide and into the bin opening. When coming from the bottom a sheet is deflected by the lower one of two adjacent deflectors and off the lower surface of a deflector into the same bin address.

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5 Thus the need for one more deflector than there are bins or guides. It will be understood that sheets are not fed alternately from top and bottom but that the feeder conveyor moves in one direction only until the sorting of the copies of one page is complete. The copies of the next page to be sorted are then fed from the opposite direction and the receiver direction of movement is reversed.

~~WHAT IS CLAIMED IS:~~

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CLAIMS

1. Paper sheet transport and deflector system for a continuous sorter mechanism having a feeder and a receiver with a predetermined number of bins, comprising:

5 a) a generally vertically disposed, reversible belt type feeder conveyor which selectively transports sheets of paper either up or down said conveyor for direction to and deflection into a predetermined bin address in said receiver, the bins in said receiver each
10 having an entrance opening of predetermined dimensions,

 b) a series of deflector devices mounted on said conveyor having a front and rear extending top walls generally at right angles to each other and located behind said belts in a retracted position and which when
15 pivoted into a paper deflect position said front and top walls are at approximately 45° angles to the plane of said belts, there being one more deflector device than the number of bins in said receiver, and

 c) deflector guide means disposed between the
20 entrance opening to each bin and said deflector devices and belts such that a paper sheet copy of one page traveling up the feeder conveyor is deflected by a first deflector device into contact with the underside of a deflector guide for guiding said sheet into a given bin and such that a
25 paper sheet copy of a second sheet traveling down the feeder conveyor is deflected into the same given bin by the deflector next above said first deflector device and by topside of the same deflector guide.

2. The paper sheet transport and deflector system according to Claim 1 and in which the deflector guide for each bin opening has a horizontal section terminating in predetermined spaced relationship to the plane of the receiver bin entrances and positioned so as to be generally
5 midway of the vertical dimension of said bin entrance opening.

3. The paper sheet transport and deflector system according to Claim 2 and in which said deflector guide
10 for each bin includes an upwardly angled leg and a downwardly angled leg diverging from said horizontal section such that the upwardly angled leg is in close proximity to said first deflector device and said downwardly angled leg is in close proximity to said deflector device next
15 below when the deflector devices are pivoted to their deflect position.

4. The paper sheet transport and deflector system according to Claim 1 and in which each deflector device is spring loaded to a normally retracted position and also
20 connected to an electrical actuator device for being pivoted to its deflect position.

5. The paper sheet transport and deflector system according to Claim 1 and in which said deflector guide are mounted in a hinged frame connected to said feeder.

5 6. The paper sheet transport and deflector system according to Claim 1 and in which each of said deflector devices has cutaway sections in the front and top walls so that when a deflector is moved to its deflect position there is no interference between
10 said deflector and the conveyor belts.

7. Paper sheet transport and deflector system for a continuous sorter mechanism having a feeder and a receiver with a predetermined number of bins, comprising:

15 (a) a generally vertically disposed, reversible multiple belt type feeder conveyor which selectively transports sheets of paper either up or down said conveyor for direction to and deflection into a predetermined bin address in said receiver, the bins in
20 said receiver each having an entrance opening of predetermined vertical dimension,

(b) a series of deflector devices mounted on said conveyor having a front wall generally parallel with and behind said belts and a rearwardly extending
25 top wall generally at right angles to said front wall

and also having cutaway sections in said front and top walls in alignment with said belts and further having end mounting means for limited pivotal movement of said deflector devices such that when pivoted into a paper deflect position said

front and top walls are at approximately 45° angles to the plane of said belts, there being one more deflector device than the number of bins in said receiver, and

5 c) deflector guide means disposed between the entrance opening to each bin and said deflector devices and belts such that a paper sheet traveling up the feeder conveyor is deflected by a first deflector device into contact with the upper surface of
10 a deflector guide for guiding said sheet into a given bin and such that a paper sheet travelling down the feeder conveyor is deflected into the same given bin by the deflector device next above said first deflector device and by the lower surface of the same deflector guide.
15

8. The paper sheet transport and deflector system according to Claim 7 and in which the deflector guide for each bin opening has a horizontal section terminating in predetermined spaced relationship to the plane
20 of the receiver bin entrances and positioned so as to be generally midway of the vertical dimension of said bin entrance opening.

9. The paper sheet transport and deflector system according to Claim 8 and in which said deflector guide
25 for each bin includes an upwardly angled leg and a

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downwardly angled leg diverging from said horizontal section such that the upwardly angled leg is in close proximity to said first deflector device and said downwardly angled leg is in

close proximity to said deflector device next below when the deflector devices are pivoted to their deflect position.

10. The paper sheet transport and deflector system according to Claim 7 and in which each deflector device is spring loaded to a normally retracted position and also connected to an electrical actuator device for being pivoted to its deflect position.

11. The paper sheet transport and deflector system according to Claim 7 and in which said deflector guides are mounted in a hinged frame connected to said feeder.

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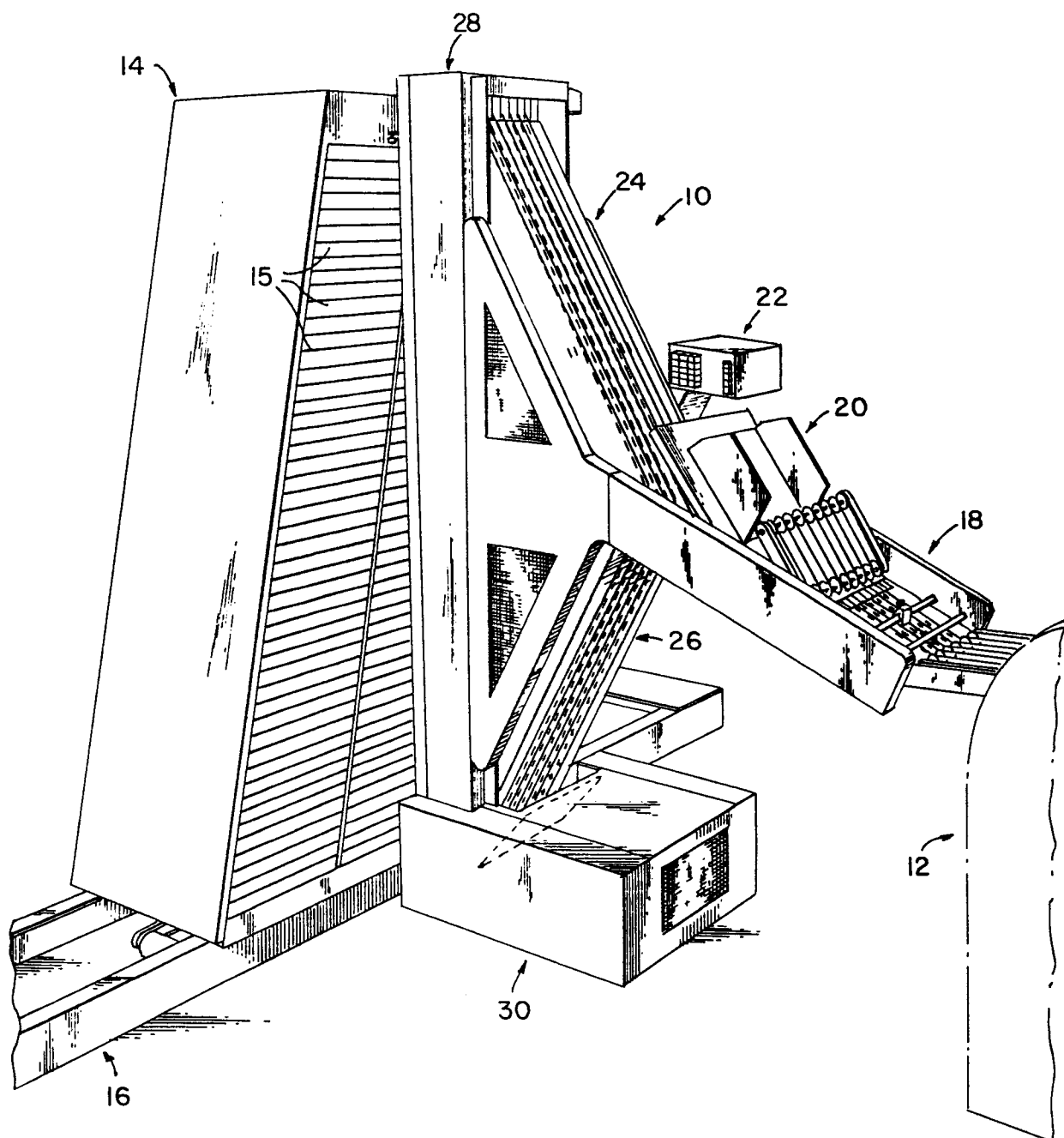


FIG. 1



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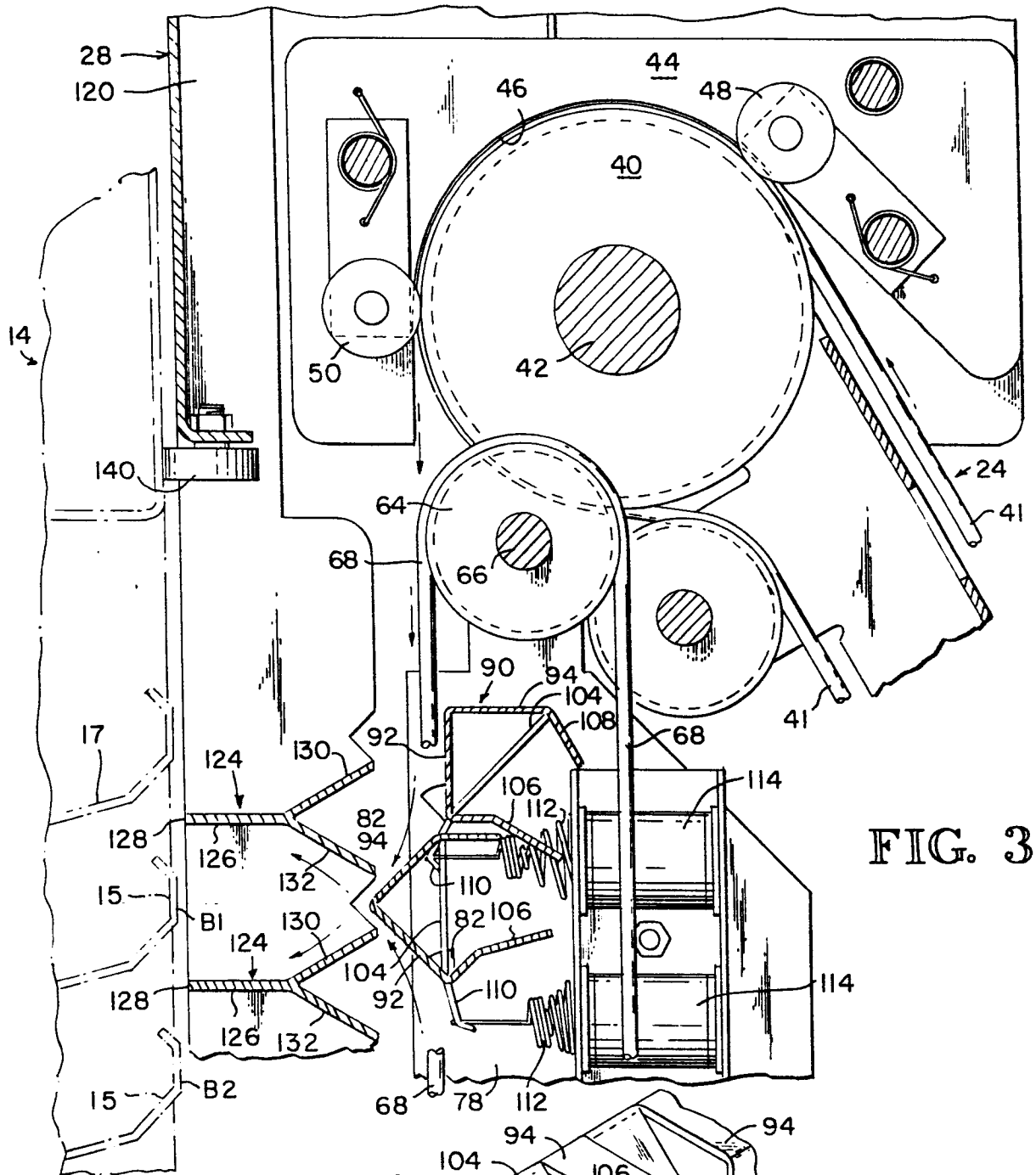


FIG. 3

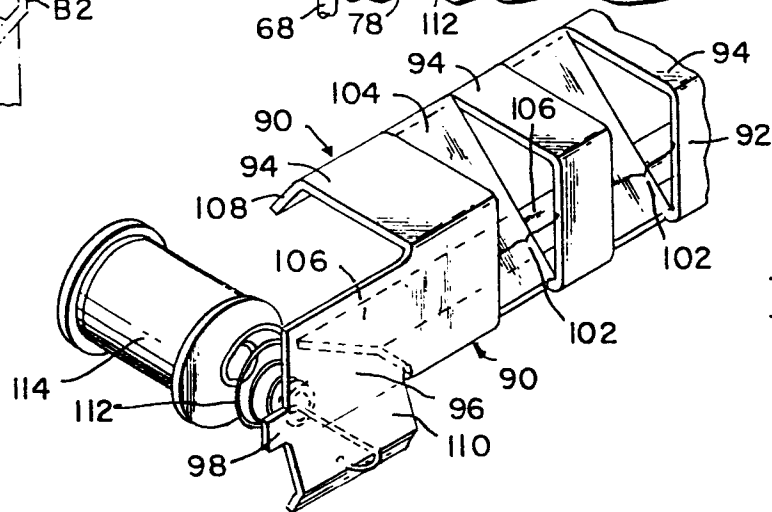


FIG. 4

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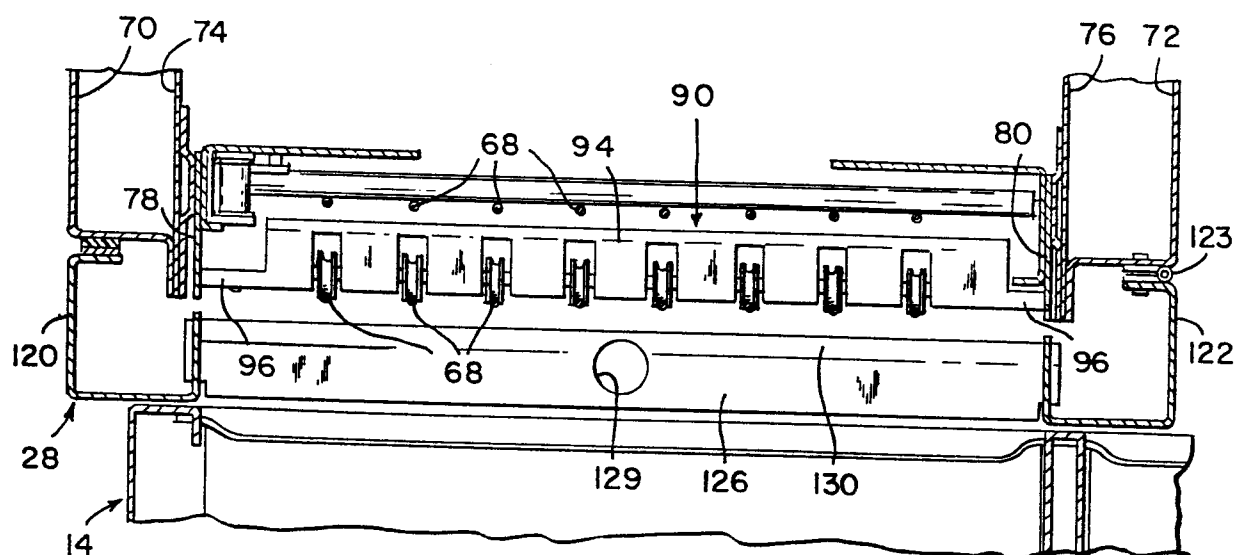


FIG. 5



European Patent
Office

EUROPEAN SEARCH REPORT

Application number
0005039
EP 79 30 06 23

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
D, A	<u>US - A - 3 938 881</u> (HOLLIDAY) * the complete description *		
D, A	<u>US - A - 3 963 277</u> (NORFIN) * the complete description *		
			TECHNICAL FIELDS SEARCHED (Int. Cl.)
			B 65 H B 07 C
			CATEGORY OF CITED DOCUMENTS
			X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons
			&: member of the same patent family, corresponding document
<div><div><input checked="" type="checkbox"/> The present search report has been drawn up for all claims</div></div>			
Place of search The Hague		Date of completion of the search 04-07-1979	Examiner LONCKE