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[33] **Great Britain**

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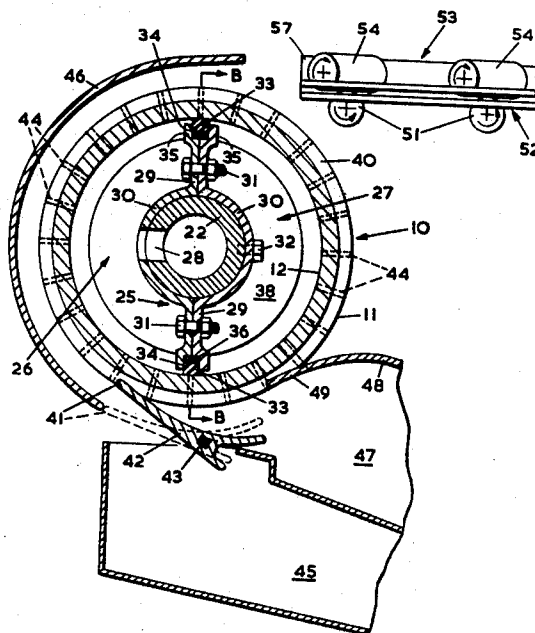
[54] **DOCUMENT TRANSFER DEVICES**
2 Claims, 3 Drawing Figs.

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271/71

[51] Int. Cl. **B65h 29/34,**
B65h 29/38

[50] Field of Search **271/27, 28,**
29, 83, 71, 64

ABSTRACT: A document transfer device suitable for changing the direction of travel of moving documents or for picking documents successively from a pile and dispatching them in a required direction. The device comprises a hollow cylindrical drum formed with holes communicating the drum interior with the cylindrical outside surface and, within the drum, a static partition which divides the interior of the drum into two pneumatically independent compartments. In operation, with the drum rotated and a reduced pressure applied to one of the compartments, a document presented to the drum above the evacuated compartment adheres to the drum and is carried round with it to a limited extent determined by the size of the evacuated compartment.



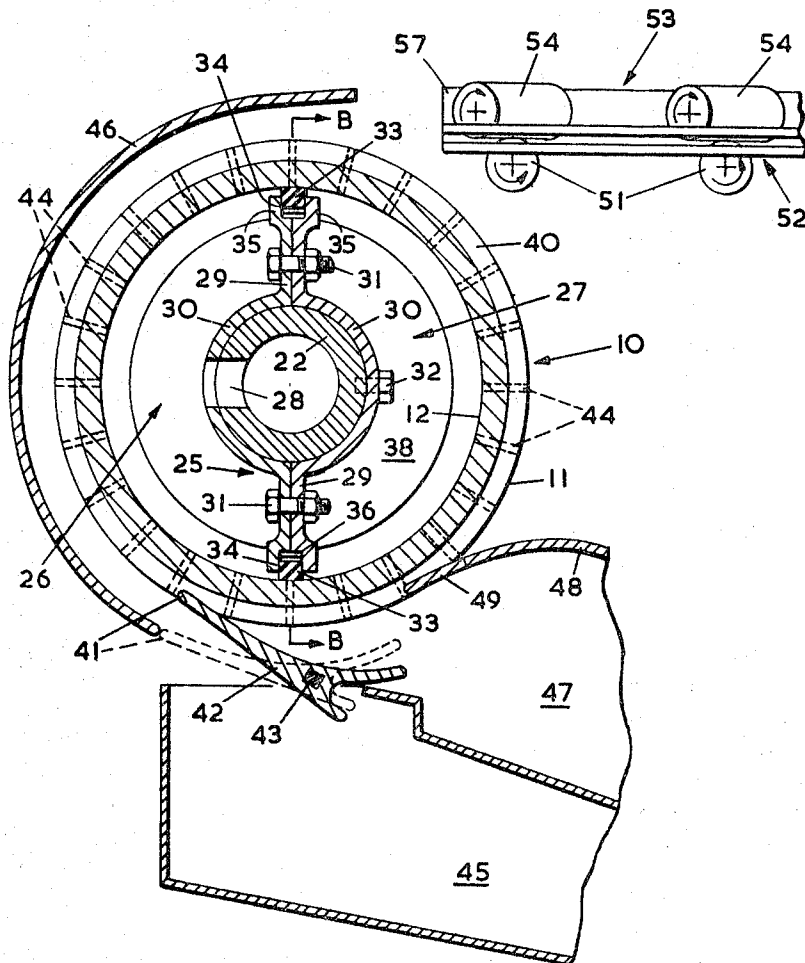


FIG. 1

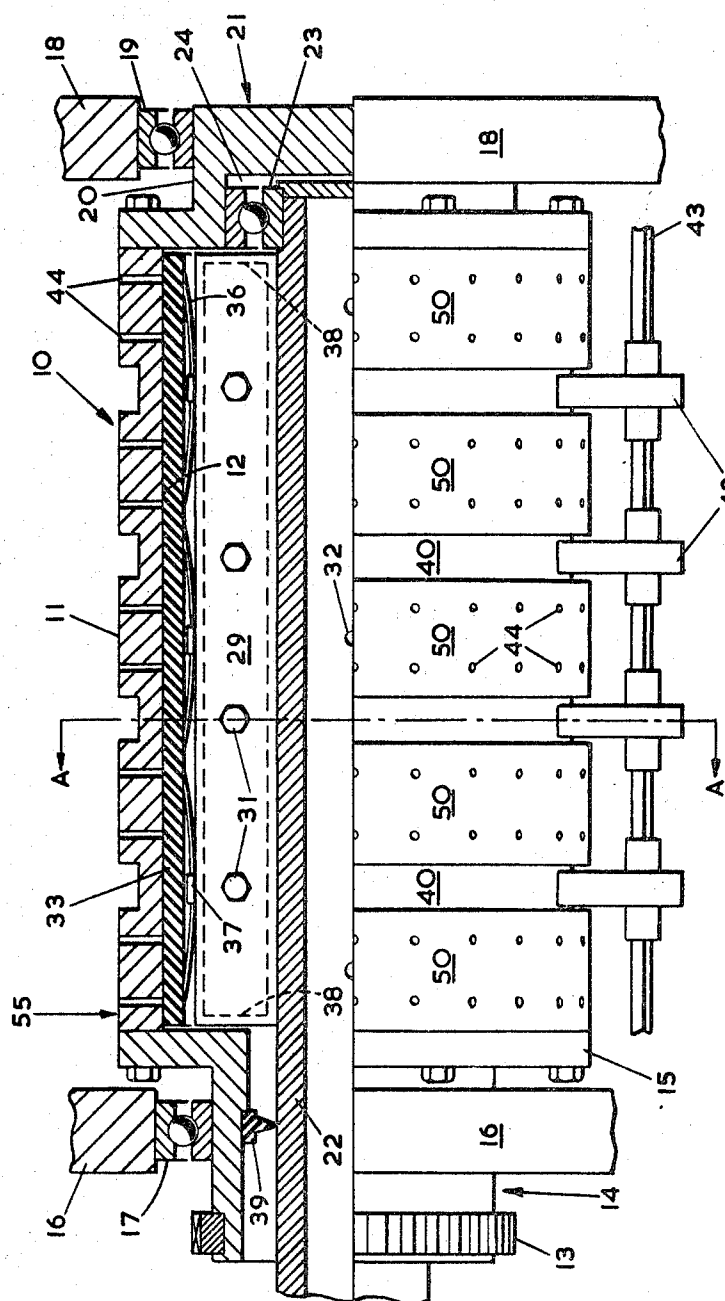


FIG. 2

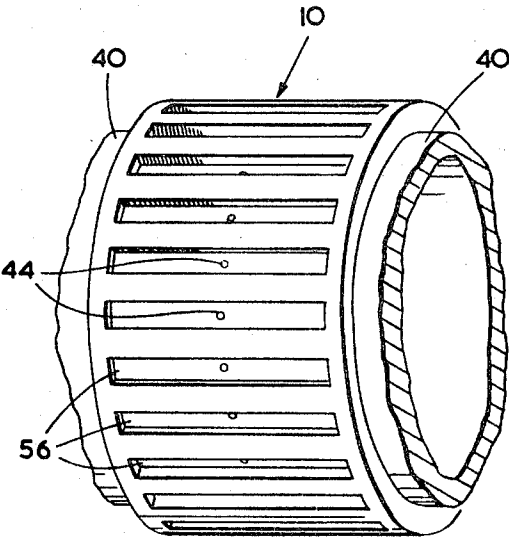


FIG. 3

DOCUMENT TRANSFER DEVICES

This invention relates to document transfer devices, more particularly to document transfer devices comprising a generally hollow cylindrical drum which is formed peripherally with holes communicating the interior of the drum with the periphery thereof and which, by means of a vacuum created in the interior of the drum, may be caused to pick up a document presented at a first station to its outside surface and by rotation may transfer the document a second station spaced peripherally of the drum from the first.

A document to be handled in this way may be initially presented to the drum by movement of the document onto the drum, or it may, for example, be the lowermost document of a generally static pile of documents.

The device may be used merely for changing the direction of document travel through a substantial angle, or, where appropriate, for dispatching the document for data processing in a direction substantially different from its initial orientation when static. In another application the device is used for stacking successively received documents in one or more piles.

Hitherto it has been customary with such devices to hold the whole of the interior of the drum at the reduced pressure required for operation, and to use a moving belt to which a vacuum is applied for picking off the documents from the drum at the second station.

Such an arrangement is unsatisfactory because the evacuating apparatus required to maintain the interior of the drum at a sufficiently low pressure has to be of considerable capacity due to the large leakage of air into the drum through the holes with which the drum is formed, and the pick off belt is expensive. In addition, the relatively large amount of air drawn into the drum carries with it a corresponding amount of debris such as paper dust, ink dust, etc. with the concomitant undesirable results.

According to the invention, a document transfer device comprises a generally cylindrical hollow drum rotatable about its axis and formed peripherally with holes communicating the interior of the drum with the periphery thereof, and a static partition within the drum and partitioning the interior of the drum into two axially extending compartments by cooperation with the surface defining the drum bore at two peripherally spaced lines of contact, whereby as the drum is rotated a vacuum created in a first one of the compartments causes a reduced pressure to be communicated to the periphery of that part of the drum for the time being defining the said first compartment, and part of a document presented to the said part of the drum is caused by differential pressure to adhere to the drum and is carried round by the drum as the drum rotates until such time as the document is forced away from the drum against the said differential pressure or the differential pressure is automatically released when the holes effective to cause the differential pressure are caused by rotation of the drum no longer to communicate with the interior of the drum at the said first compartment.

It will therefore be understood that the angle at the centre of the drum which is subtended by the partition can be made the same, or substantially the same, as the angle through which it is required to turn a document handled by the drum. Because only that part of the drum which is actively used during document transfer need be evacuated, the capacity of the evacuating apparatus need only be small and no pickoff belt need be used.

Preferably the partition cooperates with the surface defining the bore of the drum by means of brushes which are resiliently urged radially against the surface and which are made of nylon impregnated with molybdenum disulphide.

Another of the features of the device will become apparent from the following specific description and appended claims and is such that little or no lubricant can be drawn into the drum from the bearings by which the drum is supported for rotation. The drum may, however, be readily dismantled for cleaning or maintenance.

In order that the invention may be more fully understood a document transfer device in accordance with the invention and one modification thereof will now be described, by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a side elevation of the device taken in section along the line AA of FIG. 2,

FIG. 2 is a front elevation of part of the device in part section along the line BB of FIG. 1 and

FIG. 3 illustrates the modification of the device.

Referring now to FIGS. 1 and 2, the device comprises a drum 10 having a generally cylindrical outside surface 11 and a cylindrical inside surface 12. The drum is rotatable about its axis by a gear mechanism of which a gear wheel 13 (FIG. 2) forms part.

The wheel 13 is mounted on a flanged member 14 having a flange 15 which is peripherally bolted against one end of the drum as shown, and this member 14 is carried by a structural member 16 through a ball race 17 and so serves externally to support the respective end of the drum for rotation.

In a similar way, the other end of the drum is externally supported for rotation by second structural member 18 which cooperates, through a ball race 19, with a shoulder 20 formed on a closure member 21 bolted to the drum.

Centrally disposed in the interior of the drum is a tubular member 22 which extends the length of the drum and is located at one end by a ball race 23 in a recess 24 in the closure member 21. At its other end the tubular member 22 is rigidly secured (by means not shown) to a fixed drum support structure of which the structural members 16 and 18 form part.

Secured to the tubular member 22 and extending axially of the drum between the member 14 and the closure member 21 is a static partition generally indicated in FIG. 1 by the reference numeral 25. As is fully described below, this partition serves to divide the drum 10 internally into two compartments 26 and 27 (FIG. 1) which are pneumatically isolated from one another so that a substantially reduced pressure may be maintained in the compartment 26 as the drum rotates.

Evacuation of compartment 26 is by a vacuum pump (not shown) which communicates with the bore of the tubular member 22 at the left-hand end of the device (as shown in FIG. 2), and thence with the compartment 26 through ports 28 formed in the tubular member.

The partition 25 comprises two plates 29 each longitudinally and centrally formed with an arcuate portion 30 and bolted together by bolts 31 so as to embrace the tubular member 22 at these arcuate portions. Bolts 32 rigidly secure the partition to the tubular member 22.

As can be seen in FIG. 1, the partition is disposed generally on an axial plane of the drum and cooperates with the inside surface 12 thereof at plastic brush blocks 33 received in axial channels 34. To provide these channels the plates 29 are each formed at their edges with shoulder portions 35. The brush blocks 33 are made of nylon impregnated with molybdenum disulphide.

Leaf springs 36 located by lands 37 (FIG. 2) bias the brush blocks towards the drum so that each block provides a longitudinally extending fluid seal between the compartments 26 and 27.

To prevent air leaking between the compartments around the ends of the partition, the latter carries at each end an annular plate 38 which is disposed closely adjacent the inside face of the respective member 14 or 21 to provide the desired seal. In addition, the closed right-hand (FIG. 2) end of the member 22 is disposed closely adjacent the closure member 21.

A seal ring 39 carried by the member 14 prevents the ingress of air along the passage formed between this member and the member 22.

The outside surface 11 of the drum is formed from five cylindrical surfaces 50 which are separated by four grooves 40 formed peripherally of the drum. The grooves 40 are each of

sufficient width to receive the leading edge 41 of a respective one of four generally wedge-shaped pickoff members 42 secured to a common shaft 43. This shaft extends axially of the drum at the underside of the device and is rotatable by an actuator (not shown) to one of two positions. In one position of the shaft the pickoff members are as shown by the full lines in FIG. 1 with their leading edges 41 received by the grooves 40, and in the other position of the shaft the pickoff members are clear of the grooves and in the position indicated in FIG. 1 by the broken lines.

In operation, the drum is continuously rotated in an anticlockwise direction (FIG. 1) and the compartment 26 is evacuated by the vacuum pump as described above.

The drum is formed around its periphery with radially extending holes 44, and the reduced pressure in the compartment 26 causes air to be drawn in through the holes 44 in the part of the drum defining that compartment, i.e. the holes formed in the left-hand side of the drum as seen in FIG. 1.

If a document is fed on to the top of the drum from the right (FIG. 1), the reduced pressure in the holes 44 over the compartment 26 will cause the leading edge of the document to adhere to the drum, and rotation of the drum will cause the document to be carried round with it. It will be seen that successive portions of the document will adhere to the drum as they contact the drum.

Assuming the pickoff members 42 to be in the position shown by the full lines in FIG. 1, the leading edge of the document continues to adhere to the drum until it reaches the pickoff members 42; at this point it is forced away from the drum against the pressure differential and is guided by the under surfaces of the pickoff members towards a bin 45. In this way documents successively fed on to the drum have their direction of travel changed by the drum through 180° and are collected in the bin 45.

An arcuate guide plate 46 conforming to the outside surface of the drum and spaced from the drum by a small distance prevents the possibility of any document being thrown free of the drum by centrifugal force.

If it is required for any reason to segregate a document on the drum from the documents fed into the bin 45, the shaft 43 is rotated to its second position so that the document is allowed to pass above the upper surfaces of the pickoff members and is allowed to fall into a second bin 47 when the differential pressure causing the document to adhere to the drum is broken by the passage of the drum past the line of contact formed with the drum by the lower brush block 33. A static pickoff plate 48 having teeth 49 which extend into the grooves 39 ensures that the document is fed neatly into this second bin.

The documents are successively fed on to the drum as previously described from a roller table illustrated in FIG. 1 only. Drive rollers 51, spaced horizontally apart and aligned perpendicularly of the direction of document travel are rotatably mounted so that a top part of their peripheral surface projects through rectangular slots formed in a horizontal plate 52. These rollers 51 are driven by means not shown in an anticlockwise direction as seen in FIG. 2.

In order to prevent any substantial slip between the drive rollers and a document on the roller table, a pinch roller structure generally indicated by the reference numeral 53 is provided. This structure is hinged along one side of the table, i.e. along the direction of document travel, and carries for rotation a plurality of pinch rollers 54, one for each drive roller. Each pinch roller is disposed above its respective drive roller and is urged towards the drive roller by the weight of the pinch roller structure. Thus a document on a roller table is positively driven between successive pairs of drive and pinch rollers.

An additional function provided by the pinch rollers 54 is to provide lateral location of a document as it passes down the roller table. The pinch rollers are inclined in the horizontal plane to the drive rollers and so tend to force the document into the plane of the paper (as seen in FIG. 1) against a side plate 57. The document is therefore received by the drum with

one of its sides at a predetermined position axially of the drum, and this position is indicated in FIG. 2 by the arrow having the reference numeral 55.

The document transfer device shown and described with respect to the drawings is only by way of example and many modifications and variations thereof which fall within the scope of the invention are possible.

If desired, the seals between compartments (provided in the described embodiment by the brush blocks 33) may be provided by axially extending pieces of rubber or like resilient material which are secured to the seal structure so as to contact the inner surface of the drum longitudinally of the drum.

To ensure that debris drawn into the drum does not adversely affect the sealing between compartments, scrapers of rubber or like resilient material may be secured to the seal structure so as to scrape clean the inside of the drum immediately in advance of each seal.

In one modification of the device shown in FIGS. 1 and 2, the holes 44 do not extend to the outside surface of the drum but terminate in rectangular grooves 56.

FIG. 3 illustrates this arrangement by showing the grooves 56 formed in only one of the cylindrical surfaces 50. It will be appreciated, however, that the other surfaces 50 are likewise formed with the longitudinally extending and circumferentially spaced grooves 56.

The provision of grooves as shown at 56 has the advantage that the partial vacuum is effective over a larger area of paper of a document being handled than is provided merely by the holes 44 of FIGS. 1 and 2. Also, the paper of the document is slightly deformed where it overlies a groove 56 subject to the partial vacuum, and the trailing edge of the groove therefore exerts a positive tractive force to move the document forward. It will therefore be seen that the grooves 56 help to prevent slipping of the document with respect to the drum. As will be seen from FIG. 3, only one hole 44 need be associated with each groove 56.

The illustrated arrangement by which the drum is supported for rotation has the advantage that none of the ball races are directly subjected to the vacuum applied to the compartment 26 so that little or no lubrication from the races will be drawn to the drum. In addition, the arrangement allows for easy dismantling for cleaning and maintenance. It will be appreciated however that other mounting arrangements which fall within the scope of the invention and which satisfy these requirements are possible.

The invention is not limited to applications in which documents are presented to the drum by movement onto the drum, but may also be used where the documents are stacked in a pile from which the drum is arranged to remove documents in succession.

The invention therefore has application to document dispensers, particularly if the drum is formed with grooves such as are indicated at 56 in FIG. 3 and which may, in the absence of pickoff members 42 and hence grooves 40, extend substantially the length of the drum.

In the embodiment shown and described, the document transfer device is used to change the direction of document travel through 180° so that the documents may be stacked in a space saving manner directly below the roller table; to that end the lines of contact formed by the brush blocks 33 are diametrically opposed. It will be appreciated, however, that any substantial angle of document movement other than 180° may be provided by suitable arrangement of the partition.

We claim:

1. A document feeding device including a fixed hollow shaft; a hollow feed drum mounted on the shaft for rotation coaxially therewith; means for feeding documents seriatim onto the outer surface of the drum at a pickup point; a plurality of circumferential grooves spaced apart along the outer surface of the drum; first stripping means pivotally mounted and movable between a first position clear of the drum and a second position to project into the grooves of the drum; second stripping means fixedly mounted to project into the

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grooves of the drum downstream of the first stripping means; first and second document feeders positioned adjacent the first and second stripping means respectively; perforations in said shaft and in said drum to allow negative air pressure applied to said shaft to apply a vacuum holding force to a document on the drum, and divider means mounted on said shaft to form an airtight contact with the inner surface of the drum along a first line adjacent to the pickup point and along a second line intermediate to the position of said first and second stripping means such that vacuum is applied to the

document on the drum only between the pickup point and said intermediate point.

2. A document feeding device as claimed in claim 1 including sealing means on the divider means adjacent the inner surface of the drum and extending along each of the first and second lines, each said sealing means including a strip of sealing material urged into airtight contact with the inner surface of the drum by spring means.

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