March 24, 1964 K. REHM 3,126,200

SEPARATING DEVICE

Filed July 26, 1961 2 Sheets-Sheet 1

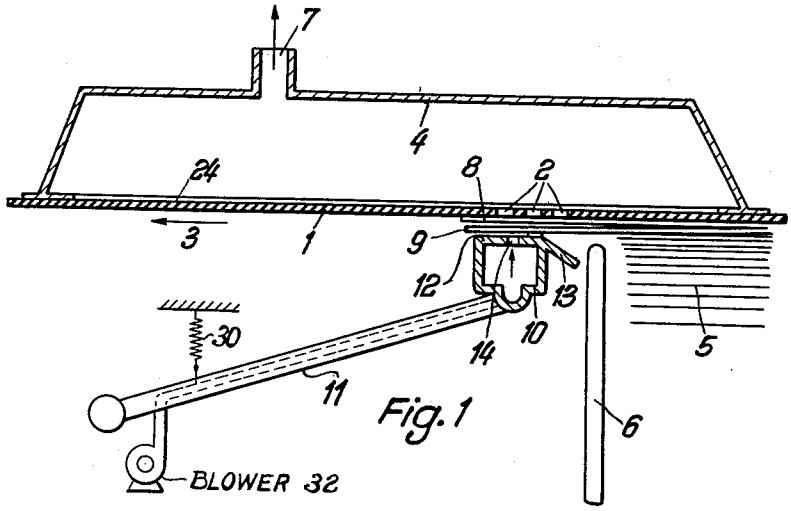

Fig. 1

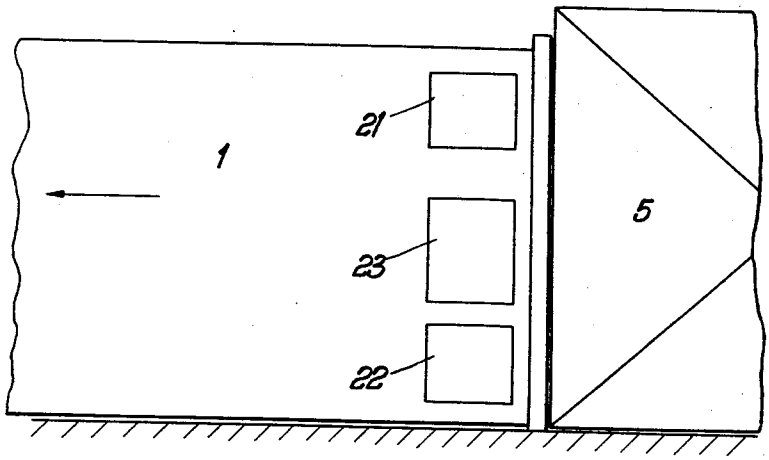

Fig. 8

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SEPARATING DEVICE

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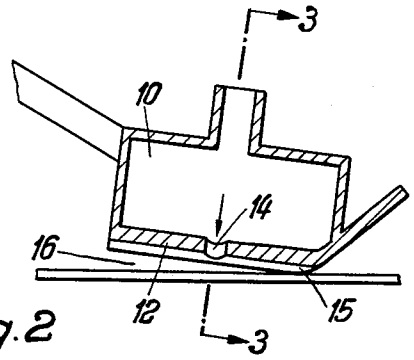

Fig. 2

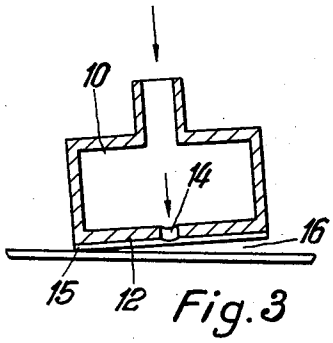

Fig. 3

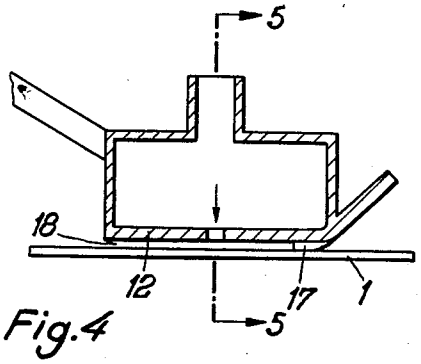

Fig. 4

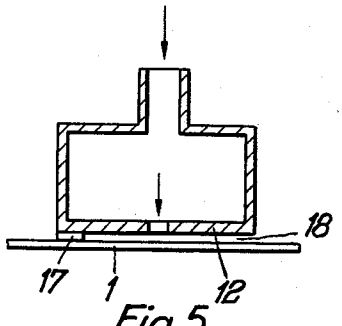

Fig. 5

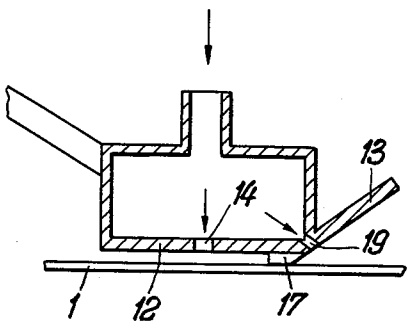

Fig. 6

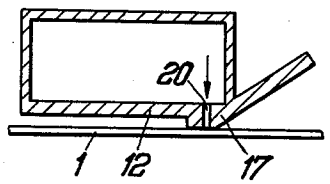

Fig. 7

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SEPARATING DEVICE

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Claims priority, application Germany July 30, 1960
19 Claims. (Cl. 271—26)

The present invention relates generally to the sorting art, and, more particularly, to a device for separating adhering articles in a sorting plant.

In automatic sorting plants handling flat material and especially mail shipments, such as letters, postcards, postal checks and forms, and the like, it is necessary that the shipments be separated from each other to assure proper handling in subsequent operations. Normally, the shipments are disposed in a stack or pile and are individually removed from this stack. In the past, shipments have been individually removed from such a stack by means such as a perforated suction belt. Such suction belts have suction openings disposed in groups spaced from one another a distance which corresponds to the desired conveying distance between shipments. The suction openings run over suction slots of a suction trough. Each group of suction openings carries a shipment away from the stack, and this shipment is carried along the belt by suction force.

In such a suction belt separating unit, two or more shipments sometimes adhere to one another and are carried along the belt at the same time. Porous shipments, especially postcards, have been found to adhere to one another especially strongly. Further shipments may be retained by suction force through a porous shipment directly abutting against the belt. Since such further shipments are held relatively tightly by the suction force, they are difficult to remove.

This is likely to lead to disturbances in subsequent parts of a sorting plant. Therefore, precautions are taken by providing special devices which secure or establish separation of the shipments. Friction strippers are known which, by frictional effect, detain those shipments not directly abutting against the conveyor belt. Since the frictional properties of the individual shipments are different, it is difficult to adjust the frictional force of the friction stripper to assure that excess shipments carried along will be detained in each case.

In my copending application Serial No. 123,000, filed July 10, 1961, yieldably supported suction members are disclosed which, by suction force, detain shipments not directly abutting against the suction belt. However, a shipment adhering due to the porosity of the belt-contacting shipment is not firmly detained in every case by the suction members since, due to this porosity, these shipments very strongly adhere to one another.

With these defects of the prior art in mind, it is a main object of the present invention to provide a separator which will separate even those shipments which adhere to each other with a relatively large force.

Another object is to provide a separator which uses pressurized air to separate overlying and adhering shipments and which is simple in construction, relatively inexpensive to manufacture, yet exceedingly effective in performing the separating operation.

These objects and other ancillary thereto are accomplished according to preferred embodiments of the invention wherein at least one yieldably supported pressure shoe faces and is slightly spaced from a suction belt. An air port is provided in the belt-facing surface of the pressure shoe. This port is provided with air at superatmospheric pressure so that shipments adhering to one another by suction or otherwise are lifted off and separated from

one another by the action of the outflowing gas. The device according to the present invention may especially be combined with a suction device.

Additional objects and advantages of the present invention will become apparent upon consideration of the following description when taken in conjuction with the accompanying drawings in which:

FIGURE 1 is a diagrammatic longitudinal sectional view through the invention used in conjuction with a suction belt type separating device.

FIGURE 2 is a longitudinal sectional view of one embodiment of the invention.

FIGURE 3 is a transverse sectional view taken substantially along the plane defined by line 3—3 of FIGURE 2.

FIGURE 4 is a longitudinal sectional view of another embodiment of the invention.

FIGURE 5 is a transverse sectional view taken substantially along the plane defined by line 5—5 of FIGURE 4.

FIGURE 6 is a longitudinal sectional view of a further embodiment of the invention.

FIGURE 7 is a longitudinal sectional view of the embodiment of FIGURE 6 taken along a plane spaced from but parallel to the plane along which FIGURE 6 is taken.

FIGURE 8 is a diagrammatic side view illustrating an arrangement of a plurality of pressure shoes cooperating with a suction belt separating device.

With more particular reference to the drawings, FIGURE 1 illustrates a suction belt 1 having groups of suction openings 2 and which moves in the direction of arrow 3 over the slit-like suction ports of a suction trough 4. The viewing plane of FIGURE 1 extends through a slit-like suction port 24. The distance between the individual groups of openings 2 on suction belt 1 corresponds to the desired conveying distance between shipments in the plant. The shipments 5 are disposed in a stack which has one side corresponding to the leading edges of the letters abutting against the wall 6. In each case only the shipment of stack 5 abutting against the belt is to be carried along by the belt due to the adhering force caused by the suction effect of a group of openings 2. The suction trough 4 is connected with a suction or vacuum producing unit at 7.

In some cases, individual shipments adhere firmly or tightly to one another or, in the case of porous shipments, several shipments are removed by a group of suction openings. This is illustrated in FIGURE 1 where two shipments 8 and 9 have been simultaneously picked up by suction openings 2. Shipment 9 must be detained since, otherwise, disturbances may occur in subsequent sections of the sorting plant. In order to achieve this, a pressure shoe 10 is arranged in opposition to suction belt 1, and is yieldably mounted by means of a swivel arm 11. A slight biasing force is applied to shoe 10 by means of spring 30 attached to swivel arm 11 to urge the shoe toward suction belt 1. The shoe surface 12 is preferably plane and is maintained at a short distance from suction belt 1, by means described below.

Due to the thickness of entering shipments, shoe 10 may be retracted at substantially right angles to the plane of suction belt 1. The end of the shoe surface facing the entering shipments defines an entering surface 13, inclined with respect to suction belt 1. This entering surface 13 is provided so that the shoe will be gently moved away from the suction belt by an entering letter. At least one air pressure port 14 is provided in the shoe surface 12 through which a gas, especially air, flows under superatmospheric pressure. The compressed air may preferably be supplied to the shoe through a hollow swivel arm 11 from an air pump 32. However, it is possible to

provide other means for feeding the compressed air to the shoe.

According to the laws of flowing gases, a vacuum or subatmospheric pressure zone is formed on the shoe surface due to the air blast issuing from port 14. Because of this subatmospheric pressure, formed by the suction effect of the outflowing air, shipments 9 not directly abutting against the belt are lifted from the underlying shipment, thus making it possible to detain them. Since compressed air continuously flows through port 14, even shipments tightly adhering to one another, for example, due to vacuum pressure when one shipment is porous, are lossened by the effect of this air current and the adhesive effect is removed.

The shoe surface 12 should always be maintained at a short distance from suction belt 1 and from shipments 8 or 9, so that the compressed air may flow unimpeded to form the suction force. In order to achieve this, special measures must be taken. These are indicated in FIGURES 2 through 7. Shoe 10 in FIGURES 2 and 3 has a plane shoe surface 12. This surface is slightly inclined with respect to the plane of suction belt 1 and has only one corner which abuts against suction belt 1 and the shipments. Due to this construction, the compressed air discharged through port 14 may freely flow into the wedge-shaped zone 16.

FIGURES 4 and 5 illustrate another arrangement of the shoe according to the invention. Shoe surface 12 in this embodiment is disposed parallel to suction belt 1. In the shipment entering zone of the shoe surface, at least one small projecting supporting abutment 17 is provided which limits the minimum distance between shoe surface 12 and suction belt 1 or the surface of a shipment. The compressed air may freely flow into the rectangular zone 18.

FIGURES 6 and 7 illustrate an embodiment similar to that of FIGURE 3. FIGURE 6 shows a shoe having a supporting abutment 17. In the shipment entering surface 13 of this shoe, an additional pressure port 19 is provided at as small an angle as possible with the direction of conveying. The air current flowing through port 19 detains the small stacks of letters carried along due to frictional effect. Port 19 has no effect on the separation of shipments held tightly to one another by vacuum pressure. FIGURE 7 is taken along a plane passing through the supporting abutment 17, and is parallel to the viewing plane of FIGURE 6. An additional pressure port 20 is formed through abutment 17. The compressed air discharged through nozzle 20 has a cushioning effect and abutment 17 tends to rest on an air cushion. This prevents wear and tear on the small supporting abutment 17 so that the distance of shoe surface 12 from suction belt 1 remains constant for quite a long duration of operation.

The dynamic suction force is a function of the air discharge velocity, as governed by the pressure and flow conditions in the zone between shoe and shipment or suction belt, respectively. In a suction member, special pressure balancing apparatus such as air chambers have to be provided in each case since, during the movements of the suction member, undesired air is drawn in, thereby reducing the vacuum pressure. Such measures are unnecessary when a shoe using superatmospheric pressure is used, and therefore the shoe may be connected directly with a pressure pump.

In a device according to the invention for separating shipments that adhere or are drawn tightly to one another, several shoes may be arranged next to one another transversely of the direction of conveying and/or one after the other longitudinally of the direction of conveying. This increases the effect of a shoe. It is also possible for one or several shoes to cooperate with a suction member. FIGURE 8 shows such an arrangement in diagrammatic form. A suction belt 1 withdraws the shipments from a stack 5. In the withdrawal region, two shoes 21 and 22 are arranged which lift the letters in the region of their top and bottom edges. In the center, opposite the suction slots of the suction trough, a suction member 23, yieldably supported in a similar manner as the shoe, is provided which, by suction force, detains shipments not directly abutting against the suction belt. Such an arrangement makes possible an especially effective separation of the shipments. The shoes and suction members may be rigidly connected with one another mechanically and supported by a common support.

Shoes according to the invention are usable even with drum-shaped separating devices since, for purposes of the present invention, suction drum means are considered equivalent to the suction belt means described above. In this case, the shoe surface has to be adapted to the usually cylindrical drum surface so that their mutual distance is the same all over.

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.

What is claimed is:

1. A device for removing the mutual adhesive effect of shipments drawn tightly to one another in a suction belt separating unit for flat material to be conveyed, especially mail shipments, comprising at least one yieldably supported shoe facing and slightly spaced from a suction belt, the shoe surface facing the shipments defining at least one port provided with a gas at superatmospheric pressure so that shipments adhering to one another or drawn tightly to one another are lifted from one another by the action of the outflowing gas.

2. A device as defined in claim 1 wherein the shoe is yieldably supported by an arm.

3. A device according to claim 1, wherein the shoe surface facing the shipments, at its upstream end, defines an inclined guiding entering surface.

4. A device according to claim 1, wherein the belt-facing shoe surface is slightly inclined transversely and longitudinally with respect to the plane of the belt so that one corner of the shoe acts as a gliding surface.

5. A device for removing the mutual adhesive effect of shipments drawn tightly to one another in a suction belt separating unit for flat material to be conveyed, especially mail shipments, comprising at least one yieldably supported shoe facing and slightly spaced from a suction belt, the shoe surface facing the shipments defining at least one port provided with a gas at superatmospheric pressure so that shipments adhering to one another or drawn tightly to one another are lifted from one another by the action of the outflowing gas, and said shoe being yieldably supported on a swivel arm.

6. A device for removing the mutual adhesive effect of shipments drawn tightly to one another in a suction belt separating unit for flat material to be conveyed, especially mail shipments, comprising at least one yieldably supported shoe facing and slightly spaced from a suction belt, the shoe surface facing the shipments defining at least one port provided with a gas at superatmospheric pressure so that shipments adhering to one another or drawn tightly to one another are lifted from one another by the action of the outflowing gas, said belt-facing shoe surface being parallel to the plane of the belt, and having at least one small elevated supporting abutment on its upstream end.

7. A device for removing the mutual adhesive effect of shipments drawn tightly to one another in a suction belt separating unit for flat material to be conveyed, especially mail shipments, comprising at least one yieldably supported shoe facing and slightly spaced from a suction belt, the shoe surface facing the shipments defining at least one port provided with a gas at superatmospheric pressure so that shipments adhering to one another or drawn tightly to one another are lifted from one another

by the action of the outflowing gas, the belt-facing shoe surface being parallel to the plane of the belt, and having at least one small elevated supporting abutment on its upstream end, and an additional port in said abutment which generates an air cushion under the supporting abutment.

8. A device for removing the mutual adhesive effect of shipments drawn tightly to one another in a suction belt separating unit for flat material to be conveyed, especially mail shipments, comprising at least one yieldably supported shoe facing and slightly spaced from a suction belt, the shoe surface facing the shipments defining at least one port provided with a gas at superatmospheric pressure so that shipments adhering to one another or drawn tightly to one another are lifted from one another by the action of the outflowing gas, the belt-facing shoe surface being parallel to the plane of the belt, and having at least one small elevated supporting abutment on its upstream end, and an additional obliquely disposed port defined in the entering surface.

9. A device for use subsequent to a shipment separating unit to separate shipments which adhere to each other, comprising, in combination: a conveying device for transporting shipments; a yieldably mounted blowing shoe slightly spaced from the conveying or shipment carrying surface of the conveying device, the shipment facing surface of said shoe having a port therein for conducting air at superatmospheric pressure toward said conveying device; means biasing said shoe surface toward said conveying surface; and abutment means on said shoe for limiting the minimum distance between said shoe surface and said conveying surface or a shipment.

10. A device for removing the mutual adhesive effect of shipments drawn tightly together in a suction belt separating unit for flat articles such as mail shipments, comprising at least one yieldably mounted blowing shoe biased toward and facing the suction belt and having a port in the belt facing surface thereof, a small sliding abutment on said surface limiting the minimum distance between said surface and the belt or a shipment thereon.

11. An arrangement for eliminating the mutual adhering effect of shipments which are drawn together in singling apparatus having a suction type transporting element, especially for mail shipments, by using the suction effect of an air blast, said arrangement comprising, at least one blowing shoe located downstream, in the direction of movement, from a singling apparatus and arranged opposite the suction type transporting element, said shoe being resiliently mounted and continuously biased toward the transporting element, the surface of said shoe which faces the shipments having a blowing opening and means for limiting the smallest distance between said surface and the shipments.

12. A device for removing the mutual adhesive effect of shipments drawn tightly to one another in a suction belt separating unit for flat material to be conveyed, especially mail shipments, comprising a plurality of yieldably supported shoes facing and slightly spaced from a suction belt and disposed next to one another transversely of the direction of conveying, the shoe surfaces facing the shipments each defining at least one port provided with a gas at superatmospheric pressure so that shipments adhering to one another or drawn tightly to one another are lifted from one another by the action of the outflowing gas.

13. A device according to claim 12, comprising at least one yieldably supported suction member cooperating with the shoes.

14. A device according to claim 13, wherein said suction member is arranged between two shoes which are active along a different portion of the shipments than the suction member, such as in the region of the top edge and bottom edge of the shipments.

15. A device according to claim 13, wherein the shoes and the suction member are rigidly connected with one another and have a common yieldable support.

16. A device for removing the mutual adhesive effect of shipments drawn tightly to one another in a suction belt separating unit for flat material to be conveyed, especially mail shipments, comprising a plurality of yieldably supported shoes facing and slightly spaced from a suction belt and disposed one after the other longitudinally of the direction of conveying, the shoe surfaces facing the shipments each defining at least one port provided with a gas at superatmospheric pressure so that shipments adhering to one another or drawn tightly to one another are lifted from one another by the action of the outflowing gas.

17. A device according to claim 16, comprising at least one yieldably supported suction member cooperating with said shoes.

18. A device for removing the mutual adhesive effect of shipments drawn tightly to one another in a suction belt separating unit for flat material to be conveyed, especially mail shipments, comprising at least one shoe facing and slightly spaced from the suction belt, and arm means for yieldably supporting such shoe, the shoe surface facing the shipments defining at least one port provided with a gas at superatmospheric pressure so that shipments adhering to one another or drawn tightly to one another are lifted from one another by the action of the outflowing gas.

19. A device for removing the mutual adhesive effect of shipments drawn tightly to one another in a suction belt separating unit for flat material to be conveyed, especially mail shipments, comprising at least one shoe facing and slightly spaced from the suction belt, means yieldably supporting said shoe and urging it toward such belt, the shoe surface facing the shipments defining at least one port provided with a gas at superatmospheric pressure so that shipments adhering to one another or drawn tightly to one another are lifted from one another by the action of the outflowing gas.

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