United States Patent [19]

Rehm et al.

[11] **3,788,636**

[45] **Jan. 29, 1974**

[54] **ROTATING SUCTION DRUM FOR DATA CARRIERS**

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[22] Filed: **May 23, 1972**

[21] Appl. No.: **256,150**

[30] **Foreign Application Priority Data**

May 29, 1971 Germany ..... P 21 26 833.7
May 29, 1971 Germany ..... HGM 71 20 974.0

[52] **U.S. Cl.** **271/4,** 271/52, 271/64, 217/196

[51] **Int. Cl.** **B65h 5/12**

[58] **Field of Search** ..... 271/74, 27–29, 271/51–53, 3, 4, 64, DIG. 2, 26 E, 80

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[57] **ABSTRACT**

A rotating suction drum passes sheet-type data carriers past at least one scanning device. The drum has an open frontal side and a zone with a plurality of channels leading to individual suction openings on the drum. A suction generator has a fan and is so disposed with respect to the drum that the entry opening for the fan passes through the open frontal side. The ratio between the sum of the areas of minimum cross section of the channels and the total area of the zone of the drum covered by the suction openings is more than 0.25.

11 Claims, 6 Drawing Figures

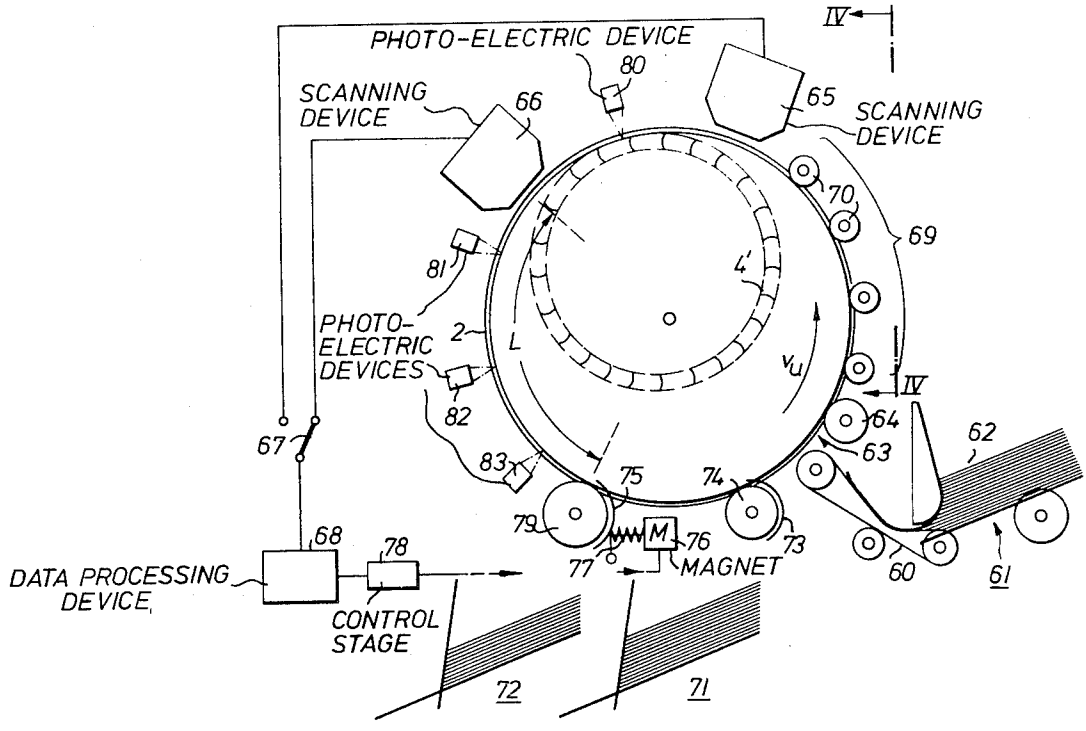
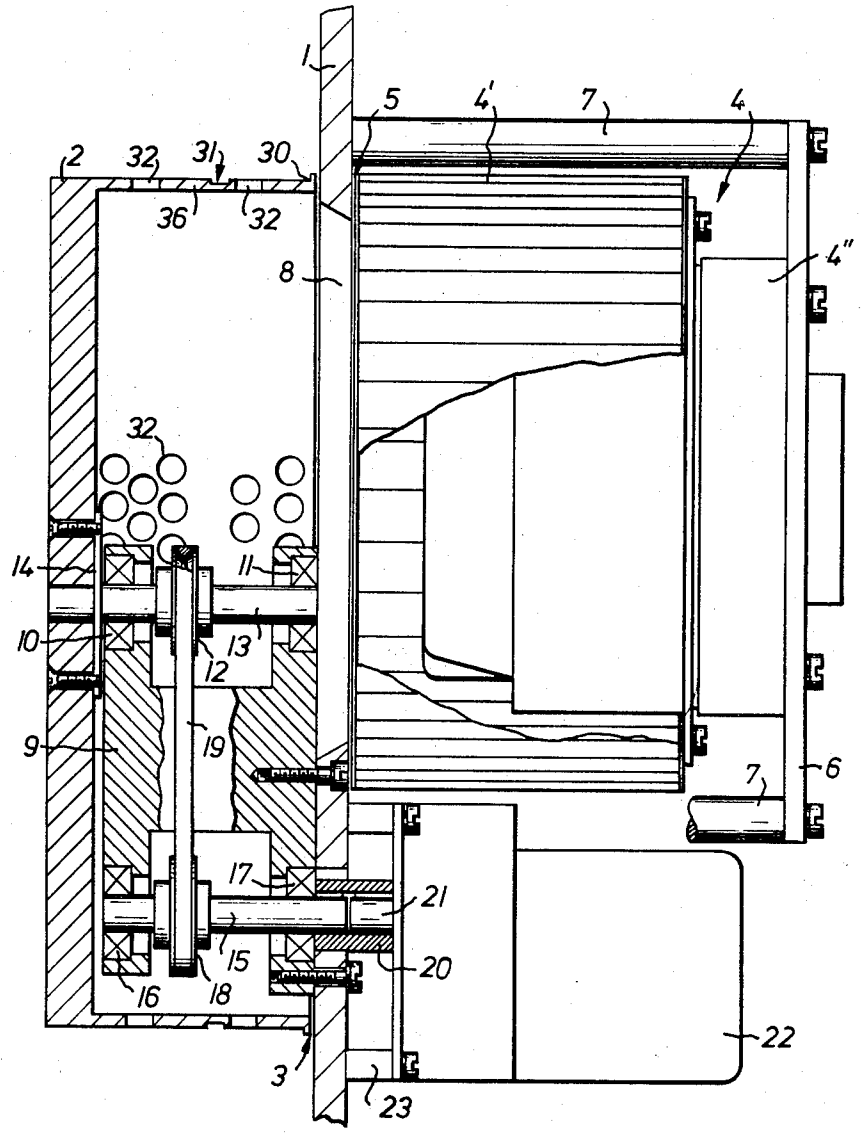


FIG. 1


1
5
4'
7
4
2
32
31
30
36
32
8
4"
32
14
11
10
13
12
9
19
7
6
17
21
15
20
16
18
22
3
23

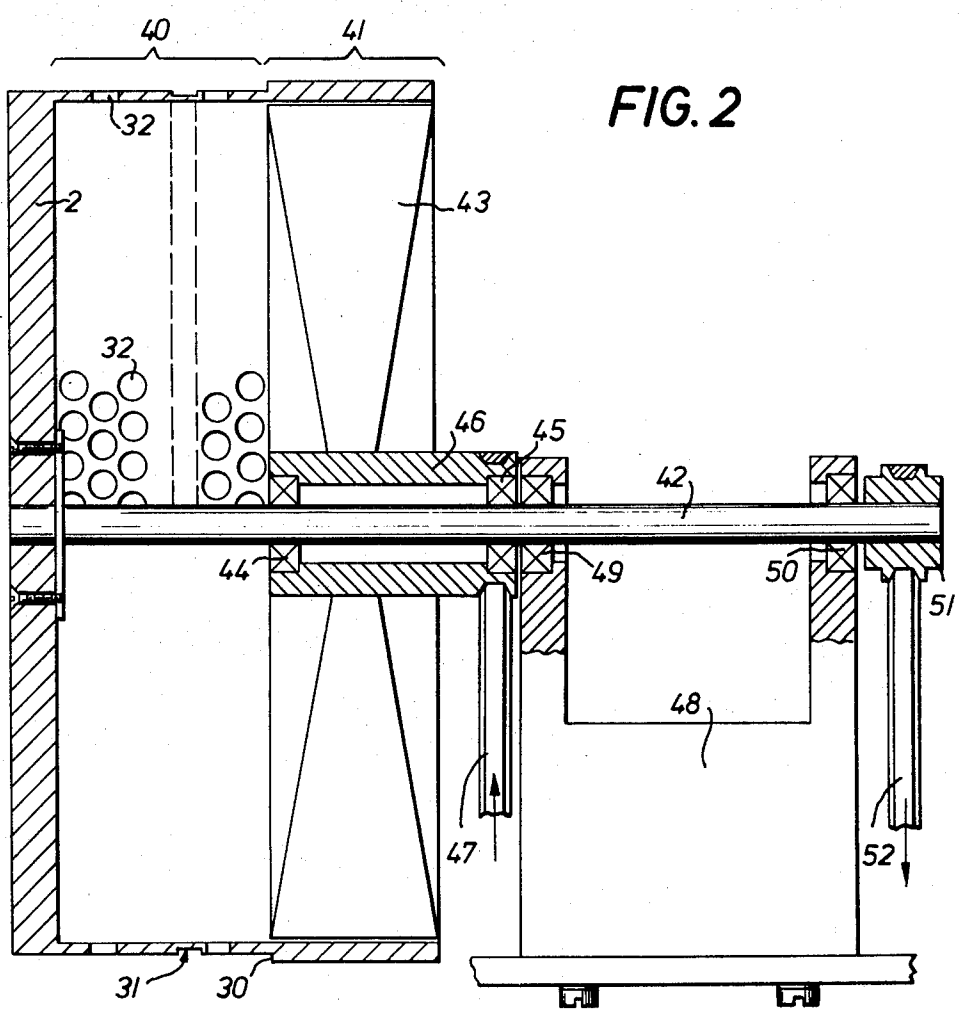


FIG. 2

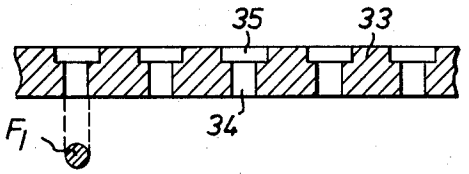


FIG. 5

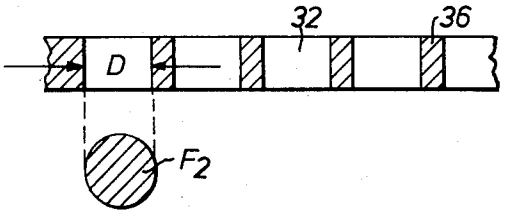


FIG. 6

FIG. 3

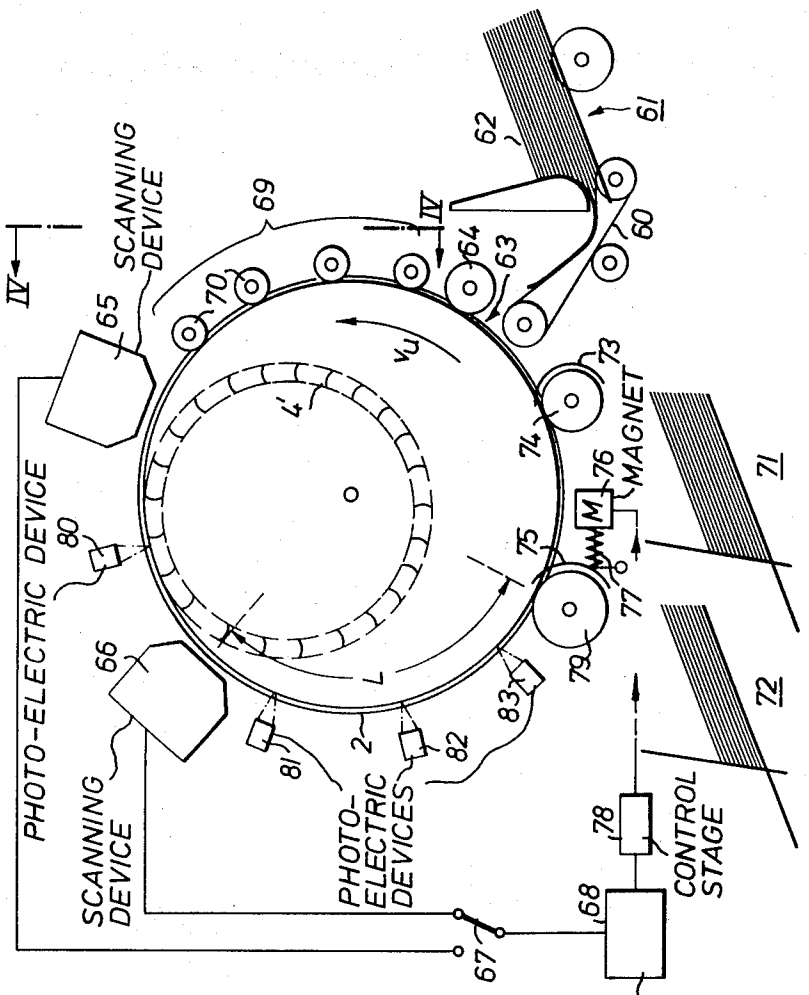
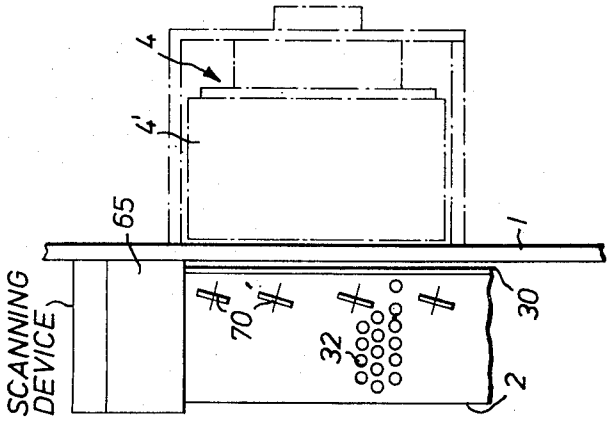

SCANNING DEVICE
PHOTO-ELECTRIC DEVICE
SCANNING DEVICE
PHOTO-ELECTRIC DEVICES
MAGNET
CONTROL STAGE
DATA PROCESSING DEVICE
IV
III

FIG. 4


SCANNING DEVICE

ROTATING SUCTION DRUM FOR DATA CARRIERS

BACKGROUND OF THE INVENTION

The present invention relates to an arrangement for passing sheet-type data carriers past one or a plurality of pickup devices and including a suction drum which is provided with suction openings, within a zone of its surface, around the entire curcumference of the drum.

In known arrangements of this type the suction drums are provided with relatively small suction openings, or at least the cross-sectional areas of the channels leading to the individual suction openings are small. The suction is produced by high-powered blowers or pumps which produce a relatively high subatmospheric pressure, corresponding to a column of water whose height is approximately 1,000 to 10,000 mm less than that of a column at atmospheric pressure, and to which the suction drum or drums are connected by means of lines. These suction generators are expensive and require a great deal of space. Furthermore these generators produce a loud noise which is often annoying.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide an arrangement of the above-mentioned type which is much less complicated with respect to the manner of producing subatmospheric pressure, has a compact structure that requires little space, and makes much less noise than known arrangements.

According to the invention the suction generator is a fan which is so arranged with respect to a suction drum that the inlet side of the fan is in communication with the interior of the suction drum through the open front side of the drum. In addition the ratio between the sum of the minimum cross-sectional areas of the channels leading to the individual suction openings and the total area of the zone covered by these suction openings on the suction drum is more than 0.25.

The fan in this connection is understood to mean a single-stage fluid flow device which, compared to a blower or a pump, has a high output but can produce only a slight pressure difference of, for example, a 20 mm column of water to a maximum of approximately a 100 mm column of water.

In general the arrangement according to the present invention has a cup-shaped suction drum which is mounted on a bedplate to be rotatably driven and so that the open face of the drum is directed toward the bedplate and the front edge of this drum is spaced from the bedplate. A fan is fastened to the other side of the bedplate, facing the suction drum, and is in communication with the interior of the drum through a passage opening which extends through the bedplate. This opening, is located within the circumference of the suction drum and the provides an inlet opening for the fan.

The suction generator may be a centrifugal fan which is so fastened to the bedplate that the open front of its impeller faces the bedplate and forms a gap therewith.

The data carriers can be applied to the suction drum individually and by hand or through an input path, or they can be transferred to the drum through a separator disposed in the vicinity of the suction drum in a continuous seqence. A guide path may then be disposed in a known manner between the point where the data carriers are transferred to the suction drum and a scanning device.

A further feature of the last-mentioned embodiment of the present invention resides in that one or more controllable discharge devices are disposed along the periphery of the suction drum in front of a fixed discharge device leading to a first stacking point for the data carriers. These controllable discharge devices lead to further stacking points and either remove the scanned data carrier selectively from the suction drum, in dependence on the evaluation of the scanned information in a data processing device, or permit the data carrier to move to the following discharge device. The circumference of the suction drum is selected to be of such a size, that with a given peripheral speed v_u, the length of the arc of the conveying path from the last scanning device to the first controllable discharge device is greater than the product $v_u.T_a$, of the peripheral speed and the evaluation time T_a required for evaluating the scanned information in the data processing device.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal view, partially in cross-section of a first embodiment of an arrangement according to the present invention.

FIG. 2 is a longitudinal cross-sectional view of a second embodiment of arrangement according to the present invention.

FIG. 3 is a simplified pictorial representation, from the front and in the direction of the drum axis, of a third embodiment of an arrangement according to the present invention.

FIG. 4 is a view, along the line IV—IV of FIG. 3, which shows schematically a portion of the arrangement of FIG. 3.

FIG. 5 is a cross-sectional detail view of the arrangement of suction openings on known suction drums.

FIG. 6 is a cross-sectional detail view of the arrangement of suction openings on the suction drum according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the arrangement shown in FIG. 1 the major components are carried by a bedplate 1. A cup-shaped suction drum 2 is mounted on bedplate 1 in such a manner that its open end faces the bedplate and there is a narrow gap, indicated generally at 3, between the edge of the drum 2 and the bedplate. On the other side of the bedplate 1, opposite the suction drum 2, there is a centrifugal fan, indicated generally at 4, with its impeller 4' and a motor 4''. The fan 4 is fastened to bedplate 1 in such a manner that the open front of the impeller 4' faces the bedplate 1 and forms a gap 5 therewith. A supporting plate 6 and spacer bolts 7 serve to fasten the fan 4 to the bedplate.

The centrifugal fan 4 also has the particular feature that is impeller 4' is not enclosed, i.e., it operates without a housing. Within the periphery of the suction drum 2 the bedplate 1 has a passage opening 8 which corresponds to the entry opening of the fan 4.

Within the suction drum 2 a bearing block 9, which is fastened to the bedplate 1, extends into the area of the passage opening 8 and there supports, by means of two bearings 10 and 11, the shaft 13 of the suction

drum which is provided with a driving pulley 12. The suction drum 2 is screwed to a collar 14 of shaft 13.

Within the suction drum 2, in the vicinity of the edge of the drum, there is a second shaft 15 which, in the illustrated embodiment, is also mounted in the bearing block 9 by means of two bearings 16 and 17 and bears a pulley 18. The pulleys 12 and 18 are connected together by means of a V-belt 19. The shaft 15 passes through the bedplate 1 and is connected with the shaft 21 of the drive motor 22 for the suction drum 2 by means of a coupling sleeve 20. Drive motor 22 is a geared device and is connected to the bedplate 1 by means of bolts 23.

The suction drum 2 is provided with a peripheral reference edge 30 as well as with a groove 31 which will be discussed below. The surface of the suction drum is also provided with suction openings 32 around its entire periphery. However for the sake of simplification only a few of these openings are shown in the drawings. As is apparent from the drawings, all of these openings are in permanent and simultaneous communication with the opening 8.

FIG. 5 is a schematic representation of a cross section through the wall 33 of a known high pressure suction drum. As can be seen, a number of channels 34 are provided and are widened into suction openings 35 of a larger cross section at the outer surface of the drum wall. The minimum cross-sectional areas F_1 for the suction air flowing through when the suction openings are open is provided by channels 34. However as seen in the schematic cross section of FIG. 6, taken through the wall 36 of the suction drum used in the present invention, the cross-sectional areas F_2 of the suction openings 32, themselves constitute the effective minimum cross-sectional areas of the channels leading to the suction openings.

In addition to the use of a fan as the suction generator, a feature of the present invention is that the ratio between the sum of the minimum cross sections F_2 of the channels leading to the individual suction openings 32 and the total area of the zone of suction drum 2 which is covered by the suction openings is greater than 0.25. This value is substantially higher than the corresponding ratio for the known suction drums, in which the ratio is, for example, in the order of 0.02 to 0.10.

In this way it is possible, inter alia, that the edges of the recording carriers which are carried along by the suction drum 2 are partially held to the suction drum by the environmental air flowing into the drum due to the existing hydrodynamic pressure. It has also been found to be advantageous to select a suction opening diameter D which is not smaller than approximately 5 mm when circular suction openings are employed.

Within the scope of the present invention the suction generator could also be an axial fan which would then be attached, for example in the embodiment shown in FIG. 1, to the passage opening 8 of the bedplate 1 in place of the centrifugal fan 4.

Another embodiment in which an axial fan is used, is shown in FIG. 2. Here the surface of the cup-shaped suction drum 2 has a closed zone 41, following the zone 40 adjacent the closed frontal side which is provided with the suction openings 32. In the area of this zone 41 the impeller 43 of the axial fan is rotatably mounted on a shaft 42 in the interior of the suction drum 2, as shown schematically, i.e., by means of two roller bearings 44 and 45. The hub 46 is a belt pulley and is driven by a motor (not shown) via a belt 47. A bearing block 48 supports the two bearings 49 and 50 for the shaft 42 of the suction drum 2. On the end of this shaft there is a pulley 51 which is driven by a motor (not shown) via a belt 52.

In an arrangement according to FIG. 1 suction drum 2 may have a diameter of 370 millimeters and a peripheral speed of 1.2 meters per second. Suction openings 32 may be of 7 millimeters in diameter. The sum of the areas of openings 32 may be 447 square centimeters and the zone of the drum covered by the suction openings may have an area of 1160 square centimeters, thus the ratio of these two values being about 0.37. Fan impeller 4' may be driven at 1,370 rpm and produce a suction pressure corresponding to a column of water 6 to 8 millimeters in height at an air mass flow of 3,000 cubic meters per hour, when drum 2 is not covered by data carriers.

The embodiment of the present invention illustrated in FIGS. 3 and 4 relates to an arrangement for processing data carriers, i.e., for separating, aligning, and scanning as well as stacking the data carriers in dependence on the evaluation of the scanned information in a data processing device.

A known separator 61, operating with a friction belt 60, feeds the data carriers 62, which were fed in separate stacks to the suction drum 2. At the transfer point indicated generally at 63, the data carriers are supported against the drum 2 by roller 64. In the vicinity of the periphery of the suction drum, two optical scanning devices, for example, 65 and 66 are disposed and these can be selectively connected with a data processing device 68 by means of a switch 67. Of course, device 68 can be of any known type.

Between the transfer point 63 and the first scanning device 65 a guide path, shown as encompassed with a bracket 69, is provided in a known manner. Here the data carriers are aligned, by obliquely arranged resilient guide rollers 70, with the above-mentioned peripheral reference edge 30 of the suction drum 2. The suction force acting on the data carriers in the area of the guide path is sufficiently low to permit the necessary displacement on the drum surface.

In the illustrated embodiments two stacking points 71 and 72 are provided. All the data carriers 62 which were carried along on the drum up to a discharge device 73 reach the first stacking point 71. This discharge device 73 is a rigid guide member which engages in the above-mentioned groove 31 of the suction drum 2, and the discharge process is aided by a roller 74 which is in contact with the surface of the suction drum 2.

The data carriers are brought to the second stacking point 72 by a controllable discharge device 75 which in a first position does not influence the data carriers and permits them to reach the discharge device 73, but in a second posiition (as shown) it removes them from the suction drum 2 and permits them to reach stacking point 72. The discharge device 75 thus constitutes a switch. It is brought into the illustrated operating position by a magnet 76 into the first, or rest, position by a spring 77. The magnet 76 is actuated by an output signal from a control stage 78 which is controlled by the data processing device 68. The discharge device 75 has a supporting roller 79 associated with it.

The information passed by the scanning device 65 or 66, depending on the position of switch 67, into the data processing device 68 is there evaluated in a known

manner. If the evaluation does not produce the desired result, for example because the recording is faulty, the respective data carriers are conducted to stack **72** by the actuation of the controllable discharge device **75**. Otherwise, they are directed to stack **71**.

In an arrangement for the scanning and subsequent removal of data carriers, the evaluation of the scanned information is effected during a certain time period T_a in a data processing device, after which time the evaluation result and thus the control signal for rendering the first discharge device operative is available. Because of the evaluation tiem required it is necessary to provide an intermediate path of sufficient length between the last scanning device and the first, controllable, discharge device. With known arrangements this is effected by a spacial conveying path composed of pairs of rollers or interacting belts.

An advantageous further embodiment of the present invention makes it possible, under given circumstances, to do without such a special conveying path. For this purpose the periphery of the suction drum **2** is given a length such that, with a given peripheral speed v_u, the arc length shown at L, from the last scanning device **66** to the controllable discharge device **75** is greater than the product $v_u.T_a$ of the peripheral speed and the evaluation time of the scanned information in the data processing device. In this manner the guide path, the scanning path, the intermediate path and the discharge path are all formed along the suction drum **2**. Photo-electric devices are indicated at **80** to **83** and arranged to emit output signals which depend on the movement of the data carriers, and these signals are also fed into the data processing device **68**. There they are evaluated, inter alia, so that a control signal associated with a certain data carrier actuates the magnet **76**, when necessary, shortly before this data carrier arrives at the controllable discharge device **75**.

It will be understood that the above description of the present invention is susceptible to various modifications, changes and adaptations, and the same are intended to be comprehended within the meaning and range of equivalents of the appended claims.

We claim:

1. In an arrangement with a rotating suction drum for the passage of sheet-type data carriers past at least one scanning device, the improvement which comprises:

a means forming part of said drum and defining an open frontal side and a closed frontal side opposite said open side;

b means defining, in a zone of said suction drum, a plurality of channels leading to individual suction openings;

c a suction generator having a fan;

d means defining an air entry opening for said fan, said fan being so disposed with respect to the said suction drum that its air entry opening is in communication, through said open frontal side of said suction drum with the interior of said drum, and the interior of said drum being constructed such that all of said suction openings are in permanent and simultaneous communication with said air entry opening, and the ratio between the sum of the areas of minimum cross section of the channels leading to the individual suction openings and the total area of the zone of said suction drum which is covered by the suction openings is more than 0.25; and

e means for rotatably and drivably mounting said suction drum, including a rotatably mounted first shaft having one end fastened to said closed frontal side of said drum, said shaft supporting said drum and extending through said drum toward said open frontal side thereof.

2. An arrangement as defined in claim **1**, wherein said fan extends parallel to the axis of rotation of said suction drum.

3. An arrangement as defined in claim **1**, further comprising a bedplate, said means for rotatably and drivably mounting said suction drum being mounted on one side of said bedplate with the open frontal side of said suction drum facing said bedplate and with a peripheral reference edge of said suction drum at the open frontal side disposed to form a gap with said bedplate, means defining a passage opening in said bedplate and disposed to lie within the periphery of said suction drum, and said fan being mounted on said bedplate on the other side of said bedplate, opposite said suction drum, and with said passage opening corresponding with the entry opening of said fan.

4. An arrangement as defined in claim **3**, wherein said means for rotatably and drivably mounting said suction drum comprises a bearing block which is fastened to said bedplate and disposed to lie in the interior of said drum and to extend into the area of said passage opening and a drive pulley on said first shaft, said first shaft having a bearing connection in said bearing block.

5. An arrangement as defined in claim **3**, wherein said fan is a centrifugal fan having an impeller with an open frontal side, said centrifugal fan being fastened to said bedplate with the open frontal side of said impeller facing said bedplate and spaced therefrom.

6. An arrangement as defined in claim **5**, wherein said impeller of said centrifugal fan is disposed to be in open communication with the ambient air.

7. An arrangement as defined in claim **1**, wherein said zone containing suction openings is on the periphery of said drum and is disposed adjacent said closed frontal side of said drum, the periphery of said drum further includes a closed zone adjacent said zone containing suction openings, and said fan comprises an axial impeller, said arrangement further comprising a shaft rotatably supporting said drum, and said impeller is mounted on said first shaft for rotation therewith relative thereto in the interior of said drum and in the region adjacent said closed zone.

8. In an arrangement with a rotating suction drum for the passage of sheet-type data carriers past at least one scanning device, the improvement which comprises:

a means forming part of said drum and defining an open frontal side and a closed frontal side opposte said open side; b means defining, in a zone of said suction drum, a plurality of channels leading to individual suction openings;

c a suction generator having a fan;

d means defining an air entry opening for said fan, said fan being so disposed with respect to the said suction drum that its air entry opening is in communication, through said open frontal side of said suction drum with the interior of said drum, and the ratio between the sum of the areas of minimum cross section of the channels leading to the individual suction openings and the total area of the zone of said suction drum which is covered by the suction openings is more than 0.25;

e a bedplate;

f means for rotatably and drivably mounting said suction drum on one side of said bedplate with the open frontal side of said suction drum facing said bedplate and with a peripheral reference edge of said suction drum at the open frontal side disposed to form a gap with said bedplate;

g means defining a passage opening in said bedplate and disposed to lie within the periphery of said suction drum, with said fan being mounted on the other side of said bedplate from said suction drum and with said passage opening corresponding with the entry opening of said fan;

h said means for rotatably and drivably mounting said suction drum comprising a bearing block which is fastened to said bedplate and disposed to lie in the interior of said drum and to extend into the area of said passage opening, a first shaft supporting said suction drum, and a drive pulley on said shaft, said shaft having a bearing connection in said bearing block;

i a second shaft which is disposed in the interior of said suction drum in the vicinity of the peripheral edge of said drum;

j a drive motor for said suction drum, said second shaft passing through said bedplate and being in communication with said drive motor;

k a pulley on said second shaft; and

l means interconnecting said pulley and said drive pulley on said first shaft to rotate said first shaft.

9. An arrangement as defined in claim **8,** wherein said second shaft is mounted in said bearing block.

10. In an arrangement with a rotating suction drum for the passage of sheet-type data carriers past at least one scanning device, the improvement which comprises:

a means forming part of said drum and defining an open frontal side and a closed frontal side opposite said open side;

b means defining, in a zone of said suction drum, a plurality of channels leading to individual suction openings;

c a suction generator having a fan;

d means defining an air entry opening for said fan, said fan being so disposed with respect to the said suction drum that its air entry opening is in communication, through said open frontal side of said suction drum with the interior of said drum, and the ratio between the sum of the areas of minimum cross section of the channels leading to the individual suction openings and the total area of the zone of said suction drum which is covered by the suction openings is more than 0.25;

e a fixed discharge device disposed along the periphery of said suction drum and leading to a first stacking location;

f at least one controlled discharge device also disposed along the periphery of said suction drum and ahead of said fixed discharge device in the direction of rotation of said suction drum, said controlled discharge device leading to a further stacking area;

g a first scanning device associated with said suction drum ahead of said controlled discharge device in the direction of rotation of said drum;

h a data processing device operatively connected to said controlled discharge device, and with the periphery of said suction drum being of such size that, with a given peripheral speed, v_u, the arc length, L, of the conveying path from said first scanning device to said controlled discharge device is greater than the product of the peripheral speed v_u and the evaluation time, T_a, of the scanned information in said data processing device, whereby each scanned data carrier is selectively removed from said suction drum by said controlled discharge device in dependance on the evaluation of the scanned information in said data processing device.

11. An arrangement as defined in claim **12,** further comprising:

i a first means associated with said suction drum for transferring data carriers to said suction drum;

j a second scanning device associated with said suction drum and in spaced relationship with said first means along the peripheral surface of said drum;

k means defining a peripheral reference edge at the open frontal side of said suction drum; and

l a second means defining a guide path for the data carriers between said first means and said second scanning device, said second means including a plurality of resilient guide rollers associated with said suction drum and mounted to extend obliquely to said peripheral reference edge, whereby consecutively fed-in data carriers received from said first means are urged by said resilient guide rollers to a position where the data carriers are aligned with said peripheral reference edge, the suction forces acting on the data carriers in the guide path being sufficiently low to permit such positioning.

* * * * *