Oct. 14, 1952 J. E. BATTERSBY 2,613,741

APPARATUS FOR CUTTING SHEETS FROM WEBS OF CARDBOARD, PAPER, AND THE LIKE

Filed March 29, 1950 3 Sheets-Sheet 1

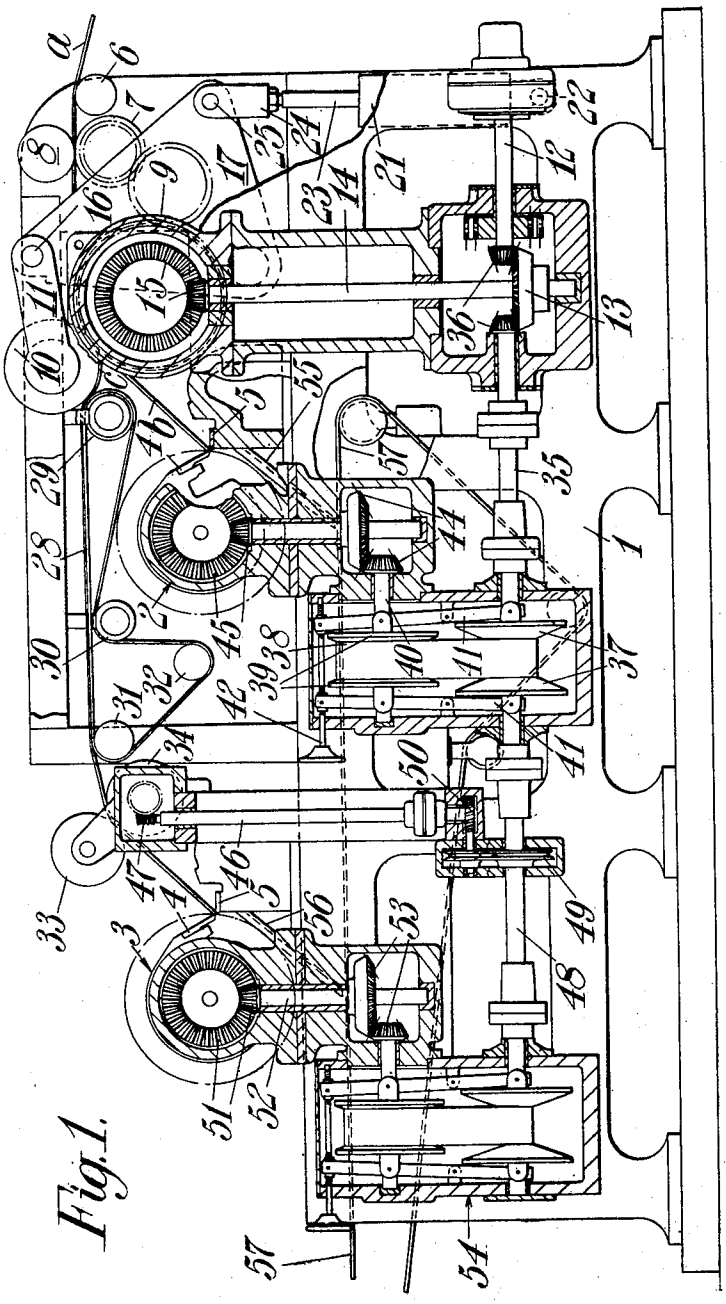


Fig. 1.

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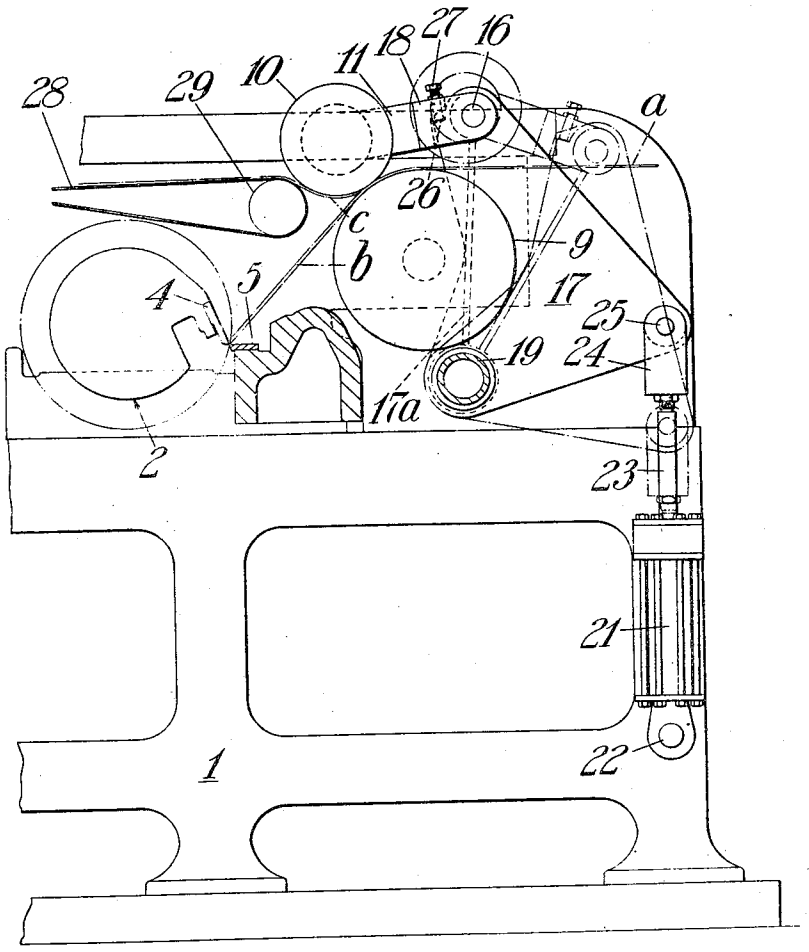



Fig. 2.

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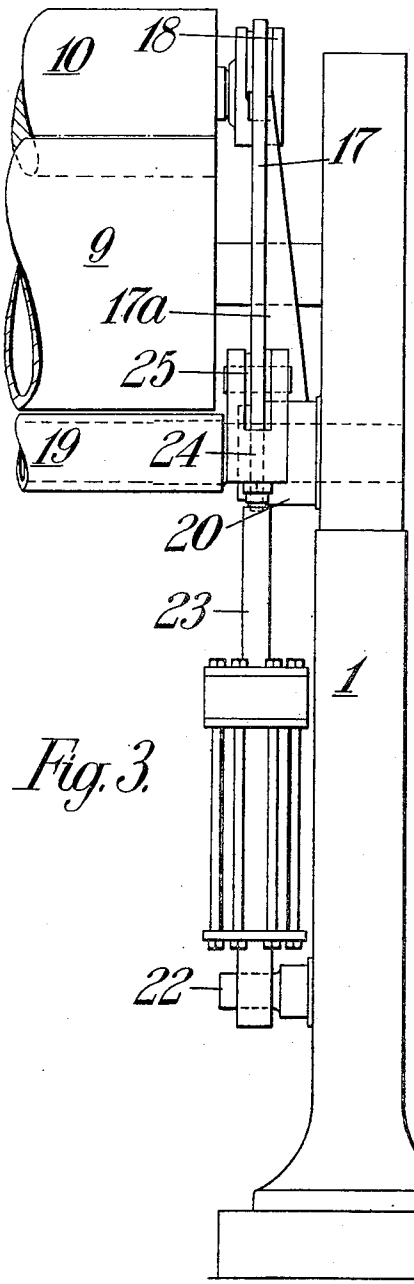



Fig. 3.

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# UNITED STATES PATENT OFFICE

2,613,741

## APPARATUS FOR CUTTING SHEETS FROM WEBS OF CARDBOARD, PAPER, AND THE LIKE

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8 Claims. (Cl. 164—68)

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This invention relates to apparatus for cutting sheets from webs of cardboard, paper and the like, of the kind comprising feed rolls for longitudinally slit webs and a plurality of cutters for cutting the webs transversely, arranged so that webs can be fed from the rolls to any one or more of the cutters. By operating the transverse cutters at different speeds, this arrangement allows one or more of the webs which have been divided longitudinally by slitting means to be fed to one of the cutters whilst the remainder are fed to another cutter and thus sheets of two different lengths can be produced simultaneously. It is usual to arrange one of a pair of cutters adjacent to the feed rolls, the second cutter being at some distance away and the webs travelling to the said second cutter over a table located above the first cutter, said webs being fed to the second cutter by auxiliary feed rolls or equivalent means.

Apparatus of the above kind is intended particularly for cutting sheets of cardboard and the like and is generally operated in tandem with the board making machine, since the thickness and rigidity of the board makes it inconvenient or difficult to wind in a reel. However the apparatus can be employed with thinner material and the webs can if desired be drawn from a reel or reels instead of direct from the board making machine. It is necessary that the webs fed to the respective cutters should leave the main feed rolls at different angles and this involves considerable difficulties both in the initial feeding of the webs and during the operation of the machine, especially with cardboard and like webs. The web tends to leave the feed rolls in the direction of their common tangent, and in the usual arrangements hitherto employed the rolls are disposed so that this tangent lies between the optimum directions for the respective cutters but nearest to the line of the table aforesaid, the webs passing to the first or nearer cutter being diverted away from the common tangent and towards the said cutter by a pair of suitably disposed guide rolls. When webs are being received from a cardboard making machine at high speed, for example 400 feet per minute, and may be many feet in width, the initial feeding of board to the respective cutters requires great skill and frequently involves extensive waste of board as well as risk of damage to the machinery. The usual practice is for an operator to cut a tail a few inches in width from the web of board with a hand knife, and this tail is fed through the main feed

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rolls and the aforesaid guide rolls to the first or nearest cutter, the tail being then gradually widened until the full width of web is being fed. A second tail is similarly cut and fed over the table to the second cutter and similarly widened. Apart from the difficulties attendant upon the above described initial web feeding operations, it is found that the appreciable angle through which the webs are bent in their path from the main feed rolls to one of the two cutters leads to irregularities in feeding under normal operating conditions and results in inaccurate cutting of the sheets. It is the object of the invention to provide improved web cutting apparatus employing duplex cutters in which the above disadvantages are overcome in a simple and convenient manner.

A further object is to provide an improved mounting of the feed rolls which draw the longitudinally slit webs and feed them to the respective cutters so that the most favourable feeding conditions may be provided for the respective cutters.

A further object is to provide an improved mounting for the aforesaid feed rolls which enables the most favourable feeding conditions to be initially provided for feeding slit webs to one of the plurality of cutters and for subsequently providing favourable feeding conditions for another of the cutters.

A further object is to provide simple and convenient means which can be power operated whereby the required adjustment of the aforesaid feed rolls may be effected.

A further object is to provide, in conjunction with means for adjustably mounting the feed rolls as described above, an arrangement whereby the feed can be readily interrupted when desired.

A further object is to provide improved means for effecting the passage of the web or webs to the cutter which is further from the feed rolls than the nearest cutter.

An example of one possible mode of carrying the invention into practical effect is illustrated in the accompanying drawings in which:

Figure 1 is a side elevation, partly in section, of a duplex sheet cutting apparatus constructed in accordance with the invention;

Figure 2 is a side elevation, partly in section to an enlarged scale, of one end of the sheet cutting apparatus showing the mechanism for adjusting the relative position of the feeding rolls;

Figure 3 is an end view of one side of the adjusting mechanism shown in Figure 2.

The invention will be described as applied by way of example to a cardboard web cutting apparatus comprising two rotary cross cutting devices of the kind having a rotating knife, generally of helical or offset form to give a straight cut across the travelling web, co-operating with a fixed knife, the cutting devices being arranged one behind the other with suitable means for supporting the web above the first cutting device and leading it to a pair of auxiliary feed rolls which feed the web to the second cutting device.

Referring to the drawings, the apparatus comprises a main frame 1 upon which are rotatably supported two rotary cutting devices indicated generally at 2 and 3. The rotatable helically disposed knives 4 of these cutting devices co-operate with fixed knives 5. The cardboard web *a* received from a board making machine or other source of supply enters the apparatus upon a supporting roll 6 and passes between rotary slitting knives 7 and 8 by the action of which it is divided longitudinally into two or more webs according to the number of pairs of slitting knives employed. The webs are drawn into the apparatus by main feed rolls 9 and 10 which are situated adjacent the first cross cutting device 2. The lower main feed roll 9 is driven and the upper roll 10 is carried by pivoted links 11 so that it rests upon the lower roll, the weight of the upper roll being sufficient to maintain the desired feeding roll pressure. This may be supplemented by weights or springs if necessary. The bearings for the lower roll 9 are fixed and this roll is driven from the main shaft 12 through bevel gearing 13, vertical shaft 14, and bevel gearing 15. The links 11 which carry the upper roll 10 are pivotally connected at 16 to a pair of plates 17 of generally triangular shape and each having a stiffening rib 17*a*. It will be understood that there are two links 11, one at either end of the roll 10, and two plates 17 similarly arranged at either side of the main frame 1. This arrangement is shown in detail in Figures 2 and 3. The links 11 have bifurcated ends 18 carrying the pivots 16. The plates 17 are rigidly connected by a hollow spindle 19 rotatably supported in bearings 20 in the main frame, the plates being thereby pivotally mounted about the axis of the said spindle which is located below and somewhat to the side of the axis of the roll 9. A hydraulic cylinder 21 is anchored at its lower end to a pivot pin 22 on one side of the main frame and its piston rod 23 has a bifurcated head 24 connected by a pivot 25 to one of the plates 17. Suitable control means of a well-known kind are provided for admitting hydraulic fluid to one or other end of the cylinder 21 to adjust the angular position of the two plates 17 and thereby vary the angular position of the upper roll 10 with respect to the lower roll 9. Each of the plates 17 has formed on it an abutment surface 26 which can be engaged by a stop screw 27 mounted on the link head 18. The arrangement is such that when the plates 17 are swung in a clockwise direction to a predetermined position, the screws 27 engage the abutment surfaces 26 and upon further movement of the plates rearwardly the links will be raised so that the upper roll 10 is lifted from the surface of the lower roll as shown in broken lines in Figure 2, and the feed of the web is thereby interrupted. Angular displacement of the plates 17 in the opposite direction will first cause the upper roll 10 to engage the lower roll and subsequently to move in an arcuate path concentric with the axis of the said lower roll.

A tape or other suitable form of conveyor 28 is arranged above the first cross cutting device 2 and is carried upon rolls 29, 30, 31 and 32. The purpose of this conveyor is to lead one or more of the slit webs to a pair of auxiliary feed rolls 33 and 34 for feeding such web or webs to the second cross cutting device 3. These auxiliary rolls are arranged with their common tangent so disposed in relation to the fixed knife 5 of the cutting device 3 that the most favourable condition for feeding the board is obtained, i. e. so that the path of the board between the feed rolls and the cutting line approximates to the common tangent of the rolls.

The drive for the first cross cutting device 2 is provided by a shaft 35 driven by a bevel gear 36 from the gear 13, and an infinitely variable ratio speed changing device comprising a pair of adjustable cone pulleys 37 on shaft 35, a belt 38, a similar pair of adjustable cone pulleys 39 on a shaft 40, and pivoted levers 41 actuated by a threaded spindle 42 for adjusting the cone pulleys. The shaft 40 drives a vertical shaft 43 through bevel gears 44 and the vertical shaft drives the cutter drum through bevel gears 45. The lower auxiliary feed roll 34 is driven from a vertical shaft 46 through skew gears 47, the said vertical shaft being driven from an extension 48 of the shaft 35 by a belt 49 and gearing 50. The second cross cutting device 3 is driven from shaft 48 through bevel gears 51, vertical shaft 52, bevel gears 53, and an infinitely variable ratio change speed device indicated generally at 54 which is similar to that previously described for driving the first cutting device 2. The sheets severed from the board webs by the cutting devices 2 and 3 are directed by inclined guides 55 and 56 to the upper horizontal surface of a tape or other suitable travelling conveyor or conveyors 57 by which they are transported to any convenient point for stacking or to a stacking device or layboy.

The arrangement is such that the longitudinally slit board web *a* is drawn into the apparatus by the main feed rolls 9 and 10. The slitting cutters 7 and 8 may be carried on the apparatus as shown in Figure 1, or they may be separately arranged and driven if desired. In the initial web feeding operation, the upper feed roll 10 is adjusted, by means of the hydraulic cylinder 21, so that the webs are fed over the conveyor 28 to the auxiliary feed rolls 33, 34 which direct the webs to the second cross cutting device 3. This is effected by adjusting the pivoted plates 17 and hence the position of the upper roll 10 in relation to the lower roll 9 so that the webs leaving the rolls at their natural angle will pass readily to the conveyor, and thus no difficulty in the initial feeding operation is encountered. To obtain this condition, the roll 10 would require to be positioned near the top of the lower roll 9 i. e. to the right as viewed in Figures 1 and 2. When it is desired to feed a web or webs to the first cross cutting device 2, the upper feed roll 10 is adjusted in the direction of web feed so that the common tangent of the rolls 9, 10 is directed downwardly to afford the most favourable conditions for feeding to the cutter. If is found that this adjustment of the rolls does not materially affect the feeding of the webs which are already travelling over the conveyor 28 to the second cutting device. A tail or strip of board is then initially fed to the main feed rolls

9 and 10 and by reason of their adjusted relation as described above this tail will be directed downwardly towards the cutting device 2 and the feed of this web can be continued thereto without difficulty or irregularity under ordinary operating conditions. This adjusted position of the main feed rolls is shown in Figures 1 and 2 and it will be seen that the common tangent of the rolls lies in the general direction of the transverse cutting line of the nearer cutting device 2. The web or webs passing to the first cutting device 2 are shown at *b*, and the web or webs passing to the second cutting device 3 are shown at *c*. When it is desired to interrupt the feeding of the webs by the rolls 9 and 10, this is readily effected by swinging the plates 17 rearwardly to the position shown in broken lines in Figure 2 which causes the roll 10 to be lifted bodily from the roll 9.

It will be understood that other mounting means for the roll 10 whereby it can be adjusted angularly in respect to the roll 9 may be employed, and the construction described represents one example of many possible arrangements. Also whilst the invention is applicable with particular advantage to the cutting of sheets from cardboard and similar relatively thick material it is not restricted thereto but may be used with thinner material such as paper and the like.

I claim:

1. In an apparatus for cutting sheets from longitudinally slit webs having a plurality of cutters for cutting the webs transversely and web feeding means arranged so that webs can be fed to any one or more of the cutters, the combination with a pair of coacting web feed rolls for feeding the slit webs to the cutters, of means for adjustably varying the relative angular relationship of the said feed roll axes in such a manner that the direction of the common tangent of the roll surfaces can be varied between positions corresponding to favourable feeding conditions for one or other of the cutters.

2. In an apparatus for cutting sheets from longitudinally slit webs having a plurality of cutters for cutting the webs transversely and web feeding means arranged so that the webs can be fed to any one or more of the cutters, the combination with a main lower web feed roll having a relatively fixed axis and a main upper web feed roll coacting with said lower roll for feeding all the webs towards the cutters, of mounting means for said upper feed roll permitting adjustment of the axis thereof over an arcuate path and means for effecting such adjustment to vary the angular relation of the upper and lower roll axes so that the direction of the common tangent of the roll surfaces can be varied between positions corresponding to favourable feeding conditions for one or other of the cutters.

3. In an apparatus according to claim 2, a pivotally adjustable structure and links connecting the main upper web feed roll with said structure, the said main upper web feed roll resting upon the lower feed roll so that by adjusting the said structure the desired arcuate adjustment of the main upper feed roll is obtained.

4. In an apparatus according to claim 2, a pivotally adjustable structure and links connecting the main upper web feed roll with said structure, the said main upper web feed roll resting upon the lower feed roll, and power means operatively connected to said structure for effecting angular adjustment thereof about its pivot whereby the desired arcuate adjustment of the main upper feed roll is obtained.



5. In an apparatus for cutting sheets from longitudinally slit webs having a plurality of cutters for cutting the webs transversely and web feeding means arranged so that webs can be fed to any one or more of the cutters, the combination with a pair of coacting web feed rolls for feeding the slit webs to the cutters of means for adjustably varying the relative angular relationship of the said feed roll axes in such a manner that the direction of the common tangent of the roll surfaces can be varied between positions corresponding to favourable feeding conditions for one or other of the cutters, and means for lifting one of the said web feed rolls away from its associated roll to interrupt the feeding of the webs.

6. In an apparatus for cutting sheets from longitudinally slit webs having a plurality of cutters for cutting the webs transversely and web feeding means arranged so that the webs can be fed to any one or more of the cutters, the combination with a main lower web feed roll having a relatively fixed axis of a main upper web feed roll coacting with the lower feed roll for feeding all the webs towards the cutters, a member pivoted about an axis, links connecting the main upper feed roll which rests upon its coacting lower feed roll so that angular adjustment of said member about its pivot effects adjustment of the main upper feed roll to vary the direction of the common tangent of the main upper and lower feed rolls between positions corresponding to favourable feeding conditions for one or other of the cutters, stop means on the said links and abutment means on the said member engageable by the link stop means when the member is angularly adjusted beyond the required range of arcuate adjustment of the roll, the arrangement being such that further movement of the member beyond the said range raises the links and thereby lifts the upper feed roll from its coacting lower roll to interrupt the feed of the webs.

7. In an apparatus for cutting sheets from longitudinally slit webs comprising coacting main web feed rolls, a cross cutting device disposed adjacent said main feed rolls for receiving a web directly therefrom, a second cross cutting device disposed at a distance from said main feed rolls, and auxiliary feed rolls for feeding a web from the main feed rolls to said second cross cutting device, the combination with said main feed rolls of means for adjusting the angular relation of the axis of one of the rolls with the axis of the coacting roll to vary the direction of the common tangent of the roll surfaces between a position affording favourable conditions for feeding a web to the second cross cutting device and a position affording favourable conditions for feeding a web to the first cross cutting device.

8. In an apparatus according to claim 7, an upper main feed roll resting upon a lower main feed roll, a pivotally mounted structure, links connecting said upper main feed roll with said pivotally mounted structure, and fluid actuated piston means operatively connected to said pivotally mounted member for rocking the same whereby the angular relation of the upper feed roll axis to the lower feed roll axis can be adjustably varied.

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