# United States Patent [19]

**Watson**

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## [54] DOCUMENT PICKER


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[51] **Int. Cl.** .....**B65h 3/12**

[58] **Field of Search** .....271/26 ES, 34, 35, 271/74, 27, 30, 32



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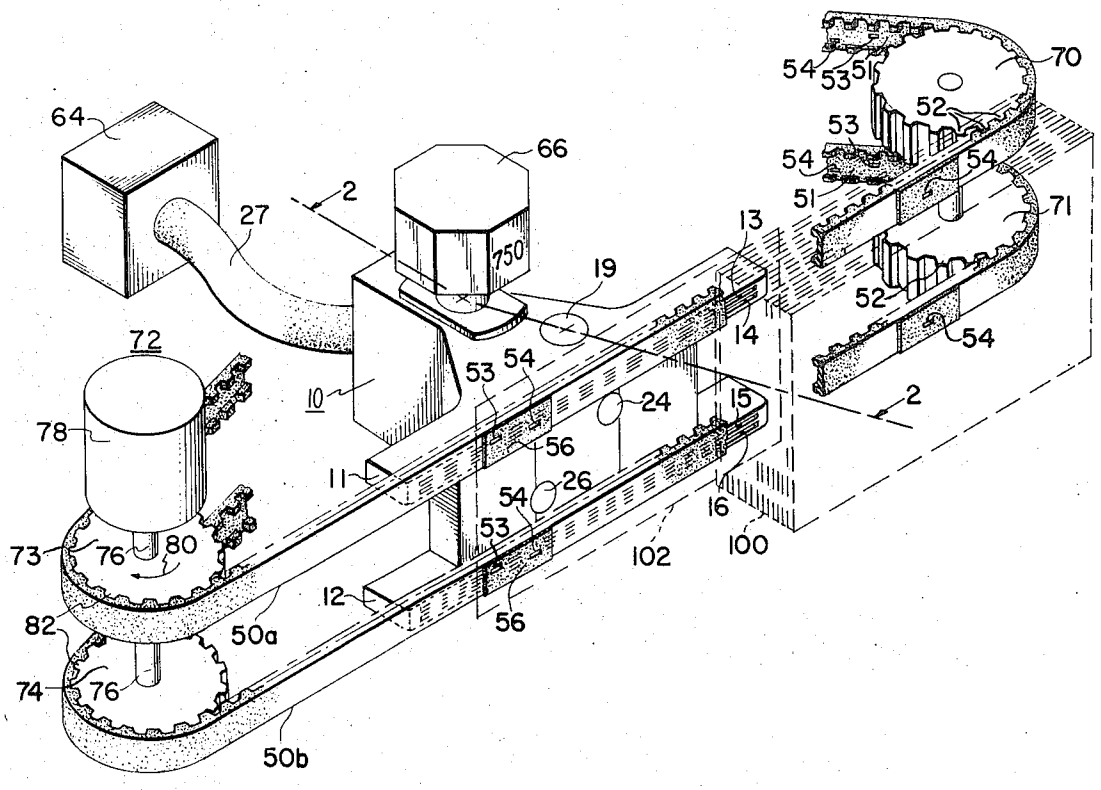
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[57] **ABSTRACT**

Vacuum-operated document picking and transporting apparatus includes a moving belt formed with two rows of apertures therein extending in the length direction of the belt either row of which may be coupled to a vacuum source. Apertures in one row may be located at different positions than those in the other and the apertures in one row may be spaced apart different distances than those in the other. Then as a portion of the belt containing an aperture passes between a stack of documents and the vacuum source, a document may be separated from the stack and transported by the belt. The phasing of the pickup and/or the number of documents picked up in a given interval of time may be changed without changing the belt speed by switching the vacuum to the other row of apertures.


**4 Claims, 2 Drawing Figures**



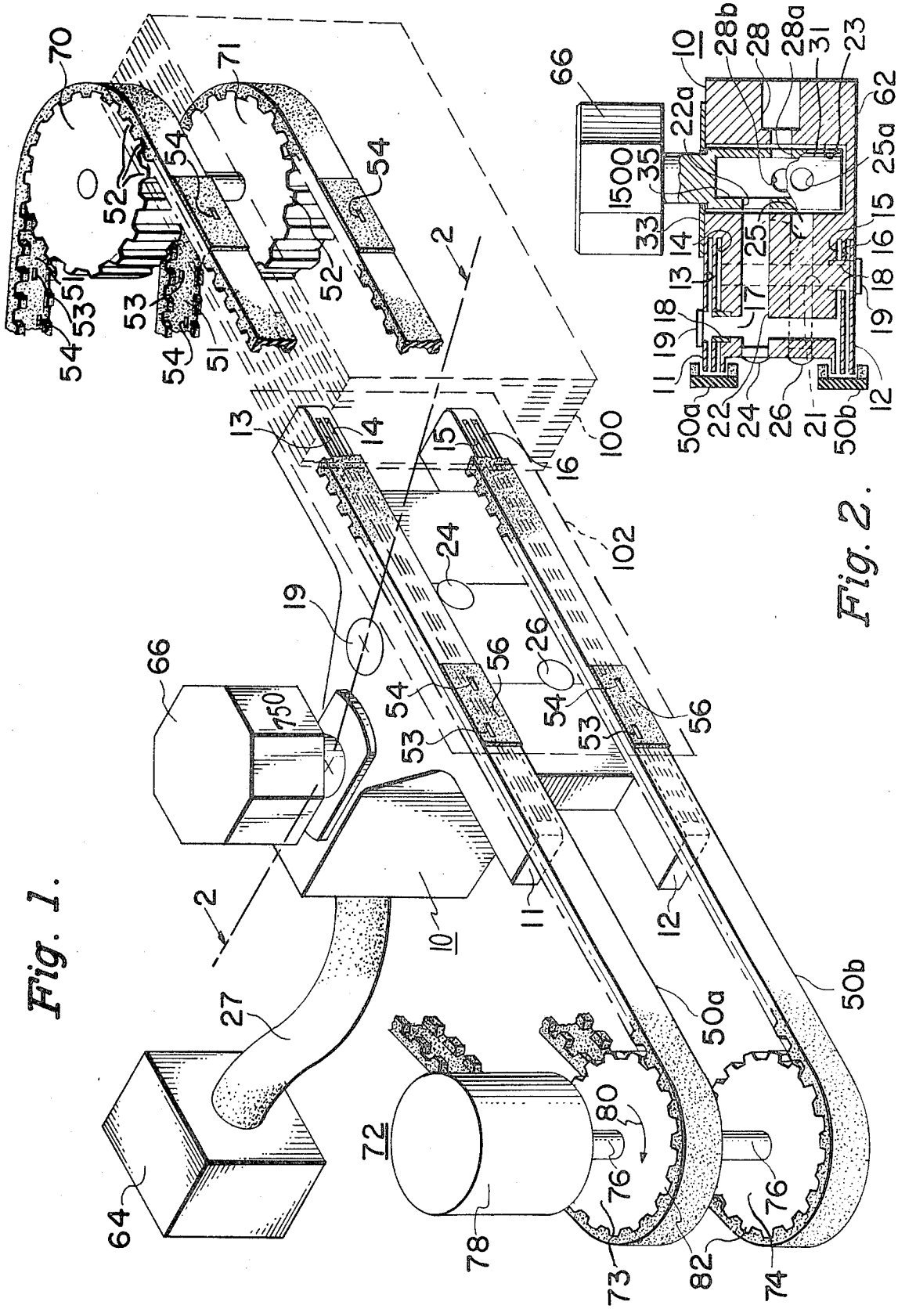

70
71
54
52
53
51
2
13
14
15
16
100
102
24
19
66
150
26
56
54
53
10
11
12
27
64
72
78
80
76
73
82
74
50a
50b

Fig. 1.


66
10
28b
28
28a
31
23
62
22a
1500
35
25a
33
14
25
15
16
13
17
18
19
11
12
50a
22
24
26
21
50b

Fig. 2.

# DOCUMENT PICKER

## BACKGROUND OF THE INVENTION

In many present day data processing devices, records or documents must be picked from a stack and transported to some utilization mechanism. Where the documents are relatively light or flexible, a moving belt having a plurality of spaced apertures is often utilized. Then a vacuum acting through the apertures attracts the documents one at a time to the moving belt to be transported thereby.

In some applications it is desirable to be able to pick documents at various rates. In prior art apparatus this has been accomplished by, for example, cutting off vacuum to a vacuum head located adjacent the belt during passage past the head of every other belt aperture. However, it is found in practice, that the means for cutting off the vacuum wears out in a very short time.

It is also sometimes desirable to alter the timing that the belt apertures pass other mechanisms. In prior art apparatus, this has been accomplished by physically moving the belt, relative to the rest of the apparatus. This involves rather complicated mechanical elements and, as is often the case, if accomplished while some of the apparatus is in motion, may prove dangerous to an operator making the change.

## SUMMARY OF THE INVENTION

An arrangement for picking documents from a document stack includes a driven belt the front surface of which passes the stack and which has two rows of apertures extending in the length dimension of the belt, apertures in one row being located at different positions than apertures in the other row. Also included is a means for creating a vacuum in the region of the belt which overlaps the leading portion (when considering belt movement direction) of the stack and extends for some distance beyond, and means for selectively applying the vacuum to one of the two rows of apertures through the back surface of the belt.

## BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view, partly schematic, of apparatus embodying one form of the invention; and

FIG. 2 is a cross-section taken along lines 2—2 of FIG. 1, being the vacuum head employed in the apparatus of FIG. 1.

## DETAILED DESCRIPTION

In FIG. 1 a pair of identical timing belts **50***a* and **50***b* (shown broken away) pass over a pair of idler gears **70** and **71**, respectively, follow a path adjacent to a vacuum head generally labeled **10** to a driving means **72**. Driving means **72** may comprise a motor **78** which is coupled to a pair of gears **73** and **74** by shaft **76**. The belts **50***a* and **50***b* pass over the gears **73** and **74**, respectively, to be rotated in the direction of arrow **80**.

Each belt **50** is an endless timing belt having a groove **51** formed around the inner periphery leaving teeth **52** on either side thereof. Teeth **52** are engaged by teeth **82** on gears **73** and **74** to provide synchronization between the belts as they are driven. Each belt is also formed with a first row of spaced apertures **53** and a second row of spaced apertures **54**. The apertures **54** on belt **50***b* align with apertures **54** on belt **50***a*; similarly, apertures **53** on the two belts are also aligned, that is, as viewed in the drawing, any aperture **53** on belt **50***b* lies directly beneath a corresponding aperture on belt **50***a*. The apertures of one set, such as apertures **54**, may be spaced half the distance apart as the apertures **53** of the other set. Further, where one aperture **53** is located close to an aperture of set **54** on the same belt, aperture **53** may lead an aperture **54**. A strip of high friction material **56** may be bonded to belt **50** in the vicinity of each aperture **53** and **54**. Successive apertures in a row are spaced apart a distance greater than the length of documents to be transported by the belts.



FIG. 2 should now be referred to. Head **10** is provided with two shoes **11** and **12** to accommodate the two vacuum belts **50***a* and **50***b*, respectively. Shoe **11** contains two slots **13** and **14** while shoe **12** contains slots **15** and **16**. The slots extend almost the length of the shoes, as illustrated in FIG. **1**. A bore **17** in head **10** connects slots **13** and **15**. It is sealed off from slot **14** by sleeve **18** which is pressed into a counterbore in head **10** after bore **17** is formed. A cap **19** closes the bore and may be attached to head **10** in any suitable manner. Slots **14** and **16** are connected in a similar manner by bore **21** (shown in phantom). A second sleeve **18** (shown in phantom) seals bore **21** from slot **15** and a cap **19** closes bore **21** at surface **62**.

A bore **22** intersects bore **17** and pierces the wall of valve chamber **23**. It is sealed at the opposite end by a plug **24**. In a similar fashion a bore **25** (shown largely in phantom) intersects **21** and also passes through wall **23**. The opposite end is sealed by a plug **26**. A vacuum supply line **27** connected to head **10** extends to a vacuum source **64** (FIG. 1). A bore **28** in head **10** continues to supply into valve chamber **23**.

Rotatable valve **31** is retained in the chamber **23** by retainer **33** which encircles the valve and is secured by a suitable means to head **10**. valve **31** contains a large bore **35** extending along a major portion of the length of valve **31**. The valve also contains a number of smaller ports connecting the large bore to various ones of the other bores previously described. In the position shown in FIG. **2**, port **28**a in valve **31** connects vacuum supply bore **28** to the interior bore **35**. A port **22***a* connects bore **35** to bore **22**. Therefore, by means of bore **28**, port **28***a*, bore **35**, port **22***a*, bore **22** and bore **17**, vacuum source **64** is connected to slots **13** and **15**.

Valve **31** also contains ports **25***a* and **28***b* which are at right angles respectively to ports **22***a* and **28***a*. A handle **66** connected to valve **31** permits it to be rotated 90° in the clockwise direction (as illustrated in FIG. 1). When valve **31** is rotated 90° from the position shown, a vacuum path is formed from vacuum source **64** through bore **28**, via port **28***b*, bore **35**, port **25***a*, bore **25**, and via bore **21** to slots **14** and **16**.

Returning to FIG. **1**, a stack of documents **100** shown in phantom is positioned opposite belts **50** and head **10** the belt lying adjacent the face of the nearest or end document of the stack. At least a portion of the documents (typically the portion commonly known as the leading edge when the document is in motion) is positioned adjacent the rightmost portion (as illustrated in FIG. **1**) of slots **13** through **16**. Document stackers are well known. Any type will perform satisfactorily which urges the stack of documents toward belts **50**.

In operation, assuming that valve **31** is in the position shown in FIG. **2**, i.e., that slots **13** and **15** are connected to vacuum source **64**, belts **50***a* and **50***b* will be driven until an aperture **53** on each belt is moved to a position

interposed between the stack of documents **100** and vacuum slots **13** and **15** respectively. At that time, a document **102** shown in phantom is attracted against the belts or rather against the frictional pads **56** and carried along as the belt is moved. Before apertures **53** reach the left side (as illustrated in FIG. **1**) of slots **13** and **15** another mechanism (not shown) may engage document **102** and move it out of the way of the belts **50** and head **10.** Since the spacing between adjacent apertures **53** is greater than the length of the documents, the operation just described is repeated every time a pair of apertures **53** is opposite document stack **100.** Document picking may be halted by disconnecting vacuum source **64.**

If it is desired to move a greater number of documents in a given time internal, valve **31** is rotated 90° to disconnect slots **13** and **15** from the vacuum source **64** and to connect slots **14** and **16** to the vacuum source. Then if documents **100** are shorter in length than the distance between adjacent apertures **54,** as each set of apertures **54** becomes interposed between stack of documents **100** and slots **14** and **16,** a document will be attracted to the belt to be transported thereby.

Since apertures **54** are more closely spaced than those of sets **53,** more documents will be handled by the system in a given unit of time.

Further since the usual reason for varying pick rate is variation in document length, and since long documents accelerate more slowly than short ones, it has been found necessary in the past when transporting long documents to shift the pick belts **50** in the direction of arrow **80** relative to the balance of the transport system. With the belts thus repositioned, documents will be picked up earlier in time. In the present apparatus the displacement, along the belt length, shown between the first group of apertures **53** and the second group **54,** accomplishes the same timing change. That is, apertures **53** which are used to pick longer documents are positioned ahead (i.e. to the left) of apertures **54.**

The number of belts illustrated and the number of apertures in each group illustrated are purely matters of engineering choice. For example, if very light-weight documents are to be transported, only a single belt may be necessary. If heavy documents are to be transported, a cluster of relatively closely spaced apertures per document in each belt **50** would be necessary rather than the single aperture illustrated. Further while only two sets of slots and, therefore, two different document pick rates have been illustrated, the principle would be applicable to any number of different rates merely by adding more rows of apertures on belts **50** and a corresponding number of slots in head **12.** In addition, opposite sets of apertures may be offset as illustrated in FIG. **1** or in line depending on the particular application. Finally, while a head having a shoe containing two slots, either one of which is selectable, has been described a head with a single slotted shoe may be utilized.

In that event the belt is shifted relative to the head in a direction normal to belt travel direction so that one or the other row of apertures is aligned with said slot. Either the belts or the head may be shifted but it may be more desirable to shift the head.

What is claimed is:

**1.** An arrangement for picking documents from the end of a stack of said documents comprising, in combination:

a driven belt means which passes one end of the stack with the front surface of the belt facing and adjacent to the exposed surface of the end document in the stack, said belt means being formed with two rows of apertures therethrough, each row extending in the direction of the length dimension of the belt means, apertures in one row being located at different positions than apertures in the other row;

means for creating a vacuum at the region of the belt means opposite the end document of the stack and

means for selectively continuously applying said vacuum solely to one of the two rows of apertures through the back surface of the belt, whereby the timing and rate of document pick-up is determined by the row of apertures to which said vacuum is applied.

**2.** An arrangement for picking documents from the end of a stack of said documents comprising, in combination:

a driven belt which passes one end of the stack with the front surface of the belt facing and adjacent to the exposed surface of the end document in the stack, said belt being formed with two rows of apertures therethrough, each row extending in the direction of the length dimension of the belt, there being a substantially greater number of apertures in one row than in the other, the apertures in said one row being spaced substantially closer together than in said other row;

means for creating a vacuum at the region of the belt which overlaps the last portion of the end document on the stack passed by the belt, and which extends a substantial distance beyond that last portion; and

means for selectively applying said vacuum to one of the two rows of apertures through the back surface of the belt.

**3.** An arrangement as set forth in claim **2** wherein adjacent apertures in said one row are spaced apart a distance somewhat greater than the length of a document.

**4.** An arrangement for picking documents from the end of a stack of said documents comprising, in combination:

a driven belt which passes one end of the stack with the front surface of the belt facing and adjacent to the exposed surface of the end document of the stack, said belt being formed with two rows of apertures therethrough, each row extending in the direction of the length dimension of the belt, apertures in one row being located at different positions than apertures in the other row and wherein the apertures in each row occur in clusters, each cluster of apertures in one row being spaced from the next adjacent cluster in that row a distance somewhat greater than a document length, and each cluster of apertures in the other row being spaced from the adjacent cluster of apertures in that row a distance substantially greater than the distance between clusters in said one row;

means for creating a vacuum at the region of the belt which overlaps the last portion of the end document on the stack passed by the belt, and which extends a substantial distance beyond that last portion; and

means for selectively applying said vacuum to one of the two rows of apertures through the back surface of the belt.

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