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STACKING CONVEYOR FOR BOOKS AND THE LIKE

Filed July 3, 1951

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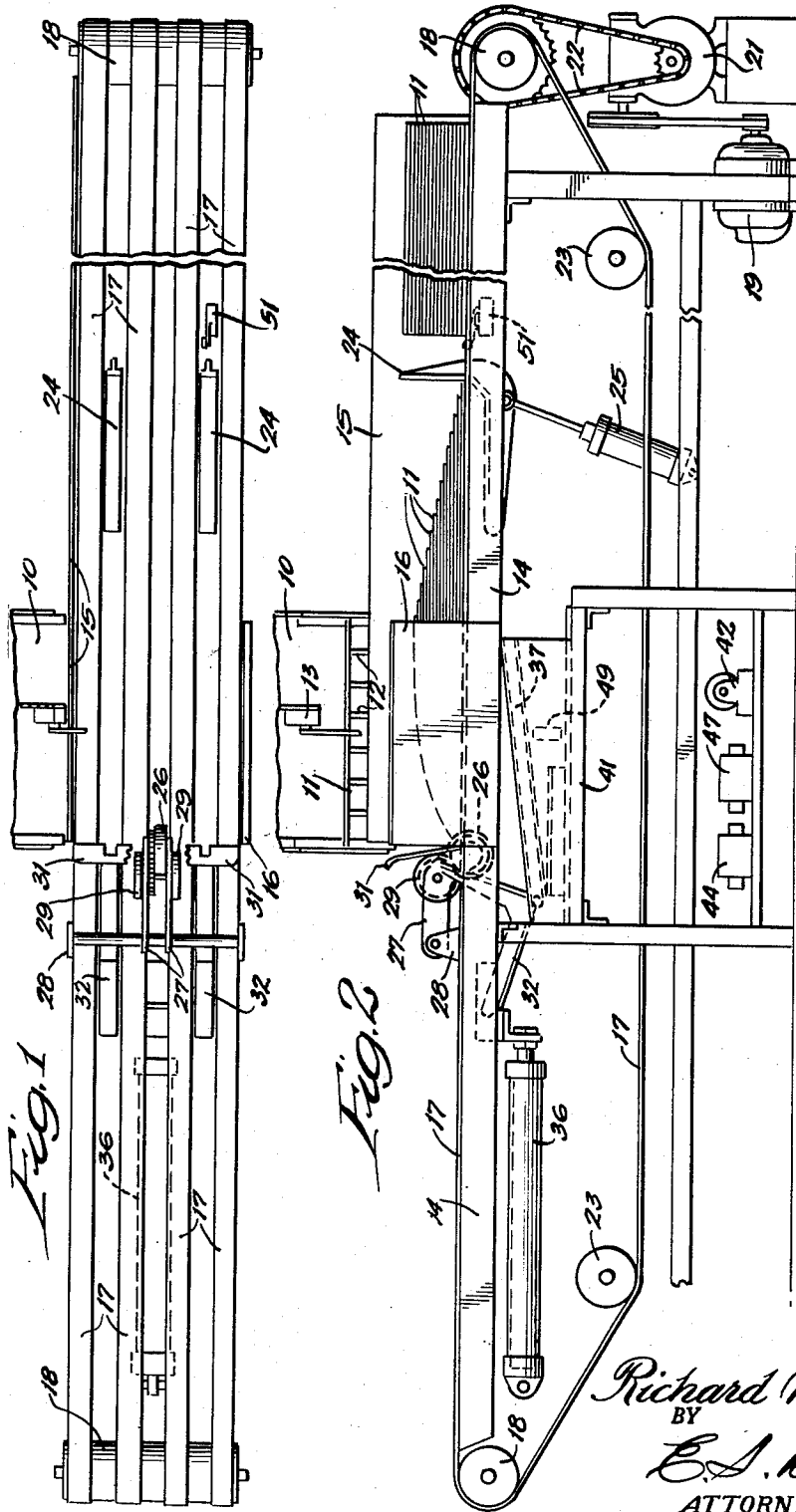


Fig. 1

Fig. 2

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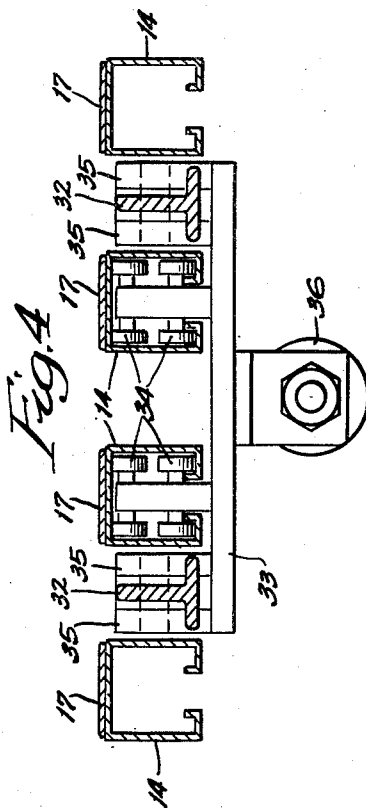
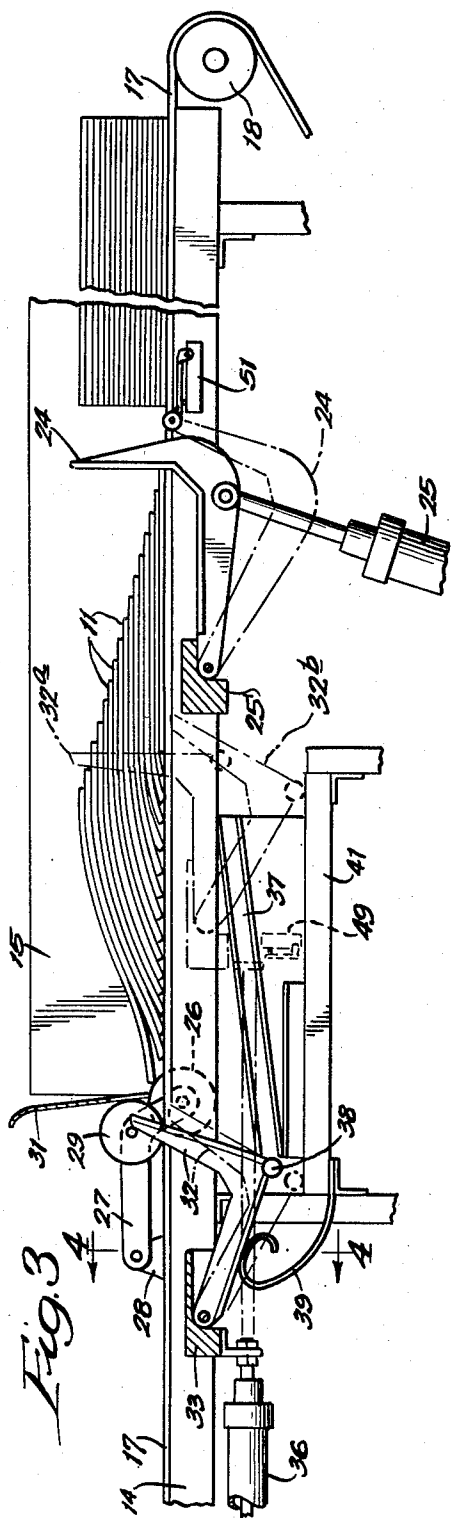
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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

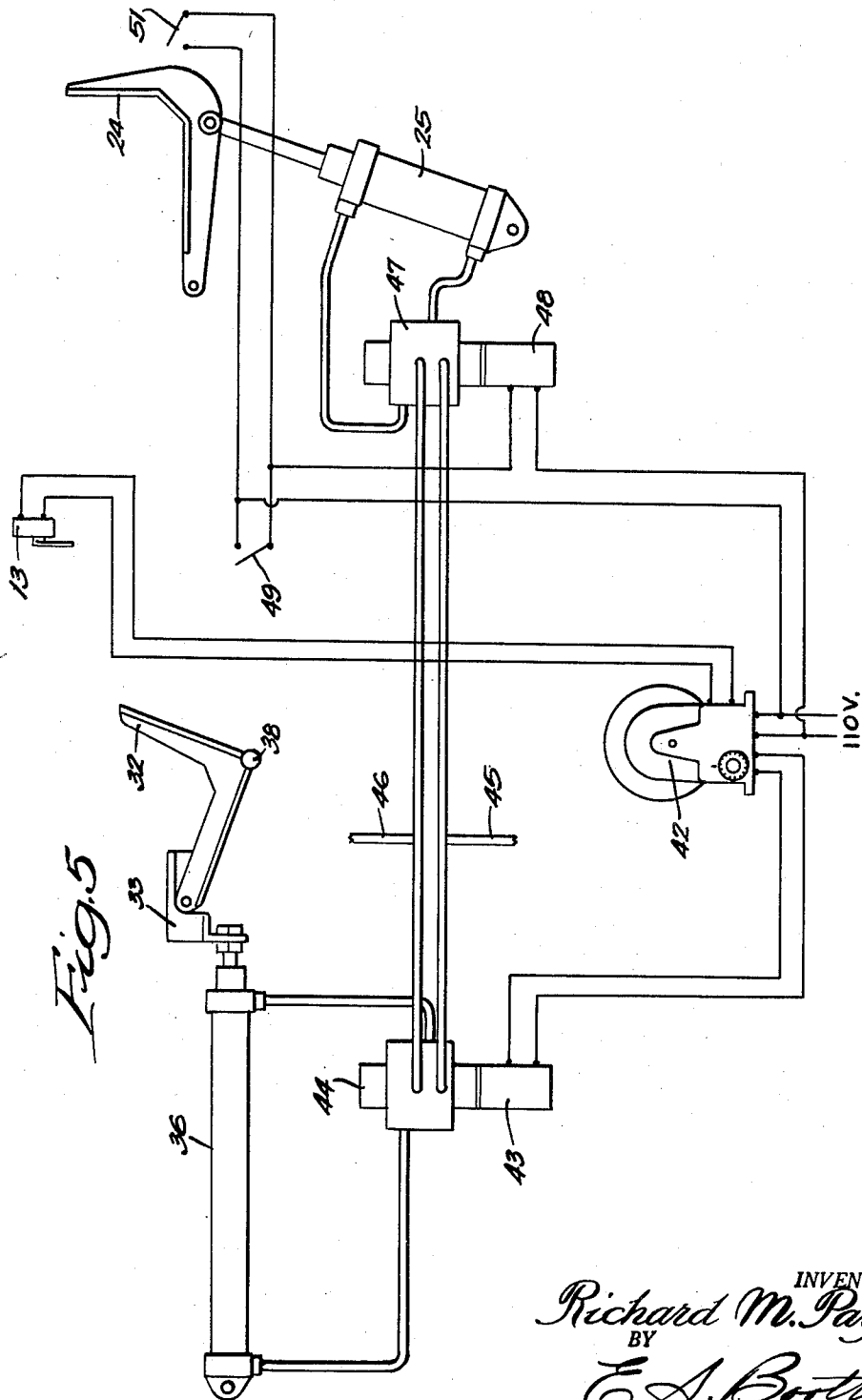


Fig. 5

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STACKING CONVEYOR FOR BOOKS AND THE LIKE

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11 Claims. (Cl. 93—93)

This invention relates to a stacking conveyor for books and the like, and more particularly to a conveyor for receiving books from a binding machine and arranging the books in regular stacks for shipping or storage.

Books such as magazines, pamphlets, and the like, are stapled or otherwise bound in a binding machine and are normally fed from the binding machine, bound edge first. It is desired that these books be stacked in regular stacks, each of which contains a predetermined number of books, and be conveyed to a convenient position for wrapping or packing.

It is one of the objects of the present invention to provide a stacking conveyor which receives individual books at a feeding station, forms the books into uniform stacks and conveys the stacked books to a packing station.

Another object is to provide a stacking conveyor in which the books are initially positioned on the conveyor in fanned out overlapping relationship and are then pushed into uniform stacks.

Still another object is to provide a stacking conveyor in which a rotating starting wheel engages the trailing edge of books fed onto the conveyor and gives them an initial feeding movement in the direction of conveyor travel. This insures that the books will be uniformly fanned out on the conveyor so that they can properly be stacked with no possibility of bending or crumpling.

A further object is to provide a stacking conveyor in which the books are pushed into a stack by a pusher finger having an angular upward and forward movement to carry the books from their fanned out relation into a straight stack.

A still further object is to provide a stacking conveyor which automatically operates to carry out stacking cycles in automatic succession.

The above and other objects and advantages of the invention will be more readily apparent when read in connection with the accompanying drawings, in which:

Figure 1 is a top plan view of a stacking conveyor embodying the invention;

Figure 2 is a side elevation;

Figure 3 is a partial transverse section;

Figure 4 is a partial transverse section on the line 4—4 of Figure 3; and

Figure 5 is a diagrammatic view of the control system.

The stacking conveyor as shown is adapted to receive books individually from a binding machine indicated generally at 10, from which books, as indicated at 11, are fed horizontally, bound edge first. As seen in Figure 2, the books pass over guide rails 12 in moving out of the binding machine and each book as it is fed from the machine trips the switch 13 which counts the books.

The conveyor comprises a frame which includes a plurality of elongated horizontally extending bars 14 spaced above the floor and at a convenient distance below the discharge level of the binding machine. At the side adjacent to the binding machine, a plate 15 extends upward from the frame to terminate just below the level at which the books leave the binding machine and at the

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opposite side of the conveyor a stop plate 16 extends upward from the frame to a level such that it will engage books fed from the binding machine and cause them to drop onto the conveyor. The plates 15 and 16 are preferably spaced a distance very slightly greater than the width of the books to be stacked so that the books will feed closely between them and will be accurately positioned on the conveyor thereby.

To move the books the conveyor includes a travelling tape 17 on each of the bars 14, the tapes being caused to move longitudinally of the bars by suitable driving wheels at the ends of the conveyor as shown at 18. One or both of the driving wheels 18 may be driven by a motor 19 through a gear reducer 21 and a sprocket chain 22. It will be understood that the tapes are endless loops continuously moving over the top of the beams from left to right as seen in Figures 1 and 2 and looped over suitable guide rollers 23 to guide them in the desired path of travel.

Movement of books on the conveyor at the feeding station adjacent to the binding machine is limited by one or more stop fingers 24 which extend upward between adjacent bars 14 into the path of the books on the conveyor. As shown, the stop fingers are angularly formed and are pivoted at their rear ends to a cross piece 25 carried by the bars. Two or more stop fingers 24 may be provided which are connected to be moved simultaneously by a fluid motor 25. Normally the stop fingers lie in the position shown to engage and stop the books on the conveyor and can be moved to the position shown in dotted lines in Figure 3 to allow the books to travel with the conveyor. When the books are held against movement by the stop fingers, the conveyor tapes simply slide under them, the conveyor being continuously in motion.

In order to insure that books fed onto the conveyor at the feeding station will be arranged in the desired fanned out relationship, a starting wheel is provided to engage and start the books. As shown, this comprises a wheel 26 projecting above the top of the conveyor between two adjacent bars 14 with its upper surface moving in the direction of conveyor travel. The starter wheel is rotatably supported at the ends of arms 27 which are pivoted on brackets 28 posterior from the feeding station. To turn the wheel, drive rollers 29 are rotatably supported on the arms 27 to engage adjacent conveyor tapes and are geared to the starting wheel to turn it. Proper engagement of the books with the starting wheel is insured by a guide plate 31 projecting above the conveyor at the posterior end of the feeding station to guide the books so that their rear edges will strike the top of the starting wheel.

As each book is fed onto the conveyor, its rear edge will strike the starting wheel and it will be given an initial urge in the direction of travel of the conveyor. Since books are fed individually as the conveyor travels they tend to overlap each other in a fanned out relationship as illustrated and after several books have been so stacked there is a tendency for a book fed from the binding machine to slide off of the stack. The starting wheel prevents this tendency and gives each book an initial movement so that the books will be held uniformly and properly overlapped with no possibility of any one book becoming crumpled when the stack is completed.

To form the books into uniform stacks, pusher fingers are provided to engage the rear edges of the fanned out books and push them into a straight stack against the stop fingers. As best seen in Figure 3, the pusher fingers are shaped as bell cranks 32 so that the forward portions thereof can project vertically through the spaces between adjacent bars. Preferably, at least two pusher fingers are provided which are pivoted at their rear ends on a travelling block 33 and which are interconnected at their front ends for movement together. As shown in Figure 4

the travelling block 33 is elongated transversely of the frame and is supported for sliding movement on the frame by roller assemblies 34 which fit into the channel shaped bars 14 to be supported for sliding movement thereby. Between adjacent bars 14, the block 33 has upwardly extending ears 35 between which the pusher fingers are pivotally mounted. The block 33 is moved longitudinally of the frame when desired by a fluid motor 36 which functions both to advance the block in the direction of conveyor travel and to retract it to its starting position.

To guide the pusher fingers for simultaneous upward and longitudinal movement, guide brackets 37 are provided lying beneath the frame and engageable with rollers or pins 38 on the pusher fingers. The pusher fingers normally lie in the position shown in full lines in Figure 3 with the pins 38 held against the upper rail of the brackets 37 by springs 39 so that when the pusher fingers are moved to the right the pins 38 will enter the brackets. As the pusher fingers move to the right they will gradually rise, due to the slope of the brackets 37, so that they will raise the rear edges of the stacked books and will push the books forward into a uniform stack against the stop fingers 24. The pusher fingers are then in the position as shown at 32a in Figure 3. At this time the pusher fingers are held up only by engagement with the stacked books and when the stacked books move away from them, they will drop down to the position shown at 32b against the horizontal guide member 41. When the block 33 is retracted to the starting position, the pusher fingers will be drawn back along the horizontal guide 41 until they engage the springs 39 which will raise them to their starting position in alignment with the brackets 37 ready for a stacking operation.

The operations are automatically controlled by a control circuit, as best seen in Figure 5. As shown, an electrical circuit is employed, including a monitor unit 42 which is connected to the switch 13 to receive pulses therefrom. The unit 42 can be set to close a switch after a predetermined number of pulses and to hold the switch closed for a predetermined interval. The monitor unit is connected to a solenoid operator 43 for a four-way valve 44 having ports connected to the opposite ends of the fluid motor 36 and supply and vent ports connected to a source of compressed air or the like through a supply pipe 45 and to vent through a vent pipe 46. A similar valve 47 connected to the same supply and vent source is provided to control the fluid motor 25. The valve 47 is controlled by a solenoid 48 connected to a voltage source through a switch 49 or a switch 51 which are in parallel. The switch 49, as shown in Figures 2 and 3 is positioned to be engaged by the block 33 when it is in its forward stacking position. The switch 51 is mounted between adjacent frame bars immediately downstream from the stop fingers 24 to be engaged and closed by the stack of books on the conveyor downstream from the stop fingers.

When the monitor unit 42 is in a condition to open the circuit to the solenoid 43, the parts will occupy the position shown in Figure 5 which is their normal position during the time that books are being fed onto the conveyor. As soon as a certain predetermined number of books have been fed to the conveyor, the monitor unit will close the circuit to the solenoid 43 and move the valve 44 to a position such that air will be supplied to the left end of the fluid motor 36 and the right end thereof will be vented. At this time, the block 33 and the pusher fingers 32 will be moved to the right to push the books into a uniform stack against the stop fingers 24.

When the pusher fingers reach their extreme right hand position, the block 33 will engage and close the switch 49 to energize the solenoid 48, thereby to supply fluid to the upper end of the motor 25 and to vent the lower end thereof. At this time, the motor 25 will swing the stop fingers downward out of the path of the books on

the conveyor so that the stacked books will travel with the conveyor toward the end thereof to a convenient packing station. As soon as the books pass the stop finger, they will engage and close the switch 51.

At this point in the cycle the monitor unit will open the circuit to the solenoid 43 so that the valve 44 will return to its initial position under the influence of gravity or a spring or both. The block 33 and the pusher fingers 32 will therefore be retracted to their initial position ready for a subsequent operation and the switch 49 will open. The solenoid 48 will, however, be kept energized by the switch 51 until the stack of books has passed the switch so that the stop fingers will not be moved up under a stack of books. As soon as the books have passed the switch 51, it will open to deenergize the solenoid 48, whereupon the valve 47 will return to its initial position and reverse the motor 25 so that it will push the stop fingers up to their effective position.

The speed of the conveyor is preferably set so that in counting a given number of books, the first book will reach the stop finger at about the same time the last book is delivered from the binding machine. Thus, while a number of books which have been fanned out on the conveyor are being stacked, books can continue to feed individually from the binding machine at a uniform rate without interfering with the first stack. By the time the first book of a succeeding stack has been moved by the conveyor to the stacking position, the first stack will be out of the way and the stop fingers will have been moved back to their effective position to stop the first book of the next succeeding stack. With this construction, delivery of books by the binding machine is not interfered with and the books are received on the conveyor and uniformly stacked in stacks, each containing a predetermined number of books rapidly and effectively.

While one embodiment of the invention has been shown and described in detail, it will be understood that this is illustrative only and not to be taken as a definition of the scope of the invention, reference being had for this purpose to the appended claims.

What is claimed is:

1. A stacking conveyor for books and the like comprising an elongated traveling conveyor adapted to receive individual books at one position, a stop adjacent to the conveyor at a point spaced from said position in the direction of travel of the conveyor to stop the movement of books on the conveyor, a circular starting wheel having its upper surface projecting above the conveyor at the upstream end of said position to receive on its upper surface the trailing edge of a book fed onto the conveyor at said position and give the book an initial urge in the direction of conveyor travel and means to drive the starting wheel in a direction such that its upper surface travels in the same direction as the conveyor.

2. A stacking conveyor for books and the like comprising an elongated traveling conveyor adapted to receive individual books at one position, a stop adjacent to the conveyor at a point spaced from said position in the direction of travel of the conveyor to stop the movement of books on the conveyor, a circular starting wheel having its upper surface projecting above the conveyor at the upstream end of said position to receive on its upper surface the trailing edge of a book fed onto the conveyor at said position and give the book an initial urge in the direction of conveyor travel, and a driving wheel engaging the conveyor to be driven thereby and connected to the starting wheel to drive it in a direction such that its upper surface travels in the same direction as the conveyor.

3. A stacking conveyor for books and the like comprising an elongated traveling conveyor adapted to receive individual books at one position, a stop adjacent to the conveyor at a point spaced from said position in the direction of travel of the conveyor to stop the movement of books on the conveyor, a circular starting wheel

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projecting above the conveyor at the upstream end of said position to receive on its upper surface the trailing edge of a book fed onto the conveyor at said position and give the book an initial urge in the direction of conveyor travel, a pusher movable in the direction of conveyor travel to push the books into a stack against the stop, means to move the pusher periodically toward the stop, and means operable after movement of the pusher to move the stop away from the conveyor whereby the stacked books can move with the conveyor.

4. A stacking conveyor for books and the like comprising an elongated traveling conveyor adapted to receive individual books at a feeding station, a stop finger movably mounted adjacent to the conveyor downstream from the feeding station and normally lying in a position to stop books on the conveyor, a pusher finger normally positioned upstream from the feeding station, power means to move the pusher finger in the direction of travel of the conveyor to push the books on the conveyor into a stack against the stop finger, control means for the power means to initiate operation thereof after a predetermined number of books have been placed on the conveyor, a second power means connected to the stop finger to move it out of the path of the books on the conveyor, a first control device for the second power means operated by the pusher finger as it moves in the direction of travel of the conveyor, and a second control device for the second power means operated by books on the conveyor moving beyond the stop finger.

5. A stacking conveyor for books and the like comprising an elongated traveling conveyor adapted to receive individual books at a feeding station, a stop finger movably mounted adjacent to the conveyor downstream from the feeding station and normally lying in the path of movement of the books on the conveyor to stop them, a pusher finger normally lying upstream of the feeding station and below the conveyor, power means to move the pusher finger in the direction of travel of the conveyor, guide means to raise the pusher finger above the conveyor as it is moved by the power means, control means for the power means to initiate operation thereof after a predetermined number of books have been placed on the conveyor, a second power means connected to the stop finger to move it out of the path of the books on the conveyor, and control means for the second power means operable by the pusher finger after the pusher finger has moved the books against the stop finger.

6. A stacking conveyor for books and the like comprising an elongated traveling conveyor adapted to receive individual books at a feeding station, a stop finger movably mounted adjacent to the conveyor downstream from the feeding station and normally lying in the path of movement of the books on the conveyor to stop them, a circular starting wheel projecting above the conveyor at the upstream end of the feeding station to receive on its upper surface the trailing edge of a book fed onto the conveyor and give it an initial urge in the direction of conveyor travel and means to move the stop finger periodically out of the path of books on the conveyor.

7. A stacking conveyor for books and the like comprising a frame including a series of elongated parallel bars, traveling conveyor tapes supported by the bars to receive individual books at a feeding station, a stop finger projecting between adjacent bars downstream from the feeding station to stop movement of books on the conveyor tapes, a pusher frame slidably mounted on the bars and normally lying upstream from the feeding station, means to move the pusher frame in the direction of conveyor travel, an angular pusher finger pivoted on the pusher frame and having a finger at one end normally lying below the bars and adapted to project upward between adjacent bars to engage the books and push them toward the stop finger, and an inclined guide engageable with the pusher finger to swing it upward as the pusher frame is moved in the direction of conveyor travel.

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8. A stacking conveyor for books and the like comprising a frame including a series of elongated parallel bars, traveling conveyor tapes supported by the bars to receive individual books at a feeding station, a stop finger projecting between adjacent bars downstream from the feeding station to stop movement of books on the conveyor tapes, a pusher frame slidably mounted on the bars and normally lying upstream from the feeding station, means to move the pusher frame in the direction of conveyor travel, an angular pusher finger pivoted on the pusher frame and having a finger at one end normally lying below the bars and adapted to project upward between adjacent bars to engage the books and push them toward the stop finger, and an inclined guide engageable with the pusher finger to swing it upward as the pusher frame is moved in the direction of conveyor travel, a starting wheel projecting above the conveyor at the upstream end of the feeding station to engage the trailing edge of a book fed onto the conveyor and give it an initial urge in the direction of conveyor travel, power means to move the stop finger downward out of the path of books on the conveyor, a first control for the power means operated by the pusher frame as it moves in the direction of travel of the conveyor, and a second control for the power means operated by movement of books on the conveyor moving downstream of the stop finger.

9. A stacking conveyor for books and the like comprising a traveling conveyor adapted to receive individual books at a feeding station, a stop adjacent to the conveyor at a point spaced from the feeding station in the direction of travel of the conveyor to stop the movement of books on the conveyor, a pusher normally positioned upstream of the feeding station and movable in the direction of conveyor travel to push the books into a stack against the stop, a counting device responsive to the books fed onto the conveyor at the feeding station, means controlled by the counting device after a predetermined number of operations thereof to move the pusher toward the stop, and means operated by the pusher after a predetermined movement thereof toward the stop to move the stop out of the path of movement of books on the conveyor.

10. A stacking conveyor for books and the like comprising a traveling conveyor adapted to receive individual books at a feeding station, a stop adjacent to the conveyor at a point spaced from the feeding station in the direction of travel of the conveyor to stop the movement of books on the conveyor, a pusher normally positioned upstream of the feeding station and movable in the direction of conveyor travel to push the books into a stack against the stop, a counting device responsive to the books fed onto the conveyor at the feeding station, means controlled by the counting device after a predetermined number of operations thereof to move the pusher toward the stop, means operated by the pusher after a predetermined movement thereof toward the stop to move the stop out of the path of movement of books on the conveyor, and means operated by books on the conveyor downstream of the stop to maintain the stop out of the path of movement of the books.

11. A stacking conveyor for books and the like comprising a traveling conveyor adapted to receive individual books at a feeding station, a stop adjacent to the conveyor at a point spaced from the feeding station in the direction of travel of the conveyor to stop the movement of books on the conveyor, a pusher normally positioned upstream of the feeding station and movable in the direction of conveyor travel to push the books into a stack against the stop, a starter wheel extending above the conveyor at the upstream side of the feeding station, means to drive the starter wheel in a direction such that its upper surface moves in the same direction as the conveyor, a counting device responsive to the books fed onto the conveyor at the feeding station, means controlled by the counting device after a predetermined number of

operations thereof to move the pusher toward the stop, and means operated by the pusher after a predetermined movement thereof toward the stop to move the stop out of the path of movement of books on the conveyor.

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