

[54] SHEET DELIVERY APPARATUS

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[51] Int. Cl. ... **B65h 29/32, B65h 29/54, B65h 29/68**

[58] Field of Search **271/74 R, 74 MS, 74 PG, 271/74 FC, 46, 68, 71, 180, 197**

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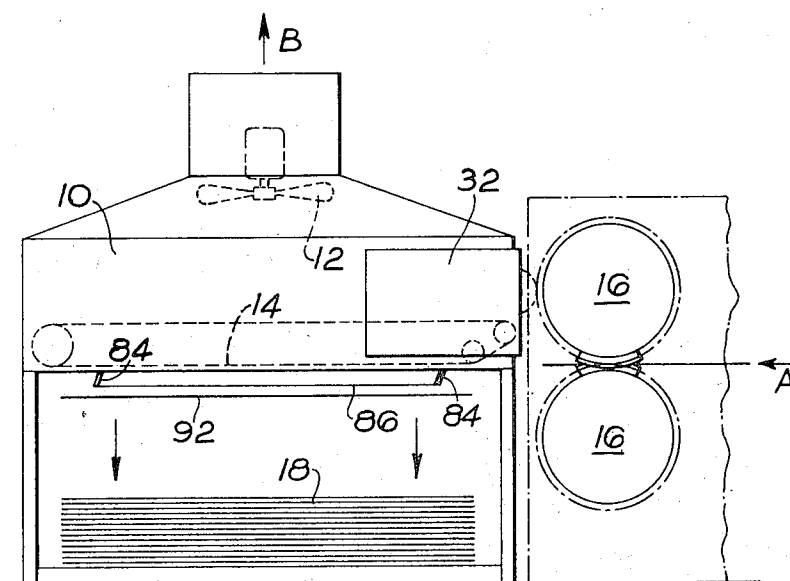
Attorney, Agent, or Firm—Marshall & Yeasting

[57]

ABSTRACT

A feeder for cut blanks of card and the like, having parallel conveyor belts with suction applied to draw the blanks against the lower run of the belts, ejector strips between the belts to be moved down into engagement with the blanks to brake them frictionally, seals carried by the ejectors to close off suction to the blanks without interfering with the suction means, and a Geneva mechanism for slowing the belts in timed relation to the ejector movement, so that the blanks are slowed, stopped and ejected to form a stack below the belts.

4 Claims, 9 Drawing Figures



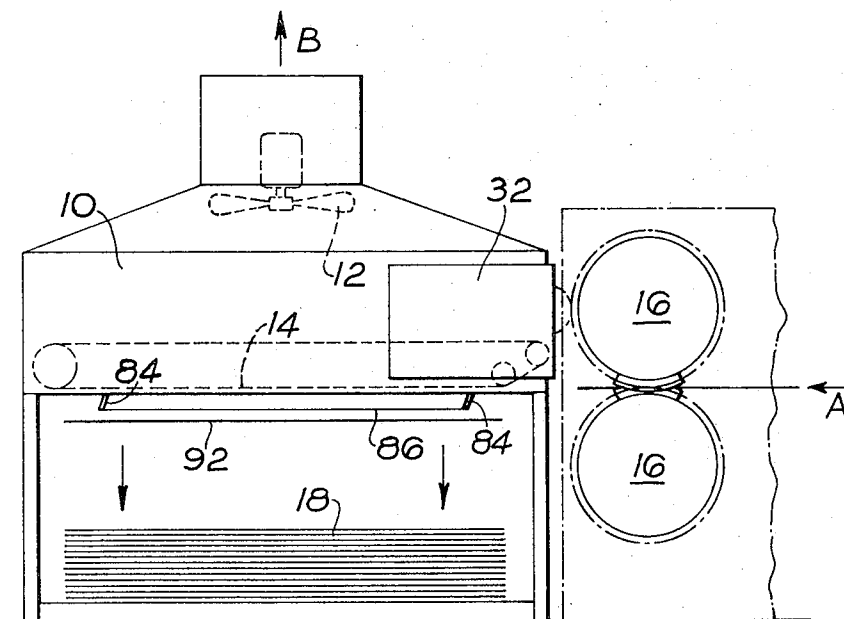


Fig. 1.

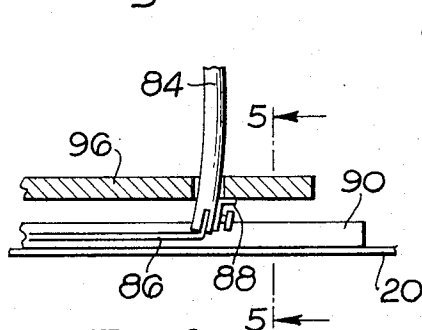


Fig. 3.

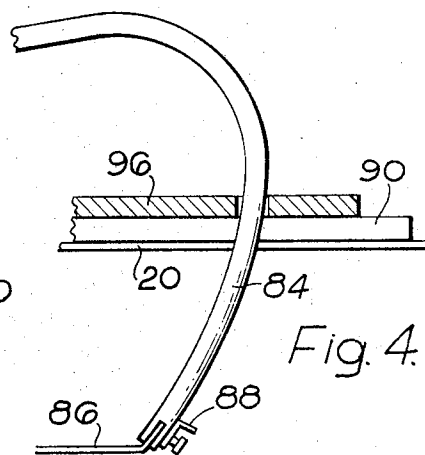


Fig. 4.

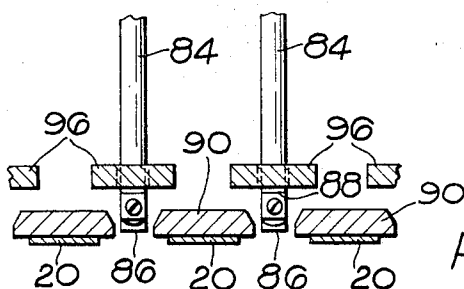


Fig. 5.

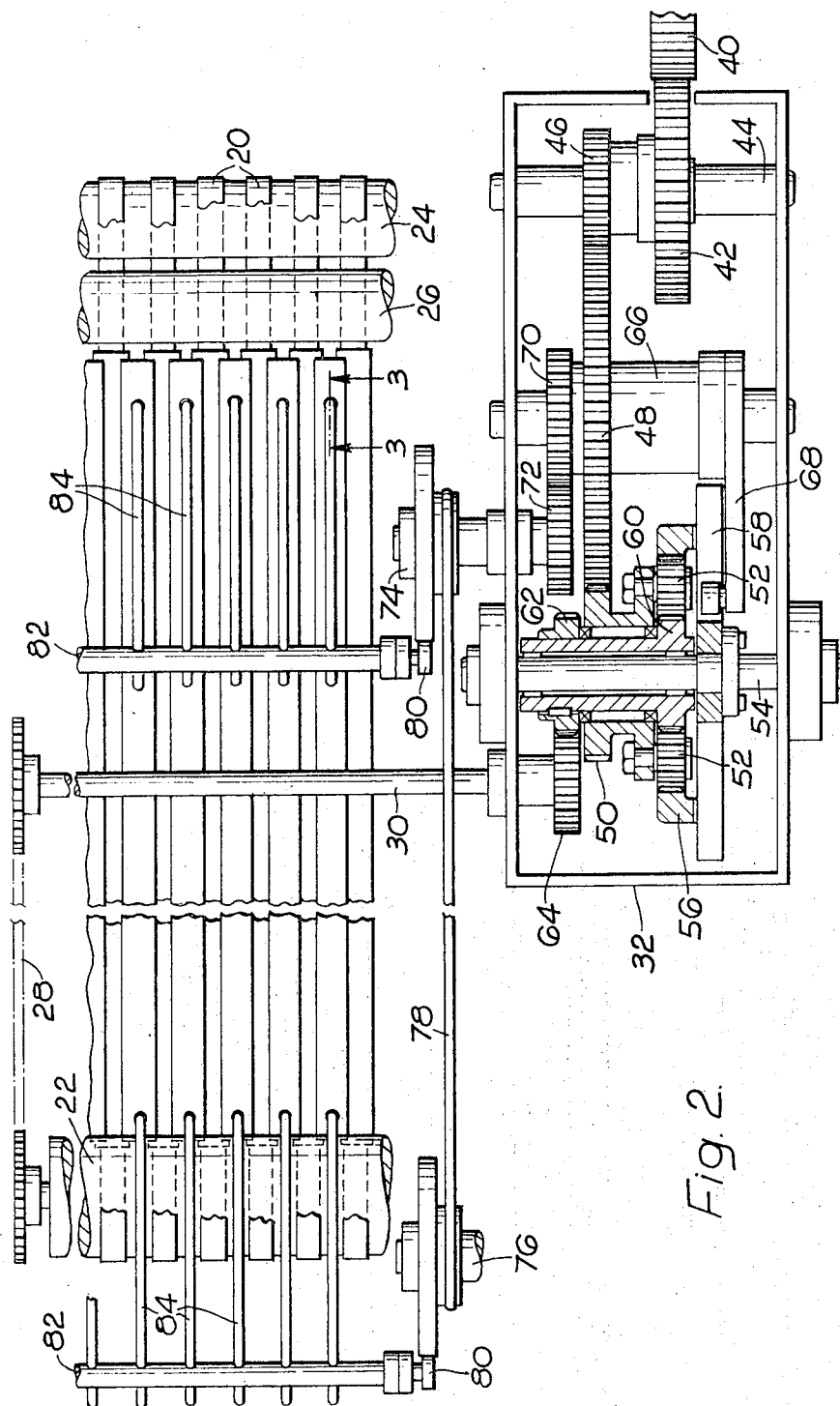
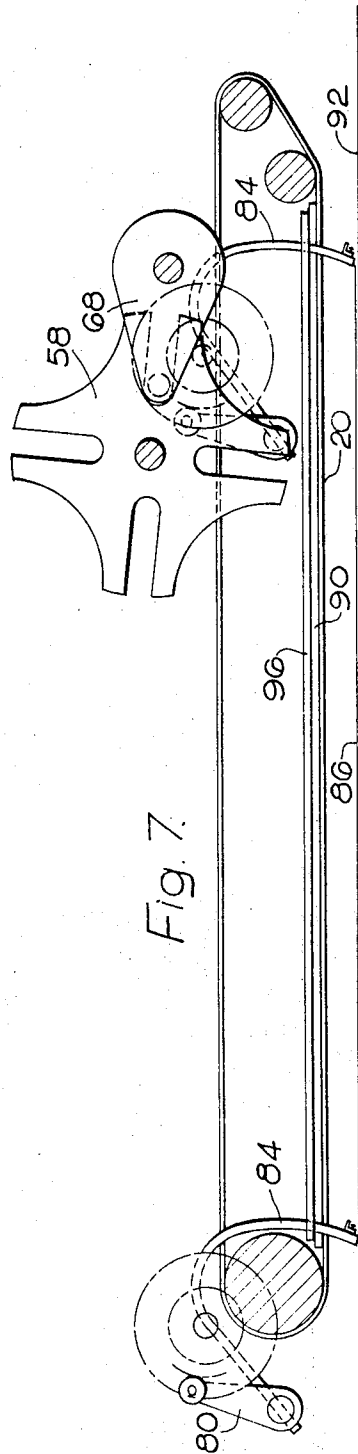
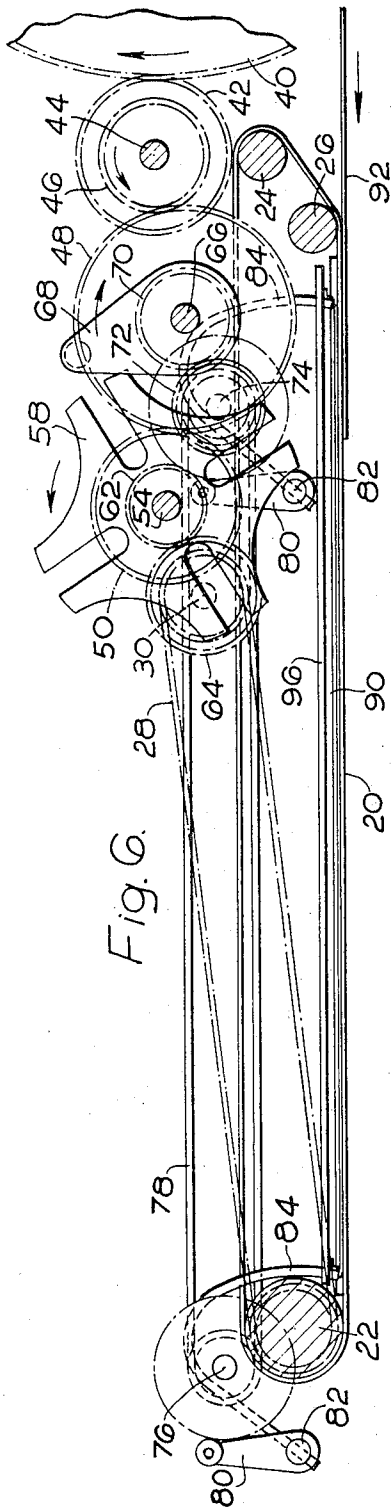


Fig. 2.



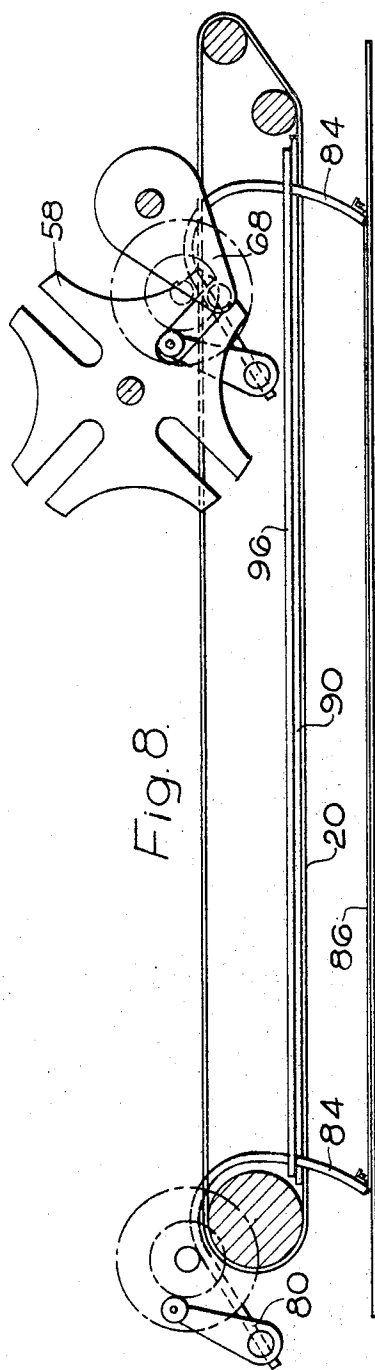


Fig. 8.

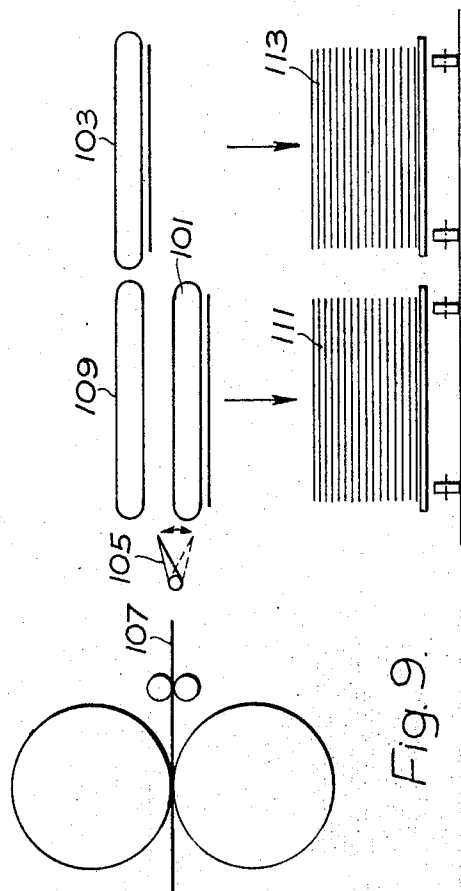


Fig. 9.

SHEET DELIVERY APPARATUS

BACKGROUND OF THE INVENTION

This invention relates to sheet delivery apparatus for use with, for example, a rotary die-cutter machine which cuts or cuts and creases a pattern in a blank of card, cardboard or the like, for receiving the cut blank from the machine before or after scrap has been stripped from the blank and delivering the blank to a stack. Hence the blank has to be slowed and stopped, and where the material is of thin card or has a complete pattern of such cuts it is relatively fragile and flexible.

SUMMARY OF THE INVENTION

In accordance with the invention sheet delivery apparatus comprises a plurality of parallel conveyor belts and suction means for drawing a blank against a lower run of said belts, means for reducing the speed of movement of the belts to slow a blank engaged therewith, and ejector means for extension through the inter-belt spaces to displace the engaged blank onto stack-forming means.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a somewhat diagrammatic side elevation of a sheet delivery apparatus;

FIG. 2 is a fragmentary and part sectional plan view of the apparatus;

FIGS. 3 and 4 illustrated a portion of the apparatus in two different positions;

FIG. 5 is a sectional elevation on the line 5—5 of FIG. 3;

FIGS. 6 to 8 are diagrammatic elevations showing parts in different positions; and

FIG. 9 is a diagrammatic view showing a modification.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings and particularly FIG. 1 thereof, the apparatus comprises an enclosed chamber 10 provided with suction means for example an extractor fan 12 in the roof of the chamber and having conveyor belt means 14 located towards the base of the chamber so that blanks travelling in the direction of the arrow A through cutting or like treatment rolls 16 pass along the underside of the lower run of the belt 14 and are arrested and discharged to accumulate in the stack 18.

Referring next to FIG. 2, to conveyor 14 comprises a series of parallel and separate, relatively narrow belts 20 which extend around end rolls 22, 24 and possibly also a tensioning roll 26. One of the rolls 22 is driven for example by a chain belt 28 from a drive shaft 30 which is an output shaft from a gear box 32. The belts are preferably driven at a speed comparable to the speed of the blanks leaving the apparatus 16 and are cyclically and in synchronism with the spacing of blanks leaving the treatment apparatus 16, slowed and reaccelerated.

Mechanism for causing the slowing and reacceleration of the belts will now be more particularly described.

Referring to FIGS. 2 and 6 to 8 it will be seen that the input to the gear box comprises gear 40 which may be

part of the apparatus 16 (thereby achieving synchronism) and this engages pinion 42 on a first shaft 44 and shaft 44 drives via a train of pinions 46, 48, 50 to impart constant speed rotation to an input member or carrier element of an epicycle gear set. The input member carries planet gears 52 and hence these are rotated about the axis of shaft 54 at constant speed. The planets mesh with an annulus gear 56 carried by a Geneva wheel 58 and also mesh with a sun gear 60 which is keyed to an output pinion 62. The latter is meshed with pinion 64 which drives shaft 30.

Hence, assuming the Geneva wheel 58 to be held stationary, constant speed drive is transmitted through the gear box to the shaft 30 and hence to the roll 22 and the belts 20.

However, pinion 48 is fast with hub 66 carrying a rotor arm 68 so that the latter is rotated synchronously and picks up one of the radial slots of the Geneva wheel once in each rotation of the arm 68 so as to turn the Geneva wheel through approximately one-quarter of a revolution for each one revolution of the arm 68. This engagement and drive is best seen in FIGS. 6 to 8. Hence, during the portion of the complete cycle (possibly representing one complete revolution of the rolls 16) when the Geneva wheel is turning, the annulus 56 is turned relative to the carrier 50 so as to contra-rotate the planets but to less effect than the rotation imparted thereto by the carrier, and the net effect is to slow the sun pinion and hence the output pinion and the belts. As the drive to the Geneva wheel is diminished and cuts out, the planets and hence the sun pinion automatically revert to full speed.

The timing of the gear box variation of belt speed relative to other operations of the apparatus will be described hereinafter.

Hub 66 also provides drive via a pair of meshed pinions 70, 72 to a first cam shaft 74 which is synchronised in rotation with a second cam shaft 76 via a flexible transmission 78. Each of the cam shafts turns a cam which operates on a corresponding cam follower to operate a pair of rocker arms 80 and each of the rocker arms carries a transverse shaft 82 which extends parallel to the end rolls 22, 24 of the belts and each forms the spine of a comb having tines 84. One tine is located between each two adjacent belts 20.

Stretched between the free ends of the tines, that is between the tines 84 adjacent the roll 22 and the tines 84 adjacent the roll 24 are a series of strips 86 each having its opposite ends anchored to the two tines, conveniently by a screw clamp retaining the end of the strip 86 in a bifurcation in the tine and also serving to anchor an L-shaped abutment piece 88 (for a purpose hereinafter described).

Conveniently the structure of the apparatus includes a series of laths 90 extending along the lower side of the chamber and forming abutments for the individual belts 20, the tines and strips 86 operating in the spaces between the adjacent laths; see FIG. 5.

It will be noted that the tines are curved, so that in the case of the left-hand ones shown in FIG. 8, the tines may be pivoted at one side of the end roll 22 and extend over the roll and then downwardly between the laths. The two sets of tines are swung synchronously, and are of a similar shape and dimensions so that the strips are maintained taut during movement between two extreme positions. In one extreme position illustrated in FIG. 5, the strips 86 are located above the

lower runs of the belts **20** and in the inter-lath spaces (or possibly above the laths). As movement of the tines commences under cam action, the strips move towards the plane occupied by the lower runs of the belts, becoming co-planar with the belts and hence, when the blank is fed in and adheres to the lower side of the lower run of the belts as a result of the suction extracting air upwardly as in FIG. 1 and indicated by the arrow B, the strips are brought into contact with the blank and because the strips are not moving in the feed direction with the belts they cause a frictional engagement with the blank along parallel zones spaced between the belt zones. As the movement continues, the strips are displaced through the plane of the belts and push the blank downwardly to the position illustrated by the reference **92** in FIG. 1 separating the blank from the belts and allowing it to descend to join the stack **18**. The strips are then returned to the FIG. 5 position.

FIG. 3 also shows the fully retracted position of the strips and FIG. 4 shows the fully extended position of the strips.

Associated with each inter-lath space is a closure member or seal flap **96** which is of a length and width sufficient to rest on both adjacent lath **90**, and apertured to permit the tines **84** to pass therethrough. During the upward movement of the tines from the FIG. 4 position to the FIG. 3 position, the abutments **88** (previously referred to) pick up the seals **96** and elevate them to the FIG. 3 position spaced above the laths, and in the opposite direction of movement of the tines the seals are lowered to the laths, reaching the latter shortly after the strips have passed through the co-planar condition with the belts towards the FIG. 4 position.

Hence, whilst the strips are merely exerting frictional resistance to movement upon the blank carried by the belts as the strips move through the co-planar position, the suction effect is reduced as the seals move towards the laths, and as these seals rest on the laths the suction effect is substantially cut-off in that air can no longer flow through the inter-belt spaces. This enables the blank to be pushed off the belts.

However when the strips return and lift the flaps **96**, the suction effect on the underside of the belts is quickly re-established because of the relatively large areas through which the air can travel, and the relatively small impediment to flow provided by the strips **86**, since the latter may be of thin material. Moreover as illustrated in FIG. 5, the laths may be provided with bevelled edges so that in the uppermost position of the strips the latter are located in a widened area facilitating air flow about them.

The timing provided by the gear box and the cams is preferably such that as a blank emerges from the treatment apparatus and engages against the underside of the belts, full suction is applied, the belts are driven at full speed and the strips are in the extreme uppermost position. As the blank travels along towards the roll **22** the belts are first slowed to slow the blank therewith, the strips are then displaced to frictionally engage the blank, whilst the suction is still applied and effective, and so slow the blank relative to the belts, and only then is suction cut off as the strips displace the blank from the belts.

It will be noted that the variation of suction effect on the blanks is achieved without any control on the extractor fan or other suction means and without any

complicated valve arrangement between the suction fan and the chamber **10** and in fact during the portion of the cycle when the flaps are in the sealing position the pressure in the chamber **10** falls below a normal figure so that upon reopening of the inter-lath spaces by elevation of the flaps **96**, the excessively low pressure in the chamber **10** is available to build up a suction effect for an incoming blank in very rapid fashion.

In the modification illustrated in FIG. 9, two complete sheet delivery apparatuses **101**, **103** are provided spaced apart along the direction of a feed path and at different elevations, a switch gate **105** being provided to deflect incoming blanks **107** so that they either pass directly to the apparatus **101** or to a conveyor, which may consist of further belts in similar fashion to the apparatus described with reference to FIGS. 1 to 8 but without any speed varying means or strips, and which is identified by the reference **109**, so as to pass such blanks to the apparatus **103**. This may enable two piles of blanks **111**, **113** to be built up, either by passing all of the blanks to the apparatus **101** until a stack is completed and then switching to the apparatus **103** while the first stack is removed, or possibly feeding alternate blanks along alternate routes, and the latter may be particularly advantageous where very closely spaced sheets arrive, in allowing greater time for the deceleration stages.

It will be appreciated that many other modifications are possible within the scope of the invention. For example, the strips may be tilted during their movement so that for example the leading end descends first or further than the trailing end of the strips which may increase the frictional effect on the leading end of the strips and/or assist in separation of the sheets from the belts against residual suction, and further in any arrangement where parts of the apparatus are duplicated to allow two or more stacks to be built up successively or together, counting means may be provided so as to cause ejection of completed batches of blanks.

The stack may in any event be formed upon a table which is arranged to be lowered intermittently or continuously so that the space between the top of the stack and the belts is maintained substantially uniform, and it will also be appreciated that it is possible to provide an intermediate conveyor between the treatment apparatus and the apparatus described, and vary the angle of the same and the height of the apparatus to like effect.

The stack may be formed between guides, which may be oscillated to produce stacks of regular shape.

I claim:

1. A sheet-delivery apparatus for cut blanks, comprising a plurality of spaced parallel conveyor belts, means for driving the belts, means for placing the space above the belt runs under reduced pressure, ejector means, means for moving the ejector means downward between the belt runs to deliver blanks which have been held against the underside of the belt runs by the reduced pressure above, and a backing member extending longitudinally along the upper surface of each belt run, the backing members above adjacent belt runs being spaced apart, wherein the improvement comprises a sealing flap arranged above and extending the full length of the space between adjacent backing members, said flap being slidably mounted on the ejector means, and an abutment on the ejector means which lifts the flap when the ejector means is moved to an

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upper position, and permits the flap to seal the space between the backing members as the ejector means is moved toward a lower position.

2. A sheet delivery apparatus according to claim 1 wherein the means for driving the belts includes speed-control means for reducing the speed of movement of the belts in synchronism with the operation of the means for moving the ejector means, to cause the cut blank to be transferred from the belt runs to the ejector means without disarranging the cut portions of the blank.

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3. Apparatus according to claim 2 wherein the means for moving the ejector means is coupled to the belt-driving means and is synchronised with said speed-control means so that the ejector means engages the blank as the belt speed approaches zero.

4. Apparatus according to claim 3 wherein the ejector means includes elongate blank-engaging portions having blank engaging faces and means for maintaining said faces parallel to the lower runs of the belts as the ejector means is extended therethrough.

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