United States Patent [19]

DeCaro

[11] **3,920,169**

[45] **Nov. 18, 1975**

[54] **DRIVING TOOL MECHANISM**

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[73] Assignee: **Textron Inc.,** Providence, R.I.

[22] Filed: **Aug. 22, 1974**

[21] Appl. No.: **499,642**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 397,998, Sept. 17, 1973, abandoned.

[52] **U.S. Cl.** **227/136;** 227/95; 227/120

[51] **Int. Cl.²** **B25C 1/00**

[58] **Field of Search** 227/66, 93, 95, 120, 136

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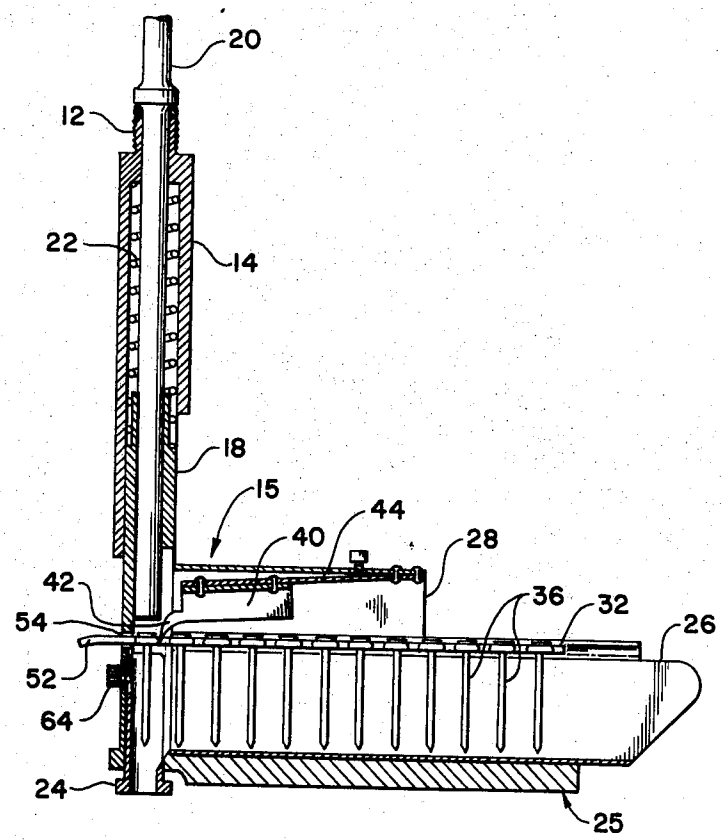
Primary Examiner—Granville Y. Custer, Jr.

Attorney, Agent, or Firm—Webb, Burden, Robinson & Webb

[57] **ABSTRACT**

A mechanism for feeding a strip of metal fasteners to an impact tool for driving the fasteners into a workpiece includes a barrel, a magazine for holding and feeding the strip to a piston in the barrel and a bushing within the barrel. The bushing is adapted to float between a first position where it engages the strip while a fastener is separated from the strip and driven and a second position where it disengages the strip to permit the strip to be advanced by the magazine to align a successive fastener with the driving piston of the impact tool and to exit the used strip through an opening in the barrel. The strip is held between the bushing and the barrel or between the bushing and a portion of the magazine which extends into the barrel.

15 Claims, 19 Drawing Figures



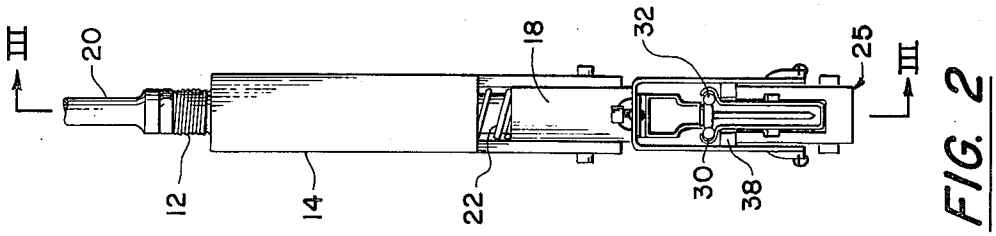


FIG. 2

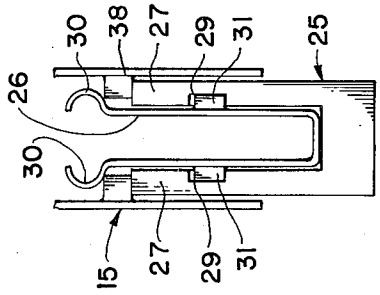


FIG. 2A

FIG. 3

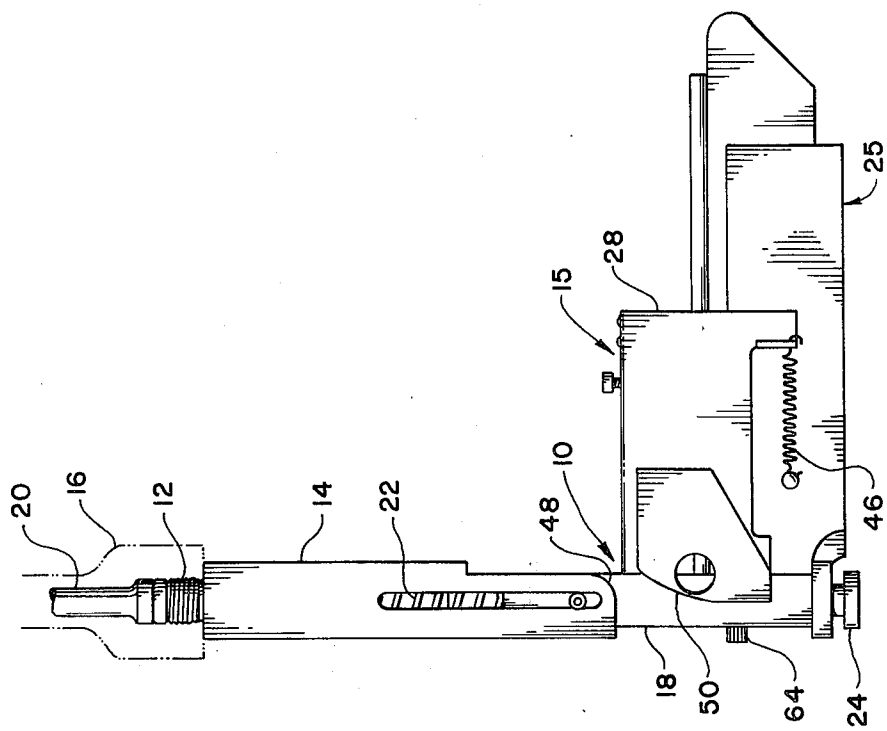


FIG. 1

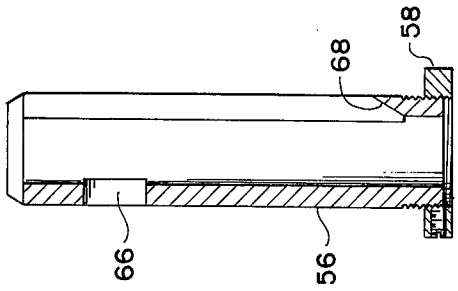


FIG. 6

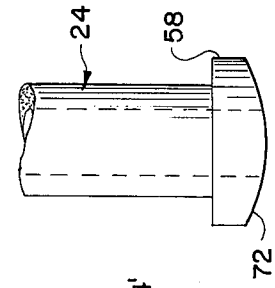


FIG. 10

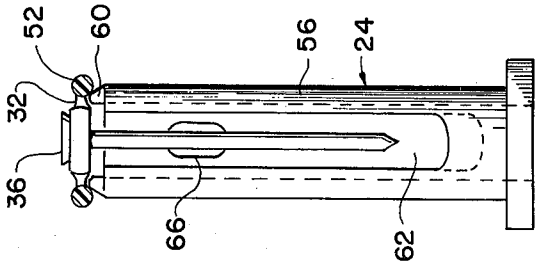


FIG. 5

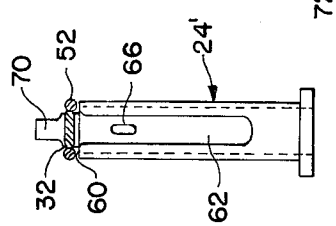


FIG. 9

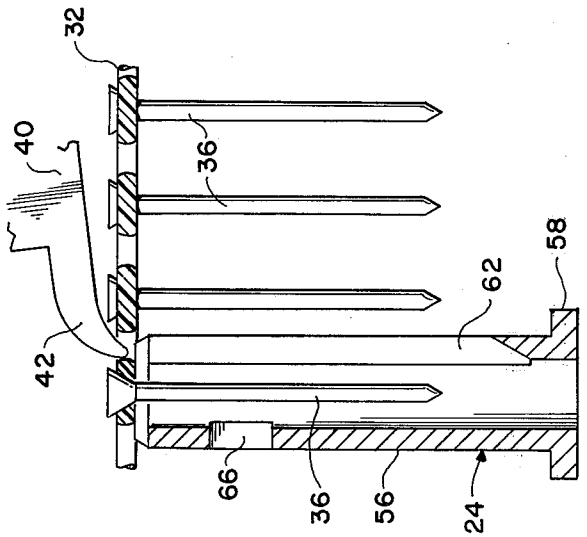


FIG. 4

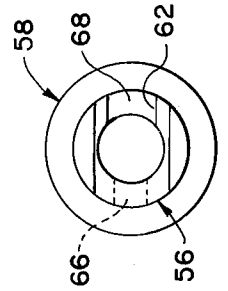


FIG. 7

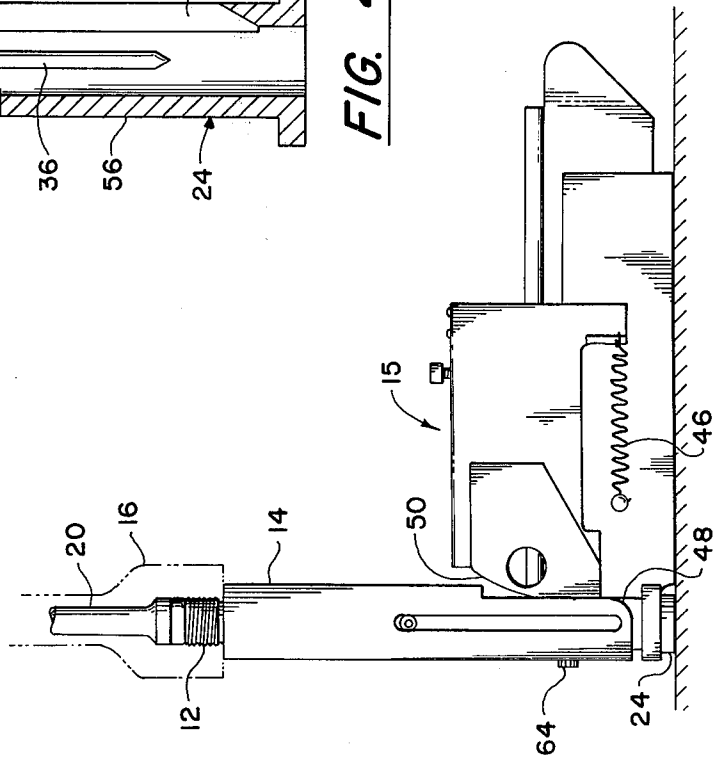


FIG. 8

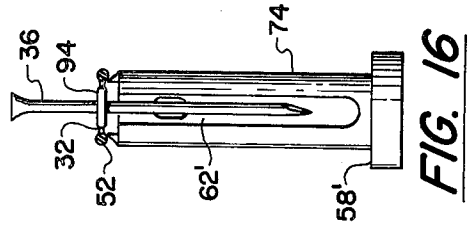


FIG. 16

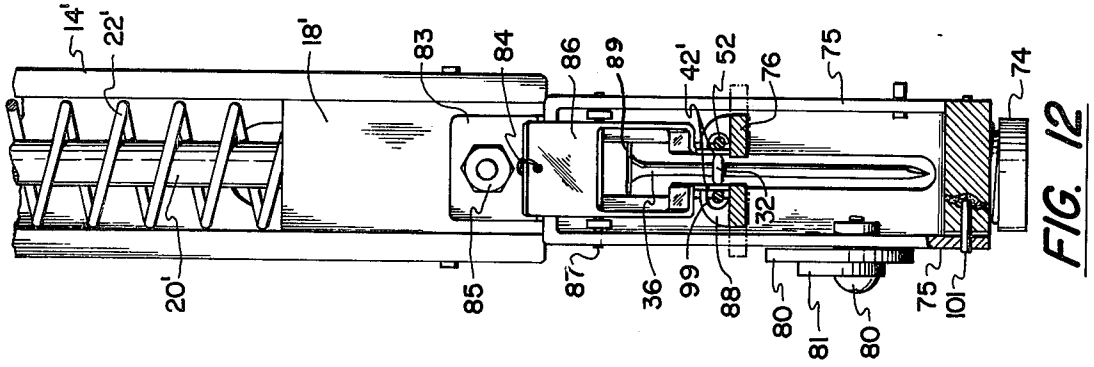


FIG. 12

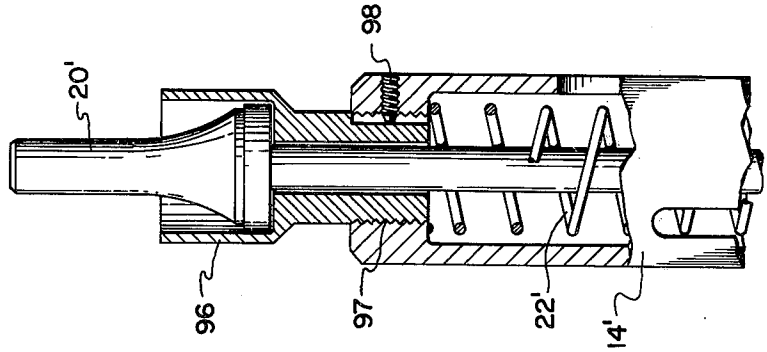


FIG. 13



FIG. 9A

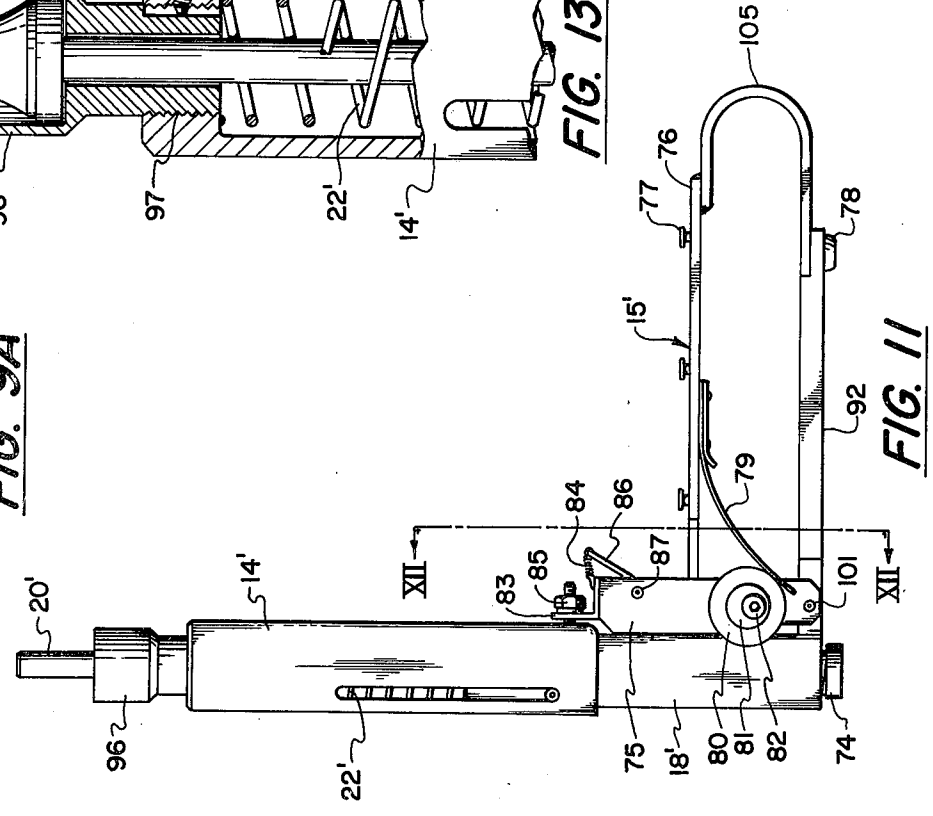


FIG. 11

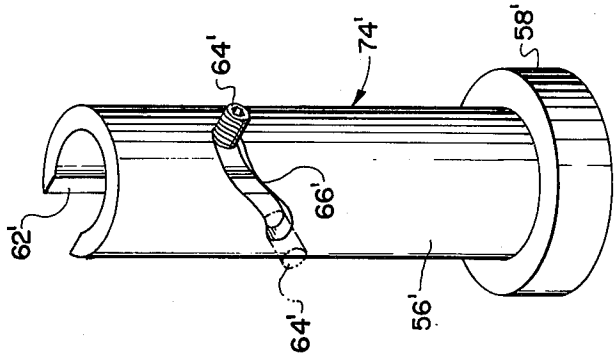


FIG. 17

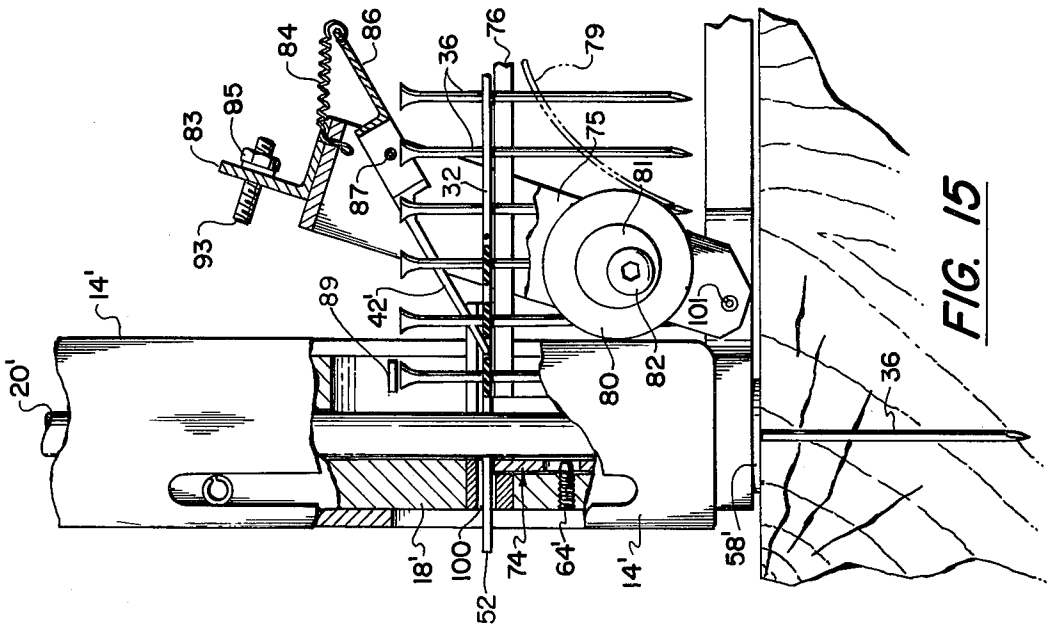


FIG. 15

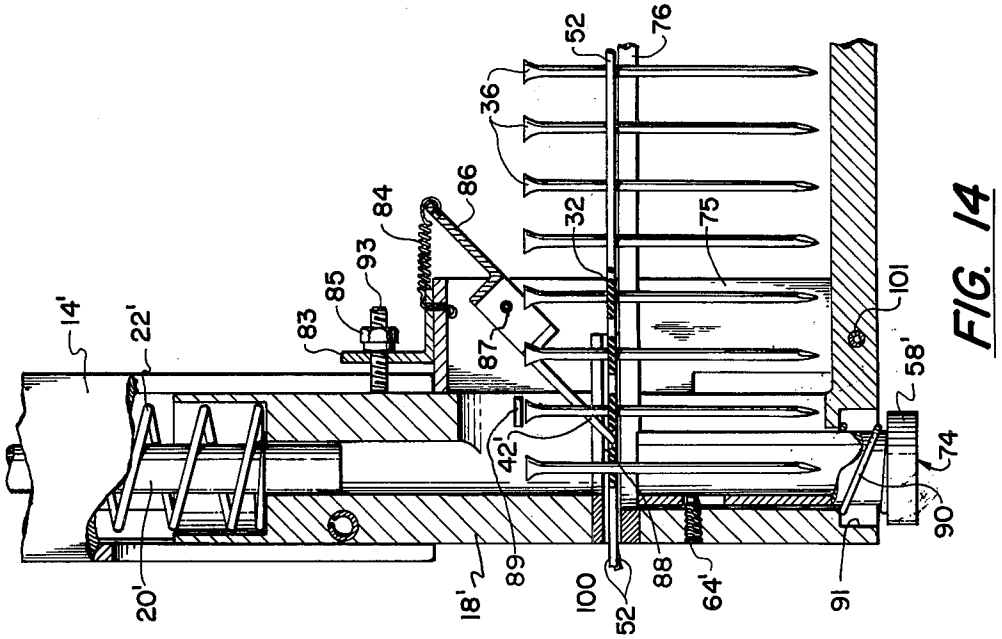


FIG. 14

DRIVING TOOL MECHANISM

This application is a continuation-in-part of my earlier filed, copending application, filed Sept. 17, 1973, bearing Ser. No. 397,998, now abandoned.

This invention relates to a tool and particularly to a mechanism for an impact tool which rapidly feeds fasteners from plastic strips into position for driving and which enables the fasteners to be disengaged from the strip in a continuous manner.

Power driven impact tools are used to drive metal fasteners in a variety of industrial applications. To increase the speed at which the fasteners can be driven and for the operator's convenience, a plurality of fasteners have been mounted on a single strip, usually made of plastic material; the strip has been fed to an impacting means, such as a pneumatic gun, and the fasteners have been driven successively from the strip into a workpiece. Recently, an improved plastic strip has been introduced in which the fasteners are positioned on the strip between two rails of plastic. It is an object of this strip construction that when a fastener is driven, it carries with it a thin plastic part of the strip in which it is embedded between the rails and that the thin plastic part serves as a washer to seal the fastener with the workpiece.

In order to drive such a fastener it is important to design a mechanism which can rapidly and effectively engage and disengage the fastener strip to permit the fastener to be properly driven into the workpiece.

Attempts have been made to develop suitable mechanisms for feeding a strip of fasteners to an impact tool which can be easily loaded with the strip and which will not be jammed by the strip which is required to carry the fastener and in certain applications provide a sealing washer on the driven fastener. One of these attempts involved the use of a standard pneumatic impact gun and an impacting piston or driver which extended within a cylindrical barrel connected to the barrel of the gun. A magazine, comprising a strip-carrying channel and slide means for advancing the strip, was mounted perpendicular to the piston and barrel. The leading end of the magazine was cammed to cooperate with the cylindrical barrel such that upon impact of the gun, the piston separated a fastener from the strip with its plastic washer, the strip rails fed through the barrel of the mechanism and another fastener was aligned with the piston for driving on the next stroke. There were several drawbacks in this design, however, including the fact that the first fastener in the magazine had to be aligned by hand with the impact piston to start the strip through the gun. In addition, it was difficult to feed the strip into the tool because of the close tolerances required in the barrel opening to support and hold the strip during the driving operation. Due to the relative softness of the plastic strip, the fasteners were not cleanly separated from the strip and the deformed plastic interferred with continuous operation of the feed mechanism. Since in this design the slide of the magazine could not be removed from the mechanism, the operator often was required to try to realign the deformed strip with the impact piston using one hand, working in the confined space between the barrel and the magazine slide. Another disadvantage of this type of mechanism was that very close manufacturing tolerances were required to insure that the strip was fed smoothly to the impact piston, properly held during

driving of the fastener and advanced to align the next fastener with the piston.

A further development in such mechanisms included extending the walls of the piston-carrying barrel so that the magazine was guided accurately with respect to the channel in which the strip was carried to prevent the strip from jamming in the mechanism. To do this, however, required even stricter tolerances and did not overcome the problems previously mentioned.

I have invented a feed mechanism for an impact tool which includes a magazine for holding a replaceable strip of fasteners and means for separating the fasteners from a part of the strip upon impact. The magazine holds and feeds the strip to the piston in the barrel. The means for separating the fasteners from the strip comprises a floating bushing which carries strip-holding edges at an end adjacent the strip. The bushing has limited movement in the barrel from a first position for holding the rails of the strip to a second position where it is disengaged from the strip to permit the strip to be advanced to align a new fastener with the driving piston. The rails are held between the bushing and the barrel or the bushing and a portion of the magazine which extends into the barrel. In a modification of the bushing, I have provided means, such as a ramped surface, for better aligning a fastener as it is driven under impact of the tool and cutting edges for facilitating removal of the washer portion from the rail portion of the strip. In another modification, the bushing is made of a plurality of parts, adjustable with respect to each other, to change the effective length of the bushing and consequently to determine the effective length of the stroke of the piston to control the action of the driven fastener. The bushing can likewise be rotated to position its fastener opening within the barrel. The bushing is readily interchangeable so that the workpiece contacting surface of different bushings may vary to conform to different workpiece profiles. The strip moving mechanism can be made adjustable to accommodate different strips and tolerance accumulations.

My invention enables a strip of fasteners to be initially properly loaded in an impact tool with substantial repeatability, and the fasteners to be driven without malfunction of the mechanism and in less time. In addition, the bushing retains the fastener in position and prevents the fastener from jamming within the driving tool.

I have further disclosed my invention in the description which follows, taken with the accompanying drawings in which:

FIG. **1** is a side elevational view of the mechanism of my invention showing the tool prior to impact;

FIG. **2** is a partial end view of the magazine;

FIG. **2A** is an enlarged end view of a portion of the magazine and slide;

FIG. **3** is a view taken along lines III—III of FIG. **2**;

FIG. **4** is an enlarged side view of the floating bushing of the invention showing its relation to a strip of fasteners;

FIG. **5** is an enlarged end view similar to FIG. **4**;

FIG. **6** shows a modification of the bushing of FIGS. **4** and **5**;

FIG. **7** is a top view of the bushing of FIG. **6**;

FIG. **8** shows the mechanism of FIG. **1** in position immediately after impact of the piston;

FIG. **9** shows a further modification of the bushing;

FIG. **9A** is a plan view of the bushing of FIG. **9**;

FIG. 10 shows the bushing with a modified works contacting head;

FIG. 11 is a side elevational view of a modified tool;

FIG. 12 is an end view of a portion of the modified tool;

FIG. 13 is a section through an adjustable stop for the driving piston;

FIG. 14 is a section through the strip moving mechanism of the modified tool;

FIG. 15 is a section through the strip moving mechanism in an extended position;

FIG. 16 is an elevational view of a bushing having a cutting edge; and

FIG. 17 is a schematic of a bushing having a helical slot.

Referring to FIG. 1, mechanism 10 for holding and feeding a fastener disposed in strip material is connected by screw threads 12 of a sleeve 14 to a conventional impact driving tool 16. A barrel 18 is moveably disposed within the sleeve and carries a reciprocable piston 20 actuatable by impact of the tool to drive a fastener, such as a nail, into a workpiece. The cross-sectional configuration of the barrel and slide is not critical, but I prefer a square cross-section for both because of the inherent strength characteristics. A coil spring 22 is disposed between an end of the barrel 18 and the end of the sleeve 14 to urge the barrel in a direction away from the impact tool. However, if the gun is used in a vertical position the spring may be eliminated. A floating bushing 24 fits within the end of the barrel as will be explained in further detail hereinafter.

A magazine 15 extends perpendicular to the end of the barrel which carries the floating bushing. The sidewall of the barrel and the bushing opposite the magazine 15 are open and aligned to permit a fastener to be advanced by the magazine into alignment with the piston for driving by the impact tool.

The magazine 15 (FIGS. 2, 2A and 3) comprises a U-shaped frame 25 having upstanding legs 27 with opposed longitudinal grooves 29 extending toward the barrel 18. A clip 26 having a pair of outwardly extending lugs 31 engageable in grooves 29 is removably mounted on the frame. The clip includes two outer C-shaped channels 30 for receiving strip 32 and for guiding the strip to the driving piston 20. The strip 32 is advanced (so that successive fasteners 36 can be driven) by a slide 28 which includes means such as lugs 38 which are engageable between the legs 27 of frame 25 and the C-shaped channels 30 permitting the slide to move toward and away from the barrel 18, FIG. 2A. Claw means 40 are secured to the top of the slide 28 and engageable with the strip 32. The claw means 40 includes a hook-shaped member 42 which is adapted to engage the strip 32 and which is resiliently attached to the slide 28 by flat spring 44 such that the hook-shaped member 42 disengages and rides over the strip 32 upon retraction of the slide 28 and engages the strip 32 upon advancement of the slide 28 to advance the strip 32 into alignment with the driving tool 16. The slide 28 is biased by at least one coil spring 46 (see FIG. 1) which is attached to the slide 28 and to the magazine 15 to urge the slide 28 along frame 25 of the magazine such that, after each impact, strip 32 is advanced by the slide 28 to present a new fastener 36 from the strip 32 to the impact piston 20. The slide 28 is retracted during each impact by the action of the sleeve 14, the leading edge 48 of which is rounded to engage a cammed surface 50 on the leading edge of the slide 28 to drive the slide 28 away from the barrel 18, the strip 32 being held in place by the floating bushing 24, as described hereinafter.

As the strip 32 advances and successive fasteners 36 are driven separating them from the strip 32 with a washer, two rails 52 are formed which advance through spaced openings 54 in the barrel 18, FIG. 3. After the strip 32 is exhausted of fasteners, the rails 52 fall out or are manually removed from openings 54 and discarded.

The floating bushing 24 (FIGS. 4 and 5) comprises tubular shank 56 and an enlarged head 58. The shank 56 is disposed in the end of the barrel 18 opposite the tool 16 and the enlarged head 58 is positioned immediately outside of barrel 18. The edges 60 on the end of the shank 56 opposite head 58 are adapted to engage the strip rails 52 to hold the strip 32 between the edges 60 and the barrel 18 adjacent the openings 54 during impact of the tool 16 to drive a fastener, FIGS. 3 and 5. The shank 56 of the bushing 24 has a longitudinal opening 62 to permit a fastener 36 to pass through it into alignment with the piston. The bushing 24 is retained in the barrel 18 by a set screw 64 (FIG. 1) which extends through the barrel 18 into a slot 66 in the sidewall of the bushing 24 opposite the opening 62. The length of the slot 66 determines the permissible movement of the bushing 24 in the barrel 18.

The bushing may be spring loaded multiple pins which engage rails 52, but preferably the bushing is made in one piece or as shown in FIG. 6, the enlarged end 58 may be threadably secured to the shank 56, thus making it possible to adjust the length of the bushing and thereby the effective length of the stroke of the driving piston. For example, if the end of a worn out piston is ground to provide a better contact surface with the fasteners to be driven, the head may be adjusted on the shank of the bushing to shorten it thereby maintaining the overall stroke as it was before the grinding. It is important to properly control the length of the stroke so as to properly drive a fastener into a workpiece without driving it short or driving it through the plastic washer.

The bushing may also include an edge ramp 68 (FIGS. 6 and 7) which is tapered inwardly and downwardly of the bushing sidewall to assist in alignment of any fastener during impact.

The bushing 24 may also include the stop 70 for the strip 32, FIG. 9. In the earlier embodiments the strip 32 was stopped when the washer carrying the fastener engaged the barrel 18, and the rails 52 of the strip 32 advanced through the spaced openings 54, FIG. 3. Stop 70 is merely an upward extension of part of the wall thickness of shank 56' so the stop 70 does not interfere with the movement of the piston 20 which passes through the central passageway of shank 56', FIG. 9A. By including the stop 70 with the bushing, the spaced openings can be replaced by a large slot (not shown) in the barrel to further simplify the loading and operation of the strip. The stop can be constructed to accommodate various strip configurations.

The head 58 of the bushing 24 may be configured to conform with the particular environment in which the fasteners are to be used. For example, where corrugated metal roofing is being installed, a bushing having a convexly contoured work contacting surface 72 can be employed to easily fit within the valleys of the corrugations, FIG. 10. The bushing is readily interchangeable by merely loosening the set screw 64, FIG. 1.

In operation, a plastic strip **32** of fasteners **36** is slipped into channels **30** such that the lead fastener **36** is positioned in alignment with the driving piston **20.** The slide **28** of the magazine **15** is pushed forwardly on the frame **25** until it engages the barrel **18** and the spring **46** is attached to the magazine **15** to maintain its forward position under the bias of the spring **46.** The impact tool **16** is then positioned such that the head **58** of the floating bushing **24** is secure against the workpiece. The continued downward movement of the tool **16** after bushing **24** is secure against the workpiece causes the top edge **60** of the bushing **24** to engage the strip **32** along the strip rails **52** for purposes of supporting and maintaining the strip **32** in fixed position during driving. The impact tool **16** is triggered to drive the piston **20** against the fastener **36,** causing a part of the strip **32** to separate with the fastener **36** and to form a sealing washer for the fastener adjacent the workpiece under the impact. During driving the sleeve **14** abuts the cammed surface **50** of the magazine slide **28** causing it to overcome the bias of spring **46** as shown in FIG. **8.** In addition, as the tool **16** impacts and the piston **20** is driven against the fastener, the edges of the strip are maintained straight by the top edge **60** of the bushing **24** pressing against the lower edge of the strip. Upon completion of the impact stroke, the tool is removed from the workpiece and the floating bushing **24** which is now free to move (float) downward disengages from the strip **32.** In addition sleeve **14** retracts relative to barrel **18** and under bias of the coil spring **22.** As the sleeve **14** retracts the slide **28** of the magazine **15** is urged forward by the spring **46** with the claw means **40** advancing the strip to align the next fastener in the strip with the piston **20** while the side rails of the strip advance through the barrel **18.**

The bushing moves, in any one stroke, between a first position wherein it supports and holds rails **52** of the strip **32** against the barrel **18** in the area adjacent openings **54** during impact and a second position (FIG. **3**) where it is disengaged from the rails **52** permitting the strip **32** to be advanced freely by the magazine slide **28** until the next impact.

I have illustrated a modified tool in FIGS. **11–16** wherein certain like parts are identified with like numerals followed by a prime.

The modified tool includes the barrel **18'** over which sleeve **14'** slides when impacted by piston **20',** FIG. **11.** The magazine **15',** however, is substantially altered from the earlier embodiment. Magazine **15'** is secured to the barrel **18'** and includes upper spaced and parallel rails **76** for accommodating the strip **32.** Rails **76** through a rail extension **105** curve about and are secured to the bottom rail mount **92** by a set screw **78** which can also accommodate setting fixtures (not shown). Guide posts **77** extend upwardly from rails **76** to guide the side rails **52** of strip **32.** Rails **76** extend all the way into the barrel **18',** FIG. **14.** Mounted atop of rails **76** within barrel **18'** are C-shaped trackways **88** which accommodate the side rails **52** of strip **32.** The rails **76** and trackways **88** are aligned with the top surface of the bushing **74,** FIGS. **12** and **14,** so that the side rails **52** of strip **32** can be engaged by the bushing **74** during impact, FIG. **15.** During impact the rails **52** are retained between the bushing **74** and the upper inner surface **99** of trackways **88.**

The slot **100** through which passes the exiting rails **52** is a single opening rather than spaced openings **54** as in the earlier embodiment. Therefore, the positioning of the fastener **36** by the feeder mechanism **75** is critical since there is no stop against which the washer portion **94** of the strip **32** abuts as described hereinbefore.

The feeder mechanism **75** is pivotably secured to the bottom rail mount **92** by pivot pin **101,** FIG. **12.** The strip **32** is engaged by spaced fingers **42'** which are connected to a finger plate extension **86** which in turn is pivotally mounted to the feeder mechanism **75** by pin **87.** Return spring **84** connected between the finger plate extension **86** and the feeder mechanism **75** urges the fingers **42'** into engagement with the strip **32** during operation.

This operation is best illustrated in FIGS. **14** and **15.** During an impact stroke, sleeve **14'** moves down over barrel **18'.** Sleeve **14'** engages cam disc **80** which is secured to feeder mechanism **75.** As sleeve **14'** engages cam disc **80,** feeder mechanism **75** pivots about pin **101** and the fingers **42'** slide back over the strip **32** to engage the strip **32** for its next advancement. After impact, flat spring **79** connected between cam disc **80** and rails **76** urge the feeder mechanism **75** forward as the sleeve **14'** moves up over barrel **18'.** As feeder mechanism **75** advances forward the strip **32** now engaged by the fingers **42'** advances into the barrel **18'** and positions the next fastener **36** into position, FIG. **14.**

I have provided two adjustments on my feeder mechanism **75** to accommodate tolerance accumulations and different fastener **36** or washer **94** spacings, FIG. **11.** Cam disc **80** is mounted off center by cam screw **82** which also extends through cam washer **81** and threadably engages the feeder mechanism **75.** By rotating cam disc **80** the positioning of the fasteners **36** within the bushing **74** is altered. I have also mounted an L-shaped bracket **83** atop the feeder mechanism **75.** A bolt **93** extends through bracket **83** and contacts barrel **18'** to control the spacing between the barrel **18'** and the feeder mechanism **75.** Bolt **93** threadably engages adjusting nut **85** so as to permit adjustment for the desired spacing.

To further assure proper alignment of the fastener **36,** I have provided an aligning pad **89** within the barrel **18'** to lightly frictionally engage the top of the fastener **36** as it enters the barrel **18',** FIG. **12.** This frictional engagement merely removes any fastener cant and assists in directing the fastener **36** along the center line of the barrel **18'.**

The bushing **74** can be spring loaded, FIG. **14,** by positioning a coil spring **90** between the enlarged head **58'** and a counterbore **91** in the bottom of the barrel **18'.** This permits the tool to be efficiently used in the horizontal as well as vertical position.

In the bushing **74** illustrated in FIG. **16,** the upper edge **95** is formed so as to form a knife edge to facilitate removal of the washer portion **94** from the rails **52.** Such a construction is particularly useful where a soft plastic is utilized in forming the strip **32.**

The bushing **74'** can also be constructed so as to rotate during its axial movement, FIG. **17.** The slot **66'** in the shank **56'** is helically formed so that as pressure is placed on the tool, the bushing **74'** overcomes the frictional engagement of the head **58'** to the workpiece and the bushing **74'** rotates about the set screw **64'.** The effect of this is to position the fastener entry slot **62'** out of registry with the barrel opening for the fasteners. This eliminates the possiblity of the fastener being driven out of the barrel if it is misaligned. The remaining operation, namely that of the bushing relative to the plastic strip **32,** can be in accordance with any of

the earlier embodiments.

I claim:

1. A mechanism for feeding a strip of metal fasteners to an impact tool having a reciprocable piston for driving the fasteners through an impact stroke into a workpiece comprising:

A. a barrel including an exit means extending through a wall thereof for attachment to the impact tool;

B. a magazine for holding the strip and disposed with respect to the barrel to feed the strip into the barrel in driving position with respect to the piston; and

C. a bushing disposed and secured within an end of the barrel and having an end positioned with respect to the strip to retainably engage edges of the strip between the bushing and the barrel wall adjacent the exit means during the impact stroke of the piston to permit separation of the fastener from the edges of the strip and to disengage from the strip after impact to permit advancement of the strip into the barrel and through the exit means.

2. The mechanism of claim 1 wherein a rail of the magazine extends into the barrel and the strip is retained between the bushing end and the rail.

3. A mechanism as set forth in claim 1 wherein the bushing is secured within the barrel by a set screw extending through a wall of the barrel and into a slot formed in a wall of the bushing.

4. A mechanism as set forth in claim 1 wherein the bushing comprises a tubular shank having an enlarged head positioned outside the barrel and a shank disposed within the barrel of the mechanism.

5. A mechanism as set forth in claim 4 including a spring positioned between the enlarged head of the bushing and the barrel so as to urge the bushing into an extended position.

6. A mechanism as set forth in claim 1 wherein the edges of the strip comprise a pair of plastic rails between which the fasteners to be driven are held, and the bushing includes a tubular shank having cutting edges on its upper end for engaging the strip rails during driving of the fastener by the tool and for facilitating separation of the fastener.

7. A mechanism as set forth in claim 1 wherein the magazine includes a strip trackway and a feeder mechanism having finger means for engaging the strip and a spring loaded pivotable cam means engageable by a sleeve surrounding the barrel during the impact stroke to slide the finger means rearward over the strip and to permit engagement of the strip thereby for advancement along the trackway into the barrel.

8. The mechanism of claim 7 wherein the cam means includes a disc off center rotatably connected to the feeder mechanism so as to be adjustable through rotation about the connection.

9. In a mechanism for feeding metal fasteners to an impact tool for driving into a workpiece, which mechanism comprises a barrel having a reciprocable piston actuatable by the tool and a magazine for feeding a strip of fasteners through an entry slot of the barrel for impacting by the piston, the improvement comprising a bushing comprising a tubular shank having an enlarged head at its lower end, an entry slot in registry with the barrel entry slot and edges on the upper end for holding the strip during impacting, said shank being disposed within the end of the barrel removed from the tool and movable between a first position where the edges engage the strip during impacting of the fastener and a second position after impacting where the edges of the bushing are disengaged from the strip.

10. A mechanism as set forth in claim 9 wherein a slot is provided in the shank of said bushing for admitting a fastener to the driving position within the barrel, the bottom of the slot being tapered inwardly toward the center of the bushing to facilitate alignment of the fastener with the piston during driving of the fastener.

11. A mechanism as set forth in claim 9 wherein said bushing head is threaded to the lower end of the tubular shank whereby the length of the bushing can be changed to maintain the effective length of the stroke despite any change in the length of the driving piston.

12. A mechanism as set forth in claim 9, said bushing having a slot in the tubular shank adjacent the barrel wall and a screw extending through the wall into the slot in the bushing shank to limit movement of the bushing within the barrel.

13. The mechanism as set forth in claim 12 wherein said bushing slot is helically formed so that the bushing rotates during movement between the first and second position thereby positioning the bushing entry slot out of registry with the barrel entry slot.

14. A mechanism as set forth in claim 9, said bushing including a stop means positioned on the end of the shank opposite the head and away from said magazine to stop the movement of the strip between successive impact strokes.

15. A mechanism as set forth in claim 9 wherein the enlarged head of said bushing includes a contoured work contacting surface.

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