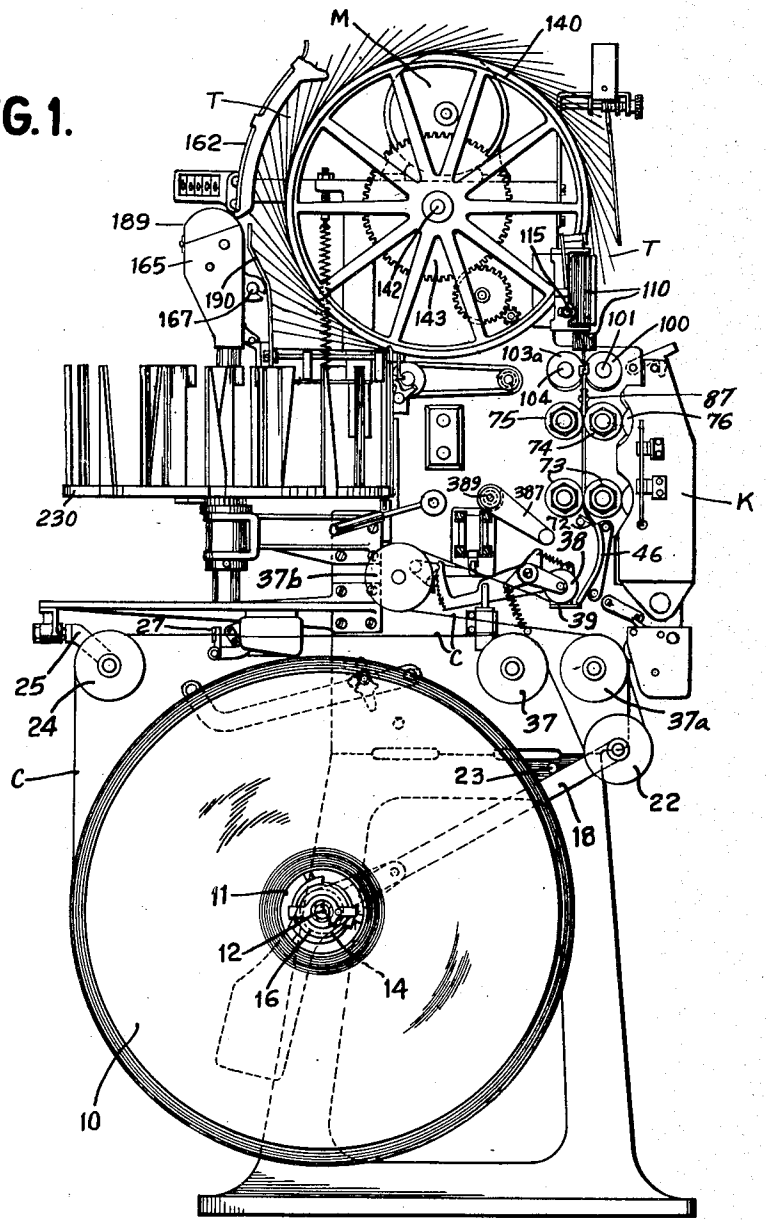
April 2, 1940. F. M. CARROLL 2,195,849

CUTTING MEANS

Original Filed Jan. 26, 1937 7 Sheets-Sheet 1

FIG. 1.



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FIG. 2.

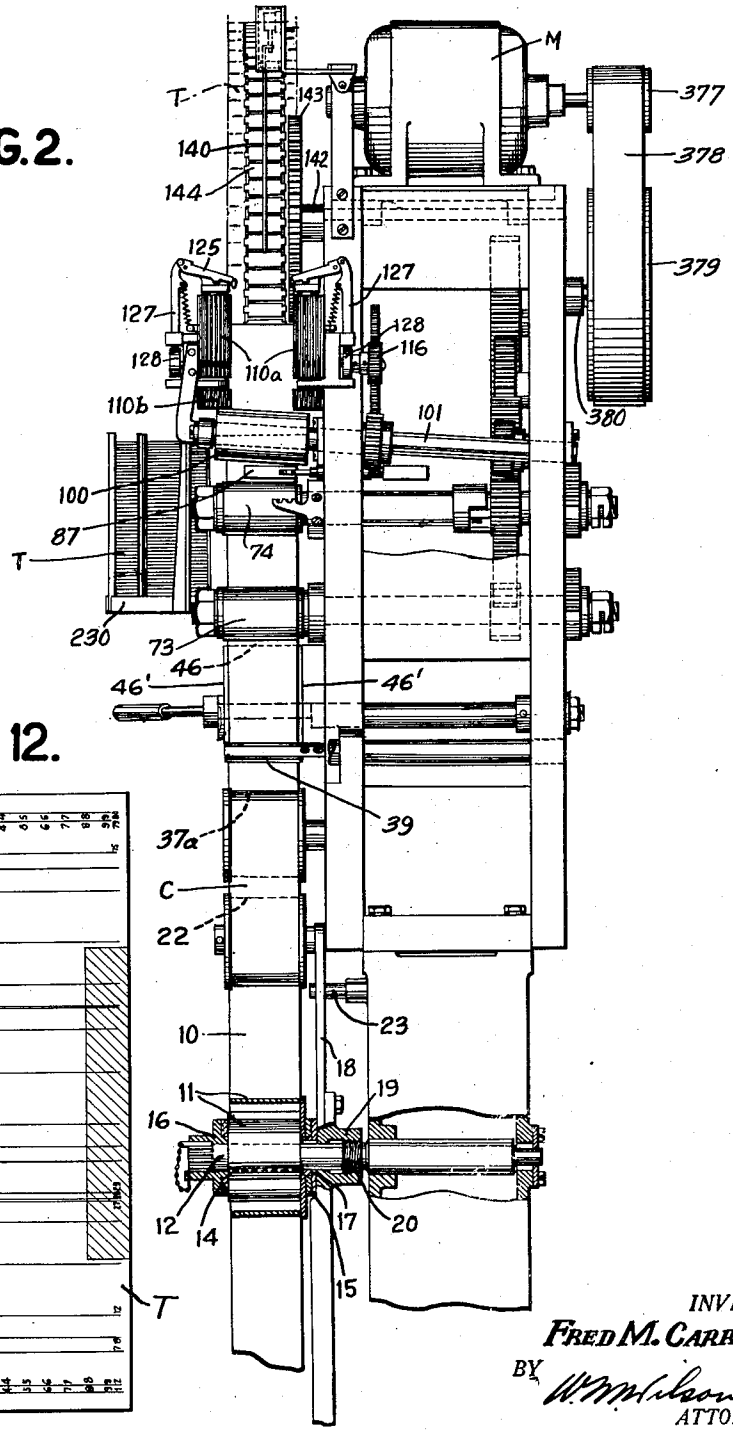
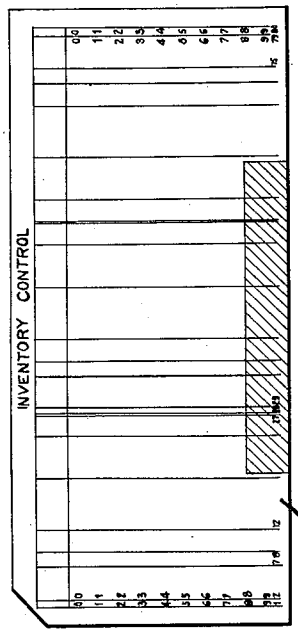


FIG. 12.



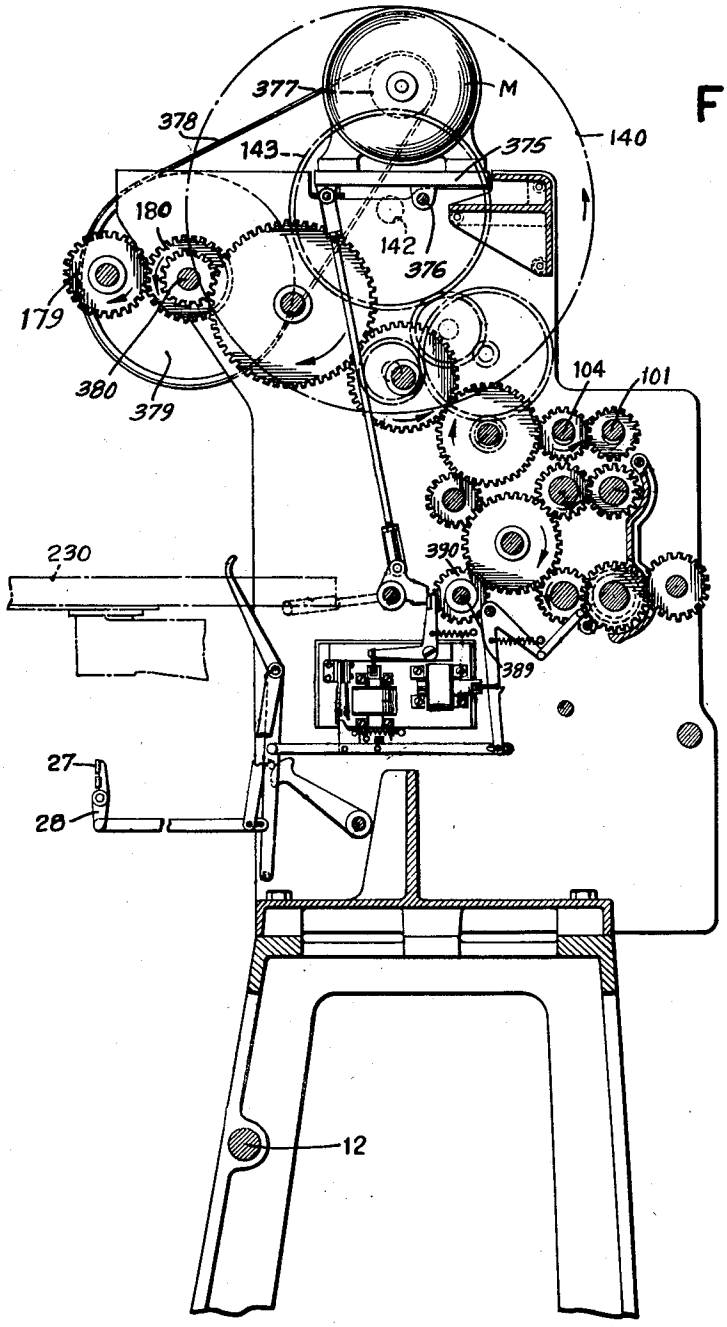
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CUTTING MEANS

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FIG. 3.



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FIG. 4

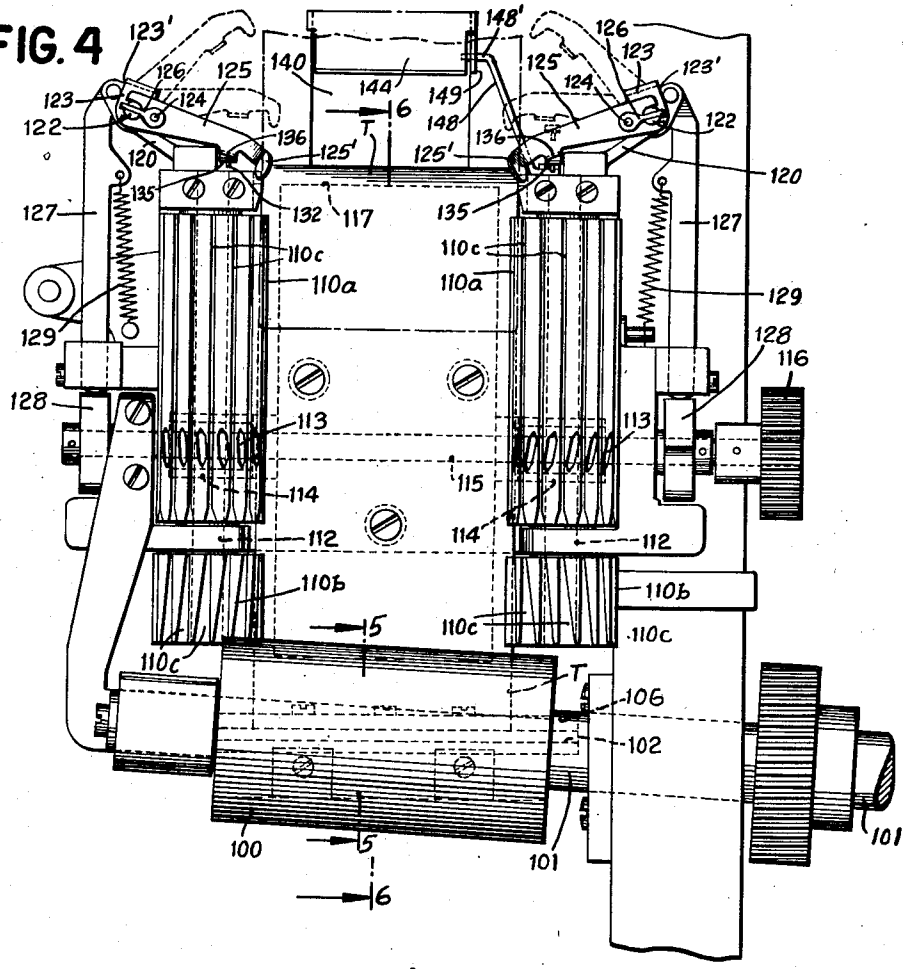
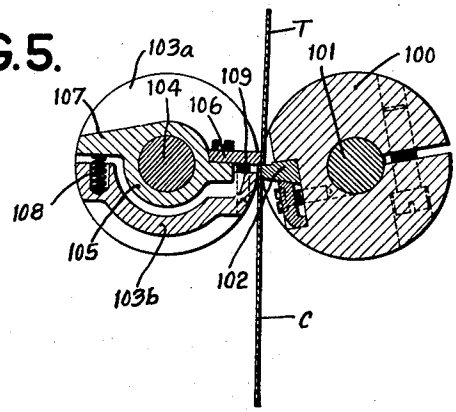


FIG. 5.



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FIG. 6.

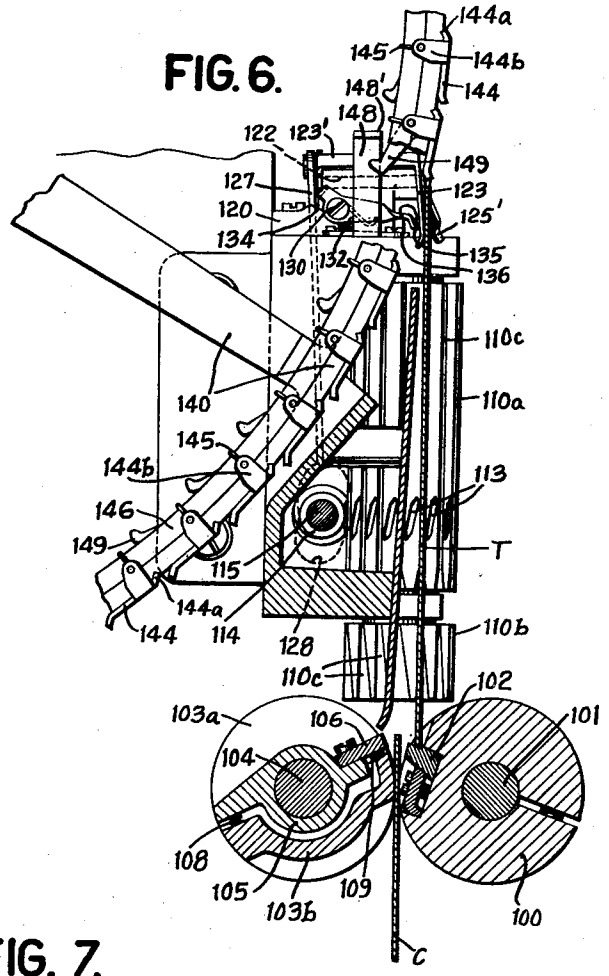
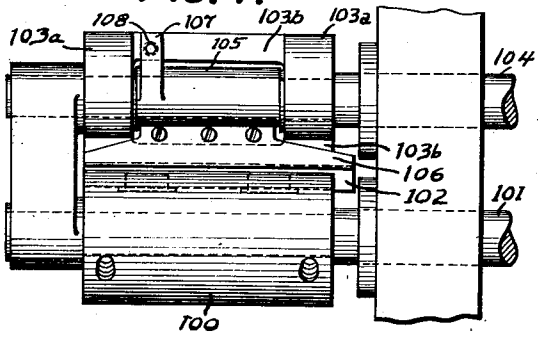


FIG. 7.



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FIG.8.

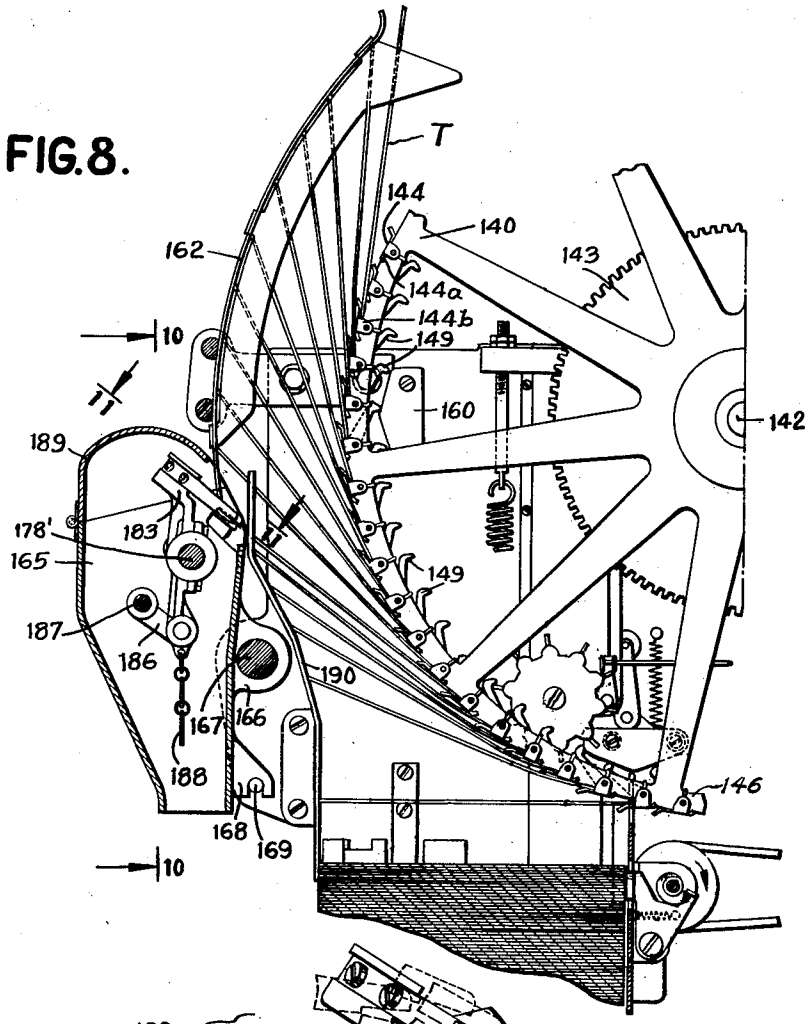
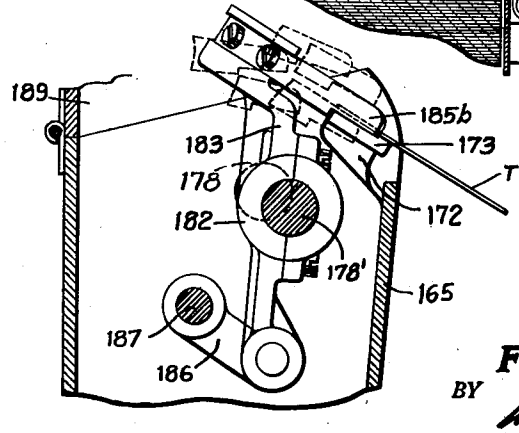


FIG.9.



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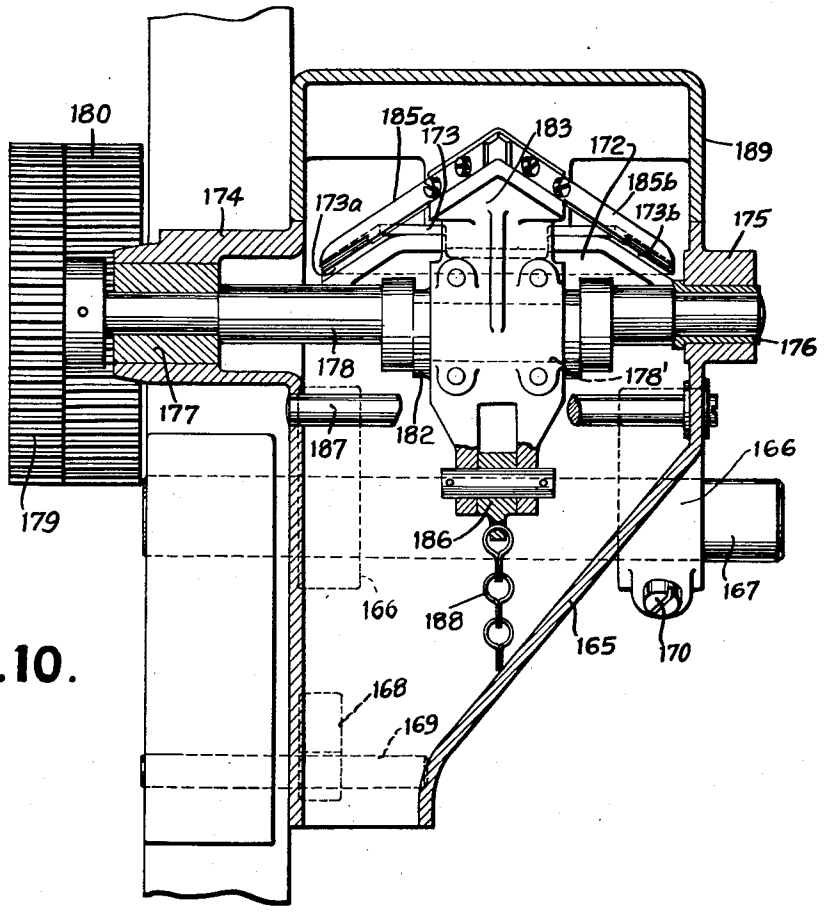
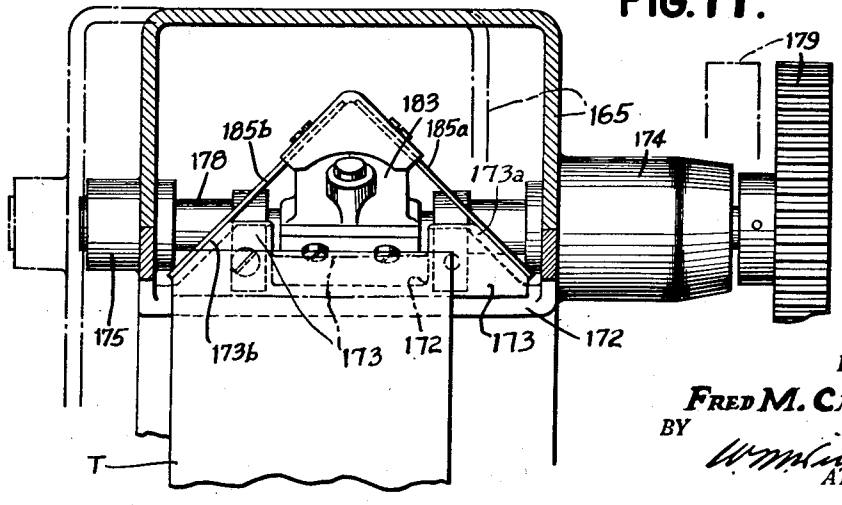


FIG. 10.

FIG. 11.



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Patented Apr. 2, 1940 2,195,849

UNITED STATES PATENT OFFICE

2,195,849

CUTTING MEANS

Fred M. Carroll, Binghamton, N. Y., assignor to International Business Machines Corporation, New York, N. Y., a corporation of New York

Original application January 26, 1937, Serial No. 122,360. Divided and this application May 4, 1938, Serial No. 205,923

10 Claims. (Cl. 164—68)

This case relates to the cutting means of a machine for operating on a web to produce printed record cards therefrom, and is a division of my application Serial No. 122,360, filed January 26, 1937 and issued as Patent No. 2,181,935, dated December 5, 1939.

The machine operates on a blank continuous strip of material, i. e., the web, to print record forms thereon which are cut apart to form card lengths, each bearing one printed form. The particular record produced is known as a tabulating card which in subsequent use is punched to control automatic bookkeeping or accounting machines.

The invention is not restricted to a machine for producing printed record cards, but may be utilized wherever it is found necessary to cut material accurately and rapidly into individual lengths.

The object of this invention is to provide novel means for cutting material into individual lengths.

Further, the object is to provide novel means for cutting the material into individual lengths while the material is moving.

Still further, the object is to cut material, for example a web, along a line at right angles to its direction of feed without interfering with the continuous feed of the material.

Another object of this invention is to provide novel means for cutting off a corner of a card. It is also an object to provide means adjustable for selectively cutting off either of the corners of an edge of a card or the like.

Further objects of the instant invention reside in any novel feature of construction or operation or novel combination of parts present in the embodiment of the invention described and shown in the accompanying drawings whether within or without the scope of the appended claims and irrespective of other specific statements as to the scope of the invention contained herein.

In the drawings:

Fig. 1 is a side view of the machine;

Fig. 2 is a front view partly in section and with parts broken away to show the normally concealed parts;

Fig. 3 is a sectional view showing the drive mechanisms;

Fig. 4 is a detail front view of the cutters, web and card guides and intermediate card delivering grippers;

Fig. 5 is a section on line 5—5 of Fig. 4 showing the cutters coacting to cut the web into a card length;

Fig. 6 is a section on line 6—6 of Fig. 4 including the cutters at a later stage of operation after the card has been cut apart from the web;

Fig. 7 is a detail plan view of the cutters;

Fig. 8 is a vertical section through the upper left hand part of Fig. 1 showing the corner cutter and associated parts;

Fig. 9 is an enlargement of the corner cutting mechanism;

Fig. 10 is a section on line 10—10 of Fig. 8;

Fig. 11 is a section on line 11—11 of Fig. 8; and

Fig. 12 shows a tabulating card on a reduced scale.

Referring to Figs. 1 and 2, the supply roll 10 of blank card material C is carried by a two-part spool 11 located on a shaft 12 fixed to a leg of the frame. The spool 11 is located between friction washers 14 and 15, the former encircling the neck of a collar 16 removably secured to the outer end of the shaft 12 adjacent the spool, and the washer 15 encircling the neck of a collar 17 keyed to shaft 12. Surrounding shaft 12 and engaging the side of collar 17 opposite friction washer 15 is the hub of a lever 18, the hub having an internally threaded nut portion 19 coacting with the threaded portion 20 of shaft 12. The outer end of lever 18 carries a guide roller 22 for the web of material C coming off the supply roll 10. The distribution of weight of the arms of lever 18 added to the weight of roller 22, is such as to impart a tendency to the lever to swing clockwise (Fig. 1). Accordingly, roller 22 would drop unless supported by the web looped around the bottom of the roller. The roller thus exerts force on the web C to maintain it under tension. As long as the web is feeding properly off the roll 10, it will act on roller 22 to support the roller 22 and lever 18 in upper position, limited by engagement of the lever with a fixed stud 23. In the upper position of lever 18, the spool 11 is free to rotate between friction washers 14 and 15. When the web stops feeding from the supply roll or is cut off above the roller 22 in a manner to release the tension of the web on roller 22, then lever 18 drops and by the coaction of its nut portion 19 with threaded portion 20 of shaft 12, the hub of the lever is moved towards spool 11, thereby compressing the spool between washers 14 and 15, which act to brake the spool and stop rotation of the supply roll 10 due to momentum.

The web of material C is led from roll 10 over a guide roller 24 journaled by an arm 25 which is swiveled to a part of the frame to tilt laterally or sidewise. The axis of lateral movement of guide roller 24 is substantially in line with the

top of the roller, and consequently with the direction of feed of the web as it leaves the guide roller. Thus, the top of the roller will have substantially no lateral tilting movement so that the web will be directed thereby in a predetermined, constant, path. The rest of the roller below the top is laterally tiltable to follow the side weave of the web as it comes off the supply roll, while the top of the roller is effective to direct the web in a straight, predetermined path. The action of roller 24 may be clear if it be considered that the roller is always tilted in the direction which the web takes as it leaves the supply roll 10.

From roller 24, the web is threaded through the horizontally extending slot of a plate 27 formed on the upper arm of a lever 28 (see Figs. 1 and 3) which forms part of a web thickness gage, fully described in my parent application.

From the thickness gage, the web proceeds over a guide roller 37, around previously mentioned web-tensioning roller 22, and around guide rollers 37*a* and 37*b*. From roller 37*b*, the web is passed between the bottom of a roll 38 and the top of a plate 39 (Figs. 1 and 2) tangentially disposed relative to roller 38. The web passes between roller 38 and plate 39, then proceeds upwardly along a convex guide plate 46, having side flanges 46′ to engage the sides of the web and prevent lateral movement of the web. The web proceeds along curved, flanged, guide plate 46, past a knife blade 72 (Fig. 1) but without touching the latter and into the grip of feed rollers 73. The curve of the web against guide plate 46 stiffens it sidewise or transversely so that pressure exerted by the sides of the web against the web-confining side flanges 46′ of plate 46 will not tend to bend or crimp the web vertically. The flanges thus engage the opposite sides of the web to guide it properly in its upward travel.

The feed rollers 73 feed the web upwardly between a type roller 74 and a platen roller 75 which constitute a printing couple. Ink is supplied to type roller 74 by an inking roll 76 which is part of an inking unit K (Fig. 1), similar to the inking unit disclosed in my Patent No. 1,563,014. As the web passes through the printing couple, successive duplicate impressions of card forms are made on a face of the web.

After leaving the printing means, the web passes between a pair of plates 87 (see Figs. 1 and 2). The plates 87 and the means connected thereto comprise a jam or kink detecting mechanism to stop the machine and cause the cutting off of the material below the feeding rollers by knife 72, in the event a kink, jam, or bend in the web is detected above the printing means, all as described in my parent application.

Feed rollers 73 have now fed the web past the printing means and past the jam detector. The feed rollers continue to feed the web, after leaving the jam detector between a pair of rotating and coacting cutter devices. One of these cutter devices comprises a shear holder sleeve 100 fixed to a spindle 101 and rigidly carrying a shear blade 102 (see Figs. 1, 2, 4, 5, 6, and 7). The coacting cutter device includes an integral member comprising end flanges or collars 103*a* snugly embracing a spindle 104 and fast to the spindle. Integrally connecting the end flanges 103*a* is a bridge piece 103*b* concavely curved concentrically with but radially distant from spindle 104. Confined between collars 103*a* and extending along the length of bridge piece 103*b* is a sleeve 105 rotatably embracing spindle 104. Sleeve 105 is prevented by engagement of its ends with the confining collars 103*a* from moving axially along spindle 104, but the sleeve may rock to a limited extent relative to the spindle. Sleeve 105 rigidly carries at one side a shear blade 106 for coacting with blade 102 to shear the web. At the opposite side, collar 105 is formed with a tail 107 projecting above the rear, flat, surface of bridge piece 103*b*. Between the latter and tail 107 is a spring 108. The spring 108 urges collar 105 clockwise (as viewed in Figs. 5 and 6) until the bottom of shear blade 106 engages the top of a screw 109 adjustably set in bridge piece 103*b*.

Spindles 101 and 104 of the coacting cutter devices are parallel to each other and to the web, but inclined, as may be understood from Figs. 2, 3, 4 to the direction of feed of the web. Blade 102 is disposed at an angle to its holder and substantially at right angles to the direction of web feed. Blade 106 is disposed along a line inclined to the horizontal and divergent from the incline of its holder 105 so that it is slightly more inclined to its holder than blade 102 to its holder. Each blade is thus wrapped around its holder in the manner of a helix. The upper cutting face (as viewed in Fig. 5) of blade 102 is ground spiral so as to define a line exactly at right angles to the length of the web during rotation of its holder 100 and during uninterrupted feed of the web. Blade 106 is ground flat along its lower surface to act as a die or abutment against which blade 102 shears the web. When the corresponding facing points of the coacting blades 102 and 106 reach the line of tangency of the circles of holders 100 and 103*a*, then these facing points are in engagement to cut the web. The different corresponding points of blades 102 and 106 from right to left (Fig. 4) along the lengths of the blades reach the line of tangency successively during rotation of their holders. As the holders rotate, the blades travel at the same speed as the web is feeding, and the right hand ends of the blades meet first and start cutting the web at the right hand side. Then, as the shear holders rotate and the web feeds, the blades wipe each other progressively from right to left and shear the web progressively along a straight line from right to left as though by a pair of scissors blades. Due to the slight difference in angularity of the blades 102 and 106 there is a true point contact between the blades as they wipe each other and due to this difference in angularity of the blades and to the blade 106 overlapping the blade 102, the blade 102 during the cutting operation lifts blade 106 against the resistance of spring 108. This insures a positive engagement of the blades at every point of their line of contact with each other and enables blade 102 to determine the line of cut across the web to be at exactly right angles to the length of the web.

In above manner, while the web is feeding upwardly continuously, the blades 102 and 106 cut the web along a straight line at right angles to the direction of feed of the web and to the length of the web. The blades are timed to cut the web at intervals such as to separate the successive impressions of duplicate card forms from each other. The portion of the web above the cutter and which has just been severed along its bottom edge from the rest of the web is now a completed, printed, individual tabulating card T (Fig. 12).

At the completion of the cutting operation, and as may be understood from Figs. 5 and 6, the card just formed is no longer under the influence of the feeding rollers 73 or the feeding means below the cutting devices. The web below the

last-formed card, however, is being fed positively by the feeding rollers 73 and the upper edge of the web, just formed by the cutting operation is now beginning to move above the cutter blades which are at the same time moving apart and out of cutting coaction (see Fig. 6). The overlap of the cutting blades results, to some extent, during the cutting operation in blade 106 forcing the lower part of the card being formed to the right (Figs. 5 and 6) and out of the plane of the web below. As indicated in Figs. 5 and 6, carrier cylinder 100 is recessed to provide a pocket directly above the working face of blade 102, and into which pocket the blade 106 may push the cut edge of the card inwardly of the cylinder and transversely out of the way of the following web, whereby the web may overtake the lower portion of the card.

Thus, at the end of the cutting operation, the lower edge of the card is above and resting on a portion of the blade 102 and the card is moving upwardly due to its own momentum and due to its being fed upwardly by rotation of the latter blade. As the latter blade is also moving to the right (Fig. 6), it is displacing the card to the right at the same time as the card is moving up. The upper edge of the web is beginning to move past the blades but is not in the same plane as the card above. Hence, the web may move past the lower edge of the card without interference from the latter. This enables the web to be fed uninterruptedly at a constant rate without hindrance from the card just formed which may be moving at a slightly slower rate. Thus, exact synchronism in the rate of feed of the card and the web are made unnecessary. The automatic shifting of the card out of the plane of the web below is effected to some extent by the cutter blades 102 and 106 due to their overlap and to movement of blade 102 to the right (Fig. 6), as explained. The main mechanism for shifting the card transversely will now be described.

Referring to Figs. 1, 2, 4, and 6, located above the shearing devices is a card guiding structure comprising a pair of parallel vertically disposed fluted rollers 110. Each roller includes an upper section 110*a* and a lower section 110*b*, both sections of a roller being fixed to a shaft 112 which is journaled on the frame. The two sections of each roller have their flutes 110*c* in vertical alinement, so as to form linear continuations, one of another. The lower, entrance, ends of the flutes of each section are flared to facilitate entry of the card into the flutes. Helical interdental notches 113 are cut in the ribs of the upper sections 110*a* for cooperating with worms 114 fixed to a horizontal continuously rotating shaft 115 which extends across the back of the fluted rollers. At one end, shaft 115 has a gear 116 operated by the driving means. As the shaft rotates, worms 114 thereon coact with notches 113 to rotate the fluted rollers 110 in opposite directions, as indicated by the arrows in Fig. 4.

Secured to the frame, between the rollers 110, is a flat vertically disposed guide plate 117 which is inclined slightly to extend further forward at the upper than at the lower end.

The normal plane of feed of the web of card material through the feeding rollers 73, printing couple 74—75, and the circular portions of elements 100 and 103*a* of the shear devices extends centrally of the fluted rollers 110. Flutes 110*c* of each roller 110 will, during rotation of the rollers, successively arrive at and then pass the normal plane of web feed. A pair of facing flutes 110*c*, one of each roller, will thus be disposed momentarily along the normal plane of web feed. These two facing flutes are closest to each other at the plane of web feed, and then during continued rotation of the rollers, move forwardly and further apart in divergent directions. When the two facing flutes are closest to each other, at the plane of web feed, they are spaced apart, horizontally, the width of the web plus a slight clearance.

Now, as the web emerges a short distance above the shearing devices, the upper end of the web enters the two facing flutes 110*c* momentarily along the plane of web feed. As the web continues to move upwardly, before being sheared, the opposite sides of the web are moving within and upwardly along the pair of flutes which have received the web. This pair of flutes thus guides the web during its movement above the shearing devices. As rollers 110 rotate in divergent directions, the pair of flutes engaging the sides of the web move forwardly, thereby forcing the portion of the web above the shears forwardly. The flutes are deep enough to maintain their engagement with the sides of the web during rotation of the fluted rollers through an anguar distance slightly greater than the distance between successive flutes on a roller. At the beginning of the feed of the web portion along the facing flutes which have received the web portion, the latter is in the normal plane of web fed, and then as the web portion moves further upwardly along the flutes, it is shifted more and more forwardly by the flutes. For this reason, the guide plate 117 is tilted forwardly at the upper end to maintain guiding engagement with the web portion between the flutes during the feed of the web portion along the entire length of the fluted rollers. The guide plate 117 thus prevents the web from bowing or curving rearwardly between the flutes.

When the upper end of the web portion nears the upper ends of the fluted rollers, the shearing blades 102 and 106 begin shearing the web portion to form an individual card T. The shearing of the web portion to form the individual card is completed when the upper end of the web portion has moved beyond the upper ends of the fluted rollers. During the shearing operation, while the lower edge of the card is still being formed, the portion of the web which is to form the card and which is now above the shearing devices has been bent forwardly or to the right (Fig. 5) by the fluted rollers. Consequently, when the shearing operation is complete and there is nothing further to restrain the lower portion of the card just formed from moving forwardly to a position above the shear blade 102, the lower portion of the card snaps forwardly out of the normal plane of web feed, and the card thus straightens out, in a plane determined by the positions of the flutes now receiving the vertical sides of the card just formed. The lower edge of the card then rests on a point of the shear blade 102, as indicated in Fig. 6; and as the blade continues its clockwise rotation, due to its engagement with the lower edge of the card it feeds the card upwardly. The sides of the card are still within the facing flutes which continue to guide the upward movement of the card and at the same time to further shift the card forwardly or to the right.

In the above manner, the card just formed is

immediately shifted forwardly out of the normal plane of web feed so as to avoid interfering with the slightly more rapid and continuous feed of the web portion now moving through the shearing devices and overtaking the card, as indicated in Fig. 6. When the upper edge of the latter web portion reaches the lower ends of the fluted rollers, the pair of facing flutes 110c following the ones guiding the last-formed card are in central position, in the plane of web feed, to receive the sides of the web portion. Thus, successive flutes 110c of the rollers 110 successively come into the plane of web feed to successively receive and guide the web as it moves above the shearing devices.

After the web has been cut to form the individual card and while it is being fed upwardly by the blade 102, gripping means come into play to grasp the card at opposite sides and to thereafter continue the feed of the card for a short distance. The card gripping means will now be described, with reference particularly to Figs. 4 and 6.

Above each fluted roller section 110a, the frame rigidly carries a bracket 120 for rotatably supporting a shaft 122 to extend transversely of the plane of the card T and inclined slightly upwardly towards the card. Mounted on shaft 122 is a yoke 123' which is integral with a gripper arm 123 to which is pinned, by a rivet 124, a coacting gripper arm 125 of thin spring steel. The rear end of arm 125 is formed to straddle shaft 122 and a tongue member 126 locks arm 125 to shaft 122 for common rotation, thereby indirectly locking yoke 123' and its arm 123 to shaft 122.

Yoke 123' is pivotally connected to a dependent bar 127, the lower portion of which is slidably guided in the frame, and the lower end of which engages a cam 128 on shaft 115. A spring 129 connected to bar 127 urges the bar downwardly towards cam 128. Cam 128 is so shaped as to rapidly reciprocate bar 127 which, in turn, oscillates yoke 123' and gripper arms 123 and 125. Since shaft 115 is continuously rotating, the gripper assembly is constantly oscillated.

Gripper arm 125 is formed at its free end with a V-shaped offset which may be considered as the gripping jaw 125'. The inherent resiliency of arm 125 urges it constantly towards arm 123 to engage jaw 125' with the side of arm 123, to grip the card between them. In order to permit the card to enter freely between the jaw 125' and the adjacent gripping end of arm 123, arm 125 is held away from the side of arm 123 until the gripper assembly is about half-way through its rising stroke, or in the lower dotted position shown in Fig. 4. To effect this result, bracket 120 journals, below the gripper assembly and at right angles to shaft 122, a pivot 130 on which is mounted a gripper release lever 132. A hairpin spring 133 between the frame and the bottom edge of release lever 132 urges the latter to rock counterclockwise (Fig. 6) until the rear end of the release lever abuts a ledge 134 of bracket 120. The forward end of lever 132 is bent to form an angular tip 135 which is in the path of movement of a tab 136 integrally formed with and projecting transversely from the springy gripper arm 125. In the lowermost position of the gripper assembly shown in full lines in Figs. 4 and 6, tab 136 is engaging the horizontal part of tip 135 and by such engagement is holding release lever 132 down in opposition to the urge of spring 133 to move the lever 132 up. Also, the free side edge of tab 136 is abutting the generally vertical part of angular tip 135, and because of this engagement, gripper arm 125 is held away from gripper arm 123 to permit the upper end of the card to freely enter between jaw 125' and gripper arm 123. Now, as the gripper assembly rises, spring 133 causes lever 132 to rise with its tip 135 following and maintaining engagement with tab 136. During such engagement, the gripper arms 123 and 125 remain spaced apart to freely receive the card. Due to the arcuate path of tip 135, the latter gradually recedes from tab 136, permitting gripper jaw 125' to gradually move towards gripper arm 123 and to finally grip the card just before the gripper assembly reaches its mid-position, shown in dotted lines in Fig. 4. At this time also, the rear end of lever 132 strikes ledge 134 of bracket 120 and can rise no further. Tab 136 of arm 125 now departs from tip 135 of lever 132, and when the gripper assembly is at about the mid-point of its rise, the tab 136 is completely above the vertical part of tab 135 (see Fig. 4).

The card is now gripped at opposite sides and near its upper end by the two gripper assemblies, one above each fluted roller. At the same time, the lower edge of the card is still on shear blade 102 which has meanwhile been feeding the card upwardly after the shearing operation. Cam 128 is of such contour as to cause the gripper assemblies to initially rise at the same speed as the card is being elevated by shear blade 102. Thus, the upper portion of the card, which enters freely between the gripper arms when the latter are in their lower position follows the gripper arms at the initial speed of the latter and remains in position between the arms to be gripped thereby when they close at about the mid-point of their rise.

The gripper assemblies after gripping the card accelerate their speed, thereby instantly withdrawing the lower edge of the card entirely above the locus of rotation of blade 102. This prevents the lower edge of the card from being bent by the shear blade 102 as it rotates rapidly past the plane of the lower portion of the card.

The gripper assemblies deliver the card to a rotary conveyor. Referring to Figs. 1, 2, and 3, the conveyor comprises a wheel or drum 140 fast to a shaft 142 which rigidly carries a gear 143 meshed with the driving mechanism. The driving mechanism, acting through gear 143, continuously rotates drum 140. Spaced equal distances around the circumference of drum 140 are clips 144 (see also Figs. 6 and 8), each to clamp a card against the periphery of the drum. The forward end of each clip is bent away from the drum to facilitate entry of a card into position between the drum periphery and the clip jaw. The clip 144 is pivoted to the rim of the drum by means of a wedge-shaped tip 144a at the rear end of the jaw 144 seating in a V-shaped bearing notch formed in the rim of the drum, there being enough play between the tip and its seat to permit the clip to rock about tip 144a relative to the drum. Ears 144b of the clip straddle the sides of the drum rim and are connected to each other by a wire spring 145 (see Figs. 6 and 8), the central portion of which engages an inwardly facing annular rib 146 of wheel 140. Spring 145 is bowed by its engagement with rib 146 so as to tend through clip ears 144b, to rock the clip clockwise about tip 144a, to engage the face of the clip with the drum periphery.

Shaft 142 of conveyor drum 140 is parallel to

the general plane of movement of the web and of the last-formed card, and the drum is so located and of such size that the right hand arc of travel of the drum periphery is substantially a continuation of the plane of the card being fed upwardly by the intermediate delivery grippers 123—125. Thus, the clips 144 will successively pass through the plane of feed of the card to reach a position for receiving a card from the card delivery grippers.

Just prior to reaching the card receiving position, the clip face is moved away from the periphery of drum 140. For this purpose, each clip 144 has one of its ears 144b formed with an extension 149 for cooperating with the bottom of a horizontal lug 148' integrally formed at the upper end of a bar 148 fixed to the frame (see Figs. 4 and 6). As the clip nears card receiving position, its extension 149 moves below lug 148'. Then, as the clip continues to rise, the free, beveled end of the extension engages the bottom of lug 148' and is thereby cammed to the right (Fig. 6), causing the clip to rock counterclockwise about pivot edge 144a against resistance of spring 145. As a result, the clip face is moved away from the periphery of the conveyor drum and to open position for enabling the upper end of the card to move between the clip face and the drum periphery. The clip remains open while it is moving through card receiving position and then as it continues to rise, extension 149 moves to the right along the bottom of lug 148' gradually permitting the clip to close. By the time the extension has ridden off the bottom of lug 148', as indicated in Fig. 6, the clip has closed and the face of the clip is gripping the card against the drum periphery.

As has been explained previously, the pair of card delivery gripper assemblies 123—125 gripped the last-formed card when about half-way along their ascending stroke. As the grippers continue to rise, the open clip 144 comes to card-receiving position, in which the space between the clip face and the drum periphery is directly above and in line with the central width of the card extending between the pair of gripper assemblies. Thus, as the card is fed upwardly by the gripper assemblies now moving through the upper half of their rise, the upper portion of the card, extending between the pair of spaced gripper assemblies moves into the space between the clip face and the drum periphery. The gripper assemblies continue to rise and move the card further along the clip face while the latter moves through and slightly past card-receiving position. The gripper assemblies gripped the card about half through their rise or when in the lower dotted position indicated in Fig. 4. After gripping the card, the assemblies continue to rise until they reach the upper dotted position. From the lower to the upper dotted line positions, the gripping ends of the gripper arms 123 and 125 move through an arc receding from the sides of the card. Thus, while the grippers are rising and feeding the card upwardly, they are also slipping off the card. About half-way between the dotted positions shown in Fig. 4, the grippers have slipped entirely off the card. Before this happened, the clip has closed and clamped the card firmly against the drum periphery. When the grippers have completely slipped off the card, the latter is gripped only by the clip 144 and will then travel along with the clip which is moving counterclockwise in a circular path.

As previously explained, the grippers 123—125 when in lower, full line position (Fig. 4) are open and receive the upper part of the card at each side of the latter. Then while moving from the full line to the middle, dotted line, position, the grippers travel at substantially the speed of the card which is moving upwardly due to its own momentum and the engagement of its lower end with the rising knife blade 102. When the grippers grip the card, they start moving more rapidly so as to snap the card completely away from the path of knife blade 102. After gripping the card, the grippers feed it into the bite of a clip 144 and while so doing move more rapidly than the clip so as to effectively advance the card further into the range of the clip face. Then the clip grips the card, and during the interval in which both the clip and the grippers 123—125 grip the card, the grippers move at substantially the speed of the clip. The different speeds of the grippers are obtained by properly shaping cams 126 which control the rise of the grippers.

In above manner, the cards are delivered to the successive clips 144 of conveyor wheel 140 to be conveyed by them away from the card printing and severing section of the machine. The successive cards carried by clips 144 after rollers 110a—110b have released the sides of the cards and while along the upper right quadrant of the locus of travel of the conveyor drum 140 hang down from the clips and lie in divergent planes. These planes diverge because the cards are gripped at different points of the drum to which the cards tend to lie tangent. Further, the cards are held in divergent planes, positively spaced apart by engagement between the under side of one card with the outer face of the clip beneath the card and following the clip which is gripping the card at its upper end. The cards continue counterclockwise with the conveyor drum 140. When they arrive at the left side of the locus of the conveyor wheel, the cards extend upwardly from their holding clips 144 (see Figs. 1 and 8). While a card is thus standing vertically with its inner edge gripped by a clip, the clip extension 149 rides onto an upper, inclined, surface of a block 160 which cams against the clip extension to rock the clip counterclockwise (as viewed in Fig. 8), thereby opening the clip slightly. The clip thus releases its grip on the lower end of the card, permitting the card to drop by gravity until the lower, inner edge of the card abuts the then upper edges of the clip ears 144b. In above manner, as a clip passes block 160, it opens sufficiently to permit the card to drop to a definite, predetermined, position on the clip. When the clip extension 149 rides off the upper inclined surface of block 160, the spring 145 recloses the clip to again clamp the lower end of the card. Thus, after the clips pass block 160, the cards are set in the clips in definite, similar predetermined, positions. The outer edges of the cards now ride along a curved plate 162 which prevents the cards, due to their weight, from flexing or bending downwardly about the clamped inner end, and maintains them substantially tangential relative to the periphery of the conveyor drum 140.

The purpose of setting the cards in definite positions relative to their holding clips 144 is to cause each card to extend the same predetermined distance from the rim of the conveyor wheel 140 when the card arrives at a corner clipping mechanism. Referring to Figs. 1, 8, 9, 10, and 11, the corner clipping mechanism includes a casing 165, formed with bosses 166 slidably em-

bracing a rod 167 rigidly carried by the frame. Casing 165 is also provided below bosses 166 with a lug 168 forked to straddle and rest on a fixed rod 169. The coaction of lug 168 with rod 169 prevents rotation of casing 165 about rod 167. One of the bosses 166 is split with the furcations tied together by a bolt 170. Thus, the casing 165 may be slid along rods 167 and 169 to either of two extreme positions and then retained in the adjusted position by turning bolt 170 to tighten the split boss firmly on rod 167.

The sides of casing 165 are integrally bridged by a brace 172 to the top of which a shear member 173 is secured. The shear member is inclined at opposite ends to provide two oppositely inclined stationary cutting edges 173*a* and 173*b* (Figs. 10 and 11).

The opposite sides of casing 165 are formed with bosses 174 and 175 in which are fixedly set bushings 176 and 177 to journal a crank shaft 178. The end of shaft 178 journaled in bushing 17 extends outside casing 165 and has fixed thereto a gear 179 meshed with a wider gear 180 of the driving train (also see Fig. 3). Crank shaft 178 is shouldered to engage the interior sides of bushings 176 and 177, as indicated in Fig. 10. Thus, crank shaft 178 is unable to move axially relative to casing 165. As a result, the horizontal adjustment of casing 165, previously explained, serves to correspondingly move shaft 165 and its gear 179.

Rotatably mounted on the eccentric, central, portion 178′ of crank shaft 178 is the hub 182 of a movable shear holder 183. At opposite ends of the eccentric portion of crank shaft 178, the latter is flanged to abut the sides of hub 182 to constrain the hub 182 and shear holder 183 to move bodily with shaft 178 in an axial direction. Thus, when casing 165 is moved horizontally for adjustment, it similarly moves shaft 178 which, in turn, forces shear holder 183 to move therewith.

Secured to oppositely inclined sides of shear holder 183, and set in V-formation, are two blades 185*a* and 185*b*. Blade 185*a* is movable in a vertical plane including therein stationary blade 173*a* while blade 185*b* is movable in a vertical plane including therein stationary blade 173*b*. Thus, blades 173*b* and 185*b* are adapted to coact to cut off the left hand outer corner of a card (as viewed in Fig. 11) while blades 173*a* and 185*a* are adapted for coaction to cut off the right hand outer corner of the card.

The horizontal position of casing 165 determines which card corner is to be cut off. When casing 165 is at the right hand limit of its horizontal range of adjustment, as shown in Fig. 11, then the pair of blades 173*b* and 185*b* are in position for cutting off the left outer corner of the card. When the casing is set at its left hand limit, as indicated in dot-and-dash lines in Fig. 11, then blades 173*a* and 185*a* coact to cut off the right hand upper corner of the card.

Gear 180 which through gear 179 rotates crank shaft 178 is of sufficient width to maintain mesh with gear 179 throughout the range of horizontal adjustment of casing 165.

Shear holder 183 is rotatably mounted on the eccentric portion 178′ of crank shaft 178. At its lower end shear holder 183 is connected to one end of a link 186 which at the other end rotatably embraces a rod 187 carried between the sides of casing 165. The connection of shear holder 183 to link 186 constrains the movable shear blades 185*a* and *b*, during rotation of crank shaft 178 to move in the locus of an ellipse, with its long axis extending along an incline substantially within the inclined plane of the card T engaging the top of stationary shear member 173. The positions of the knife blade 185*a* at different points of its elliptical path are shown in dotted lines in Fig. 9. Thus, during rotation of shaft 178, the movable shear blades 185*a* and *b* move rapidly down to wipe the stationary shear blades 173*a*, then retreat along the lower half of the elliptical locus thereby withdrawing completely from the stationary blades, and finally move through the upper half of the elliptical locus towards, above, and then again into cutting coaction with the stationary blades. Due to the inclined major axis of the elliptical path of blade 185*a* being coincident with the plane of the card being cut, the knife blade changes direction as it cuts through the card. Thus, the cutting blade strikes the card substantially at right angles to the plane of the card, to provide a clean predetermined cut. Further, the elliptical path of the movable cutters is such as avoid encounter of the blade with the card above the one in cutting position, and without requiring the two cards to be spaced as far apart as if the cutters moved in a circular path.

It has been explained that the cards before reaching the corner cutter have been moved within their holding clips 144 to a definite and predetermined position and that their outer edges are then moving along plate 162. This plate engages the card until the outer end of the card enters the casing 165. As the card moves further, its outer end momentarily rests on the flat top of stationary shear member 173. In accordance with the horizontal adjustment of casing 165, either the left or right hand stationary blade 173*a* and 173*b* is underlying a corner of the outer end of the card. As the card lies on shear member 173, the movable shear blade 185*a* and 185*b* come down rapidly, and one of them, depending on the adjustment of casing 165, coacts with the stationary blade underlying a card corner to shear off this corner. As indicated in Fig. 11, the left hand blade 173*b* is underlying the left outer corner of the card so that the left hand blade 185*b* coacts therewith to cut off the left outer corner of the card. The remaining portion of the outer end of the card is remote from the shear blades 173*a* and 185*a*.

The card is continuously in motion while its corner is being cut but the descent of the movable blade is so timed and so rapid that the cutting operation is practically instantaneous, and always cuts off a definite predetermined corner length of the card.

The chips cut off by the corner cutter drop down the interior of the casing 165 and out of the machine. A chain 188 is carried by link 136, the agitation of the chain helping to clear the casing of chips. A cover 189 is hinged to casing 165 and may be opened to expose the interior of the casing and provide access to the parts therein.

After its corner is cut off, the card continues downwardly, with its outer edge riding along the incline of a guide plate 190 (see Figs. 1 and 8). The successive cards drop into a stacker mechanism 230 which is fully described in my parent application, and need not be explained herein.

The machine is powered by an electric motor M (Figs. 1, 2, 3) mounted on a base plate 375 hinged by a rod 376 to the top of the frame. A pulley 377 on the motor shaft is connected by a driving belt 378 to a pulley 379 on a shaft 380.

Pulley 379 drives the various gear trains for actuating the several mechanisms of the machine described hereinbefore. A manual drive for the different mechanisms is also provided by a hand crank 387 (Fig. 1) connected to shaft 389 on which a gear 390 (Fig. 3) is fixed. Gear 390 is in a train of gearing leading to shaft 380 of driven pulley 379. Thus operation of crank 387 actuates shaft 380 to manually drive the various mechanisms of the machine.

Summary

The web of material C feeds off the supply roll 10, around a swivel-supported guide roll 24, through the slot of thickness-detecting element 27 over guide roll 37 around tension-reacting roller 22, and over guide roller 37*a*. The web then passes around roller 37*b*, then between roller 38 and plate 39, along guide plate 46, past emergency cutter 72, and into the grip of feed rollers 73. The latter feed the web through the printing couple 74—75 which prints successive card forms on a face of the web. The web then proceeds through plates 87 of the jam detecting device, then between rotary shear devices including blades 102 and 106 (Fig. 6), and into a pair of vertical guide flutes 110*c* of spaced, fluted, rollers 110*a*—110*b*. As the web is moving upwardly, blades 102 and 106 coact with a scissors action to shear the web and form a separate tabulating card T, now above the cutting blades. Due to the momentum of the card and to the engagement of the top of blade 102 with the bottom of the card, the card continues its upward feed and the card, as its cut is completed, enters at its upper end between the now open jaws of delivery grippers 123—125. The latter are then in their lower position and now start their rising stroke. As the grippers rise, the card due to its velocity and to feeding action of blade 102 follows and remains in position between the jaws of the grippers. Before the latter reach the mid-position of their rising stroke, their jaws close and grip the card to continue upward feed of the card. The upper end of the card is then gripped at opposite sides by the pair of delivery grippers 123—125. While this is happening the flutes 110*c* guiding the web above the cutters are moving the web forwardly and out of the plane of the web below the cutters. Delivery grippers 123—125 deliver the card to a clip 144 on a conveyor drum 140 which continuously rotates counterclockwise (Fig. 1).

As a card reaches a position at the upper left side of the conveyor drum locus, a cam block 160 acts on extension 149, of the clip 144 holding the card, for opening the clip. The card then drops by gravity to a definite position relative to the periphery of the conveyor drum 140. The card then proceeds to a corner clipper adjustable to clip either left or right hand upper card corner.

After passing the corner clipper, the card is guided into stacking mechanism 230.

While there has been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. In a machine of the class described; a cutter blade having its cutting edge constantly facing in one general direction; means to convey cards, one behind another and with their outer edges spaced apart, past the cutter blade; and means for repeatedly interposing the blade between the outer edges of successive pairs of cards and then across the leading card of each pair to cut off an outer edge portion of each successively leading card.

2. In a machine of the class described; a cutter blade having its cutting edge constantly facing in one general direction; means to convey cards, one behind another and with their outer edges spaced apart, past the cutter blade; and means for repeatedly interposing the blade between the outer edges of successive pairs of cards while the latter are in motion and then across the leading card of each pair to cut off an outer edge portion of each successively leading card while the latter is in motion.

3. In a machine of the class described; a conveyor having means to grip successive cards by their inner edges, leaving their outer edges free of the gripping means and spaced apart, to a cutting position; cutting means including a stationary die and a movable cutting blade, and means for moving the blade between the outer edges of a pair of successive cards as the leading card of the pair arrives at the cutting position and then across the latter card to coact with the die for cutting off an outer edge portion of the leading card.

4. In a machine of the class described; a conveyor having means to grip successive cards by their inner edges, leaving their outer edges free and spaced apart, cutting means, and means for moving the cutting means repeatedly between the outer edges of the pairs of successive cards while the cards are in motion and then across the leading card of each pair to cut off an outer edge portion thereof.

5. In a machine of the class described; means to move cards successively past a cutting position, a corner cutting unit for cutting off a corner of an edge of each card as the latter traverses the cutting position, and means for mounting the cutting unit for movement lengthwise of said card edge for selectively locating the unit for cutting off either corner of said card edge.

6. In a machine of the class described; means to move cards successively past a cutting position, a corner cutting unit for cutting off a card corner as each card reaches the cutting position and including a cutter with a pair of cutting edges spaced apart and at an angle to each other, correspondingly located dies for coacting with the cutting edges, one coacting cutting edge and die being adapted to cut off one corner of one edge of each card and the other cutting edge and die being adapted to cut off the opposite corner of said card edge, and means for mounting said cutting unit for adjustment lengthwise of said card edge for selectively locating either one of the pairs of companion cutting edges and dies for cutting off a card corner.

7. In a machine of the class described; a cutter to cut out an edge portion of a card, a conveyor to successively convey cards one behind and spaced from another to a cutting position, and means for moving the cutter in one direction between adjacent cards to a location across the card in cutting position and then in another direction across the edge of the card in cutting posi-

tion to cut out an edge portion of the latter card.

8. In a machine of the class described; a corner cutting blade to cut off a corner of a card, a conveyor to convey cards, one behind and spaced from another, to a cutting position, and means for moving the cutting blade in an effectively elliptical path, from a position external to the locus of the card edge to be cut, into the space between the card at the cutting position and the following card, then across a corner of the card at the cutting position to cut off said corner, and then rearwardly out of the path of the cards.

9. In a machine for forming cards; a movable card conveyor having a plurality of spaced clips, each gripping one edge of a card, to hold the card on the conveyor with the opposite edge extending free, means for cutting out a portion of the free edge of each card as the conveyor successively moves the cards past a cutting position, and means for temporarily releasing the grip of a clip on a card to enable the card to be set on the conveyor in a definite position relative to the cutting means prior to the cutting operation.

10. A machine for cutting a continuously fed web into lengths, comprising a rotating carrier provided with a fixed blade, a rotating shaft, a member carried thereby and formed with spaced, circular end flanges and a bridge connecting the flanges and extending parallel to the shaft, a blade holder rotatably mounted on said shaft and formed with a tail facing a rear portion of the bridge to limit rearward rotation of the holder with respect to the member, a blade fixed to the front end of the holder and abutted by the other blade during rotation of the carrier and the member for thereby cutting the web, and a spring between said tail and said bridge for normally maintaining said holder in forwardly rotated position with respect to the member, with the bottom of the blade carried by said holder engaged with a front portion of the bridge, said spring enabling the holder and blade to be rocked rearwardly, by engagement with the other blade, to an extent limited by effectual engagement of said tail with the rear portion of the bridge.

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