

[54] **MULTIPLE SHOT FASTENING GUN**

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[73] Assignee: **Swingline, Inc.**, Long Island City, N.Y.

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[52] U.S. Cl. **227/132**

[51] Int. Cl.² **B25C 1/00**

[58] Field of Search 227/120, 132, 146

[56] **References Cited**

UNITED STATES PATENTS

3,758,016 9/1973 Olney et al. 227/132

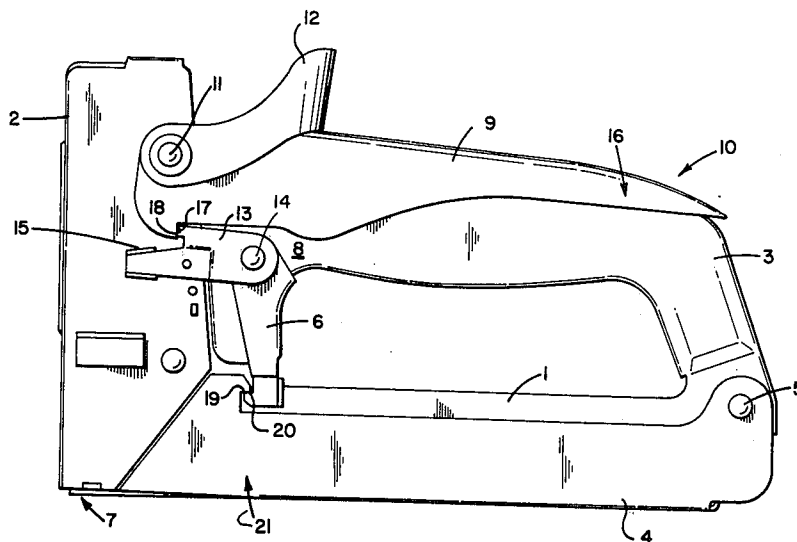
Primary Examiner—Granville Y. Custer, Jr.

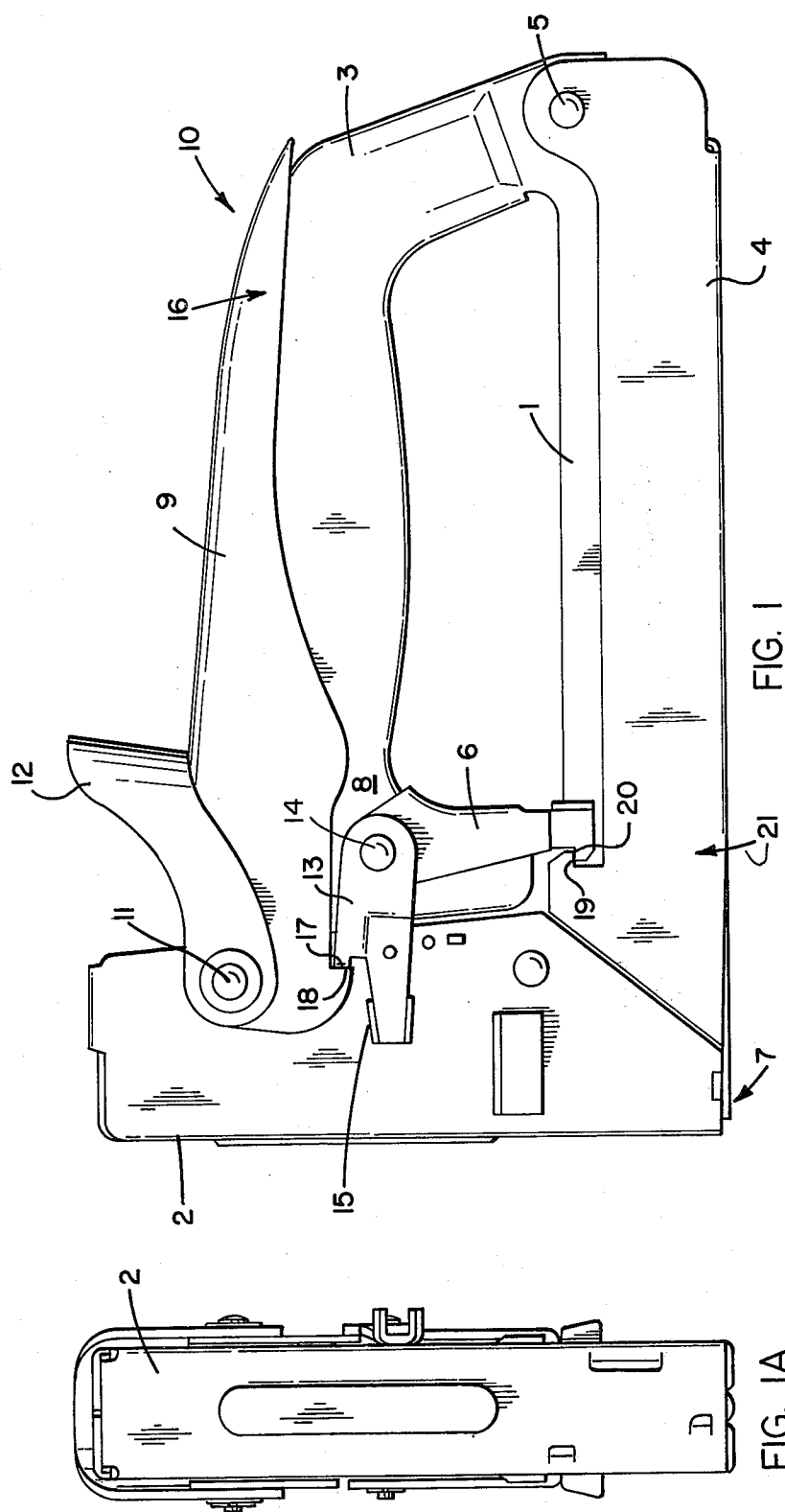
Attorney, Agent, or Firm—Pennie & Edmonds

[57] **ABSTRACT**

A gun-type manually operable tool for driving fastening elements, such as nails, into a work piece. The tool comprises a driving means including spring-loaded ram means movable through a series of arming strokes and firing shots to drive the fastener into the work piece. The tool is constructed to accomplish at least two driving shots for each fastener using a ram having multiple driving surfaces which are positioned by the fastening element and by cam arrangements to accomplish at least two driving shots.

3 Claims, 13 Drawing Figures





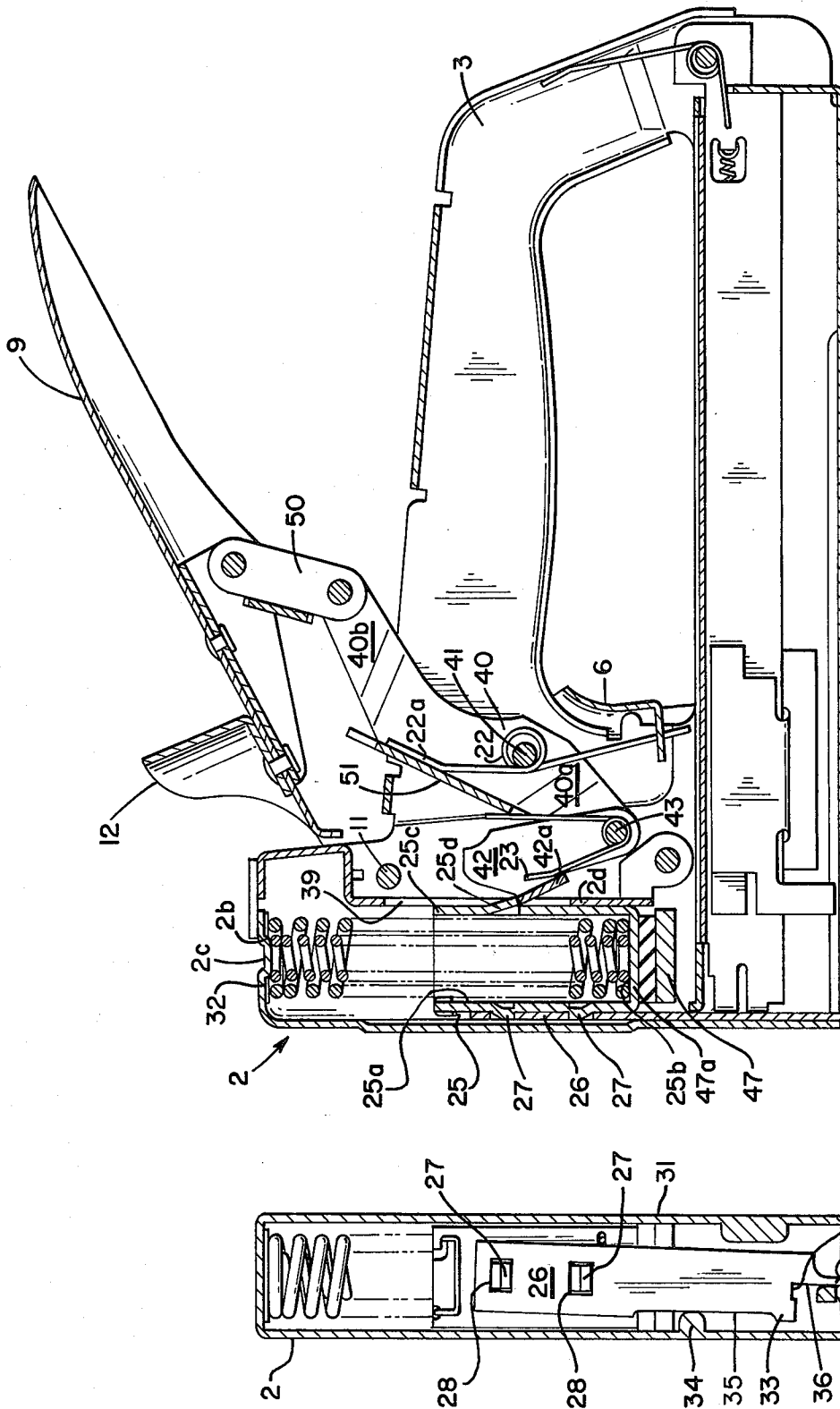


FIG. 2

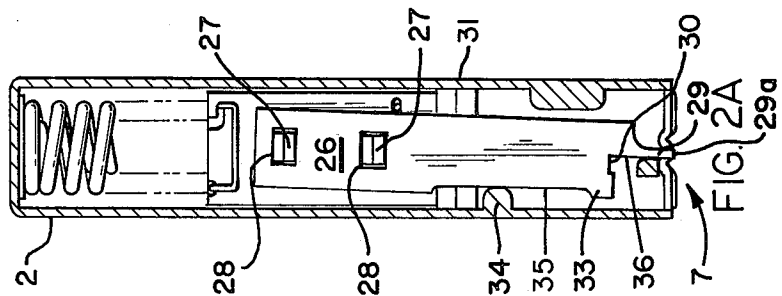


FIG. 2A

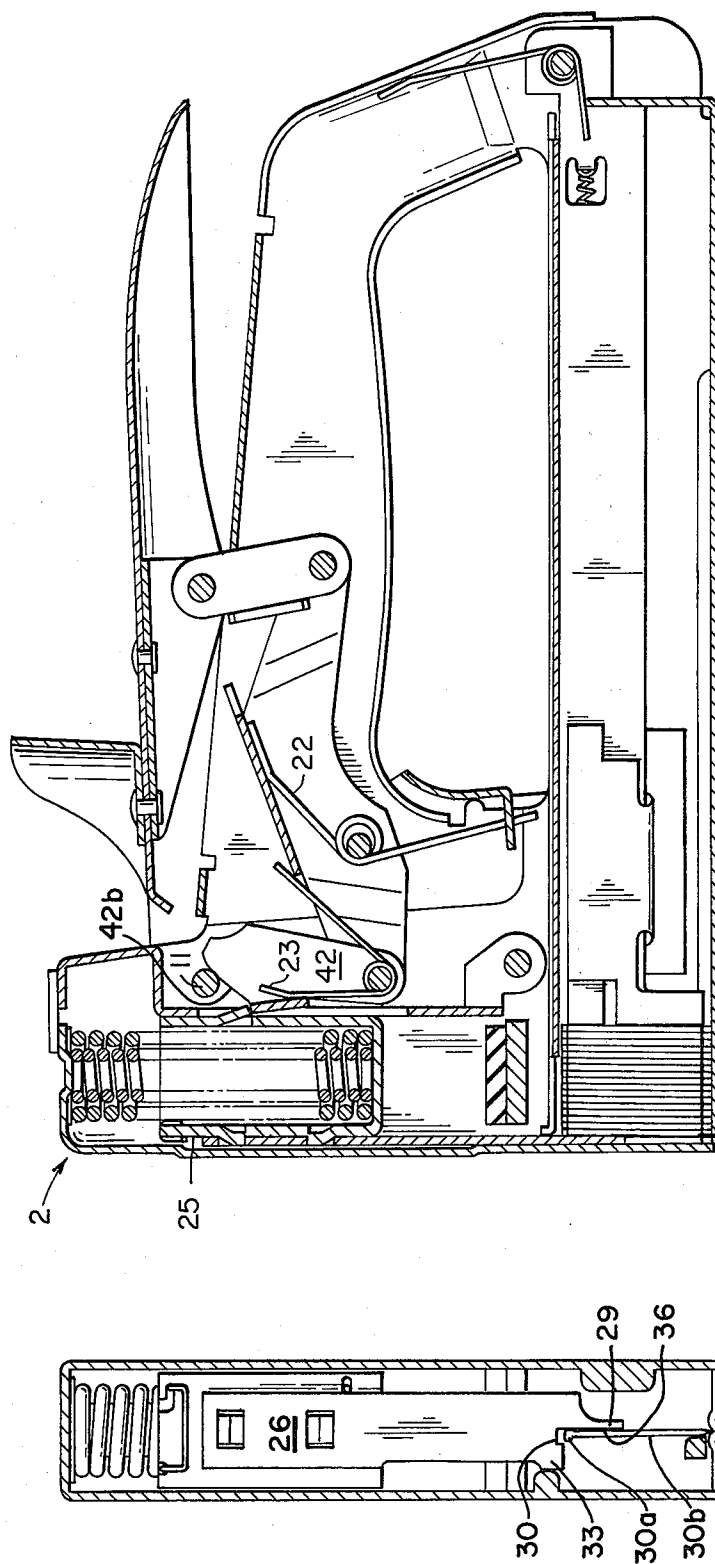


FIG. 3

FIG. 3A

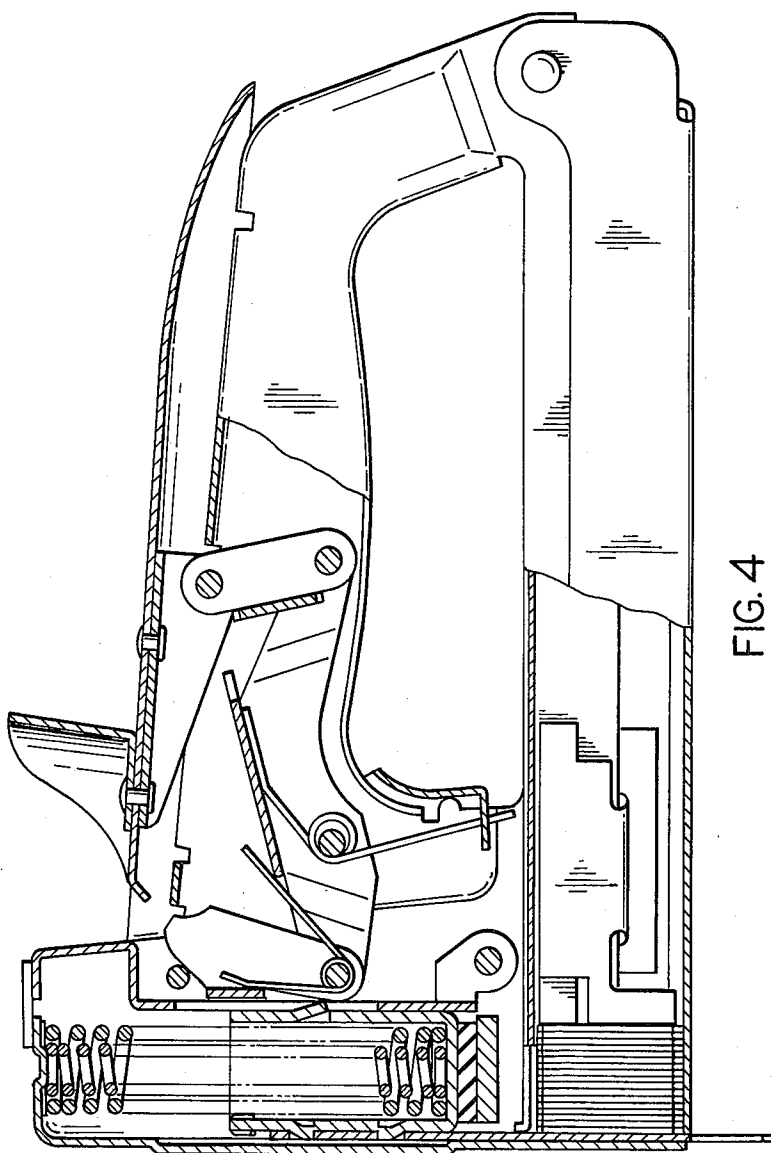


FIG. 4

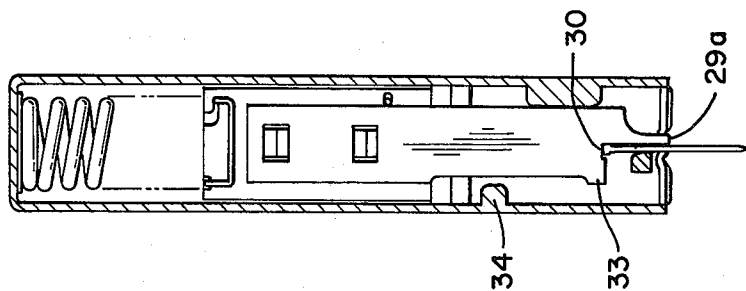


FIG. 4A

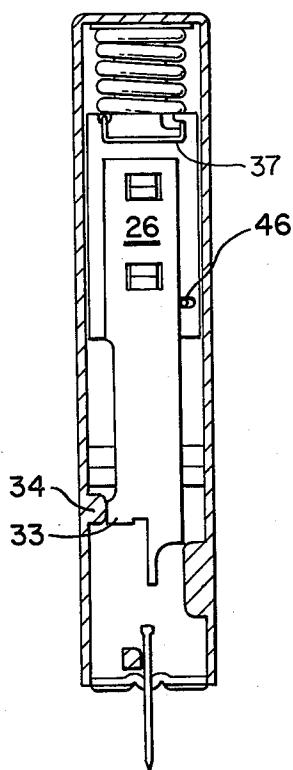


FIG. 5

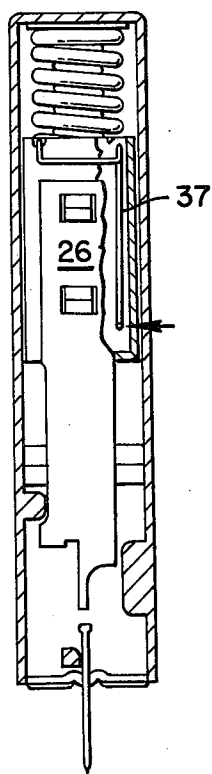


FIG. 6

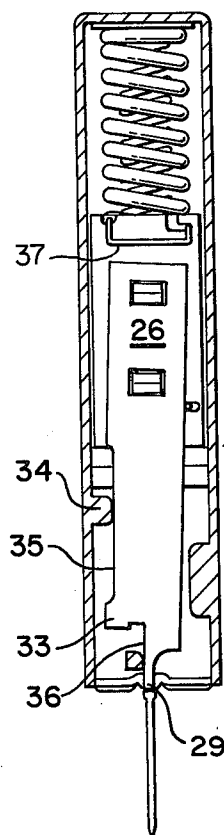


FIG. 7

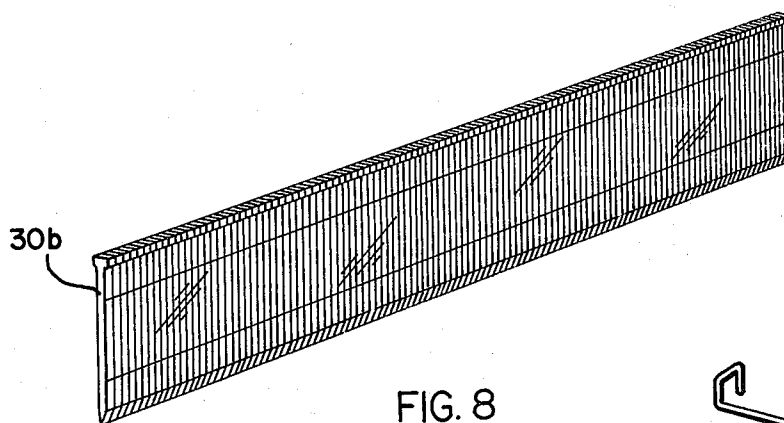


FIG. 8

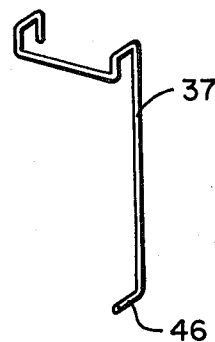


FIG. 9

MULTIPLE SHOT FASTENING GUN

BACKGROUND OF THE INVENTION

Spring powered nail guns have been proposed and used to drive fasteners including the type of gun disclosed in U.S. Patent application No. 438,168 filed Jan. 30, 1974 and assigned to the assignee of the present application.

The gun of the present invention includes a mechanism permitting the gun to be loaded and fired to provide for two or more driving shots by the hammer element. This improvement permits fastening to be accomplished where greater driving forces and energies are required.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of the gun; and FIG. 1A is a front elevational view of the gun;

FIG. 2 is a sectioned side elevational view of the gun with handle raised; and FIG. 2A is a sectioned front elevational view of the gun in that position;

FIG. 3 is a sectioned elevational view with handle lowered during arming of the firing mechanism; and FIG. 3A is a front elevational view of the gun in that position;

FIG. 4 and 4A show the gun after completion of the first driving stroke;

FIG. 5 is a front view showing the ram raised for the second stroke;

FIG. 6 shows the ram descending during the second stroke;

FIG. 7 shows the nail after driving is complete;

FIG. 8 shows a group of nails lined up for feeding by the magazine to the driving station; and

FIG. 9 shows the spring which urges the driver blade in a clockwise manner.

DETAILED DESCRIPTION OF THE INVENTION

With reference to FIGS. 1 and 2, a fastening element driving tool constructed according to the present invention comprises a frame indicated generally by reference numeral 10. The frame 10, which includes a gripping handle 3 as shown, supports a housing for the operating components of the tool. The housing includes magazine 1 and sheath 2. A cover 4 for magazine 1 is pivotally secured to the rear end of the frame by hinge pin 5. The cover 4 is swingable, upon release of cover latch 6, about hinge pin 5 to expose, for purposes of loading, the magazine-type fastening element feeding means contained within magazine. This feeding means is operable to successively feed individual fastening elements one at a time to the driving station of the tool which is indicated generally by reference numeral 7. Sheath 2 houses the component parts of a selectively operable fastening element driving means which, upon activation, acts to drive a waiting fastening element situated at the driving station out of the tool and into a work piece.

The forward end portion 8 of the frame supports a specially constructed actuating means for operating the driving means. The actuating means includes, as shown in FIGS. 1 and 2, an actuator arm 9 pivotally connected to frame 10 by hinge pin 11 and spring biased toward its open position (FIG. 2) by arm 22a of torsion spring 22 as shown in FIG. 3. The actuating means further includes a specially constructed linkage means responsive to the actuator trigger which acts to cock and fire

the driving means. The linkage means will also be described more fully below. As shown arm 9 carries at its forward end a hand guard 12 which is also mounted on hinge pin 11 and fixed in place relative to arm 9 by rivet means as indicated in FIG. 2.

For the purpose of locking the arm 9 in the fully closed or locked position shown in FIG. 1, a trigger latch 13 pivotally secured to the forward end 8 of gripping handle 3 by hinge pin 14 is provided. Trigger latch 13 is provided with a thumb rest 15 for the purpose of permitting convenient rotation thereof to thereby permit pivotal movement of arm 9 to its open or unlocked position. To release arm 9, it is helpful to depress it slightly from its locked position as shown in FIG. 1 in the direction of arrow 16. Such movement it will be recognized slightly separates contacting locking surfaces 17 and 18 of arm 9 and latch 13, respectively, to provide enough clearance between these locking surfaces permitting easy release of the trigger. Similarly, it is helpful, for purposes of releasing cover 4, to depress cover 4 slightly from its closed position as shown in FIG. 2 in the direction of arrow 21. This movement provides sufficient clearance between locking surfaces 19, 20 on cover 4 and cover latch 6, respectively, to permit latch 6 to be easily pivoted from its locked position to its open position (as indicated by arrow 21 in FIG. 1) thereby separating locking surfaces 19, 20 to allow cover 4 to be swung open. Trigger latch 13, on the other hand, is held securely in its locked position with its locking surface 18 engaging locking surface 17 of trigger 9 by force of engagement between these locking surfaces created by arm 22a of torsion spring 22 biasing the trigger 9 toward its open position. Thus trigger 9 is safely prevented from flying accidentally into open position when the tool is not being used.

Referring now to FIGS. 2 and 2A, the driving means contained within housing sheath 2 includes an elongated hollow ram member 25 which is mounted for selective cyclical movement between two longitudinally spaced apart positions within sheath 2 for each driving shot. In one of these positions, ram 25 is situated in the lower portion of sheath 2 as shown in FIG. 2 and 2A. In the other position, ram 25 is situated in the upper portion of sheath 2 as shown in FIG. 3. As will be more fully explained below in that portion of the description which described the operation of the tool upon multiple shot hammering of a nail the ram 25 is moved through two or more complete cycles. Each cycle includes ram movement from its initial rest position shown in FIG. 2 upward to the firing position shown in FIG. 3 (such upward movement representing the upstroke of the cycle) and then down again to its rest position shown in FIG. 4 (such downward movement representing the downstroke of the cycle). Rearwardly facing wall 25c of ram 25 is equipped with a shear-formed lifting lug 25d which moves within thru-slotway 39 formed in the rear wall 2d of sheath 2 during the upstroke and downstroke of the ram.

Connected to the ram 25 for movement therewith is a driver blade 26. The driver blade 26 is secured to ram 25 by spaced shearformed lugs 27 which are received in spaced openings 28 in driver blade 26. Blade 26 is capable of swinging or pivoting in relation to ram 25 about axes parallel to the longitudinal axis of the row of nails to be driven (FIG. 8). The driver blade 26 has two driving surfaces, one notched surface 30 is formed at the base of tongue 29 and the other is surface 29a

formed on the flat end of tongue 29. During the first downstroke or shot surface 30 is brought into contact with the head 30a of a nail 30b to be driven (FIG. 3A). The driver blade 26 and connected ram 25 are guided within sheath 2 by a slide-way defined by shearformed guide detents 31 projecting inwardly from the front wall 2a of sheath 2 on opposite sides of driver blade 26 as best shown in FIG. 2A. The blade 26 is further guided by lip 33, sheath protrusion 34, by nail 30b and by surfaces 35 and 36 to accomplish driving the nail during the first and second shots. The position of the fastener determines which blade driving surface, 29a or 30, will be guided against the end of the fastener to drive the fastener into the work piece.

For the purpose of enabling ram 25 and driver blade 26 to undergo downward movement with sufficient force to drive nail 30b out of the tool with sufficient force to move it a distance down into a work piece, a composite compression spring 32 is provided. As shown, this spring is disposed within bore 25a of ram 25 with one of its ends resting on the bottom plate 25b of ram 25 and with its other end abutting the top plate 2b of sheath 2. An inwardly protruding boss 2c is carried by the top plate 2b of sheath 2 for the purpose of retaining spring 32 aligned in bore 25a of ram 25. With this construction, it will be recognized that the ram 25 and thus driver blade 26 are biased toward the driving station 7 of the tool.

For the purpose of cocking the ram (i.e., lifting it to firing position) and releasing it so that it may be moved forcefully downward under the force exerted upon it by compression spring 32 an actuating means, previously mentioned, is provided. The actuating means comprises trigger 9 and a linkage means operatively connected between ram 25 and trigger 9. The linkage means comprises a ram lifter member 42, a pivotally mounted lever link 40 and a special cam-cam follower means. The link 40 is pivotally mounted at a point approximately midway along its length on stationary link pin 41 to define two arms 40a and 40b situated on either side of link pin 41. The ram lifter 42 pivotally mounted on the forward end of lever arm 40a for movement therewith by pin 43. Linkage 50 connects trigger 9 and link 40. As shown one arm of spring 22 engages the latch 6 for cover 4 and the other arm engages the plate 51. Spring 22 is therefore operative to bias the cover latch 6 in the locked position shown in FIG. 1 and to urge rotation of link 40 about pin 41 in a counter clockwise direction (as viewed in the drawings) thus moving trigger 9 into the open position and ram lifter 42 into a position adjacent ram stop 47 and buffer 47a.

One arm of spring 23 engages cam plate 51 and the other arm engages lifter plate 42a on ram lifter 42. With this arrangement the ram lifter plate is urged into engagement with the lifting lug on the ram. Spring 23 insures that this engagement is maintained during the upstroke or arming stroke of the ram until such time as these two members are disengaged by the coaction of cam surface 42b of ram lifter 42 with the trigger hinge pin 11 (FIG. 3).

In operation of the gun, the trigger latch 13 is depressed as previously described freeing the trigger 9 which will be automatically moved to the open position shown in FIG. 2 by the action of arm 22a of spring 22. With this movement of the trigger 9, the various component parts of the linkage means assume the position

shown in FIG. 2 wherein it will be noted that the ram lifting plate 42a on ram lifter 42 is disposed in contact with ram lifting lug 25d and ram 25 which is in its lowermost position resting against the shock absorbing buffer pad 47a supported by ram stop 47. To arm and fire the tool the operator depresses trigger 9 to move it toward its closed position adjacent gripping portion 3 of the frame. This movement causes movement of linkage 50 to in turn pivot link 40 in a clockwise direction (as viewed in FIG. 2) causing ram lifter 42 to thereby lift the ram 25 and connected driver blade 26 to the position shown in FIG. 3 just prior to the completion of the arming stroke. As this position is reached, the cam surface 42b of ram lifter 42 is brought into engagement with hinge pin 11 thereby causing clockwise movement of ram lifter 42 relative to link 40 away from ram 25. This movement, as continued, causes disengagement of the ram lifting plate 42a and the ram lifting lug 25d thus releasing the ram for downward movement (i.e., the firing shot) toward the driving station under the force exerted by compression spring 32.

As blade 26 descends blade lip 33 rides on sheath protrusion 34 to guide side 36 of tongue 29 along the side of the nail to be driven. Upon blade 26 further descending surface 30 engages nail head 30a to break the nail off the nest of nails (see FIG. 8) in the magazine and to drive the nail a substantial distance into the work piece. Upon completion of this first shot, the nail is positioned partially driven as shown in FIG. 4A. To complete the driving of the nail, the gun is again cocked by the operator raising the ram member 25 and releasing it for downward movement as shown in FIGS. 5-7. During the second downstroke, the lower portion of the blade 26 is able to swing to the left as lip 33 and sheath protrusion 34 disengage since the upper part of the nail is not in a position to engage tongue side 36 to prevent such swinging movement. The blade 26 is biased in a clockwise direction by spring 37 (FIG. 9) which has end 46 engaging the edge of the blade. As vertical blade surface 35 rides along sheath protrusion 34 during further descent of blade 26 (FIG. 3), tongue 29 is caused to strike and thereby finish driving the nail in the second and final stroke.

After the driving of one nail, the magazine delivers to the driving station the next nail in the strip. The driving operation is then ready to be repeated.

We claim:

1. A tool for driving a fastening element into a work piece comprising:
 - a. a frame including a ram housing;
 - b. magazine means mounted on the frame for feeding sequentially a plurality of fastening elements to a driving station;
 - c. spring loaded ram means mounted in the housing on the frame for movement through multiple arming strokes against the force of the spring in a direction away from the driving station and through successive firing shots back toward the driving station under the force of the spring into driving contact with a waiting fastening element situated at the driving station;
 - d. movable means engageable with the ram means for advancing the ram means through the arming stroke;
 - e. release means for effecting disengagement between the ram means and the movable means upon completion of the arming stroke;

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- f. driving blade means having at least two fastening element driving surfaces said blade means being pivotably attached to the ram means; and
 - g. guide means associated with said housing engageable with the driving blade means to guide the first of said driving surfaces against the fastening element to complete a first driving shot driving the fastening element through a hole in the stapler housing and to guide the second of said blade surfaces against the fastening element in a successive driving shot to thereby drive the fastening element further into a work piece.
2. The tool in accordance with claim 1 in which the driving blade includes a tongue engageable with the fastening element to be driven to guide the first blade driving surface positioned adjacent the upper part of the tongue into contact with the fastening element and in which the second driving element surface is below the first driving surface so that the fastening element is driven further in the work during the second stroke of the blade.
3. A tool in accordance with claim 1, wherein said guide means comprises:
- a. spring means for urging said pivotally mounted driving blade means toward a wall of the housing

- of the tool;
- b. abutment means associated with said housing located adjacent said hole;
- c. engagement means on said first driving surface for engaging the top of said fastening element;
- d. tongue means for engaging the side of said fastening element, said fastening element being positioned before being driven in position with said tongue adjacent its side and said abutment adjacent its opposite side, said driving blade being dimensioned and configured to engage the top of said fastener element with said engagement means, one side of the fastener element with said tongue means and urge the fastener element against said abutment to guide said fastener element through the hole into the work piece as the driving blade means is advanced; and
- e. cam means associated with said housing for guiding said driving blade means, as said driving blade means is urged toward said cam means, along a path along which said second driving surface engages the top of said fastening element during successive strokes to drive said fastener further into the work piece.

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