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Olney et al.

[11] **3,758,016**

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[54] **TACKER**

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[21] Appl. No.: **190,155**

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

[51] **Int. Cl.** **B25c 5/10**

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

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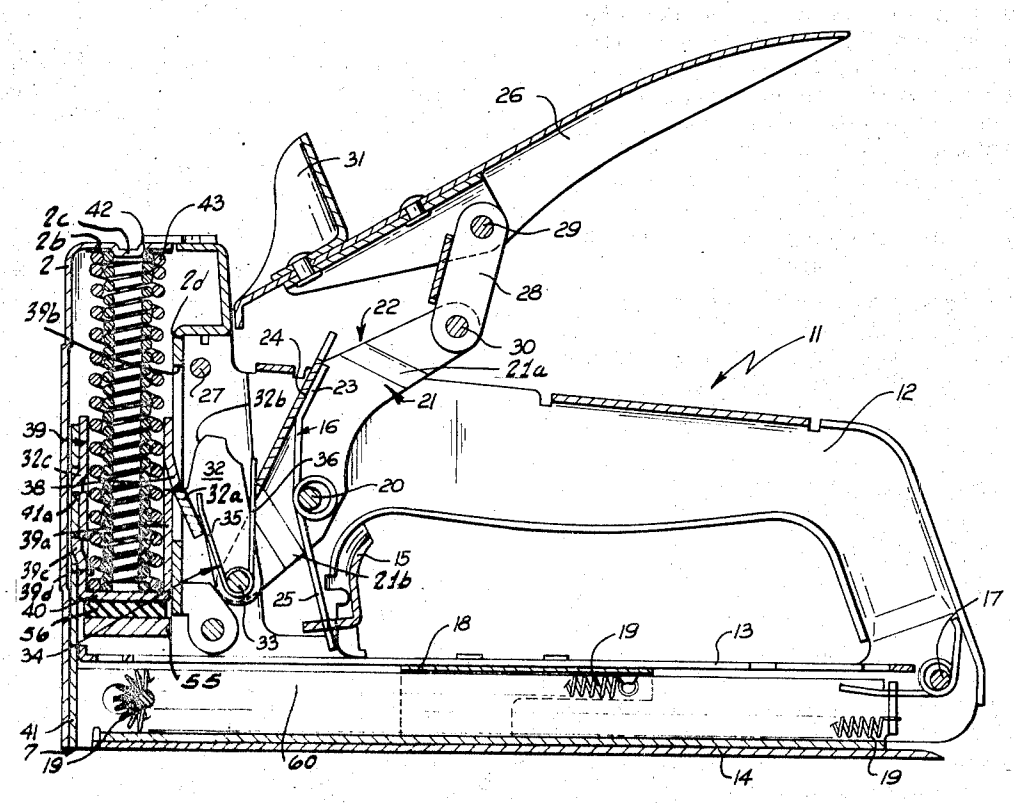
[57] **ABSTRACT**

A gun-type manually operable tool for firing a fastening element such as a staple into a work piece is disclosed. The tool comprises a driving means including a spring loaded ram means movable through an arming and firing stroke into contact with a staple situated at the driving station of the tool. A movable means engageable with the ram means operates to move the ram means through the arming stroke and release means is provided for automatically effecting disengagement between the ram means and movable means at the completion of the arming stroke permitting movement of the ram means through the firing stroke. The tool is actuated by depressing a pivotally mounted actuating handle which is responsively connected to the movable means by a linkage means. The movable means includes a ram lifting member which is pivotally mounted on one link of the linkage means and the release means includes a pin element disposed in the path of movement of the ram lifting member; the pin acting as a cam to pivot the ram lifting element out of engagement with the ram at the completion of the arming stroke. Advantageously, the pin element also serves to pivotally mount the actuating handle. Also, the tool includes a magazine means for incrementally feeding fastening elements to the driving station and a window in the external housing of the tool having visual measuring means for determining the length of the fastening elements loaded in the tool.

5 Claims, 5 Drawing Figures



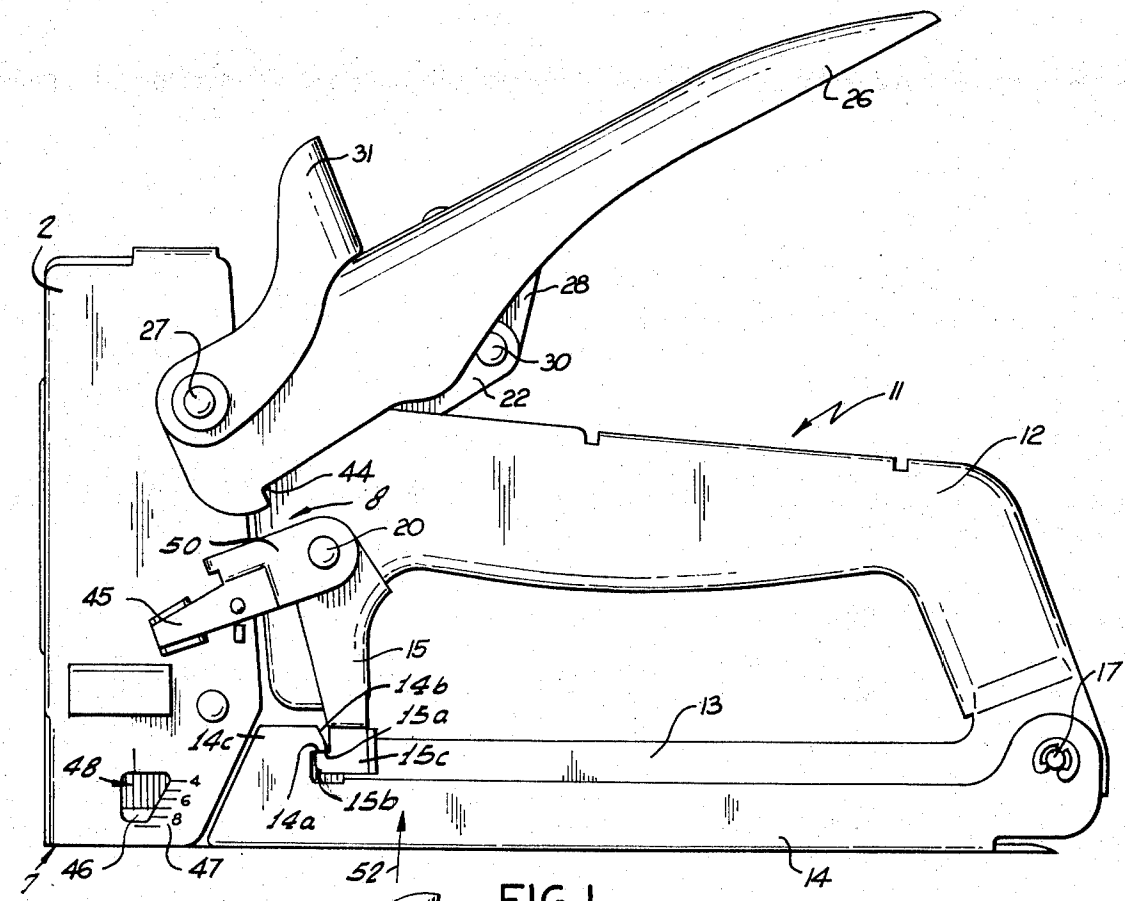


FIG. 1

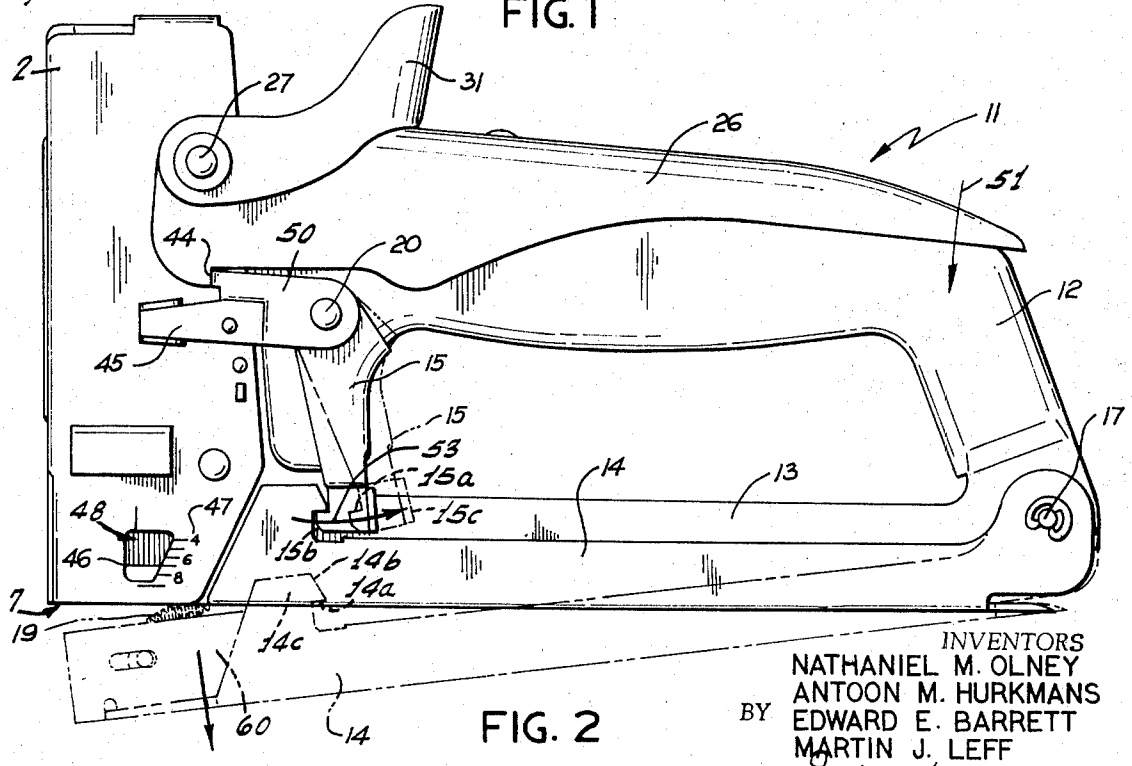


FIG. 2

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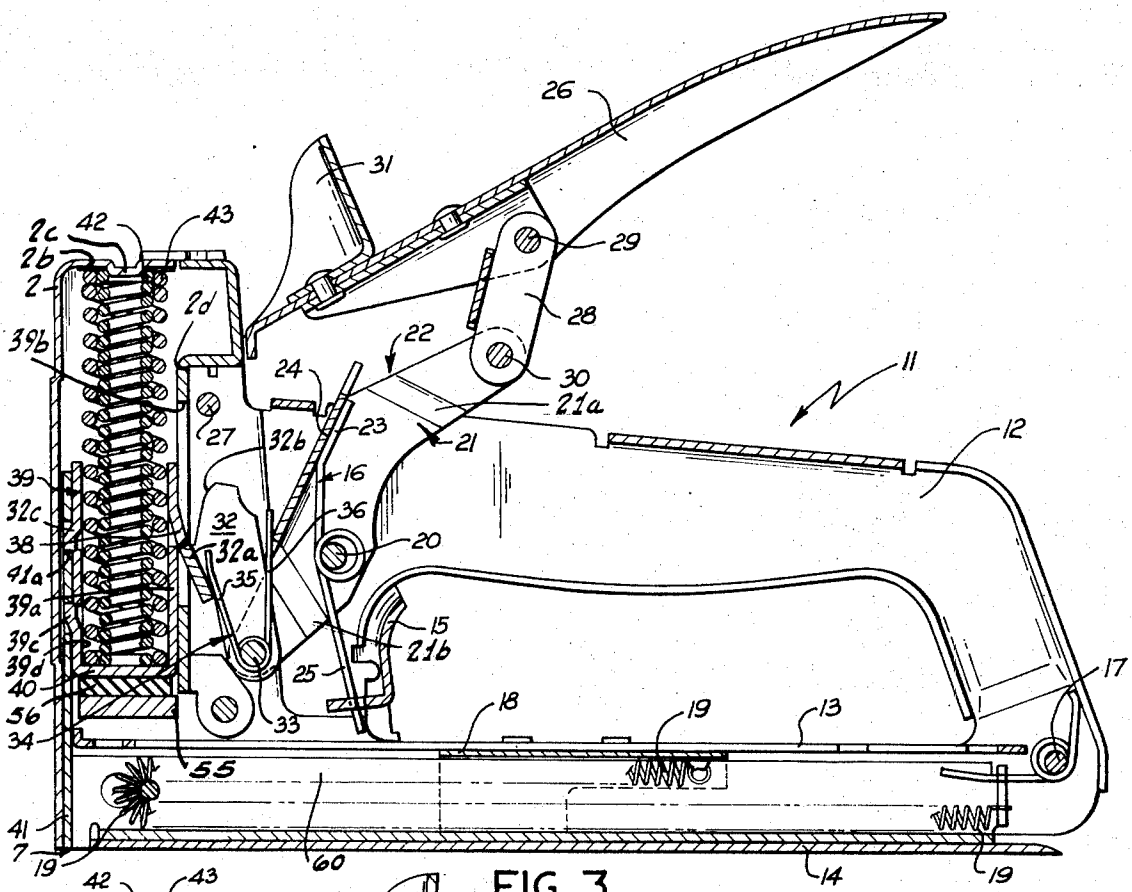

FIG. 3

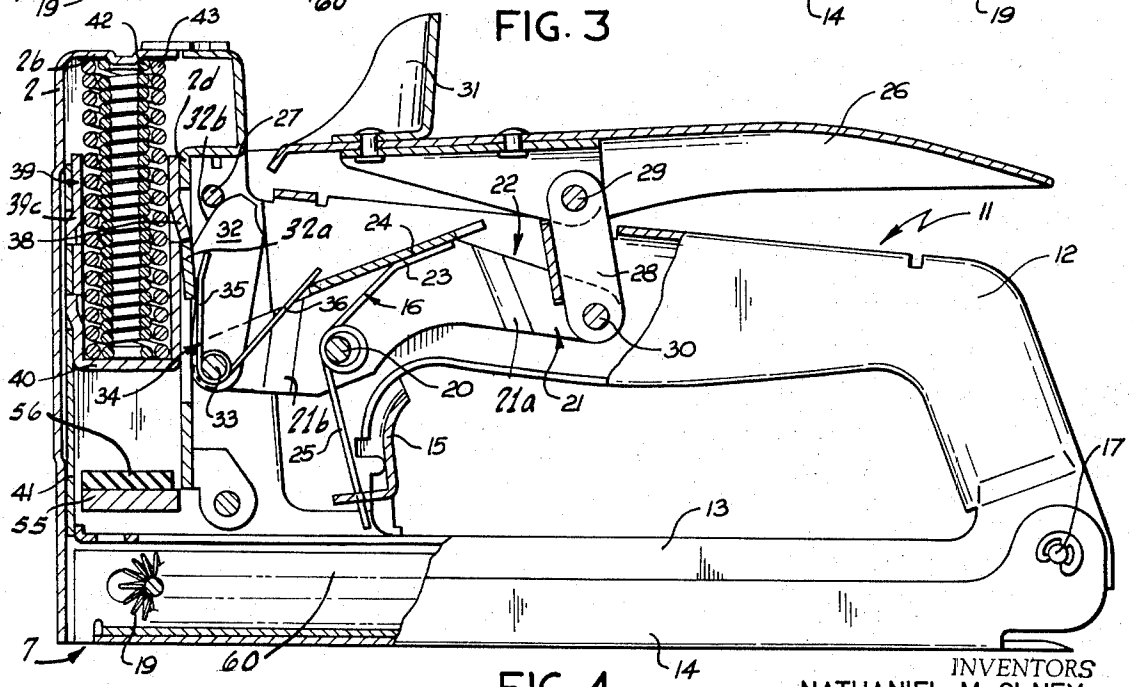

FIG. 4

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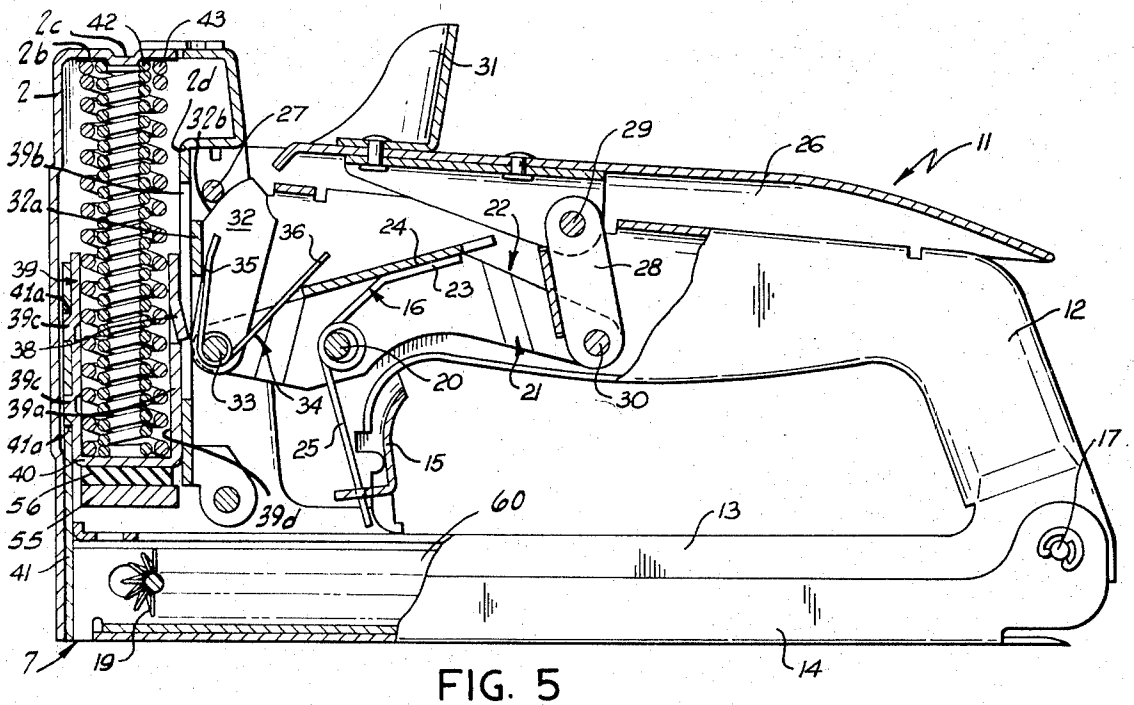

FIG. 5

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BACKGROUND OF THE INVENTION

This invention relates generally to fastening element driving tools and, more particularly, to a manually operable gun-type tool for driving a staple into a work piece. This type of tool commonly includes a spring biased ram carrying a driver blade which is movable through an arming stroke and firing stroke in opposite directions. At the completion of the arming stroke the ram is released and the force provided by the then compressed spring drives the driver blade downwardly against a waiting fastener element situated at the driving station of the tool to drive it into a work piece with considerable force. Such tools also commonly include a magazine which contains a plurality of fastening elements and a spring loaded follower means within the magazine to incrementally advance the fastening elements into operative relationship with the driver blade.

In tools of this type there are a number of problems which must be solved. In the first place the force necessary to arm the ram must be as low as possible to prevent fatigue of the operator. Concurrent with this is the contradictory or opposing requirement that the compressive force produced at the conclusion of the arming stroke of the ram be as high as possible. These contradictory requirements are effectively balanced with a tool according to the present invention.

SUMMARY OF THE INVENTION

A fastening element driving tool constructed in accordance with the teachings of the present invention includes a frame which supports a magazine means for feeding a plurality of fastening elements in sucession to the discharge or driving station of the tool, a selectively operable driving means which acts to forcefully eject a waiting fastening element out of the tool and into the work piece and an actuating means for operating the driving means. The actuating means includes a handle pivotally mounted on a pin element and a linkage means which is operatively connected between the handle and driving means.

The magazine means of a fastening element driving tool constructed according to this invention includes an elongated guide for directing a strip of separable fastening elements to the driving station and a spring loaded follow block acting to automatically advance the fastening element strip incrementally forward toward the driving station along the guide after the lead fastening element in the strip is ejected by the driving means.

The driving means of a tool constructed according to the present invention may include, as presently preferred, a spring loaded elongated ram member mounted for selected cyclical reciprocal movement away from the driving station and then back to the driving station under the force of the spring to eject a waiting fastening element. With such a construction a fastening element is fired each time the ram is moved through a complete cycle of movement. Each cycle involves two strokes; the first stroke or arming stroke being defined by movement of the ram away from the driving station and the second stroke or firing stroke by its movement back to the driving station. The ram moves through a complete cycle without interruption between strokes. In other words the first and second strokes occur one after the other in a substantially continuous fashion. This two-stroke movement of the ram occurs in response to a single stroke or uni-directional movement of the operating handle. To provide this movement, the actuating means includes a ram lifting member engaging the ram and connected to the linkage means which operates to move the ram thorugh its first stroke against the force of the spring. The actuating means further includes a cam release means which is operable, at the completion of the arming stroke, to disengage the ram lifting member from the ram thus permitting the ram to move through its firing stroke under the force of the spring. The cam release means includes the pin element supporting the handle. This handle pin is disposed in the path of movement of the ram lifting member and it functions to engage a sloping cam surface on the ram lifting member at the completion of the arming stroke to pivot the ram lifting member out of engagement with the ram thus permitting it to undergo the firing stroke.

A tool constructed according to this invention also includes a window in the tool housing disposed adjacent the magazine means near the driving station of the tool. The window has a length at least equal to the length of the longest fastening element which the tool is able to handle. And, measuring means in the form of graduations are carried alongside the window to conveniently indicate the size of a fastening element about to be fired simply by visual inspection without having to open the magazine cover.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation view of a tool constructed according to the present invention showing the operating trigger in open position.

FIG. 2 is a side elevation view of the tool shown in FIG. 1 but with the operating trigger in closed position.

FIG. 3 is a partially broken away side elevation view of the tool shown in FIG. 1 depicting the driving means at the beginning of its arming stroke.

FIG. 4 is a partially broken away side elevation view of the tool shown in FIG. 1 depicting the driving means at the completion of the arming stroke.

FIG. 5 is a partially broken away side elevation view of the tool shown in FIG. 1 depicting the driving means at the completion of the firing stroke.

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 11. The frame 11, which includes a gripping portion 12 as shown, supports a housing for the operating components of the tool. The housing includes case channel 13 and housing or sheath 2. A cover 14 for case channel 13 is pivotally secured to the rear end of the frame by hinge pin 17. The cover 14 is swingable, upon release of cover latch 15, about hinge pin 17 to expose, for pusposes of loading, the magazine-type fastening element feeding means contained within case channel 13. This feeding means, which will be described more fully hereinafter, is operable to sucessively 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 driving means will also be described more fully below. The forward end portion **8** of the frame supports an actuating means for operating the driving means. The actuating means includes, as shown in FIGS. **1** and **2**, an actuator handle **26** pivotally connected to frame **11** by hinge pin **27** and spring biased toward its open position (FIG. **1**) by arm **23** of torsion spring **16** as shown in FIG. **3–5**. The actuating means further includes a linkage means responsive to the actuator handle which acts to cock and fire the driving means. The linkage means, which is not shown in FIGS. **1** and **2**, will also be described more fully below. As shown handle **26** carries at its forward end a hand guard **31** which is also mounted on hinge pin **27** and fixed in place relative to handle **26** by rivet means (not shown in FIGS. **1** and **2**). For the purpose of locking the handle **26** in the fully closed or locked position shown in FIG. **2**, a latch **50** pivotally secured to the forward end **8** of gripping portion **12** by hinge pin **20** is provided. Latch **50** is provided with a thumb rest portion **45** for the purpose of permitting convenient rotation thereof from the position shown in FIG. **2** to the position shown in FIG. **1** to thereby permit pivotal movement of handle **26** to its open or unlocked position as shown in FIG. **1**. To release handle **26**, it is helpful to depress it slightly from its locked position as shown in FIG. **2** in the direction of arrow **51**. Such movement it will be recognized slightly separates contacting locking surfaces **44** and **44*a*** of handle **26** and latch **50**, respectively, to provide enough clearance between these locking surfaces permitting easy release of the trigger. Similarly, it is helpful, for purposes of releasing cover **14**, to depress cover **14** slightly from its closed position as shown in FIG. **1** and by solid lines in FIG. **2** in the direction of arrow **52** (FIG. **1**). This movement provides sufficient clearance between locking surfaces **14*a***, **15*a*** on cover **14** and cover latch **15**, respectively, to permit latch **15** to be easily pivoted from its locked position to its open position (as indicated by arrow **53** in FIG. **2**) thereby separating locking surfaces **14*a***, **15*a*** to allow cover **14** to be swung open. The open positions of latch **15** and the partially opened position of cover **14** are indicated by dotted lines in FIG. **2**. As will be seen in FIG. **3**, cover latch **15** is itself spring biased in locked position by arm **25** of torsion spring **16** thus insuring against accidental opening of th cover during operation. Trigger latch **50**, on the other hand, is held securely in its locked position with its locking surface **44*a*** engaging locking surface **44** of handle **26** by force of engagement between these locking surfaces created by arm **23** of torsion spring **16** biasing the handle **26** toward its open position. Thus handle **26** is safely prevented from flying accidently into open position when the tool is not being used.

It should be noted at this point in the description that the embodiment of the invention shown in the drawings is constructed for use in driving two-prong staples into a work piece. However, it will become readily apparent that many structural features of the present invention can be utilized in a tool intended for driving other fastening elements as, for example, conventional nails.

Referring now to FIGS. **3**, **4** and **5**, the driving means contained within sheath **2** includes an elongated hollow ram member **39** which is mounted for selective cyclical two-stroke movement between two longitudinally spaced apart positions within sheath **2** each time a staple is fired from the tool. In one of these positions, ram **39** is situated in the lower portion of sheath **2** as shown in FIGS. **3** and **5**. In the other position, ram **39** is situated in the upper portion of sheath **2** as shown in FIG. **4**. As will be more fully explained below in that portion of the description which describes the operation of the tool, upon each firing of a staple the ram **39** is moved through one complete cycle; i.e., from its initial rest position at the start of the arming stroke shown in FIG. **3** upward to the completion of the arming stroke or firing position shown in FIG. **4** (such upward movement representing the arming stroke of the cycle) and then down again to its rest position shown in FIG. **5** (such downward movement representing the firing stroke of the cycle). For a purpose to be described more fully hereinafter the rear wall **39*a*** of ram **39** is equipped with a shear-formed lifting lug **38** which moves within thruslotway **39*b*** formed in the rear wall **2*d*** of sheath **2** during the upstroke and downstroke of the ram. Connected to the ram **39** for movement therewith is a driver blade **41**. The driver blade **41** is secured to ram **39** by spaced shear-formed lugs **39*c*** on the front wall of ram **39**; lugs **39c** being received in spaced openings **41*a*** in driver blade **41**.

For the purpose of enabling ram **39** and driver blade **41** to undergo downward movement with sufficient force to drive a staple out of the tool with sufficient force to penetrate a work piece, a composite compression spring **42**, **43** is provided; spring **42** being disposed within spring **43** as shown. This composite spring is disposed within bore **39*d*** of ram **39** with one of its ends resting on the bottom plate **40** of ram **39** with its other end abutting the top plate **2*b*** of sheath **2**. An inwardly protruding boss **2*c*** is carried by the top plate **2*b*** of sheath **2** for the purpose of retaining the spring aligned in the bore of the ram. With this construction, it will be recongnized that the ram **39** and thus driver blade **41** 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 the composite compression spring assembly **42**, **43** an actuating means, previously mentioned, is provided. The actuating means comprises handle **26**, ram lifting member **32** and a linkage means operatively connected between ram lifting member and handle **26**. The linkage means comprises a pivotally mounted lever link **21** and a second link **28**. The link **21** is pivotally mounted at a point approximately midway along its length on stationary pin **20** to define two arms **21*a*** and **21*b*** situated on either side of link pin **20**. The ram lifter **32** is pivotally mounted on the forward end of lever arm **21*b*** for movement therewith by floating pin **33**. Link **28** is pivotally connected at one end to the rearward end of link **21** and at its other end to handle **26** by floating pins **30**, **29** as shown. Torsion spring **16**, previously mentioned, is looped about pivot pin **20**. As shown arm **25** of spring **16** engages the latch **15** for cover **14** and the other arm **23** engages the underside of plate **24** carried by link **21**. Spring **16** is therefore operative to bias the cover latch **15** in the locked position shown in FIG. **2** and to urge rotation of link **21** about pin **20** in a counter clockwise direction (as viewed in the drawings) thus moving handle **26** into the open position and ram lifter **32** into a position adjacent ram stop **55** and buffer **56**.

As mentioned above, ram lifter **32** is pivotally connected to link **21** by pin **33**. A second torsion spring **34**

is looped about pin 33 as shown. One arm 36 of spring 34 engages plate 24 and the other arm 35 engages lifter plate 23*a*on ram lifter 32. With this arrangement the ram lifter plate is urged into engagement with the lifting lug 38 on the ram. Spring 34 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 32*b* of ram lifter 32 with the handle hinge pin 27 as will be more fully explained below.

The magazine means for feeding fastening elements to the driving station of the tool includes a guide 60 and a spring-biased follow block 18. Guide 60 slidably supports a row of staples for incremental movement toward the driving station under the force exerted by follow block 18 which is slidable longitudinally on guide 60 in contacting relation to the last or rearmost staple in the row. To incrementally advance the nail strip to the driving station 7 of the tool, the follow block 18 is urged forwardly by means of spring 19 in a conventional manner.

As mentioned previously, a tool according to this invention includes a visual indicator means which permits the operator of the tool to readily determine the size of the staples contained within the magazine means and whether the row of previously loaded staples has been exhausted. The indicator means includes, as best shown in FIGS. 1 and 2, a window 46 and gradation marks 47 positioned along side window 46. The window, as shown, is located in the side of housing 2 near the driving station 7 of the tool. The gradations 47 in the construction shown includes numerical characters spaced apart by fractions of an inch, as for example, sixteenths of an inch. The uppermost character (numeral 4 in the drawings) is positioned even with the upper end of the staples appearing through window 46 so that size can readily be determined simply by reading the numerical character 47 nearest the lower end of the staple. For example, staples 48 shown through window 46 in FIGS. 1 and 2 are all of equal size having a length of about 7/16 of an inch. With a tool having an indicating means as described, the tool operator can, without opening cover 14 to check, readily determine by mere visual inspection when a staple of improper size for the job at hand is about to be fired and take appropriate corrective action before firing. With previously known constructions, the operator was alerted, if at all, to such a condition only after the improper size staple had been fired. In some applications, the tool operator might not be alerted at all inasmuch as once a staple is driven into a work piece its size can not, depending upon the nature of the work piece, always be determined. Thus the danger that a given job will be completed with improper size staples is advantageously reduced.

The operation of the tool thus far described is as follows. The cover latch 15 is first pulled back to permit cover 14 to be swung into open position exposing the staple guide and follow block. The follow block is then moved to the rear on guide 60 and held there while a row of staples is loaded onto the guide. The follow block is then released thus moving the row of staples forward on guide 60 to bring the first staple in the row into firing position at the driving station of the tool. The cover 14 is then swung to a closed position and snapped into locked condition by cam action between cam surfaces 14*b*, 15*b* of locking tabs 14*c*, 15*c* on cover 14 and cover latch 15, respectively. The handle latch 50 is then depressed as previously described freeing the handle 26 which will be automatically moved to the position shown in FIG. 3 by the action of arm 23 of spring 16. With this movement of the handle 26, the various component parts of the linkage means assume the position shown in FIG. 3 wherein it will be noted that the ram lifting plate 32*a* on ram lifter 32 is disposed in contact with ram lifting lug 38 on ram 39 which is in its lowermost position resting against the shock absorbing buffer pad 56 supported by ram stop 55. To fire the tool the operator depresses handle 26 to move it toward its closed position adjacent gripping portion 12 of the frame. This movement causes pivotal movement of link 21 in a clockwise direction (as viewed in FIG. 3), in turn, causing ram lifter 32 to move upward to thereby lift the ram 39 and connected driver blade 41 to the position shown in FIG. 4 which is the completion of the arming stroke. Just prior to reaching this position, the cam surface 32*b* of ram lifter 32 is brought into engagement with hinge pin 27 thereby causing clockwise pivotal movement of ram lifter 32 relative to link 21 away from ram 39. This movement it will be recognized causes disengagement of the ram lifting plate 32*a* and the ram lifting lug 38 thus releasing the ram for downward movement (i.e., its firing stroke) toward the driving station under the force exerted by composite compression spring 42, 43. Ram 39 thus begins forceful downward movement toward the driving station thereby bringing the end of the driver blade 41 into forceful contact with a waiting staple to drive it out of the tool into the work piece.

After firing of the staple, the pressure exerted by the tool operator on handle 26 may be released thereby permitting the handle and linkage means to automatically move back to their initial position as shown in FIG. 3 for refiring. At the same time the next staple in the row is ready to be advanced by the spring loaded follow block into firing position at the driving station during the next arming stroke. This next staple may then be advanced and driven by again depressing handle 26 as described above in connection with the first firing of the tool.

we claim:

1. In a tool for driving a fastening element into a work piece which comprises a frame, magazine means mounted on the frame for incrementally feeding a fastening element to a driving station in the tool, spring loaded ram means mounted on the frame for upward movement through an arming stroke against the force of the spring in a direction away from the driving station and back toward the driving station through a firing stroke under the force of the spring into driving contact with an incrementally fed fastening element situated at the driving station and actuating means for moving the ram means through the arming stroke, the improvement wherein said actuating means includes:

a. an operating handle mounted for pivotal movement between an open and closed position;

b. a pivotally mounted and generally vertically moveable lifting member engageable with the ram means for advancing the ram means through the arming stroke, said lifting member having a sloping cam surface facing the ram means;

c. linkage means pivoted on said frame connected between the handle on said frame and the lifting member; and

d. pin means pivotally mounting the handle, said pin means being disposed in the path of longitudinal movement of the lifting member during the arming stroke at a position such that as the ram means approaches completion of the arming stroke said sloping cam surface contacts said pin means causing said lifting member to pivot out of engagement with the ram means whereby the firing stroke is automatically initiated.

2. The improvement according to claim **1** wherein:

a. said linkage means includes:

1. a first link pivotally mounted on said frame for rotational movement about an axis located intermediate its ends; and

2. a second link pivotally connected at one of its ends to said handle and the other of its ends to one end of said first link, said lifting member being pivotally mounted on the other end of said first link.

3. The improvement according to claim **2** wherein:

a. said first link is biased for rotation in a direction such that said handle is biased toward the open position; and

b. said lifting member is biased in a direction diverging away from said first link into engagement with said ram means.

4. The improvement according to claim **3** wherein said tool is equipped with a housing enclosing said actuating means and further including:

a. indicator means for visually determining the size of fastening elements about to be delivered to the driving station for driving, said indicator means including:

1. a window in said housing through which said about-to-be delivered fastening elements are visually observable; and

2. gradation marks carried by the housing alongside said window, said gradation marks being relatively spaced in increments indicative of the length of the fastening elements appearing through said window.

5. The improvement according to claim **1** wherein said tool is equipped with a housing enclosing said actuating means and further including:

a. indicator means for visually determining the size of fastening elements about to be delivered to the driving station for driving, said indicator means including:

1. a window in said housing through which said about-to-be delivered fastening elements are visually observable; and

2. gradation marks carried by the housing alongside said window, said gradation marks being relatively spaced in increments indicative of the length of the fastening elements appearing through said window.

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