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G. BURKHARDT ET AL
DEVICE FOR STACKING AND RESEPARATING FLAT RECTANGULAR
ITEMS OF MAIL, SUCH AS LETTERS

3,363,782

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4 Sheets-Sheet 1

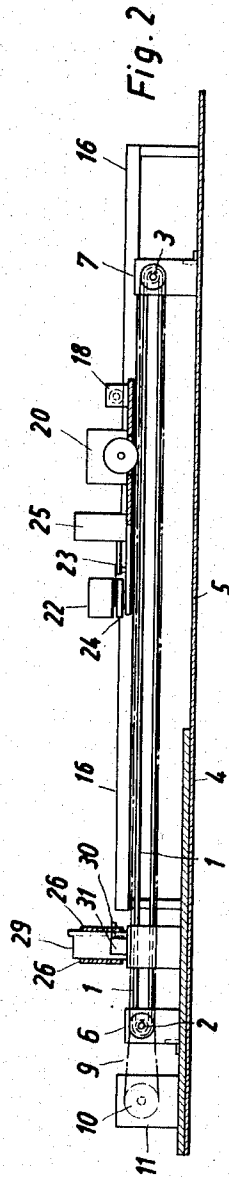


Fig. 2

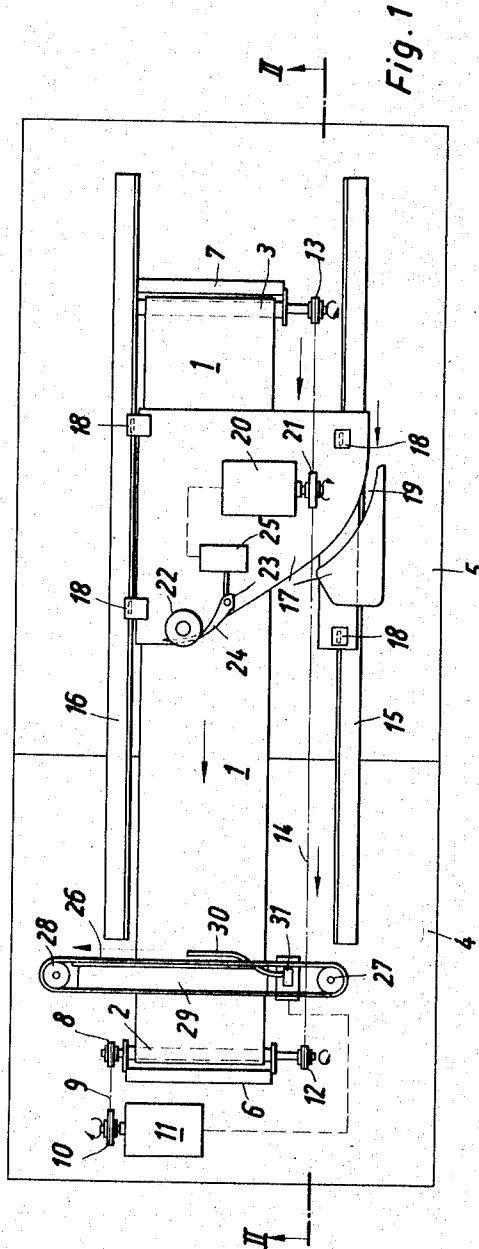


Fig. 1

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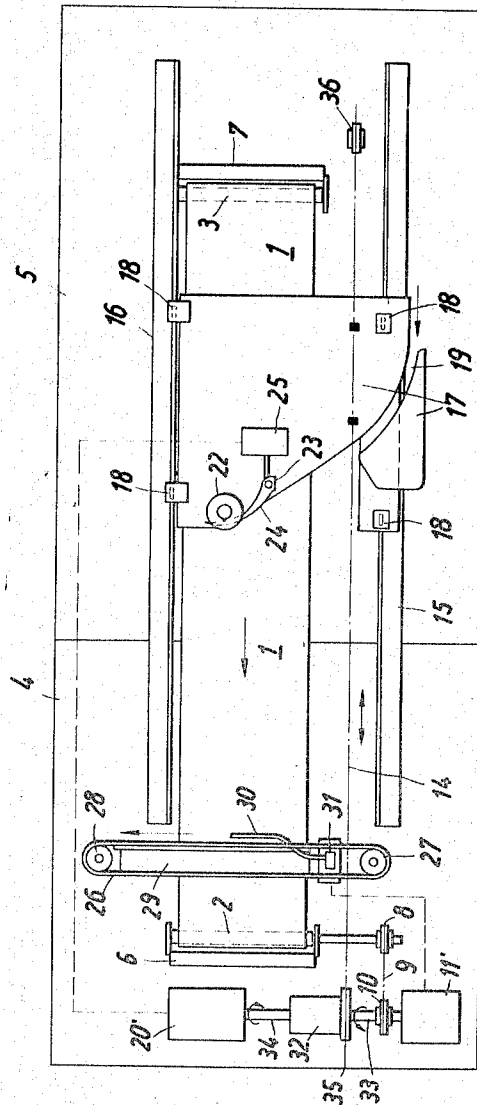
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Fig. 3



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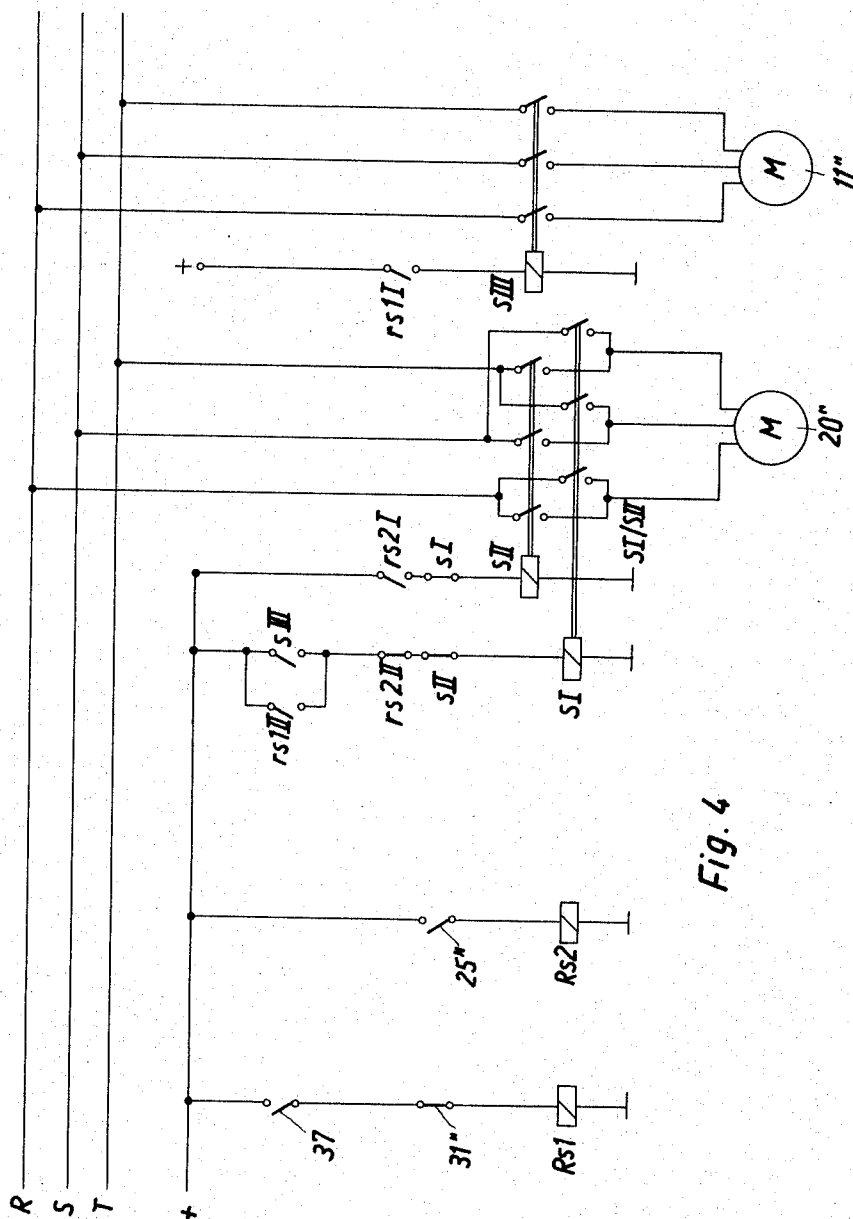


Fig. 4

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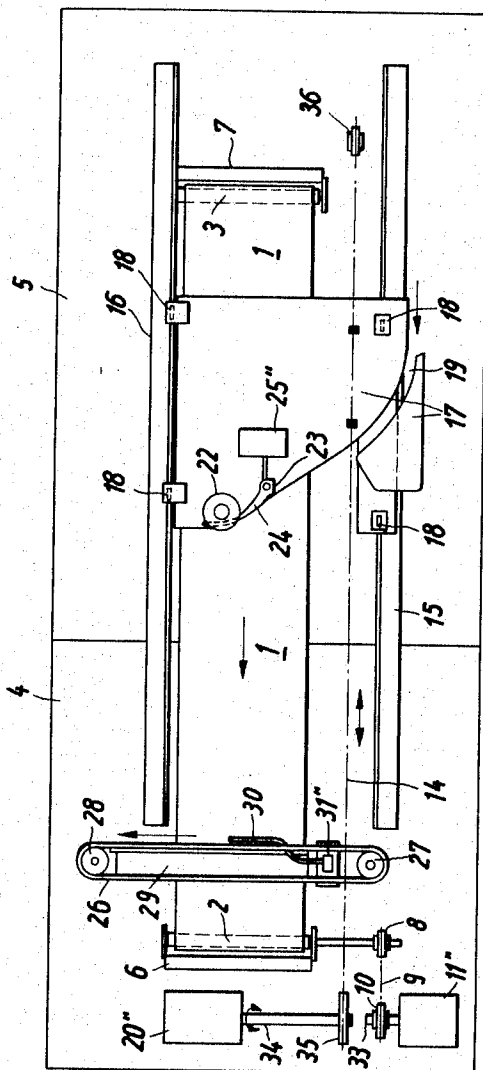
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Fig. 5



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**DEVICE FOR STACKING AND RESEPARATING
FLAT RECTANGULAR ITEMS OF MAIL, SUCH
AS LETTERS**

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11 Claims. (Cl. 214—7)

This invention relates to a device for the simultaneous stacking and re-separating of flat rectangular items of mail, such as letters. Devices of this kind are known which comprise a floor-forming belt which serves as a support for the stack and which is moved towards the separator when the stacked items of mail are to be separated, and a stacking carriage which is controlled by a sensing member mounted on the stacking carriage and responsive to the pile pressure.

In the stackers of this kind previously used, it was customary to provide two contacts at the side of the stacking carriage supporting the end of the pile, for the control of the forward and backward travel of the stacking carriage according to the fullness of the stacker. These contacts respond to the pressure which the stacking carriage exerts on the pile. The first contact operates when the pressure of the stacking carriage on the pile exceeds a predetermined limit during the forward travel and switches over the drive of the stacking carriage to the opposite direction of rotation so that the stacking carriage travels backwards. The backward movement continues until the second contact detects that the pressure of the stacking carriage on the pile has dropped below a predetermined pressure. This contact then again switches the drive of the stacking carriage back to the original direction of rotation so that the carriage again travels forwards. This kind of control of the stacking carriage has the great disadvantage that, because of its inertia, the stacking carriage always travels somewhat beyond the "correct" position and consequently, with a sensitive adjustment of the contacts, is continuously moved backwards and forwards, that is to say it executes an oscillatory motion.

The object of the invention is to avoid such oscillatory movement. This is achieved in such a manner that the sensing member only serves to control the backward travel of the stacking carriage and for this purpose only responds when the pile pressure exceeds a predetermined value, and that control and drive means are provided which cause the forward travel of the carriage when the sensing member does not respond and the floor belt is driven at the same time.

One embodiment of the invention includes a motor which serves for the drive of the stacking carriage, and which motor can run selectively in both direction of rotation in known manner and can move the stacking carriage either towards or away from the separator by means of a pulling device. The electrical switching means for the motor are designed in such a manner that it is only switched on in the direction of rotation which causes a movement of the carriage towards the separator if the drive for the floor belt is switched on simultaneously.

In a further embodiment, a motor serves as driving means for the stacking carriage, which motor has such a direction of rotation and co-acts in such a manner with endless pulling means and the stacking carriage that the latter only moves away from the separator when the sensing member detects that the predetermined pressure value has been exceeded.

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It is also possible, within the scope of the invention for the drive of the floor belt to cause the drive of the stacking carriage towards the separator by means of endless pulling means running parallel with the floor belt, while the drive of the stacking carriage for the opposite direction of movement co-acts with the endless pulling means and the stacking carriage in such a manner that, during the period when the mentioned first drive is switched on, the stacking carriage receives a speed component opposite to the aforesaid one and which may be greater, in its absolute value, than the first component.

Said pulling means may, to advantage, be constructed in the form of an endless chain.

It has further proved to be an advantage to mount the drive for the stacking carriage on the carriage itself and to cause it to co-act with the chain by means of a sprocket mounted on its shaft in such a manner that when the motor on the stacking carriage is switched on, the latter receives a speed component which is superimposed on its original one so that movement in the opposite direction results.

Another possible embodiment of the invention is one in which a fixedly mounted differential gearing is provided, to the one input shaft the drive of the floor belt is coupled and to the other input shaft of which the drive of the stacking carriage is coupled, and the differential gearing drives through its drive shaft, a chain secured to the stacking carriage.

These and further features of the invention will now be described with reference to the accompanying drawings:

FIGURE 1 shows in plan view a first example of an embodiment of a device according to the invention;

FIGURE 2 shows a side view of this device in section along the line II—II of FIGURE 1;

FIGURE 3 shows in plan view a further embodiment;

FIGURE 4 shows the circuit diagram of a third embodiment of the invention as shown in FIGURE 5.

As shown in FIGURES 1 and 2, a floor belt 1 is provided for the support of items of mail (not illustrated here for the sake of clarity). This floor belt runs over guide pulleys 2 and 3 in the direction of the arrow shown. Bearing brackets 6 and 7, which support the guide pulleys 2 and 3, are secured to base plates 4 and 5. Secured to one end of the journal of the guide pulley 2 is a chain wheel 8 which is driven by a first motor 11 through a chain 9 and a second chain wheel 10, and sets the floor belt 1 in motion. A chain wheel 12 is likewise secured to the other end of the journal of the guide pulley 2, but has such a pitch diameter that a higher speed is imparted to the chain 14 than to the floor belt 1. A further idling chain wheel 13 is mounted on the journal of the guide pulley 3 to guide the chain 14. The chain is driven by the chain wheel 12 in such a manner that it moves in the direction of the arrow. Mounted beside the floor belt 1 and parallel thereto are two guide rails 15 and 16 which rest on the base plates 4 and 5 and on which a stacking carriage 17 can move by means of its rollers 18. The feed of the items of mail to be stacked is effected from the side where the guide rail 15 is located through a slot 19 in the direction of the arrow. The conveyor belts which serve to convey and guide the items of mail to this slot 19 and the associated conveying rollers are not shown for the sake of clarity and because they are of no interest in this connection. A second motor 20 is mounted on the stacking carriage and its shaft carries a chain wheel 21 which co-acts with the chain 14. A so-called stacking roller 22 is also mounted on the stacking carriage 17 as well as a sensing lever 24 which is pivotable about a pin 23. This sensing lever, actuates a contact, for example a microswitch 25, and responds to pressure to switch on the motor 20 when the pressure exerted by the pile on the stacking carriage, and hence on the sensing lever 24,

exceeds a predetermined value, and it switches the motor off again when the pressure drops below a predetermined value.

Mounted at the end of the floor belt 1, at the side of the pile remote from the stacking carriage 17 is a separating belt 26 which is driven in the direction of the arrow by one of the guide pulleys 27, 28 when the items in the pile have to be separated individually. The separating belt 26 is constructed in the form of a belt with groups of holes and co-acts with a suction chamber 29. Finally, between this belt and the pile there is mounted a sensing lever 30 which co-acts with a microswitch 31 to detect when the pressure of the pile towards the separating belt 26 exceeds a predetermined value. The microswitch 31 then switches off the drive of the floor belt 1, that is to say the motor 11.

The mode of operation of the embodiment of the invention described is as follows:

It is assumed, as the normal case, that a series of items of mail have already been piled up in the stacker and that the separator is running continuously. In this case, the floor belt, too, runs continuously because the sensing lever 30 does not detect too great an increase in the pile pressure at the separator. The stacking carriage 17 is likewise displaced continuously towards the separator with the motor 20 stopped. If now the stacking up of new items takes place more quickly than their separation, the pile grows. The sensing lever 24 detects an increase in the pressure of the pile on the stacking carriage 17 and switches on the motor 20. The latter imparts to the carriage a relative movement counter to the direction in which the floor belt is running, as a result of its chain wheel 21 running in engagement with the chain 14, so that the stacking carriage moves backwards and the pile pressure drops despite the arrival of fresh items of mail. When this pressure drops below a certain predetermined value, the sensing lever 24 again switches off the motor 20 of the stacking carriage through the switch 25, so that the carriage again begins to move towards the separator by being pulled by the chain 14 driven by the floor belt motor.

If stacking only is to be effected with the separator stopped, the floor belt 1 is also at rest. The stacking carriage moves backwards more or less continuously, controlled by the switch 25, according to the arrival of fresh items to be stacked.

Finally, the case may be considered in which only separation is carried out but no stacking up of fresh items of mail takes place. In this case, the stacking carriage follows the pile under the pull of the chain, and, as a result of its higher speed in comparison with that of the floor belt, it increases the pressure on the pile until the sensing lever 24 switches on the motor 20 through the switch 25. This drives the stacking carriage for a short time in the opposite direction so that the carriage lags behind in relation to the floor belt until the pressure of the stacking carriage on the pile has become lower.

With this mode of operation of the device according to the invention it is clear that the control of the movement of the stacking carriage can be finely adjusted both in the two extreme cases, where the separator is stopped or the stacking up is stopped, and with every possible state of movement of the device between these extremes for each of these phases.

FIGURE 3 shows another embodiment of the invention. All the components which were used in the device as shown in FIGURES 1 and 2 are given the reference numerals used in these figures. The difference between the device shown in FIGURE 3 in comparison with that already described is that the motor 20' is no longer mounted on the movable stacking carriage, but fixedly mounted and that a differential gearing 32 is provided, and coupled to one input shaft 33 is the first motor 11' and to the other shaft 34 is the second motor 20'. With chain wheel 35 secured thereto, the output shaft of the

differential gearing drives the chain 14 which runs over a chain wheel 36. This can no longer be mounted on the shaft of the guide pulley 3 of the floor belt but is independently mounted. The direction of rotation of the two motors 11' and 20' is such that different directions of rotation are set up at the two input shafts of the differential gearing. When the motor 20' is switched off, a speed determined by the motor 11' is imparted to the stacking carriage by the differential gearing 32, which speed is somewhat higher than that of the floor belt because of the gear ratio. When the motor 20' is switched on, however, the drive speeds of the two motors are superimposed on one another so that the stacking carriage is driven by the difference between the two speeds including the plus or minus sign—so that the stacking carriage lags behind in comparison with the movement of the floor belt or even travels in the opposite direction.

In this device, the motion of the stacking carriage depending on the conditions prevailing in the stacker coincide with that of the stacking carriage in the device shown in FIGURES 1 and 2, but here the drive of the stacking carriage is not effected directly by a motor secured thereto but the speed and/or the direction of movement of the drive chain 14 of the stacking carriage is varied by the differential gearing 32.

In the embodiments described with reference to FIGURES 1 to 3, it is an advantage to construct both motors in the form of brake motors.

Apart from these two mechanical solutions, the invention can also be realised by an electric control of the two motors as shown in FIGURE 4. FIGURE 5 shows a device which is designed for this control and in which the mechanical construction is very similar to that of the device shown in FIGURE 3. Instead of the motor 20, which has only one direction of rotation, in this third embodiment a motor 20'' is used which runs in both directions of rotation and drives the stacking carriage directly through a chain wheel 35 and a chain 14. In this embodiment, the motor 20'' and the motor 11'' for the drive of the floor belt are combined in their operation through their electrical control, but mechanically they work entirely independently of one another.

The motor 20'' is connected to the mains through the contactors SI, SII, which can switch over the phase, whereas the motor 11'' is connected to the mains through a single contactor SIII. In the energising circuit for the relay Rs1 is the switch 31' which switches on the floor belt in FIGURES 1 and 3, and the switch 37 which is only actuated if the separator is to operate. The switch 25'', which is actuated by the sensing lever 24 (FIGURES 1 and 3), is shown as a make contact which energizes the relay Rs2 when being closed, that is to say when the pressure of the pile becomes too great at the stacking carriage.

The contactors SI and SII cause the switching on of the motor 20'' and the switching over of its direction of rotation. In the energizing circuit of SI, there are a make contactors 2II, a break contact sII, and a parallel connection of make contacts sIII and rsIII. The contactor SIII causes the switching on of the motor 11''.

A make contact rs2I and a break contact sI are in the energizing circuit of the contactor SII.

With the switches and relay contacts in the position described, the circuit operates as follows: The switch 31' is already in the position "floor belt running." The floor belt should only begin to run, however, when the separator is switched on. When this has been done through actuation of the switch 37, the relay Rs1 is operated. Through the closing of its contact rs1I, this relay energizes the contactor SIII. At the same time, through the closing of its contact rs1II, it energizes the contactor SI. Thus, the floor belt motor 11'' and the stacking carriage motor 20'' are switched on simultaneously and the contact sI is opened. The stacking carriage travels towards the separator. In addition, the contactor SIII closes its 75 contact sIII which is connected in parallel with the con-

tact *rsIII*. This contact *sIII* is, however, of no significance with regard to the starting operation.

When the sensing lever on the stacking carriage detects that the pressure exerted by the pile on the stacking carriage is exceeding a predetermined value, it closes the switch 25". Now the relay *R_{s2}* is energized. It closes its contact *rs21* and opens its contact *rs2II*. The contactor *SI* releases and the contact *sI* is closed: on the other hand the contactor *SII* is energized. The contactor *SI* is switched over and so the direction of rotation of the stacking-carriage motor 20" is reversed. The stacking carriage then runs backwards in the manner already described. In addition, the contactor *SII* opens its contact *sII*.

If the pressure of the pile on the sensing lever at the separator exceeds a predetermined value during any phase of movement of the stacking carriage, for example during its advance, then the switch 31" is opened and the relay *R_{s1}* releases. The latter also happens when the separator is switched off, for example. The relay *R_{s1}* opens its two contacts *rs1I* and *rs1II*. The motor of the stacking carriage is, however, not stopped at this moment but only after the contactors *SIII*, which is no longer energized after the closing of the contact *rs1I* has released and opened its contact *sIII*.

If, however, the stacking carriage happens to be moving backwards, when the relay *R_{s1}* releases as a result of the opening of one of the switches inserted in its energizing circuit, the movement of the stacking carriage is not disturbed as a result. As already mentioned, the parallel connection of the contacts *sIII* and *rs1II* offers a particular advantage. By this means, the effect is achieved that the stacking-carriage motor 20" is switched on simultaneously with the floor belt motor 11" and it is not necessary to wait for the energization of the contactor *SIII*. On the other hand, when both motors are switched off the motor 20" is switched off first since the contactor *III* has also released; thus the motor 20" is switched off later than the motor 11". By this means, it is possible to ensure that the stacking carriage, which reaches its operating speed more slowly than the floor belt, always has a lead over the floor belt even under unfavorable operating conditions, for example with very frequent switching on and off of the motor.

The auxiliary contacts *sI* and *sII* in the energizing circuits of the contactors *SI* and *SII* are provided for the protection of the motor 20". It is impossible to avoid that the contacts of the contactors *SI/SII* stick during a change-over operation, particularly after a large number of switching operations. In such a case, during the next switching over of the motor 20" to the opposite direction of rotation, the second contactor would be actuated, although the first is still switched on. This is avoided by the provision of the two contacts *sI* and *sII* because the auxiliary contact in the energizing circuit of the one contactor is always open when the other contactor is energized. This auxiliary contact remains open until the contacts of the energized contactor are opened again.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. A device for stacking flat articles, comprising, in combination:

- (a) a floor belt providing a support for a pile of flat articles;
- (b) means for continuously driving said floor belt toward a separating zone when articles are to be separated;
- (c) a stacking carriage adjacent said floor belt and movable toward and away from said separating zone for retaining a pile of flat articles between said carriage and said separating zone;
- (d) sensing means on said carriage for responding to the pressure of the pile when a predetermined pile pressure is exceeded; and
- (e) control and drive means for causing the stacking carriage to move backwardly away from said separat-

ing zone when said sensing means responds and for causing the stacking carriage to move forwardly only when (1) the sensing means does not respond, and (2) the floor belt is being driven.

2. A device as defined in claim 1 wherein said driving means is electrically controlled and said control and drive means includes a bidirectional motor which can selectively run in either direction, pulling means connected to said motor and said carriage for moving the carriage toward and away from said separating zone, and electrical switching means for controlling said motor so that it is only switched on in the direction of rotation which causes the carriage to move toward the separating zone if said sensing means does not respond and if the driving means for the floor belt is switched on at the same time.

3. A device for stacking flat articles, comprising, in combination:

- (a) a floor belt providing a support for a pile of flat articles;
- (b) means for driving said floor belt toward a separating zone;
- (c) a stacking carriage adjacent said floor belt and movable toward and away from said separating zone for retaining a pile of flat articles between said carriage and said zone;
- (d) sensing means on said carriage for responding to the pressure of the pile; and
- (e) control and drive means for causing the stacking carriage to move backwardly away from said separating zone when activated by said sensing means which occurs only when a predetermined pile pressure is exceeded and for causing the stacking carriage to move forwardly which occurs when the sensing means does not respond and while the floor belt is being driven, said control and drive means including a motor and endless pulling means connected to said carriage, said motor having such a direction of rotation that it coacts with the endless pulling means and the stacking carriage so the latter only moves away from the separating zone when the sensing means detects that the predetermined pile pressure has been exceeded.

4. A device as defined in claim 3 wherein said driving means includes endless pulling means extending parallel to the floor belt for driving the stacking carriage forwardly, said control and drive means for moving the carriage backwardly coacting with said endless pulling means and the carriage so that during the period when the driving means is activated the carriage is provided with a speed component in the forward direction which may be greater in its absolute value than the component in the backward direction.

5. A device as claimed in claim 4, characterised in that the endless pulling means is a chain.

6. A device as defined in claim 5 wherein said control and drive means includes a motor mounted on said carriage and having a chain wheel connected thereto and coacting with said chain so that when the motor is activated a speed component in the backward direction is superimposed on the original speed component acting on the carriage in the forward direction.

7. A device as claimed in claim 6, characterised in that the motor mounted on the stacking carriage can only assume a specific and constant speed of rotation.

8. A device as defined in claim 5 wherein fixedly mounted differential gearing is provided having two input shafts one of which is a portion of said driving means and the other of which is a portion of said control and drive means and having an output shaft driving the chain which is connected to said carriage.

9. A device for stacking flat articles, comprising, in combination:

- (a) a floor belt providing a support for a pile of flat articles;

- (b) means for driving said floor belt toward a separating zone;
 - (c) a stacking carriage adjacent said floor belt and movable toward and away from said separating zone for retaining a pile of flat articles between said carriage and said zone; 5
 - (d) first sensing means on said carriage for responding to the pressure of the pile;
 - (e) control and drive means for causing the stacking carriage to move backwardly away from said separating zone when activated by said sensing means which occurs only when a predetermined pile pressure is exceeded and for causing the stacking carriage to move forwardly which occurs when the sensing means does not respond and while the floor belt is being driven; and 10 15
 - (f) second sensing means disposed in said zone and responding to pile pressure for stopping said driving means when the pile pressure at said zone rises above a predetermined value. 20
10. A device for stacking flat articles, comprising, in combination:
- (a) a floor belt providing a support for a pile of flat articles;
 - (b) means for driving said floor belt toward a separating zone; 25
 - (c) a stacking carriage adjacent said floor belt and movable toward and away from said separating zone for retaining a pile of flat articles between said carriage and said zone; 30
 - (d) sensing means on said carriage for responding to the pressure of the pile;
 - (e) control and drive means for causing the stacking carriage to move backwardly away from the separating zone when activated by said sensing means which occurs only when a predetermined pile pressure is exceeded and for causing the stacking car- 35

riage to move forwardly which occurs when the sensing means does not respond and while the floor belt is being driven, said control and drive means including a motor and endless chain means arranged so that said endless chain means runs somewhat faster than said floor belt.

11. A device for stacking flat articles, comprising, in combination:

- (a) a floor belt providing a support for a pile of flat articles;
- (b) means for driving said floor belt toward a separating zone;
- (c) a stacking carriage adjacent said floor belt and movable toward and away from said separating zone for retaining a pile of flat articles between said carriage and said zone;
- (d) sensing means on said carriage for responding to the pressure of the pile;
- (e) control and drive means for causing the stacking carriage to move backwardly away from the separating zone when activated by said sensing means which occurs only when a predetermined pile pressure is exceeded and for causing the stacking carriage to move forwardly which occurs when the sensing means does not respond and while the floor belt is being driven, said control and drive means including brake motors.

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