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FOREIGN PATENTS

187,468	1/1964	Sweden	144/32
820,001	9/1959	Great Britain	144/32

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[54] TOOL FOR DRIVING FASTENERS 5 Claims, 7 Drawing Figs.

[52] U.S. Cl. **144/32**,
 206/56, 227/136
 [51] Int. Cl. **B25b 23/00**
 [50] Field of Search 144/32;
 206/56DF, (Inquired); 227/136, (Inquired)

[56] **References Cited**
UNITED STATES PATENTS

2,152,977	4/1939	Schindel	144/32X
2,878,700	3/1959	Reynolds	144/32X
2,943,652	7/1960	Chilton	144/32
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ABSTRACT: A tool is provided for driving fasteners, such as nails, screws and the like, into a workpiece. The tool has a guide with a forwardly opening bore containing a fastener driving spindle which is longitudinally movable in the bore in a forward driving stroke and a rearward retraction stroke. The fasteners are prepackaged in a friable carrier strip to which the fasteners are secured in spaced relation and which is fed endwise into the guide bore following each retraction stroke of the tool spindle to locate the currently leading fastener on the strip in coaxial driving position within the bore in front of the spindle. During each forward driving stroke, the spindle shears and fragments the leading end of the carrier strip to release the leading fastener and drive the latter forwardly into a workpiece.

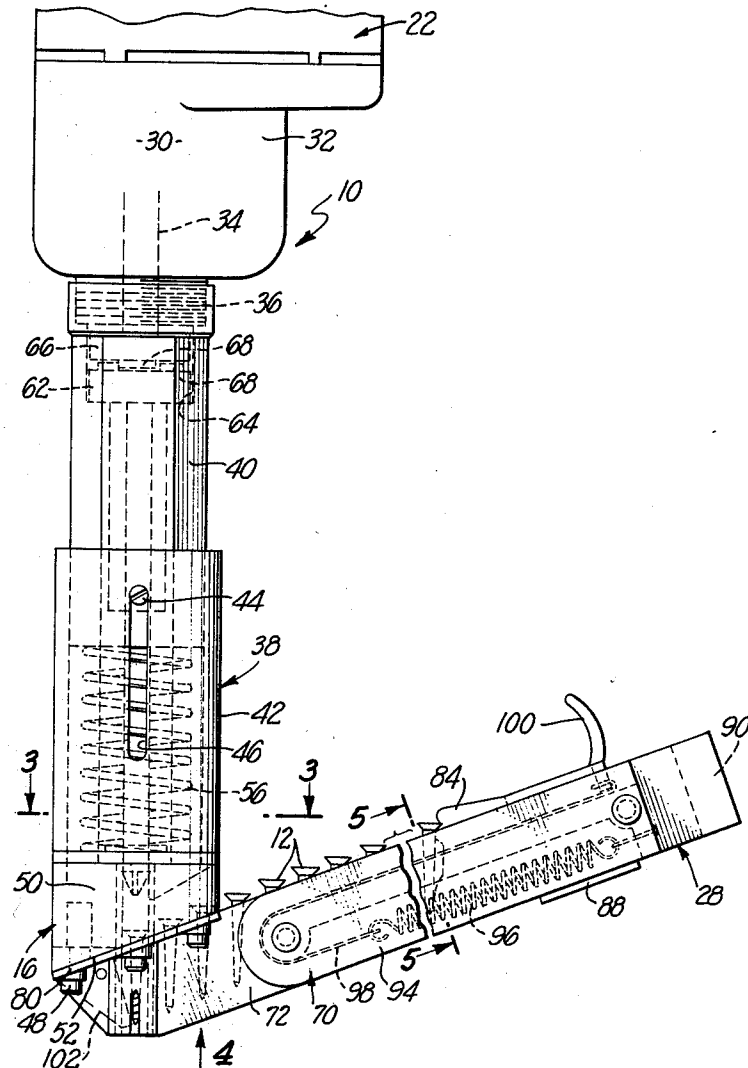


FIG. 1.

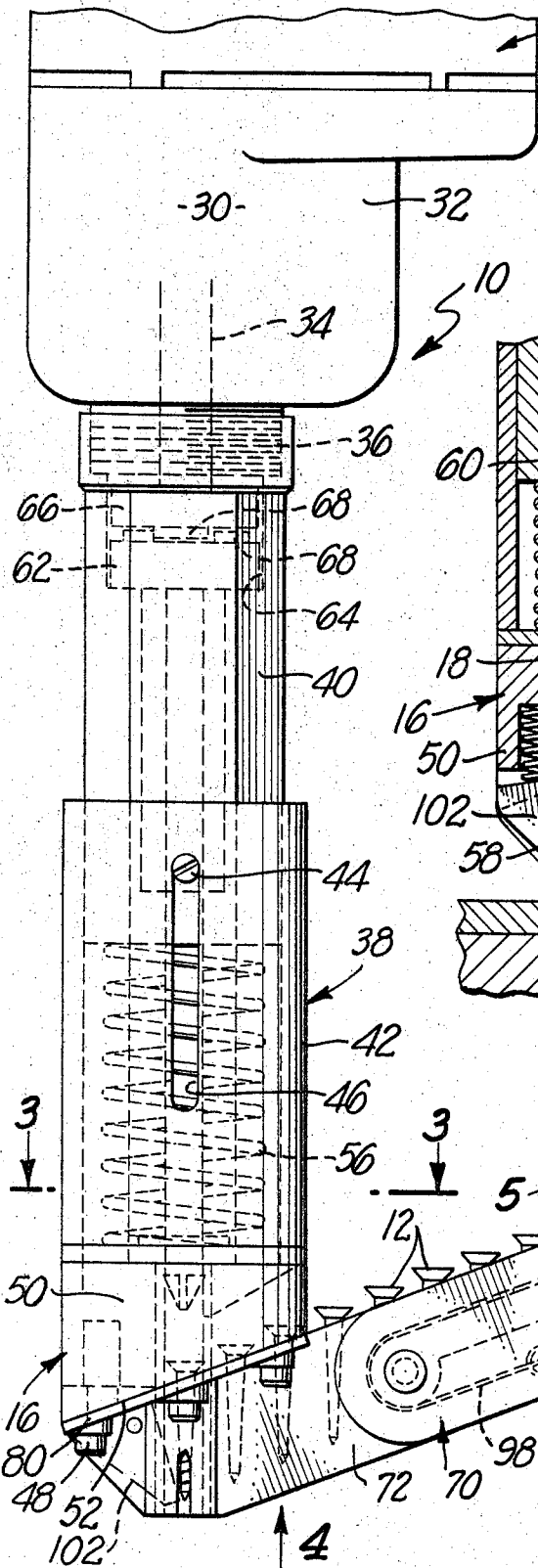


FIG. 3.

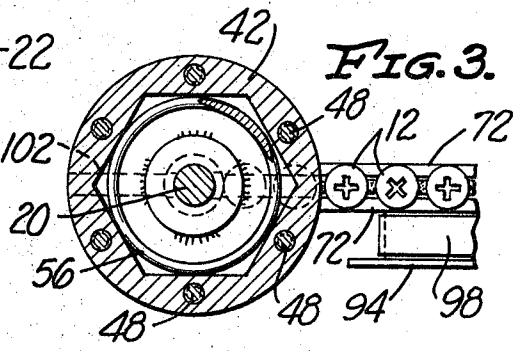
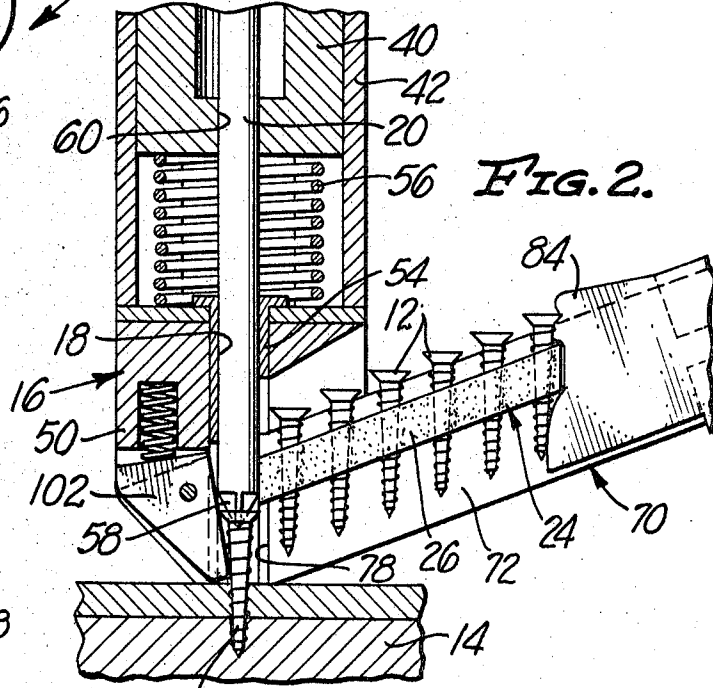
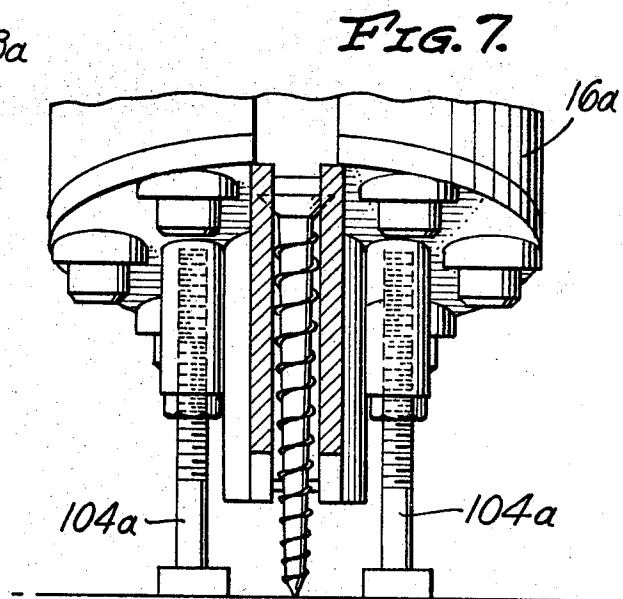
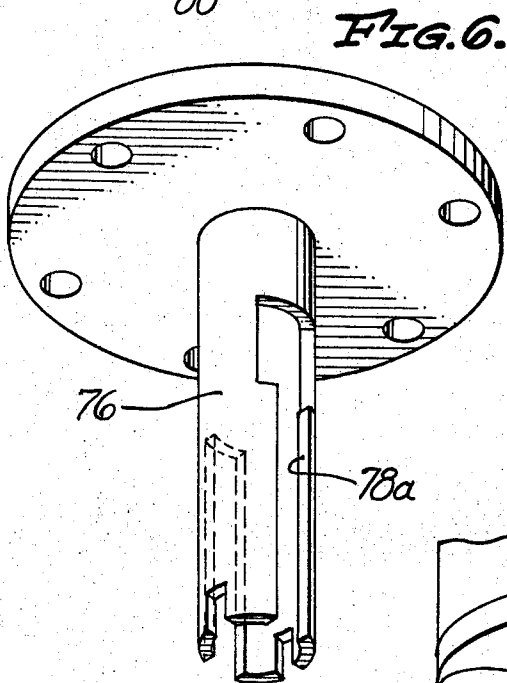
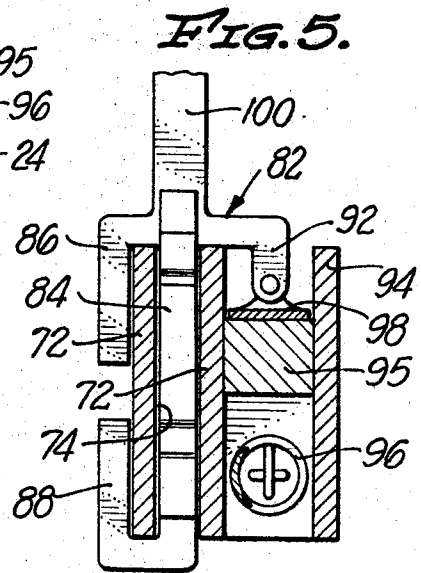
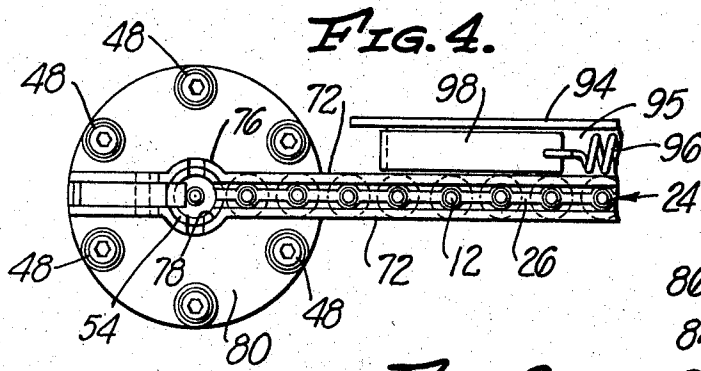


FIG. 2.



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TOOL FOR DRIVING FASTENERS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to a tool for driving fasteners, such as screws, nails, and the like, into a workpiece. The invention relates more particularly to such a tool wherein the fasteners are prepackaged in a carrier strip which is fed endwise to the tool to successively locate the fasteners in driving position in front of a fastener driving spindle, and wherein further the spindle is movable through a driving stroke in such a way as to separate from the carrier strip and drive into a workpiece the fastener currently in driving position.

2. Prior Art

The present invention is concerned generally with fastener driving tools of the class having a fastener driving spindle which is longitudinally movable through a forward driving stroke and a rearward retraction stroke, and infeed means for feeding the fasteners to be driven in succession to a driving position in front of the spindle when the latter is retracted. During each driving stroke, the spindle engages the fastener currently in driving position and drives the fastener forwardly from the tool into a workpiece. Tools of this class are well known in the art and are used to drive nails, screws, and other types of fasteners. The existing tools, while widely diverse in construction and operation, are subject to certain common deficiencies which detract from their usefulness. Foremost among these deficiencies are complexity of construction, high cost of manufacture, and tendency to jamming and other forms of malfunction. These deficiencies result, in large part, from the types of fastener infeed actions which are employed in the tools. Thus, many of the existing tools utilize an infeed action involving feeding of totally discrete or unattached fasteners. Examples of tools utilizing such a fastener infeed action are found in U.S. Pat. Nos. 2,943,652; 3,157,884; 3,294,130 and 2,770,269. This type of infeed action necessitates the use of relatively complex and costly infeed mechanisms for advancing the fasteners in succession to the tool, gating the fasteners in succession to driving position, and releasably holding the fasteners in driving position until driven.

Another type of fastener infeed action which is employed in some fastener driving tools of the kind under discussion involves the use of prepackaged fasteners that are preassembled in a strip pack including a carrier strip to which the fasteners are secured in spaced relation. During operation of such tools, the fastener strip is fed endwise to the tool intermittently in timed relation to the reciprocating motion of the fastener driving spindle. By way of example, U.S. Pat. No. 2,009,580 discloses a fastener driving tool of this kind. The existing tools of this type are commonly characterized, again, by a strip infeed mechanism which is relatively complex in construction, costly to manufacture, prone to malfunction, and otherwise not totally satisfactory.

SUMMARY OF THE INVENTION

The present invention provides a fastener driving tool of the general class described having an improved strip type fastener infeed action and mechanism. The infeed mechanism is characterized by optimum simplicity of construction, economy of manufacture, immunity to jamming and other types of malfunction, and other highly desirable features of construction and operation. In general terms, the present tool is characterized by a guide having a bore in which is longitudinally movable the fastener driving spindle. The fasteners to be driven are prepackaged in a strip pack including a friable or fragile strip to which the fasteners are secured in longitudinally spaced relation. Infeed means are provided on the tool for feeding the carrier strip endwise into the guide bore, laterally of the bore, each time the spindle retracts to locate the currently leading fastener on the strip in coaxial driving position within the guide bore, in front of the spindle. In the particular embodiment of the invention which has been

selected for presentation in this disclosure, the infeed means comprises an infeed magazine which contains the fastener carrier strip and a spring loaded follower behind the strip for constantly urging or pushing the strip forwardly through the magazine into the guide bore. During each forward driving stroke, the spindle shears and fragments a leading portion of the carrier strip within the guide bore to release from the strip the fastener currently in driving position and then drive this fastener forwardly into the workpiece.

The tool has other unique features which particularly adapt the tool to its intended uses. One of these features resides in the fact that the infeed magazine is relatively simple and quick to reload by the tool operator, such that the reloading procedure does not delay operation of the tool for any appreciable length of time. Another feature of the tool resides in extended work-engaging members or feet which may be used on the tool to permit driving of relatively long fasteners, and wherein viewing slots are provided to facilitate the accurate positioning or spotting of fasteners, particularly with respect to predrilled holes. According to yet another and highly important feature of the invention, the fastener driving structure of the tool, that is, the tool guide, driving spindle, and infeed magazine, are constructed in the form of an attachment or adapter that may be applied to a conventional motorized spindle actuator or driver. The particular embodiment of the invention which has been selected for illustration in this disclosure, for example, is a self-feeding screw driver attachment or adapter for a conventional hand drill motor.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary side elevation of the present fastener driving tool, in this instance a screw driver;

FIG. 2 is a fragmentary longitudinal section through the lower portion of the tool in FIG. 1;

FIG. 3 is a section taken on line 3-3 in FIG. 1;

FIG. 4 is a view looking in the direction of the arrow 4 in FIG. 1;

FIG. 5 is an enlarged section taken on line 5-5 in FIG. 1;

FIG. 6 is an enlarged fragmentary perspective view of a portion of the tool guide; and

FIG. 7 is an enlarged fragmentary longitudinal section through a modified fastener driving tool according to the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In general terms, the invention provides a tool, represented in the drawings by the tool 10, for driving fasteners 12 into a workpiece 14. The tool has a guide 16 with front and rear ends and a longitudinal bore 18 opening through these ends. Movable within the bore 18 is a fastener driving spindle 20. Means 22 are provided for moving the spindle longitudinally relative to the guide through alternate rearward retraction strokes and forward driving strokes. According to a unique and highly important feature of the invention, the fasteners 12 are prepackaged in a strip pack 24. This strip pack includes a relatively longitudinally rigid fastener carrier tape or strip 26 to which the fasteners 12 are secured in longitudinally spaced relation with the axes of the fasteners extending laterally of the strip. In the particular embodiment of the invention illustrated, the fasteners extend at a slight angle to the strip for reasons to be explained presently. The tool is equipped with infeed means 28 for feeding the carrier strip 26 endwise into the guide bore 18, through one side of the bore, following each retraction stroke of the tool spindle 20 to locate the currently leading fastener 12 on the strip in coaxial driving position within the bore in front of the tool spindle, as shown in FIG. 1. During the following forward driving stroke of the spindle, the latter engages the fastener in driving position, separates this fastener from the carrier strip, and drives the fastener forwardly from the guide bore into the workpiece 14.

Referring now in more detail to the inventive embodiment which has been selected for illustration, the fasteners 12

shown are screws, and the illustrated fastener driving tool 10 is a motorized screw driver wherein the spindle 20 is both moved longitudinally and driven in rotation to drive the screws 12 into the workpiece 14. In this instance, the means 22 for moving the spindle through its driving and retraction strokes comprises a conventional motorized hand drill 30 including a body 32 which houses a motor (not shown). The tool body also has a hand grip (not shown) by which the tool may be held. Extending from the front end of the tool body is a motor driven shaft 34. The protruding front end of this shaft is commonly surrounded by a threaded shoulder or collar 36 on the tool body 32.

The actual fastener driving structure 38 of the present invention constitutes an adapter or attachment which may be secured to the conventional motorized hand drill 22. This adapter or attachment includes the guide 16, spindle 20, and fastener infeed means 28. Guide 16 has two telescopically interfitted sleeves 40 and 42. In this instance, the upper or rear sleeve 40 is polygonal in external cross section and fits slidably within the lower or front sleeve 42. The sleeves are joined by a screw 44 which is threaded in the sleeve 40 and extends through a slot 46 in the sleeve 42 to limit relative longitudinal movement of the sleeves. The upper end of the rear sleeve 40 is internally threaded for connection to the threaded collar 36 on the tool body 32, thus to releasably secure the fastener driving adapter or attachment 38 to the body. Secured by screws 48 to the front end of the front sleeve 42 is a tip member 50 which contains the guide bore 18. This guide bore is located on a common axis of the sleeves 40, 42 and opens upwardly to the interior of the sleeves and downwardly through the lower face of the tip member. Face 52 is inclined at an acute angle relative to the common axis of the sleeves 40, 42, for reasons to appear presently. In this instance, the guide bore 18 is formed by a bearing insert 54 which is fixed within a bore in the tip member 50. Acting between the sleeves 40, 42 is a coil spring 56 which urges the sleeves apart to their positions of FIG. 1.

The lower end of the fastener driving spindle 20 fits slidably and rotatably within the guide bore 18 and, in this instance, is provided with a screw driver tip 58. The spindle extends upwardly through a bearing bore 60 in the front end of the rear sleeve 40 to the upper end of the latter sleeve. Fixed to the upper end of the spindle is a clutch collar 62. This clutch collar is contained within a counterbore 64 at the upper end of the rear sleeve. The counterbore contains a second clutch collar 66 which is secured to the motor shaft 34. Collars 62, 66 have interengaging teeth 68 which are free to separate axially when the driving attachment 38 is removed from the tool body 32. When the attachment is assembled on the tool body, the clutch teeth 68 interengage to effectively drivably couple the spindle 20 to the motor shaft 34.

As noted earlier, the fastener strip pack 24 comprises a number of fasteners 12, in this instance screws, joined side by side to the carrier tape or strip 26. This carrier strip may be constructed of various materials and in various ways but preferably comprises a friable plastic, such as polystyrene or polyurethane. One method of fabricating such a fastener strip pack is disclosed in my prior U.S. Pat. No. 3,303,632. The shanks of the screws 12 extend through the carrier strip in such a way that the screw heads are exposed above the strip and the screw points are exposed below the strip.

The fastener infeed means 28 comprises an infeed magazine 70. This infeed magazine has a pair of spaced parallel walls 72 defining therebetween an intervening guideway 74. Adjacent one end, the magazine walls arch outwardly away from one another to define a generally cylindrical sleeve-like formation 76 containing a bore 78. Integrally joined to the upper edges of the walls in concentric relation to the sleeve formation 76 is a mounting plate 80. This mounting plate is secured by the screws 48 to the lower inclined face 52 of the guide tip member 50 in such a way that the magazine bore 78 is coaxially aligned with the guide bore 18. The magazine 70 extends upwardly at an acute angle from the guide bore, as shown.

From this description, it is evident that the magazine bore 78 effectively forms a continuation of the guide bore 18. The magazine guideway 74 opens at one end to the bore 78, through one side of the bore, as shown.

The magazine guideway 74 is laterally dimensioned to receive, with a sliding fit, the fastener carrier strip 26, such that the strip and its attached fasteners or screws 12 can slide along the guideway toward the guide bore 78. The screw heads project laterally beyond the sides of the carrier strip and rest slidably on the upper edges of the magazine sidewalls 72 to vertically support the screws and carrier strip. At this point, it is significant to note that the longitudinal axes of the screws are inclined relative to the longitudinal axis of the carrier strip at an acute angle approximately equal to the angle between the guide bore 18, 78 and the longitudinal axis of the magazine guideway 74, such that the screws are vertically stepped and parallel the guide bore, as shown.

Positioned within the magazine 70, behind the fastener strip pack 24, is a spring-loaded follower 82 which urges the pack inwardly toward the guide bore 18, 78. This follower includes a follower plate 84 which slides in the magazine guideway 74. Joined to the upper and lower edges of the plate are flanges 86, 88 which extend laterally across the upper and lower edges of one magazine sidewall 72 and then toward one another across the outer surface of this sidewall so as to form, in effect, a rectangular bearing sleeve which slidably supports the follower plate 84 on the magazine 70 for movement along its guideway 74. The outer ends of the magazine walls 72 are joined by an intervening block 90 which closes the outer end of the guideway, whereby the follower plate 84 is captivated in the guideway.

Joined to the upper edge of the follower plate 84 and projecting laterally from the plate in a direction opposite to the plate flanges 86, 88 is an arm 92. The outer end of this arm turns downwardly at right angles and projects into the space between the adjacent magazine sidewall 72 and a plate 94 secured to the later wall. Disposed between the wall and plate is a guide 95 which extends longitudinally of the magazine 70, intermediate the upper and lower edges of the plate 94 and the adjacent magazine sidewall 72. The inner end of this guide, that is, the end of the guide adjacent the guide bore 18, 78, is rounded, as shown. Below the outer end of the guide is a tension spring 96, the outer end of which is attached to the magazine, as shown. A flexible metal band 98 is secured at its ends to the opposite end of the spring 96 and to the follower plate arm 92, respectively, and extends inwardly from the arm along the upper side of the guide 95, then around the curved inner end of the guide, and finally outwardly along the underside of the guide to the spring 96. The underside of the guide is relieved to accommodate the spring, as shown. It is now evident, therefore, that the spring 96 acts through the band 98 to urge the follower plate 84 inwardly toward the guide bore 18, 78. Rising from the rear end of the follower plate is a finger-piece or grip 100 by which the plate may be retracted outwardly along the guideway against the action of the spring 96. The follower plate is thus retracted to permit insertion or loading of a fastener strip pack 24 into the magazine 70 in front of the follower plate. If desired, means (not shown) may be provided for releasably retaining the follower plate in its retracted position to facilitate loading of the magazine.

The inner leading edge of the follower plate 84 engages the rear end of the fastener strip pack 24 so as to urge the latter inwardly along the magazine guideway 74 toward the guide bore 18, 78. Preferably, this leading plate edge is contoured, as shown, to engage the protruding upper and lower ends of the trailing or outermost screw 12 in the pack.

In use of the present tool, the latter is held by the tool body 30. Initially, the forward guide sleeve 42 will be extended forwardly by the guide spring 56 to the position of FIG. 1, wherein the tool spindle 20 occupies its retracted position relative to the guide 16. In this retracted position, the spindle clears the lateral opening 78a to the guide bore 18, 78 through which the magazine guideway 74 opens to the bore. The

spring-loaded follower plate 84 then urges the fastener strip pack 24 inwardly to its position shown, wherein the leading fastener or screw 12 in the carrier strip 26 is coaxially disposed in position within the bore, in front of the spindle. In this regard, it is significant to note that the opening 78a is enlarged at its upper end to accommodate passage of the screw heads through the opening into the guide bore. Of further significance is the fact that the first or leading screw 12 is spaced from the leading end of the carrier strip to be coaxially disposed in the guide bore when inward movement of the strip is terminated by abutment of the strip against the far wall of the bore. Slots in the lower portion of sleeve 76 of the tool guide (FIG. 6) provide a view to permit accurate spotting of the screw into the workpiece, this being of particular importance with a predrilled workpiece. The tool is then pressed against the workpiece 14 to retract the forward guide sleeve 42 rearwardly relative to the rear guide sleeve 40 and thereby effect relative forward movement of the spindle 20 through its driving stroke. The spindle drive motor is simultaneously energized to drive the spindle in rotation. The screw driver tip 58 on the spindle then mates with the screw in driving position to drive the latter in rotation and simultaneously advance the screw forwardly through the guide bore into the workpiece. During this driving stroke, the friable carrier strip 26 is sheared and/or fragmented to separate the screw from the strip. After the screw has been driven, the tool is removed from the workpiece to permit return of the parts to their original position of FIG. 1. At this point, the follower plate 84 again advances the fastener strip pack 24 inwardly through the fastener magazine 70 to locate the next screw in driving position.

Pivotally mounted in a slot in the front end of the guide 16 is a spring-loaded retainer plate 102. This plate exerts a resilient lateral force against each screw 12 as the latter is initially driven forwardly from the carrier strip 26 and serves to retain the screw and screw driver tip 58 in driving engagement until the screw engages the workpiece.

The modified fastener driving tool 10a illustrated in FIG. 7 is identical to the tool 10, just described, except that the front guide 16a of the tool is equipped with adjustable supporting legs 104a which engage the workpiece to permit driving of relatively long screws, and to provide for viewing the workpiece and screw to assist in accurate spotting of the screw. These adjustable supporting legs may comprise screws which are threaded in the front end of the guide, as shown.

While the invention has been disclosed in connection with certain illustrative embodiments thereof, it will be evident to those versed in the art that various modifications of the invention are possible within the spirit and scope of the following claims.

I claim:

1. A fastener driving tool comprising:
 - a guide having front and rear ends and a longitudinal bore opening through said front end;
 - a fastener driving spindle movable longitudinally in said bore;
 - means for moving said spindle longitudinally in said bore

through alternate rearward retraction and forward driving strokes;

- a fastener strip pack including a relatively longitudinally rigid carrier strip, and a number of fasteners secured to said strip in longitudinally spaced relation therealong with the longitudinal axes of said fasteners extending transverse to the longitudinal axis of said strip;

infeed means for feeding said carrier strip longitudinally into said guide bore through one side of said bore following each retraction stroke of said spindle to locate the currently leading fastener on said strip in coaxial driving position within said bore in front of said spindle, said infeed means comprising an infeed magazine attached to and extending laterally from said guide and containing a guideway opening at one end laterally to said guide bore, said carrier strip being slidably contained within said guideway for longitudinal movement along said guideway, and spring-loaded follower means engaging the trailing end of said strip for urging said strip toward said bore;

said spindle comprising a forward driving tip for separating the leading fastener currently in driving position from said carrier strip and driving said leading fastener forwardly through said bore into a workpiece positioned in front of said bore during the following driving stroke of said spindle; and

said carrier strip comprising a friable material which is sheared and fragmented by said spindle during each driving stroke of said spindle to effect release from said carrier strip of the leading fastener currently in driving position within said guide bore.

2. A tool according to claim 1 wherein: said follower means comprises a follower slidable in said guideway behind said carrier strip, and a spring extending along one side of said guideway externally thereof and secured at one end to said magazine and at the other end to said follower.

3. A tool according to claim 2 wherein: said means for moving said spindle comprises a body at the rear of said guide, means supporting said guide on said body for relative axial movement relative to said body and spindle, said infeed means moving in unison with said guide, means on the front end of said guide engageable with a workpiece positioned in front of said guide, whereby forward pressure on said body moves said body forwardly relative to said spindle to move said spindle through its driving stroke relative to said guide, and a spring acting between said guide and body for urging a said guide forwardly relative to said body.

4. A tool according to claim 3 wherein: said mounting means comprises a sleeve surrounding said spindle and secured at one end to said body, and means joining the other end of said guide and sleeve in slidable telescoping relation.

5. A tool according to claim 4 wherein: said fasteners extend through said carrier strip in such a way that the ends of each fastener are exposed beyond opposite sides of said carrier strip; and the leading end of said follower adjacent said carrier strip spaced shoulders engaging the protruding ends of the adjacent trailing fastener in said carrier strip.