March 24, 1964 K. REHM 3,126,201

STRIPPING DEVICE

Filed July 10, 1961 2 Sheets-Sheet 1

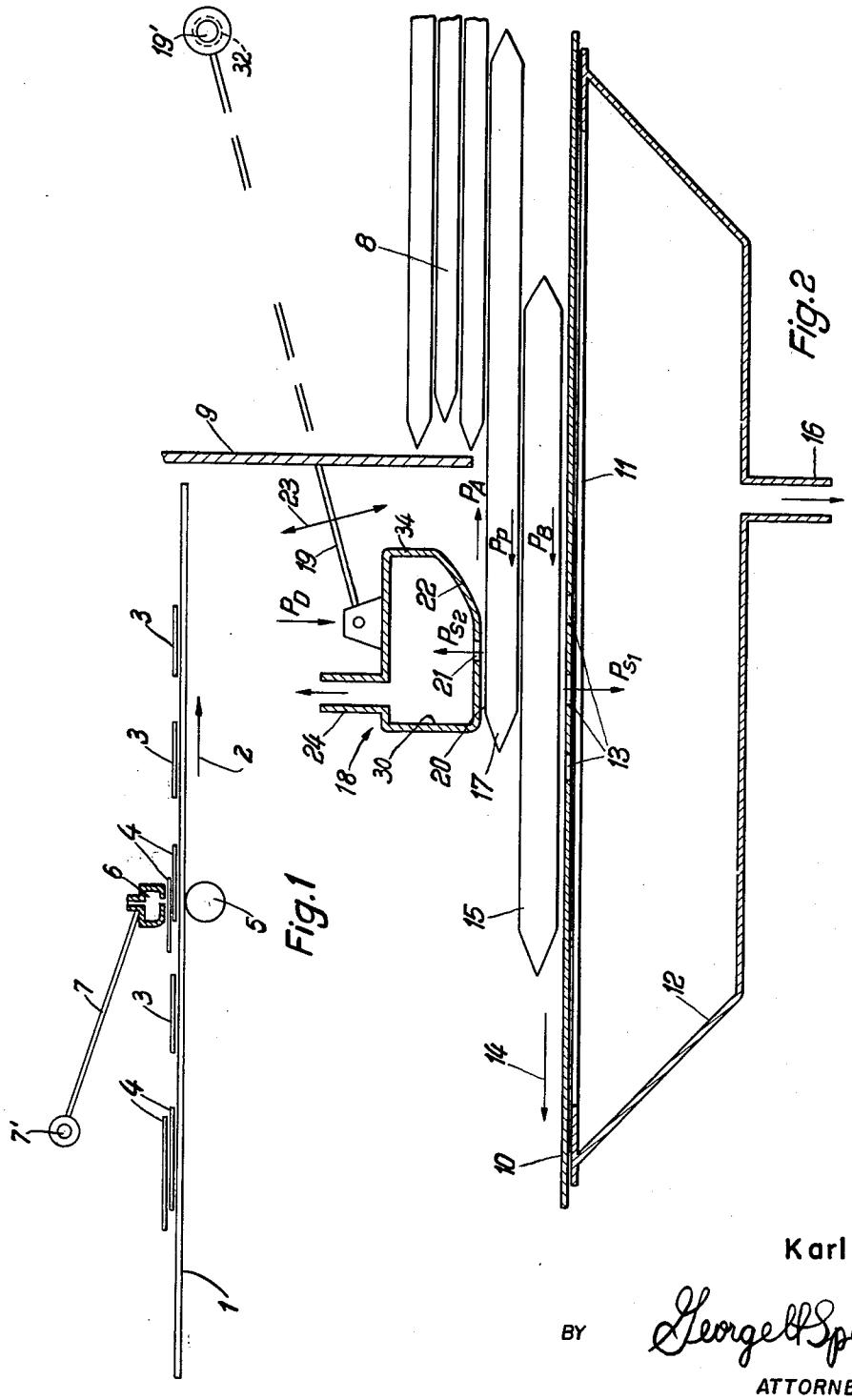


Fig. 1

Fig. 2

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Fig. 3

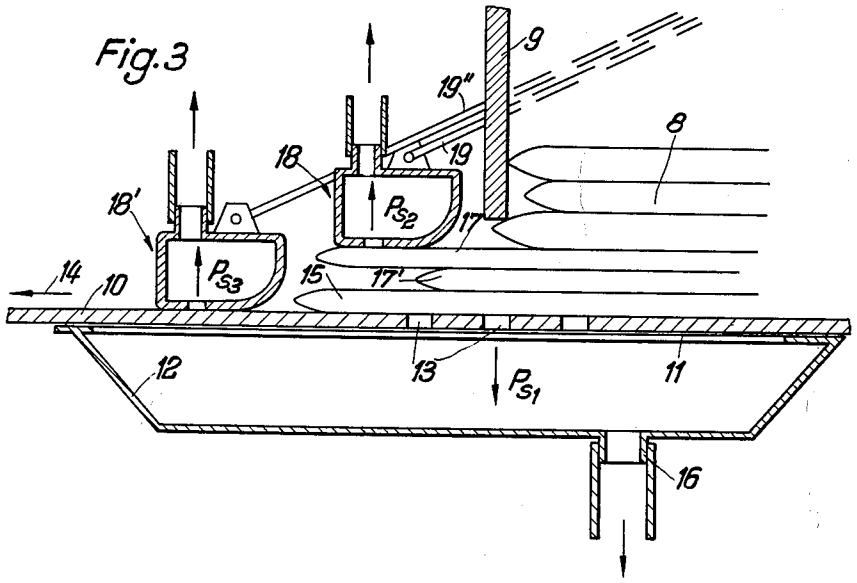
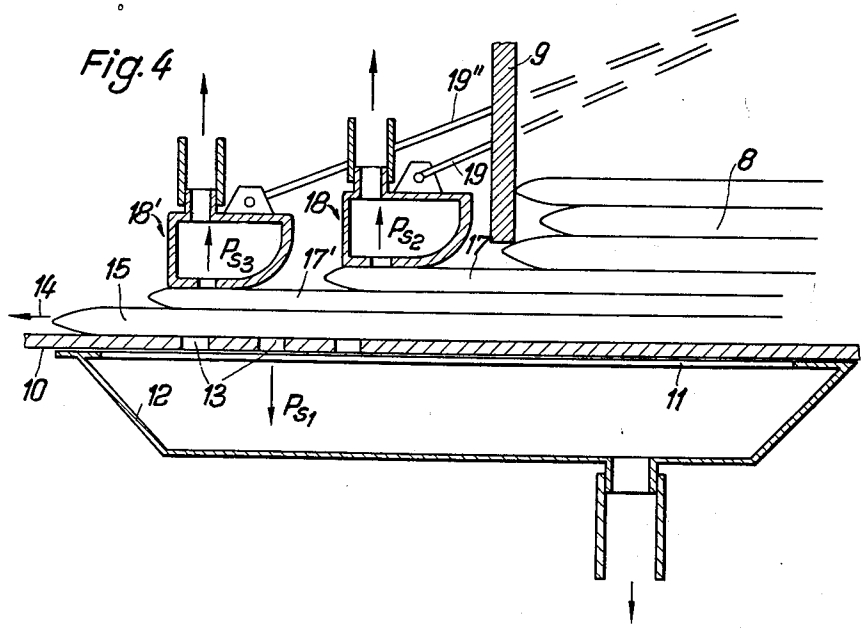


Fig. 4



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STRIPPING DEVICE

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8 Claims. (Cl. 271—32)

The present invention relates generally to automatic sorting, and more particularly, to a device in a plant for automatically sorting flat articles, wherein, as is known, the shipments or articles to be processed have been singled out or separated from each other.

The characteristics of different articles may vary to a large extent, especially in the handling of mail shipments. There are, for example, rigid and flexible shipments, thin and thick shipments, etc. The behavior of the shipments in the separating devices is therefore a statistical one, i.e., there is in each case only a certain probability for a shipment actually to be properly separated by the separating device. This is true for instance for the suction belt type separating devices wherein a suction belt runs over a suction trough, and has perforation fields which draw off the shipments from a stack.

Poorly separated shipments lead to disturbances or misroutings in the succeeding parts of sorting plants, for example, in switches or in scanning devices. Therefore, endeavors are being made to improve the separation of the shipments by special additional devices. For this purpose, friction strippers have been used. Such strippers include a swivel arm which is covered along its front edge by a material having a high coefficient of friction, for example, polyvinyl chloride or rubber. The swivel arm is pressed against the shipment conveying device and detains the excess shipments by frictional engagement therewith. In order to achieve this, the frictional force between the friction stripper and a shipment, such as a letter, directly abutting against it must, on the one hand, be greater than the friction force effective between two letters lying one against the other and, on the other hand, smaller than the frictional force acting between the conveyor belt and a letter directly contacting and being carried by it. This condition, however, is difficult to meet and it is hardly possible to maintain it for any length of time for shipments which constantly vary.

With these defects of the prior art in mind, it is a main object of the invention to provide a device for completing the separating operation which the separating device fails to do from time to time.

Another object of the invention is to provide a stripping member for separating overlapping shipments and which acts upon every shipment regardless of the thickness thereof.

These objects and others ancillary thereto are accomplished according to preferred embodiments of the present invention wherein a device is provided for securing or establishing the separation of flat shipments, especially of mail shipments. After a separation process, these shipments are carried by an endless conveying device by applying vacuum pressure which acts in addition to friction forces to retain shipments on the conveying device. This device avoids the drawbacks of the previously mentioned friction stripper, permitting a substantial increase in the certainty of the separating operation. This device has at least one stripping member which is yieldably supported, is constantly urged against the shipment carrying side of the conveying device by a relatively small displacement force, and has on its active surface facing this conveyor side one or more suction ports in communication with a vacuum pressure chamber.

The conveying device carrying the shipments may be

the suction belt of a known suction belt type separating device. However, the device may also cooperate with other known separating devices, for instance with a suction drum type separating device, or it may be arranged at any other desired point in a sorting plant.

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

FIGURE 1 is a diagrammatic view of the invention.

FIGURE 2 is an enlarged vertical sectional view of one stripping member arrangement.

FIGURE 3 is a vertical sectional view of another stripping member arrangement.

FIGURE 4 is a view similar to that of FIGURE 3, but with the shipments in a more advanced position.

With more particular reference to the drawings, FIGURE 1 illustrates a conveyor belt 1 driven in the direction of arrow 2 and running over guide rolls (not shown). Both properly and poorly separated shipments 3 and 4, respectively, are shown on this conveyor belt. These shipments were delivered to conveyor belt 1 by a preceding separating device (not shown). The adhesive force between the shipments contacting the conveyor belt and the belt itself is increased by means which are known per se in order to retain the shipments on the belt. This increase may be accomplished electrostatically. However, the conveyor belt may be of the suction type wherein the adhesive force is increased by vacuum pressure. A roller 5 supports the portion of the conveyor belt shown. A stripping member 6 is arranged above the conveyor belt 1 and is fastened to an arm 7 pivoted about a shaft 7'. This stripping member has on its active surface, facing the conveyor belt, a suction port in communication with a vacuum pressure chamber.

By selecting an appropriate vacuum pressure or suitable cross-sectional area of the suction port, the effective frictional force between the stripping member 6 and the shipment against which it abuts may be adjusted so that, on the one hand, it is larger than the frictional force between two shipments 4 lying against each other and, on the other hand, smaller than the frictional force between the conveyor belt and a shipment 3 lying directly upon belt 1. Separated shipments 3 are, therefore, not affected by the stripping member, since the dragging or adhering force of these shipments to the conveyor belt 1 is greater than the retaining force of the stripping member on these shipments. However, the uppermost of shipments 4 is retained by the stripping member 6. This causes poorly separated shipments 4 to be separated completely. A shipment thus retained is subsequently carried along by the conveyor belt 1 along a portion thereof where there is no shipment.

A preferred embodiment of the invention is shown in FIGURE 2. This embodiment cooperates with a separating device known per se which draws off letters or shipments from a stack. The stacked letters 8 each has one edge thereof abutting against a stationary wall 9. An endless suction belt 10 is guided over the suction slots 11 of a suction trough 12. In FIGURE 2, the suction trough is shown in longitudinal section. The suction belt 10 has groups of suction openings 13 which are arranged on the suction belt at a distance corresponding to the desired conveying distance of the letters. Suction belt 10 is moved in the direction of arrow 14. In each case, the bottom letter 15 of stack 8 is removed by adhering to the belt 10 by suction due to a group of suction openings 13. The suction trough 12 is connected at 16 with a vacuum pressure unit.

Now, it is possible that a further letter 17 adheres to a letter 15 and is also carried along by suction belt 10. In the case of so-called "sucking-through" shipments, one

or more further shipments may be removed from the stack by adhering to the bottom shipment 15. Such supernumerary shipments are detained by the present invention. This is done by means of a stripping member 18, constantly under vacuum pressure, which is designed as a flexibly supported rigid hollow body 34. In its position of rest, this stripping member 18 abuts against the suction belt 10 under the effect of a relatively small pressing force P_D, such as the type caused by a small axial spring 32, so that the required vacuum pressure can be maintained with a minimum of air consumption. The hollow space within body 34 serves as a small air chamber 30 and is advantageous because undesired air leaks in during the up-and-down movements of the stripping member when a letter passes. Under certain circumstances, the air may not be transported away sufficiently fast over the long feed lines. This hollow body 34 is fastened to a swivel arm 19 which is journaled on a fixed shaft 19' biased by axial spring 32 in a counter-clockwise direction. The active surface 20 of the stripping member is preferably designed as a plane surface. One or several suction ports 21 are provided through this surface. The active surface 20 may be covered by a material having a high coefficient of friction, for example, polyvinyl chloride or a material sold in Germany under the trade name Vulkolan. Along its upstream end, the surface of the suction member forms a smooth inclined or curved entering surface 22 having a very low coefficient of friction. Thus, the leading edges of the letters or shipments first engage the entering surface 22, whereupon the stripping member 18 is raised according to the thickness of the letter. This causes the swivel arm 19 to move approximately in the direction of double arrow 23. With this construction of the entering surface, the leading edges of the letters are largely protected from damage. The full frictional force of the stripping member acts only when the suction ports 21 are completely covered by a letter 17. This causes the full retaining force to appear only when the leading edge of a letter has passed the entering edge of the suction member, which results in further protection of the shipments. The vacuum chamber 30 of the stripping member 18 is connected with a conduit 24 of a vacuum pressure unit.

The mode of operation of the stripping member 18 according to the present invention may be more readily understood from a consideration of the following: If two letters 15 and 17 are between the suction type conveyor belt 10 and the vacuum stripper 18, the adhesive power P_B between the letter 15 and the belt, the stripping force P_A which acts upon the letter 17 due to the stripper, and the frictional force P_P between the two letters, have the following values:

$$P_B = P_{s1} \cdot \mu_B$$

$$P_A = P_{s2} \cdot \mu_A$$

and

$$P_P = P_D \cdot \mu_P$$

where P_{s1} is the suction force of suction type conveyor belt 10; P_{s2} is the suction force of stripping member 18; P_D is the surface pressure exerted by the downward biasing of the stripping member; and μ_B, μ_A, μ_P, are the frictional coefficients between suction belt 10 and letter 15, letter 17 and active surface 20 of the stripping member, and between the two letters 15 and 17, respectively.

The stripping force P_A must be greater than the force P_P between the two letters 15 and 17. It must be smaller than the adhesive force P_B, with which the letters are carried along by suction belt 10. Otherwise, the letters already separated would be impeded in their movement by the stripping member 18 and, under certain circumstances, even damaged. The operating conditions of the stripping member thus are:

$$P_P < P_A < P_B$$

Since the frictional force between two shipments, for example 15 and 17, is proportional to the surface pressure P_D of the stripping member 18, this surface pressure must be kept appropriately small, bearing in mind that there will be variations of the mutual frictional coefficient μ_P due to the differences in shipments or letters. This condition is easy to meet. Also the values P_{s1} and and P_{s2} may easily be chosen so that the relationship $P_A < P_B$ is always preserved, and the stripping member according to the invention reliably operates even under adverse operating conditions.

The suction force P_{s2} exerted by stripping member 18 need only be sufficiently large so that the condition $P_{s2} \cdot \mu_A = P_A < P_B$ is met. The condition $P_A < P_B$ may be easily met because the stripping member 18 is flexibly supported and is constantly exposed to a displacing force in a direction towards the conveying belt 10. This causes a supernumerary shipment 17 to contact directly the active surface 20 of stripping member 18 immediately after it is carried along by shipment 15 and belt 10, and to be immediately exposed to the retaining force which has the value $P_{s2} \cdot \mu_A$.

If, as in known devices, the stripper were fixedly mounted at a predetermined distance from conveying device 10, the suction force P_{s2}' of such a stripper would under certain circumstances have to be substantially greater than normal, since it would have to be sufficiently strong to draw the shipments against its active surface by suction force alone, in the case of shipments smaller in thickness than the distance between the belt and the stripper. In the case of a shipment having a high coefficient of friction μ_A, this greater suction force P_{s2}' could, after the shipment abuts against the active surface, cause an adhesive force $P_A' = P_{s2}' \cdot \mu_A$ which is so high that the condition $P_A' < P_B$ would no longer be met.

With the stripping members according to the present invention, the suction ports 21 are normally closed and therefore the air consumption is small and the vacuum pressure unit used may have a nominal capacity.

The arrangement of stripping members may be varied and several independent stripping members 18 may be arranged next to one another perpendicular to the direction of conveying. In FIGURE 2, this would be perpendicular to the plane of the drawing. In this manner, the device will properly operate on single shipments which vary in thickness from one side to the other.

Several of the stripping members 18 or of the abovementioned series of stripping members may be arranged one after the other in the direction of conveying. FIGURES 3 and 4 illustrate the mode of operation of an embodiment of this type and show the letters in two successive positions. In addition to the stripping member 18 already disclosed in connection with FIGURE 2, a further stripping member 18' is used which is fastened to a swivel arm 19''. In accordance with FIGURE 3, assume that, due to the imperfect mode of operation of the suction belt separating device 9 . . . 13, a further letter 17' is interposed between the two letters 15 and 17 when letter 15 is drawn off from stack 8. Then, first the uppermost letter 17 comes into engagement with the active surface of stripping member 18 and is retained with the force $P_{s2} \cdot \mu_A$. The letters 17' and 15 are carried along by suction belt 10. Thereupon, according to FIGURE 4, the letter 17' enters the effective zone of the second stripping member 18' and is retained by the latter with the force $P_{s3} \cdot \mu_A$, so that only the letter 15 is carried along by belt 10 (with the force $P_{s1} \cdot \mu_B$). The next group of holes 13, brought forward by the continuous movement of the belt, then draws off the letter 17', and the group of holes 13 after that draws off the letters 17. The next group of holes 13 now carries along the next letter from stack 8, which letter up to now was shielded from the suction trough 12 by the letters 17 and 17'. This is accomplished because the stripping members 18 and 18', respectively, directly follow the drawing off zone of the suction belt separating device.

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 assuring that flat shipments are separated from each other, especially mail shipments or the like, comprising an endless conveying device carrying the shipments by adhesion; at least one yieldably supported stripping means permanently urged against the conveying side of the conveying device by a relatively small displacing force, and having on its active surface facing this side of the conveying device at least one suction port in communication with a vacuum pressure chamber.

2. A device according to claim 1, wherein said conveying device includes a suction belt, a suction trough provided with slit-like openings over which said belt runs, and perforation fields in said belt which correspond to the desired conveying distances between shipments.

3. A device according to claim 1, wherein said stripping means includes a pivoted arm by which it is mounted.

4. A device according to claim 1, wherein the upstream portion of the active surface of the stripping means which is the entering surface for the shipments defines an inclined guiding surface which is smooth to reduce friction.

5. A device according to claim 1, wherein the active surface of the stripping means is constructed of a material with a high coefficient of friction.

6. A device for stripping and separating overlapping shipments in a sorting plant, comprising, in combination: a suction type conveyor belt for carrying shipments and holding shipments thereon by vacuum pressure; movable stripping means biased toward engagement with said belt and having a vacuum pressure port for applying a restraining force on shipments being carried by said belt, the suction force of the stripping means on the shipments being less than the suction force of the conveyor belt on said shipments, whereby said stripping means will only retain shipments which are not in direct contact with said conveyor belt.

7. A device for assuring that flat shipments are separated from each other, especially mail shipments or the like, comprising an endless conveying device carrying the shipments by adhesion; and several yieldably supported stripping means independent of one another and arranged in a series next to one another and perpendicular to the direction of conveying, said stripping means being permanently urged against the conveying side of the conveying device by a relatively small displacing force, and each having on its active surface facing this side of the conveying device at least one suction portion in communication with a vacuum pressure chamber.

8. A device for assuring that flat shipments are separated from each other, especially mail shipments or the like, comprising an endless conveying device carrying the shipments by adhesion; and several yieldably supported stripping means independent of one another and succeeding one another in the direction of conveying, said stripping means being permanently urged against the conveying side of the conveying device by a relatively small displacing force, and each having on its active surface facing this side of the conveying device at least one suction port in communication with a vacuum pressure chamber.

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