Oct. 25, 1949. C. W. APGAR ET AL 2,485,952

CONTROL MECHANISM FOR CONVEYER APPARATUS

Filed Jan. 30, 1945 4 Sheets-Sheet 1

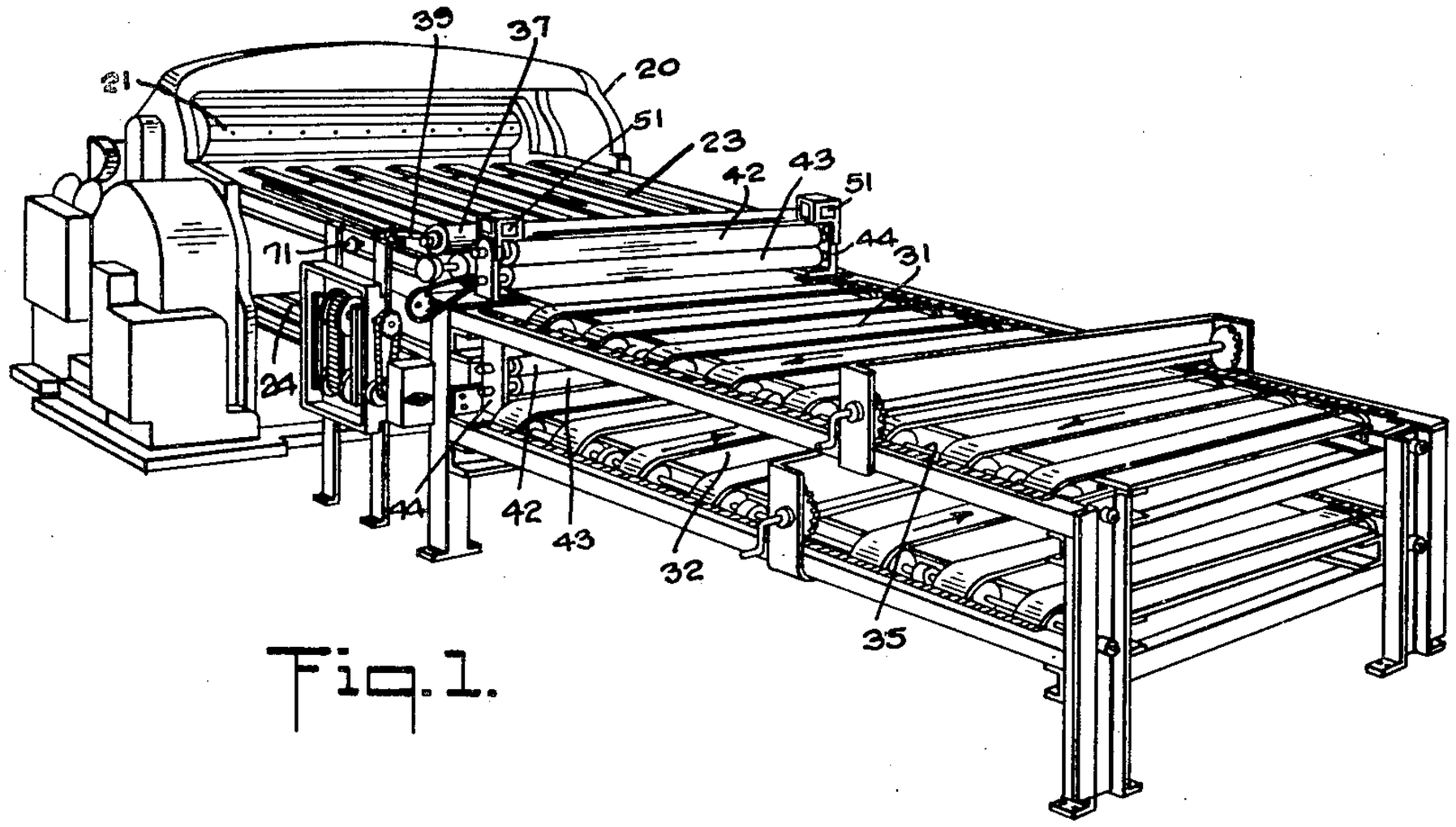


Fig. 1.

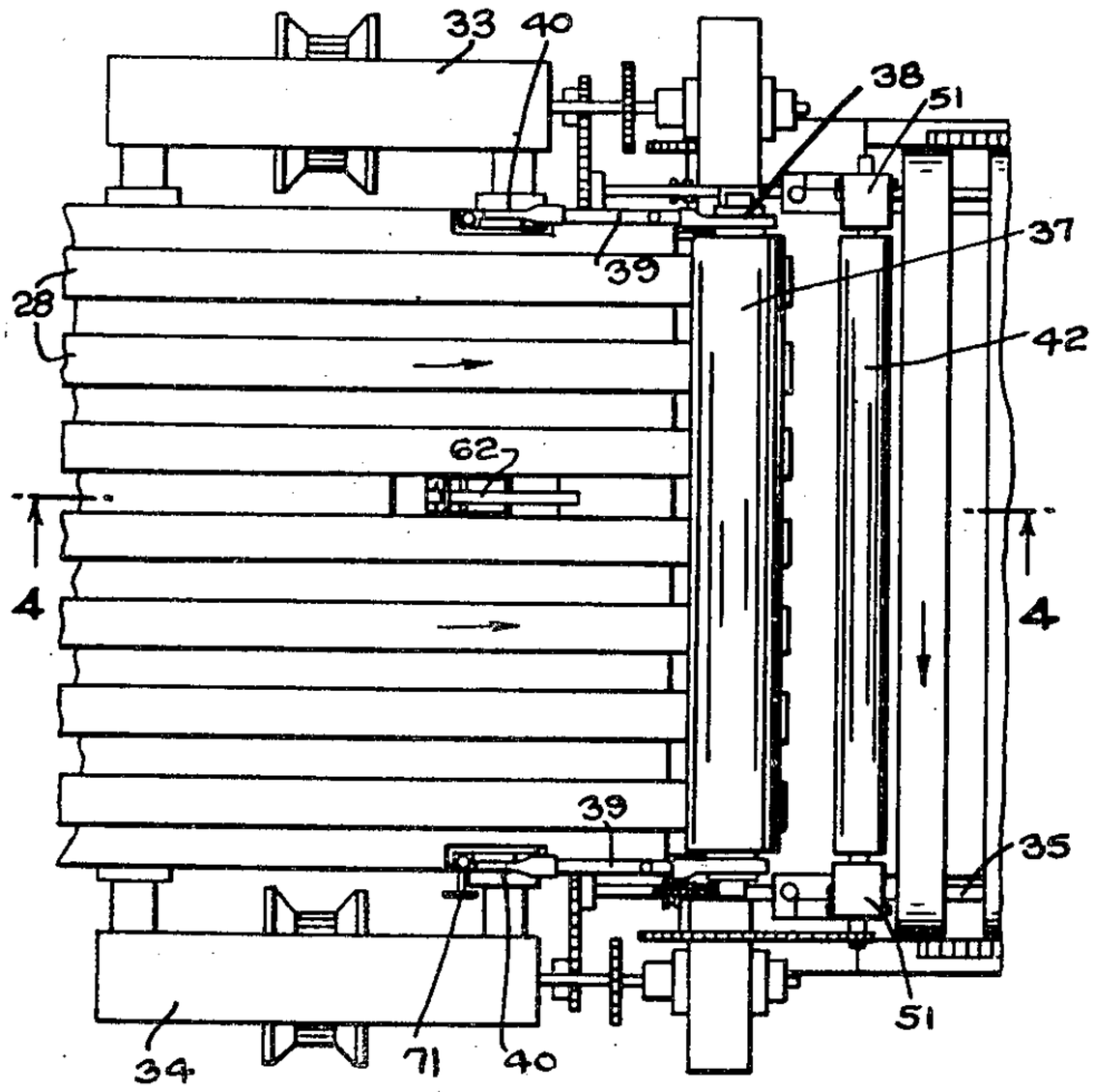


Fig. 2.

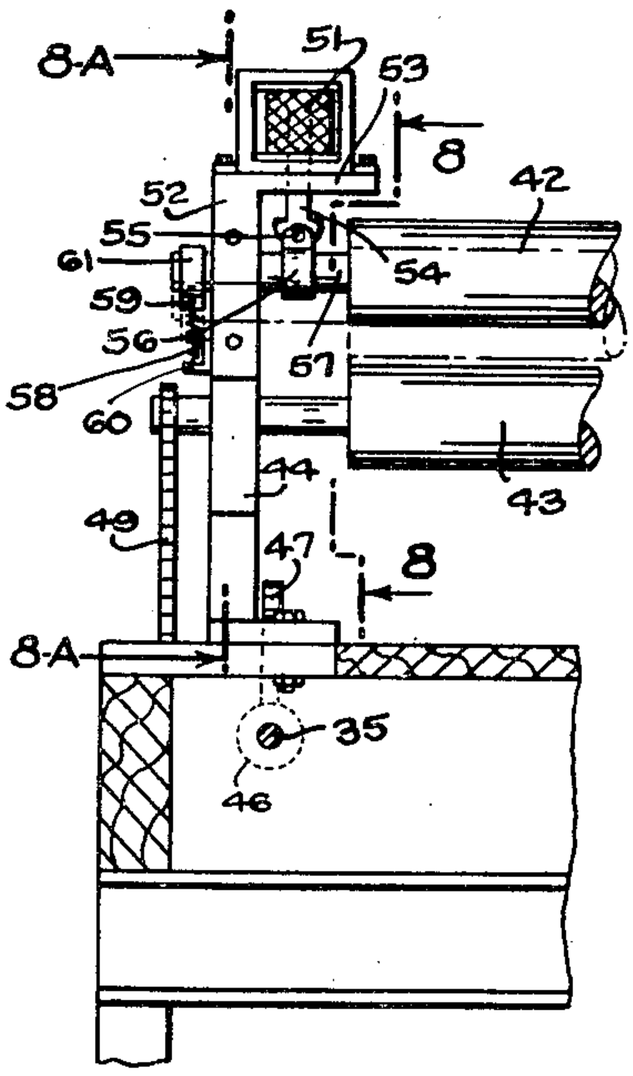


Fig. 6.

INVENTOR.
CHARLES W. APGAR
BY ABRAHAM L. ROSENFELD
Leon Edelson
ATTORNEY

Oct. 25, 1949. C. W. APGAR ET AL 2,485,952

CONTROL MECHANISM FOR CONVEYER APPARATUS

Filed Jan. 30, 1945

4 Sheets-Sheet 2

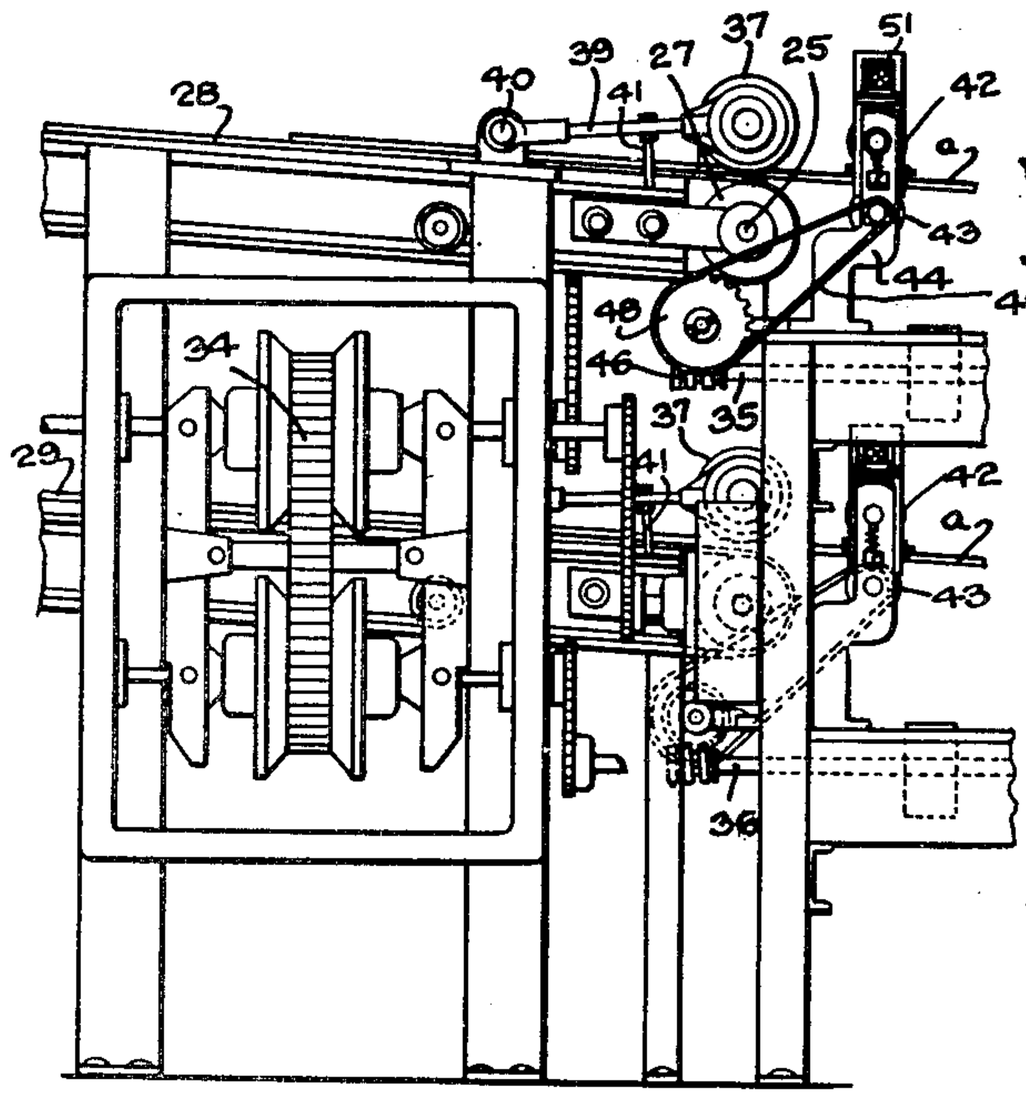


Fig. 3.

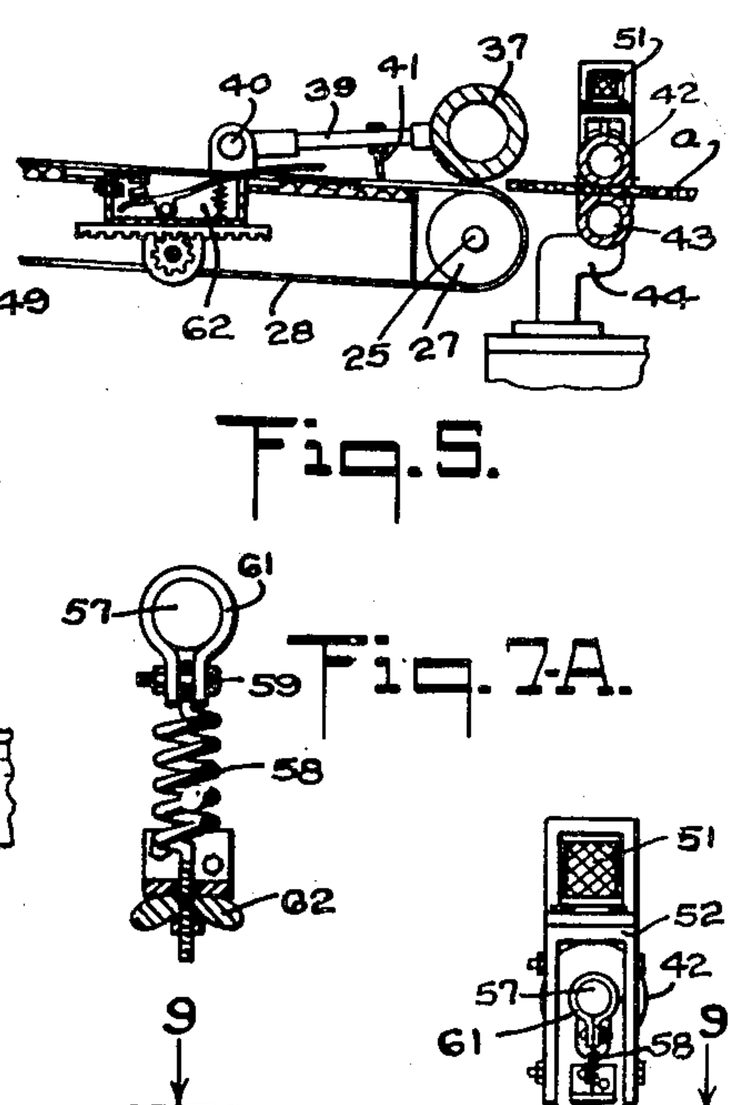


Fig. 5.

Fig. 7-A.

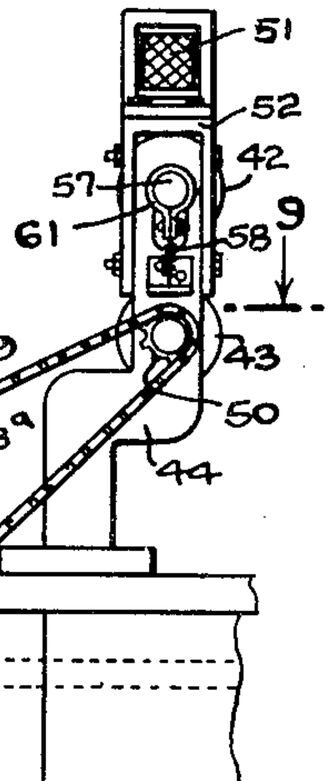


Fig. 7.

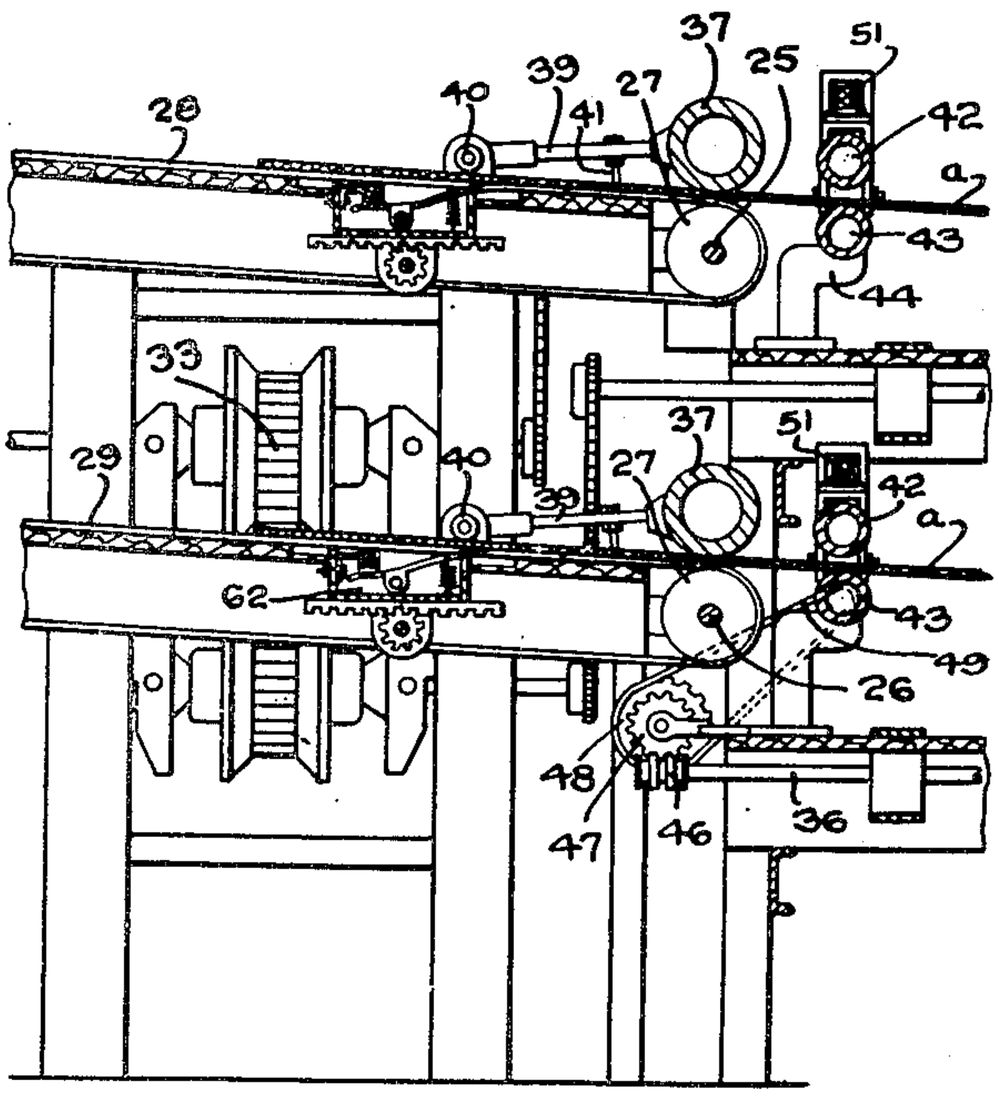


Fig. 4.

INVENTOR.
CHARLES W. APGAR
BY ABRAHAM L. ROSENFELD
Leon Edelson
ATTORNEY

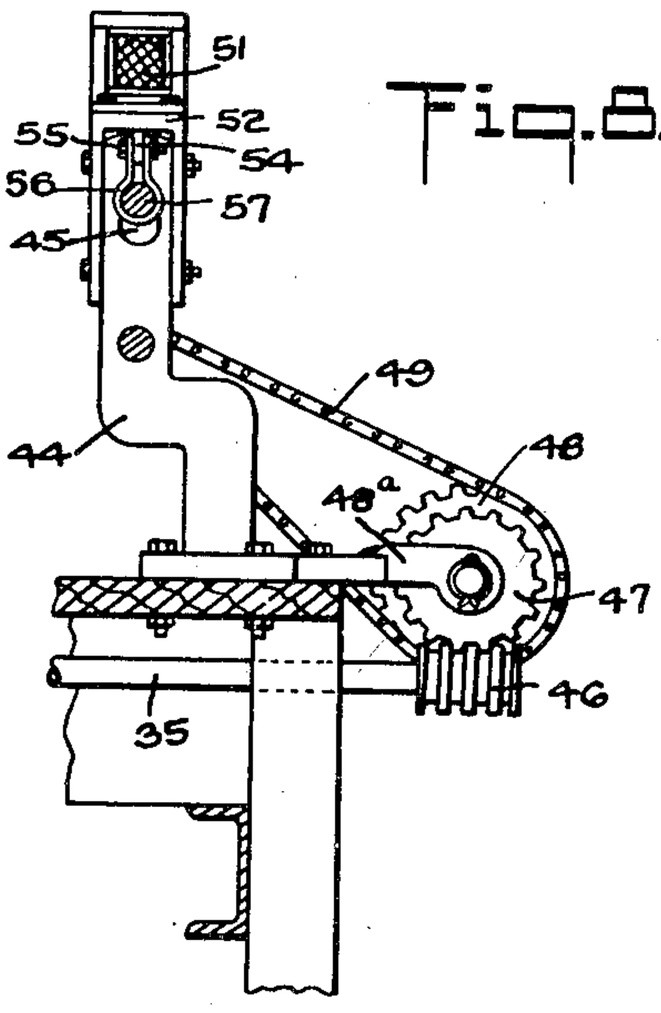
Oct. 25, 1949. C. W. APGAR ET AL 2,485,952

CONTROL MECHANISM FOR CONVEYER APPARATUS

Filed Jan. 30, 1945

4 Sheets-Sheet 3

Fig. 8.



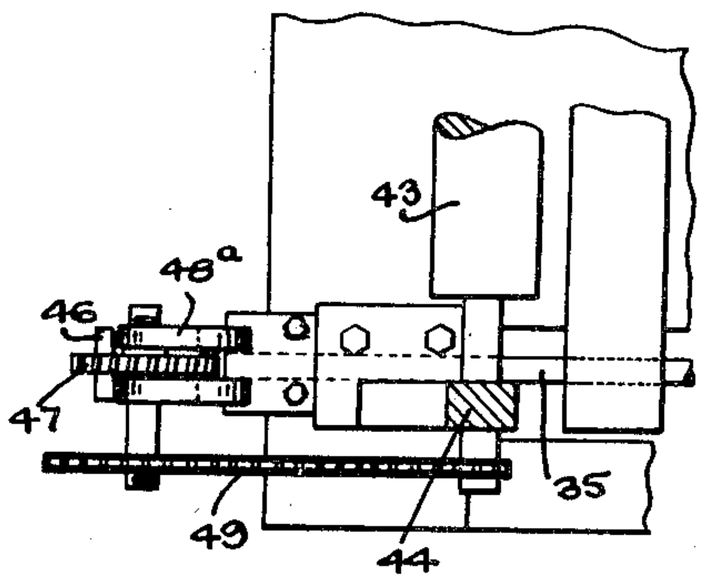


Fig. 9.

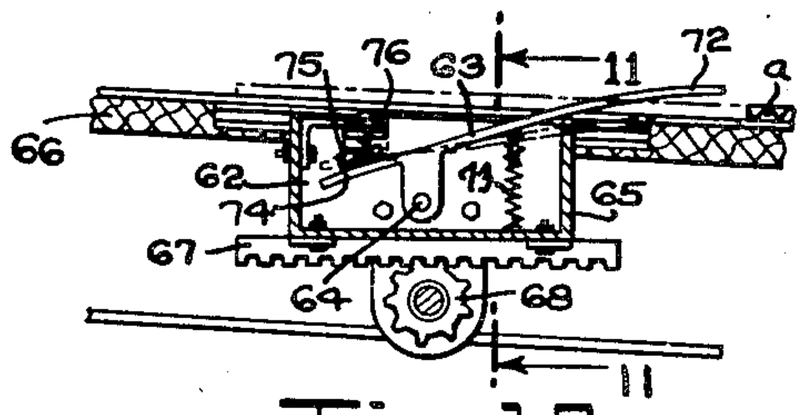
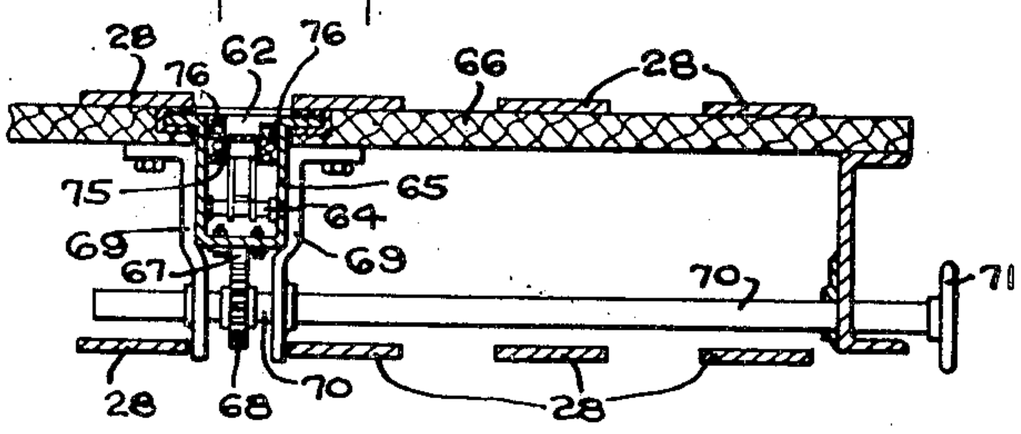


Fig. 10.

Fig. 11.



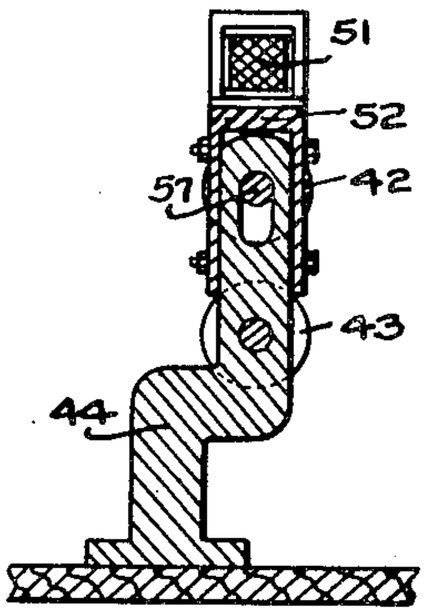


Fig. 8-A.

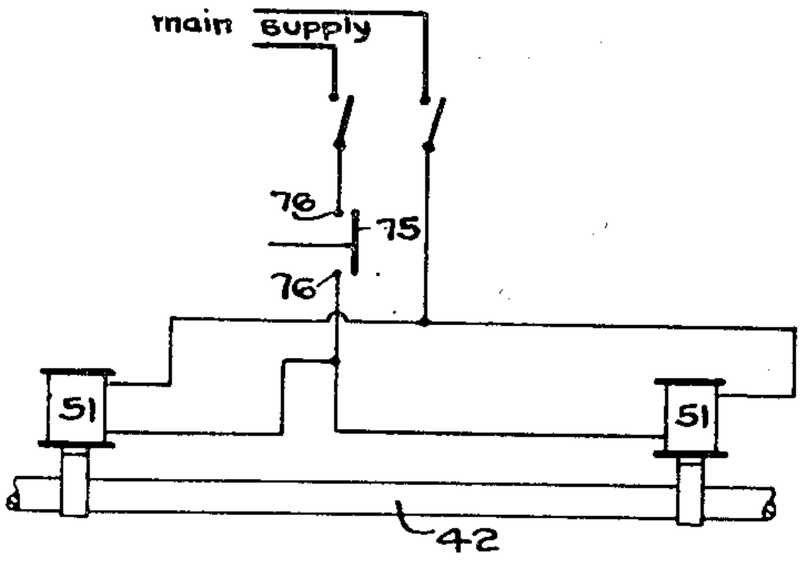


Fig. 12.

INVENTOR.
CHARLES W. APGAR
BY ABRAHAM L. ROSENFELD
Leo Nelson
ATTORNEY

Oct. 25, 1949. C. W. APGAR ET AL 2,485,952

CONTROL MECHANISM FOR CONVEYER APPARATUS

Filed Jan. 30, 1945

4 Sheets-Sheet 4

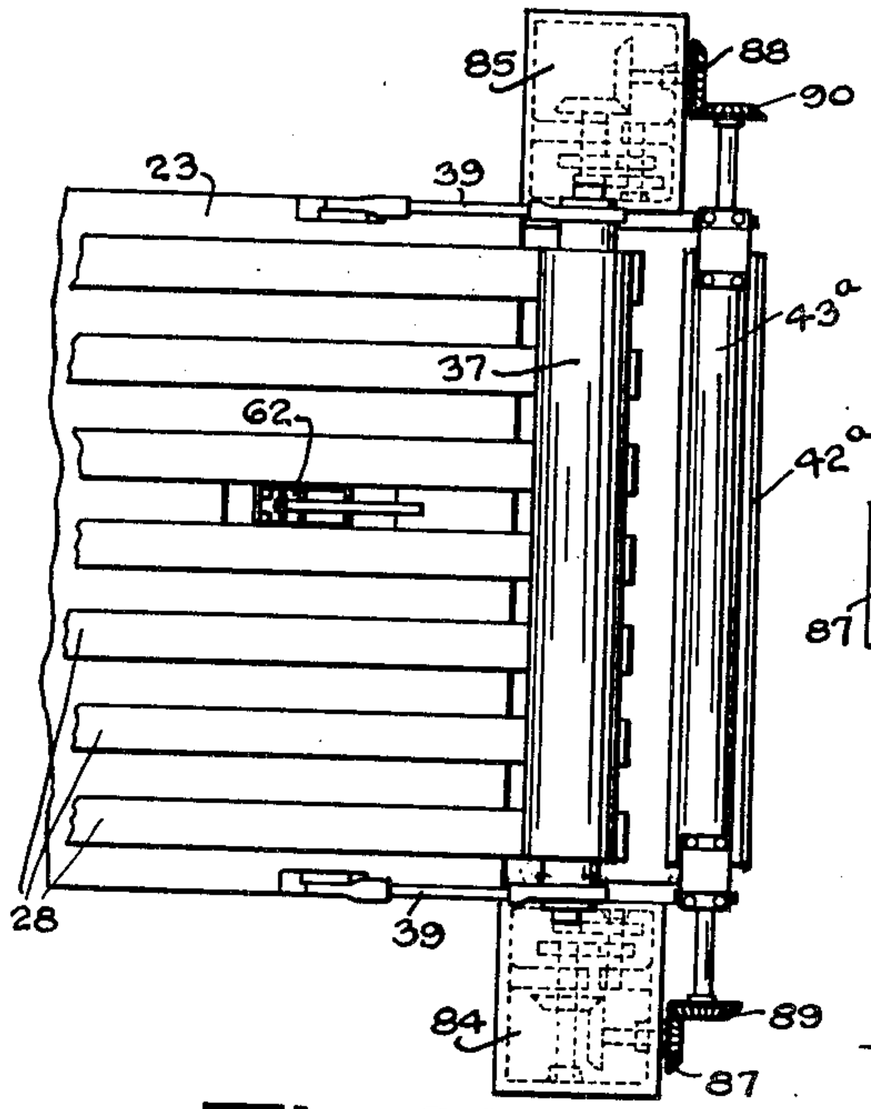


Fig. 13.

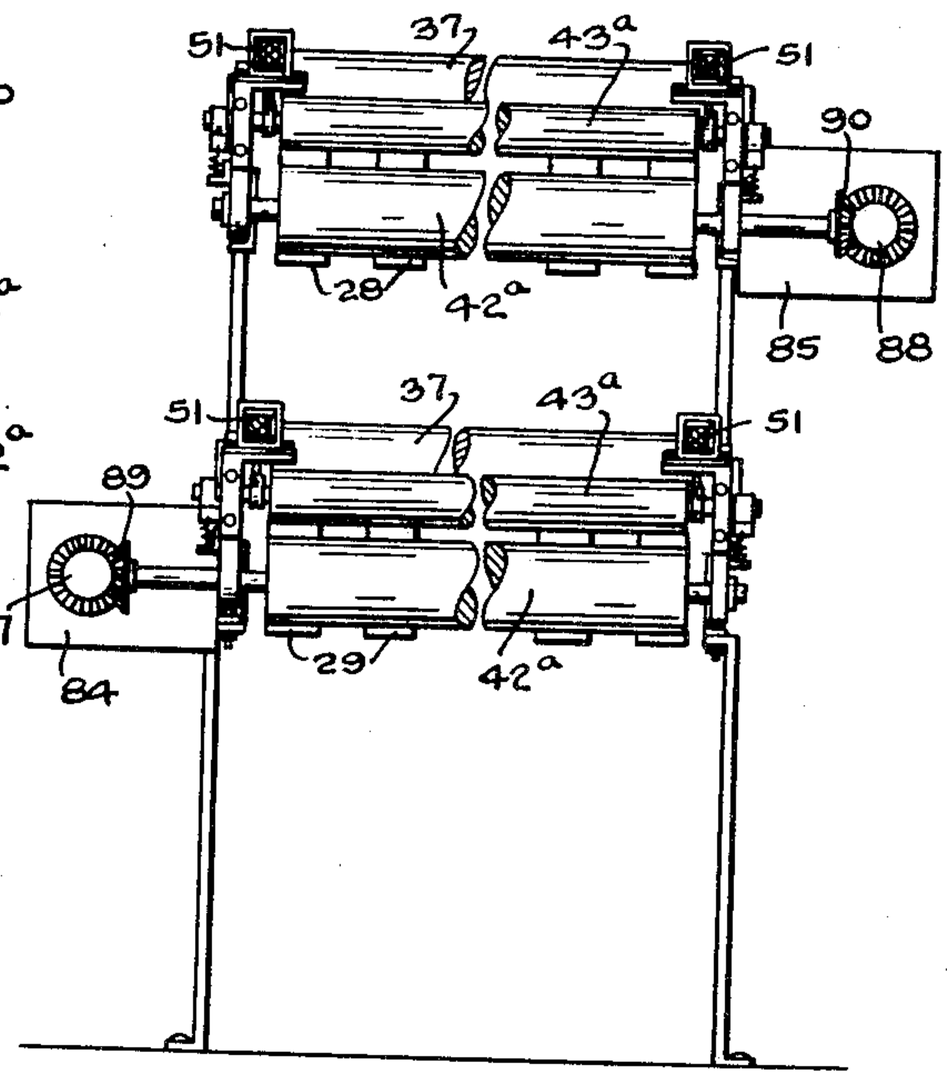


Fig. 14.

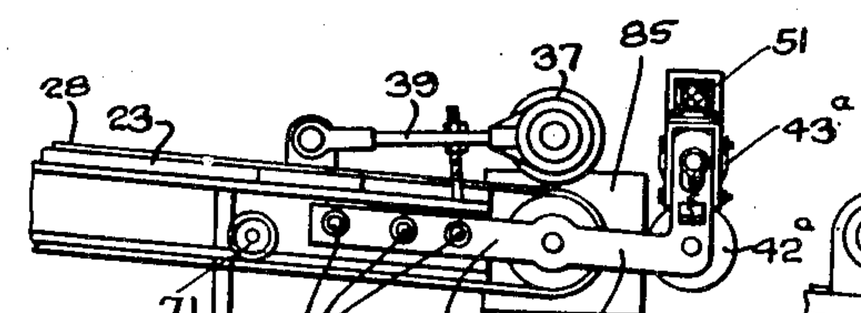


Fig. 15.

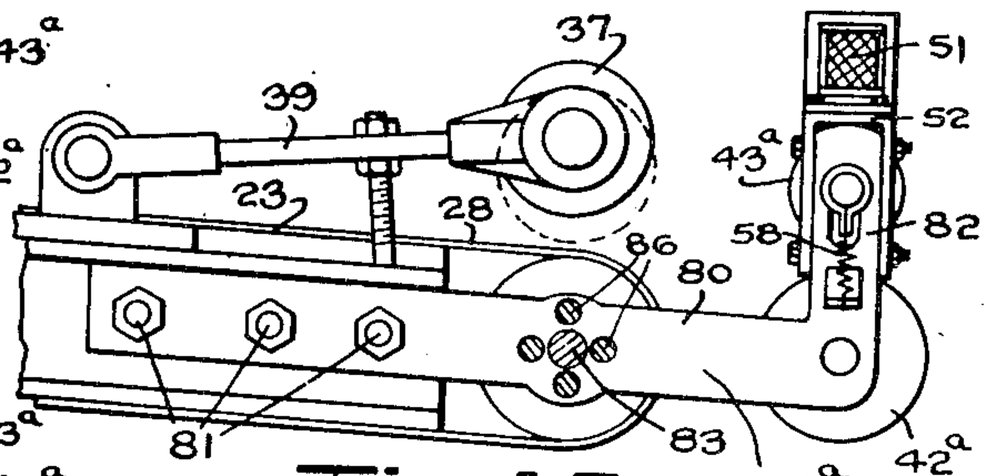


Fig. 16.

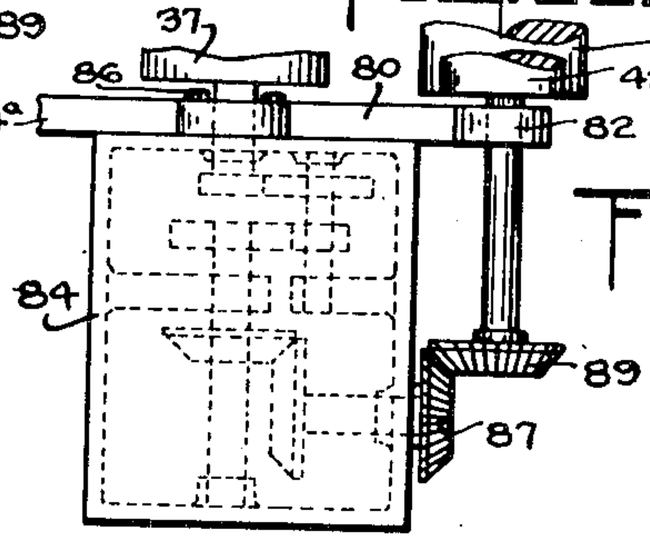


Fig. 17

INVENTOR.
CHARLES W. APGAR
BY ABRAHAM L. ROSENFELD
Leonard Nelson
ATTORNEY

Patented Oct. 25, 1949

2,485,952

UNITED STATES PATENT OFFICE

2,485,952

CONTROL MECHANISM FOR CONVEYER APPARATUS

Charles W. Apgar and Abraham L. Rosenfeld, Philadelphia, Pa., assignors to Abraham L. Rosenfeld, Charles W. Apgar, and Fredric R. Mann, all of Philadelphia, Pa., as trustees

Application January 30, 1945, Serial No. 575,314

15 Claims. (Cl. 198—20)

1

This invention relates generally to apparatus for handling sheet material, of the type such as is shown and described in the pending application of Charles W. Apgar, Serial No. 554,092, filed September 14, 1944, and more particularly to improvements in the means for controlling the delivery speed of the sheet as it is discharged from the main discharge conveyor of the apparatus.

In the operation of the apparatus disclosed in the pending Apgar application aforesaid, it is desirable that the forward motion of the sheets as delivered from the mechanism by which they are cut to predetermined size or otherwise processed be arrested or slowed down sufficiently to facilitate their being stacked into piles convenient to be handled. To that end, the apparatus of the pending application discloses stock take-off conveyor mechanism in one form of which is employed a back-board operative to arrest the forward movement of the sheets as they are successively delivered from the main discharge conveyor onto the take-off conveyor, while in another form thereof a so-called stock transfer means is employed in operative association with the main discharge conveyor to arrest or reduce the forward motion of the sheets as the same are delivered from the main discharge conveyor.

The present invention has as its primary object to provide an improved arrangement of the so-called stock transfer means whereby the same may be employed effectively in association with the stock take-off apparatus of the pending application or independently thereof, in which latter case the stock transfer means of the present invention may be arranged for operative association with the main delivery conveyor of any sheet processing apparatus, such as one in which the sheets are cut to predetermined size or in which sheets of predetermined size are slotted and scored or surface printed.

More specifically, it is among the objects of the present invention to provide in immediate association with a sheet processing apparatus, such as the conventional corrugator employed in the manufacture of corrugated paper board, means operative in association with the sheet discharge conveyor of such apparatus for arresting the forward motion of the sheet at approximately the instant the sheet is discharged from the conveyor, in consequence of which the sheet, having been deprived of its forward momentum, drops flatwise from off the discharge end of the conveyor onto a stationary table whereon the sheets may be stacked for convenient handling or onto a

2

movable table or conveyor such as the lateral take-off conveyor shown and described in the pending Apgar application hereinbefore referred to.

A further object of the present invention is to provide for electrical operation and control of the motion arresting means aforesaid, with provision for varying the time of actuation of said means to synchronize the same with the speed of delivery of the sheet from the main discharge conveyor of the corrugator or other such apparatus with which the mechanism of the present invention is associated.

Still another and important object of the present invention is to provide an electrically operated motion arresting mechanism of the character aforesaid which is adapted to be driven by and in sychronism with the discharge conveyor of the corrugator or other such main apparatus or to be driven by and in synchronism with an auxiliary stock take-off apparatus on the order of that disclosed in the pending Apgar application aforesaid.

Other objects and advantages of the invention will appear more fully hereinafter, it being understood that the present invention consists in the combination, construction, location and relative arrangement of parts, all as described in detail hereinafter, as shown in the accompanying drawings, and as finally pointed out in the appended claims.

In the accompanying drawings, which illustrate certain preferred embodiments of the present invention, Figure 1 is a perspective view of one embodiment of the present invention showing the motion arresting means operatively associated with an auxiliary stock take-off apparatus disposed at the delivery end of the main discharge conveyor of a double deck corrugator;

Figure 2 is a top plan view of the motion arresting mechanism shown in Figure 1 in conjunction with the adjacent end portions of the main discharge conveyor and the stock take-off mechanism;

Figure 3 is a side elevational view of that portion of the apparatus which is shown in Figure 2;

Figure 4 is a longitudinal sectional view taken along the line 4—4 of Figure 2;

Figure 5 is a view of the motion arresting means per se, the means shown in this figure being the same as that shown in Figure 4, but with the sheet hold-down roll operative to engage the sheet to arrest its forward motion;

Figure 6 is a front elevational view of a side portion of one set of the motion arresting means.

Figure 7 is a view showing the driving connec-

tion between the stock take-off apparatus and the motion arresting means of the present invention;

Figure 7A is a view showing a detail of construction, more specifically the spring means for exerting a downward bias upon the hold-down roll;

Figure 8 is a view of the mechanism shown in Figure 7 as it appears when taken along the line 8—8 of Figure 6;

Figure 8A is a view taken on the line 8A—8A of Figure 6;

Figure 9 is a view taken on the line 9—9 of Figure 7;

Figure 10 is an enlarged view of the switch for controlling the energization and deenergization of the electro-magnets operatively associated with the hold-down roll;

Figure 11 is a sectional view taken on the line 11—11 of Figure 10;

Figure 12 is a view showing the electrical circuit for control of the electro-magnets operatively associated with a hold-down roll;

Figure 13 is a top plan view of another embodiment of the present invention showing the motion arresting means operatively associated with the main discharge conveyor of the corrugator;

Figure 14 is a front end elevation of the apparatus as shown in Figure 13;

Figure 15 is a side elevational view thereof;

Figure 16 is an enlarged view showing the means for mounting in position the hold-down roll and its associated parts; and

Figure 17 is a view in plan of the reduction gear box through which driving power is transmitted to the driven roll of the motion arresting mechanism of the present invention.

The present invention is designed for use in combination with the conventional apparatus for manufacturing corrugated paper board, which manufacture generally includes the feeding of continuous webs of sheet material, such as paper or cardboard, through various calendering and other sheet processing units arranged in line, to produce the finished product well known in the art. The final operation in such manufacture is to cut the fabricated web into sheets of predetermined size, this being effected by means of sheet cutting units, which usually consist of a pair of rotary cutter rolls arranged almost at the end of the line of the processing units, or it may be to slot and score or impress printed matter upon the pre-cut sheets. Upon completion of any of these operations, the sheets are discharged from the main apparatus by conveyor belts which conventionally deliver them to a point where the sheets may be taken up for disposition as desired. In order to save space and increase production, the processing of the corrugated board is generally effected at two levels, all of the operations for each web being performed in each of the two levels. In such case, each level of the machine is provided with its own sheet cutting unit by means of which the fabricated web is severed into sheets of predetermined length. For the purposes of the present invention it is deemed unnecessary to illustrate the entire apparatus and consequently only the cutting unit thereof, designated by the reference numeral 20, is shown, it being understood that for the purposes of the present invention such cutting unit may also represent the entire machine employed in the manufacture of sheeted material such as corrugated paper board or other

sheet material which is ultimately cut to sheets of desired size, or it may be replaced by some other type of unit, as for example, a sheet printing unit or a slotting and scoring unit.

While it is not necessary to describe the cutting unit 20 in detail, reference is made to the dual pairs 21 and 22 of the rotary cutters respectively disposed at different levels, and to the discharge conveyors 23 and 24, each of which supports the free end of the continuous web while it is being severed and convey the severed sheets away from the cutter rolls. The conveyors 23 and 24 each have a forward shaft 25 and 26, respectively, each shaft also carrying a series of pulleys 27 about which are fitted the endless belts 28 of the upper level conveyor and the endless belts 29 of the lower level conveyor. The shafts 25 and 26 receive power respectively from the belts 28 and 29 which are driven in synchronism with the cutting rolls of the machine and by means which do not form part of the present invention. It will be understood that each pair of the rotary cutters is provided with means well known in the art for adjusting the rate of rotation thereof for the purpose of varying the length of the sheet which is severed from the end of the continuous web.

In the customary use of the apparatus thus far described, the cut sheets are delivered from the cutter rolls by the conveyor belts 28 and 29 to receiving tables disposed immediately in front of the stock discharge conveyors 23 and 24. However, this rendered the handling and stacking of the cut sheets difficult, and to obviate this difficulty, the apparatus of the pending Apgar application aforesaid was developed to provide an arrangement by means of which the sheets, upon their discharge from the main conveyors 23 and 24, are delivered substantially at right angles to their original direction of travel, thus effecting a lateral discharge of the cut sheets. This lateral discharge is effected by the auxiliary stock take-off conveyors described in the prior Apgar application, the final lateral delivery of the sheets respectively received from the main discharge conveyors 23 and 24 being preferably in opposite directions relatively to each other. Inasmuch as the auxiliary stock take-off conveyors for effecting lateral discharge for the sheets is fully described in the prior application aforesaid, it is deemed unnecessary to describe the same in detail herein and accordingly, only such parts thereof as are necessary for a clear understanding of the present invention will be specifically described, reference being made to said prior pending application for such further details of construction and operation of the auxiliary stock take-off conveyors as may be required.

The auxiliary stock take-off conveyors are respectively designated in the accompanying drawings by the reference numerals 31 and 32, the take-off conveyor 31 being designed for cooperation with the main discharge conveyor 23 and the take-off conveyor 32 being similarly designed for cooperation with the main discharge conveyor 24. The upper stock take-off conveyor 31 is driven from the main discharge conveyor 23 through the intervention of a suitable variable drive mechanism designated generally by the reference numeral 33, while the lower stock take-off apparatus is correspondingly driven from the main discharge conveyor 24 through the intervention of a similar variable drive mechanism generally designated by the reference numeral 34. The endless belts of

the stock take-off conveyors are fitted about pulleys which are suitably secured to and rotate with a pair of laterally spaced shafts which respectively extend longitudinally along either side of the conveyors.

In the case of the upper take-off conveyor **31**, one of these longitudinally extending shafts is operatively connected to the variable drive mechanism **33** and thus becomes the driving shaft for the said take-off conveyor **31**, while its opposite shaft **35** operates as a driven shaft, rotation being imparted thereto by means of the endless belts of the take-off conveyor **31**. In the case of the lower stock take-off conveyor **32**, the same condition prevails except that the relative positions of the driving and driven shafts thereof are reversed, the driven shaft being that designated **36** in Figures 3 and 4.

Referring now more particularly to the apparatus illustrated in Figure 1, it will be observed that each of the main discharge conveyors **23** and **24** thereof is equipped at its outer end with a sheet hold-down roll **37**, each such roll being freely rotatable and disposed immediately above the belt pulleys at the delivery end of the particular main discharge conveyor with which said hold-down roll is associated. Each of said hold-down rolls **37**, which are preferably formed of hollow or tubular construction, is fitted at its outer ends with oppositely extending stub shafts or stems **38** respectively journalled in a pair of pivoted bracket members **39—39** suitably secured, as at **40—40**, to the stationary supporting frame of the main belt conveyor. The function of these hold-down rolls **37** is, of course, to maintain the stock in frictional engagement with the moving belts of the conveyor and so insure the delivery thereof to and through the rolls of the motion arresting mechanism to be presently described. In order to maintain the hold-down roll **37** in vertically adjusted relation with respect to the belts of the discharge conveyor, the pivoted supporting brackets **39—39** for the roll are each provided with adjusting studs **41** (see Figures 3, 4 and 5) by means of which the spacing between the hold-down roll and belts of the discharge conveyor with which it is associated may be varied as desired.

It will be understood, of course, that each deck or level of the apparatus is provided with its own motion arresting mechanism, and inasmuch as these mechanisms are substantially identical in construction, only that one which is operatively associated with the upper level discharge and take-off conveyors of the apparatus will be described in detail. However, in order to identify the corresponding parts of the lower level motion arresting mechanism, the same reference numerals are applied thereto as for the corresponding parts of the upper level mechanism.

Operatively associated with the upper level main discharge conveyor **23** and mounted immediately in advance of the discharge end thereof are a pair of rolls **42** and **43**, the lower roll **43** being journalled for rotation about a fixed horizontal axis, while the upper roll **42** is so supported that it may be alternately lifted away from and dropped toward the lower roll **43**. It will be noted that the lower roll **43** is so mounted that the upper plane of the discharge conveyor **23** is substantially tangential to the upper edge of said roll **43**, in consequence of which the stock, as delivered from the said discharge conveyor, passes over and is supported by the roll **43**, as shown quite clearly

in Figure 4, wherein the stock is designated by the reference character *a*.

The two rolls **42** and **43** are commonly supported in horizontally extending, substantially parallel relation between a pair of brackets **44** secured in any suitable manner upon a stationary part of the frame of the apparatus. As most clearly appears in Figures 8 and 8A, each of these brackets is provided in its upper portion with an elongated slot or opening **45**, which slots respectively receive the opposite reduced ends of the roll **42** and permit the latter to be bodily shifted vertically with respect to the lower roll **43** within the limits of the slots **45** and by the means and for the purposes to be hereinafter described.

The axially fixed roll **43** is positively driven, in the case of the upper level motion arresting mechanism, from the driven shaft **35** of the stock take-off apparatus, while the corresponding roll **43** of the lower level motion arresting mechanism is positively driven by the shaft **36** of the lower level stock take-off apparatus. However, inasmuch as both of these shafts **35** and **36** of the stock take-off apparatus are respectively driven through the intervention of the upper and lower level stock take-off conveyor belts, which in turn are respectively driven by the endmost shafts of the main discharge conveyors **23** and **24** through the intervention of the variable drive mechanisms **33** and **34**, all as described more particularly in the pending Apgar application aforesaid, it will be apparent that the rotative speed of each roll **43** of the motion arresting mechanism bears a definite and fixed relation to the delivery speed of the main discharge conveyor with which said roll is immediately associated. Stated in another way, the roll **43** is so driven by the endmost shaft of the main discharge conveyor **23** (or **24**) as to provide for said roll a speed of rotation which is substantially less than that of the said endmost shaft of the discharge conveyor.

In order to effect this driving connection between the roll **43** and the driven shaft **35** of the upper level unit and between the roll **43** and the driven shaft **36** of the lower level unit, each of said shafts **35** and **36** is fitted at its rear end with a worm or endless screw **46** (see particularly Figures 3, 4, 7, 8 and 9) which is in mesh with a worm wheel **47** journalled within a bracket **48a** suitably supported upon a stationary part of the main frame of the stock take-off apparatus. The transversely extending shaft of the worm wheel **47** is in turn fitted with a sprocket wheel **48**, which is connected by means of the sprocket chain **49** to a sprocket wheel **50** fitted upon the outer end of the supporting shaft of the roll **43** (see Figure 7).

Secured to the upper end of each of the journal brackets **44** for the rolls **42** and **43** is an electromagnetic solenoid designated generally by the reference numeral **51**, this solenoid **51** being in each instance supported upon its associated bracket **44** by means of an adaptor element **52** which may be bolted or otherwise secured to the bracket, as shown, for example, in Figures 7, 8 and 9. The adaptor **52** is provided with a laterally extending shelf or platform **53** for the solenoid **51**, its disposition being such that the vertical axis of the solenoid supported thereby is substantially perpendicular to and in the plane of the horizontal axis of the roll **42**. The lower extremity of the central core or plunger **54** of the solenoid is secured, as at **55**, to a strap **56** which freely embraces the reduced end **57** of the roll **42**, the opposite end of said end roll being similarly supported by the lower end of the cen-

tral core or plunger of the electro-magnetic solenoid mounted above said opposite end of the roll 42. The straps 56—56 by which the roll 42 is suspended from the plungers of the electro-magnetic solenoids 51—51 in effect constitute bearings for the ends of the shaft 42 which permit free rotation thereof. Preferably, the roll 42 is downwardly biased by means of coiled tension springs 58 which are suitably secured between the opposite extremities of the roll 42, as at 59, and a fixed element 60 secured to the bracket 44. In order not to interfere with the free rotation of the roll 42, the upper ends of each of the springs 58 is secured to a collar or strap 61 fitted freely over the outer extremity of the roll (see Figure 6). Also, in order to adjust the tension of the spring 58, the lower end thereof may be in the form of a threaded shank upon which is threaded an adjusting nut 62 (see Figure 7A).

The arrangement just described is generally such that upon energization of the electro-magnetic solenoids operatively associated with the roll 42, the latter will be lifted upwardly and away from the lower roll 43 against the biasing pull of the springs 58, while upon deenergization of said solenoids, the roll 42, of its own weight, drops instantly toward the lower roll 43, such downward movement of the roll 42 being expedited by the downward pull of the biasing springs 58.

While it is preferable to employ a pair of solenoids for each roll 42 with the solenoids respectively arranged at opposite ends of the roll, as shown, for example, in Figures 1 and 2, this is not essential in all cases. Instead, only one electro-magnetic solenoid may be employed at one or the other end of the roll 42 upon energization of which that end of the roll which is secured to the movable core or plunger of the solenoid is lifted to an extent sufficient to tilt the roll 42 upwardly with respect to the lower roll 43 and so provide a space between the rolls 42 and 43 between which the stock discharged from the main conveyor 23 (or 24) may freely pass. In such case, the opposite reduced end 57 of the roll 42 normally rests in the bottom of the elongated slot 45 of the bracket 44.

The vertical shiftable roll 42 functions as a drop roll which, upon deenergization of the solenoid or solenoids 51, engages the stock *a* as it passes over the roll 43 to arrest or slow down the delivery speed of the cut sheet at the instant just prior to its final discharge from off the roll 43. As has been pointed out hereinbefore, the rotative speed of the roll 43 is so reduced in relation to the speed of the end shaft 25 of the main discharge conveyor 23 (or, in the case of the lower level arrangement, in relation to the rotative speed of the end shaft 26 of the discharge conveyor 24) that the surface speed of the roll 43 is substantially less than the surface speed of the discharge conveyor with which it is immediately associated. Consequently, upon discharge of the stock from the main conveyor and engagement thereof between the rolls 42 and 43, its speed of travel will be reduced from the high surface speed of the main discharge conveyor to the relatively low surface speed of the roll 43, this latter speed being of such order as to insure continued advance of the stock through the rolls 42 and 43 without imparting any forward momentum to the stock when it passes free of the rolls 42 and 43. This action is best illustrated in Figures 3 and 5. In Figure 3, the stock *a* is in the process of being fed through the rolls 42 and 43 by the main discharge conveyor at a rate of travel which is equal to the surface speed of the said conveyor. In the position of the stock, as shown in Figure 3, the drop roll 42 is held in its proper position out of engagement with the stock under the influence of the energized electro-magnetic solenoids 51. As the stock *a* progresses to the point shown in Figure 5, in which case it is no longer subject to the positive feed of the main discharge conveyor operating at its relatively high surface speed, the solenoids 51 will have been deenergized to permit the roll 42 to drop into engagement with the rear end portion of the stock as it passes over the roll 43 operating at a relatively low surface speed. The drop roll 42 thus presses the stock into engagement with the roll 43 with the result that the speed of travel of the stock is reduced to a value which approximates the surface speed of the positively driven roll 43, this speed being of such low order that as the end of the stock becomes free of the roll 43, the stock immediately drops downwardly on to a supporting table or the like, the successive sheets of stock so delivered from the main discharge conveyor being thereby stacked into a pile convenient to be handled.

In order to control the energization and deenergization of the solenoids 51 in timed relation to the delivery of the stock to and through the motion arresting mechanism just described, a switch gear designated generally by the reference numeral 62 is employed, this switch gear being preferably best shown in Figures 5, 10 and 11. Generally, this switch gear includes a spring pressed arm 63 which is pivoted, as at 64, within a suitable housing or box 65 therefor. This box 65 is slidably disposed within an elongated slot provided therefor in the stationary table 66 of the main discharge conveyor, this table providing the surface over which travel the endless belts 28 of the conveyor. Preferably, the switch box 65 is located more or less centrally between the opposite sides of the conveyor (see Figure 2), the bottom of the box being fitted with a rack bar 67 extending longitudinally of the conveyor, this rack bar being in mesh with a pinion 68. This pinion 68 is journalled in any suitable manner beneath the table 66 of the conveyor, as within a pair of journal brackets 69—69 fixedly disposed to either side of the slidable switch box 65. The journalled shaft 70 of the pinion is preferably extended to beyond one side of the main supporting frame of the conveyor and the outer free end of said extended shaft is provided with a hand wheel 71 for effecting rotation of the pinion 68 in one direction or another to rack the switch box forwardly or rearwardly into any desired adjusted position.

The pivoted switch arm 63 is forwardly and upwardly extended, as at 72, and is given an upward bias by a coiled compression spring 73 so that normally it assumes the position shown in Figure 10, in which position the forward free end portion of the switch arm 63 extends above the upper surface of the discharge conveyor belts 28. The rearwardly extending portion 74 of the switch arm is provided with a transversely extending terminal bridging element 75, this element being adapted to bridge a pair of laterally spaced electrical terminals 76 suitably mounted in the upper rear corners of the switch box 65. Normally, when the switch arm is spring-pressed into its full line position shown in Figure 10, the bridging member 75 is out of contact with the

electrical terminals 76. However, when the stock *a* is delivered along the conveyor into the full line position shown in Figure 4 and the dotted line position shown in Figure 10, the forward end of the stock passes over the upwardly projecting portion 72 of the switch arm 63 and depresses it into the dotted line position shown in Figure 10, in which latter position the terminal elements 76 are bridged by the circuit closing bridging element 75 to thereby close the circuit to the electro-magnetic solenoids 51 and so effect their energization. The wiring diagram of the circuit for controlling the supply of energizing current to the solenoids is shown in Figure 12.

As the stock *a* continues to pass over the switch arm 63, its weight maintains the latter in its depressed circuit closing condition with the result that the solenoids 51 are energized and so raise the roll 42 well out of contact with the roll 43. With the roll 42 so lifted by the solenoids 51, the stock *a* is free to be delivered over the roll 43 at a rate of travel equal to the surface speed of the main discharge conveyor belts 28 (or 29 in the case of the lower level unit). In this connection, it will be noted that the roll 43 operating at a surface speed less than that of the discharge conveyor does not interfere with the free high speed travel of the stock *a* over said roll, this condition prevailing so long as the drop roll 42 is held raised out of contact with the stock by the energized solenoids 51.

However, as soon as the stock *a* travels along the discharge conveyor to a distance sufficient that its rear end passes free of the switch arm 63, the latter immediately moves into circuit-opening position with resultant deenergization of the solenoids 51. Upon such deenergization of the solenoids 51, the drop roll 42, of its own weight and under the influence of the springs 58, drops into engagement with the stock as it passes over the roll 42 and so slows down the stock to a speed of travel comparable to the surface speed of the roll 43. By properly adjusting the position of the switch gear longitudinally of the discharge conveyor by means of the adjusting rack and pinion hereinbefore described, or by any other suitable means, the operation of the circuit breaking switch may be so timed as to effect deenergization of the solenoids and consequent lowering of the drop roll 42 at the instant that the stock passes free of the main discharge conveyor and its associated stock hold-down roll 37. Thus, as the surface speed of the main discharge conveyor is increased so as to increase the speed of delivery of the stock delivered through the rolls 42 and 43, the switch gear is adjusted rearwardly so as to provide increased time for the drop roll 42 to engage the stock upon deenergization of the solenoids 51, while, conversely, as the surface speed of the discharge conveyor is reduced, the switch gear is adjusted forwardly to reduce the effective length between the drop roll 42 and the forward end of the circuit breaking switch and so provide adequate time for engagement of the stock by the roll 42 following release of the stock from the main discharge conveyor. In all cases, the adjustment of the switch gear should be such that deenergization of the solenoids occurs in time to effect engagement of the drop roll 42 with the stock at about the instant when the stock is delivered free of the main discharge conveyor.

It will be observed that the switch arm 63 is provided with an upwardly and forwardly extending elongated portion 72 so as to effect actuation of the switch and consequent energization of the solenoids 51 immediately upon engagement by the leading end of the stock with the heel of said elongated portion. The switch arm remains depressed during the entire period of travel of the stock thereover and is released only when the rear end of the stock passes free of the toe of the elongated portion of the switch arm. This construction of the switch insures that energization of the solenoid and consequent lifting of the drop roll 43 occurs in such timed relation to the delivery speed of the stock that the rolls of the slow-down mechanism will separate or open in ample time to permit the front end of the stock to pass freely therebetween. However, the release of the switch to effect deenergization of the solenoid and consequent lowering of the drop roll 43 is so delayed by the elongated portion of the switch arm remaining depressed for a period of time longer than that required for the stock normally to pass over the switch-actuating point that the drop roll does not engage the stock until about the instant that the latter is delivered free of the main discharge conveyor.

In the apparatus of the form shown in Figures 1 to 9, inclusive, in which the auxiliary stock take-off conveyor is operatively associated with and driven in timed relation to the main delivery conveyor through the intervention of the variable drive mechanism, it will be apparent that by adjustment of this mechanism the speed of operation of the discharge conveyors of the lateral take-off may be increased or decreased as desired to change the degree of overlap of the sheets successively delivered from the main discharge conveyor to the lateral discharge conveyor. At the same time, by so varying the speed of operation of the take-off conveyor the surface speed of the drive roll 43 of the slow-down mechanism operatively associated therewith is correspondingly varied.

Because of this interconnection in operation of the main delivery conveyor and its slow-down mechanism with the lateral discharge conveyor, it becomes a simple matter to adjust the apparatus as a whole for most efficient and satisfactory handling of sheets of stock of varying lengths without changing the delivery speed of the main apparatus. Thus, where for a given delivery speed of the main conveyor 23 (or 24) sheets of a particular length are being discharged laterally from the take-off apparatus with too small an overlap or "fanning" between successive sheets, by the simple expedient of adjusting the variable drive to provide for a reduced speed of operation of the lateral discharge conveyor the sheets successively received by the latter will move laterally with increased overlap therebetween. Also, as the speed of the lateral take-off conveyor is reduced, the speed of rotation of the drive roll 43 of the slow-down mechanism will also be correspondingly reduced to provide for such further reduction in its surface speed that the sheets are substantially deprived of all forward momentum upon their final discharge from between the rolls of the slow-down mechanism. Efficient and uniform stacking of the sheets upon the lateral discharge conveyor with any desired degree of overlap therebetween is thereby obtainable with the apparatus of the present invention irrespective of the length of the sheet being handled.

It will be noted that in the construction of the apparatus as just described and as shown in Figures 1 to 9, inclusive, the lower drive roll 43 of

the feed slow-down mechanism derives its power from the freely driven shaft of the auxiliary stock take-off mecnanism, this shaft being that designated by the numeral 35 in the case of the upper level take-off and that designated by the numeral 36 in the case of the lower level take-off. These shafts 35 and 36 in turn are respectively driven by the lateral belts of the take-off units which are powered by the variable drive mechanisms operatively associated with and driven by the end shafts of the main discharge conveyors 23 and 24. As has been previously indicated, it is not always necessary to employ the lateral take-off mechanisms in conjunction with the feed slow-down mechanisms and in such case, it becomes desirable to provide an arrangement whereby the slow-down mechanisms are respectively operated directly by the main discharge conveyor with which they are associated. Such an arrangement is illustrated in Figures 13 to 17, inclusive.

Referring now to these latter figures, it will be observed that each of the main discharge conveyors 23 and 24 is provided at its discharge end with a feed slow-down unit of the general character hereinbefore described, each such unit including an upper drop roll 43ª and a lower driven roll 42ª. These rolls function in the same manner and for the same purpose as the corresponding rolls 43 and 42 of the form of apparatus hereinbefore described, the opposite ends of these rolls being suitably supported between a pair of side brackets 44ª respectively mounted upon opposite sides of the frame of the discharge conveyor. It will be noted that these brackets 44ª—44ª for each pair of rolls 43ª and 42ª are each generally of L-shape in longitudinal section, the long arm 80 of which is secured to the side of the discharge conveyor frame by the bolts 81, while the short arm 82 thereof is vertically disposed forwardly of the discharge end of the discharge conveyor.

The arms 80 of the brackets 44ª are each apertured, as at 83, to permit the projection therethrough of the opposite free extremities of the forward end belt pulley shaft of the discharge conveyor. In the case of the upper level discharge conveyor 23, one end of the said belt pulley shaft extends into a gear reduction box 85, while in the case of the lower discharge conveyor 24, the opposite end of its corresponding belt pulley shaft is extended into a second gear reduction box 84. These gear reduction boxes 84 and 85 are preferably mounted upon and carried by the proximate brackets 80 which support the rolls of the slow-down mechanism, as by means of studs 86 (see Figure 16) projecting outwardly of the gear reduction box for securement to the roll supporting bracket 44ª.

The output shafts of the gear reduction boxes 84 and 85 are respectively fitted with bevel gears 87 and 88, the bevel gear 87 being in mesh with a bevel gear 89 fitted upon one end of the driven roll 42ª of the lower level feed slow-down mechanism, while the bevel gear 88 of the gear reduction box 85 is in mesh with a bevel gear 90 fitted upon the end of the driven shaft 42ª of the upper level feed slow-down mechanism. By means of the arrangement just described, the said driven rolls, 42ª of the feed slow-down mechanisms are driven directly by the main discharge conveyors with which such mechanisms are respectively associated through the intervention of the gear reduction boxes. Thus, the rolls 42ª of the feed slow-down mechanisms operate at a surface

speed considerably less than that of the discharge conveyors with which they are associated.

In all other respects, the apparatus, as illustrated in Figures 13 to 17, is similar to that of Figures 1, et seq., the drop rolls 43ª of the slow-down mechanisms operating in timed relation to the speed of the stock delivered from the main discharge conveyors to reduce the rate of travel of the stock to cause the same to drop vertically into stacked piles as it passes free of the roll 42ª. As in the previously described arrangement, the electro-magnetic solenoids 51 which control the raising and lowering of the drop roll 43 are included in circuit with a slidably adjustable switch gear 62 similar in all respects to that hereinbefore described, these solenoids, of course, being operative to lift the roll 43ª upon energization thereof and to permit it to drop into engagement with the sock as it passes over the roll 42ª upon de-energization thereof.

It will be apparent, of course, that the several arrangements hereinbefore described are subject to various other changes and modifications without departing from the general principles or real spirit of the present invention, and the said invention is accordingly intended to be claimed broadly as well as specifically as indicated by the appended claims.

What is claimed as new and useful is:

1. In an apparatus for handling stock delivered in sheet form from a main apparatus having a stock discharge conveyor, a feed slow-down mechanism including a pair of vertically spaced rolls disposed in advance of and operatively associated with the discharge end of the conveyor, the lower of said rolls being disposed with its upper surface substantially in the plane of the stock-receiving surface of the conveyor and the upper of said rolls being bodily shiftable vertically with respect to said plane, means for driving said lower roll at a surface speed substantially less than that of the discharge conveyor, and means operative to drop said upper roll into engagement with the stock as the same passes over the lower driven roll and is delivered free of the discharge conveyor.

2. In an apparatus for handling stock delivered in sheet form from a main apparatus having a stock discharge conveyor, a feed slow-down mechanism including a pair of vertically spaced rolls disposed in advance of and operatively associated with the discharge end of the conveyor, the lower of said rolls being disposed with its upper surface substantially in the plane of the stock-receiving surface of the conveyor and being driven at a surface speed substantially less than that of the conveyor, means operative to hold said upper roll in spaced vertical relation with respect to said lower driven roll during feed of the stock therethrough by the said conveyor, and means operative to release said upper roll and permit it to drop into engagement with the stock passing over said driven roll automatically as the stock is advanced by the conveyor to a predetermined point.

3. In an apparatus of the character defined in claim 2 wherein the raising and lowering of said upper roll is effected automatically by electro-magnetic solenoid means.

4. In an apparatus of the character defined in claim 2 wherein is included electro-magnetic solenoid means operative upon said upper roll to effect alternate raising and lowering thereof with respect to the driven roll in accordance with the advance of the stock along the discharge conveyor.

5. In combination, a main discharge conveyor

for sheets pre-cut to predetermined size, and a feed slow-down mechanism operatively associated with the discharge conveyor for reducing the speed of said sheet substantially below the surface speed of the conveyor automatically as the sheet is advanced by the conveyor to a predetermined point in relation to said slow-down mechanism, said slow-down mechanism including a sheet feeding roll driven at a surface speed substantially less than that of the conveyor, and a drop-roll operative to press the sheet into positive engagement with said feeding roll automatically as the sheet is delivered free of the conveyor.

6. In combination, a main discharge conveyor for sheets pre-cut to predetermined size, and a feed slow-down mechanism operatively associated with the discharge conveyor for reducing the speed of said sheet substantially below the surface speed of the conveyor automatically as the sheet is advanced by the conveyor to a predetermined point in relation to said slow-down mechanism, said slow-down mechanism including a sheet feeding roll driven at a surface speed substantially less than that of the conveyor, a drop-roll bodily shiftable toward and away from the sheet feeding roll, and means for alternately raising and lowering said drop-roll relatively to said sheet feeding roll in accordance with the advance of the stock along the conveyor.

7. In combination, a main discharge conveyor for sheets pre-cut to predetermined size, and a feed slow-down mechanism operatively associated with the discharge conveyor for reducing the speed of said sheet substantially below the surface speed of the conveyor automatically as the sheet is advanced by the conveyor to a predetermined point in relation to said slow-down mechanism, said slow-down mechanism including a sheet feeding roll driven at a surface speed substantially less than that of the conveyor, a drop-roll bodily shiftable toward and away from the sheet feeding roll, and electromagnetic solenoid means operative to alternately raise and lower said drop-roll in accordance with the advance of the stock along the conveyor and through said slow-down mechanism.

8. In combination, a main discharge conveyor for sheets cut to predetermined size, and a feed slow-down mechanism operative to reduce the forward speed of the sheets successively delivered from the conveyor, said mechanism including a drive roll for the delivered sheets operative at a surface speed substantially lower than that of the conveyor, and a drop-roll positioned above said drive roll automatically engageable with the successive sheets as predetermined lengths thereof pass freely over said drive roll to press the same into positive engagement with said drive roll.

9. In combination, a main discharge conveyor for sheets cut to predetermined size, and a feed slow-down mechanism operative to reduce the forward speed of the sheets successively delivered from the conveyor, said mechanism including a drive roll for the delivered sheets operative at a surface speed substantially lower than that of the conveyor, a drop-roll positioned above said drive roll automatically engageable with the successive sheets as predetermined lengths thereof pass freely over said drive roll to press the same into positive engagement with said drive roll, and electro-magnetic solenoid means operative to alternately raise and lower said drop-roll upon alternate energization and deenergization of said means.

10. In combination, a main discharge conveyor for sheets cut to predetermined size, and a feed slow-down mechanism operative to reduce the forward speed of the sheets successively delivered from the conveyor, said mechanism including a drive roll for the delivered sheets operative at a surface speed substantially lower than that of the conveyor, a drop-roll positioned above said drive roll automatically engageable with the successive sheets as predetermined lengths thereof pass freely over said drive roll to press the same into positive engagement with said drive roll, electromagnetic solenoid means operative to alternately raise and lower said drop-roll upon alternate energization and deenergization of said means, and means included in circuit with said electro-magnetic solenoid means for effecting said alternate energization and deenergization thereof in accordance with the advance of the sheets successively along the discharge conveyor and through said slow-down mechanism.

11. In combination, a main discharge conveyor for sheets cut to predetermined size, and a feed slow-down mechanism operative to reduce the forward speed of the sheets successively delivered from the conveyor, said mechanism including a drive roll for the delivered sheets operative at a surface speed substantially lower than that of the conveyor, a drop-roll positioned above said drive roll automatically engageable with the successive sheets as predetermined lengths thereof pass freely over said drive roll to press the same into positive engagement with said drive roll, electro-magnetic solenoid means operative to alternately raise and lower said drop-roll upon alternate energization and deenergization of said means, and a control device for said electro-magnetic solenoid means operatively disposed in the path of travel of the sheets along the discharge conveyor and operative to effect deenergization of said means and corresponding lowering of said drop-roll automatically as the rear end of a given sheet passes free of said control device.

12. In combination, a main discharge conveyor for sheets cut to predetermined size, and a feed slow-down mechanism operative to reduce the forward speed of the sheets successively delivered from the conveyor, said mechanism including a drive roll for the delivered sheets operative at a surface speed substantially lower than that of the conveyor, a drop-roll positioned above said drive roll automatically engageable with the successive sheets as predetermined lengths thereof pass freely over said drive roll to press the same into positive engagement with said drive roll, electro-magnetic solenoid means operative to alternately raise and lower said drop-roll upon alternate energization and deenergization of said means, and a control device for said electro-magnetic solenoid means operatively disposed in the path of travel of the sheets along the discharge conveyor and operative to effect deenergization of said means and corresponding lowering of said drop-roll automatically as the rear end of a given sheet passes free of said control device, said control device being adjustable toward and away from said slow-down mechanism to compensate for variations in surface speed of the discharge conveyor.

13. In an apparatus for handling and distributing stock delivered in sheet form from a main fabricating apparatus having associated therewith a conveyor including a set of endless belts for successively moving the sheets forwardly, a

sheet distributing unit disposed in advance of said conveyor, said distributing unit having conveyor belts movable laterally of the direction of the first-mentioned conveyor belts, driving means for said second-mentioned conveyor belts operative by said first-mentioned conveyor, and electrically operated means for arresting the forward movement of said sheets as the same are successively deposited upon said second-mentioned conveyor belts, said motion arresting means including a drive roll operative at a surface speed substantially less than the surface speed of the first-mentioned conveyor and an associated drop-roll positioned above said drive roll operative to engage successive sheets automatically as predetermined lengths thereof pass over said drive roll to press the same into positive engagement with said drive roll.

14. In an apparatus for handling and distributing stock delivered in sheet form from a corrugated board fabricating apparatus of the type having a stock discharge conveyor, a stock take-off conveyor operating in a direction transversely of said discharge conveyor, and electrically operated means operatively associated with said conveyors and disposed in intervening relation with respect thereto to check forward motion of the sheets as the same are successively delivered from said discharge conveyor just prior to their deposit on said take-off conveyor, said means being rendered effective to check but not entirely arrest the forward motion of each individual sheet

by the movement of such sheet on said first-mentioned conveyor.

15. In an apparatus for handling and distributing stock delivered in sheet form from a main fabricating apparatus having associated therewith a conveyor including a set of endless belts for successively moving the sheets forwardly, a sheet distributing unit disposed in advance of said conveyor, said distributing unit having conveyor belts movable laterally of the direction of the first-mentioned conveyor belts, driving means for said second-mentioned conveyor belts operative by said first-mentioned conveyor, and electrically operated means for reducing the forward movement of said sheets just prior to their being successively deposited upon said second-mentioned conveyor belts, said means being rendered effective to substantially reduce but not completely arrest the forward movement of each individual sheet by the forward travel of such sheet on said first-mentioned conveyor.

CHARLES W. APGAR.
ABRAHAM L. ROSENFELD.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,581,583	Low	Apr. 20, 1926
2,177,460	Renz	Oct. 24, 1939