Dec. 17, 1968 F. N. STEPHENS ETAL 3,416,787

TICKETMAKING MACHINE

Filed July 8, 1966 5 Sheets-Sheet 1

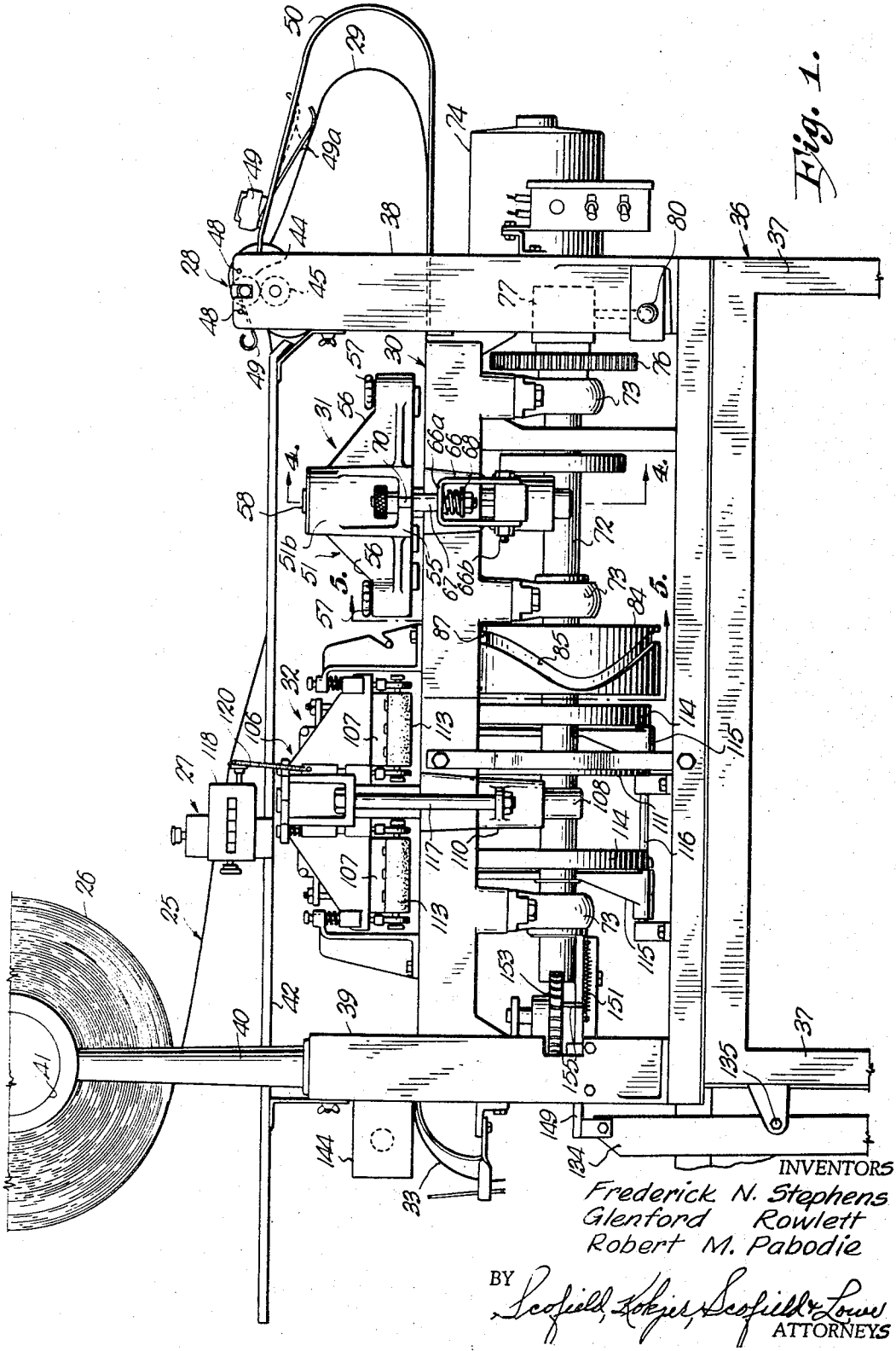


Fig. 1.

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TICKETMAKING MACHINE

Filed July 8, 1966 5 Sheets-Sheet 2

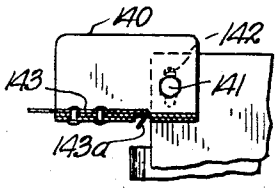


Fig. 6.

Fig. 1a.

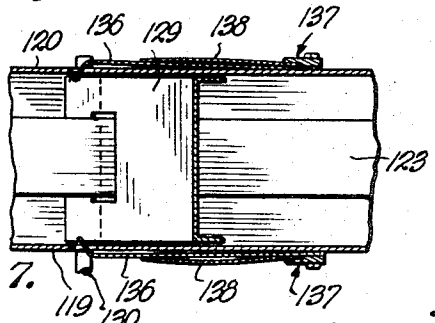


Fig. 7.

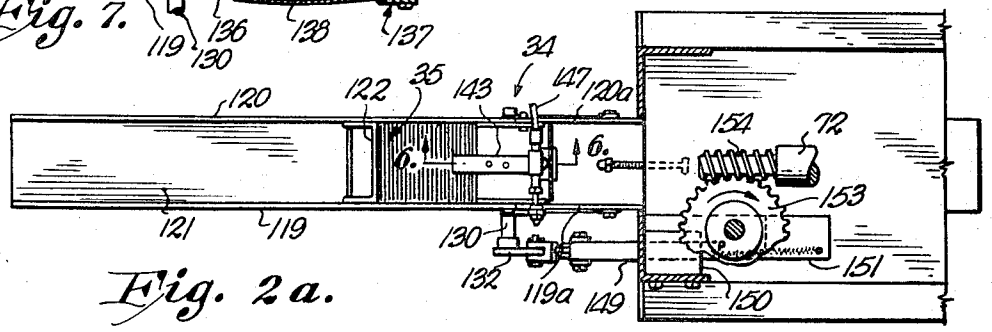


Fig. 2a.

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TICKETMAKING MACHINE

Filed July 8, 1966 5 Sheets-Sheet 3

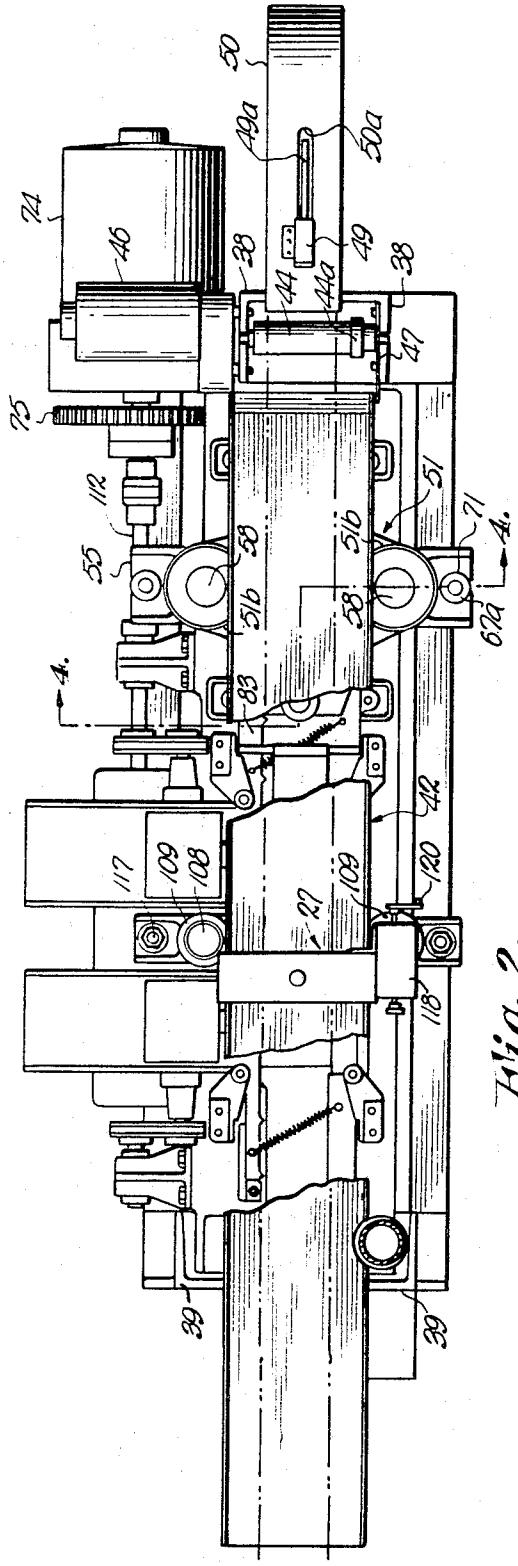


Fig. 2.

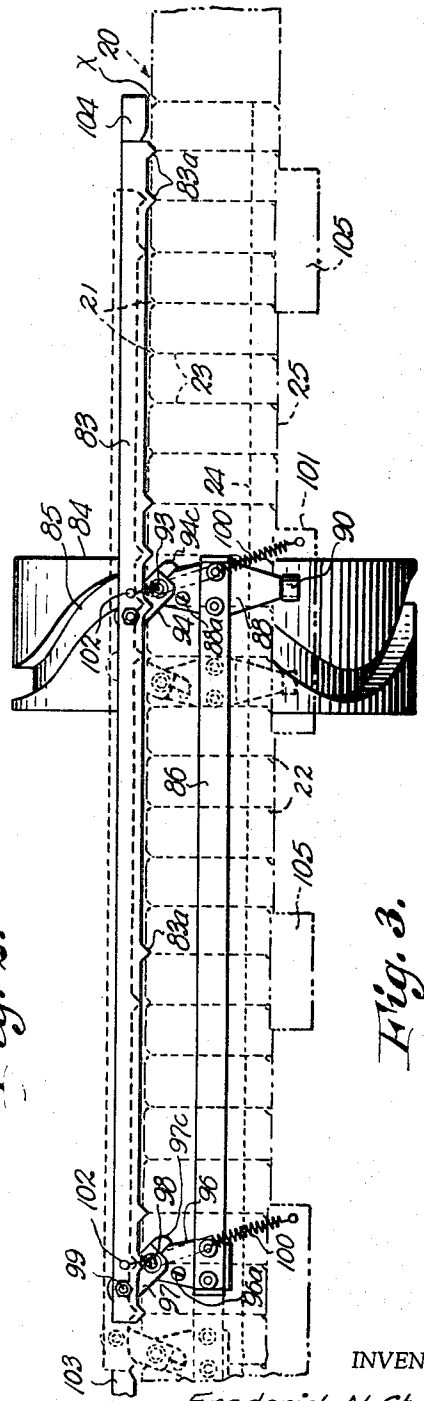


Fig. 3.

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TICKETMAKING MACHINE

Filed July 8, 1966 5 Sheets-Sheet 4

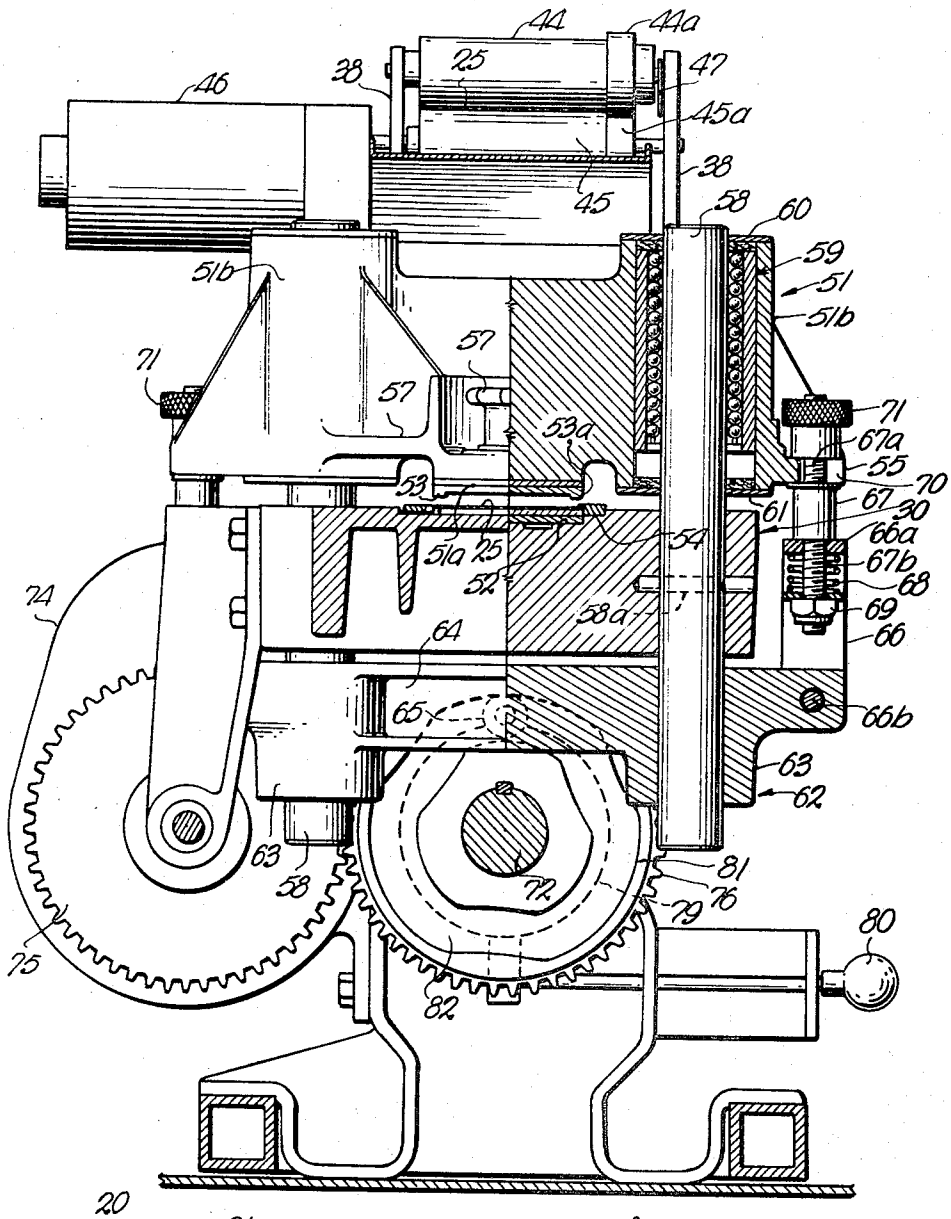


Fig. 4.

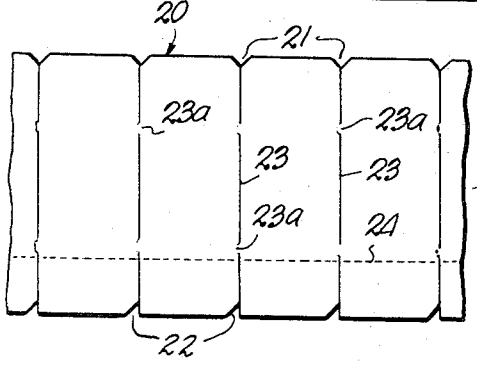


Fig. 10.

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TICKETMAKING MACHINE

Filed July 8, 1966 5 Sheets-Sheet 5

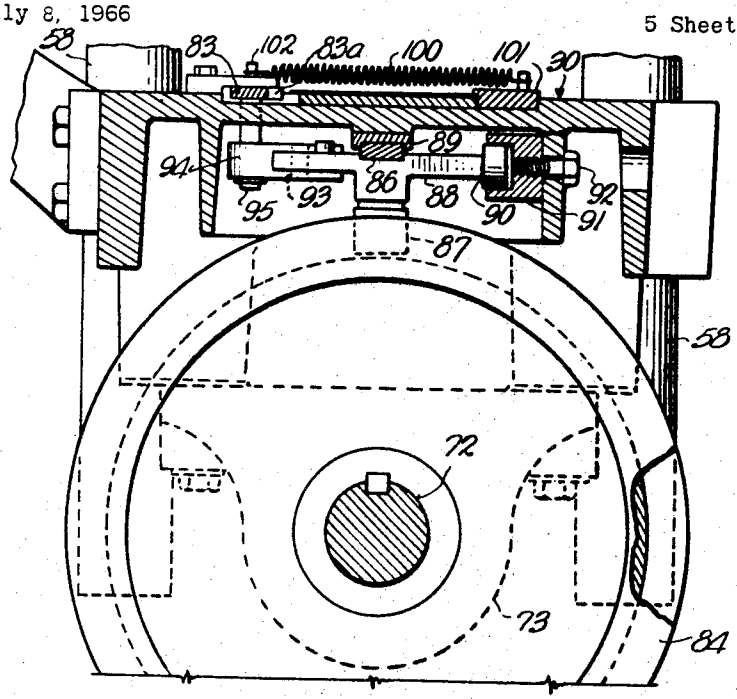


Fig. 5.

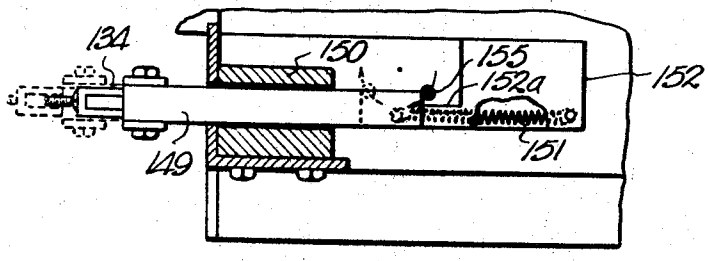


Fig. 8.

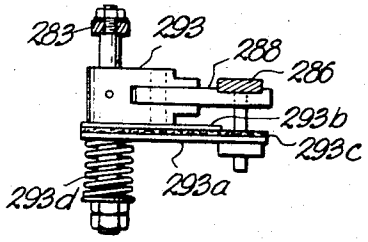


Fig. 9.

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United States Patent Office 3,416,787
Patented Dec. 17, 1968

3,416,787

TICKETMAKING MACHINE

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Filed July 8, 1966, Ser. No. 563,861
8 Claims. (Cl. 270—79)

ABSTRACT OF THE DISCLOSURE

A machine capable of substantially continuously drawing a web of paperboard or the like from a roll, punching the web to form severable tickets or tags with the individual tickets or tags arranged transversely of the web, advancing them through a printing station in stepwise fashion and subsequently forming the web into a fan folded stack of connected strips of multiple ticket length.

Background and summary of the invention

A principal object of the invention is to provide in a machine of the character described a high speed incremental feeding mechanism capable of advancing a strip of ticket stock in accurately controlled steps so as to assure of exact placement of the individual ticket sections at the printing station in order that they carefully and accurately printed.

Another object of the invention is to provide in a machine of the character described a drive arrangement through which accurate timing of the tag punching and feeding as well as printing is achieved. In our machine, the main operating components of the unit are driven from a single motor and main drive shaft. Each operation is thus accurately timed in relation to the others and there is no opportunity for production of an imperfect product.

Still another object of the invention is to provide in a machine of the character described a continuously operating automatic fan folding mechanism which operates to arrange the emitted strip of severable tickets into a fan-folded stack of linear strips of equal and predetermined length.

Other objects of the invention are to provide in a machine of the character described means for properly feeding the paperboard strips into the machine in order to maintain a continuously available supply of paperboard for the punching and printing; for sensing the trailing end of the strip and automatically shutting off the machine in response to its arrival so that a new supply of paperboard stock can be spliced on; and for assuring of high speed operation with a minimum of supervision required.

Other and further objects of the invention, together with the features of novelty appurtenant thereto, will appear in the course of the following description.

Detailed description

In the accompanying drawings, which form a part of the specification and are to be read in conjunction therewith, and in which like reference numerals indicate like parts in the various views;

FIG. 1 is a partial side elevational view of a preferred machine embodying the invention, the lower frame and left hand end of the machine being shown only fragmentarily as is the roll of paperboard stock on the upper side of the machine;

FIG. 1*a* is a fragmentary side elevational view taken from the same side as FIG. **1** and showing the fan-fold arrangement which extends from the left hand side of the machine as viewed in FIG. 1, but which is not included in FIG. 1, parts being broken away for purposes of illustration;

FIG. 2 is a top plan view of that portion of the machine shown in FIG. 1, with the exception that the view is taken on a line below the roll of paperboard so that the column on which the roll is supported is shown in section, other parts being broken away for purposes of illustration;

FIG. 2*a* is a top plan view of that portion of the machine illustrated in FIG. 1*a*, some parts being broken away for purposes of illustration;

FIG. 3 is a schematic view of the web advancing and indexing means looking down on top of the indexing bar, the bar and its directly associated parts shown in solid lines in one position and in broken lines in another with the ticket web and other components also shown in broken lines;

FIG. 4 is an enlarged fragmentary sectional view taken generally along the line **4—4** of FIGS. 1 and 2 in the direction of the arrows;

FIG. 5 is an enlarged fragmentary sectional view taken generally along line **5—5** of FIG. 1 in the direction of the arrows;

FIG. 6 is an enlarged fragmentary sectional view taken along line **6—6** of FIG. 2*a* in the direction of the arrows;

FIG. 7 is an enlarged fragmentary sectional view taken generally along line **7—7** of FIG. 1*a* in the direction of the arrows, the fan folding member in this instance being shown in its retracted position rather than in the forward folding position of FIG. 1*a*;

FIG. 8 is an enlarged fragmentary sectional view taken generally along line **8—8** of FIG. 1*a* in the direction of the arrows, the parts, however, being shown in solid lines in the positions which correspond to the retracted position for the fan-fold member rather than in the forward position illustrated in FIG. 1*a*;

FIG. 9 is an enlarged sectional view of a modified form of structure employed in and which would be visible in its modified form in FIG. 5; and

FIG. 10 is a plan view of a segment of a strip of punched tickets which are produced by the machine.

Referring to the drawings, the general purpose of the machine is to produce a continuous linear web of severable tickets having a configuration such as shown in FIG. 10. The paperboard strip **20** has been provided at uniform intervals with V-shaped notches **21** in one edge. Half notches **22** are provided in the lower edge and individual severable tickets are formed by cut lines **23** which are interrupted at **23***a* so that the tickets remain connected by connector portions. Score lines **24** running lengthwise of the strip may also be provided. While other configurations for the tickets can be present, one of the important provisions of the invention is the production of the notches **21** and/or **22** since, as will be seen, these notches play an important part in moving the web through the machine and indexing it in position for subsequent printing operations.

In general the web of tickets is formed by initially unwinding a continuous web **25** of paperboard of the like from a supply roll **26**. This web is directed through a sensing mechanism **27** to a web feeding mechanism **28**. The feed mechanism feeds the web into a loop portion **29** and the web is reversed and passed horizontally across the bed or table **30** of the machine. The strip passes first through a punching and scoring assembly **31**, then through a printing station **32**, and emerges from the table at the left hand end as indicated at **33**. Referring to FIG. 1*a*, which shows the machine as continued from the left hand side of FIG. 1, the emerging strip portion **33** is fed downwardly into a fan-fold mechanism **34** where it is folded into equal length strips stacked on side in the stack **35**.

Turning now to a more specific description of the

various components of the machine, in its preferred form the machine is supported on a table-like frame **36** having the supporting legs **37**. Each end of the frame has extending upwardly from the top thereof spaced parallel standards, those at the input end (the end adjacent web loop **29**) identified at **38** and those at the output end at **39**.

Supported on one of the standards **39** and extending upwardly therefrom is the post **40** which carries at its upper end a horizontally projecting rotary hub (not shown) which carries the roll **26** of paperboard stock. A similar but oppositely projecting hub **41** is positioned on the side of pedestal or post **40** opposite from roll **26**. This hub is adapted to receive a supplemental roll. The post **40** is mounted for manual rotation about its upright axis so that when roll **26** is exhausted a new roll (not shown) placed on hub **41** can be swung into position simply by rotating the post 180°.

Extending lengthwise of the machine and supported by appropriate brackets secured to standards **39** and **38** is a shallow channel-like platform **42**. This platform terminates just short of the standards **38**, and, as can be seen, the web **25** is supported by it as the web approaches the upper end of standards **38**.

The web passes through a pair of cooperating friction drive drawing rolls **44**, **45**, which are supported between the standards **38**. The lower roll **45** is drivingly connected with the output shaft of a gear box which is powered by an electric motor **46**. Both rolls preferably have contacting roller surfaces **44***a*, **45***a* which cooperate to drive the rolls and rubber or similar gripping surfaces which grip the paperboard web firmly therebetween. The upper roll is held in engagement with the lower roll by a spring wire hold-down **47**, which passes beneath pins **48** on opposite sides of the stub axles at the end of roller **44**. The stub axles of the roller **44** are trunnioned in notches formed in the upper ends of the standards **38**.

Following its departure from the rolls **44**, **45**, the web is formed into the open, reversely directed loop **29**. In order to control the size of the loop **29** and to assure of a constantly available supply of untensioned paperboard to the punching and printing mechanisms, a microswitch **49** is mounted on a reversely curved shield **50** which is supported from the standards **38**. Switch **49** has the operating arm **49***a* which is operatively connected with the contacts of the switch **49** and is spring or otherwise biased downwardly. The arm is positioned to be engaged by the loop. The switch **49** is electrically connected by leads (not shown) in the circuit to the motor **46**. The "ON" position for the switch **49** coincides with the position of arm **49***a* shown in solid lines in FIG. 1. The "OFF" position for the switch coincides with the broken line position shown for the arm. Should the loop be expanded sufficiently by the feeding of paperboard to the printing and punching mechanism as to force the arm **49***a* to move to the broken line position therefor, the contacts of the switch **49** will be opened and the feed rolls will be stopped. The shield **50** is provided with an opening **50***a* to receive the arm when it is displaced to the broken line position. As the size of the loop decreases the loop withdraws from the switch arm **49***a* and eventually the switch is closed, thereby restarting the motor. Thus a loop of substantially continuous size is maintained.

As the unwound web proceeds across the table **30** from loop **29**, it passes initially beneath the vertically reciprocable die head **51** which carries punching elements which cooperate with a corresponding die plate **52** therebelow to punch out the pattern of notches **21** (FIG. 10), as well as form the cross cut lines **23** and score lines **24**. Referring to FIG. 4, the notch cutting projections on the underside of the die head are indicated at **53**, **53***a*, respectively. The web **25** passes across the die plate **52**. A hold-down **54** having a rabbeted inner edge which overlaps the edge of the strip assists in guiding the web **25** through the punching and forming area.

Die head **51** is preferably a single casting having the oppositely extending lateral flanges **55** and the fore and aft extensions **56**. The fore and aft sections **56** carry at the outer ends thereof hand knobs **57** which are connected with bolts which serve to secure the punch plate **51***a*, on which projections **53**, **53***a* are formed, to the under side of the head. These can be unscrewed to release one punch plate and mount another when it is desired to change the pattern.

The die head **51** is guided for vertical reciprocatory movement on spaced vertical posts **58** which extend upwardly through the body of table **30** on opposite sides of the path of movement of the web. The posts are each received centrally in the barrel sections **51***b* of the die head. As seen particularly from FIG. 4, each section **51***b* of the die head has a central vertical cylindrical passageway therein in which is fitted a bearing structure **59** to facilitate free upward and downward movement of the die head. The upper and lower ends of the bearing cavity are closed by closure plates **60**, **61**.

The power to reciprocate die head **51** is supplied from below the table **30**. The posts **58** are fixed by pins **58***a* in the body of the table **30**, and remain stationary. Guided on the lower extensions of posts **58** below the table **30** is a cross head **62**. The cross head **62** has the two spaced boss portions **63**, each of which is provided with a vertical cylindrical passageway which slidably fits on the corresponding post **58**. The boss portions **63** are interconnected by a web portion **64** which carries centrally thereof on one side a roller cam follower **65**. Reciprocation of the cross head **62** and, as will be seen, corresponding reciprocation of the upper die head **51** is achieved by vertical reciprocation of cam follower **65**.

The outer ends of cross head **62** each have pivotally secured thereto U-shaped yoke members **66**. The yoke members are pivoted on pins **66***b* and each has a bight portion **66***a* at its distal end. Connected with and extending centrally upwardly from bight portion **66***a* is a connector member **67** having a cylindrical central portion and oppositely projecting upper and lower threaded portions **67***a*, **67***b*. The lower threaded portion **67***b* of member **67** extends through a registering aperture in bight **66***a* and into the space between the legs of yoke **66**. A coil compression spring **68** encircles portion **67***b* and a nut and washer combination **69** retains the lower end of the spring. The upper end of the spring bears against the under side of bight **66***a* of the yoke. The threaded upper extension **67***a* of member **67** is received in notch **70** cut into the side edge of the flange **55** formed as a part of the die head **51**. A nut **71** having a knurled portion to facilitate manual manipulation thereof is threaded on the upper end of the upper threaded extension **67***a* of member **67** and when drawn down tight secures the die head firmly to the lower reciprocating cross head **62**. It will be noted that the lower sides of the flanges **55** adjacent the notch **70** rest upon the shoulder formed between the main body of member **67** and its upper threaded extension. A washer is also present.

Obviously, the die head can be disconnected from the reciprocating cross head by backing off the nuts **71** sufficiently that the assembly constituting the yoke **66** and member **67** can be swung outwardly to disengage the nuts **71** from the upper surfaces of the flanges **55**. Once this is done, the die head can be lifted upwardly off the posts **58** for the purpose that may be desired, such as replacing the punch plate.

The power for reciprocating the die head **51** and, for that matter, for operating substantially all the other components along table **30**, is supplied through the rotation of a main drive shaft **72** which extends horizontally substantially the length of the main portion of the machine beneath the table **30**. This shaft is supported at intervals in bearings **73** secured to the underside of the table.

The shaft is driven from an electric motor **74** which is mounted to one side of the unit and supported from one of the standards **38** (see FIG. 2). The output shaft of the motor **74** carries a drive gear **75** which meshes with the

driven gear **76** which is carried on the input side of a coaxial clutch assembly **77** of conventional design. The clutch is operated through a clutch operating control **80**. The shaft **72** is connected with the output side of the clutch. Any conventional mechanism of this type may be utilized.

Mounted on the drive shaft **72** below the die head **51** is a rotary camming member **81** having the cam track **82** in the face thereof confronting the cross head **62**. The cam track **82** receives the roller cam follower **65** earlier described which is connected with the head.

As is evident from FIG. 4, the cam track is such as to produce three reciprocation cycles for each revolution of shaft **72**. In FIG. 4, the cam follower and track are shown in a position which corresponds with the raised position for the die head **51**. As the shaft rotates, the camming member operates to pull the cross head **62** down and then raise it again for one complete reciprocation stroke. This is repeated three times for each revolution of the shaft. The downward thrust of the cross head is applied to the die head **51** through the medium of the side connecting arrangements earlier described. The resilient connection between the upper die head and the cross head provided by springs **68** absorbs shock as the die projections are brought into engagement with the paperboard web and on through to form the notches and other score and severance lines earlier described.

The feeding and indexing of the paperboard web through the punching die assembly and on also through the printing station **32** is accomplished by means of a mechanism now to be described.

Referring to FIGS. 2, 3, 4 and 5, positioned to one side of the web and extending a substantial portion of the length of the table **30** is an elongate bar member **83** having on that edge confronting the side edge of the web a plurality of teeth **83***a* which are adapted to fit within the notches **21** punched into the web. The bar **83** moves in a generally rectangular pattern which consists of an inward movement toward the side edge of the web and normal to the longitudinal axis of the web, a movement lengthwise or parallel with the axis of the web toward the output end of the machine with the teeth **83***a* engaged with the notches, an outward movement directly away from the side edge of the web, and a retraction movement parallel with but spaced from the web toward the input end of the machine. The general pattern of movement can perhaps best be discerned from FIG. 3 which shows in solid lines the bar ready for web carrying movement toward the output end of the machine and in broken lines the position of the bar as it is ready for retraction back to pick up a new set of notches.

In order to better explain the orientation of the bar with respect to the remainder of the machine and referring again to FIG. 3, X marks the location of the point where notching is done to form notches **21**. The endmost tooth **83***a* at the right hand end of bar **83** is spaced one ticket width from this notch. The linear displacement of the bar, i.e. that in the direction of movement of the web is equal also to the thickness of one ticket. Accordingly, for each cycle of displacement of the indexing bar the web is moved one ticket width.

The longitudinal displacement of the indixing bar **83** is effected through the medium of a rotary camming wheel **84** having the peripheral cam track **85**, and a drive bar **86** which is operatively connected with cam member **84** through a roller cam follower **87** mounted on the under side of the drive bar casting **88**. The drive bar casting **88** is secured to drive bar **86**. The cam member **84** is mounted on the main drive shaft **72** and the shape of the cam track **85** is such that for each revolution of the drive shaft the drive bar **86** will be reciprocated fore and aft through three complete cycles. FIG. 3 shows the relative positions of the parts at the start of a cycle.

The top of the drive bar **86** slidably bears against a wear plate **89** (see FIG. 5). The drive bar casting **88** is guided for movement in a horizontal plane by means of a guide roller **90** on that side thereof opposite from the index bar **83**. The roller **90** is received within a recessed linear track formed in a member **91** which is secured as by bolt **92** to a depending flange on the under side of the main body of the table **30**.

The drive bar casting **88** includes a portion projecting toward the index bar **83**. Pivotally secured to this portion on the vertical axis **93** is a link member **94** which in turn is pivoted to the index bar by a vertical pin **95**. The other end of the drive bar **86** has a bracket **96** likewise projecting toward the index bar **83**. A link member **97** is pivoted as at **98** to bracket **96** and to the index bar **83** at **99**. It will be observed also that two tension springs **100** extend diagonally across and above the ticket web. These springs are each anchored at one end to stationary guide and hold down members **101** and connect at the other end with pins **102** on the upper side of the index bar. It will be observed from FIG. 3 that when bar **83** is in its inner, web engaging position (the solid line position), the angle of the springs is such that spring force is directed substantially through pivots **93**, **98** and therefore there is no net moment tending to rotate links **94**, **97** clockwise. Thus the springs **97** serve to maintain the bar resiliently biased toward and into engagement with the side edge of the web through the medium of the teeth **83***a*.

The limits of longitudinal movement of the index bar **83**, i.e., in the lengthwise direction thereof, are determined by the limit stops **103**, **104** at the opposite ends of the bar. Again referring to FIG. 3, and starting with the solid line position for the index bar **83**, as the camming member **84** rotates, the drive bar casting **88** will be impelled to the left and through the medium of the linking arrangement will carry the index bar **83** with it. After displacement of the index bar equal to one ticket width, the left hand end of the index bar will strike stop **103** and further leftward movement of the index bar **83** will be thereafter prevented. However, the drive bar **86** will continue to advance and linkage formed by pivot links **94**, **97** will act as a toggle thereby applying outward thrust to the index bar. The pivotal movement of links **94**, **97** is limited in each case by an extension **94***c*, **97***c* which engages a pin **96***a*, **88***a* on the bracket **96** or drive bar casting **88**, as the case may be.

As the drive bar **86** is moved back to the right by the camming member **84** the index bar **83** is carried with it. The springs **97** maintain the toggle linkages in extended position since all force components thereof are to the right of the pivot axes **93**, **98**. The index bar **83** will move only so far as permitted by the right end stop **104**. However, the drive bar **86** continues to move after the index bar has been stopped and as a result the toggles are again collapsed, thereby drawing the index bar inwardly toward and again into engagement with the notches in the web. At this point the drive bar casting **88** has reached its maximum retraction point and the cycle is again initiated as the bar reverses direction and begins to move again to the left.

It will thus be seen that for each reciprocation of the drive bar **86** the index bar **83** moves in a rectangular pattern, i.e., it advances one ticket width, disengages outwardly from the web, retracts one ticket width and is again moved linearly toward and into engagement with the strip. The indexing action is positive and there is no way in which any slippage can result.

The web is restrained against lateral movement by engagement of the side edge opposite from notches **21** by guide members **105** spaced along the table **30**. These guide members have lips which slightly overlie the top surface of the web adjacent the edge of the web in order to prevent it from raising off its support surface.

The fundamental component of the printing station **32** which forms a part of this invention is a reciprocatory printing head **106** which carries printing plate **107** on the under side thereof. The printing head **106** is reciprocated

in much the same fashion as the die head **51**. To this end there are provided on opposite sides of the moving web, vertical stationary cylindrical columns or posts **108** over which are slidably mounted barrels or cylinders **109** which form a part of the printing head **106**. The posts **108** have extensions below the table **30** and these slidably guide a cross head **110** which is constructed much like cross head **62**. Cross head **110** has a cam follower which engages in a cam slot in the face of a camming member **111** secured to shaft **72**. The difference between cam **111** and cam **81** for the punching die is that the cam slot in cam **111** is designed to produce one complete reciprocation of its cross head **110** for each revolution of the shaft rather than three as in the case of the punching die. The reason for this is that the printing head **106** is arranged in this case to print three tickets at a time.

The remaining details of the printing mechanism itself are not part of this invention and accordingly only a brief description will be given. The doctor rolls for applying ink to the applicator rolls and other aspects of the printing mechanism can be driven by a continuation from the drive shaft of motor **74** located to one side of the unit. Thus a jack shaft **112** extends axially from drive gear **75** and toward and into driving relationship with various components. The ink applicator rolls are indicated at **113** and these are moved under and across with the printing faces of plates **107** when the printing head is in its raised or retracted position, thus to deposit ink on the plates after which the rolls **113** are again retracted. The drive for the ink applicator rolls **113** can be a cam drive also, driving cams being shown at **114** and the arms which support the rolls at **115**. These arms are pivoted at their lower ends on a shaft **116** and cam followers on the arms **115** interconnect with cam slots in the faces of the cam members **114** to oscillate the arms toward and away from the side of the machine so as to run the rollers in and out beneath the printing head.

The printing head **106** is supported from the lower reciprocatory cross head **110** by means of the side connector rods **117** which are secured at their lower ends to flanges on the head **110** and at the upper ends to brackets extending to opposite sides of and forming a part of the printing head **106**. A mechanical counter **118** is positioned above the printing head, the counter having an actuating arm **119** (see FIG. 2) which is connected with the printing head through the medium of a tension spring **120**. Each reciprocation of the head is thereby registered on the dial of counter **118** and it is an easy matter to determine total number of tickets that have been processed by multiplying the number shown by three.

After the tickets are printed with whatever indicia may be desired, they proceed on and off the left hand end of the table as at **33** and toward and into the fan-fold mechanism now to be described.

Referring to FIGS. 1*a* and 2*a*, positioned on the end of the frame **37** and secured thereto are two spaced vertical sheets **119**, **120** which are joined together by a channel-like member **121** whose web forms the bottom of a trough between the sheets. Positioned within this trough is an upright channel-shaped member **122** which is slidable lengthwise in the trough. This member is secured to one end of a flexible belt or strap **123** which proceeds toward the main frame of the machine adjacent the bottom of the trough and is connected with one end of a cord or cable **124** which is reeved through pulleys **125**, **126** and **127** and has secured to its other end a weight **128**. The weight serves to bias the member **122** toward the frame end of the trough.

Also positioned between the sheets **119**, **120** and in a space between the bottom forming member **121** and the frame is a pivotal fan folding member **129**. As can best be seen in FIG. 7, the cross section of member **129** is that of a shallow channel with the flanges projecting on the side toward the main frame. The lower end of fold member **129** is secured to a shaft **130** which in turn is journaled beneath the trough by a pair of brackets **131**. One end of the shaft is provided with a crank arm **132** extending therefrom. This arm is in turn secured by a pivotal link member **133** to an elongate lever **134** which extends upwardly on the outside of the sheet **119**. The lever **134** is pivoted at **135** to the end of the frame. Obviously, clockwise motion of lever **134** will produce a clockwise pivoting of the folding member **129** about its axis **130** and counterclockwise movement will return the fold member to its broken line position of FIG. 1*a*.

The inner ends of the trough side walls **119**, **120**, i.e. those ends closest to the frame, have portions **119***a*, **120***a* of somewhat greater height. Secured to each sidewall in this zone are three spring flexed members **136** which operate when folded web sections are formed by the folding member to restrain them against returning with the folding member **129** when it is pivoted back in the clockwise direction (as viewed in FIG. 1*a*) to the starting position. These elements are all construced in identical manner and reference to FIG. 7 will provide a clear understanding of them.

As can be seen, each member **136** comprises a rectangular strip or sheet of flexible metal which is secured to the adjacent side wall by a bolt and bracket arrangement **137**. The bracket has a lip beneath which is received one end of a slightly concaved leaf spring member **138** which serves to bias the flexible member **136** toward the sidewall. At its outer or free end, each flexible member **136** is bent to form an inwardly projecting tang which in the case of the lower two members projects into the trough through an elongate slot **139** formed in the trough. In the case of the uppermost members the tangs thereof proceed inwardly past the vertical edge of the elevated side wall sections **119***a*, **120***a*.

A similar catch arrangement is provided on the top of the trough between the sidewalls, this being illustrated in detail in FIGS. 2*a* and 6. It will be noted that a channel shaped member **140** extends between the sidewalls and is adjustably secured thereto by bolts **141** which fit through elongate slots **142**. The web of the channel section carries a flexible element **143** riveted thereto, the projecting end of this element being reversely bent with the bent portion **143***a* extending downwardly through an opening in the web. The bent tab **143***a* is in generally the same vertical plane with the tangs of the side mounted members **136**. This plane is just slightly to the right hand side of the plane of the face of the fold member **129** when the pusher member is in its fully extended or outermost position, i.e. the position illustrated in FIG. 1*a*.

Returning again briefly to FIG. 1, it will be seen that the printed and punched web emerges from the left hand end of the unit and, if desired, is passed as it does beneath a print drying lamp or heating element **144**, then turned downwardly by its natural gravity weight toward a guide member **145**. This guide member leads downwardly as shown in FIG. 1*a* to the inner side of a bracket **146**. The bracket **146** mounts an air hose **147** with a lateral jet **148** adapted to strike the web to the outside of and below the lower terminus of the guide **145**. More will be said about the purpose of this jet at a later point herein.

Returning now to the lever arm **134**, the upper end thereof is pivotally connected with a slide element **149** which proceeds through an apertured guide member **150**. Referring to FIG. 8, a tension spring **151** is connected with the slide and with a stationary block **152** and this spring resiliently urges the lever arm **134** towards a retracted position which is somewhat clockwise of the position shown in FIG. 1*a*. In FIG. 8, however, we have shown the slide and lever in the retracted position, the broken line position in FIG. 8 coinciding with the solid line positions of FIGS. 1*a* and 2*a*. When retracted, the end of slide **149** engages a projecting portion **152***a* on the stationary block **152**. It will be noted that the projecting portion is of lesser width than the width of the

slide so that there is an exposed shoulder on the end of the slide.

As can be seen in FIGS. 1*a* and 2*a*, disposed above the slide **149** and block **152** is a rotary gear **153** which is drivingly engaged by a worm **154** on the end of the main drive shaft **72**. The gear **153** has a downwardly projecting non-axial pin **155** which, during a certain phase of the revolution of gear **153**, will engage slide **149** and shift it from the FIG. 8 solid line position toward the broken line position thereof, which, as earlier noted, is the solid line position of FIGS. 1*a* and 2*a*. Once the pin passes the shoulder, the spring **151** again returns the slide and thereby retracts the lever. It will be apparent that for each revolution of the gear **153**, the slide is in its forwardmost position for only a small increment thereof.

It will be helpful at this point to describe the operation of the fan-fold mechanism. Starting with the position of the parts shown in FIG. 1*a* as the pin **155** slips off the slide **149**, the slide is retracted, as earlier noted. This rotates lever arm **134** clockwise and applies a clockwise rotation to the folding member **129**, thus rotating it to a position in which it is inclined from the vertical with its upper end relatively close to the end of the frame. As the folding member is retracted, the previously folded sheets or strips are prevented from returning with it through engagement thereof along the edges with the tangs of the members **136** and **143**. While these tangs have been deflected outwardly due to the engagement therewith of the side flanges of the pusher member, when the flanges depart the fingers move in between the pusher and previously folded strips to engage the latter and hold them in the upright position.

With the fold member in the retracted position, the advancing web proceeds downwardly and is guided into the generally V-shaped gap between the endmost already folded sheet and the retracted fold member. The advancing web will thus form a loop descending in this gap and formation of this loop is promoted by the jet of air emerging through the jet nozzle **148**. As the bottom of the loop approaches the bottom of the V-shaped gap, the gear mounted pin **155** is moved around and into position to engage slide **149**. The pin pushes the slide **149** outwardly thereby rotating lever **134** counterclockwise, with a concurrent rotation of the folding element **129**. The folding element thus folds or pushes the loop into flat condition toward and into engagement with the preceeding folded strip. Upon subsequent retraction in the next cycle of operation, this newly added strip will be retained in the stack by the tangs of members **136** and **143** and a new strip can be folded and added. The weight **128** acting through cord **124** and the strap **123** continues to compress the stack against the retaining tangs.

Operation

The operation of the preferred embodiment of the invention has been largely described in conjunction with the foregoing description. However, it may be well to summarize briefly the various operative features of the invention and the results produced.

In order to load the machine, the shaft **72** is turned to a position in which the punching die head **51** and printing head **106** are in the raised or elevated condition. The timing of the indexing bar mechanism is such that when the punching die **51** is elevated the indexing bar **83** is in the out or disengaged position.

The web **25** is unrolled from roll **26**, passed through the sensing mechanism **27** and then fed through drive rolls **44**, **45** into the loop area from whence it is passed back across the table **30** beneath the punching die and preferably entirely through the printing mechanism also. Enough of the web is driven through rolls **44**, **45** as to substantially fill loop **50** so as to insure of an untensioned supply of web to be drawn across the table **30** of the machine. Once the web is in position with its edges confined by the guide plates earlier described, the clutch **77** can then be engaged by manipulation of knob **80** to start the machine.

We have found that the teeth **83** on the index bar bite sufficiently into the edge web to cause it to advance for each reciprocation thereof prior to formation of the notches. However, since the bar end is placed only one ticket width away from the mechanism for forming notches **21**, the second cycle of the bar will result in a notch being engaged by the endmost tooth **83***a* and, of course, for the next cycle still another tooth will be engaged, thus progressively advancing the web. When the first formed notch is finally moved into and through the printing mechanism to engage with the endmost tooth at the opposite end of bar **83**, the machine is in proper condition for full production.

As has been explained, the index bar **83** provides a positive feeding and indexing of the web, both in the punching area **31** and printing area **32**. The web is halted while the teeth are still engaged, the teeth are disengaged, the bar returns to pick up the web once again and before any advance movement of the bar **83** takes place the teeth are reengaged. This feature of the invention assures of very accurate placement of the web in relation to the die and printing heads while still operating at relatively high speeds.

As the printed strip emerges from table **30**, it passes downwardly into the fan-fold mechanism and there is folded into the stack **35** of fan folded strips in the manner described in detail above. Naturally, these stacks can be removed and separated when desired.

The operation of the machine can be easily supervised by a single worker and indeed very little attention need be given to the machine while it is operating. When a roll **26** is exhausted, the trailing end of the strip will pass the sensing mechanism **27** which is operatively connected with the motor **74** through a series electrical circuit. Mechanism **27** contains a sensing switch on a cross bar beneath the strip connected with the operating contacts of a switch. As the end of the strip leaves the bar, the switch will open due to the absence of weight and de-energize the motor **74**. The machine is thus shut off and will not again start operation until the end of a new roll has been fed through the sensing mechanism and spliced onto the trailing end of the exhausted roll.

It has earlier been pointed out that a supplemental roll can be placed on hub **41**. In order to bring the supplemental roll into operating position, it is only necessary to rotate the post 180°. While the new roll is being exhausted, a roll to replace roll **26** can be placed on the hub which formerly held roll **26**.

The switch **49** and its operating arm **49***a* insure that at all times there is a free loop of web in position to be drawn into the machine. Thus, there are no tension forces operating to interfere with the feeding of the web through the unit.

In FIG. 9, we have shown a modified arrangement for interconnecting the drive bar and index bar. In the modified arrangement the drive bar is indicated at **286** and the index bar at **283**. **288** indicates a portion of the drive bar casting which is pivotally connected with the link **293**.

It will be noted that a friction disc **293***c* of fibrous or other frictional material is interposed between two plates **293***a* and **293***b* which are connected respectively with the link **293** and the drive bar **286**. The lower plate **293***a* is spring biased upwardly against the friction disc by a spring **293***d*. The purpose of this arrangement is to replace the springs **100** of the earlier embodiment. The frictional engagement between plates **293***b* and **293***a* and the frictional material **293***c* serves to restrain the index bar in either the inner or outer position as it moves between its limit stops. It also inhibits bouncing of the index bar off the stop members and insures of accurate inward movement of the bar for engagement of the teeth thereof with the notches.

From the foregoing, it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth together with other advantages which are obvious and which are inherent to the structure.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having thus described our invention, we claim:

1. In apparatus for forming an open notch in at least one side edge of a web of paper or the like and advancing the web in step-wise fashion following formation of the notches, the combination of

a table over which the web is carried,

means for forming spaced notches in one side edge of the web as it is advanced on the table, and

means for advancing the web in stepwise increments across the table away from the notch forming means including an indexing bar adjacent said one side edge of the web and means for reciprocating the bar in opposed directions parallel with the direction of advance of the web, said bar having a web advancing stroke and a bar retraction stroke, and

notch engaging means on the bar moving in a plane which is substantially the same as the plane of the web and operable to enter laterally with respect to the web and engage within notches in said web during the web advancing stroke and apply an advancing force on the web as the index bar is displaced in its web advancing stroke and disengageable from the notches on completion of the web advancing stroke and initiation of the retraction stroke.

2. Apparatus as in claim 1 including

a rotatable roll supply of web,

means for drawing said web from said roll and feeding it toward said table,

control means for said feeding means operable to maintain a web loop in advance of the table, thus to free the web from tension in that portion of the web advancing across the table.

3. The combination as in claim 1, including

a rotating shaft beneath the table aligned generally with the direction of advance of the web,

the notching means including a reciprocable die head above the table and a cross head below the table connected with the die head,

the web advancing means including an indexing bar drive mechanism below the table, and

means respectively operably connecting said cross head and drive mechanism with said shaft.

4. The combination as in claim 1,

said means for advancing the web including

a linearly oscillating drive bar substantially parallel with said index bar,

toggle link means connecting said drive bar with said index bar,

stop means limiting the possible longitudinal displacement of said index bar to less than the oscillation stroke of said drive bar,

said stop means cooperating with said index bar to effect alternate extension and collapse of said toggle link means whereby to displace the index bar laterally away from and back toward said drive bar at the longitudinal limit positions for the index bar, and

means for yieldably retaining said toggle link means in extended condition during the longitudinal displacement of the index bar in the direction opposite to that of web advance whereby said index bar is disengaged from the web during such movement.

5. The combination as in claim 1, including

a rotating shaft,

separate means respectively operably connecting the notching means and web advancing means with said shaft,

web folding mechanism for receiving said web from said table and operable to progressively fold same in a fan folded stack, and

means for powering said folding mechanism from said shaft.

6. The combination as in claim 5,

said web folding mechanism including

a trough for receiving said web,

means for forming a loop in the web as it progresses into said trough,

folding means operable to flatten said loop and then retract to permit formation of another loop, and

means for retaining the flattened loop in flattened condition upon retraction of the folding means thereby to provide a space between the folding means and flattened loop for reception of the succeeding loop.

7. Apparatus for feeding and indexing a web of material having notches in one side edge thereof in stepwise fashion in a direction substantially parallel with said one side edge, said apparatus comprising

an indexing bar positioned near and substantially parallel with said one side edge of the web,

a drive bar spaced from and substantially parallel with said indexing bar,

means for linearly oscillating said drive bar on its longitudinal center line,

toggle link means interconnecting said indexing bar with said drive bar and arranged to collapse upon relative movement between said indexing bar and drive bar in one direction and extend upon relative movement between said bars in the other direction,

means operable to effect said relative movements whereby to alternately extend and collapse said toggle link means whereby to move said indexing bar laterally into and away from engagement with said one side edge, and

means operable to restrain said link means in said extended and collapsed positions whereby to cause said index bar to be carried with said drive bar in the intervals between collapse and extension of said link means.

8. Apparatus as in claim 7,

said means operable to effect said relative movements comprising limit stop means at opposite ends of the index bar operable to limit the oscillation stroke of said index bar to less than that of said drive bar.

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