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IMPLEMENT FOR DRIVING STAPLES

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3 Sheets-Sheet 2

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By: Attorney
This invention relates to a manual implement for feeding and driving staples, tacks or other fasteners, usually in strip form, and is adapted for operation in the manner of a hammer to drive the staples, tacks or the like into wood or other penetrable material.

It is a primary object of this invention to devise for the purpose mentioned an implement which is inexpensive, simple and sturdy in construction and dependable in operation. In accomplishing this end, I utilize a minimum of working and moving parts all of which may be of rugged design. The construction is accordingly light in weight and serviceable over a long period of use.

Another object of my invention is to utilize a predominantly velocity force for operation of the driving mechanism. This makes for a reduction in weight, also for less effort in operation. In addition, the action is such as to impart a powerful driving stroke which will cause each fastening element in turn to be driven safely into materials which may even be relatively hard.

Another object of my invention is the utilization with a swinging hammer of a driver which is curved from end to end and concentric with the pivotal point about which the hammer is oscillated. In the movement of the driver which is frictionless through a curved path, the endmost staple or fastening element is deflected from the transverse position, which it occupies relative to a magazine core, to a slightly slanted position conforming with the proximate surface of the guideway through which the staple is advanced, the provision of dependable means to accomplish this end being also an object of my invention.

A further object includes the optional provision of a spring detent in connection with the hammer by which to prevent accidental or premature operation thereof, this detent also exerting a spring force in initiating movement of the hammer when the implement first makes contact with the surface of the material into which the fastening element is to be driven; a stroke control by which to prevent forward driving of a staple except when the hammer movement is started from a predetermined initial position; and a variable-ratio motion-transmitting connection between the hammer and a work-engaging striker, this connection actively to exert an increasing resistance to return movement of the hammer near the end of this stroke.

These and various other objects of my invention, as hereinafter disclosed, are attainable by a construction of which certain preferred em-

bodiments are set forth in the accompanying drawings wherein:

Figure 1 is a side elevation of the implement in its entirety with the enclosing casing therefor shown in longitudinal section;

Fig. 2 is a horizontal section taken on line 2—2 of Fig. 1;

Fig. 3 is a transverse section taken on line 3—3 of Fig. 1;

Figs. 4 and 5 are sectional detail views taken on lines 4—4 and 5—5, respectively, of Fig. 1;

Fig. 6 is a fragmentary central longitudinal section through the acting end of the implement shown with its parts in the positions which they occupy at the conclusion of a staple-driving operation;

Fig. 7 is a fragmentary perspective view of the front end of the staple core, the head of the bar associated therewith, and the guideway block, these three parts, for greater clarity, being separated instead of interfitting as in normal assembled relation;

Fig. 8 is a view in elevation of the driving end of a modified construction of driving implement;

Fig. 9 is an enlarged detail in section, taken on line 9—9 of Fig. 8;

Fig. 10, which is an elevational view, shows the hammer in its normal position of rest ready to start driving stroke;

Fig. 11 is an end elevation in which the hammer is shown in the position of Fig. 10;

Fig. 12, which is a view similar to Fig. 10, shows the hammer as held out of its normal rest position wherein it is incapable of dislodging a fresh staple from the strip;

Fig. 13 is an end elevation in which the hammer is shown in the position of Fig. 12; and

Fig. 14 is a detail in section taken on line 14—14 of Fig. 12.

The present implement comprises a hammer swingingly mounted upon a hollow handle in which is provided a magazine for holding a supply of staples or other fasteners; it comprises also means for automatically feeding the staples or fasteners into driving position relative to the hammer, and a driver connected with the hammer, released by impact when a blow is struck, to advance with high velocity to force each staple or fastener successively into the work. While the invention as illustrated and described is referred to as an implement for driving substantially U-shaped staples, it is to be understood that it may, with slight modification, feed and drive fasteners of other types such as tacks, brads, nails or the like. Throughout the specification
and claims, therefore, the term "staple" is used to indicate broadly all forms of pointed fasteners which may be driven to position by the implement of my invention.

To utilize for the handle a bar B slotted centrally at 15 for its length and having at its forward end a head 16, its opposite end region being bifurcated to provide a pair of spaced legs 17. Potted within the bar slot and between the legs is a core C facing in its rearward region an upwardly facing slot separated by a pair of walls 18 which are spaced from the proximate faces of the bar legs. These walls are inset to provide shoulders 19 (see Fig. 7) which continue lengthwise of the core. The upper edges of the core walls terminate short of a pair of flanges 20 extending inwardly from the bar legs to define between them a slot. The core so formed and fitted within the bar is adapted to receive a strip of staples 5 which may be slidingly fitted therein from the rear end.

To advance the staple strip I employ a channelled follower 21 adapted to straddle and ride upon the two core walls 18. This follower is connected to a hook fitting 22 carried at one end of a spring tape 23 which tends to wind itself about a pin 24 which is supported between spring ears 25 upstanding from the bar B. The tension inherent in the tape will act to draw forward the follower, thereby advancing the staple strip.

At its forward end the core, including its top walls 18, is vertically convex very slightly as at 26 (see Fig. 7), but adjacent its side edges, below the shoulders 19, it is curved backwardly as at 27 in a manner whereby to clear the overhanging sharpened ends of the staple 5 that occupies the endmost position upon the core. The head 16 at the bar end, adjacent its two forward edges, is vertically cut back as at 33 to leave between these cuts a pair of spaced forwardly extending shoulders 31 adjacent opposite sides of the central slot 15 wherein may be fitted a guildeyway block E of hardened steel or the like. This block is formed adjacent opposite edges with flanges 32 each notched at 33 and extended rearwardly to interfit with the forward end of the bar B. When in place, this block may be secured beneath the overhanging head 16 with the aid of screws 34 with assurance that the interfit between the head and bar will render these parts relatively immovable. The inner face of the block is vertically concave concentrically with the face 26 of the core, and in conjunction therewith presents a pair of spaced curving walls forming part of an arcuate guildeyway having opposite vertical walls 35 formed interiorly of the flanges 32.

The bar B with interfitted core C constitutes the handle by which the implement is wielded. It is desirable enclosed within a casing F of plastic, sheet metal, or the like which may be secured as by screws 36 to the bar. Cross pins 37 may be employed to connect the bar and core immovably to each other. Along its top the casing is slotted at 38 (see Fig. 3), the opposite slot edges being shouldered to provide a seat for a closure 39 in the form of a strip pivoted at one end as at 40 and terminating at its other in a spring clasp 41 adapted to releasably engage the rear end of the handle. Normally this closure remains locked in place, but when opened will afford access to the rear end of the handle to facilitate removal therefrom of the follower and insertion of a fresh staple strip.

With a magazine handle of this description I associate the staple driver now to be described. This comprises two strokeable parts, viz., (1) a hammer H having a pair of spaced arms 46 pivotally connected at 45 to the bar B, and at the swinging forward ends of which are pivots 47 adapted to be oscillated in a vertical plane through a fixed arcuate path; and (2) in conjunction therewith a striker S which may comprise two spaced companion arms 48 pivotally connected to a pin 49 which is extended rearwardly through the bar head 16 and the core fitted within the slot thereof, the two striker arms being joined at a point below the handle by a nose 50 which extends transversely just forward of the block E. The striker arms, as shown, are angled in the region of the pivot 49 to provide lower portions extending more nearly horizontally and upper portions extending nearly vertically for interconnection at their upper ends by a cross pin 51 whereon is carried a rotatable roller 52. This roller is free to ride along the upper face of the hammer arms between which may be carried, the hammer arms being between which the hammer arms, the hammer arm being normally maintained in an uppermost position which is determined by the position of the roller 52 when the striker arms 48 are most nearly vertical. In this position the roller rides under a spring clip 55 carried by the hammer head and defining with the runaway plate 53 spaced walls slightly converging to form (1) a non-reactive cushion stop for the roller and (2) a tension restraining means therefor.

The forward face of the hammer head 16 is a slot 57 opening upon its underside to receive one end portion of an arcuate driver D in the general form of a blade. As by one or more screws 58 this driver may be secured fixedly to the hammer head so as to operate therewith as a unit. The longitudinal curve of this driver is concentric with the pivot 46 of the hammer, and as it is accordingly free to move frictionlessly within the arcuate guildeyway provided between the forward end of the core and the block E. So that this guildeyway may be continuous a slot 59 in line therewith is formed through the bar head 16 (see Fig. 7). The aligned under faces of the bar B, core C and guildeyway block E, in the region adjacent the forward or striking end of the implement, are desirably slanted upwardly a few degrees at c (see Fig. 6), so that at the moment of driving a staple into the work the opposite end of the implement need not be held closely thereto in order to correctly position the delivery end of the device. This is of advantage because sufficient space between the handle and the work is thereby assured to prevent injury to the fingers of the operator.

In operation, the implement is swung toward the work with which the nose of the striker is first to engage, thereupon initiating a rocking movement of the arms 46 to shift the roller away from beneath the spring clip. Momentarily the hammer is restrained from movement pending displacement of the roller from beneath the spring clip. During this brief interval there is some spring energy available to be released the moment that the roller is freed for movement away therefrom. When this takes place, and the roller has advanced outwardly sufficiently for its point of
engagement with the spring clip to shift to a point rearwardly of a line between the axial points 48 and 51, the released spring force assists in initiating a rapid downward swinging movement of the hammer which is impelled on its way predominantly by the velocity of the stroke which is imparted to the implement. The hammer advances with it the driver which proceeds through the guideway to shear the endmost staple from the strip and start it toward the work. The staple thus forced downwardly by the driver is guided throughout its descent so as to enter the work wherein it is driven accurately and unfailingly.

At the conclusion of the operating stroke, the parts will be related about as shown in Fig. 6 where it will be observed the nose of the striker has been raised to an uppermost position. At this moment the roller at the opposite end of the striker has been shifted away to its furthestmost position from the spring clip; when the implement is lifted away from the work, however, the roller will return to its starting position due to upward swinging of the hammer in response to tension exerted by the spring arms 55.

In the construction just described, the driver D is in the form of an arcuate blade having for its center the point pendent about which the hammer swings. A modification of this part of the mechanism is indicated in Figs. 8 and 9 wherein the implement handle may be substantially the same as already described. The driver D, however, is here shown as straight from end to end, being connected to and recessed in a cross head 61 through which is extended an axle pin 62 mounting on its ends a pair of rollers 63 movable within horizontal slots 64 formed in flanges 65 which depend from the hammer head 47. As the hammer swings downwardly these rollers will shift rearwardly within the slots permitting the driver to descend vertically free of any bending strain.

The hammers under description have the advantageous feature of a yielding restraining device which will act to prevent starting movement of the hammer stroke in response to only a light tap or jar. If and when such a false movement does take place, the endmost staple may be severed from the strip without being advanced a distance sufficient for delivery from the staple guideway. Such a condition promotes jamming because the driver may not succeed, on the next stroke, in severing and advancing proportionately the next succeeding staple against the obstruction already in the guideway. To avoid such a contingency I may employ a stroke control, as best illustrated in Figs. 10-14, comprising a spring arm 70 extending vertically to one side of the movement path of the hammer head, with the lower end of the arm recessed in and anchored to the side of the bar head 16, as by a screw 71. At its upper end the arm extremity is laterally turned to provide a lip 72 extending toward the hammer head for engagement with the side thereof at a point slightly below its top face when the hammer head is in its uppermost position (see Fig. 10). In conjunction with this spring arm is a finger 73 having one end recessed in and fixedly secured as at 74 to the outer face of an arm 48 of the striker, the finger being protected forwardly to lie between the spring arm 70 and the hammer head. Since each striker arm lies to the outside of the hammer, it follows that the anchored end of the finger is removed from the proximate side face of the hammer slightly further than is the spring arm itself. I take advantage of this relationship to slant the finger inwardly whereby, as it advances forwardly, it operates as a cam to displace the spring arm outwardly, and desirably the finger is bowed endwise (see Fig. 14) for the spring arm displacement for rapid and adequate movement during the initial part of the finger advance.

In operation, each full driving stroke of the hammer will normally be followed by a full return stroke in response to tension force of the spring arms 55. If, however, the driving stroke be less than complete, as in case of a tap or light blow by a careless or inexperienced operator, the return stroke will start from an intermediate point and in consequence be shortened to an extent sufficient to prevent the hammer from acquiring its normal velocity. In such circumstances, the arm 70 will remain sprung in toward the hammer with whose head the lip 72 will then engage to prevent a full return stroke, as shown in Fig. 12, the forward end of the driver then remaining in front of the staple strip where it is ineffective, on the next down stroke, to dislodge the endmost staple. To condition the hammer for another driving stroke, the implement should be operated idly whereby the hammer will be advanced through a full forward stroke to clear the guide-way of any staple then disposed ahead of the driver; after impact, the hammer will be ready to swing back through a full return stroke, responsive to tension of the spring arms 55, and in so doing will acquire velocity sufficient for the finger 73 to cam outwardly the spring arm 70 during the moment that the top face of the hammer head is due to pass the lip 72 so that interference with completion of a full return stroke is thereby prevented in such circumstances. A timing relationship is accordingly involved assuring a complete return stroke only when the hammer starts back from an end position. The operator may thereafter proceed to use the implement with full assurance that the guideway is then cleared and that the endmost staple next to be severed from the strip will encounter no obstruction when entering the guideway and advancing the through in response to motion which is imparted thereto by the driver when advanced into engagement therewith. At the moment of severance, the endmost staple is substantially vertically disposed and not transverse to a line which is radial with respect to the hammer (see Fig. 7), but with commencement of its downward movement the staple legs engage the curved faces 27 at the forward end of the core whereby to deflect the staple to a position which is transverse to a line which is radial with respect to the hammer and into line with the arcuate guideway at that point, thereby assuring a correct positioning with relation to the driver in engagement therewith.

When the striker first makes impact with the work, the roller is shifted along the hammer runway until about opposite the end of the clip. At this point the spring clip will exert upon the roller a force which is transmitted to the forward side of a line between its axis and the striker pivotal point, tending to speed the roller rearwardly across the runway in harmony with a similarly directed force produced from the striker itself; and as the roller is ejected from the spring clip, the hammer, which up to that point has been almost completely restrained from starting on its driving stroke, is concurrently released to execute this movement free of any interference.

I would have it noted that the operative con-
connection between the striker and staple driver is separable yet normally closed by reason of tension exerted by the spring arms; that interengaging parts operate through a variable ratio to transmit motion from the staple driver to the striker and vice versa; and that during return stroke of the staple driver the striker acts increasingly to impose resistance to such motion whereby a deceleration takes place before the striker is brought to a cushion stop beneath the spring clip. The connection between the striker and staple driver being separable, the movements of these parts are, to some extent, independent so that it is possible for one to separate from the other under certain conditions. As an example, when the tool is held head down to drive a staple into a vertical surface, the force of gravity is then added to the velocity force which impels the hammer forwardly although opposing movement of the striker in the same operation; if movement of the hammer is favored by its separation from the staple means for feeding staples successively into the guideway while permitting the driver to advance independently of the striker. 12. In a stapling implement, a handle, a staple magazine in the handle, a guideway at one end of the magazine in line with the driver and through which staples are adapted to be ejected successively in response to advance of the driver, and a guide- way block opposite the magazine forming an extremity for the handle, the lower face of the block and adjacent portion of the handle lower face being tapered in mutual alignment at an angle out of line with the remainder of the handle lower face. 13. In a stapling implement, a handle, a hammer having an arm mounted on the handle, a driver affixed to the hammer for movement therewith, tension means for normally returning the staple driver to an initial position, a staple driver movable by impact with the work, an operative connection between the striker and staple driver, and a staple control mounted on the handle engageable by the cam in response to movement of the striker and cooperating with the staple driver to determine the extent of operating stroke thereof. 14. In a stapling implement, a staple driver, a handle wherein the staple driver and staple are mounted for moving strokes, a spring acting to move the staple driver through one of its moving strokes, an operative connection between the striker and staple driver, and a staple control comprising interengaging parts carried by the handle and striker, one fixed and the other movable and cooperating to permit return movement of the staple driver to its initial position only upon completion of a full stroke. 15. In a stapling implement, a handle, a hammer comprising an arm swingingly mounted on the handle near one end thereof, a head on the arm, a driver connected with the head for longitudinally advance concurrently with moving movement of the hammer, and a cam movable by impact with the cam and connected with the hammer for sliding movement toward and from the head thereof adapted to transmit thereto a variable ratio force to produce operation thereof. 16. In a stapling implement, a handle, a hammer mounted on the handle, a driver affixed to the handle for movement therewith, a staple magazine in the handle, a guideway at one end of the magazine in line with the driver and through which staples are adapted to be ejected successively in response to advance of the driver, and a guide- way block opposite the magazine forming an extremity for the handle, the lower face of the block and adjacent portion of the handle lower face being tapered in mutual alignment at an angle out of line with the remainder of the handle lower face. 17. In a stapling implement, a handle, a hammer having an arm mounted on the handle, a driver affixed to the hammer for movement therewith, tension means for normally returning the hammer to an initial position, and a staple control mounted on the handle engageable by the cam in response to movement of the work, the staple comprising a roller movable along the hammer arm adapted to transmit to the hammer a variable force counter to the force exerted by the tension means. 18. In a stapling implement, a handle, a hammer mounted on the handle for moving about a fixed axis, a driver curved from end to end in concentricity with the same axis connected to the hammer for operation therewith, a guideway curved from end to end in concentricity with the same axis, and means for feeding staple successively in the guideway at a point ahead of the driver when in retracted position.
driver mounted to swing on the handle, a striker movable by impact with the work, means establishing between the staple driver and striker a separable sliding connection for transmitting motion from the striker to the driver while permitting the driver to advance independently of the striker, and a tension device in connection with the staple driver for normally maintaining the latter against separation from the striker.

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