

July 7, 1942.

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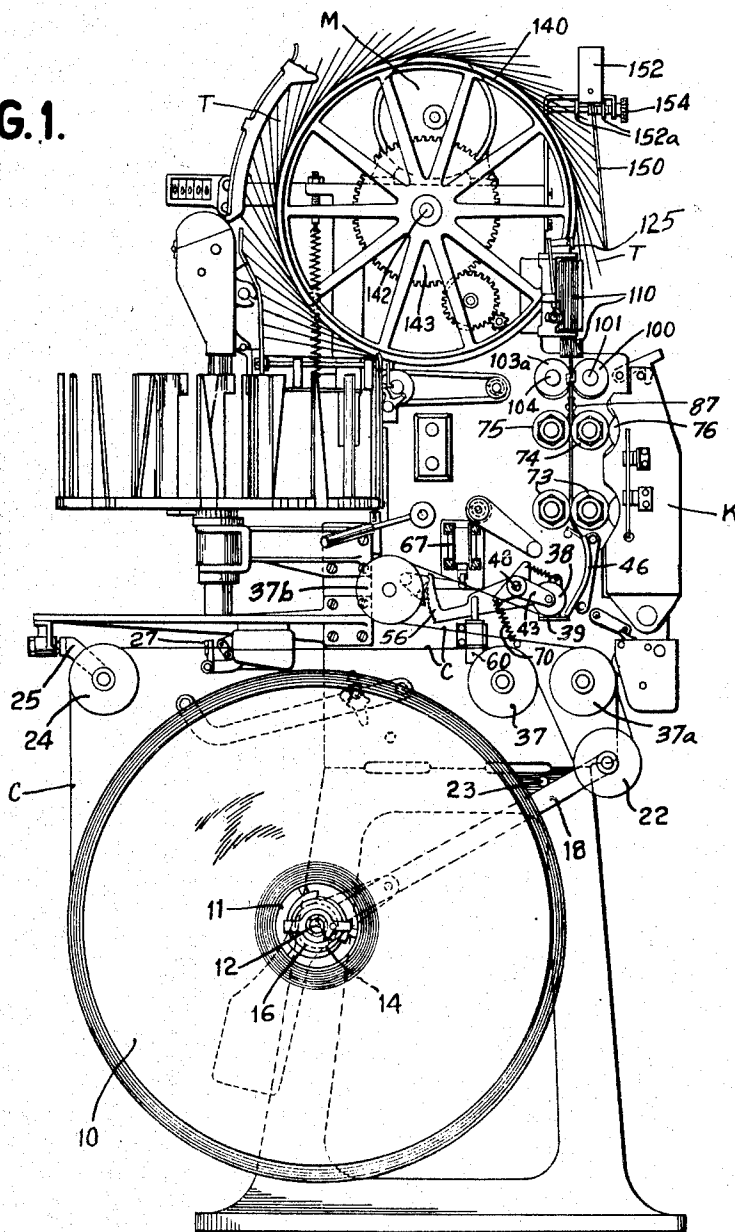
2,288,786

WEB STRAIGHTENING MEANS

Original Filed Jan. 26, 1937

4 Sheets-Sheet 1

FIG. 1.



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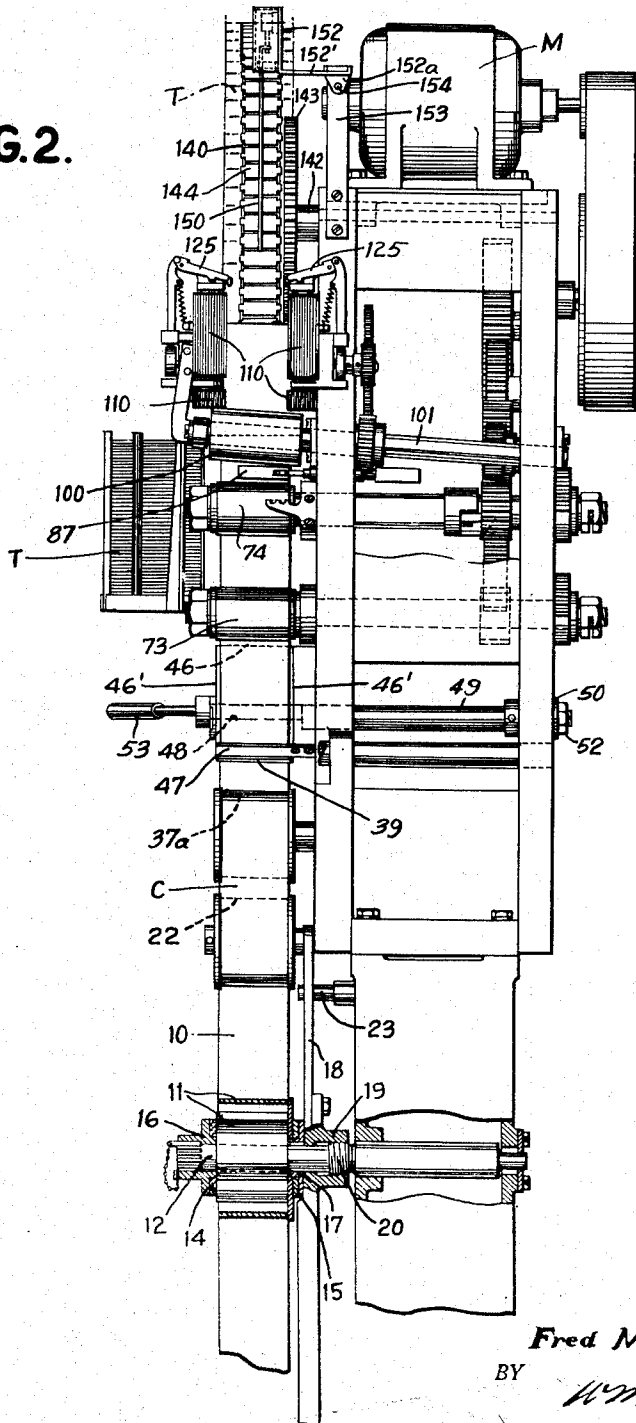
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WEB STRAIGHTENING MEANS

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4 Sheets-Sheet 2

FIG. 2.



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4 Sheets-Sheet 3

FIG. 4.

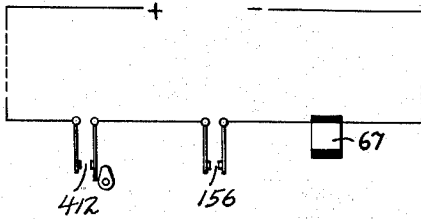


FIG. 5.

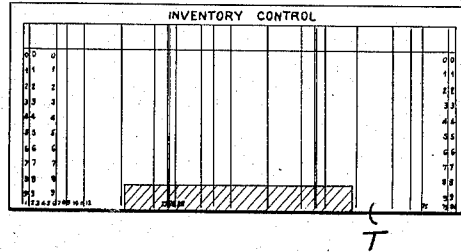


FIG. 3.

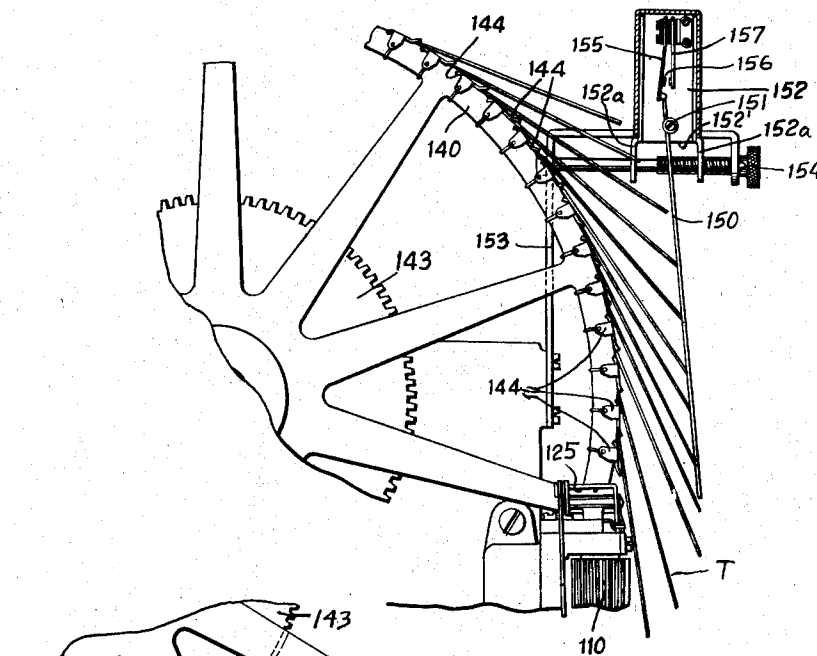
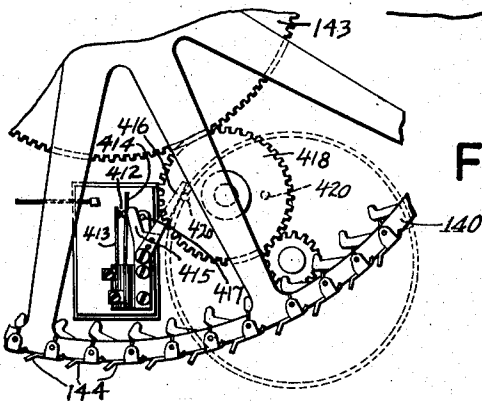


FIG. 6.

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WEB STRAIGHTENING MEANS

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4 Sheets-Sheet 4

FIG. 7.

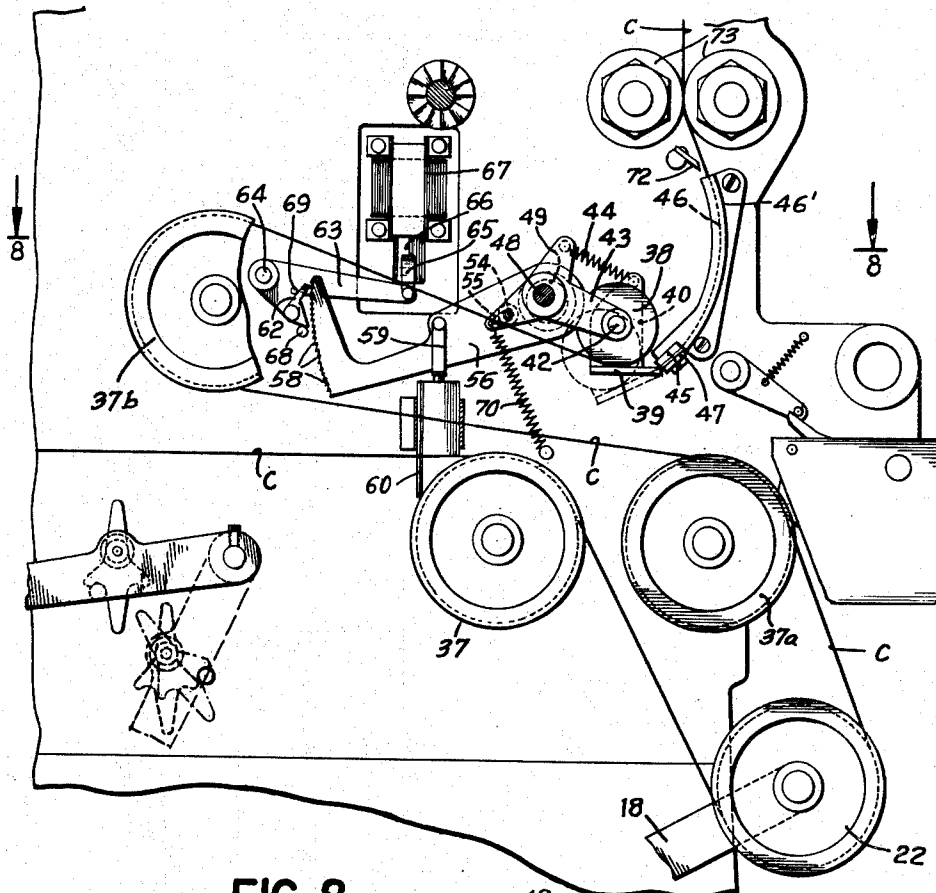
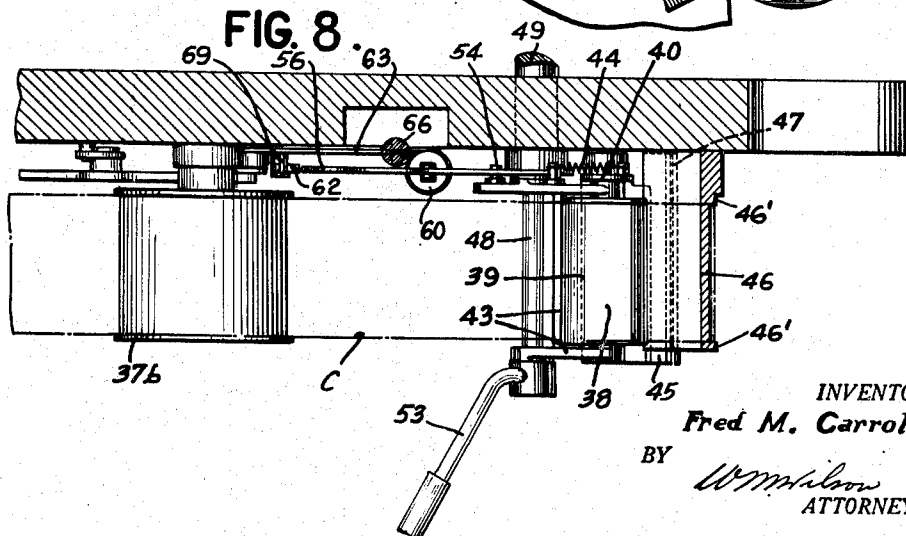


FIG. 8.



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UNITED STATES PATENT OFFICE

2,288,786

WEB STRAIGHTENING MEANS

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Original application January 26, 1937, Serial No.
122,360. Divided and this application April 27,
1938, Serial No. 204,524

19 Claims. (Cl. 92-70)

This case relates to web straightening or decurling means, and is a division of my application, Serial No. 122,360, filed January 26, 1937 and now Patent No. 2,181,935, dated December 5, 1939.

The machine with which this application is concerned is a card forming machine acting on a web to produce record or tabulating cards. These cards are intended for subsequent use in accounting systems, and in order that they be properly acted on in such systems, it is desirable that they be as flat as possible.

Accordingly, it is an object of the present invention to provide novel means to cause the machine to produce substantially perfectly flat cards.

The initial curl or curvature of the web may vary with several factors. One factor, when the web is supplied in the form of a roll, is the length of time the roll has lain in stock, since the longer the roll is in stock, the more set the web becomes in the curvature of the convolutions of the roll. Another factor affecting the curvature of the web is the variation in diameter, and, therefore, of curvature, of the different convolutions of the roll. Still another factor is the initial curvature of the web prior to being wound in the form of a roll. Moreover, the web during its feeding through the card forming machine and the elements which produce the cards from the web may have its curvature varied by such elements. Furthermore, the transfer of the finished card to the card removing or conveying means may affect the straightness of the card.

To take care of all these influences on the straightness of the finished cards, it is another object of the present invention to provide means for governing operation of the straightening means in accordance with the degree of flatness or straightness of the finished cards. This object is, further, to automatically govern operation or adjustment of the straightening means by means which detects the degree of straightness of the finished cards. The object is, still further, to maintain the straightening means in a constant state of flux, sensitively responsive to governing action.

Aside from its particular application to a record card forming machine, the present invention is applicable to the straightening of any web, sheet, strip, or length of material, and the objects of the invention may be broadened to apply to the straightening of any web, sheet, strip, or length of material.

Further, the device, herein disclosed as utilized

for straightening or decurling a web, may also, if desired, be used to impart a curl or curvature to a length of material. It is, therefore, to be understood that the invention is not restricted in its objects to the particular application of the invention to the straightening of a length of material but may also apply to the curling of a length of material.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

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 an enlarged view partly in section of the upper right hand corner of Fig. 1 showing the card straightness or flatness detecting means;

Fig. 4 indicates the part of the circuit relating to the straightening means;

Fig. 5 shows the card after it has been cut and printed, the card being shown on a reduced scale;

Fig. 6 is a detail view of make and break contacts and control related to the straightening means;

Fig. 7 is a detail view of the intermediate part of Fig. 1 showing the web straightening mechanism;

Fig. 8 is a section on line 8-8 of Fig. 7.

It is to be understood that the straightening means disclosed herein is not limited in utility to a card forming machine, but may be utilized in other machines in which a straightening action on a sheet, web, or strip is found desirable.

Briefly, the machine feeds a web at an angle to a straightening element which imparts a straightening action to the web depending on the angle of the web as the latter passes over or around the straightening element. To increase the positiveness of the straightening action and to maintain the web at the required angle to the straightening means, the first straightening element is in coaction with a second straightening element which underlies the web, and in combination with the first straightening element pinches the web as it passes between the straightening elements. The angle of entry of the web to the first straightening element or the relative or angular positions of the coacting straighten-

ing elements determines the degree and direction of straightening correction imparted to the web. After passing the straightening means, the web is fed through printing and then cutting means, forming individual printed cards from the web. The individual cards are transported to a conveyor and while on the conveyor, the straightness of the cards is sensed by means which regulates the action of the straightening means according to the degree of straightness of the sensed cards.

In detail and 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 coaxing 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 thereby 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 which forms part of a web thickness gage, the function and operation of which are explained in my parent application, Serial No. 122,360, now Patent 2,181,935 issued December 5, 1939, of which this case is a division.

From the thickness gage, the web proceeds over a guide roller 31, around previously mentioned web-tensioning roller 22, and around guide rollers 31a and 31b. From roller 31b, the web is passed between the bottom of a roll 38 and the top of a plate 39 tangentially disposed relative to roller 38 (refer to Figs. 1, 7, and 8). Plate 39 is rigidly provided at one side with a vertical arm 40 freely mounted on the shaft 42 of roll 38. Shaft 42 of roller 38 is journaled between the sides of a yoke 43. Between yoke 43 and arm 40 is a spring 44 urging the arm and the plate 39 rigid therewith to rock counterclockwise (Fig. 7) about the periphery of roller 38. At its right hand end, plate 39 abuts the right angular lower corner of a straightener block 45. The web passes between roller 38 and plate 39, then proceeds between the plate and straightener block 45. The straightener block is rigidly secured to the lower end of a convex guide plate 46, having side flanges 46' to engage the sides of the web and prevent lateral movement of the web. As the web is fed around block 45 and upwardly along guide plate 46, the pressure of the lower corner of the block on the web as the web changes direction tends to impart a curvature to the web opposite to its curvature as part of roll 10. The net effect of the action of block 45 is to compensate for the initial curvature of the web so as to straighten the web preparatory to its proceeding through the printing and cutting means, to be described later. The degree of straightening imparted by block 45 to the web depends on the angle of entry of the web relative to the block as the web passes around the lower corner of the block. This angle of the web depends in turn on the position of the plate 39 and of roller 38. The greater the angle, the greater the straightening effect of block 45.

Thus, in the full line positions of roller 38 and plate 39 in Fig. 7, the angle is most abrupt and the straightening effect is the maximum required while in the lower, dotted line, positions, the angle is a minimum and the straightening effect the least.

The drag of the paper on the surface of plate 39 and the action of spring 44 maintain the right hand end of plate 39 against the lower corner of straightener block 45, in all positions of roller 38. Thus, as the roller moves down, plate 39 rocks counterclockwise and its right hand end slides slightly along the lower corner of block 45. Consequently, plate 39 constantly, firmly, and positively holds the web against the lower corner of block 45, and serves as a web supporting surface opposite the block corner coaxing with the latter to increase the positiveness of the straightening action which tends to curve the web in the direction of curvature of the guide 46. In effect, plate 39 and block 45 coact as straightening elements pinching the web between them. Further, plate 39 prevents the part of the web between the roll 38 and the block 45 from bowing downwardly, a condition which would make the angle of entry of the web to block 45 largely indeterminate. By maintaining plate 39 as a constant straight bridge between roll 38 and block 45, the angle of entry of the web to the block is always a definitely determined one, depending on the angle of the plate.

In order to continue to prevent bowing of the web away from block 45 after the web passes the edge of plate 39, a horizontally disposed guide bar 47 (also see Fig. 2) is provided parallel to the

face of block 45. Bar 47 holds the web against the parallel face of block 45.

For reasons previously explained herein, it is desired to maintain, constantly and automatically, a regulating or governing control over the action of the straightening means, and to keep the straightening means in a constant state of flux sensitively reactive to the governing control exercised by means which senses the flatness of the finished cards. The means for controlling the action and condition of the straightening means includes the following means:

Referring to Figs. 7 and 8, yoke 43 is pivotally carried by the round portion 48 of a shaft 49 which is rotatably carried by the frame. Normally, shaft 49 is stationary, being held so by a friction, spring, washer 50 between the frame and a nut 52 on the shaft (see Fig. 2). The outer end of portion 48 of shaft 49 carries a handle 53 which may be manipulated to rock the shaft 49. Round portion 48 is eccentric of the axis of shaft 49 and, consequently, when the shaft is rotated, the position of the eccentric portion 48 is changed to, in turn, adjust the position of yoke 43 and the roller 38 and plate 39 carried thereby. Yoke 43 has a pin 54 passing through a slot 55 of a ratchet sector 56 rotatably carried by the concentric portion of shaft 49. Thus, when yoke 43 is adjusted, through the pin and slot connection with sector 56, adjustment of the sector will also be effected. The purpose of the manual adjustment of yoke 43 is to provide for a manual setting of the roller 38, plate 39, and sector 56 to the proper initial positions.

Sector 56 is provided with ratchet teeth 58 and is connected to the plunger 59 of a dash pot 60. The purpose of the dash pot is to retard descent of the sector.

Opposite ratchet teeth 58 is a dog 62 weighted to tend to engage its nose with the ratchet teeth. The dog is pivotally carried by a lever 63 pivoted on a stud 64 carried by the frame. The lever 63 is connected through a link 65 to the plunger 66 of a solenoid 67. When the solenoid is in deenergized condition, the plunger 66 is at its lower limit and lever 63 is at its clockwise limit (as viewed in Fig. 7). In this latter position of lever 63, the bottom of dog 62 is abutting a fixed stud 68 and is thereby maintained in a counterclockwise position against a pin 69 on lever 63 and with its nose free of ratchet teeth 58.

When solenoid 67 is energized, it elevates a plunger 66 to rock lever 63 counterclockwise, thereby causing dog 62 to rise. As soon as the dog is free of stud 68, its nose engages one of the teeth 58 to raise sector 56 against resistance of a spring 70. The energization of solenoid 67 is momentary, as will be brought out later; hence dog 62 raises sector 56 a small amount and then returns downwardly. The sector tends to descend also but its return action is retarded by dash pot 60, so that dog 62 moves down faster and through a greater distance than the sector in any given time. Consequently, upon two successive energizations of solenoid 67, following each other in rapid succession, the dog engages a lower ratchet tooth 58 upon the second rise than it did not upon the first rise, thereby moving the sector further upward the second time than it did the first time. In this manner, successive energizations of solenoid 67 may intermittently move sector 56 upwardly till the latter reaches its upper limit. On the other hand, 75

if the successive energizations of the solenoid occur at such intervals as permit the sector to descend a distance greater than the down stroke of the dog 62, the latter will, at the beginning of the second rise, engage a higher tooth 58 than upon the first rise and at the end of the second rise the sector will be in a lower position than previously. The sector may thus gradually come to its lowest position, shown in Fig. 7. The lower the sector the greater the angle which plate 39 makes with the straightener block 45 and the greater the straightening action of the plate and block. If the coaction of block 45 and plate 39 overcompensates the initial curvature of the web, then solenoid 67 will be energized, by means presently to be described, to raise the sector to reduce the angle of plate 39 to the straightening block, and to thereby reduce the straightening effect of the plate and block. If the straightening effect is too little, the solenoid will be deenergized and dog 62 will remain released from sector teeth 58, permitting the sector to move down and increase the straightening effect of block 45. In operation, the sector 56 will be in constant oscillation to maintain the straightening action constantly in flux depending on the amount of straightening required, as determined from the sensing of the degree of straightness of finished cards, as will be described later on.

The web, after straightening, proceeds along curved, flanged, guide plate 46, past a knife blade 72 (Fig. 7), but without touching the latter, and into the grip of feed rollers 73. The curve of the web against guide plate 46 stiffens it sideways 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 (see Figs. 1 and 2). 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 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 passing the printing couple, the web is fed between a pair of curved plates 87 which, as explained in my parent application, form part of 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 (Fig. 7), in the event a kink, jam, or bend in the web is detected above the printing means.

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 coating cutter devices 100 and 103a, respectively mounted on spindles 101 and 104.

While the web is feeding upwardly continuously, the cutter devices 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, in a manner which is explained in my parent application. 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 bot-

tom edge from the rest of the web is now a printed, individual tabulating card T such as shown in Fig. 5. During the cutting operation, the portion of the web above the cutters moves between paired guide flutes of a pair of spaced, oppositely rotating fluted guide rollers 110. These guide flutes guide the upper edge of the card, now being cut from the web, to a pair of reciprocating grippers 125, which grip the opposite side portions of the card, and after the card has been completely severed from the web, lift the card into the grip of one of the clamps or clips 144 (see Fig. 3) equally spaced about the periphery of a card conveying drum 140. Drum 140 is continuously rotated counterclockwise (Fig. 1) through a train of gearing including gear 143 on shaft 142 of the drum, the gearing being driven by a motor M. During rotation of the drum, its clips 144, just before reaching a card receiving position, are temporarily opened to receive the upper edge of the card being gripped and elevated by grippers 125. Grippers 125 then release the card and the clip 144 into which the upper edge of the card has been intruded closes and now grips the card firmly to the periphery of the drum 140. The above means for transferring the cards from the cutting means to the conveyor 140 and the construction and operation of the latter are fully described in my parent application and need not be further explained herein.

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 guide rollers 110 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.

While the cards are still at the right side of the locus of travel of the conveyor drum 140 and while extending at different inclinations from the drum, as indicated in Fig. 3, the lower edges of a number (in this instance, five) of successive cards ride along a light wire 150 (Figs. 1, 2 and 3) pivotally suspended from a pivot stud 151 which is carried by a vertical wall of a casing 152 which has a horizontal extension 152' slidably engaging the bottom of the horizontal leg of an angle bracket 153 (as indicated in Fig. 2). Extension 152' has ears 152a through which a screw 154 passes. The screw 154 is rotatably carried by bracket 153 and its threaded portion coacts with a threaded hole in one of the ears 152a while its smooth shank portion passes freely through the other ear 152a. Casing 152 is thus slidably mounted for movement along the horizontal leg of bracket 153. The purpose of thus slidably mounting casing 152 is to provide for adjustment of the casing towards or away from the outer edges of the cards on the conveyor drum. By turning screw 154, the casing 152 may be moved towards or away from the cards on the drum. Since wire 150 moves with the casing, the adjustment of the casing also adjusts the wire to engage the requisite number of cards with the required pressure.

The upper end of wire 150 is bent angularly as indicated in Fig. 2 and, through insulation, engages a light spring contact blade 155. Blade 155 carries one of the points of a switch 156, the other point of which is carried by the blade 157. Switch 156 is in the circuit of solenoid 67 (Fig. 7) which, as previously explained, controls the position of ratchet sector 56 to determine the degree of straightening of the web to be effected by the straightening block 45. When switch 156 is open, the solenoid is deenergized and the ratchet sector is moving down to increase the straightening effect. When switch 156 closes, the solenoid is energized to raise the ratchet sector for reducing the straightening effect.

Wire 150 is constantly sensing the lower edges of a group of five successive cards at the right side of the conveyor wheel 140. If these cards have been overstraightened, that is, if the initial curvature of the web coming off the supply roll 10 has been overcompensated by straightener block 45, then the cards will have been given a convex curvature approaching the curvature of the conveyor wheel rim and their lower edges will extend closer to the wheel rim than if the cards were absolutely straight and uncurved. If the cards have been correctly straightened, their lower edges will lie further out than when the cards have a convex curvature. If the cards have not been straightened enough, they will have a concave curvature, and when on the drum 140 and adjacent wire 150 their lower ends will extend still further out than when the cards have been properly straightened.

When the action of straightener block 45 has not sufficiently compensated for the initial curvature of a portion of the web, so that the cards formed from this portion of the web have their lower ends extending too far out from the periphery of the conveyor drum, then as these cards wipe the wire 150, they move the wire into counterclockwise position (as viewed in Fig. 3). As a result, the upper end of wire 150 is holding spring blade 155 away from blade 157, and switch 156 is open.

With switch 156 open, solenoid 67 is deenergized, permitting ratchet sector 56 to descend, which causes roller 38 and plate 39 to rise and increase the angle of the web to the straightener block 45, thereby increasing the straightening effect.

When the straightener block 45 has overcompensated the initial curvature of a portion of the web, the lower edges of the cards formed from this web portion extend too far in towards the drum periphery, so that as they wipe wire 150, they permit the wire to be moved clockwise by the pressure of spring blade 155, thereby closing the switch 156. Consequently, solenoid 67 is energized to cause ratchet sector 56 to rise and reduce the straightening action.

In above manner, when the web has been over-straightened, switch 156 is closed to result in a reduction of the straightening action. When the web has not been straightened enough, switch 156 is open to result in an increase in the straightening effect.

When the cards have been perfectly straightened, their lower ends as they ride along wire 150 will hold the wire intermediately between extreme switch opening and closing positions, so that switch 156 will still be open. Thus, when the cards have been perfectly straightened switch 156 will be open and solenoid 67 deenergized to in-

crease the straightening effect. The increase in straightening effect will impart a convex curvature to the web. The cards following the perfectly straightened cards will thus be convexly curved, thereby permitting switch 156 to close for causing reduction in the straightening action. From the position in which wire 150 is held by perfectly straightened cards, it need move only a very slight amount clockwise to cause switch 156 to close. Thus, the cards following the perfectly straight ones need be only minutely convex to effect closing of switch 156. Also, the reduction in straightening action which then follows need be only very small before the cards become straight enough to open switch 156.

Thus, switch 156 will be constantly opening and closing to cause intermittent deenergization and energization of solenoid 67. Every time the solenoid is deenergized, it permits the ratchet sector 56 to descend in order to increase the straightening action. When energized, the solenoid causes the ratchet section to rise and tend to reduce the straightening effect. When the cards sensed by wire 150 are perfectly straight, deenergization and energization of solenoid 67 follow each other rapidly, as explained above. Thus, ratchet sector 56 will be constantly in oscillation from a position in which the straightening action produces substantially perfectly straight cards to a position in which the straightening action increases slightly. The tendency is thus for the straightening action to increase. This tendency exactly compensates for the gradual increase of initial curvature of the web due to diminution of the supply roll. The net effect is to provide a straightening action, throughout the operation of the machine on a supply roll 10, which will produce cards varying from absolute straightness to imperceptible degrees of departure from absolute straightness.

The control of the straightening action by the finished cards takes into account any action on the web of the parts through which the web passes prior to its delivery to conveyer drum 140.

By causing wire 150, due to its sensitive response to changes in the degree of straightness of the cards, to oscillate constantly through a mean position to in turn cause constant oscillation, about means positions, of ratchet sector 56, the straightening control is maintained in constant flux, alert to changes in the degree of straightness of the card. The mean positions of the straightening control sector 56 vary with the initial curvature of the web and in any particular mean position of the sector, the straightening means has a corresponding resultant straightening effect. Thus, as the supply roll 10 diminishes in diameter, the web curvature is initially greater and the resultant straightening action must be increased by lowering the mean position of the ratchet sector. Before the increase in resultant straightening effect takes place, the cards riding along wire 150 will cause the wire to hold switch 156 open longer than normal. Consequently, solenoid 67 will remain deenergized longer than the normal interval, permitting the ratchet sector to descend to a lower position than previously, for increasing the straightening action. The normal oscillation of sector 56 will then resume about a new and lower mean position.

As indicated in the circuit diagram (Fig. 4), in series between the opposite sides of the current supply, are solenoid 67 which controls operation of sector 56 of the web straightening mechanism, switch 156 controlled by card sensing wire 150, and timing contacts 412. These timing contacts

close periodically during operation of the machine, in order to time the making and breaking of the circuit of solenoid 67. Thus, if switch 156 is held closed by over-straightened cards, the circuit of solenoid 67 will be broken and made repeatedly by contacts 412, so as to provide several successive driving impulses of the solenoid plunger.

Timing contacts 412, as shown in Fig. 6, are carried by spring blades 413 and 414. Engaging blade 414 is an insulating block 415 fixed to a pivoted arm 416. Spring blade 414 is flexed to move away from blade 413, and the pressure of blade 414 on block 415 urges the latter to engage a stop pin 417. Gear 418 meshed with gear 143 of conveyor drum 140 has a pair of pins 420 extending transversely and located at diametrically opposite points. As gear 418 rotates, first one and then the other pin 420 engages arm 416 to rock it towards blade 414. This causes block 415 to move blade 414 towards blade 413 to close timing contacts 412. The pin 420 then rides off the free end of arm 416, permitting contacts 412 to open.

In above manner, contacts 412 are periodically closed to time the making and breaking of the circuit of straightener-regulating solenoid 67 which is under the further control of switch 156.

The term strip material may be used, for convenience, in any of the subjoined claims, to refer to lengths of material or material comparatively long with respect to its width, and is not to be understood as limited to the material specifically disclosed herein but to any material, flat or otherwise, capable of being decurled by the disclosed machine.

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 combination; decurling means flexing moving strip material to straighten the material, mechanism feeding the material past the decurling means to be straightened, automatic means for gaging the flexing action required to straighten the material, an automatic power actuator and means controlled by the gaging means for controlling the power actuator to selectively actuate the decurling means to maintain constantly the required flexing action.

2. In combination; decurling means flexing moving strip material to straighten the material, mechanism feeding the material past the decurling means to be straightened, means for gaging the flexing action required to straighten the material, and electrical means controlled by the gaging means for varying the flexing action to provide the required straightening effect.

3. In combination; decurling means flexing moving strip material to straighten the material, mechanism feeding the material past the decurling means to be straightened, electrical means controlled by the material for gaging the flexing action required to produce the necessary straightening effect, and means controlled by the electrical gaging means for governing operation of the decurling means to provide the necessary straightening effect.

4. In combination; decurling means flexing strip material to straighten the material, mechanism feeding the material past the decurling means to be straightened, an electrical device for adjusting the decurling means to vary the flexing action thereof, means for gaging the flexing action required to straighten the material and including a switch selectively conditioned under control of the material, and a circuit controlled by the switch for operating said electrical device to govern the flexing action of the decurling means in accordance with operation of the gaging means.

5. In combination; decurling means flexing strip material, while the material is in motion, for straightening the material, mechanism for feeding the material past the decurling means to be straightened, means including an electrical actuator for adjusting the decurling means to vary the decurling action thereof, means controlled by the material for gaging the flexing action required to straighten the material, and a circuit controlled by the gaging means for energizing the electrical actuator to adjust the decurling means for causing the material to be properly straightened.

6. In combination; decurling means flexing strip material, while the material is in motion to straighten the material, mechanism feeding the material past the decurling means to be straightened, means for effecting step by step adjustment of the decurling means to vary the flexing action thereof, and means for timing the interval between said steps to limit the extent of variation in the flexing action during the feed of a predetermined portion of the material past the decurling means.

7. In combination; decurling means flexing strip material to straighten the material, mechanism feeding the material past the decurling means to be straightened, reciprocable means having a forward stroke effective to adjust the decurling means for varying the flexing action thereof and having an idle return stroke, a device operable for effecting the forward stroke of the reciprocable means, means for gaging the degree of straightness of the material, and means controlled by the gaging means for intermittently operating the device to provide successive effective forward strokes of the reciprocable means for adjusting the decurling means.

8. In combination; decurling means flexing strip material, while the material is in motion, to straighten the material and including a device adjustable to vary the flexing action, mechanism feeding the material past the decurling means to be straightened, and means controlled by the material solely in accordance with the flexure thereof for governing operation of said device to maintain the material issuing from the decurling means in straightened condition.

9. In combination; decurling means flexing strip material, while the material is in motion, to straighten the material and including a device adjustable to vary the flexing action, mechanism feeding the material past the decurling means to be straightened, and means controlled by the material in accordance with the flexure thereof subsequent to passing the decurling means for governing operation of the device to maintain the material issuing from the decurling means in straightened condition.

10. In combination; decurling means flexing strip material to straighten the material while the material is moving past the decurling means,

mechanism to feed the material past the decurling means to be straightened, gaging means controlled by the material subsequent to its passing the decurling means for determining whether the material has been overstraightened or understraightened, and means controlled by the gaging means in accordance with the determination thereby for automatically operating the decurling means to increase or decrease its straightening effect.

11. In a machine in which sheet material is supplied in the form of a roll; decurling means to flex the material, while the material is in motion to straighten the material, mechanism to feed the material from the roll past the decurling means to be straightened thereby, means remote from the roll and responsive solely to the flexure of the material for gaging the decurling action required to straighten the material, and means controlled by the gaging means according to the response thereof to the flexure of the material for regulating operation of the decurling means.

12. In a machine of the class described in which apparatus is provided to operate on strip material and which may by such operation affect the flexure of the material; decurling means flexing the material while the material is feeding towards said apparatus, mechanism for feeding the material successively past the decurling means and said apparatus, means coacting with the material after passing said apparatus for gaging the flexure of the material, and means controlled by the gaging means for regulating the continued operation of the decurling means so as to cause the material issuing from the said apparatus after being operated on thereby to be in substantially straightened condition.

13. In a machine having means to form cards from a web of sheet material; a decurling unit flexing the web while the material is feeding towards the forming means, mechanism to feed the web successively past the decurling unit and forming means, means coacting with the cards after issuing from the forming means for gaging the degree of straightness of the cards, and means controlled by the gaging means for automatically governing the continued operation of the decurling unit.

14. In a machine having means for forming sheets from a web of sheet material; a decurling unit, mechanism to feed the web successively past the decurling unit and the forming means to be successively decurled and formed into individual sheets, means for receiving the sheets from the forming means, means controlled by the sheets while on the receiving means for detecting the degree of straightness of the sheets, and means controlled by the detecting means for regulating the continuing action of the decurling means.

15. In a machine having means to form individual sheets from a web of sheet material; a decurling unit, mechanism for feeding the web successively through the decurling unit and the forming means to be successively decurled and formed into individual sheets, means for removing the sheets from the forming means and including sheet conveying means, means coacting with the sheets while carried by the conveying means to gage the flexure of the sheets, and means controlled by the gaging means for automatically governing continued operation of the decurling unit.

16. In a machine having means to form individual, separated sheets from a web of sheet material; a decurling unit, mechanism to feed

the web successively through the decurling unit and the forming means to be successively decurled and formed into individual sheets, means coating with the edges of a series of successively formed individual sheets to gage the degree of straightness of the sheets of said series, and means controlled by the gaging means in accordance with the control thereof by the series of sheets for governing continued operation of the decurling unit.

17. In a machine having means to cut a web of sheet material into separate cards; a decurling unit, mechanism for feeding the web past the decurling unit and the cutting means to be successively decurled and formed into cards, means for removing the cards from the cutting means and including a conveyor having clamps, each for holding one card by one edge with the rest of the card extending outwardly to leave a free, outer edge, the position of which is related to the degree of straightness of the card, means engaging said free edges of the cards to gage the degree of straightness of the cards, and means controlled by the gaging means for governing continued operation of the decurling unit.

18. In a machine having means to cut a web of sheet material into individual cards; decurling means for decurling the web prior to the cutting operation, mechanism to feed the web successively through the decurling means and the cutting means, means for removing the cards from

the cutting means and including a device for carrying the cards by one of their edges with the rest of each card extending outwardly, leaving a free edge the position of which depends on the flexure of the card, means for simultaneously engaging a series of successive ones of said free card edges to gage the flexure of the cards of said series, and means controlled by the gaging means for automatically adjusting the decurling means to regulate the continued decurling effect thereof.

19. In combination; decurling means flexing strip material while the material is in motion to straighten the material and including a movably mounted part movable to vary the flexing action of the decurling means upon the material, mechanism feeding the material past the decurling means to be straightened thereby, actuating means operable in successive steps to effect movement in one direction of the aforesaid part of the decurling means for varying the flexing action, said part of the decurling means moving in the opposite direction between the said successive steps, gaging means for coating with the material to gage its flexure, means for timing the interval between the steps of operation of the actuating means, and means controlled by the gaging means and the timing means for operating the actuating means.

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