April 5, 1966 F. G. MARTIN 3,244,343

FLEXIBLE STRIP FEEDING AND FOLDING MECHANISM

Filed May 5, 1964 3 Sheets-Sheet 1

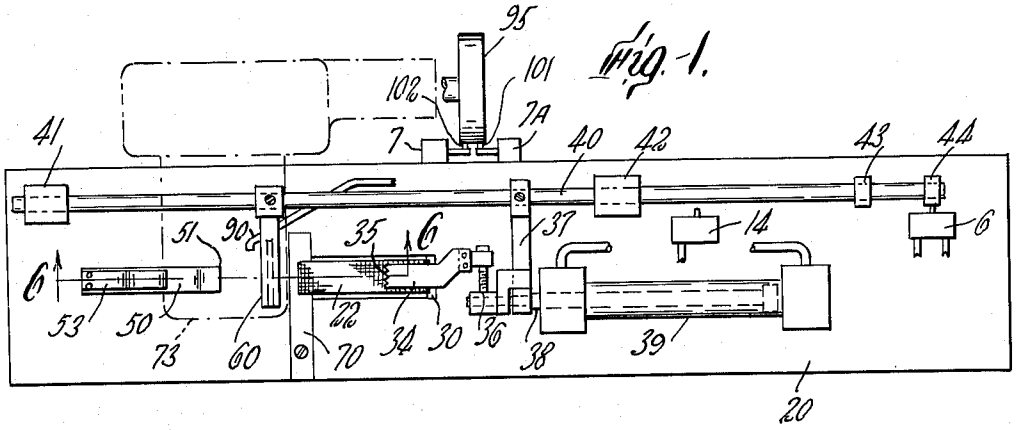


Fig. 1.

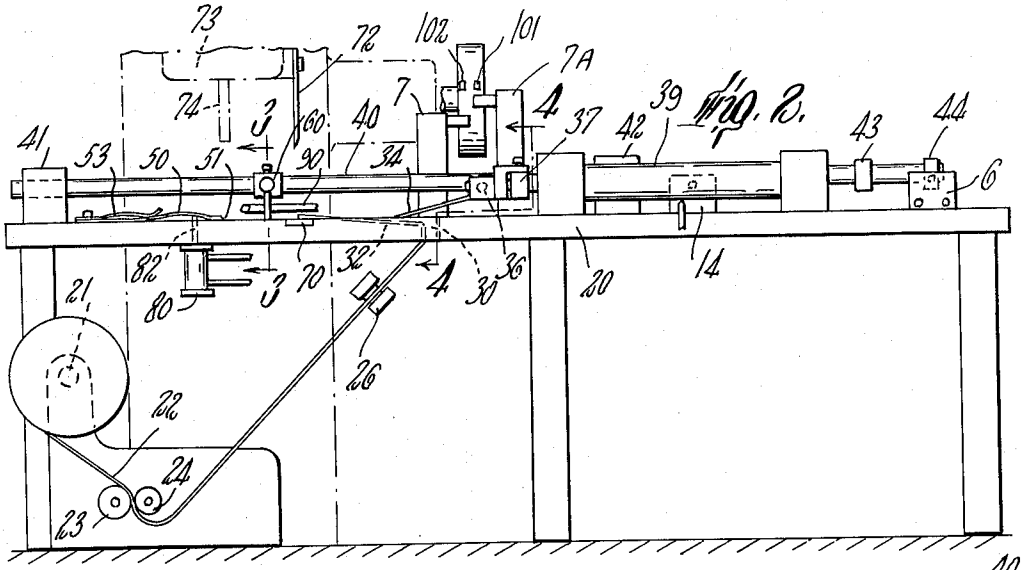


Fig. 2.

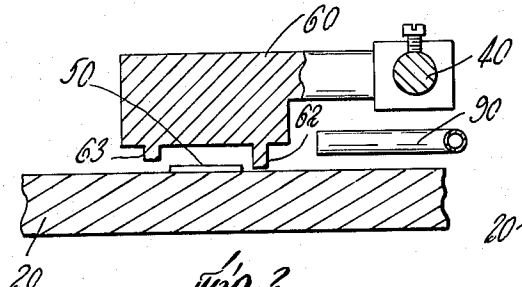


Fig. 3.

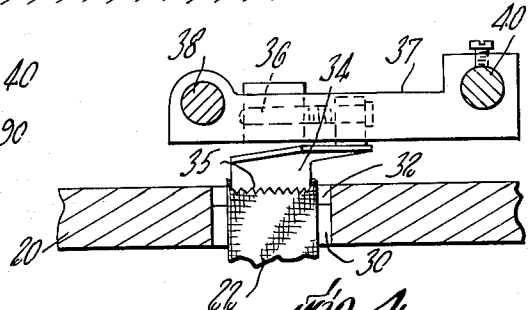


Fig. 4.

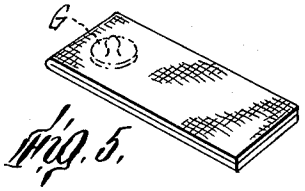


Fig. 5.

April 5, 1966 F. G. MARTIN 3,244,343

FLEXIBLE STRIP FEEDING AND FOLDING MECHANISM

Filed May 5, 1964 3 Sheets-Sheet 2

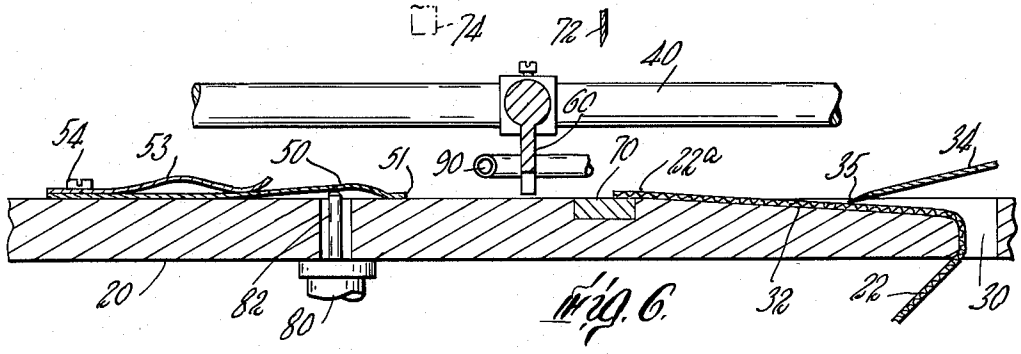


Fig. 6.

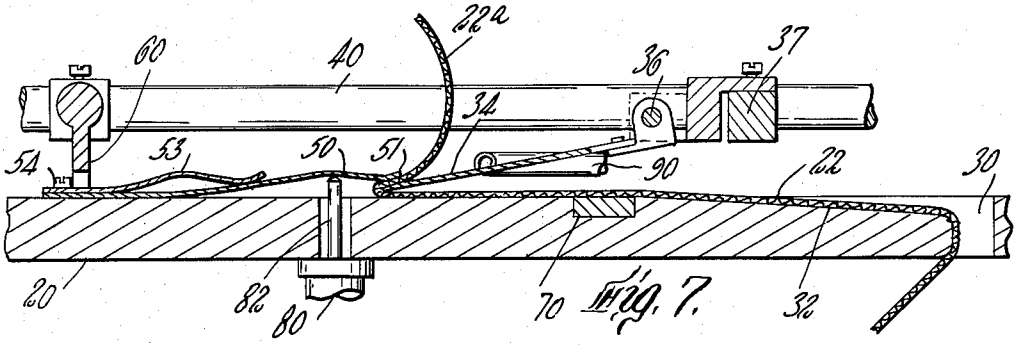


Fig. 7.

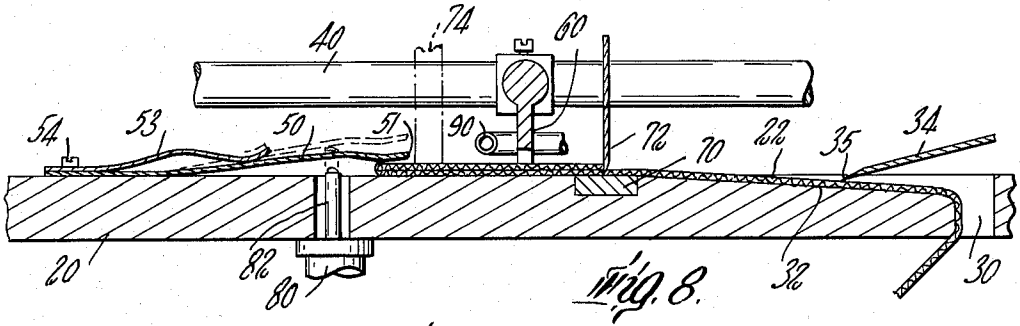


Fig. 8.

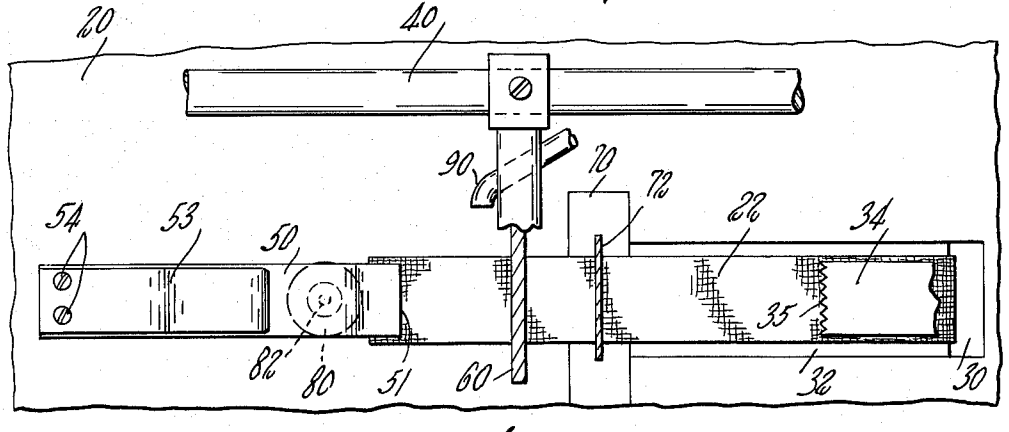


Fig. 9.

April 5, 1966 F. G. MARTIN 3,244,343

FLEXIBLE STRIP FEEDING AND FOLDING MECHANISM

Filed May 5, 1964 3 Sheets-Sheet 3

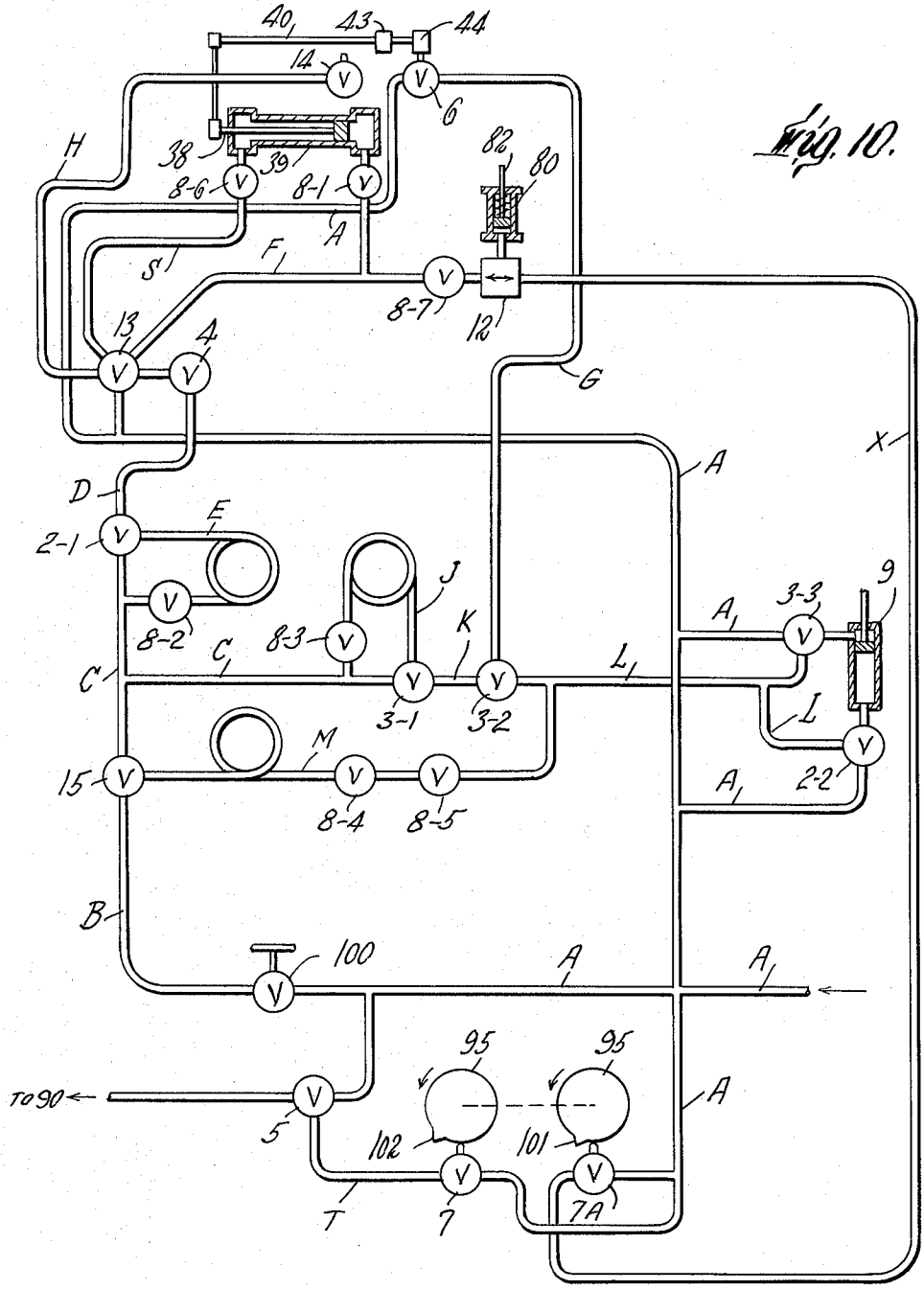


Fig. 10.

United States Patent Office

3,244,343

Patented Apr. 5, 1966

3,244,343

FLEXIBLE STRIP FEEDING AND FOLDING MECHANISM

Frank G. Martin, Agawam, Mass., assignor to The William Carter Company, Needham Heights, Mass., a corporation of Massachusetts

Filed May 5, 1964, Ser. No. 364,952
14 Claims. (Cl. 227—76)

This invention relates to automatic machinery for converting a continuous strip of flexible material into individual units of uniform length of the strip material folded on itself. Such double layer units, when made from narrow, woven, knit or other strip material, and particularly when the layers are substantially co-extensive, find use in garment fabrication as tabs or reinforcements for snap fastening elements or as labels or hangers, the folded end of the tab forming a non-raveling edge and the substantially aligned cut ends being seamed into a hem or otherwise attached to the garment to prevent raveling of the cut ends.

When the folded units are intended to carry snap fastener elements, the mechanism of this invention may be combined and sychronized with the jaws of a snap fastening element setting machine for cyclically attaching fastener elements through the folded over double layer strip material; or other stamping, printing, punching, or sewing operations may be substituted.

It is a primary object of the invention to provide automatic sequential feeding, folding, severing, and ejecting mechanism for flexible strip material which may, if desired, be supplemented by another sequential operation performed before or simultaneously with the severing operation and before ejection of the finished product from the machine.

It is a further object of the invention to provide a mechanism wherein the feed of the strip material is intermittent but cyclical so that all the operations for forming one individual unit are performed with each feed, so that this feed may be cyclically timed to provide automatic fabrication of successive units.

It is a further object of the invention to provide mechanism which will insure that each unit is properly folded with its folded sections in at least lateral register and usually substantially co-extensive in length, and which will perform the necessary operations in such manner that the individual units will be uniform in size and appearance.

These and other objects of the invention will be better understood when taken in connection with a description of a typical apparatus embodying the invention which is shown in the accompanying drawings, wherein:

FIG. 1 is a plan view of the machine, showing certain optional parts in dotted lines;

FIG. 2 is a side elevational view of the apparatus shown in FIG. 1;

FIG. 3 is an enlarged cross-sectional view taken along line 3—3 of FIG. 2;

FIG. 4 is an enlarged cross-sectional view taken along the line 4—4 of FIG. 2;

FIG. 5 is a perspective view of a folded individual unit fabricated by the apparatus of the invention, showing in dotted lines an optional snap fastener element set through the double folded unit;

FIG. 6 is an enlarged cross-sectional view taken along the line 6—6 of FIG. 1, showing certain parts only;

FIG. 7 is a view similar to FIG. 6, showing the same parts in their respective positions at an intermediate stage in the cycle of the mechanism;

FIG. 8 is a further view, similar to those shown in FIGS. 6 and 7, with the parts in their respective positions at a still later stage in the cycle;

FIG. 9 is a plan view of the mechanism with the parts in the positions shown in FIG. 8; and

FIG. 10 is a schematic diagram of a compressed air system for controlling the operation of the mechanism shown in the previous figures.

The apparatus includes a suitably supported flat bed 20 having therebeneath, as shown in FIG. 2, an arbor 21 for supporting a roll of flexible strip material such as narrow woven cloth tape 22, which is fed between driving rolls 23, 24, and a tensioning device 26 upwardly through a slit 30 (FIG. 4) in bed 20 into an inclined guide trough 32 leading up to the plane of the bed. Roll 23 is intermittently driven to always maintain a given amount of slack beyond the rolls as by a conventional slack detector (not shown).

Feeding means for the tape includes a spring-loaded blade 34, having a serrated leading edge 35, and extending yieldingly downward at an acute angle onto the top surface of the strip material 22 as it lies in the trough 32.

The feed blade 34 (FIGS. 1 and 2) is pivotally mounted on a drive arm 36 connected through a crossbar 37 to the piston 38 of an air cylinder 39. Crossbar 37 is also adjustably fastened to a drive rod 40 carried by spaced bearings 41 and 42 so that rod 40 will move in unison with feed blade 34 for a purpose to be later described.

The stroke of the piston 38 of air cylinder 39 is controlled by poppet valve 14 actuated by longitudinally adjustable abutment 43 mounted on drive rod 40.

Fastened to bed 20 and extending from the left hand end of the bed towards the feed blade 34 is a hold-down 50 in the form of a resilient locking spring having tip 51 whose undersurface is knurled or otherwise roughened to enhance its gripping capability. The hold-down 50 overlaps the path of terminal advance motion of the blade 34 but is adapted to be lifted up off bed 20 to permit the advancing blade to tuck a cross-fold of strip material under the hold-down 50. Before or as the blade starts to retract, the hold-down 50 is released from its raised position so that the cross-fold is resiliently locked thereunder to permit the blade 34 to be retracted from between the folds of the tuck. To this end the presssure of hold-down 50 is enhanced by a supplemental leaf spring 53 which is fastened to the bed 20 along with hold-down 50 by screws 54.

Drive rod 40, previously referred to, also supports a wiper blade 60 adjustably but rigidly fixed to rod 40 and extending transversely of the bed over the path of feed blade 34 an adjustably fixed distance in front of the blade 34. As shown in FIG. 3, the wiper 60 has two spaced legs 62 and 63 so that it straddles hold-down 50 and overlying reinforcing leaf spring 53 with its legs extending down towards and traveling just above the surface of bed 20. The legs 62 and 63 in their travel just straddle a tape strip 22 being fed to the machine. One of the legs 63 may be shorter than the other as shown, to aid in releasing a completed unit laterally outwardly therebeneath.

Positioned midway of the stroke of feed blade 34 is a wear plate 70 flush with bed 20 surmounted by a crusher cutter 72 depending from a vertically reciprocating head 73. The head 73 may also carry a fastener element punch 74, shown in dotted lines, or other tool for vertical reciprocation close to the inner end of the hold-down 50.

Beneath the hold-down 50 is an air cylinder 80 (FIG. 2) for reciprocating a vertical pin or plunger 82 upwardly through an aperture in bed 20 to mechanically raise the hold-down 50 for insertion of the cross-fold, permit it to drop during retraction of the blade from between the fold, and then raise it again when it is desired to eject a finished unit from the machine. The ejection can either

be done by hand, or preferably, in the case of small woven tape, can effectively be done by a cross air blast emanating from a nozzle **90** (FIG. 1).

FIGS. 6–9 show the operation in more detail. FIG. 6 illustrates the position of the parts at the beginning of a cycle. Feed blade **34** rests on the upper surface of strip material **22** at a fixed distance ahead of cutter **72** equal to approximately one half of the stroke of blade **34**. The leading end **22***a* of strip **22** lies adjacent the path of cutter **72** as a result of a cutter stroke during the previous cycle.

mmrdlu fwyp gkqj fwyp rdlu aoin rdlu fwyp gkqjmm

As blade **34** advances from the position shown in FIG. 6 to the position shown in FIG. 7, the leading edge **22***a* of the strip material strikes the closed hold-down **50**, and because the strip material is flexible, it runs up over the tip **51**. As soon as the edge **22***a* has passed the end of tip **51**, hold-down **50** is raised by an air cylinder **80**, and the strip material continues to flow over tip **51** until the serrated blade edge **35**, frictionally engaging the tape well behind this loose end **22***a* passes during its terminal motion beneath raised hold-down **50** and jams the strip material into a cross-fold underlying the raised hold-down **50**. The hold-down is then immediately released to grip and lock the strip fold as the blade **34** retracts to the position shown in FIG. 8, sliding over the strip material against the grip of the hold-down **50**. During this retraction motion the wiper **60** moves from the position shown in FIG. 7 to the position shown in FIG. 8 and wipes down the loose overfold end of strip material **22** so that it is laid down in doubled-back registered relation with the underlying strip with its end not quite reaching the path of cutter **72**.

As or after the wiper blade **60** reaches the terminal point of its inward motion and during a dwell thereof, if necessary, the cutter knife is moved downwardly by the end of the overlapping fold to cut the underlying strip into a length which makes it approximately co-extensive with the overlying fold.

During the cutter stroke the work head **73** may also move a snap fastener jaw or other instrumentality downwardly to set a snap fastener element through the double-layer folded strip.

As soon as the knife is sufficiently retracted, air cylinder **80** is again actuated to move the pin **82** into the dotted line position shown in FIG. 8 to lift the hold-down **50** so that the folded unit will be released. Air is then blasted through nozzle **90** to blow the finished unit sideways off the bed out from under the hold-down and the short wiper leg **63** and out of the path of the feed blade. The unit has the appearance shown in FIG. 5 with the snap fastener element G shown in dotted lines as optional.

The cycle is then repeated.

Sequential means for driving the mechanism includes, as shown in FIG. 1, two poppet valves **6** and **14** located for actuation by abutments **43** and **44** on rod **40**, and a double cam **95** which has one revolution in each cycle synchronous with reciprocation of head **74** by virtue of a single revolution clutch (not shown) actuated by an air cylinder **9**, shown in FIG. 10. FIG. 10 also shows air cylinders **39** and **80** and a conduit leading to nozzle **90**.

The control and timing system (FIG. 10) includes a source of compressed air connected through lines A to a series of valves, including valves **5**, **6**, **7**, **7***a*, 4-way valve **13**, normally closed valve **3–3**, and normally open valve **2–2**.

Lines A are also connected to start valve **100** which when opened pressurizes line B and line C through normally open valve **15**. Valve **2–1** is also normally open, pressurizing line D, opening normally closed valve **4** and shifting 4-way valve **13** to pressurize line F and actuate air cylinder **39** at a speed controlled by exhaust flow through valve **8–6**. As the abutment **44** leaves its engagement with poppet valve **6**, line G is exhausted so that valve **3–2** closes. During the interval since the opening of valve **15**, timing lines E and J both become pressurized at rates controlled by flow control valves **8–2** and **8–3**, respectively. Line E finally closes valve **2–1**, exhausting line D and closing valve **4**. Line J finally opens valve **3–1**, pressurizing line K.

Meanwhile, by the time blade **34** has advanced about one-half inch, flow valve **8–7** in line F pressurizes air cylinder **80** through shuttle valve **12** to raise hold-down **50**.

When abutment **43** on rod **40** reaches poppet valve **14**, line H is exhausted, causing 4-way valve **13** to shift so that line F is exhausted and the piston of air cylinder **39** retracts by reason of pressurizing of line S at a rate controlled by exhaust through flow control valve **8–1**.

Exhaustion of line F also depressurizes air cylinder **80**, causing said hold-down **50** to drop.

Upon full retraction of the piston of air cylinder **39**, valve **6** is opened to pressurize line G, open normally closed valve **3–2**, and pressurize lines L from line K to open normally closed valve **3–3** and close normally open valve **2–2** to retract cylinder **9**, causing the single revolution clutch to be actuated and cause reciprocation of the snap fastener head **73** and one revolution of cam **95**. Simultaneously, line M is pressurized from line L at a rate controlled by flow control valve **8–5**, and when the pressure in line M has built up, it closes valve **15**, exhausting lines C, E, J, K and L with resulting closing of valve **3–3** and opening of valve **2–2** to reset air cylinder **9**.

Line M is slowly exhausted through reverse flow valve **8–4** to reopen valve **15** and start a new cycle.

Meanwhile, cam **101**, towards the end of its revolution and towards the end of the cycle of the reciprocating head **73**, actuates valve **7***a* to pressurize line X and cause plunger **82** to rise again through air cylinder **80**. Shortly thereafter, cam **102** opens valve **7** to pressurize line T and open valve **5** and permit air ingress to the nozzle **90**. Valves **7** and **7***a* apply momentary pressure and reset themselves with passage of the cam.

While the forward edge of tip **51** of hold-down **50** may be slightly underbeveled or bent up so as to permit the leading edge of blade **34** to act as the hold-down lifting means, positive lifting as by plunger **82** has been found more reliable, since any gap provided between the edge of tip **51** and the bed to permit self-entry of the blade tends to result in a leading end **22***a* of the strip sometimes catching under the edge, causing a misoperation, since the leading edge **22***a* must pass up over the hold-down in order to permit the blade to tuck a clean double layer fold beneath the hold-down. If desired, the hold-down in its lowered position can pass into a recess in the bed so that its top surface is flush with the surface of the bed, though this has been found not to be essential; or a separate element in the form of a removable guard could be provided, but this would require extra parts which are not needed when the hold-down end seats flush on the bed and then is positively raised (to permit ready blade entry) by the plunger **82** which is already present to perform the later strip release step.

What is claimed is:

1. Flexible strip feeding, folding and severing mechanism comprising

a bed,

a hold-down mounted on said bed for movement towards and away from said bed,

strip feeding means movable along said bed towards and away from said hold-down and cooperating with said hold-down to form a cross-fold in a continuous flexible strip as it is fed towards said hold-down by said feeding means and to tuck the cross-fold beneath the hold-down during terminal forward motion of said feeding means, and

a cutter movable into the path of a strip fed by said feed means along a line intermediate the ends of the travel path of said feeding means to sever a fed

strip portion at a given distance back of a cross-fold thereof tucked beneath said hold-down.

2. Mechanism as claimed in claim 1, wherein the line of cutter severance is approximately midway of the stroke of said feeding means.

3. Flexible strip feeding, folding and severing mechanism comprising

a bed,

a hold-down mounted above said bed for movement towards and away from said bed to receive and hold therebetween a fold of a flexible strip,

a blade having a protruding leading edge mounted on said bed for reciprocation along a pathway terminating under said hold-down,

means for advancing said blade to pass said leading blade edge under said hold-down and form under said raised hold-down a fold of a flexible strip wrapped around said leading edge,

means for retracting said blade to leave said fold held beneath said hold-down in its lowered position,

a wiper movable along the overfold portion of the strip to wipe said overfold portion into doubled-back lateral register with the underlying portion of said strip, and

means for severing said strip beyond the end of the doubled-back overlying fold.

4. Flexible strip feeding, folding and severing mechanism as claimed in claim 3, having means for ejecting the folded severed unit from beneath the hold-down.

5. Flexible strip feeding, folding and severing mechanism comprising

a bed,

a hold-down mounted above said bed for movement towards and away from said bed to receive and hold therebetween a fold of a flexible strip,

means for lifting said hold-down into a raised position,

a blade having a protruding leading edge mounted on said bed for reciprocation along a pathway terminating under said hold-down,

means for advancing said blade to pass said leading blade edge under said raised hold-down and deposit under said hold-down a fold of a flexible strip wrapped around said leading edge,

means for retracting said blade to leave said fold held beneath said lowered hold-down,

a wiper movable along the overfold portion of the strip to wipe said overfold portion into doubled-back lateral register with the underlying portion of said strip,

means for severeing said strip beyond the end of the doubled-back overlying fold,

means for relifting the hold-down to release the deposited folded strip, and

means for ejecting the folded, severed and released unit from beneath the raised hold-down.

6. Flexible strip feeding, folding and severing mechanism comprising

a bed,

a resilient hold-down mounted above said bed for resilient yielding movement towards said bed to receive and resiliently hold therebetween a fold of a flexible strip,

a blade having a protruding leading edge mounted on said bed for reciprocation along a pathway terminating under said hold-down,

means for advancing said blade to pass said leading blade edge under said hold-down and jam a fold of a flexible strip wrapped around said leading edge under said hold-down,

means for retracting said blade to leave said fold jammed beneath said hold-down,

a wiper movable along the overfold portion of the strip to wipe said overfold portion into doubled-back lateral register with the underlying portion of said strip,

means for severing said strip just beyond the end of the doubled-back overlying fold,

means for positively raising the hold-down from its fold-jamming position to release the folded severed strip, and

means for ejecting the folded, severed and released unit from beneath the positively raised hold-down.

7. Apparatus for converting continuous flexible strip material into separate folded over double layer units, each carrying a snap fastener element, comprising

a bed,

a vertically reciprocating snap fastener element setting head mounted over said bed at a work station along said bed,

a hold-down mounted above said bed adjacent one side of said station for movement towards and away from said bed to receive in raised position and hold therebetween in lowered position a cross-fold in a flexible strip,

means for raising and lowering said hold-down,

a feed blade having a protruding leading edge mounted on said bed for reciprocation along a pathway passing through said station and terminating under said hold-down,

said blade being resiliently urged toward said bed to engage the top surface of a strip material laid on said bed beneath said blade,

means for leading continuous strip material onto said bed for engagement back of its leading end by said blade and feed thereof during the forward stroke of said blade across said station into a folded position jammed and held beneath said hold-down,

said feed blade sliding back over said held strip material during the return stroke of said feed blade,

a wiper mounted for reciprocation over part of said blade path from a position beyond the forward stroke end of said blade path through said work station to a position on the opposite side of said work station from said hold-down,

a cutter mounted for vertical reciprocation along a path intersecting said blade path between the ends thereof and on the other side of said station from said hold-down,

driving means for cyclically advancing said feed blade to feed the leading end of said strip through said station over said lowered hold-down and thereafter jam a fold of said strip under said raised hold-down, for retracting said blade and said wiper to wipe the overfold of said strip while it is held by said lowered hold-down into doubled-back lateral register with the underlying portion of said strip and for reciprocating said snap fastener element setting head and said cutter,

means for cyclically actuating said hold-down raising means to release successive, folded, severed units, and

means for ejecting said released units from beneath said raised hold-down.

8. Apparatus as claimed in claim 7, wherein the feed blade and the wiper are mounted in longitudinally spaced relation and reciprocate in unison from a common drive means.

9. Apparatus as claimed in claim 7, wherein the cutter and snap fastener setting head are mounted in laterally spaced relation on a common head and reciprocate in unison from a common drive means.

10. Apparatus as claimed in claim 7, wherein the cutter path of reciprocation is approximately midway of the feed blade stroke.

11. Apparatus as claimed in claim 7, wherein said hold-down is resilient and the means for raising and lowering said hold-down includes a reciprocable plunger movable upwardly from beneath said hold-down to raise said hold-down against its own resilience away from said bed and downwardly to permit the resilience of said hold-down to return itself to lowered position.

12. Apparatus as claimed in claim 11, wherein the driving means includes a first motor for reciprocating said feed blade and said wiper in unison and a second motor for reciprocating said setting head and said cutter in unison, and timing means for actuating said motors sequentially in each cycle in the above-named numerical order.

13. Apparatus as claimed in claim 12, having additional timing means for actuating said hold-down raising means to raise said hold-down after commencement of the forward advance of said feed blade but before its terminal advance and for lowering said hold-down before said feed blade starts to retract.

14. Apparatus as claimed in claim 13, wherein the additional timing means reactuates said hold-down means to re-raise said hold-down in each cycle after said cutter has severed said strip.

No references cited.

GRANVILLE Y. CUSTER, JR., *Primary Examiner.*