Oct. 17, 1967

N. R. DOHERTY

3,347,441

ELECTRIC FASTENING TOOL

Filed Nov. 24, 1965

5 Sheets-Sheet 1

FIG. 1

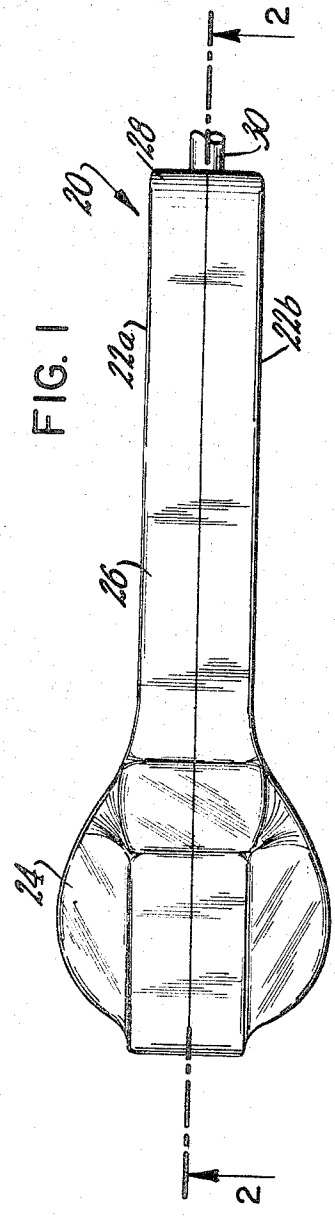

FIG. 2

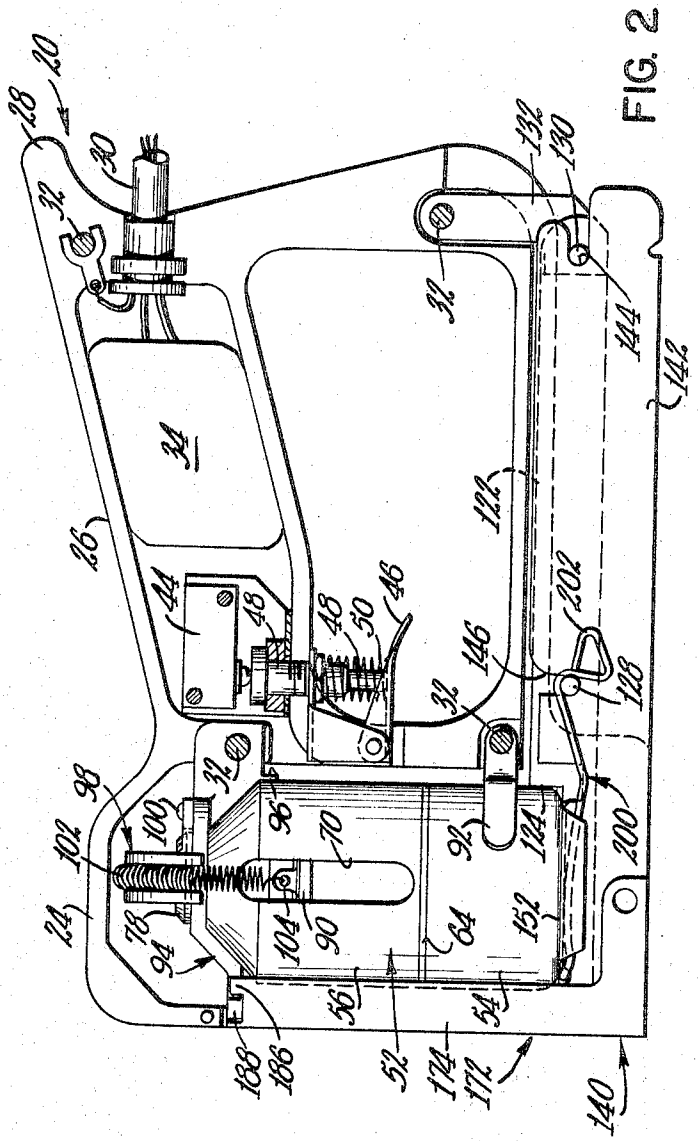

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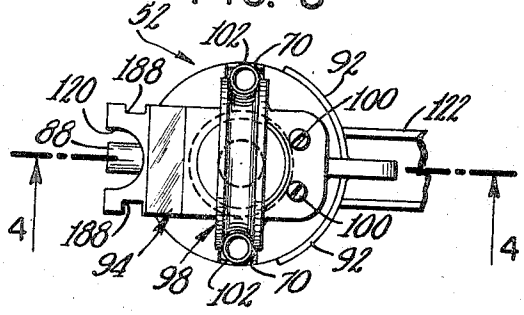
FIG. 3



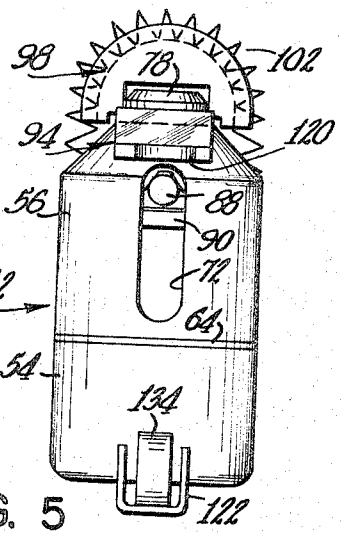


FIG. 5

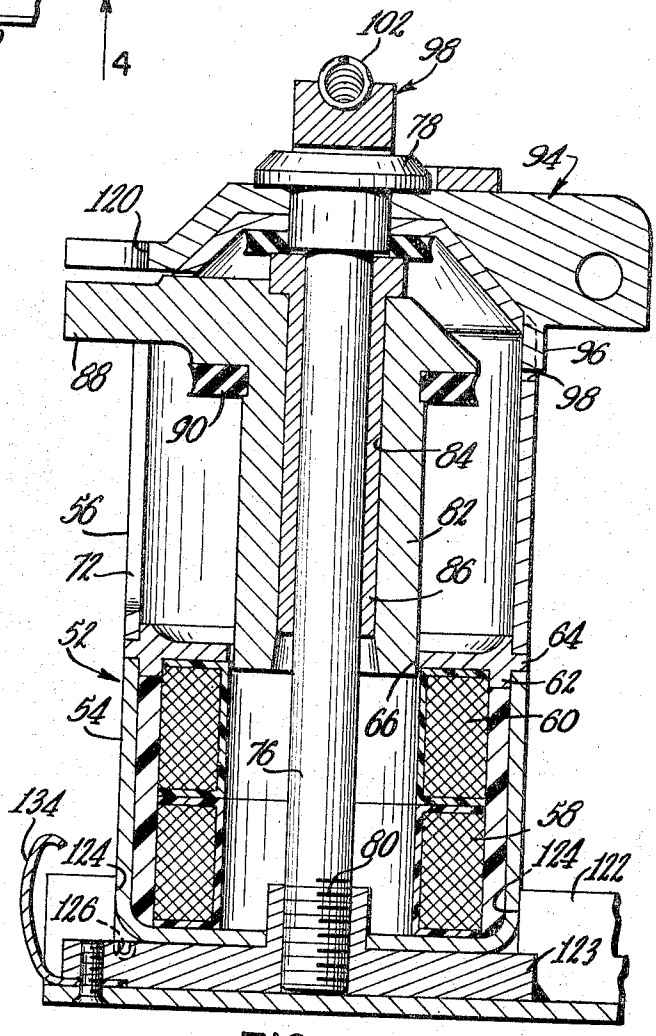


FIG. 4

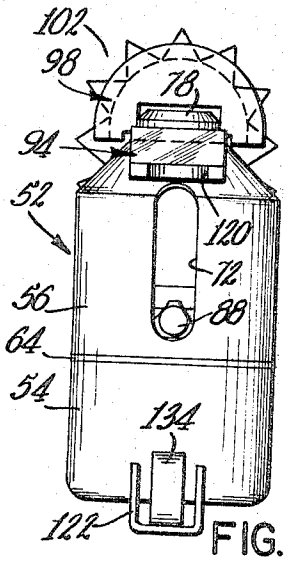


FIG. 6

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ELECTRIC FASTENING TOOL

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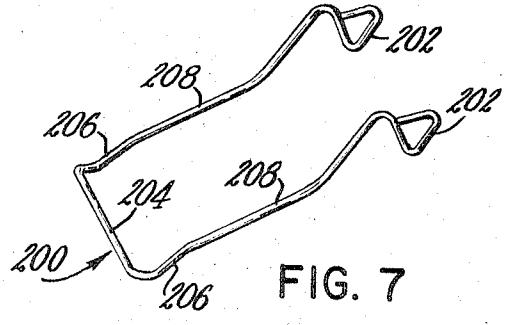
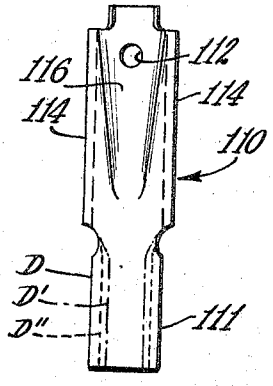


FIG. 7

FIG. 8



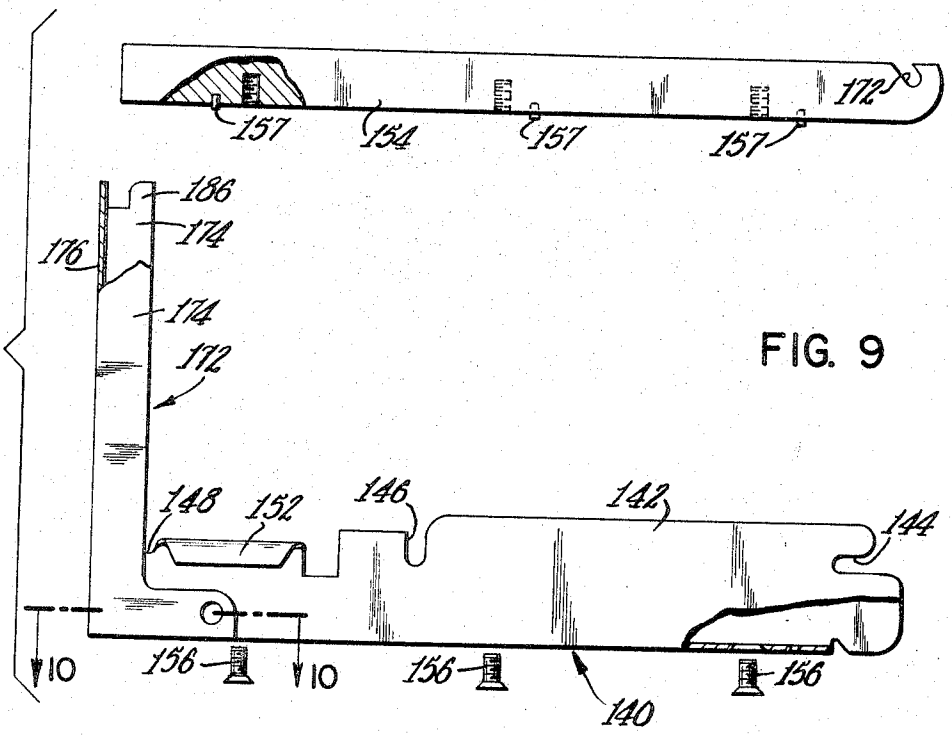


FIG. 9

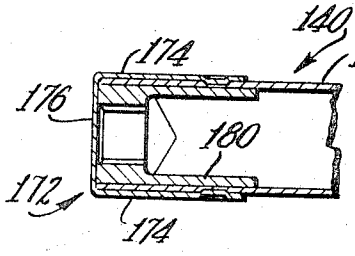


FIG. 10

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ELECTRIC FASTENING TOOL

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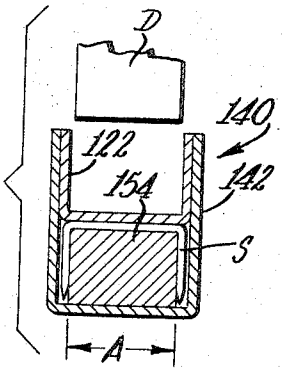

FIG. 11

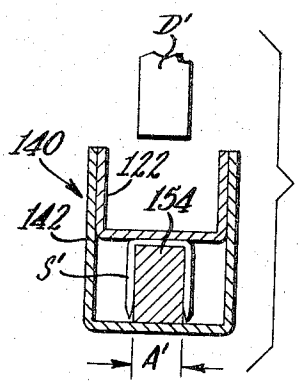

FIG. 12

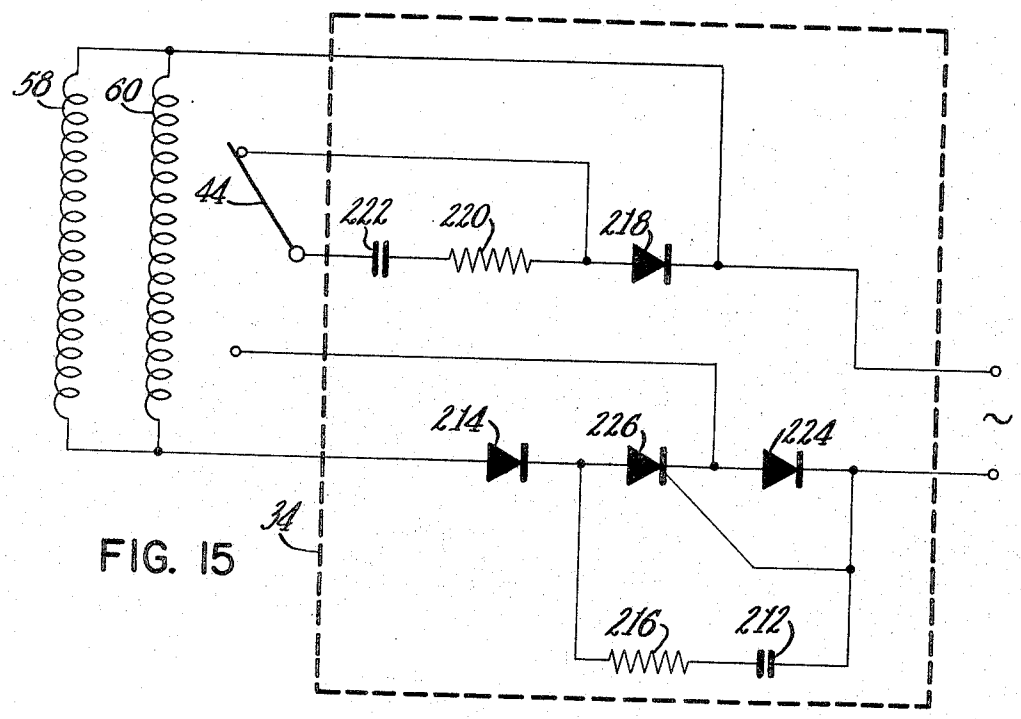

FIG. 15

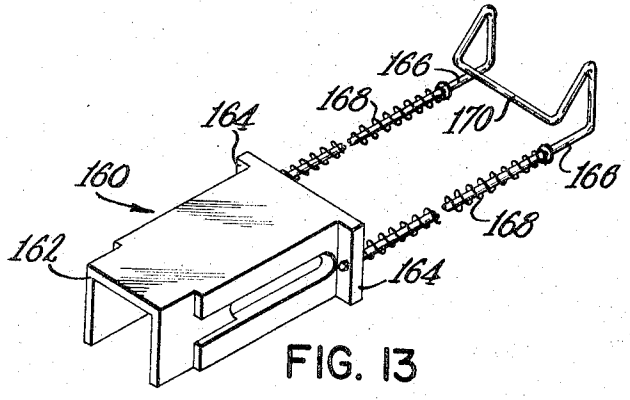

FIG. 13

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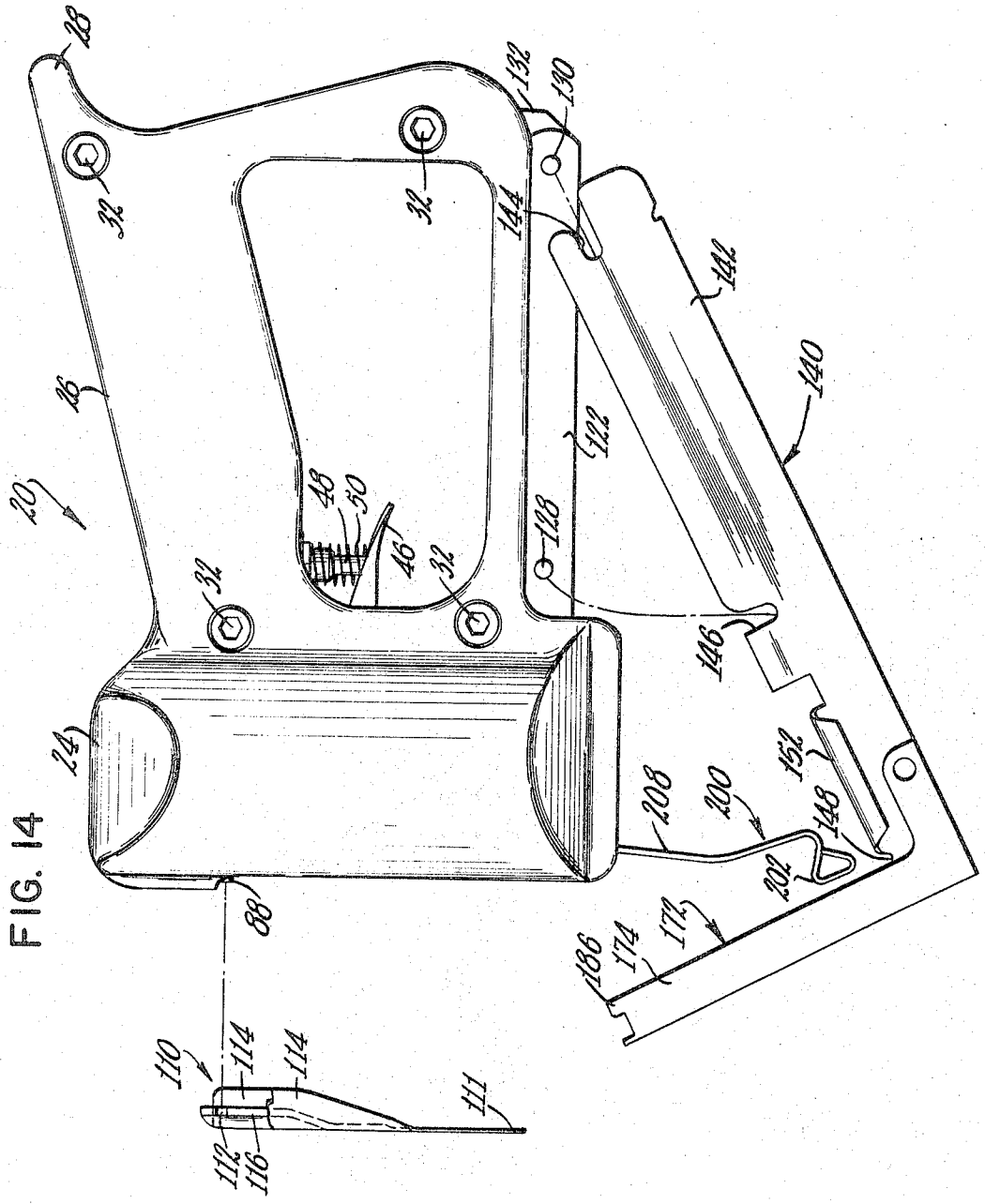

FIG. 14

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United States Patent Office 3,347,441
Patented Oct. 17, 1967

3,347,441

ELECTRIC FASTENING TOOL

Norman R. Doherty, Farmingdale, N.Y., assignor to Electric Stapler Corporation

Filed Nov. 24, 1965, Ser. No. 509,475
12 Claims. (Cl. 227—131)

This invention relates to a fastener driving tool and more particularly to an electrically operated staple driving tool having interchangeable means for accommodating a fastening means of diverse size and shape.

The prior art contains many examples of powered fastening tools of various types. Broadly, they may be broken down into two major categories, namely, pneumatically and electrically driven tools. Considering first the pneumatically driven tools, it is readily apparent that there are several deficiencies in the apparatus now on the market. A common characteristic of pneumatically operated staple fasteners is bulkiness, heavy weight and awkwardness to handle. In order to provide sufficient driving force, the cylinder and piston must be inordinately large.

Another deficiency of these tools is that both the cylinder and the driver blade are assembled as an integral, non-separable package. Therefore, if it is ever desired to interchange or use staples of another size, the tool must be returned to the factory, taken apart there and reassembled with the properly sized components.

Another common characteristic of the pneumatically operated tools is that the driver blade is coaxial with the piston. Therefore, the tool cannot be used in close proximity to an obstruction.

Probably the greatest deficiency of pneumatically operated fastening tools is that a source of compressed air is an absolute essential. Quite frequently the compressed air source is not readily available. Therefore, the tool is not completely universal.

Electrically operated fastening devices representing the second major category suffer at least some of these as well as other deficiencies. First, the power package, usually in the form of a solenoid, has had to be excessively large in order to deliver sufficient power to drive the blade and the staples. Concurrent with the large solenoid size is a high power requirement resulting in an excessive heat output. As with the pneumatically operated tools, the conventional electrically driven stapler has the driver blade positioned coaxially with the armature of the solenoid. Once again the operator cannot work too closely to an obstruction.

The electrically operated tools of the prior art were generally bulky, heavy and awkward to handle. Further, they did not readily adapt themselves to interchageability. That is, staples having different widths, lengths or gauge wire could not easily be used in one gun. It has also been found that the electrically operated solenoids of the prior art were relatively slow in operation. That is, staples could not be fired with any great rapidity. This resulted in a tendency for the staplers to jam when the operator tried to drive them in too fast succession.

By way of contrast, the present invention is lightweight and readily portable, thereby providing substantially increased utility. The solenoid utilized in the present invention is substantially improved over similar devices used in the prior art. Overheating of a solenoid is prevented thus assuring a longer and more useful life for the present invention. This also permits the stapler to be fired repetitively for long periods of time. A particularly noteworthy feature of the present invention is the mounting of the driver blade. Means are provided to make the driver blade removable from the linearly movable solenoid armature. The driver blade is mounted in a cantilevered fashion off to one side of the solenoid. Only the

thickness of the metal housing stands between the driver blade and any obstruction near which the operator may have to work.

Another major feature of the instant invention is the complete interchangeability of the driver blade, the staple supply magazine and the head housing. The present construction fills a long recognized need for a single, basic gun that will accommodate a wide range of staple sizes. By changing the staple supply magazine and the driver blade, not only can different gauge wire staples be used, but staples having different length legs and different spacings transversely between the legs can be fired.

In contrast to the prior art, the structure to be described hereinafter comprises a housing having a permanently mounted power package in the form of a solenoid, rectifier-SCR package and switch means to energize the solenoid. The stapler driving blade, as well as the combination staple magazine and head housing, is readily removable without the use of separable fasteners such as nuts, bolts, rivets and the like. No special tools and no special skills are required to effect the interchangeability. Moreover, there is no danger involved of damaging the tool or hurting the assembler as there may be with some of the prior art devices. A minimum of time and effort is required to change the staple sizes, since the blade and the magazine are not secured by separable fasteners.

The present invention will be described in connection with means for driving wire staples. More particularly, the structure of an improved solenoid will be described as will a novel staple supply and driving structure that may be readily removed as complete and self-contained units from the power portion of the tool and be interchanged with similarly functioning but differently sized structures. It is also to be understood that the basic concept of this invention may be applied to staple clinching as well as staple tacking devices, and, in addition, to tools for driving other fasteners, such as nails, brads, tacks, pins and the like.

Accordingly, it is an object of the present invention to provide an improved, lightweight, hand-held, electrically driven staple fastening tool.

It is another object to provide improved actuating means for the driving blade of an electrically powered fastening tool.

It is another object to provide an improved solenoid for an electrically powered fastening tool.

A feature of the present invention is that the staple-driving blade is mounted in a cantilevered relationship with respect to the driving blade actuating means.

Yet another object of the present invention is to provide an electrically driven fastening tool having the driving blade positioned as close to the front of the housing as possible.

A particular feature of this invention is the inclusion, in an electrically actuated fastening tool, of a driving blade removably linked to a solenoid armature having an elongated, coaxial bearing adapted to slidably receive the solenoid armature.

It is also an object of this invention to provide, in an electrically actuated fastener driving tool, an elongated centrally positioned bearing for the axially slidable armature.

Still another object of the present invention is to provide an improved electrically operated tool that is usable with fasteners having a wide range of widths.

Yet another object is to provide structure in the aforementioned tool whereby the fastener supply magazine and the fastener driving blade are readily separable from the housing containing the power package and the solenoid armature, respectively.

It is a further feature of this invention to provide an improved electric stapler or tacker capable of accommo-

dating a wide range of interchangeable driver blades and supply magazines.

Still another feature is to provide the aforementioned interchangeability without recourse to the usual hardware, such as screws, nuts, rivets or threaded fasteners of any type.

A particular object of this invention is to provide a removable fastener supply magazine having an integral driver blade guide track for the aforementioned tool.

A further object is to provide low cost yet rugged driver blades and supply magazines that may be interchangeably used with a single basic tool having a self contained power package.

Yet another feature of the present invention is the fact that the power package, which represents the most expensive portion of the tool, is common to a wide range of supply magazines in driver blades.

It is still another feature of this invention to provide a single power package and housing, together with a set or range of driver blades and supply magazines, the total cost for which is far less than the prior art devices having a comparable range.

These and other features, objects and advantages of the invention will, in part, be pointed out with particularity and will, in part, become obvious from the following more detailed description of the invention, taken in conjunction with the accompanying drawing, which forms an integral part thereof.

In the various figures of the drawing like reference characters designate like parts.

In the drawing:

FIG. 1 is a plan view of the present invention;

FIG. 2 is a side elevational view partly in section taken along line 2—2 of FIG. 1;

FIG. 3 is a plan view of the solenoid used in the present invention;

FIG. 4 is a sectional side elevational view taken along line 4—4 of FIG. 3;

FIG. 5 is a front elevational view of the solenoid with the armature in the uppermost position;

FIG. 6 is a front elevational view of the solenoid with the armature in the lowermost position;

FIG. 7 is a pictorial view of the spring clip utilized to hold the major components of the present invention together;

FIG. 8 is a schematic front view of the range of driver blade widths available for use with the present invention;

FIG. 9 is an exploded side elevational view, partly in section, of the staple guide track;

FIG. 10 is a sectional plan view taken along line 10—10 of FIG. 9;

FIG. 11 is a schematic transverse view of the staple guide track illustrating the widest staple usable with the present invention;

FIG. 12 is another schematic transverse view of the staple guide track illustrating the narrowest staple that may be used with this invention;

FIG. 13 is a pictorial view of a staple pusher bar;

FIG. 14 is an exploded side elevational view of the major assemblies comprising the present invention;

FIG. 15 is a schematic drawing of the circuit used in the present invention.

Referring now to the drawings and in particular to FIG. 1 and FIG. 2, there is shown an improved, electrically powered fastening tool 20 comprising the present invention. For the purpose of this description the apparatus will be broken down into several major components.

I. *Housing*

The housing, in the embodiment illustrated, is formed in two halves 22*a* and 22*b*. The front portion 24 of the combined housing halves is substantially cylindrical in shape while the mid-portion 26 of the housing defines a hand-gripping area. Rear portion 28 admits the line cord

30 which is adapted to be connected to a suitable source of electrical power. The housing halves are held together by a number of screws 32 which pass through clearance holes in one part of the housing and are threadably engaged in the opposite side of the housing.

As may be seen in FIG. 2, the conductors of the line cord are connected to an electronic package 34 described more fully hereinafter in conjunction with the circuit drawing of FIG. 15.

A snap action type switch 44; for example, the type made by Cherry Electric Product Corporation under Catalog No. E34, is suitably secured to the housing in midportion 26, such that the contact button thereof extends downwardly into the hand-gripping opening. Trigger 46 is pivotally mounted just below the switch contact button and is provided with an actuating member 48 resiliently biased by spring number 50. An upward force on the trigger closes or opens the contacts of the switch, depending on the particular circuit employed; i.e., actuated by making or breaking a circuit.

Solenoid 52 is mounted in the forward section of the housing just ahead of the switch member. The solenoid case is comprised of a cylindrical, ferromagnetic, lower section 54 and upper section 56. In the embodiment illustrated, the wire coils 58 and 60, connected in parallel, are disposed in the base section. Ferromagnetic cover member 62, which retains the coils in place, is provided with a circular flange portion 64 of substantially the same diameter as the outside diameter of the lower section of the solenoid housing. The central bore 66 of the cover member is made with substantially the same diameter as that of the linearly movable solenoid armature but with sufficient clearance so that the armature moves freely therethrough.

Upper ferromagnetic case section 56 is also cylindrical and seats on the upper surface of a cover member flange portion 64. The upper case section is provided with elongated slots 70 on each side thereof and a single elongated slot 72 in the front. The purpose of these slots will be made evident hereinafter. The construction of the solenoid case just described is by way of illustration only, it being understood that the case sections may be fabricated as a single, drawn piece.

A non-magnetic shaft 76, having a head end 78 seated above the top end of the solenoid case and a threaded lower end 80 passing through the wire coils and the lower section of the solenoid housing, slidingly supports solenoid armature 82. Central bore 84 of the armature is provided with an elongated sleeve bearing 86, preferably a porous, magnetizable material having an iron content of the order of 85%. This provides free sliding linear movement of the armature with respect to the shaft. The upper end of the armature is provided with a flange portion and a resilient annular member 90.

The lower portion of the solenoid case has welded thereto a strap 92. One of the screws that hold the housing halves together passes through an aperture in the strap so that the solenoid may be securely held in the housing. Bracket 94, which will be described hereinafter more fully in connection with the interchangeability of the supply magazine, is held on the top of the solenoid housing by the central non-magnetic shaft 76. This bracket is provided on the righthand end thereof with a tab member 96 that keys into an aperture 98 in the upper solenoid housing. The righthand end of the bracket is also provided with an aperture through which another of the housing connecting screws pass. Thus, it will be seen that the solenoid, by means of the two housing screws, is securely held and is unlikely to be vibrated loose. Bracket 98, having an arcuate, grooved crown 100, is secured to bracket 94 by means of several screws 95. An extensible coil spring 102 is disposed in the crown groove, such that the ends thereof may be secured to tabs 104 on either side of the armature. Spring 102 returns and holds the armature in its original upward position after the

completion of the downward stroke. The slots in the opposed sides of the solenoid case provide clearance for the movement of the solenoid tabs. The spring arrangement is an improvement over the use of a compression spring about the central shaft **76** which would prevent the use of the long bearing employed in this design. Finally, a blade driver pin **106** is provided integrally with the upper end of the solenoid armature and substantially at a right angle thereto. Slot **72** in the front of the solenoid housing provides clearance for the movement of the blade driver pin.

II. *Driver blade*

Driver blade **110** is provided at its upper end with an aperture **112** so that it may be loosely supported on the drive pin of the solenoid armature. The driver blade, which may be a metal stamping, forging, etc., is also provided with a pair of spaced, parallel, side flanges **114** and an arcuate central portion **116**, which serve to stiffen the blade. With the blade mounted on the armature driver pin, the arcuate central portion of the blade is disposed in an arcuate notch or cutout **120** of bracket **94**. The flat lower end **111** of the blade is positioned over the forwardmost staple. For different gauge staples different thickness blades could be interchanged. The range of driver blades that may be utilized with the present invention is schematically shown in FIG. 8. The largest width blade is called out as D; the smallest width blade is called out as D'; all the blade widths in between the smallest and the largest are represented as D''.

The solenoid case is secured to an elongated upwardly facing channel member **122** by means of a nut **123** welded thereto. The central shaft member **76** of the solenoid is threadably engaged in the nut. At the lefthand end of the channel member, as may be seen in FIG. 2, the solenoid housing is seated in a notch **124** in each of the legs of the channel member. The lefthand end of each leg of the channel member is also provided with a notch **126** to receive the spring clip that holds the several major components of the tool together. This will be described in detail subsequently.

To the right of the solenoid the channel member is provided with a transverse pin **128**, having laterally extending ends, while at the righthand end of the channel member a second pin **130** is secured transversely. One end of the linkage **132** is mounted on the second transverse pin, while the opposite end of the linkage has an aperture that receives one of the screws holding the two housing halves together. Another function of the second pin, which also has laterally extending ends, will be described in conjunction with the interchangeability of the staple supply magazine. Finally, a leaf spring **134** is rigidly secured to the forward end of the channel, such that it bears against the rearward surface of the driver blade. The function of the spring member is to urge the driver blade forward against the inside surface of the head housing in a manner to be described more fully hereinafter.

III. *Staple supply magazine and blade guide track*

A particular feature of the present invention is the use of a one-piece, combination staple supply magazine and head housing **140** which is removably attached to the remainder of the tool without conventional fasteners. The staple supply magazine portion is comprised of an upwardly facing channel member **142** having a horizontal notch **144** formed in each of the side walls thereof at the righthand end. Notches **144** are adapted to receive the laterally extending ends of the transverse pin **130** provided at the righthand end of channel member **122**. A second upwardly facing notch **146** is formed in each of the side walls of channel member **142** proximate the midpoint thereof, such that they mate with the laterally extending ends of pin **128** of channel member **122**. A third notch **148** is formed at the lefthand end of channel member **142** in order to receive the transverse portion of the clip member that holds the components of the tool together. Notches **148** are in registry with notches **126** formed in the channel member **122**.

In the assembled condition, pin **128**, which is disposed in the notches at the midportion of the channel member, prevents any longitudinal movement of the magazine with respect to the housing. Finally, a pair of laterally extending ears **152** are formed by bending over the top edges of channel member **142** just rearward of notches **148** and forward of notches **146**. In the assembled condition notches **148**, ears **152** and the laterally extending ends of the midportion pin **128** cooperate with the means for retaining all the components. The manner in which this is done will be explained more fully hereinafter.

An elongated rectangular bar **154** is secured to the base wall of channel member **142**. In the embodiment illustrated, a plurality of screws **156** perform this function although the bar and channel may be welded. To aid in the accurate positioning of the central bar, pins **157** are aso included to act as locating means. The bar **154** is spaced from the side walls of channel member **142** to define guide tracks for the parallel legs of the staple. The bar is also spaced from the upwardly facing channel member that supports the solenoid in order to provide clearance for the transverse leg of the staple. Staple pusher bar **160**, as may best be seen in FIG. 12, is comprised of a downwardly facing channel **162** having flanges **164** extending transversely from either side at the righthand end thereof. Elongated rods **166** are each slidably seated in apertures in the flanges and each rod has positioned thereabout a coil spring **168**. The righthand end of the rods are joined by transverse member **170**, arranged to fit into a transverse notch **172** in the bar member **154** when the pusher bar is disposed in the staple supply magazine. The parallel spring member urges the stick of downwardly facing U-shaped staples towards the forward end of the tool.

The staples S are adhesively secured together and have a width dimension substantially the same as the width of the bar member on which they ride. The staple stick is limited in its upward movement by channel member **122**. It should be noted at this time that the side walls of channel member **142**, the top surface of bar **154**, and the transverse web of channel **122** are spaced from each other by a dimension sufficient to form a guide track for accepting the legs and the transverse sections respectively of the staple stick.

The head housing or blade guide means is formed by an upstanding L-shaped channel **172** having spaced side walls **174** straddlingly secured to the outer surfaces of the side walls of channel member **142** at the forward end thereof. Transverse wall **176** of the head housing represents the forwardmost point of the tool. A die block **180** is also included and is spaced from the inside surface of the transverse wall of the head housing to provide passage for the staples. For different gauge staples the die block would, of course, be positioned differently to provide the appropriate spacing between itself and the inner surface of the transverse head housing wall. Thus, a range of staple gauges may be accepted by providing a number of supply magazines having differently positioned die blocks.

It is to be understood, of course, that a suitable driver blade would be selected for each staple gauge. Regardless of the width of the blade at the bottom, the blade flanges **114** are guided in their vertical movement by the spaced side walls **174** of the head housing. The upper ends of the side walls of the head housing are also provided with tabs **186** arranged to engage notches **188** in bracket **94** when the magazine is assembled to the tool housing. The function of the tabs and the notches will be described subsequently in conjunction with the means to retain the various parts locked together.

FIG. 11 and FIG. 12 are transverse sections through typical staple supply magazines and differ only in the

width of the staples they accommodate. Taking the extreme sizes, the magazine in FIG. 11 will accept a staple S having transverse spacing A between the legs thereof. The magazine of FIG. 12 would accept a staple S' having a transverse dimension between the legs of A'. In either case, the spaced parallel legs of the staple are close to, or perhaps only slightly larger than, the width of the bar member secured to the channel of the supply magazine. A stick of staples is disposed in the guide track defined by the space between the upstanding walls of the channel member and the sides of the bar. The driver blade D and D' that would most effectively be used with staples S and S', respectively, are schematically shown superimposed thereabove.

It should be noted that only the bar member need be changed for different width staples. By leaving the channel member **142** constant, the tabs in the upper portions of the head housing side walls will mate with a single or constant width bracket **94** secured to the solenoid. Similarly, only the lower staple-engaging portion of the blade need be altered to correspond with the width of the staple being used. In this connection it should be noted that for any staple of lighter gauge than the maximum permitted suitable filler members are provided in between the die block and the inside surface of the upper channel. This assures that the driver blade, which is suitably dimensioned for each staple size, is accurately guided throughout its entire travel.

IV. *Means to releasably secure the components*

A single resilient spring clip **200** is all that is required to hold the components in the assembled condition. Finger pressure applied to the ends **202** of the clip on either side of the tool housing is all that is needed to release the clip. In this manner the combination staple supply magazine and blade guide track is easily released from the housing and the driver blade is easily removed from the solenoid. It is obvious, then, that no screws, bolts, nuts, rivets or similar fasteners are required to hold the major components together. In fact, no tools or any special skills of any sort are needed. Further, the resiliency of the clip absorbs at least some of the shock arising from the driving of each staple and therefore the clip reduces the likelihood of fracturing any of the stapler parts.

Referring in detail now to FIG. 7, spring clip **200** is seen to comprise a central transverse section **204**, which is in assembled condition disposed across channel member **142** in notch **148**. The solenoid, secured over the clip to the channel **122**, retains the clip in the channel whereby the clip is very loosely pivotable in the spaced notches **126** and notches **148**. Parallel leg members **206** of the clip member extends from each end of tranverse section **204** and are provided with extensions **208** formed at an angle to the legs. The extensions terminate in the finger-gripping portions **202**. It will be seen that when portions **202** are snapped over the laterally extending ends of pin **128**, each junction of the legs and the extensions are disposed below and bear upwardly with substantial force against the laterally extending ears **152** formed on channel member **142**. In this manner the three major elements of the tool are releasably secured to each other.

V. *Assembly and disassembly*

Reference may be had to FIG. 14 for an understanding of the ease and simplicity of disassembling, interchanging and reassembling the major sections of the tool. First, the proper driver blade for the particular gauge and size staples to be used is loosely placed on the cantilevered and outwardly extending driver pin integral with the solenoid armature. The bottom end of the blade rests on the leaf spring **134** secured to channel member **122**. Then, with the housing and power package in one hand and the combination staple supply magazine and head housing in the other hand, the laterally extending ends of transverse pin **130** are inserted into notches **144**. With the pin **130** acting as the pivot point, the magazine and head housing are swung upwardly until tabs **186** in the upper sidewalls of the head housing are seated in spaced notches **188** of the bracket secured to the top of the solenoid. The ends of pin **128** are thereby seated in notches **146** of the channel member **142**. It should be noted that spring member **134** attached to the forward end of the channel member **122** bears against the lower end of the driver blade, urging it against the inner surface of the head housing. In combination, then, the space side walls **174**, the inside surface of the transverse wall **176**, and the leaf spring **134** define a guide for the travel blade which is arranged to slide therethrough.

At this point in the assembling of the tool, clip **200** is hanging downwardly in the registered notches of the channel members. The ends of the clip member are then forced over and into engagement with the laterally extending ends of the midportion pin **128** and the tool is ready for operation. The procedure for disassembly of the tool is just the reverse of that described for the assembly and is equally as simple. The end of the clip member are released by finger pressure so that the clip loosely hangs down and the tabs of the head housing are pushed out of the solenoid bracket notches. With downward pressure on the top of the head housing, the pin **130** will thereby be released from the rearward channel notches and the magazine and driver blade are available for removal and interchange with differently sized members that are designed to give optimum performance with different size staples. The staples may range upward in width from $\frac{1}{32}$ of an inch.

VI. *Circuitry*

With the trigger switch **44** "off," capacitor **212** charges to the peak positive line voltage through solenoid coils **58** and **60**, diode **214** and resistor **216**. The trigger switch may be closed randomly (by the operator) at any time during the AC cycle. If the switch should close during a positive half cycle of the supply, diode **218** prevents flow of current until the line reverses polarity. With the line negative, gate current flows from the line through the SCR **226** gate, the switch **44**, resistor **220** and diode **218** to charge capacitor **222**. Current has to take this path because diode **224** prevents current flow directly from the line in the reverse direction to the switch. Even although the line is negative the SCR **226** will trigger as soon as the gate current flows, because the SCR's anode is always forward biased by previously charged capacitor **212**. With SCR **226** gated "on," the discharge time constant of the R-C network (capacitor **212** and resistor **216**) and the SCR **226** is long enough to maintain SCR **226** in conduction until the line once more reverses polarity. With the line positive once more, load current is able to flow from the line through the solenoid coils and the still conducting SCR **226**. At the end of this half cycle, when the line goes negative again, SCR **226** is reverse biased and turns off. For the SCR **226** to trigger again two conditions must be satisfied, namely: (1) Capacitor **212** must be recharged, which requires at least one cycle off time; and (2) Capacitor **212** must be discharged, so that gate current is able to flow again. These conditions can only be satisfied if the switch is released for at least one full cycle of the line. This feature precludes misfiring due to contact bounce.

The advantages and features of the present invention may be summarized as follows:

(1) The entire structure is compact, rugged and easy to handle.

(2) All of the individual components are easy to manufacture and assemble, so that the cost of the tool is kept low.

(3) The power package and housing, which represent the major cost of the tool, is common to many relatively

inexpensive supply magazines and driver blades covering a range of sizes. At a minimum of cost the user has an entire set of staplers.

(4) No special tool or skill is required to change the device for use with different sized staples.

(5) When the apparatus is changed for different sized staple sizes, the power package need not be disturbed by inexperienced personnel. Only the head housing, the staple supply magazine and the driver blade are removed with the power package remaining in the housing.

(6) The blade guide or head housing is integral with the removable staple supply magazine.

(7) The tool housing and power package can accept a range of different width staple supply magazines and driver blades.

(8) Because of the simplicity of this assembly, a jammed staple can be removed very easily.

(9) Because the driver blade is loosely mounted and so easy to remove, a damaged or worn blade can be replaced without completely dismantling the tool or returning it to the factory.

(10) The principles of the present invention may be used to drive staples having a straight transverse section or staples having offset portions in the transverse section.

(11) The tool can be used to drive a variety of different fasteners, such as staples, pins, brads, nails, etc.

(12) The solenoid is provided with an extremely long bearing, thus assuring a perfectly linear travel thereof.

(13) The return spring for the solenoid armature is external of the case, thus permitting a maximum length bearing for the armature.

(14) The flanges on the driver blade provide a very rugged construction that will assure a long life for the tool.

(15) The construction of the housing assures comfortable handling of the tool with the major portion of the weight at the forward end in a most useful and comfortable position.

(16) Servicing and assembly of the tool is extremely simple since only a few screws hold the two housing halves together.

While the present invention is primarily concerned with means for interchangeably accepting different width staples, it should be evident that secondary features are also available. Thus, by providing a range of magazines, with differently dimensioned die blocks and guide bars, many gauges of staples could be used with a single tool and power package. Further, by making the guide bar of different heights, staples having different length legs could also be used with a single tool. Obviously, then, the interchangeable features of the present invention provide that almost any combination of staple width, gauge or length of leg can be used. The improved solenoid assures long life and ease of operation with a minimum of heat being generated. The solenoid further provides sufficient power to drive a wide range of fastener sizes.

Having thus disclosed the best embodiment of the invention presently contemplated, it is to be understood that various changes and modifications may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. An electrically powered tool for driving any one of a plurality of fasteners having unlike configurations into a workpiece, said tool having interchangeable components of the type described, said tool comprising:

(a) a housing open along the length of the bottom thereof and along at least a portion of the front thereof;

(b) a solenoid assembly comprised of a casing having a slot therein, a wound coil having a central bore and a magnetizable armature linearly movable through the bore of said coil, said solenoid being secured within said housing with a portion of said armature extending outwardly through the slot of said casing;

(c) elongated spring means having a portion fixed relative to said casing and at least one free end secured to said armature externally of said casing, said spring means being arranged to return said armature to its original position at the end of each stroke;

(d) a trigger carried by said housing;

(e) switch means contained in said housing in electrical connection with said solenoid, said trigger being arranged to actuate said switch means whereby said solenoid is energized;

(f) a fastener driver blade loosely secured to the externally extending portion of said armature for movement together therewith, said driver blade being disposed on the outside of said solenoid casing for movement in a plane parallel to that of said armature;

(g) a combination head and fastener supply housing removably mounted on said housing in covering relationship to the open front and bottom surfaces, respectively, thereof, the head portion of said combination housing defining a guide track for said driver blade, the fastener supply portion of said combination housing defining a guide track for the fasteners to be driven;

(h) a fastener pusher bar slidingly disposed in the fastener supply portion of said combination housing; and

(i) retaining means to releasably hold said combination housing on said tool housing.

2. The apparatus in accordance with claim 1 wherein said housing is comprised of two concave mating sections joined along a common, longitudinal central axis, said forward portion being hollow and shaped to receive said solenoid and said driver blade, said hand-gripping portion being hollow and shaped to receive said switch means, said forward portion and said rearward portion being spaced from each other to define a finger opening in combination with said hand-gripping portion, said trigger being postioned in the finger opening whereby, when the user holds the hand-gripping portion, one of the user's fingers will engage said trigger.

3. The apparatus in accordance with claim 1 wherein said solenoid armature includes an elongated central bore and an elongated hollow bearing integrally secured therein, said solenoid further including a central shaft extending therethrough and arranged to slidingly support said armature bearing.

4. The apparatus in accordance with claim 3 wherein said bearing is substantially the same length as said solenoid armature.

5. The apparatus in accordance with claim 3 wherein said bearing is magnetizable material.

6. The apparatus in accordance with claim 3 wherein said bearing is a porous, magnetizable material comprised predominantly of iron.

7. The apparatus in accordance with claim 1 wherein there is included a bracket integrally secured to the top of said solenoid casing, said bracket having an arcuate, annular groove spanning said solenoid casing, wherein said casing includes a pair of opposed side notches formed in the wall thereof, wherein said armature includes a pair of opposed tabs and wherein the ends of said spring means are secured to said armature tabs and the midportion of said spring means is seated in the annular groove of said bracket.

8. The apparatus in accordance with claim 1 wherein there is included a latching member positioned on the top said solenoid, said latching member having a radially extending portion provided with a pair of notches, the head portion of said combination head fastener supply housing including a pair of spaced ears arranged to releasably interfit with the notches of said latching member when said tool is assembled.

9. The apparatus in accordance with claim 8 wherein said solenoid casing is provided with a keyway and said latching member includes a key engaged in said keyway.

10. The apparatus in accordance with claim 1 including a second spring member positioned between said solenoid casing and said driver blade, said second spring member being arranged to urge the lower portion of said driver blade towards the forward end of said tool.

11. The apparatus in accordance with claim 1 wherein said fastener supply housing is comprised of an elongated U-shaped channel and an elongated, centrally located bar secured to the transverse leg of said channel.

12. The apparatus in accordance with claim 1 wherein said fastener pusher bar is comprised of an inverted U-shaped member having opposed, laterally extending flanges each with an aperture therein, an elongated rod slidably disposed in each of the apertures in said flanges,

a spring member arranged to bias each of said rods with respect to said flanges and means to retain said pusher bar in said fastener supply housing whereby said U-shaped member urges the fasteners towards the forward end of said tool.

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