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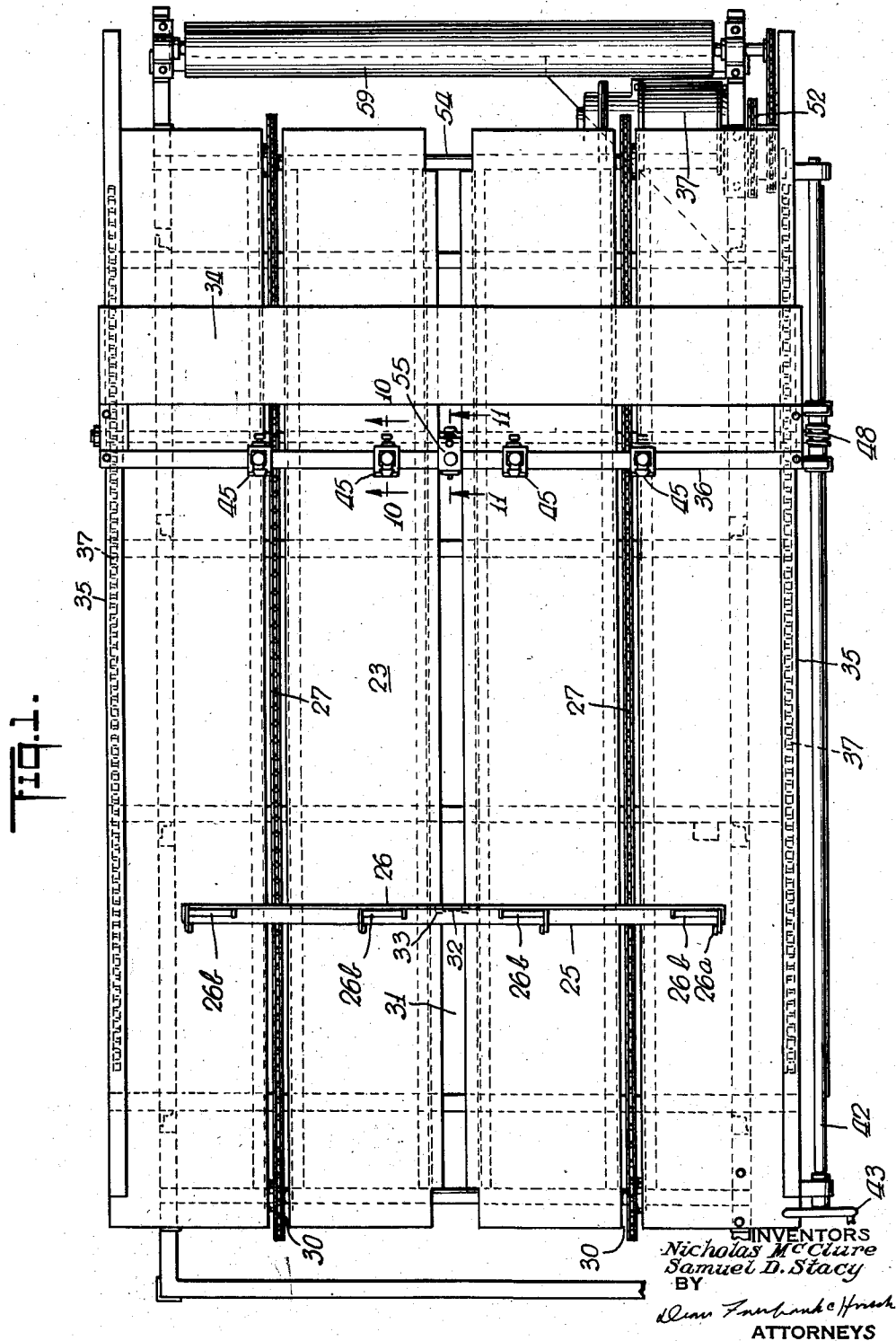
N. McCLURE ET AL

2,655,272

SHEET STACKING AND DELIVERING MACHINE

Filed May 14, 1948

3 Sheets-Sheet 1



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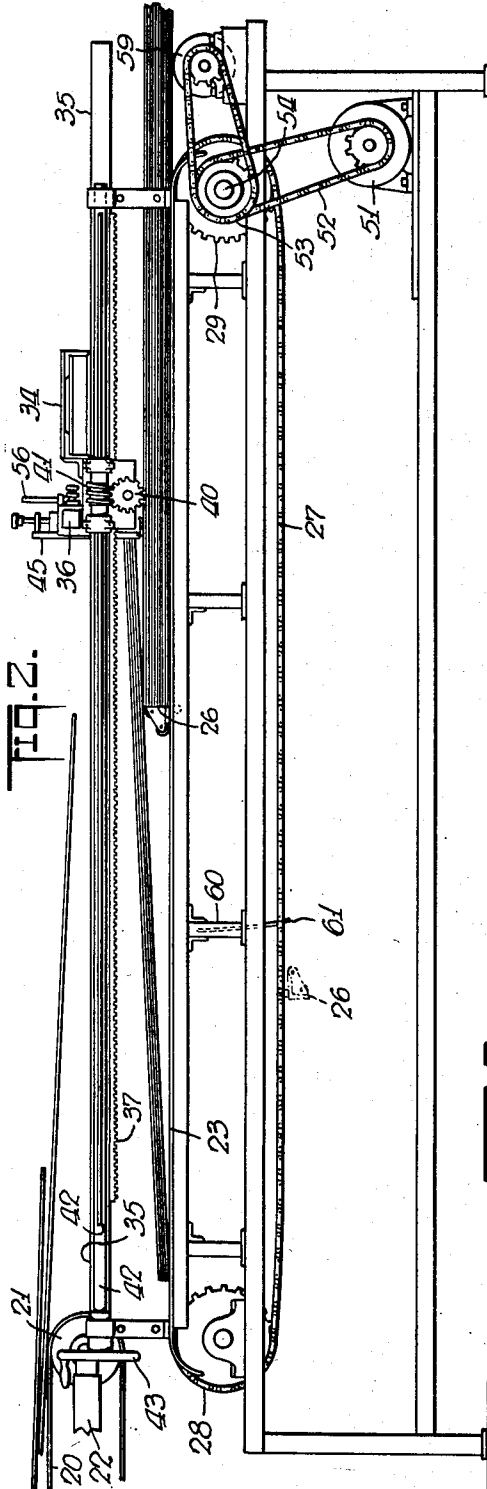
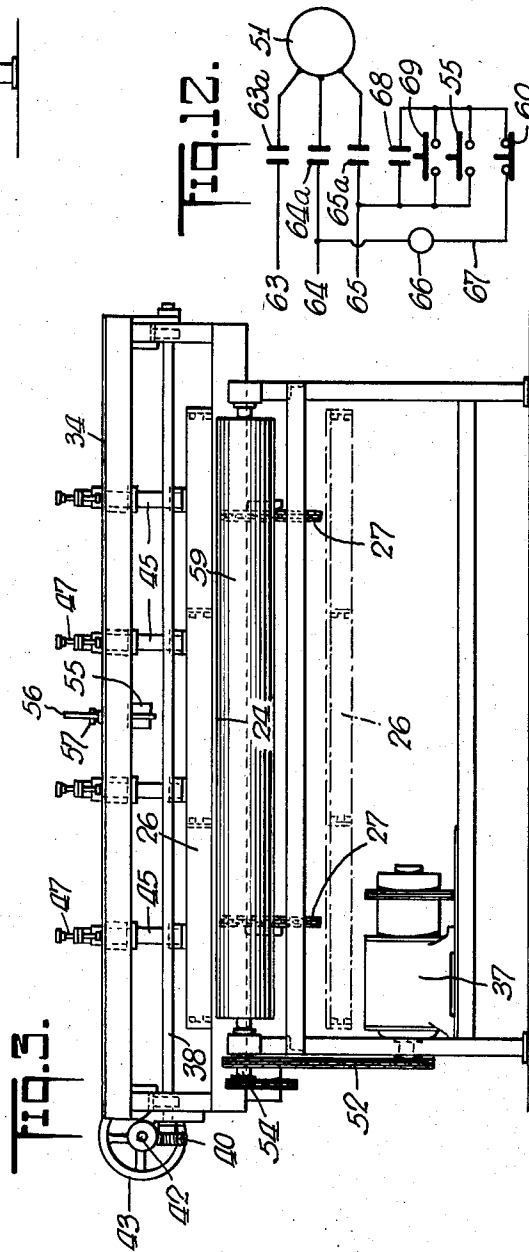
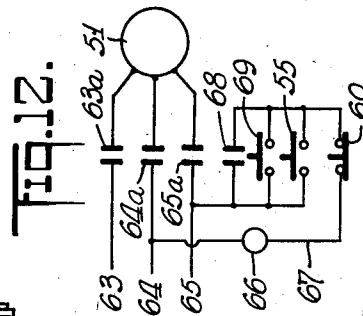
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SHEET STACKING AND DELIVERING MACHINE

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3 Sheets-Sheet 2



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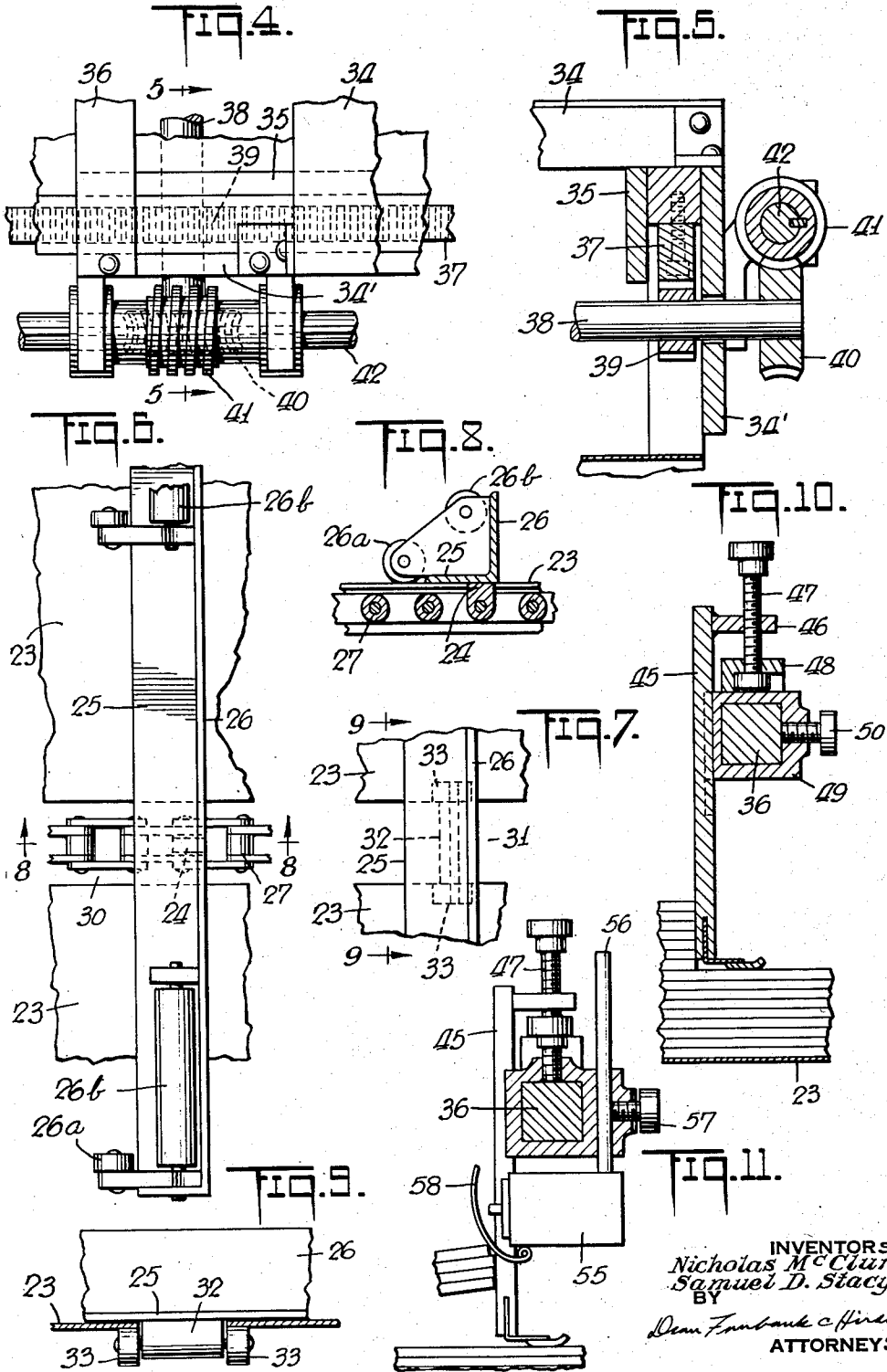
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SHEET STACKING AND DELIVERING MACHINE

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3 Sheets-Sheet 3



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SHEET STACKING AND DELIVERING
MACHINE

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10 Claims. (Cl. 214—8.5)

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In the manufacture of double faced corrugated board and other types of stiff sheet material, a plurality of wide sheets which may or may not have been slitted lengthwise, are delivered in succession from cut-off mechanism and assembled in superposed relationship to form stacks.

With constantly increasing operating speeds on corrugating units, the speed at which the sheets are delivered at the cut-off end is becoming correspondingly greater. Modern machines for making double faced corrugated board deliver the sheet material through the cutting mechanism at a speed of 350 to 500 linear feet per minute, and a serious problem is presented in regard to stacking and disposing of the resulting product. This has now reached a point where men can no longer pick up the separate sheets by hand and load them on trucks, as was once common practice.

Various types of sheet handling equipment have been tried, and experience has indicated very definitely that it is desirable to deliver the sheets in small stacks or batches which, depending upon sheet size and operator's preference, contain from 15 to as many as 25 sheets per batch.

The present invention relates to machines for receiving and stacking such stiff sheets or boards, and as important features, provides means whereby the boards as delivered, are slowed down in speed, formed into a stack, and batches of predetermined height are removed at relatively low speed and in succession from the bottom of the stack without interfering with the continuous delivery of further sheets to the top of the pile. If the sheets have been slitted lengthwise there will be a plurality of such batches side by side which may be separately picked up and loaded on a truck or pallet.

In carrying out the invention there is provided a vertically disposed stop member in the path of movement of the sheets and spaced above the supporting table or platform, and a pusher of a height only slightly less than the height of the stop above the table, which moves along the table to engage the end of the sheets forming the lower portion of the stack and to push a batch of the sheets beneath the stop and deliver the batch from the table, whereupon the remaining boards in the stack drop to the table.

The stop is preferably vertically adjustable, so as to leave the correct amount of space therebeneath for the pusher to freely pass and to advance a batch of a predetermined height, and is

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adjustable lengthwise of the table so that it may be positioned in accordance with the length into which the sheets have been cut at the cut-off mechanism.

As another feature of the invention the pusher is carried by endless members such as chains, so that after a batch has been pushed beneath the stop, the pusher returns beneath the table preparatory to pushing out another batch. The pusher is preferably operated intermittently and is started after sheets have accumulated on the lower edge of the table to a height of at least about twice the height of the pusher. After a batch has been pushed out from the bottom and beneath the stop, the pusher may remain at rest below the upper surface of the table until the stack again reaches the predetermined height. Preferably means are provided for slowing down the sheets after they leave the cut-off, and as they are passing onto the stack, so that they will be in partially overlapped relationship and will not strike the stop at too high a speed.

Preferably means are provided for speeding up each batch after it is freed from the superposed sheets of the stack, so that the batch will not interfere with the swinging of the pusher to a position below the level of the table preparatory to the return movement for pushing another batch.

The stopping and starting of the pusher may be controlled by suitable switches, the starting switch being controlled in accordance with the height of the stack accumulated in advance of the stop, and the stopping switch may be of any suitable type and automatically operated when the pusher reaches a predetermined position in its return movement beneath the table.

In the accompanying drawing only one embodiment of the invention has been illustrated, but it will be obvious that many changes may be made in the details of construction and arrangement of the parts without departing from the scope of the invention. In these drawings:

Fig. 1 is a plan view of the machine.

Fig. 2 is a side elevation.

Fig. 3 is an end elevation of the discharge end. The remaining figures are on a larger scale.

Fig. 4 is a plan view of a portion of the means for adjusting the stop along the table.

Fig. 5 is a section on the line 5—5 of Fig. 4.

Fig. 6 is a top view of a portion of the table showing one end portion of the pusher for advancing a batch, and the driving means therefor.

Fig. 7 is a view similar to Fig. 6, and showing a central portion of the pusher.

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Fig. 8 is a section on the line 8—8 of Fig. 6.

Fig. 9 is a section on the line 9—9 of Fig. 7.

Fig. 10 is a vertical section showing a means for vertically adjusting the sheet stop, said section being taken on the line 10—10 of Fig. 1.

Fig. 11 is a vertical section showing the starting switch for the batch advancing means, said section being taken on the line 11—11 of Fig. 1, and

Fig. 12 is a wiring diagram.

Mechanism involving the present invention may be used in connection with any suitable machine which forms the stiff sheets, cuts them into sections, and delivers them in succession. The sheet forming means may be a machine for making double faced corrugated paper, and the sheets which are cut off at the delivery end of the machine are preferably slowed down before reaching the table. As shown, a conveyor 20 is provided onto which the sheets drop, and by means of which the cut off sheets are advanced at a somewhat lower speed than the speed at which the stiff sheet is being produced. Thus the successive sections as advanced will be in a somewhat overlapped position, and the sheets will travel onto the stack on the table at a lower speed than that at which they were produced. If desired, the pulley 21 of the conveyor 20 may be vertically adjustable, for instance by pivotally mounting an arm 22 which supports the pulley 21.

Our improved machine includes a table or platform 23 disposed beyond the conveyor 20, and this is preferably subdivided longitudinally into sections to facilitate the operation of the pusher which moves over the table. As shown in Figs. 6 to 9, this pusher is in the form of an angle iron extending transversely of the platform and having a horizontal flange 25 slidable on the table and a vertical flange 26 which engages the ends of a sufficient number of the sheets to form the desired batch and push them along the table. This angle iron pusher preferably has rollers 26a engaging the table and longer rollers 26b engaging the underside of the stack as a batch is being pushed beneath the sheet stop as shown in Fig. 2. The pusher is preferably operated intermittently, and may be operated by endless members such as chains 27 traveling around sprocket wheels 28 and 29 at the receiving and delivery ends of the table. The upper run of each chain is disposed below the upper surface of the table, and in or below a longitudinal slot 30 in the table, and the pusher is secured to the chains by lugs 24 (Fig. 8). The table may also be provided with an intermediate slot 31, and the pusher may have a depending flange 32 in which are journaled rollers 33 which engage the underside of the table (Figs. 7 and 9).

For supporting the sheet stops there are provided a bridge 34 and a transverse bar 36 rigid therewith. These are slidable along side frame members 35 and are supported by or above the table. One or both of the side frame members 35 carries a rack bar 37 with the teeth thereof on the lower side, and the bridge has supports 34' for a transverse shaft 38 having a pinion 39 engaging this rack bar. On the outer end of the shaft 38 is a gear 40 engaging a worm gear 41 keyed to and slidable along a shaft 42. Thus by any suitable means, such as a hand wheel 43, the shaft 42 may be rotated to rotate the shaft 38, and the pinion 39 will travel along the rack bar to adjust the entire bridge along the table and to a position selected in accordance with the length of the sheets.

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The transverse bar 36 which is rigidly secured to and movable with the bridge 34, carries a plurality of sheet stops which may be of the type shown in Fig. 10. If the delivered sheets be slitted lengthwise into strips these stops may be adjusted along the bar so that there will be a stop in the path of movement of each stack of strips. Each sheet stop may be a vertical bar 45 which is supported by and adjustable vertically and also along the transverse bar 36. As shown, each stop has a flange 46 through which extends an adjusting screw 47, the head held beneath a flange 48 connected to a sleeve 49 slidable along the bar. The sleeve 49 also has a set screw 50 whereby the sleeve and the sheet stop may be held in adjusted position along the length of the bar 36.

The lower end of each sheet stop 45 is held at a fixed distance above the table 23 by means of the screw 47, to permit the pusher to pass therebeneath. The sleeve 49 may have a dovetailed vertical groove in one side thereof, in which the vertical bar or stop 45 may slide during adjustment for batches of different heights, and which holds the bar against sidewise or tilting movement.

In normal running of the machine it is not necessary to move the bridge and sheet stops along the table, but adjustment is made in accordance with the frequency of the cut-off mechanism of the sheet, so that the stops will be at the proper place along the table and in respect to the length of the sheets being delivered against them.

In operation the sheets are delivered by the conveyor 20 and will travel by their own momentum until they come into engagement with the sheet stops 45. When the stack has been built up to approximately a preselected height the pusher removes a batch of sheets from the bottom of the stack. This pusher, as previously noted, slides along the table, and its vertical flange 26 is of a height but slightly less than the distance to which the sheet stops are adjusted above the table. The two chains 27 in the slots 30 are connected to the pusher, and the chains are driven by a motor 51 through a chain 52 to a sprocket 53 on a transverse shaft 54 which has the sprocket wheels 29 secured thereon. The motor is intermittently operated, and when the motor is at rest the pusher is on the lower run of the chains 27 beneath the table, and in the position illustrated in dotted lines in Fig. 2.

For starting the motor when the stack of sheets on the table reaches a predetermined height above the lower ends of the stops, there is provided a starting switch 55 which may be vertically adjusted by a supporting rod 56 and set screw 57, and in respect to the transverse bar 36, and disposed between two of the stops. The switch has an operating lever 58 pivoted at its lower end and normally extending out beyond the vertical plane of the stops. As successive sheets come to rest against the stops the height of the stack increases until sheets reach the lower end of the switch lever, and then each successive sheet as delivered pushes the switch lever inwardly slightly. The circuit is eventually closed at the switch, and the motor is started. The pusher is carried to the left from the position shown in dotted lines in Fig. 2, around the sprocket wheels 28, and onto the table 23, engages the edges of the sheets forming the lower portion of the stack, and a batch is pushed out.

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The superposed sheets then drop to the table below the switch.

The switch 55 is merely a starting switch and the motor does not stop when the superposed sheets drop to the table. When the pusher reaches the sprocket wheels 28 it swings around and returns along the lower run of the chains.

In order to permit this swinging of the sheet pusher there is provided a roller 59 spaced a short distance beyond the sprockets 29, and at such an elevation as to support the batch as it passes thereover. This roller 59 is driven from the motor 51 and has a higher peripheral speed than the speed of advancement of the pusher. Thus, when the pusher passes beneath the sheet stops and the batch no longer serves to support any superposed sheets, the batch resting on the roller 59 will be advanced at a slightly higher rate than the speed of movement of the pusher, so that by the time the rear end of the batch passes over the axis of the sprockets 28, it will have been advanced beyond the pusher, and the pusher will be free to swing around the sprockets and to the lower run. The pusher is then stopped at any convenient point along the length of the return movement beneath the table. As shown, a stop switch 60 is mounted on the under side of the table and has a switch lever 61 depending into the path of the pusher. Thus, when the pusher engages the switch lever, the current to the motor will be cut off, and the pusher will come to a stop at a short distance beyond the switch. The electric circuit of the motor, with the two switches therein, may be of the character shown in Fig. 12, so that after the pusher has been stopped beneath the platform by the action of the switch 60, that switch may close without restarting the motor, and the motor is not started again until the switch 55 or the switch 69 is again closed, when the stack of sheets on the table has been built up to the required height, or when the operator desires to deliver a smaller batch.

In Fig. 12 there is shown a wiring diagram of a control circuit which may be employed. The A. C. motor 51 has three feed lines 63, 64 and 65, with movable contacts 63a, 64a and 65a, which are operated by a contactor holding coil 66 in a branch line 67 connecting the lines 64 and 65. In the branch line, and in series with the coil and in parallel with each other, are the starting switch 55, a circuit closer 68 operated by the coil 66, and preferably a foot operated switch 69 located at the delivery end of the machine so that if desired, the operator may start the pusher to deliver a batch of sheets, even though the batch is not high enough to automatically close the switch 55.

When the batch gets high enough to close the starting switch 55, or when the operator closes the foot switch 69, a circuit flows through the line 67 and the coil 66, whereupon the circuit is closed at 63a, 64a, 65a and 68 by the action of the coil 66, and the motor starts. Even though the switch 55 or the switch 69, or both, be immediately thereafter opened, the coil will remain energized and the contacts 63a, 64a, 65a and 68 held closed. When the stop switch 60 is opened the circuit to the coil is opened, the contacts operated by the coil are opened, and the motor is stopped.

The sheets as delivered from the cut-off may be somewhat warped, and to counteract warpage it is customary in loading a truck or pallet to reverse the position of each batch in respect to

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the previous one, in such a manner that the concave end of a batch faces the convex end of a preceding batch. With prior machines and with the present high speeds, the handling of the sheets from the take-off table to the trucks or pallets means much work and effort. The sheets have to be not only stacked, as above described, to counteract warpage, but have to be stacked neatly. The operator has to watch until a sufficient number of sheets have accumulated, and each batch of 25 to 35 sheets has to be set on end and the sheets have to be shifted and pushed so that the ends of the sheet in the batch are even with each other before being lifted onto the truck. The number of sheets in a batch varies a great deal, because each batch has to be taken off the table to permit sheets to accumulate and form another batch.

Our improved mechanism overcomes a great many of these troubles. It piles up the sheets evenly, and always delivers the same number of sheets to the operator on the take-off table, and leaves sufficient time to load them on the truck or pallet.

Having thus described our invention what we claim as new and desire to secure by Letters Patent is:

1. A machine for stacking and delivering stiff sheets, including a table, means for projecting sheets edgewise in succession to form a stack, a stop in the path of the sheets and spaced at a predetermined elevation above said table and in the path of movement of said sheets, and a pusher of a height substantially equal to the elevation of the lower side of said stop and movable over said table in one direction and beneath said stop to push out a batch of sheets from the bottom of the stack, and movable in the reverse direction beneath said table.

2. A machine for stacking and delivering stiff sheets, which includes a stationary table, endless chains having superposed runs lengthwise of said table and therebeneath, a pusher on said table and connected to said chains, and movable over said table in one direction and beneath said table in the opposite direction, means for automatically stopping said chains and pusher with the latter in a predetermined position below the table, and means for automatically starting said chains and pusher when a stack of sheets of predetermined height has accumulated on the table, to remove from the bottom of said stack a batch of sheets.

3. A machine for stacking and delivering stiff sheets, which includes a table onto which the sheets are delivered in succession to form a stack, a stop in the path of movement of said sheets and spaced at a predetermined elevation above said table, a pusher movable over said table and beneath said stop to push out a batch of sheets from the bottom of the stack, a motor for operating said pusher to move it lengthwise across the table and back beneath the table, a switch for starting said motor when the batch reaches a predetermined height, and means for stopping said motor with said pusher beneath the table.

4. A machine for stacking and delivering stiff sheets, including a table having a slot lengthwise thereof, a chain having an upper run juxtaposed to said slot, a pusher movable over said table and connected to said chain, a stop above the table and intermediate of the ends of the latter, and having its lower edge at an elevation but slightly greater than the plane in which the upper edge of said pusher travels when moving

over said table, means for operating said chain to advance said pusher and deliver a batch of sheets beneath said stop when the stack reaches a predetermined height, and means for advancing the batch at a faster speed than the pusher when the latter approaches the end of said table.

5. A machine for stacking and delivering stiff sheets, which includes a table onto which said sheets are delivered in succession to form a stack, means for slowing down the speed of movement of the sheets as they pass onto the table, a stop in the path of movement of said sheets and spaced above said table, and a pusher movable onto said table at one end, beneath said stop, and below said table at the opposite end, for pushing batches of sheets from the bottom of a stack accumulating against said stop.

6. A machine for stacking and delivering stiff sheets, including a table onto which said sheets are delivered in succession to form a stack, a stop in the path of movement of said sheets and spaced above said table, a pusher movable over said table to force batches of sheets from the bottom of the stack beneath said stop, an endless chain for moving said pusher over said table in one direction and back beneath the table in the opposite direction, a motor for operating said chain, a motor starting switch above said table, in the path of movement of the sheets and operated by them, for starting the motor when the stack reaches a predetermined height, and a second switch for automatically stopping said motor when said pusher reaches a predetermined position beneath said table.

7. A machine for stacking and delivering stiff sheets, including a table onto which the sheets are delivered, a stop in the path of movement of the sheets whereby the sheets accumulate as a stack, said stop being spaced above said table, a pusher for delivering a batch of sheets from the bottom of the stack beneath said stop, means for slowing down the speed of the sheets as they pass onto the table, and means for speeding up the delivered batch of sheets as they leave the table.

8. A machine for stacking and delivering stiff sheets, including a table onto which the sheets are delivered, a stop in the path of movement of the sheets whereby the sheets accumulate as a stack, said stop being spaced above said table, a pusher for delivering a batch of sheets from the bottom of the stack beneath said stop, means for adjusting the elevation of said stop so that its lower edge is but slightly higher than the path of travel of the upper edge of the pusher when moving over said table, means for slowing down the speed of the sheets as they pass onto the

table, a roller at the opposite end of the table and onto which the batch is delivered, and means for rotating said roller at a higher peripheral speed than the rate of travel of the pusher.

9. An apparatus for forming and delivering batches of successively delivered stiff sheets, each batch being of a predetermined height, said apparatus including a table, means at one end of said table for projecting said sheets edgewise in succession onto the table, a stop in the path of movement of said sheets, whereby a stack is piled up on the table, the lower edge of said stop being spaced above the table to a distance equal to the height of the desired batch, a pusher movable over said table and beneath said stop, and of a height less than the spacing of said stop above the table by an amount less than the thickness of a sheet, and means for starting the operation of the pusher when the height of the stack exceeds the height of the desired batch.

10. A machine for forming and delivering batches of stiff sheets, including a table, means for delivering thereonto stiff sheets in succession, each sheet being delivered on top of the preceding sheet, a stop spaced above said table and vertically adjustable to a distance equal to the height of a desired batch of said sheets, a pusher of a height equal to that of the desired batch of sheets, and endless flexible members in spaced vertical planes and connected to said pusher, each of said members having an upper run for moving said pusher along said table to advance the sheet, push a batch beneath said stop, and deliver it from said table, and a lower run disposed beneath said table.

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