ARRANGEMENT FOR THE CONTROLLED DISCHARGE OF INDIVIDUAL FLAT ITEMS

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ABSTRACT
An arrangement for the controlled discharge of individual flat items from a stack of items. A separator removes the items from the stack and sequentially feeds the items into two conveying channels, which channels are disposed so they converge at a common discharge point. A controllable release device is arranged along each of the channels. Each release device has an abutment, which can be moved into position to prevent continued movement of an item through the channel, and an acceleration member, which is moved into position to accelerate the discharge of the item from the channel when the abutment is moved out of the path of the item. A signal generator is arranged along each of the channels so as to provide a signal indicative of the presence of an item within the channel. The output signals of the signal generators are coupled to a control circuit, which prevents an item from being fed into any channel already occupied by an item. A discharge circuit selectively provides discharge signals to each of the controllable release devices for controlling the position of the abutments and the acceleration members for controlling the continued passage of items along the respective channel to the discharge point.

14 Claims, 8 Drawing Figures
1 ARRANGEMENT FOR THE CONTROLLED DISCHARGE OF INDIVIDUAL FLAT ITEMS

BACKGROUND OF THE INVENTION

The present invention relates to an arrangement for the controlled discharge of individual flat items, letters in particular, from a stack, which arrangement includes a separator for removing the items from the stack and an interrupter for interrupting the operation of the separator whenever a control signal is received.

An arrangement of this type is known, for example, from German Auslegeschrift (published Patent application) No. 1,267,005, which discloses a separator utilizing a plurality of parallel friction belts which continuously rotate between the slits of a suction trough. The interrupter associated with this separator is realized by pivotal spacer fingers which can be moved by a setting member from a rest position in which they retreat between the belts behind their surfaces to an operating position in which they keep the first item of the stack away from the surface of the friction belts and thus render the belts ineffective.

The instruction signals for controlling the discharge of items can be externally applied in the known arrangement. With such an arrangement, it is possible to either obtain individual items at any desired point in time or, with the application of periodic discharge signals, to discharge the items from the stack with equidistant spacings of their leading edges. Furthermore, the discharge signal for the next item in the arrangement can be produced in dependence on the passage of the trailing edges of the previously separated item by a signal generator, such as, for example, a photodiode with an aligned light source. Thus, the arrangement provides a sequence of discharged items which are equally spaced, i.e., the same spacing exists between the trailing edges of one item and the leading edge of the next item.

With this known arrangement, however, a certain time expires after the arrival of a discharge signal before an item is accelerated to the conveying speed of the friction belts due to the inertia of the item. This may lead to varying delays between the discharge signal and the moment of discharge of an item when the system is used for the controlled discharge of items having different masses, such as letters, for example. This same drawback, which is a result of the varying slip of the different items, occurs to some extent in all known separators employing a revolving separating member.

There are also known arrangements which utilize suction belt separators, the suction belts of which are provided with a group or a plurality of groups of suction openings which are uniformly distributed over the periphery of the suction belt. These separators may be so designed that they will assure a higher separation dependability than separators with a continuously perforated suction belt. Such suction conveyor belts are used, for example, in the arrangement disclosed in U.S. Pat. No. 3,504,909, which has a particularly high dependability that no double discharges will occur. In the arrangement disclosed by this patent, a first separator is arranged to remove the items from a stack. The output of this first separator is fed to the input of a second separator. A testing member is disposed in the region of the second separator which influences the separation process in the first separator in dependence on the presence of an item in this region. For this purpose, the output of the testing member is coupled to an interrupter which is provided at the first separator which prevents the removal of a further item when a previous item is still disposed in the second separator at a certain point in time. The interrupters may be, for example, spacer fingers, as in the above-described known arrangement, or a valve which is inserted between the suction trough and the suction air generator and is controlled by a control signal.

However, in all separators employing suction belts with groups of holes, the removal of the items always takes place at a given time which is determined by the passage of one of the groups of holes by the suction trough, so that the items principally cannot be removed with the same spacing between them but only with the same spacing between their leading edges. With a controlled discharge of individual items with the use of an interrupter, these items are likewise discharged at said given points in time and not with a constant delay with respect to a discharge signal.

SUMMARY OF THE INVENTION

An object of the present invention is to provide an arrangement for the controlled discharge of individual items from a stack which avoids the above-mentioned drawbacks.

Another object of the present invention is to provide such an arrangement in which the delay between the discharge signal and the time of actual discharge is substantially constant independent of the inertia of the items.

A further object of the present invention is to provide such an arrangement in which the items can be discharged with a constant time delay between successive items, i.e., the distance between the trailing edge of one item and the leading edge of the next item is constant.

These objectives are accomplished in the arrangement according to the present invention by providing an additional control device subsequent to and in operative connection with the separator device. The separator device is arranged adjacent to the stack of items so as to be able to remove the items, and associated with the separator device is an interrupter which interrupts the operation of the separator device upon receipt of a control signal.

The control device includes at least two conveying channels which are arranged to receive the items discharged by the separator device. These conveying channels are disposed so as to converge at a common discharge point. Along each of the channels, there is arranged an abutment, which can be moved into the path of an item along the channel so as to prevent continued passage of an item, and an acceleration member, which is positioned such that it accelerates the discharge of an item from the channel when the abutment is removed from the path of the item so as to allow the item to continue its passage. There is also disposed along each of the channels a signal generator for providing an output signal indicative of the presence of an item within the channel. The outputs of the signal generators are coupled to a control circuit which prevents an item from being fed into any channel which is already occupied by an item. A discharge circuit selectively provides discharge signals for controlling the
movement of the abutment out of the path of an item so as to allow the item to continue along the channel to the discharge point.

**BRIEF DESCRIPTION OF THE DRAWINGS**

FIG. 1 is a plan view of a first embodiment of an arrangement according to the present invention for the individual discharge of flat items including a separator and two parallel conveying channels with a controllable abutment arranged along each of the channels.

FIG. 2 is a simplified schematic circuit diagram of an embodiment of a control and discharge signal circuit suitable for controlling the arrangement shown in FIG. 1.

FIG. 3 is a plan view of a modified embodiment of the arrangement shown in FIG. 1 in which a tandem separator device is utilized.

FIG. 4 is a plan view of another modified embodiment of the arrangement shown in FIG. 1 where three parallel conveying channels are arranged to receive the items from the separator.

FIG. 5 is a schematic representation of the arrangement shown in FIG. 4.

FIG. 6 is a schematic circuit diagram of a control and discharge signal circuit suitable to control the arrangement shown in FIGS. 4 and 5.

FIG. 7 is a schematic plan view of a second embodiment of an arrangement according to the present invention including two suction belt separators operating in a push-pull arrangement and two directly associated conveying channels.

FIG. 8 is a schematic plan view of a modified embodiment of the arrangement shown in FIG. 7 with two suction belt separators operating in a push-pull arrangement and three conveying channels coupled to the separator via a deflector arrangement.

**DESCRIPTION OF THE PREFERRED EMBODIMENTS**

As shown in FIG. 1, a first embodiment of an arrangement for the controlled discharge of individual flat items such as, for example, letters, includes a separator 1 having its output connection to two conveying channels 3 and 4, via a deflector arrangement containing a deflector flap 2. The conveying channels 3 and 4 lead to the common output, or discharge, point 5.

The separator 1 includes, in a known manner, in its pick-up region a suction trough 21 which is disposed opposite the stack of items 20 and cooperates with a suction conveyor belt 24 which runs over rollers 22 and 23. The suction conveyor belt 24 is provided with a group of suction openings, which are not shown in the drawing. Teflon movable pneumatic strippers 25, which are known, for example, from German Offenlegungsschrift (laid-open patent application) No. 1,611,390, as well as a pressure roller 26 are disposed at the output end of the separator. The suction trough 21 is connected with a suction air source, not shown in the drawing, via an electromagnetically actuated valve 28 and a line 27. This valve 28 can effectively act as an interrupter by closing off the line 27 and rendering the separator temporarily inoperative.

The conveying channels 3 and 4 are part of a conveying system including upright conveyor belts, deflection rollers and guide rollers. The conveying channel 3 is defined by two conveyor belts 30 and 31, which are guided around deflection rollers 32 and 33 or 34 and 35, respectively, and guide rollers such as, for example, guide roller 36. Conveying channel 4 is correspondingly defined by conveyor belts 37 and 38 which are guided around deflection rollers 39 and 40 or 41 and 42, respectively, and guide rollers, such as, for example, guide roller 36.

The items are fed from the separator 1 into the conveying channels 3 and 4 by use of deflection rollers 43 and 44 of two guide belts 45 and 46, respectively. The deflector flap 2 is disposed between belts 45 and 46. The deflector flap can then be driven, for example, in the direction of a first deflection position by a tension switch 47 and in the direction of a second deflection position by an electromagnet 48, such as illustrated in the schematic diagram of FIG. 2. At the output of the deflector arrangement, the items are positively gripped at deflection rollers 34 and 41 between guide belt 45 and conveyer belt 31 or guide belt 46 and conveyer belt 38. A common guide strip 49 is disposed in both conveying channels to help provide converging paths for the channels to the discharge point 5.

The conveyor belts 30, 31 and 37, 38 are guided at such a distance from one another that no significant force is exerted on items lying between either set of belts. In each of the conveying channels 3 and 4, at a distance A from the output of the deflector arrangement including the deflector flap 2, which distance is greater than the length of the longest item to be fed into the arrangement, there is provided a controllable abutment 50 or 51, respectively. The abutments 50 and 51 along with associated acceleration rollers 52 and 53, respectively, which are functionally coupled with their associated abutments, form controllable release devices for each of the channels. The acceleration roller 52 or 53 is mechanically coupled with the respective abutment via a two-armed lever 54 and is arranged along the path between the respective abutment and the deflector flap 2.

In FIG. 1, the abutment 51 and the acceleration roller 53 are in a first position in which the abutment prevents passage of an item 20'. The abutment 50 and the acceleration roller 52 in channel 3, however, are disposed in a second position in which the abutment releases item 20" allowing its continued passage through the channel. In this second position, the acceleration roller 52 strongly presses conveyor belt 30 against the conveyor belt 31 which is supported by guide roller 35, so that the item which is between the belts is accelerated to the speed of the conveyor belts in the shortest possible time. In general, there are several known devices in which flat items are stopped and may be continued at any desired time, any of which devices can be utilized in the arrangement of the present invention. As shown in FIG. 2, the abutments and the coupled acceleration rollers are held in the first position by a spring 55 or 55' and are brought into the second position by an electromagnet 56 or 57, against the force of the spring.

A signal generator in the form of a light detector 60 or 61, such as, for example, a photodiode, with an associated light source 60' or 61', respectively, is disposed in each of the conveying channels 3 or 4, respectively. The signal generators provide signals indicative of the presence of an item within the channel.

As shown in FIG. 2, the output signals from the two light detectors 60 and 61 are fed to the two inputs of a bistable circuit 63. The output signal of the branch of
the switching circuit 63 controlled by the output signal of light detector 61 actuates the electromagnet 48 for the deflector flap 2. This circuit arrangement, therefore, controls the deflector flap 2 so that the items 20 which come from separator 1 reach a free conveying channel 3 or 4. Additionally, a control signal for the interupter is generated by the control circuit of the arrangement when the number of items disposed in the area of the abutments and possibly on the way thereto is equal to the number of conveying channels, i.e. when all of the channels are already occupied. The items disposed in the area of the abutments can be detected by the signal generators, i.e. in this case the two light detectors 60 and 61. The items still on the path could be detected in a known manner by one or a plurality of further monitoring devices equipped with light detector arrangements.

In the embodiment shown in FIG. 1, however, the dimensions and distances are advantageously selected such that the distance B between the separator 1 and the light detectors 60 and 61 is smaller than the smallest possible distance between the leading edges of two items which are consecutively removed from the stack.

It, therefore, is sufficient to monitor the presence of items in the areas in front of abutments 50 and 51 and to emit a control signal for the interrupter of the separation process whenever both light detectors 60 and 61 indicate the presence of an item in their respective channels. For this purpose, the outputs of the light detectors 60 and 61 are connected with the inputs of a NOR circuit 64 whose output signal is the control signal for the interrupter of the separator 1, i.e. valve 28. If no signal is present at either of the two inputs of the NOR circuit 64, i.e. when both light detectors are darkened by an item, a control signal is provided to actuate the valve 28 and thus the separation process is interrupted.

The embodiment, shown in FIG. 2, also contains a discharge signal circuit for the actuation of abutments 50 and 51, which permits the discharge of individual items by providing individual discharge signals at the appropriate times or the discharge of a series of items with the same spacing between their leading edges by the provision of periodic discharge signals.

The discharge signals which are applied, for example, by an external source, via a terminal 65 are fed to a switching circuit 66 which acts as a frequency divider and which changes its respective switching state at the arrival of a signal. The outputs of this switching circuit are connected, each via an AND circuit 67 or 68, respectively, with the inputs of a monostable switching circuit 69 or 70, respectively. The outputs of the circuits 69 and 70 in turn are coupled to the electromagnets 56 and 57, respectively, which serve to actuate abutments 50 and 51, respectively. A discharge signal applied to the input of one of the monostable circuits 69 or 70 produces at its output a pulse of a duration which is sufficient to allow an item to be removed from the range of the respectively actuated abutment. The second inputs of the AND circuits 67 and 68 are each controlled via an inverter 71 or 72 by the output signals from the light detectors 60 or 61, respectively. In this way a discharge signal coming from the switching circuit 66 which is intended, for example, for abutment 51 will actuate the electromagnet 57 of abutment 51 only when the light detector 61 disposed in the area of this abutment is darkened by an item 20.

The operation of the embodiment illustrated in FIGS. 1 and 2 is described below. It is assumed that at the beginning of the operation there are no items present in conveying channels 3 and 4. Both light detectors 60 and 61 emit a logic 1 to the inputs of switching circuit 63 so that its switching state is not defined. It is assumed that a 0 is present at the output leading to electromagnet 48 so that the deflector flap 2 takes on the illustrated rest position. The first item coming from the separator 1 thus enters conveying channel 3 and advances to its abutment 50 whereby it darkens the light detector 60. Thus a 0 appears at the left input of the switching circuit 63 so that its righthand output produces a 1 and the deflector flap 2 is brought into its other position via electromagnet 48 and the next item coming from the separator enters the conveying channel 4. Then the light detector 61 is also darkened by an item and also emits a 0. Nothing changes in the switching state of the switching circuit 63 but a 1 appears at the output of the NOR circuit 64 so that the valve 28 of the separator 1 is blocked and interrupts the separation process. The already described discharge signal circuit with elements 65 to 72 provides that the discharge signals which control the discharge of items from conveying channels 3 and 4 are alternatively coupled to the electromagnets 56 and 57 of abutments 50 and 51, respectively. Since the signals from the light detectors 60 and 61 are also utilized, the electromagnets are only actuated at that abutment where an item is present.

The modified embodiment illustrated in FIG. 3 differs from that of FIG. 1 in that instead of the simple suction belt separator 1 a so-called tandem separator 6 is utilized. The tandem separator 6 has two series connected separators and a common suction conveyor belt 80 which is provided with groups of suction openings and is brought over the suction troughs 81 and 82 of the two separators. This type of tandem separator and its operation is described in detail in U.S. Pat. No. 3,504,909 and, therefore, the separator shown in FIG. 3 is only briefly described below.

At the output of each of the two separators, there are disposed pneumatic strippers 25 or 25', respectively, as well as pressure rollers 26 or 26'. In the first separator an item 20 is removed from the stack at suction trough 81 by each group of suction openings in suction conveyor belt 80 unless the separation process is interrupted by a valve 83. Each separated item travels over a further pressure roller 84 into the area of suction trough 82 of the second separator. Here, the item is stopped at a controllable abutment, which now temporarily terminates the conveying path and then immediately thereafter releases the item. Shortly thereafter (because of the detour via a roller 86) the respective group of suction openings of the suction conveyor belt 80 also arrives, grips the item in the suction area of suction trough 82 and brings it to the output of the separator which is defined by rollers 26 and 87. An abutment 85, as described in German published Pat. application No. 2,063,874, corresponding to U.S. Pat. No. 3,730,514, issued May 1st, 1973 to Gisbert Burkhardt, is actuated by a pneumatically operated setting member, which is not illustrated here, whose connection with a pneumatic source is controlled by a valve 98 which cooperates with the suction openings of the suction conveyor belt 80.
The inverted output of a light detector 88 provides a signal as long as this light detector is darkened by an item disposed in the area of the suction trough 82. A signal generator which is formed by a light detector 89, which is controlled by the suction openings of the suction conveyor belt 80, produces an interrogation signal for the signal of the light detector 88 when the light detector 88 has been released by the trailing edge of the item leaving the output of the second separator. During normal operation, no signal from light detector 88 is detected during the interrogation intervals. If, however, two items have been removed by the first separator in spite of strippers 25, there is a good probability that the second item will not be trapped at the suction trough 82 during the second separation process or will be retained by the pneumatic strippers 25 and that only the first item will be fed to the output of the separator by the suction conveyor belt. During the interrogation interval, a signal from the light detector 88 is detected in this case, with the result that valve 83 of the suction trough 81 is blocked until the second item has also left the second separator. In this manner, a very high separation dependability is attained so that the purpose for which the arrangement of the present invention is intended, i.e. the dependable discharge of individual items at the desired times, is further enhanced.

The valve 28, which serves as an interrupter, is inserted into the suction line 90 of the second suction trough 82. If this valve is blocked by a control signal coming from the control circuit, e.g. from the NOR circuit 64 of FIG. 2, an item entering the area of the second suction trough 82 will no longer be fed to the rollers 26 and 87 of the separator. Thus the light detector 88 remains darkened also during the interrogation interval so that, as described above, the separation at the first suction trough 81 is also interrupted.

The modified embodiment shown in FIGS. 4 and 5 differs from that of FIG. 1 in that there are three conveying channels 7, 8 and 9 connected in parallel, subsequent to the separator 1 instead of the above-described two conveying channels. These three channels 7, 8 and 9 are formed by facing sections of conveyor belts 100 and 101, 102 and 103 and 104 and 105. Along each of the three channels, there is arranged an abutment 106, 107 or 108, respectively, with an acceleration roller 109, 110 or 111, respectively, as well as a light detector 112, 113 or 114, respectively. A further light detector 115 which monitors the passage of items is disposed in front of the deflector arrangement, which here includes two individually actuated deflector flaps 10 and 11. The arrangement includes, in addition to the deflection and guide rollers required for the conveyor belts similar to those described above with respect to FIG. 1, several guide surfaces or stripes 116, 117 and 118, the surfaces of which cooperate with the abutments 106, 107 and 108, respectively.

The deflector flaps 10 and 11 are switched into their deflected position by electromagnets 119 or 120, respectively, while they are biased in their rest position by a spring 121, in which position the items are fed into the center conveying channel 8. The abutments 106, 107 and 108 are driven from their first position into their second position, against the force of a respective spring 122 by electromagnets 123, 124 and 125, respectively. The valve 28 serves as the interrupter of separator 1 and includes switching member 126.

The control and discharge signal circuit, which is schematically illustrated in FIG. 6, makes it possible to release the items individually at any selected points of time, at periodically successive instances with their leading edges uniformly spaced, or with identical spaces (interstices) between the items. In the first and second cases, the discharge signals are externally applied and in the third case the discharge signals are produced in the discharge signal circuit itself.

In addition to the external discharge signals obtained via input terminals 150 and 151, the control and discharge signal circuit receives additional input signals from the light detectors 112 to 115. The output signals of these light detectors are fed to: the electromagnets 119 and 120 to actuate the deflector flaps 10 or 11, respectively; the switching member 126 of valve 28°; and, the electromagnets 123, 124 and 125 to actuate the abutments 106, 107 or 108 and the corresponding acceleration rollers 109, 110, or 111, respectively. These output signals from the light detectors 112 to 115 are applied either directly, or in negated form, by the inverters 152, 153, 154 and 155.

As can be seen from FIG. 6, the setting signals for the electromagnets 119 and 120 to actuate the deflector flaps 10 or 11 are produced with the aid of AND circuits 156 and 157, which receive the signals from the light detectors 112 and 114 directly and the signals from the light detectors 113 and 115 in negated form. Thus the deflector flap 10 for conveying channel 7 is set when the light detector 112 is bright and the deflector flap 11 for conveying channel 9 is set when the light detector 114 of this conveying channel is bright and at the same time the light detector 113 of the center conveying channel 8 is dark. Both setting signals, however, only become effective if the light detector 115 is darkened by a passing item.

The control signal for the valve 28° is derived from the output signal of an AND circuit 158 to which the negated signals from the three light detectors 112, 113 and 114 are fed. Consequently a control signal for the valve 28° to interrupt the separation process is given when all three light detectors are darkened by an item.

The discharge signal circuit is designed so as to automatically generate a cyclic sequence of actuation signals for abutments 106 to 108 in such a manner that the arrangement discharges a succession of items with the same spaces between them. In controlling the discharge of items, an AND circuit 159 generates an actuation signal for abutment 106 of conveying channel 7, an AND circuit 160 generates an actuation signal for abutment 107 of conveying channel 8 and an AND circuit 161 generates an actuation signal for abutment 108 of conveying channel 9. The inputs of AND circuits 159, 160 and 161 receive the direct signals from the light detectors 114, 112 and 113 of the cyclically preceding conveying channel 9, 7 or 8, respectively (each via a pulse stage 162, 163 or 164, respectively) and the negated signals from the light detectors of the other two conveying channels. A signal therefore is present, for example, at the output of AND circuit 160 for the actuation of abutment 107 of conveying channel 8 when the light detector 112 of conveying channel 7 is light (due to discharge of its item) and light detectors 113 and 114 of conveying channel 8 itself and of the third conveying channel 9 are darkened by an item. The pulse stages 162, 163, 164 serve the purpose of maintaining
the signal emitted by the bright light detector for a certain period of time even if the light detector has been darkened in the meantime by the next item furnished by the separator.

Included in the lines between the AND circuits 159, 160 and 161 and the electromagnets 123, 124 and 125 for the actuation of the abutments are AND circuits 165, 166 and 167 respectively, as well as delay circuits 168, 169 and 170, respectively. The AND circuits 165, 166 or 167 are provided for coupling the signals produced by AND circuits 159, 160 and 161 to electromagnets 123, 124 and 125, respectively, only as long as it is desired to have items discharged, in which case a 1 is applied to the input terminal 150 of the discharge signal circuit, for example, by the use of a switch 171.

The delay circuits 169, 170 and 168 determine the time interval between the passage of the trailing edge of an item by the light detector 112, 113 or 114, respectively, of a conveying channel and the actuation of the discharge signal, which has been automatically generated in the AND circuit 160, 161 or 159, respectively, at the abutment 107, 108 or 106 of the cyclically next conveying channel 8, 9 or 7, respectively. This time interval is selected in dependence upon the different path lengths of the items from the abutment to the outlet of the arrangement and the desired spacing between successive items.

The above-described operation for the automatic generation of discharge signals which become effective in cyclic sequence at the abutments 106, 107 and 108 (when one of the light barriers 112, 113 or 114 is bright and the other two are dark) can only occur if the cyclic discharge of items has already been started. At the beginning of the release of items or when this discharge process is temporarily interrupted, an item is disposed in each one of the three conveying channels 7, 8 and 9 so that all three light detectors 112, 113 and 114 are dark. A signal will then be generated at the output of the AND circuit 158 to prevent the further forwarding of items by the separator 1.

In order to be able to release an individual item from the above-mentioned operating state or the first item of a series of items, the above-mentioned output signal of AND circuit 158 is fed to the AND circuit 165 via an OR circuit 172 thus initiating the discharge operation.

In order to be able to discharge individual items at any desired point in time a pulse generator 173 is provided which is controllable by an external signal applied via input terminal 151. If a 1 is applied to this input terminal 151, for example, through the use of a key 174 or by an output signal generated by the order circuit of a subsequent portion of the system, the pulse generator 173 will apply a signal to the AND circuits 165, 166, and 167 whose duration is sufficient for the discharge of an item. The actuated AND circuit 165 will emit a sufficient discharge signal to actuate the abutment 106 of conveying channel 7 so that the item in the channel is discharged.

The discharge of the item in conveying channel 7 enables the light detector 112 to receive light thereby emitting a signal to initiate the automatic discharge of the next item from conveying channel 8 as described above. Since, however, the signal of pulse generator 173 has now faded, thus blocking the AND circuit 166, the abutment 107 remains at rest. The arrival of a further item in the conveying channel 7 will then reinstate the original state. Only when the discharge signals are generated via the input terminal 151 in a very rapid sequence, which is similar to the automatic cyclic discharge operation, will items also be discharged from the other conveying channels.

In the embodiment of the present invention illustrated in FIG. 7, two separators 12 and 13 are provided with each separator being directly connected to a respective conveying channel 14 or 15. Along the channels 14 and 15, there are arranged controllable abutments 200 or 201, respectively, and acceleration rollers 202 or 203, respectively, and these channels lead to the common output of the arrangement.

The two separators 12 and 13 can be basically automatic units which operate independently of one another. In the present embodiment, however, it is provided that the items are transferred from the separators to the subsequent conveying channels 14 and 15 in an alternating sequence and in rigid time association. This synchronized operation is accomplished by constructing the two separators in the manner disclosed by German Offenlegungsschrift (laid-open patent application) No. 2,042,243, such that a common suction belt 206 is guided over the suction troughs 204 and 205 of the two separators. The suction belt is provided with a group of suction openings, or a plurality of groups of suction openings, which are distributed over the periphery. Each suction trough 204 and 205 is connected to the common subatmospheric pressure source (not shown) via a valve 207 or 208, respectively. Light detectors 209 and 210, which are disposed in conveying channels 14 and 15, respectively, produce output signals which are negated by inverters 211 and 212, respectively, and serve as the control signals for the valves 207 and 208, respectively. Thus a control signal for the valve of a separator is produced whenever the signal generator of the respective conveying channel 14 or 15 indicates the presence of an item.

In an arrangement such as that shown in FIG. 7, however, it is principally only necessary that the control signals of a control circuit prevent that a further item be fed by a separator to a conveying channel in which there already is an item. Due to the synchronous push-pull type coupling of the two separators 12 and 13, it is also possible to provide such control with the use of a common valve for the two suction troughs 204 and 205 if the control signal is generated in correspondence with the positioning of the suction openings of the common suction conveyor belt 206 with respect to the suction trough 204 or 205 of the separator, which corresponds to the occupied conveying channel.

The electromagnets 213 and 214 which serve to actuate abutments 200 and 201 may be connected to a discharge signal circuit similar to that illustrated in FIG. 2 (elements 65 to 72) or to a discharge signal circuit which automatically transmits alternating discharge signals to the electromagnets.

In FIG. 8 which shows a modified embodiment of the arrangement shown in FIG. 7, two separators 12 and 13 remove the items 20 from the two stacks and feed the items into three corresponding conveying channels 16, 17 and 18. The separators 12 and 13 are coupled to these channels via two deflectors 230 and 231 and the channels lead to a common output point of the arrangement. Along the channels 16, 17 and 18, there are arranged controllable abutments 232, 233 and 234, respectively, and acceleration rollers 235, 236 and 237,
respectively. A light detector 238, 239 or 240, respectively, is disposed in each conveying channel and responds to the presence of an item within the channel. Further light detectors 241 and 242 serve to monitor the arrival of items in the area of the deflectors 230 and 231, respectively.

The feeding of items to the individual conveying channels 16, 17 and 18 is effected in such a manner that separator 12 feeds items to conveying channels 16 and 17 and separator 13 feeds items to conveying channels 17 and 18. The actuation of deflectors 230 and 231 by their electromagnets 243 and 244, respectively, is controlled such that each separator furnishes an average of about two thirds of the items of its associated stack to the outer conveying channel 16 of 18, respectively, and one third of its items to the center conveying channel 17.

As can be seen in the drawings, in the embodiment of FIG. 8, the same separators are used as those utilized in the embodiment of FIG. 7 and, therefore, the separators can be controlled with respect to an interruption of the input of items into conveying channels 16, 17 and 18 in a similar manner as described above with respect to FIG. 7. In the embodiment illustrated in FIG. 8, however, each suction trough 204 and 205 again has its own valve 207 or 208, respectively, associated to it.

The abutments 232, 233 and 234 are actuated by electromagnets 245, 246 and 247, respectively. The same discharge signal circuit can be used as that explained in connection with FIG. 6 with respect to the actuation of abutments 106, 107 and 108.

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 for the controlled discharge of individual flat items from at least one stack, including separator means for discharging the items from the stack and interrupter means for interrupting the operation of the separator means upon receipt of a control signal, the improvement comprising:
   a. conveying means, having at least two conveying channels, said conveying channels being arranged to receive the items discharged from said separator means and being disposed so as to converge at a common discharge point;
   b. at least two controllable release means, each associated with a respective one of said channels, each said controllable release means having a controllable abutment disposed at a distance from the inlet of said channel which is greater than the length of the longest item to be received by said channel, and an acceleration means disposed between said controllable abutment and the inlet of said channel and being operatively coupled to said controllable abutments, said controllable release means being arranged to be selectively switched between a first position where said controllable abutment is positioned within said channel to prevent continued passage of an item along said channel and a second position where said controllable abutment is removed from said channel and said acceleration means is moved into an operative position so as to accelerate the discharge of an item from said channel;
   c. at least two signal generator means, each disposed in a respective one of said channels for providing an output signal indicative of the presence of an item within said channel;
   d. control means coupled to the outputs of said signal generators for preventing an item from being fed into any of said channels already occupied by an item; and,
   e. discharge means for selectively providing discharge signals to each said controllable release means for selectively switching each said controllable release means into its second position thus enabling an item within the respective said channel to continue along said channel to said discharge point.

2. An arrangement as defined in claim 1 wherein said conveying means includes deflector means for directing an item discharged from said separator means into one of said channels and said control means is coupled to said deflector means causing said deflector means to direct the item to an unoccupied one of said channels.

3. An arrangement as defined in claim 2 wherein said separator means includes two separators; said conveying means includes three channels; said deflector means includes two deflectors, each deflector being positioned adjacent the outlet of one of said separators for deflecting an item discharged from the associated said separator.

4. An arrangement as defined in claim 1 wherein said separator means includes two separators each associated with a respective one of said channels.

5. An arrangement as defined in claim 4 wherein said interrupter means includes two interrupters, each associated with a respective one of said separators, and said control means provides control signals to said interrupters for preventing said separators from discharging an item into said channel if said channel is already occupied by an item.

6. An arrangement as defined in claim 1 wherein said separator means includes rotating discharge means arranged to remove the items from the stack.

7. An arrangement as defined in claim 6 wherein said separator means includes at least one separator having a suction trough disposed in the region of said separator adjacent the stack of items and a suction conveyor belt being provided with a plurality of suction openings and being arranged to cooperate with said suction trough.

8. An arrangement as defined in claim 1 wherein each said signal generator means is spaced from said separator means by a distance smaller than the smallest possible distance between the leading edges of two items consecutively removed from the stack of items, said control means generates a control signal when all of said signal generator means indicate the presence of an item in each of their respective channels and said interrupter means is coupled to said control means for receiving the control signal and in response thereto interrupting the operation of said separator means.

9. An arrangement as defined in claim 1 wherein said discharge means includes an externally actuated signal source.

10. An arrangement as defined in claim 1 wherein said discharge means selectively couples the discharge
signals to each said controllable release means in a cyclic sequence.

11. An arrangement as defined in claim 10 wherein said discharge means is coupled to the output of each said signal generator means so that the discharge signals are generated in dependence on the output signals of said signal generator means and said discharge means couples the discharge signals to said controllable release means associated with one channel upon actuation of said signal generator means associated with the cyclically preceding one of said channels by the trailing edge of an item which has been released by the associated said controllable abutment.

12. An arrangement as defined in claim 7 wherein said separator means includes two said separators, each arranged adjacent a respective stack of items, said separators operating in a push-pull manner to sequentially discharge items from the two stacks of items in a rigid time association to said associated conveying channels.

13. An arrangement as defined in claim 12 wherein said suction conveyor belt is an endless belt arranged to cooperate with said suction trough of both said separators.

14. An arrangement as defined in claim 1 wherein said separator means includes two series-connected suction troughs and a common, endless conveyor suction belt arranged to cooperate with both of said suction troughs, and said interrupter is operatively associated with said second suction trough.

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