

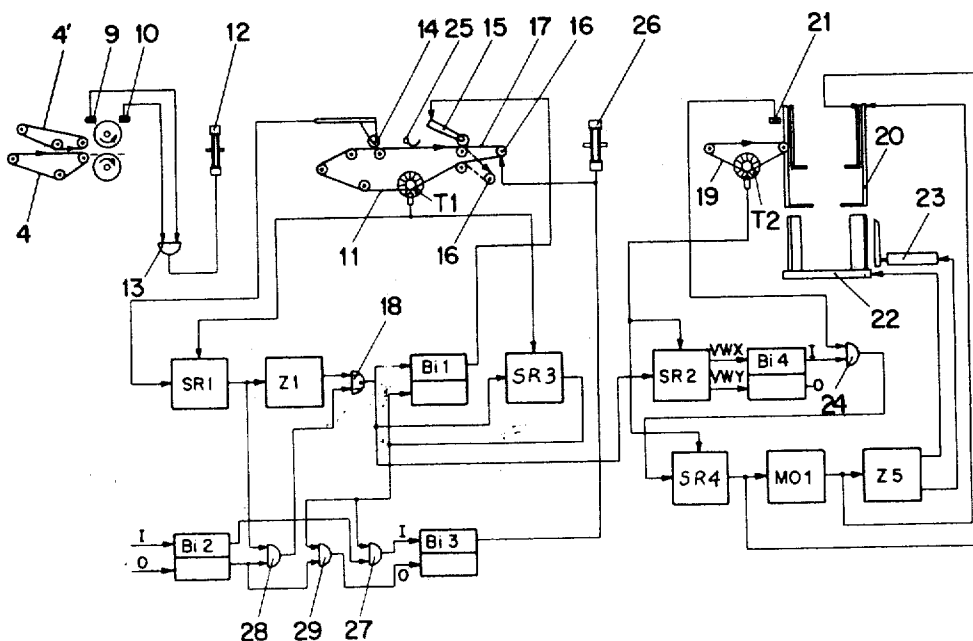
- [54] **METHOD AND ARRANGEMENT FOR HANDLING STREAMS OF SHEET GOODS**
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[51] Int. Cl..... **B65h 33/12**
[58] Field of Search 271/46, 47, 57, 258, 259; 93/93 L, 93 R, 93 DP

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[57] **ABSTRACT**
A stream of sheet goods is conveyed along a predetermined path. The stream of sheet goods is separated at a separating location along said path into successive stream segments separated from each other in the direction of said path by separating gaps. A receiver unit located downstream of the separating location receives successive ones of the stream segments and performs a handling operation with each stream segment. A gap-detecting unit is located intermediate the separating location and the receiver unit and generates a gap-detecting signal upon travel of a gap in said stream past the gap-detecting unit. A gating unit is operative upon creation of a separating gap at said separating location for generating a gating signal after elapse of a time interval corresponding substantially to the time required for the separating gap to reach the gap-detecting unit. A control arrangement causes the receiver unit to initiate a handling operation in response to generation of both a gap-detecting signal and a gating signal, whereby to prevent initiation of a handling operation in response to travel past said gap-detecting means of a gap in said stream not created by said separating means.

14 Claims, 3 Drawing Figures



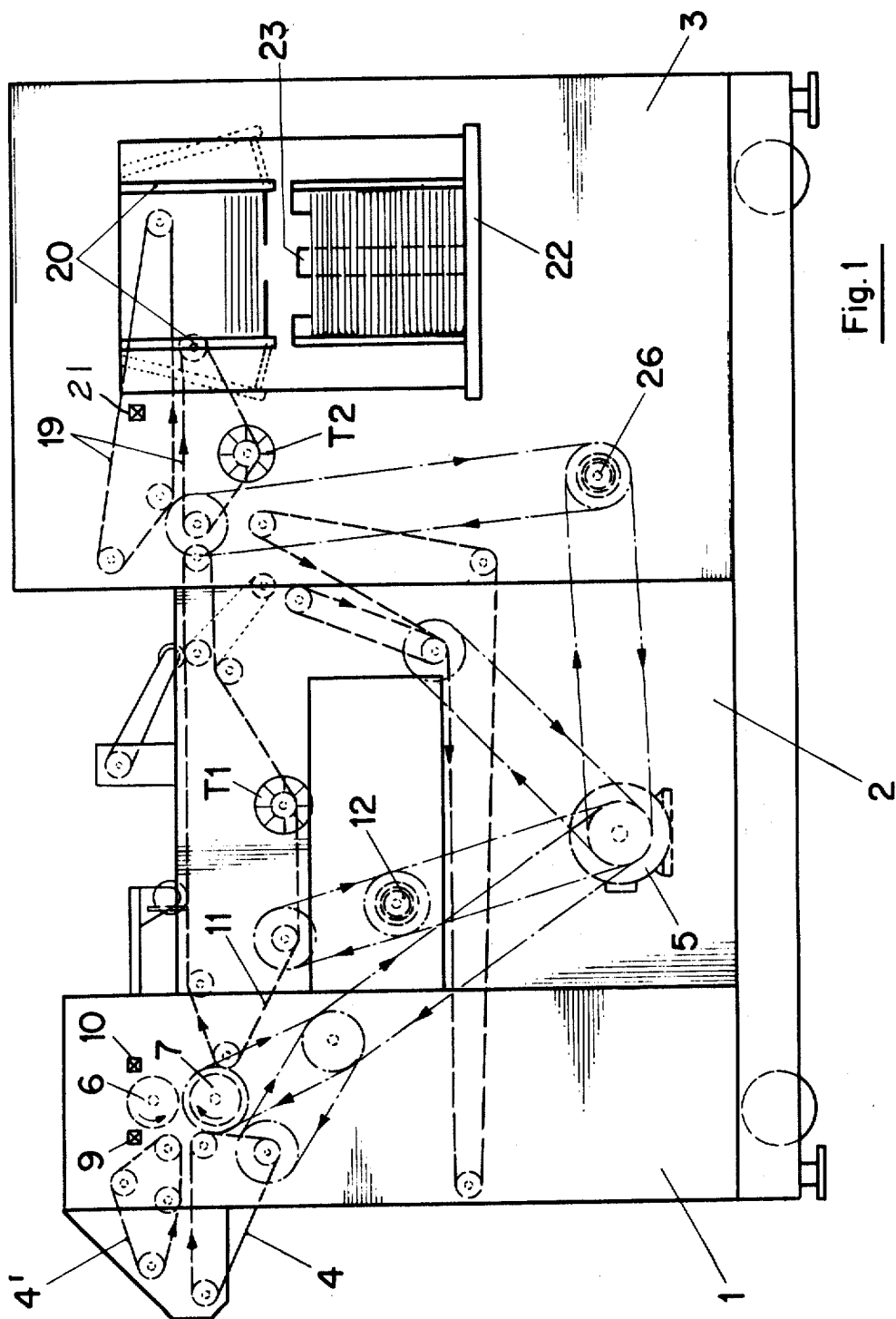


Fig. 1

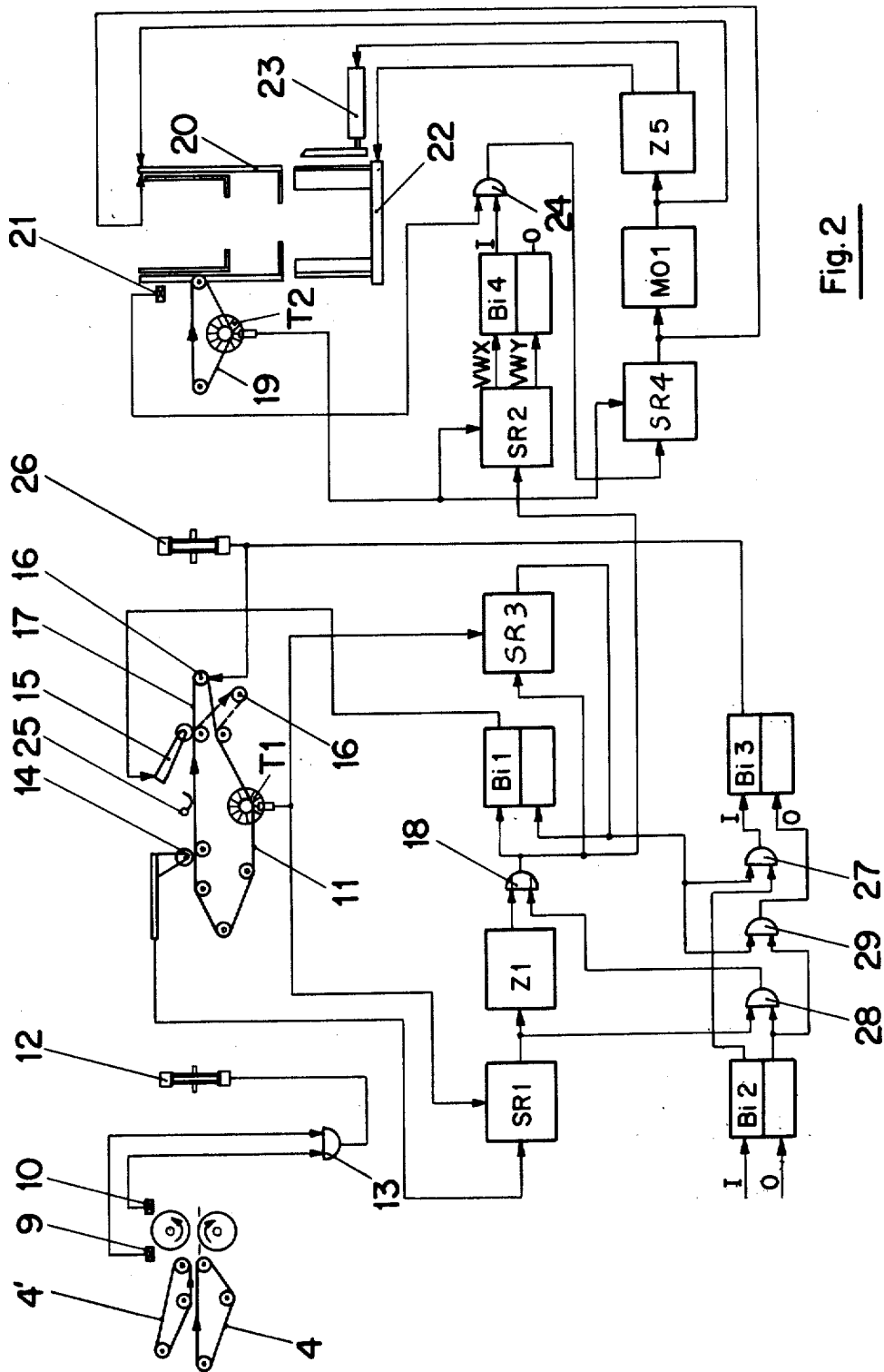
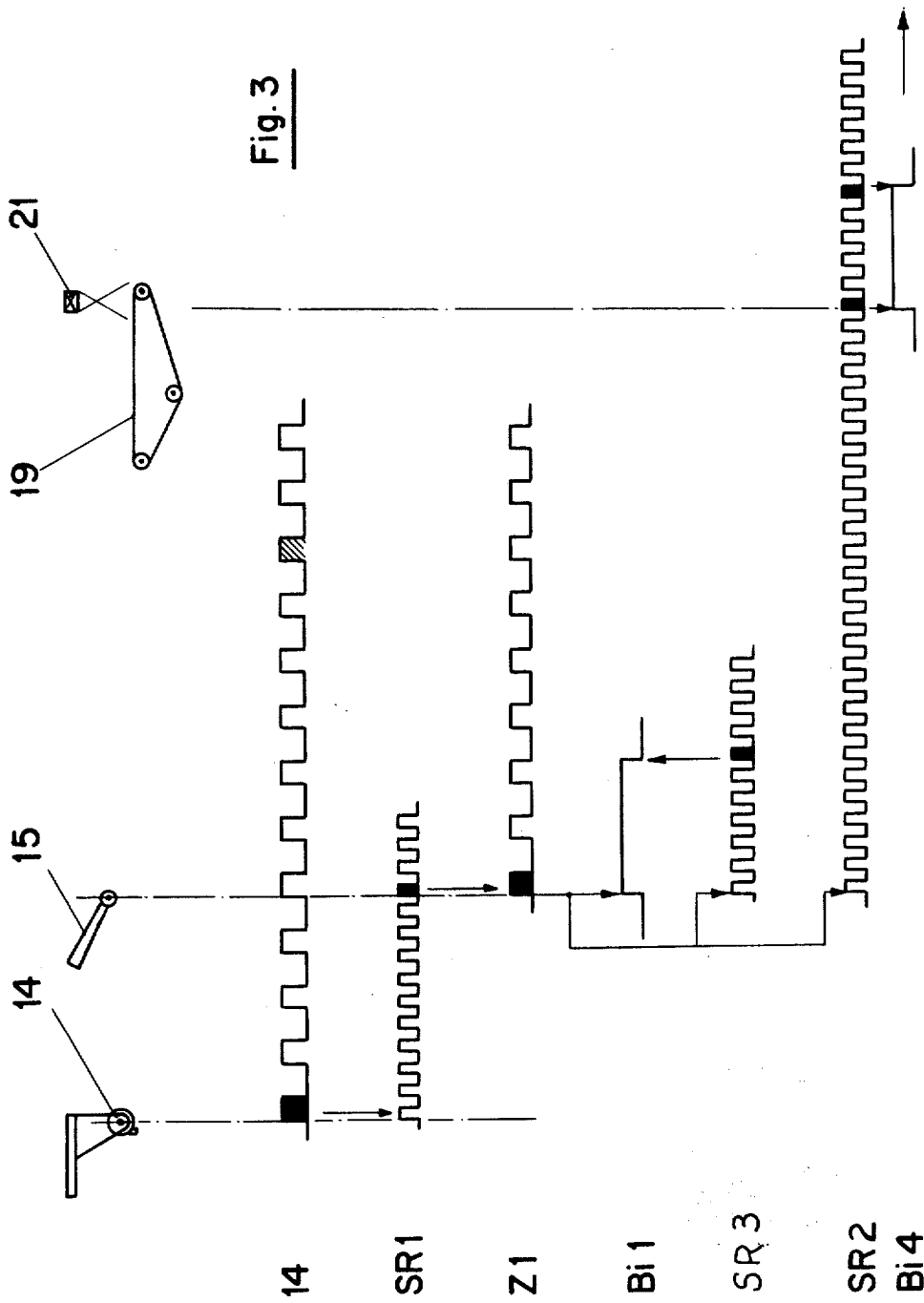


Fig. 2



METHOD AND ARRANGEMENT FOR HANDLING STREAMS OF SHEET GOODS

BACKGROUND OF THE INVENTION

The present invention relates to systems for the handling of streams of sheet goods, particularly lapped streams of folded paper sheets, such as newspaper components and newspaper sections or unbound or bound folded book leaves.

More particularly, the invention relates to systems of the type which separate a stream of sheet goods into successive stream segments travelling along a predetermined path and separated from each other in the direction of said path by separating gaps.

In arrangements of this type it is possible to detect the travel past a fixed reference location of complete stream segments, not directly by counting the number of sheet-goods units passing by, but instead indirectly by detecting the gaps between successive stream segments. A problem arises, however, inasmuch as malfunction of the sheet transporting arrangement may result in the improper development of gaps in addition to the separating gaps between successive stream segments. For example, it may be desired that each stream segment contain ten units of sheet goods, with the sheet goods of each stream segment being formed into a stack, and with the successive stacks of ten units each being laid upon each other in crisscross fashion. It is possible to automatically determine the arrival at the stacker of a complete stream segment containing ten units by detecting the arrival of the separating gap which comes at the end of a complete stream segment. However, if for any reason a gap is improperly formed within an individual stream segment, the stacker will form stacks having less than the required number of units. Where completely automated sheet-goods handling systems are involved, such faulty detection of the beginnings and ends of stream segments can produce an immense amount of confusion and wastage of sheet goods, for example where the sheet goods of a stream segment are consecutively numbered pages, or the like.

SUMMARY OF THE INVENTION

It is the general object of the invention to provide a method and arrangement for handling streams of sheet goods, particularly lapped streams of folded paper sheets, which avoids the difficulties explained above.

It is a more particular object of the invention to provide a method and arrangement according to which the travel past a reference location of complete stream segments can be determined, by detecting the separating gaps between successive stream segments, without incurring the risk of malfunction due to improper formation of gaps within a single stream segment.

This object, and others which will become more understandable from the following description of a specific embodiment, can be met according to the invention by providing an arrangement for handling streams of sheet goods, particularly lapped streams of folded paper sheets. The arrangement includes conveying means for conveying a stream of sheet goods along a predetermined path. Separating means separates the stream of sheet goods into successive stream segments separated from each other in the direction of the path by separating gaps. Receiving means located down-

stream of the separating means receives successive ones of the stream segments and performs a handling operation with each stream segment. Gap-detecting means is located intermediate the separating means and the receiving means and produces a gap-detecting signal upon travel of a gap in said stream past the gap-detecting means. Gating means is operative upon creation of a separating gap by the separating means for generating a gating signal after elapse of a time interval corresponding substantially to the time required for the separating gap to reach the gap-detecting means. And control means causes the receiving means to initiate a handling operation in response to generation of both a gap-detecting signal and a gating signal, whereby to prevent initiation of a handling operation in response to travel past the gap-detecting means of a gap not created by the separating means.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates in schematic form an arrangement operative for dividing a stream of sheet goods into stream segments having equal numbers of sheet-goods units, operative for forming each stream segment into a stack, and operative for laying the thus-formed stacks on top of each other in crisscrossed fashion;

FIG. 2 illustrates in more schematic form portions of the arrangement shown in FIG. 1, together with logic circuitry necessary for effecting proper operation of the arrangement; and

FIG. 3 is a pulse diagram illustrating some of the signals generated in the circuit of FIG. 2, to facilitate understanding of the operation of the system.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The arrangement illustrated in FIG. 1 is composed of three basic stages designated by reference numerals 1, 2 and 3. Stage 1 is an arrangement adapted to receive a lapped stream of folded paper sheets discharged from the output of a non-illustrated rotary printing machine. Stage 1 is operative for eliminating any gaps existing in the stream of sheets.

Stage 2 is operative for separating the stream into successive stream segments containing equal numbers of sheets, with the segments being separated from each other, in the direction of the path of travel of the stream, by separating gaps.

Stage 3 receives the successive stream segments, forms each stream segment into a stack, and then lays the stacks one on top of another in crisscrossed manner. Arrangements corresponding to stage 3 are disclosed in Swiss Nos. 496,574 and 484,818.

The stage 1 is so positioned with respect to the output of the non-illustrated rotary printing machine that the sheets discharged by the printing machine are discharged onto conveyor belt 4 which is driven by a motor 5. An upper conveyor belt 4' cooperates with the lower conveyor belt 4 and travels at the same velocity as the lower conveyor belt 4. The two conveyor

belts 4, 4' physically engage the incoming stream of paper sheets at both the upper and lower sides of the stream, so as to convey the stream of sheets in a positive and accurate manner.

Immediately downstream of the cooperating conveyor belts 4, 4' there is located a pair of cooperating conveyor rollers 6, 7, also driven by the motor 5. Photoelectric detectors 9 and 10 are respectively located upstream and downstream of the pair of rollers 6, 7, and are operative for detecting gaps in the stream of sheets, so that such gaps can be eliminated in a manner described below.

The cooperating rollers 6 and 7 discharge the individual sheets of the lapped stream one after the other onto an additional conveyor belt 11, whose speed of travel is the same as that of the cooperating conveyor belts 4 and 4'. The conveyor belt 11 is driven by motor 5 through the intermediary of a coupling 12. The coupling 12 is controlled by the photoelectric detectors 9 and 10 in cooperation with an AND-gate 13 (see FIG. 2, upper lefthand corner). So long as the photoelectric detectors 9 and 10 fail to detect the improper presence of a gap in the stream of sheets passing between cooperating rollers 6 and 7, coupling 12 transmits the driving force motor 5 to conveyor belt 11, so that the stream of sheets moves from conveyor belts 4, 4' through rollers 6, 7 and onto conveyor belt 11 without interruption. However, if photoelectric detectors 9 and 10 do detect the improper presence of a gap in the stream of sheets passing between cooperating rollers 6 and 7, then the signal at the output of AND-gate 13 (see FIG. 2) disappears. The signal at the output of AND-gate 13 constitutes the activating signal for the coupling 12, and accordingly coupling 12 will be deactivated, and further motion of conveyor belt 11 will cease. The lapped sheets resting on the upper run of belt 11 will remain in place, whereas the conveyor belts 4, 4' and rollers 6, 7 will continue to operate. Accordingly, the gap which caused stopping of belt 11 will quickly be filled by one or more sheets discharged onto the conveyor belt 11 by the pair of rollers 6, 7. As soon as the photoelectric detectors 9 and 10 determine that the gap has been filled in this manner, coupling 12 is re-activated, and conveyor belt 11 is again driven.

The stream of sheets travelling on the upper run of conveyor belt 11 is monitored by a metering device 14. In the present embodiment the metering device 14 is operative for generating a pulse for each paper sheet travelling past the metering device 14. The manner in which such pulses are generated is per se conventional. For example, each sheet may be provided with a special marking to which the metering device 14 is responsive, or the metering device 14 may operate on the basis of any of the other well known principles employed for such devices. Metering device 14 generates these pulses, so that the pulses may be counted in order to determine when a desired number of sheets has passed by.

Located downstream of metering device 14 is a separating device 15 which is operative for separating the stream of sheets into successive stream segments separated from each other, in the direction of travel of the stream, by separating gaps. Separating device 15 includes a damming arm which can be lowered to physically engage the stream of sheets travelling on belt 11. When the damming arm is lowered, the paper sheets located upstream of the point of engagement are pre-

vented from travelling further, while the sheets already located downstream of the point of engagement continue to travel. In this way separating gap is formed between two successive stream segments. After such separating gap has been formed, the damming arm is raised, to permit free travel of the sheets of the next stream segment. The lowering and raising of the damming arm 15 is performed in dependence upon the operation of the metering device 14, in a manner which will be described with reference to FIG. 2.

When damming arm 15 is lowered, the sheets already located downstream of the point of engagement of the damming arm 15 continue to travel and are discharged from conveyor belt 11 onto the lower one of the pair of conveyor belts 19 of the third or receiving stage 3. The stream segment, which may for instance consist of 50 sheets, is engaged from both above and below by the pair of conveyor belts 19, for positive and accurate conveyance to the schematically illustrated stacking unit.

The stacking unit comprises two swingably mounted aligning members 20. When aligning members 20 are in the position shown in solid lines in FIG. 1, they form a rectangular bin into which the sheets of a stream segment neatly fall one by one, to form a neat stack. A photoelectric gap-detecting device 21 is located just upstream of the stacker. Sheets continue to travel into the bin formed by members 20 until detector 21 detects the presence of the separating gap coming at the end of the complete stream segment. In this way it is determined that all the sheets of one complete stream segment have been discharged into the bin formed by members 20. When the sheets of a stream segment have been thusly stacked, the members 20 swing apart, causing the formed stack to drop, as a whole, down onto the rotatable stacking table 22. After the stack has been dropped, the aligning members 20 swing back to the position shown in solid lines in FIG. 1, thus forming again the rectangular stacking bin. Subsequent thereto, the stacking table 22 is rotated by an angle of 90°, so that when the next stack is dropped onto the table 22 it will fall upon the first stack in direction transverse to the length of the first stack. In other words, the stacks will be laid on table 22 one on top of another in crisscrossed manner.

After a predetermined number of stacks have been laid, in crisscrossed manner, upon the stacking table 22, a shoving member 23 shoves the entire pile of stacks off the table 22 onto a non-illustrated conveyor, so that piling up of a new pile of crisscrossed stacks can commence.

The circuitry which coordinates and times the above-described operations is disclosed in FIG. 2.

The metering device 14 generates a pulse for each sheet travelling past the metering device. These pulses are counted by a counter Z1. However, the pulses from metering device 14 are applied to counter Z1 only indirectly, through the intermediary of shift register SR1. The shift register SR1, as is conventional, has a information signal input and a shifting signal input. The pulses from metering device 14 are applied to the information signal input of shift register SR1.

The purpose of providing shift register SR1 intermediate the metering device 14 and the counter Z1 is to introduce a time delay in the reception by counter Z1 of the pulses to be counted. This time delay is equal, or approximately equal, to the time required for a sheet

detected by metering device 14 to reach the region of the damming device 15. Thus, a pulse corresponding to a particular sheet will reach the counter Z1 at approximately the same time that the sheet in question reaches the damming device 15. Accordingly, while the metering device 14 is located considerably upstream of damming device 15, the time delay introduced by shift register SR1 will cause the counting operation to be performed as though the metering device 14 were located in the immediate vicinity of the damming device 15.

In conventional manner, the time delay furnished by shift register SR1 is determined by the number of shift-register stages and the frequency of the shifting signals. In FIG. 2, the shifting signals are applied to the shifting signal input of SR1 from a shifting-signal generator T1 whose operation is synchronized with the motion of the conveyor belt 11. The shifting-signal generator T1 can for example be a simple tachometer-type generator.

As will be evident to persons skilled in the art, the shift register SR1 should contain a sufficiently large number of stages, and the frequency of the shifting pulses should be sufficiently high, for discrete registration by shift register SR1 of all the pulses generated by metering device 14, without losing any of the pulses generated by metering device 14.

Counter Z1 is preset to generate an output signal after a predetermined number of pulses from metering device 14 has been counted, for instance ten pulses. When an output signal from counter Z1 is generated it will be applied, via OR-gate 18, to the upper input of flip-flop Bi1. The upper output of flip-flop Bi1 will become energized, and will apply an activating signal to the damming device 15, causing the damming arm of the device 15 to be lowered to physically engage the stream of sheets on the upper run of conveyor belt 11.

As explained with reference to FIG. 1, lowering of the damming arm 15 causes damming up sheets located upstream of the point of engagement while permitting continued travel of the sheets located downstream of the point of engagement, so that the desired separating gap between two stream segments is formed. Clearly, while the damming arm 15 remains lowered, the length of the separating gap will continuously increase, and of course it is desired to put a limit upon the length of the separating gap, and preferably to making all the separating gaps of equal length. To establish the length for the separating gaps, another shift register, designated SR3, is provided. When counter Z1 applies a command signal to the upper input of flip-flop Bi1, to effect lowering of the damming arm 15, the command signal is also applied to the information-signal input of shift register SR3. The output of shift register SR3 is connected to the lower input of flip-flop Bi1. Shift register SR3 serves to introduce a time delay between the time the command signal is applied to the upper input of Bi1 and the time a signal is applied to the lower input of Bi1 to effect raising of damming arm 15. Specifically, the command signal which effects lowering of arm 15 and which is also applied to the first stage of register SR3, will be shifted along the stages of register SR3 and will eventually reach the output of register SR3 and become applied to the lower input of flip-flop Bi1, to effect raising of arm 15. The shifting of the command signal along the stages of register SR3 is controlled by the shifting pulses generated by shifting-signal generator T1. Advantageously, the total time delay introduced by shift register SR3 — i.e., the length of time that dam-

ming arm 15 engages the stream of sheets — is equal to the time required for conveyor belt 11 to move a distance equal to the spacing between metering device 14 and the point of engagement of arm 15 plus the length in direction of travel of one sheet being conveyed plus one half the overlap between the lapped sheets. However, the time delay furnished by shift register SR3 can have other values, and the greater the time delay the greater will be the length of each separating gap.

The now-separated stream segment, which is assumed by way of example to contain 10 sheets, continues to travel towards the stacker. The sheets of the stream segment are dropped, one by one, into the stacking bin formed by the aligning members 20, until all the 10 sheets in the stream segment have fallen into the stacking bin. The fact that the entire stream segment has been stacked in the bin is determined by detecting the separating gap at the end of the stream segment. Detection of the separating gap is accomplished by photoelectric gap-detecting means 21. As soon as a gap is detected in the stream of sheets travelling towards the stacker, detector 21 generates a signal which is applied to one input of an AND-gate 24. The output of AND-gate 24 is connected to the input of the activating means SR4, MO1, Z5 for the aligning members 20, the turnable stacking table 22 and the shoving member 23.

It would be possible to apply the signal from gap detector 21 directly to the activating means SR4, MO1, Z5, without the intermediary of AND-gate 24. However, if that were done, the risks described in the introductory part of this application will arise. Specifically, if any gaps are formed within an individual stream segment — e.g., gaps not formed by damming arm 15 — the gap detector 21, if AND-gate 24 were not present, would initiate dropping of the stack onto the table 22, even though less than all ten sheets of the stream segment had been received. In the case of automated sheet handling systems, and particularly where numbered pages and the like are involved, such faulty operation is intolerable, and it is for this reason that the AND-gate 24 is provided. The manner in which this kind of faulty operation is prevented by provision of AND-gate 24 will now be described.

As mentioned before, after 10 sheets have travelled past the region of damming arm 15, counter Z1 applies a command signal to the upper input of flip-flop Bi1 to effect lowering of damming arm 15 and creation of a separating gap. At the same time, however, this command signal is also applied to the information-signal input of further shift register SR2. Shift register SR2 is provided to introduce a time delay. Specifically, the time delay provided by shift register SR2 is substantially equal to the time required for the leading edge of the separating gap created by the lowering of arm 15 to reach the gap-detecting means 21. The command signal from counter Z1 will be applied to the first stage of register SR2 at approximately the time that the leading edge of the respective separating gap is being formed. This command signal will move along through the shift register in synchronism with the travel of the leading edge of the separating gap towards the gap-detecting means 21. The shifting pulses for the shift register SR2 are generated by a second shift-pulse generator T2, which is synchronized with the conveyor belt 19 located just upstream of the stacking unit. At approximately the time that the leading edge of the sepa-

rating gap reaches the gap-detecting means 21, the command signal registered in register SR2 will have reached a particular shift-register stage designated VWX, the output of which is connected to the upper input of flip-flop Bi4. The upper output of Bi4 is connected to the second input of AND-gate 24, and accordingly a gating signal will be applied to the second input of AND-gate 24 beginning at approximately the moment that the leading edge of the separating gap should reach gap detector 21. Now, if the detector 21 in fact detects a gap subsequent to this moment, an activating signal will appear at the output of AND-gate 24, and will be applied to the activating means SR4, MO1, Z5 whose operation will be described below.

It will be appreciated that an activating signal will not be generated at the output of AND-gate 24 before the command signal reaches stage VWX of register SR2, even if gap detector 21 detects a gap. Such a detected gap would evidently not be one of the separating gaps created by damming arm 15 and would evidently not serve to correctly indicate the passage by detector 21 of a complete stream segment of ten sheets. Accordingly, activation of the members 20, 22 and 23 will not occur in response to travel past detector 21 of gaps not created by damming arm 15 — i.e., will not occur in response to travel past detector 21 of gaps not occurring at the end of the ten sheets of a complete stream segment. It is in this manner that the illustrated arrangement overcomes the difficulty set forth in the introductory part of this description.

Assuming, now that the gating signal has been applied to the lower input of AND-gate 24, and assuming moreover that detector 21 now detects the separating gap occurring at the end of a stream segment, an activating signal appears at the output of AND-gate 24 and is applied to the information-signal input of shift register SR4. The purpose of shift register SR4 is to provide a time delay sufficient to ensure that the last sheet of the stream segment preceding the detected gap has fallen neatly into place in the rectangular stacking bin formed by aligning members 20. After this time delay has elapsed, a command signal appears at the output of shift register SR4. This signal is immediately applied to the (non-illustrated) control device for the aligning members 20, and the members 20 swing apart causing the stack formed from the sheets of the stream segment to drop down onto the rotatable stacking table 22.

The command signal from the output of SR4 is furthermore applied to a monostable multivibrator MO1, which introduces a further time delay sufficient to ensure that the entire stack formed between members 20 has fallen down onto the stacking table 20. After elapse of such further time delay, a signal appears at the output of monostable multivibrator MO1 and is applied to the (non-illustrated) control device for member 20, causing members 20 to swing back to their normal position, so as to again form a rectangular stacking bin for the sheets of a stream segment.

The signal appearing at the output of MO1 to effect swinging together of members 20, is also applied to a counter Z5 having two outputs. The upper output of counter Z5 is connected to the (non-illustrated) electrical control device for rotary stacking table 22. Generation of this signal at the upper output of Z5 causes the table 22 to turn through 90°, so that the next stack of sheets falling onto the pile will fall transverse to the preceding stack.

The signal appearing at the lower output of counter Z5 is applied to the schematically depicted electrical control device for shoving member 23, and when a signal appears at the lower output of counter Z5 shoving device 23 shoves the entire pile of crisscrossed stacks off the table 22 onto a non-illustrated conveyor, so that piling-up of a new pile of crisscrossed stacks can begin.

Counter Z5 can for example be a ring counter, with the output of each and every stage of the ring counter connected to the upper output of Z5, so as to effect rotation by 90° after each and every stack is dropped onto the pile forming on table 22. Alternatively, the output of every second stage of such a ring counter could be connected to the upper output of Z5, so that rotation by 90° of the turntable 22 would occur after every second stack of sheets drops onto the pile forming on table 22. Other possible connections will be evident.

If counter Z5 comprises a ring counter having ten stages, for example, then the output of a single one of the ten stages could constitute the lower output of Z5. In that event, shoving member 23 would shove the pile of crisscrossed stacks off the table 22 after ten stacks have been dropped onto the table 22. Obviously, these numbers are only exemplary.

As remarked earlier, generation of an activating pulse at the output of AND-gate 24, to initiate all the stacking operations just described, can occur only if a gating signal is present at the lower input of AND-gate 24. As also remarked earlier, this gating signal commences when the command signal which first effected lowering of damming arm 15 reaches that stage of shift register SR2 designated VWX. Clearly, the gating signal cannot persist indefinitely but must be terminated, preferably after a time delay corresponding to the time required for the entire separating gap to travel past detector 21. In other words, it is preferable that the duration of the gating signal be substantially concurrent with the predicted duration of the time interval during which a separating gap will be traveling past the detector 21. To effect termination of the gating signal at the moment when the trailing edge of the separating gap should have reached detector 21, the output of a further shift-register stage, designated VWY, is connected to the lower input of flip-flop Bi4. After the command signal which initiates lowering of arm 15 reaches shift-register stage VWX, it will subsequently reach shift-register stage VWY, to terminate application of the gating pulse at the lower input of AND-gate 24. After this moment, and until the gating signal is again applied, any gaps detected by detector 21 will not result in swinging apart of aligning members 20 and will not result in the other piling operations described above.

With regard to the embodiment shown in FIG. 2, it is noted that the VWY output of SR2 can be eliminated, in which case the output of AND-gate 24 would have to be additionally connected to the lower input of Bi4, to effect the necessary resetting of flip-flop Bi4 after the separating gap has moved past the detector 21.

The arrangement illustrated in FIG. 2 is furthermore characterized by a malfunction-responsive shutdown feature. Implementation of this shutdown feature involves the provision of components Bi2, 28, 29, 27, Bi3 and 26, whose existence can be completely ignored when considering those feature of the operation described above.

During normal operation of the illustrated arrangement the upper output of flip-flop Bi3, for reasons explained below, will be energized. This upper output is connected to coupling arrangement 26 and also to a dumping arrangement 16. Coupling arrangement 26 connects the output shaft of motor 5 to the drive roller for cooperating conveyor belts 19 (see FIG. 1). If coupling arrangement 26 becomes deactivated, motion of conveyor belts 19 ceases. Coupling arrangement 26 remains activated as long as the upper output of flip-flop Bi3 remains energized. If the lower output of Bi3 becomes energized, coupling arrangement 26 becomes deactivated, and the cooperating conveyor belts 19 stop.

Furthermore, if energization of the upper output of Bi3 ceases, a non-illustrated mechanism causes downward swinging of guide roller 16 from its solid-line position in FIG. 2 to its broken-line position. This results in the formation of a dumping path, and as the conveyor belt 11 continues to travel some sheets riding on its upper run will be dumped off the belt 11 into a non-illustrated reject bin, instead of proceeding in the normal manner towards conveyor belts 19.

This dumping operation will occur when malfunction is detected. To this end, one or more malfunction detectors, of per se conventional construction, will be provided at one or more locations along the path of travel of the sheets. One such malfunction detector 25 is shown in FIG. 2. This detector 25 has the form of a switch which becomes activated in the event that the stream of sheets includes one or more crumpled sheets, or a jammed bunch of sheets. Other such detectors can for example be positioned at the sides of the conveyor belt, to detect whether the sheets are improperly oriented skew to the path of travel so as to improperly extend over the lateral edge of the conveyor belt. Still other malfunction detectors can be provided for detecting whatever types of malfunction situations are characteristic of the particular sheet handling installation involved.

When the malfunction switch 25 becomes activated, it applies a signal to the lower or O-input of flip-flop Bi2, causing energization of the lower output of Bi2. During normal operation — i.e., when switch 25 has not been activated or when switch 25 has been reset after having been activated — it is the upper output of Bi2 that is energized.

When malfunction switch 25 becomes activated in response to malfunction, a gating signal is accordingly applied to both AND-gate 28 and AND-gate 29. As a result, the delayed pulses from metering device 14 appearing at the output of SR1 will be applied directly to the upper input of Bi1, without having to pass through counter Z1. Thus, almost immediately upon activation of malfunction switch 25, the upper output of Bi1 will become energized, and the damming arm 15 will be lowered into engagement with the stream of sheets on belt 11. These same pulses (appearing at the output of SR1) will also be applied to shift register SR3, and after the short delay provided by SR3, these pulses will begin to appear at the output of SR3 and be applied to the upper input of AND-gate 29. AND-gate 29 is already enabled, as just mentioned, and the signal appearing at the output of AND-gate 29 will be applied to the lower input of flip-flop Bi3, causing de-energization of the upper of Bi3. As a result, coupling arrangement 26 will become deactivated causing conveyor belts 19 to stop.

Also, the non-illustrated moving mechanism associated with roller 16 will cause roller 16 to swing downwards to form a dumping path and dump any sheets located downstream of damming arm 15. Of course, as an alternative to this operation, it is also advantageous to shut-down the entire arrangement, namely the motor 5 for illustrated arrangement, and also the non-illustrated rotary printing machine, when this possibility is appropriate.

In any event after the case of the malfunction has been eliminated, the malfunction-detecting switch 25 can be manually or otherwise reset, to re-energize the upper output of flip-flop Bi2, so that normal operation can recommence.

It is thought that the operation of the arrangement as just described will be sufficient for an understanding of the invention. However, to supplement the foregoing verbal description of the operation of the illustrated embodiment, reference may be had to the pulse diagram shown in FIG. 3. The pulse trains depicted in FIG. 3 are labelled, at their left ends, to indicate the circuit component with which they are associated.

The pulses from metering device 14, as explained above, are applied to counter Z1 after a time delay introduced by shift register SR1. This is indicated graphically in the first three pulse trains (labelled 14, SR1 and Z1) of FIG. 3. The first shaded pulse in pulse-train 14 is an arbitrarily selected pulse chosen for purposes of explanation. The shaded pulse in pulse-train SR1 corresponds to the shaded pulse in pulse-train 14, thereby indicating the time delay involved. The number of pulses in pulse-train SR1 preceding the shaded pulse indicate the number of shift-register stages through which the shaded pulse in train 14 had to pass to generate the time delay. The shaded pulse in pulse-train Z1 is coincident with the shaded pulse train SR1, indicating that when a pulse appears at the output of SR1 it is applied directly to the input of counter Z1. The shaded pulse in train Z1 happens to be that pulse which produces an output signal at the output of Z1, to effect lowering of the damming arm 15. That this is the case is clear from pulse-train Bi1, it being seen that an output pulse effective for lowering damming arm 15 commences when the shaded pulse has been counted by counter Z1. The arrow extending from the shaded pulse in train Z1 to the first pulse in train SR3 is indicative of the fact that the output pulse of counter Z1 is applied directly to the input of SR3. The displacement of the shaded pulse of train SR3 relative to the shaded pulse of train Z1 represents the time-delay introduced by shift register SR3. As was explained in the foregoing verbal description of the operation, the appearance of a pulse at the output of SR3 terminates energization of the upper output of Bi1, and this is evident from FIG. 3, inasmuch as the shaded pulse in train SR3 coincides with the end of the pulse Bi1. The arrow extending from the shaded pulse in train Z1 to the first pulse in the train SR2 indicates the fact, already explained, that the output pulse of counter Z1 is applied directly to the input of shift register SR2. The relative displacement between the shaded pulse in train Z1 and the first shaded pulse in train SR2 represents the time-delay furnished by shift register SR2. The relative displacement between the shaded pulse in train Z1 and the second shaded pulse in train SR2 indicates the additional time delay provided by shift register SR2. Finally, the pulse labelled bi4 indicates the duration of the gating signal

applied to the lower input of AND-gate 24. As can be seen from FIG. 3, the gating pulse commences when the command pulse (shaded pulse in train Z1) reaches the VWX stage of shift register SR2 and terminates when the command pulse reaches the VWY stage of shift register SR2.

The second shaded pulse in train 14 is the next pulse in that train which will effect generation of a signal at the output of counter Z1, but such generation will occur only after a time delay introduced by SR1 and accordingly, is not shown in FIG. 3.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of constructions and circuits differing from the types described above.

While the invention has been illustrated and described as embodied in an arrangement for handling a lapped stream of folded paper sheets, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

With respect to the counters and shift registers illustrated in the drawing, it is to be understood that any or all of them may be adjustable, so as to vary the number of sheets per stream segment, so as to vary the length of the separating gap, and so forth. The circuitry of adjustable counters and adjustable shift registers is too well known to require explicit description herein.

Also, whereas the final stage of the illustrated arrangement is a crisscross piling unit, it is evident that the invention is applicable regardless of what the receiving unit happens to be. Furthermore, whereas the sheet goods handled in the illustrated embodiment are folded paper sheets, the individual sheet-goods units could likewise be stacks of paper sheets, and bound or unbound, sheets of material other than paper, or indeed any articles or products which can be conveyed in a stream, lapped or otherwise, and which are separated into stream segments prior to some handling or processing operation.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired too be protected by Letters Patent is set forth in the appended claims:

1. An arrangement for handling streams of sheet goods, particularly lapped streams of folded paper sheets, comprising, in combination, conveying means for conveying a stream of sheet goods along predetermined path; separating means for separating said stream of sheet goods into successive stream segments separated from each other in the direction of said path by separating gaps; receiving means downstream of said separating means operative for receiving successive ones of said stream segments and performing a handling operation with each stream segment; gap-detecting means located intermediate said separating means and said receiving means and operative for generating a gap-detecting signal upon travel of a gap in said stream past said gap-detecting means; gating

means operative upon creation of a separating gap by said separating means for generating a gating signal after elapse of a delay time interval, and including synchronizing means for generating a synchronizing pulse each time said conveying means moves a predetermined fixed distance, and means for causing said time interval to have duration dependent upon the time interval required for the generation of a preselected number of said synchronizing pulses and corresponding substantially to the time required for the separating gap to reach said gap-detecting means; and control means for causing said receiving means to initiate a handling operation in response to generation of both a gap-detecting signal and a gating signal, whereby to prevent initiation of a handling operation in response to travel past said gap-detecting means of a gap not created by said separating means.

2. An arrangement as defined in claim 1, wherein said separating means comprises means for creating a separating gap by physically engaging said stream of sheet goods at a predetermined location along said path and holding back sheet goods upstream of said location while permitting continued travel of the sheet goods located downstream of said location in order to create a separating gap.

3. An arrangement as defined in claim 1, wherein said control means comprises an AND-gate having one input connected to said gating means to receive said gating signal and having another input connected to said gap-detecting means to receive gap-detecting signal and having an output, and activating means having an input connected to said output of said AND-gate and operative for causing said receiving means to initiate a handling operation.

4. An arrangement as defined in claim 1, wherein said gap-detecting means is located immediately upstream of said receiving means, so that concurrent generation of a gap-detecting signal and a gating signal will indicate that a complete stream segment has been received by said receiving means.

5. An arrangement as defined in claim 1; and further including means for causing said separating means to separate said stream into stream segments containing equal numbers of sheet goods.

6. An arrangement as defined in claim 1, wherein said gating means comprises means operative for generating a gating signal which commences after elapse of a time interval corresponding to the time required for the leading edge of the separating gap to reach said gap-detecting means and which terminates after elapse of a time interval corresponding to the time required for the trailing edge of the separating gap to reach said gap-detecting means, so that said gating signal is substantially contemporaneous with the travel of the respective separating gap past said gap-detecting means.

7. An arrangement as defined in claim 1, wherein said gap-detecting means comprises photoelectric means operative for detecting travel past said photoelectric means of a gap in said stream.

8. An arrangement for handling streams of sheet goods, particularly lapped streams of folded paper sheets, comprising, in combination, conveying means for conveying a stream of sheet goods along a predetermined path; separating means for separating said stream of sheet goods into successive stream segments separated from each other in the direction of said path by separating gaps; gap-detecting means located at a

predetermined part of said path and operative for generating a gap-detecting signal upon travel of a gap in said stream past said gap-detecting means; gating means operative upon creation of a separating gap by said separating means for generating a gating signal after elapse of a delay time interval, and including synchronizing means for generating a synchronizing pulse each time said conveying means moves a predetermined fixed distance, and means for causing said time interval to have a duration dependent upon the time interval required for the generation of a preselected number of said synchronizing pulses and corresponding substantially to the time required for the separating gap to reach said gap-detecting means; and stream-travel monitoring means operative in response to concurrent generation of both a gap-detecting signal and a gating signal for indicating travel past said gap-detecting means of a gap created by said separating means while not indicating travel past over gap-detecting means of gaps not created by said separating means

9. An arrangement for handling streams of sheet goods, particularly lapped stream of folded paper sheets, comprising, in combination, conveying means for conveying a stream of sheet goods along a predetermined path; separating means for separating said stream of sheet goods into successive stream segments separated from each other in the direction of said path by separating gaps; receiving means downstream of said separating means operative for receiving successive ones of said stream segments and performing a handling operation with each stream segment; gap-detecting means located intermediate said separating means and said receiving means and operative for generating a gap-detecting signal upon travel of a gap in said stream past said gap-detecting means; gating means operative upon creation of a separating gap by said separation means for generating a gating signal after elapse of a time interval corresponding substantially to the time required for the separating gap to reach said gap-detecting means; and control means for causing said receiving means to initiate a handling operation in response to generation of both a gap-detecting signal and a gating signal, whereby to prevent initiation of a handling operation in response to travel past said gap-detecting means of a gap not created by said separating means, wherein said separating means is operative for creating a separating gap upon receipt of a command signal and wherein said gating means comprises a shift register having an information signal input and a shifting signal input and comprising a plurality of shift-register stages connected to each other in succession with the output of one of said shift-register stages being connected to the input of said control means for applying a gating signal to the latter; means for applying a command signal to said separating means to effect creation of a separating gap and for also applying the command signal to the information signal input of said shift register; means for applying shifting signals to said shifting signal input of said shift register in synchronism with the operation of said conveying means and with such a frequency relative to the rate of conveyance of the sheet goods that said command signal reaches said one of said shift-register stages at substantially the time that the corresponding separating gap reaches said gap-detecting means.

10. An arrangement as defined in claim 9, wherein said gating means further includes a flip-flop having

first and second inputs and respective first and second outputs, with said first output being connected to the input of said control means for applying a gating signal to the latter, and with said first input being connected to the output of said one of said shift-register stages, and with said second input being connected to the output of a further shift-register stage connected downstream of said one of said shift-register stages, with the frequency of said shifting signals relative to the rate of conveyance of the sheet goods and also the relative location in said shift register of said one and said further shift-register stages being such that said command signal reaches said further shift-register stage at substantially the time that the trailing end of the respective separating gap reaches said gap-detecting means.

11. An arrangement for handling streams of sheet goods, particularly lapped streams of folded paper sheets, comprising, in combination, conveying means for conveying a stream of sheet goods along a predetermined path; separating means for separating said stream of sheet goods into successive stream segments separated from each other in the direction of said path by said separating gaps; gap-detecting means located at a predetermined part of said path and operative for generating a gap-detecting signal upon travel of a gap in said stream past said gap-detecting means; gating means operative upon creation of a separating gap by said separating means for generating a gating signal after elapse of a delay time interval corresponding substantially to the time required for the separating gap to reach said gap-detecting means, and including means for generating a train of synchronizing pulses at a rate dependent upon the speed of operation of said conveying means, and means for automatically regulating the duration of said time interval in dependence upon the rate of generation of said synchronizing pulses; and stream-travel monitoring means operative in response to concurrent generation of both a gap-detecting signal and a gating signal for indicating travel past said gap-detecting means of a gap created by said separating means while not indicating travel past said gap-detecting means of gaps not created by said separating means.

12. An arrangement for handling streams of sheet goods, particularly lapped streams of folded paper sheets, comprising, in combination, conveying means for conveying a stream of sheet goods along a predetermined path; separating means for separating said stream of sheet goods into successive stream segments separated from each other in the direction of said path by separating gaps; gap-detecting means located at a predetermined part of said path and operative for generating a gap-detecting signal upon travel of a gap in said stream past said gap-detecting means; gating means operative upon creation of a separating gap by said separating means for generating a gating signal after elapse of a delay time interval, and including time-delay-regulating means operative for automatically regulating the duration of said time interval in dependence upon the speed of operation of said conveying means to cause said time interval to have a duration corresponding substantially to the time required for the separating gap to reach said gap-detecting means; and stream-travel monitoring means operative in response to concurrent generation of both a gap-detecting signal and a gating signal for indicating travel past said gap-detecting means of a gap created by said separating

means while not indicating travel past said gap-detecting means of gaps not created by said separating means.

13. An arrangement for handling streams of sheet goods, particularly lapped streams of folded paper sheets, comprising, in combination, conveying means 5 for conveying a stream of sheet goods along a predetermined path, separating means for separating said stream of sheet goods into successive stream segments separated from each other in the direction of said path by separating gaps; receiving means downstream of 10 said separating means operative for receiving successive ones of said stream segments and performing a handling operation with each stream segment; gap-detecting means located intermediate said separating means and said receiving means and operative for generating a gap-detecting signal upon travel of a gap in 15 said stream past said gap-detecting means; gating means operative upon creation of a separating gap by said separating means for generating a gating signal after elapse of a delay time interval corresponding substantially to the time required for the separating gap to reach said gap-detecting means, and including means 20 for generating a train of synchronizing pulses at a rate proportional to the speed of operation of said conveying means, and means for automatically regulating the duration of said time interval in dependence upon the rate of generation of said synchronizing pulses; and control means for causing said receiving means to initiate a handling operation in response to generation of 30 both a gap-detecting signal and a gating signal, whereby to prevent initiation of a handling operation in response to travel past said gap-detecting means of a gap not cre-

ated by said separating means.

14. An arrangement for handling streams of sheet goods, particularly lapped streams of folded paper sheets, comprising, in combination, conveying means 5 for conveying a stream of sheet goods along a predetermined path; separating means for separating said stream of sheet goods into successive stream segments separated from each other in the direction of said path by separating gaps; receiving means downstream of 10 said separating means operative for receiving successive ones of said stream segments and performing a handling operation with each stream segment; gap-detecting means located intermediate said separating means and said receiving means and operative for generating a gap-detecting signal upon travel of a gap in 15 said stream past said gap-detecting means; gating means operative upon creation of a separating gap by said separating means for generating a gating signal after elapse of a delay time interval, and including time-delay-regulating means operative for automatically regulating the duration of said time interval in dependence 20 upon the speed of operation of said conveying means to cause said time interval to have a duration corresponding substantially to the time required for the separating gap to reach said gap-detecting means; and the control means for causing said receiving means to initiate a handling operation in response to generation of 30 both a gap-detecting signal and a gating signal, whereby to prevent initiation of a handling operation in response to travel past said gap-detecting means of a gap not created by said separating means.

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