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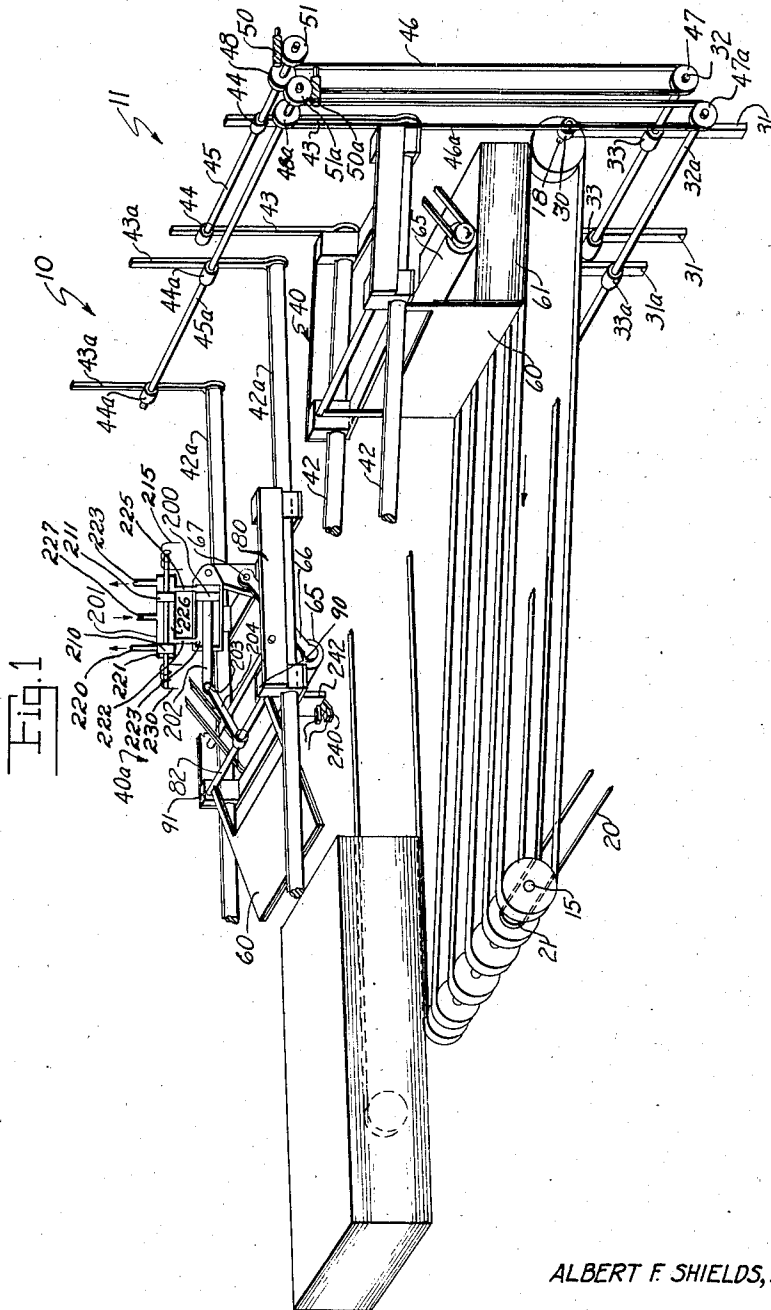
A. F. SHIELDS

2,414,337

TAKE-OFF TABLE

Filed March 6, 1945

3 Sheets-Sheet 1



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BY *Astrolenk & Faber*
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Jan. 14, 1947.

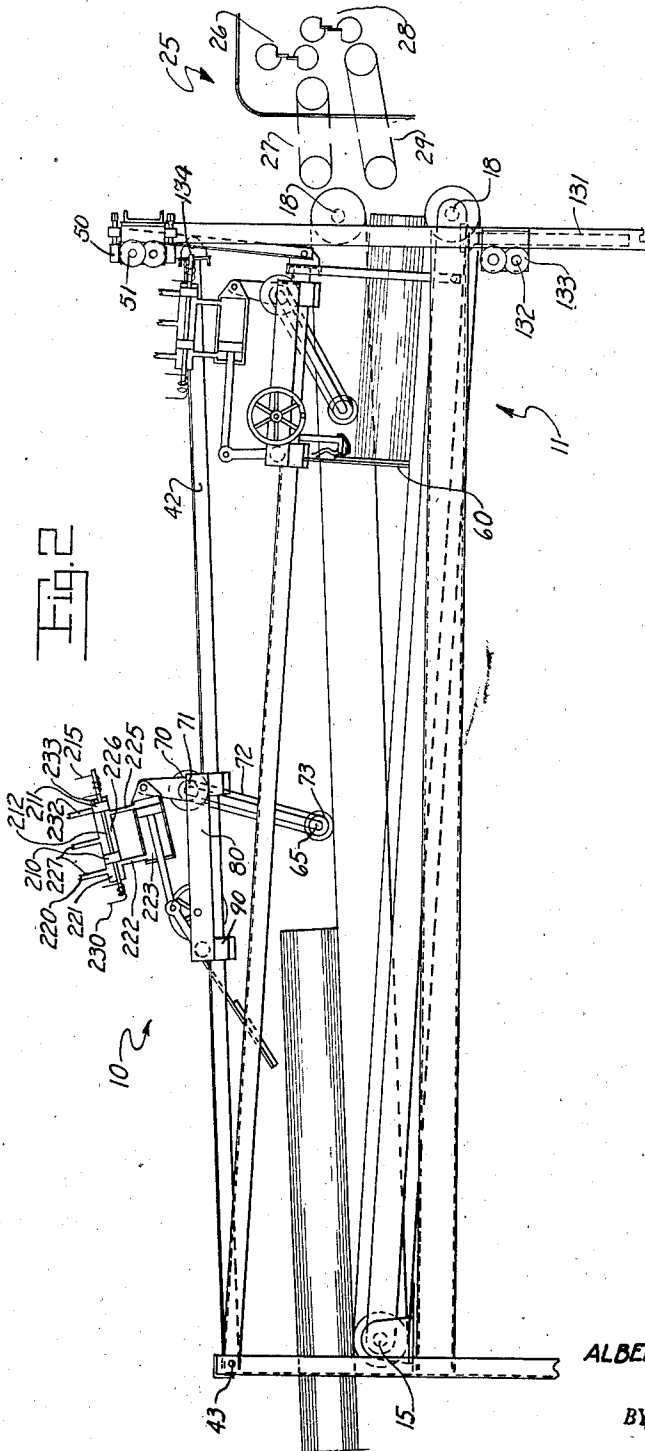
A. F. SHIELDS

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TAKE-OFF TABLE

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3 Sheets-Sheet 2



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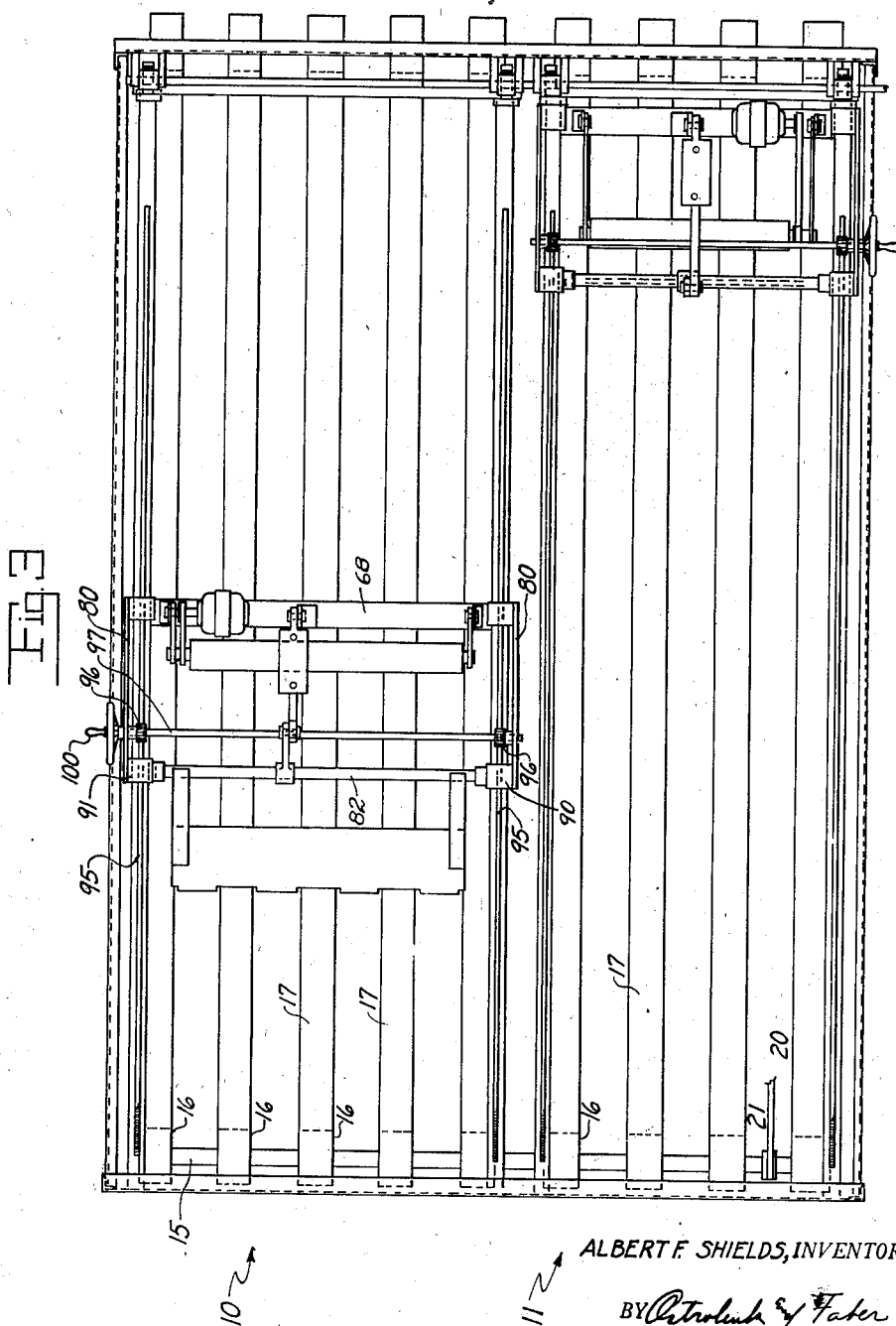
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TAKE-OFF TABLE

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3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE

2,414,337

TAKE-OFF TABLE

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Application March 6, 1945, Serial No. 581,315

14 Claims. (Cl. 271-64)

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My present invention relates to a sheet stacker and delivery unit, more commonly known as a take-off table, designed to cooperate with paper machinery to receive and stack cut sheets of paper, fiber board or corrugated board, and to deliver the stacks in predetermined quantities. My invention has its primary application in the manufacture of corrugated board.

In the manufacture of corrugated board, particularly of the double face variety, the sheets must be cut and stacked prior to handling, owing to the fact that the double face corrugated board is not flexible. The general operation consists of passing the corrugating medium between a pair of corrugating rollers which impress on the corrugating medium the flutes which are characteristic of corrugated board, then adhesively applying one of the liners to the corrugated medium, and then adhesively applying the opposite lines on the exposed side of the corrugated medium to form the double face board.

The double face corrugated sheet thus formed is passed over suitable drying and tempering means and then through other apparatus, such as slitting and scoring machines, and then through a cut-off mechanism which cuts off and feeds out sheets of predetermined length.

Since corrugating machines of the present time cut and feed out corrugated board at rates often averaging 250 feet per minute, and sometimes much faster, up to about 400 feet per minute, the cut sheets which may be anywhere from 30" to 180" long emerge from the cut off at a rate of about 20 sheets (for the 15 ft. lengths) to 100 sheets (for the 2½ ft. lengths) per minute. The short lengths are far more common. Accordingly, the operator finds it very difficult to remove and stack the sheets neatly and take them quickly out of the delivery path of the following sheets.

My novel take-off table is designed automatically to pile up stacks of predetermined height or number and to deliver the stack as a unit. Thus, where 30" sheets are cut and delivered at a rate of 100 a minute, a stack of predetermined height or number may be delivered every minute or fraction of a minute, and all that the operator need do is make sure that the stack is loaded on the proper conveyance for removal. The operator need not stack or count the sheets nor estimate the number of sheets in the stack; nor need he handle each sheet individually, but rather handles stacks of sheets simultaneously. And the sheets are automatically removed group by group from the delivery path.

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While my device is thus of real value on corrugating machines having a production of the rate of 250 ft. per minute; with modern corrugators, which may be run as high as 400 ft. per minute, my take-off table, aside from obviating the many difficulties previously encountered, becomes an absolute necessity.

Accordingly, a primary object of my invention is the provision of an automatic sheet stacking and stack delivery device.

Another object of my invention is the provision of an automatic sheet stacking and stack delivery device which will automatically deliver stacks of predetermined number or height at regular intervals.

Another object of my invention is the provision of an automatic sheet stacking and stack delivery device particularly adapted for use at the end of a continuous sheet making machine.

Often in the manufacture of corrugated board, the double face corrugated sheet is made of a sufficient width to accommodate at least two sheets, of the same or different sizes laid side by side and sometimes four or five sheets are run out side by side. The corrugated sheet is slit longitudinally and then passed through a duplex knife consisting of separate sets of knife blades for acting on different portions of the sheet so that different sizes and lengths of cut may be delivered.

Another object of my invention, therefore, is the provision of a novel take-off table or sheet stacking and delivery device particularly adapted to this duplex operation comprising at least two sections which may independently cooperate with the separate duplex cutting units but which may be arranged for simultaneous coaction with either one of the duplex cutting units when an extra wide sheet is to be cut, delivered and stacked.

These and many other objects of my invention will become apparent in the following specification and drawings in which:

Figure 1 is a schematic view in perspective of my novel take off table showing the operation thereof.

Figure 2 is a schematic side view of my novel take-off table.

Figure 3 is a top plan view of my novel take-off table.

Referring now to the figures, the take-off table comprises two separately operable sections 10 and 11 mounted on a common base. Each section is exactly similar in construction and operation. Accordingly, the description of either

of the sections will be applicable to the other section as well. The sections 10 and 11 have at their delivery end a common shaft 15 having a plurality of guide rolls 16, 16, 16 for the belts 17.

The opposite or feed end of each section has an individual belt shaft 18 for each section 10 and 11.

The shaft 15, while freely rotatable, is mounted in stationary bearings and is driven from any suitable source of power by the belt 20 and pulley 21 at a constant rate.

The drive for the common shaft 15 is adjusted to the speed of the paper feed, so that the stack when completed will be delivered before the first sheet of the next stack moves into place, and so that the delivery gate will have an opportunity to open and close after one stack is completed and before the first sheet of the next stack moves against the gate as hereinafter described.

The duplex cutting machine 25, Figure 2, has an upper pair of knives 26 with a belt delivery 27 and a lower pair of knives 28 with a belt delivery 29. Take-off table section 11 is shown lowered to a position where it cooperates with the delivery belt 29 of the lower knives 28. Take-off table section 10 is shown raised to cooperate with the delivery belt 27 of the upper knives 26.

The respective shafts 18 for each of the take-off table sections 10 and 11 may be raised and lowered so that either section 10 or 11 may cooperate with either of the delivery belts 27 and 29 of the cut-off knives 28 and 29.

Referring to the shaft 18 of take-off table section 11, the shaft is rotatably mounted in a pair of bearings 30 (Figure 1) to which are connected the racks 31, 31. A pinion shaft 32, carrying the pinions 33, 33 is rotatably mounted in suitable bearings so that the pinions 33, 33 coast with the racks 31, 31. Rotation of shaft 32 in any suitable manner causes the pinions 33 to rotate and thus to move the racks 31, 31 vertically. Rotation is secured as hereinafter described by operation of worm 50 to turn worm gear 51, thus rotating shaft 45, sprocket 48 and operating chain 46.

By this means, the belt shaft 18 of section 11 may be raised or lowered to cooperate either with the delivery belt 27 of the cut-off or the delivery belt 29 of the cut-off, and so that the belts 17 of take-off table section 11 may receive sheets from either cut off.

The gate mechanism indicated generally at 40 of Figure 1 is mounted on a pair of rails 42, 42 which are pivoted at the delivery end of the mechanism on the stationary pivot 43, which is a shaft common to both the take-off tables 10 and 11. The rails 42, 42 of take-off table section 11 are hung at the feed end of the take-off table from rack members 44, 44 which are engaged by pinions 44, 44 on shaft 45. Shaft 45 is rotated by means of the chain 46 extending between sprocket 47 on shaft 32 and sprocket on shaft 45. Accordingly, when the shaft 32 of take-off table section 11 is raised, the rails 42, 42 which carry the gate mechanism are raised at the feed end, and, therefore, the entire feed end of the take-off section 11 is raised to cooperate with the particular delivery belt of the duplex knife.

A slightly modified form shown in the side view of Figure 2 may be used in which a single vertical rack 131 holds shaft 18 and is connected by links 134 to rails 42; rack 131 is acted on by a pinion 133 on the shaft 132 to raise shaft 18 simultaneously with rails 42.

Take-off table section 10 may be operated in

the same manner from the same side of the machine (Figure 1) by shaft 32a carrying pinions 33a cooperating with racks 31a for the movable shaft of take-off table section 10. Shaft 32a is connected to the upper shaft 45a by chain 46a connected between sprockets 47a and 48a; shaft 45a carries pinions 44a to operate racks 43a to operate the rails 42a of take-off table section 10.

Again referring to Figure 2, a single rack member similar to member 131 for section 11 may be used for section 10 instead of the chain connection.

Shafts 32 and 32a of Figure 1 may, as above pointed out, be operated by a handle rotating worm 50 and 50a. The worm and worm gear set are used to give a high mechanical advantage in lifting the weight of this unit and also because a worm and worm gear combination is self-locking, thus removing the need for a ratchet or some such locking means.

During the operation of the entire mechanism, including the paper making or combining machinery and the delivery of the cut off, the shaft 15 is continuously operated. The gate 60 is in the down position. Accordingly, as the sheets 61 are fed off the delivery end of the cut-off onto the belts 17, the first sheet 61 is fed right up to the gate 60 where it is held against the gate by the friction of belts 17. The delivery may be sufficiently rapid to drive succeeding sheets up against the gate. However, in order to ensure that the upper sheets above the lowest sheets in the stack will be delivered up to the gate, and to hold them down and prevent fluttering, a small feed roller 65 is supported by the gate assembly and is connected to a pair of opposite links 66 pivotally mounted at 67 on the cross bar 63 of the main frame which carries the gate on rails 42. A motor 70 carried on the cross bar 63 has a drive pulley 71 axially aligned with the pivot 67 of links 66. A drive belt or chain 72 connects pulley 71 with pulley 73 on the roller 65 to drive the same in a clockwise direction with respect to Figures 1 and 2. The roller 65 is sufficiently heavy to drop down of its own weight on the top of the stack.

The sheets 61 are fed out by the delivery belt of the cut-off mechanism up to the roller 65 and the roller continues to feed the sheet up to the gate 60 where it is brought to a stop and then is only frictionally engaged by the rotating roller 65. When the gate 60 is lifted, as hereinafter described, the entire stack is fed toward the left or delivery end of the take-off table as shown in connection with take-off table section 10 (Figures 1, 2 and 3) and is fed off the delivery end of the take-off table either onto a stationary platform, whence the stack may be lifted, or onto a conveyor belt.

It will be obvious that belts 17 must accordingly move at a sufficient speed to allow the gate 60 to open, the stack 61 to move out and the gate to close once more to stop the next sheet immediately before the next sheet can reach the gate 60.

Accordingly, for 30" sheets, the entire operation must take place within a period of time of the order of half a second, and the device is adjusted to operate with sufficient speed to accommodate the shortest sheet.

The gates of take-off table sections 10 and 11 are shown adjusted for different lengths of sheets. The take-off table section 11 is shown operating on very short sheets and take-off table

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section 10 is shown operating on rather long sheets.

As previously pointed out, the gate assembly 40 comprises a frame having a cross bar 68 and side bars 80. The cross bar 68 connects the side bars 80 at the feed side end of the gate assembly. The delivery end of the side bars 80 are connected by the cross shaft 82 which carries to the gate 60. The gate 60 is keyed to the cross shaft 82 and is rotatable therewith. Side bars 80 are provided with blocks 90-91 which slide on the tracks 42, the tracks 42 being suitably arranged to retain the side bars.

In one preferred form, the side bars, as indicated in Figure 3, have blocks 90-91 having openings which slidably receive the guide bars 42. Tracks 42 are provided with racks 95, 95 which cooperate with pinions 96, 96 mounted on the shaft 97 carried between the side bars 80, 80 of the gate assembly 40, the said shaft 97 being rotatable by the handle 100. Operation of this handle will adjust the position of the gate with respect to the length of the sheet which is to be taken off, the gate being moved toward the delivery end for long sheets and toward the feed end for short sheets.

The gate is operated pneumatically by a piston 200 controlled by a solenoid control valve 201. Piston 200 has an extension 202 connected at the pivot 203 to the crank 204 which is keyed to the shaft 82 to rotate the same. Movement of the piston 200 toward the right will raise the gate 60, and movement of the piston 200 toward the left will lower the gate 60.

The solenoid control valve 201 comprises a double valve comprising valve elements 210 and 211 combined together by tie rod 212 for simultaneous operation.

When solenoid 215 is operated to move the valves toward the right, air pressure is admitted from inlet 220, to valve chamber 221, and then through passage 222 to the cylinder 223 to operate the piston 200 to the right to raise the gate. Air is exhausted from behind the piston through passage 225 into the valve chamber section 226 and out through passage 227. When solenoid 230 is operated to pull the valve to the left, air enters through passage 232 and valve chamber section 233, to the passage 225, to drive the piston 200 towards the left; and the air exhausts through passage 222, valve chamber section 226 and passage 227. When solenoid 230 is operated to pull the valve to the left, air enters through passage 232 and valve chamber section 233, to the passage 225, to drive the piston 200 towards the left; and the air exhausts through passage 227.

The solenoids 230 and 215 are controlled by vertically adjustable switch 240 (which is preferably a micro-switch). Switch 240 is mounted on bracket 242 supported between cross bars 80 adjacent the said side of the gate 60, and, as above pointed out, is vertically adjustable for desired stack height. When the appropriate number of sheets has been pushed up against the gate 60 in the manner above described, the topmost sheet operates the switch 240 to energize solenoid 215 and open the gate. When the stack has been moved out from beneath the switch 240, then this switch operates to de-energize solenoid 215.

Switch 240 is connected in such a manner that when not engaged by a stack, solenoid 230 is continuously energized to maintain the valve in a position to close the gate. The operation of switch 240 when the stack reaches the pre-set

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height de-energizes solenoid 230 and energizes solenoid 215. Removal of the stack operates switch 240 once more to de-energize solenoid 215 and energize solenoid 230.

By this means, therefore, a positive opening and closing of the gate 60 is obtained, utilizing the solenoids to control a valve which controls air under sufficient pressure to actuate the gate with the rapidity required. A foot switch may be arranged paralleling switch 240 to trip the gate open when waste paper comes through or to deliver a stack of less than predetermined height when desired.

The switch operator 240 is placed up near the feed side of the gate, as above pointed out, so that the solenoid 215 will be continuously energized until the stack 61 moves out from beneath the gate will be promptly closed. In appropriate cases, a sheet counter may be used to energize the solenoids after a pre-set sheet count to deliver stacks of predetermined number rather than of predetermined height.

The vertical adjustability of the feed ends of my take-off table sections 10 and 11 is an important feature which increases the utility and adjustability of my take-off table. The take-off table as a whole is mounted on rollers so that it may be moved laterally with respect to the cut-off. The take-off table sections 10 and 11 may be utilized individually to cooperate with separate feed outs 27 and 29 of the duplex cut-off knife 25. When, however, an extra wide sheet is being cut by either of the cut-off knives 26 or 28, and the entire width of both sections 10 and 11 is required, then both sections 10 and 11 may have their feed ends adjusted to cooperate with the feed out of one of the cutting knife assemblies, thus giving a take-off table of double the width.

Where cut-off knife 26 is cutting a relatively narrow sheet and cut-off knife 28 is cutting a relatively wide sheet, the entire take-off table unit may be moved laterally so that the dividing line between the take-off tables will be adjusted to the dividing line between the pairs of sheets being cut.

By this means, my novel compound take-off table may readily be used irrespective of the proportional width of the sheets being cut, and the longitudinal boundaries between the sheets being cut may be made to coincide with the longitudinal boundaries of the take-off table sections 10 and 11 simply by moving the take-off table unit as a whole laterally.

By this means, therefore, I have provided a take-off table mechanism which will stack and deliver sheets of any length and any width within the limits of the entire unit; that is, the take-off table is so designed that both sections may be used simultaneously for a single wide delivery, and the sections may be used independently for separate deliveries wherein either the left side can be lower and the right side upper or vice versa. The individual gates may be adjusted for separate sheet lengths and for different stack heights, or they may be adjusted for simultaneous operation. All of the adjustments are simple and obvious and readily operative even by an unskilled user.

In the foregoing, I have described my invention only in connection with a specific commercially effective embodiment thereof. Since my invention is capable of many variations and modifications which will be obvious to those skilled in the art, I prefer to be bound not by

the specific disclosures herein but only by the appended claims.

I claim:

1. A take-off table for receiving sheets from the delivery end of apparatus; said take-off table comprising at least a pair of parallel sections; means for independently adjusting the height of the portion of each section adjacent said delivery end of the apparatus; said sections being simultaneously movable normal to the direction of delivery to shift the dividing line between said parallel sections with respect to the said delivery end of the apparatus; said height adjusting means being selectively operable to adjust the said portions of each section to the same height and to different heights.

2. A take-off table for receiving sheets from the delivery end of apparatus; said take-off table comprising at least a pair of parallel sections; means for independently adjusting the height of the portion of each section adjacent said delivery end of the apparatus; said sections being simultaneously movable normal to the direction of delivery to shift the dividing line between said parallel sections with respect to the said delivery end of the apparatus, the portion of each section adjacent the delivery end being selectively operable to positions higher and lower than the other section.

3. A take-off table for receiving sheets from a plurality of deliveries at different levels; said take-off table having a plurality of parallel sections equal to the number of levels of delivery; each section extending along the line of delivery; the portion of each section adjacent the deliveries being selectively operable to different levels to cooperate with each of the deliveries.

4. A take-off table for receiving sheets from a plurality of deliveries at different levels; said take-off table having a plurality of parallel sections equal to the number of levels of delivery; each section extending along the line of delivery; the portion of each section adjacent the deliveries being selectively operable to different levels to cooperate with each of the deliveries; each such section being operable to the levels of any of the deliveries.

5. A take-off table for receiving sheets from a plurality of deliveries at different levels; said take-off table having a plurality of parallel sections equal to the number of levels of delivery; each section extending along the line of delivery; the portion of each section adjacent the deliveries being selectively operable to different levels to cooperate with each of the deliveries; all of said sections being operable to cooperate simultaneously with one of said deliveries.

6. A take-off table for receiving sheets from a plurality of deliveries at different levels; said take-off table having a plurality of parallel sections equal to the number of levels of delivery; each section extending along the line of delivery; the portion of each section adjacent the deliveries being selectively operable to different levels to cooperate with each of the deliveries; said take-off table being movable in a direction normal to that of delivery to shift the sections laterally with respect to the deliveries.

7. A take-off table for receiving sheets from a plurality of deliveries at different levels; said take-off table having a plurality of parallel sections equal to the number of levels of delivery; each section extending along the line of delivery; the portion of each section adjacent the deliveries being selectively operable to different levels to

cooperate with each of the deliveries; each section comprising a moving belt for moving sheets substantially along the line of delivery; a gate normal to the path of movement of the belt for blocking the movement of sheets thereon to cause the formation of a stack of sheets and means for raising the gate to deliver a stack of sheets.

8. A take-off table for receiving sheets from a plurality of deliveries at different levels; said take-off table having a plurality of parallel sections equal to the number of levels of delivery; each section extending along the line of delivery; the portion of each section adjacent the deliveries being selectively operable to different levels to cooperate with each of the deliveries; each section comprising a moving belt for moving sheets substantially along the line of delivery; a gate normal to the path of movement of the belt for blocking the movement of sheets thereon to cause the formation of a stack of sheets and means for raising the gate to deliver a stack of sheets; the position of said gate being adjustable for sheet length.

9. A take-off table for receiving sheets from a plurality of deliveries at different levels; said take-off table having a plurality of parallel sections equal to the number of levels of delivery; each section extending along the line of delivery; the portion of each section adjacent the deliveries being selectively operable to different levels to cooperate with each of the deliveries; each section comprising a moving belt for moving sheets substantially along the line of delivery; a gate normal to the path of movement of the belt for blocking the movement of sheets thereon to cause the formation of a stack of sheets and means operated by the height of the stack, for raising the gate to deliver a stack of sheets.

10. A take-off table for receiving sheets from a plurality of deliveries at different levels; said take-off table having a plurality of parallel sections equal to the number of levels of delivery; each section extending along the line of delivery; the portion of each section adjacent the deliveries being selectively operable to different levels to cooperate with each of the deliveries; each section comprising a moving belt for moving sheets substantially along the line of delivery; a gate normal to the path of movement of the belt for blocking the movement of sheets thereon to cause the formation of a stack of sheets and means for raising the gate to deliver a stack of sheets; the position of the gate of each section being independently adjustable for the sheet length received by that section.

11. A take-off table for receiving sheets from a plurality of deliveries at different levels; said take-off table having a plurality of parallel sections equal to the number of levels of delivery; each section extending along the line of delivery; the portion of each section adjacent the deliveries being selectively operable to different levels to cooperate with each of the deliveries; each section comprising a moving belt for moving sheets substantially along the line of delivery; a gate normal to the path of movement of the belt for blocking the movement of sheets thereon to cause the formation of a stack of sheets and means for raising the gate to deliver a stack of sheets and for maintaining the gate open until the stack has moved beyond it.

12. A take-off table for receiving sheets from a plurality of deliveries at different levels; said take-off table having a plurality of parallel sections equal to the number of levels of delivery;

each section extending along the line of delivery; the portion of each section adjacent the deliveries being selectively operable to different levels to cooperate with each of the deliveries; each section comprising a moving belt for moving sheets substantially along the line of delivery; a gate normal to the path of movement of the belt for blocking the movement of sheets thereon to cause the formation of a stack of sheets and means for raising the gate to deliver a stack of sheets and for maintaining the gate open until the stack has moved beyond it; means for closing the gate immediately after the stack has passed beneath it.

13. A take-off table for receiving sheets from a plurality of deliveries at different levels; said take-off table having a plurality of parallel sections equal to the number of levels of delivery; each section extending along the line of delivery; the portion of each section adjacent the deliveries being selectively operable to different levels to cooperate with each of the deliveries; each section comprising a moving belt for moving sheets substantially along the line of delivery; a gate normal to the path of movement of the belt for

blocking the movement of sheets thereon to cause the formation of a stack of sheets and means for raising the gate to deliver a stack of sheets; and additional means for feeding the sheets up to the gate.

14. A take-off table for receiving sheets from a plurality of deliveries at different levels; said take-off table having a plurality of parallel sections equal to the number of levels of delivery; each section extending along the line of delivery; the portion of each section adjacent the deliveries being selectively operable to different levels to cooperate with each of the deliveries; each section comprising a moving belt for moving sheets substantially along the line of delivery; a gate normal to the path of movement of the belt for blocking the movement of sheets thereon to cause the formation of a stack of sheets and means for raising the gate to deliver a stack of sheets; and a driven roller above the belt and biased toward said belt for engaging the upper surface of the sheets of the stack and moving the sheets up to the gate.

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