Jan. 25, 1966 J. E. WARD 3,231,168

FASTENER FORMING AND DRIVING TOOL

Filed Nov. 18, 1963 3 Sheets-Sheet 1

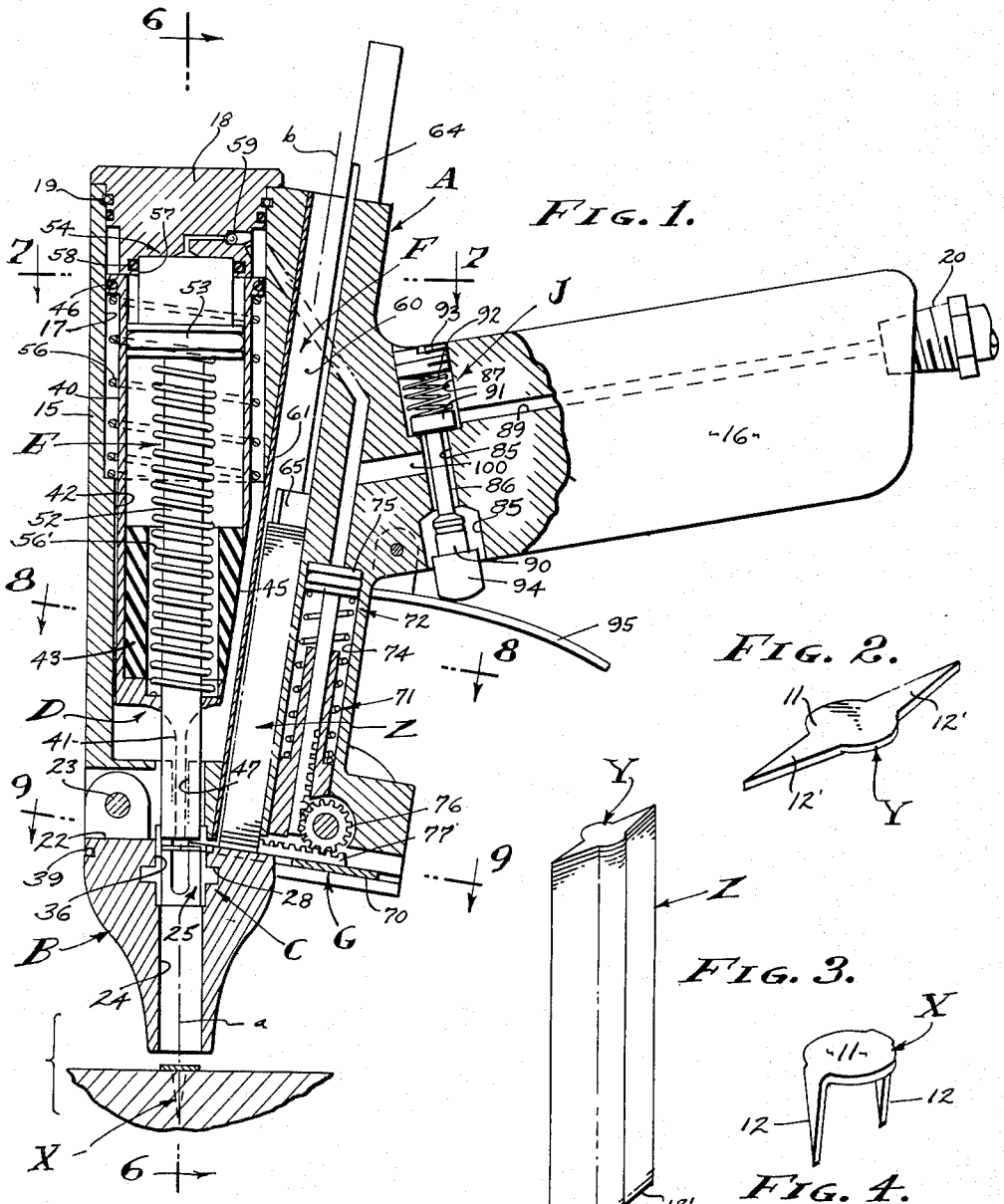


FIG. 1.

FIG. 2.

FIG. 3.

FIG. 4.

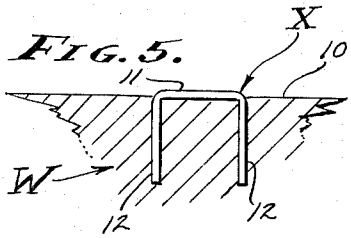


FIG. 5.

INVENTOR.
JAMES E. WARD
BY
W. N. Tamwell
AGENT

Jan. 25, 1966 J. E. WARD 3,231,168

FASTENER FORMING AND DRIVING TOOL

Filed Nov. 18, 1963 3 Sheets-Sheet 2

FIG. 6.

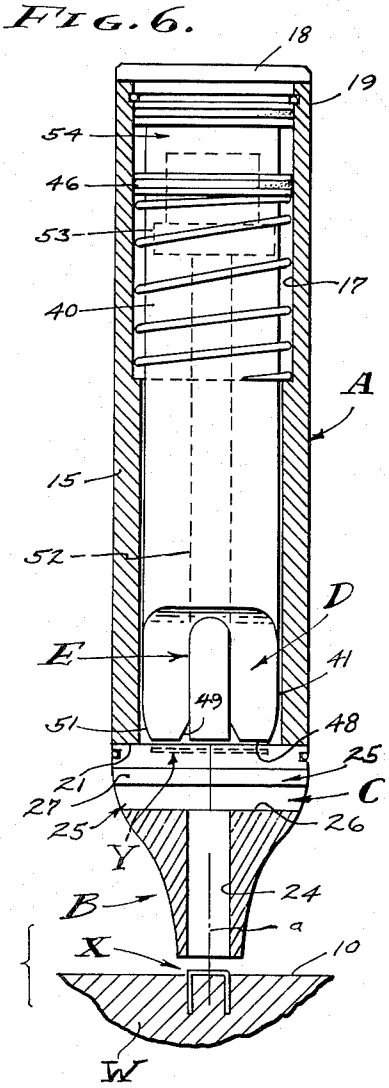


FIG. 7.

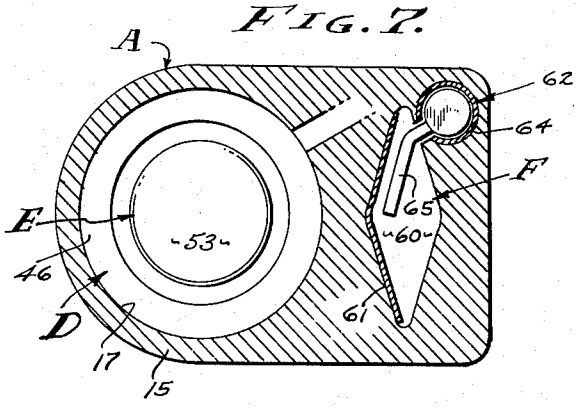


FIG. 8.

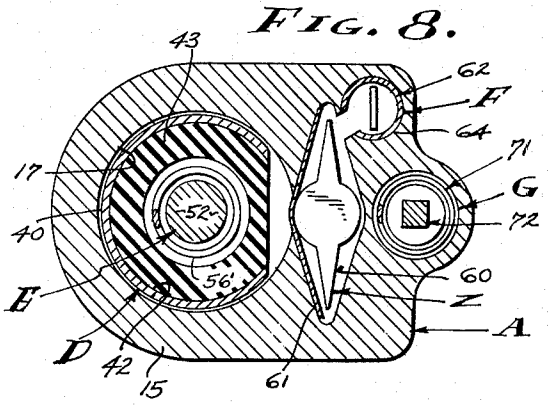


FIG. 9.

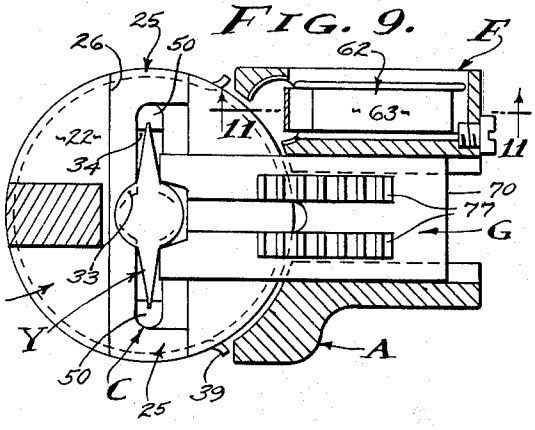
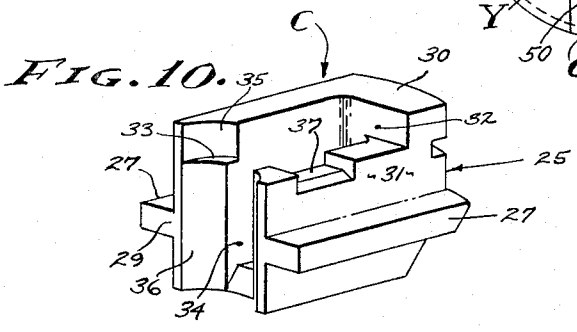


FIG. 10.



INVENTOR.
JAMES E. WARD
BY
W. F. Yarnall
AGENT

Jan. 25, 1966 J. E. WARD 3,231,168

FASTENER FORMING AND DRIVING TOOL

Filed Nov. 18, 1963 3 Sheets-Sheet 3

FIG. 11.

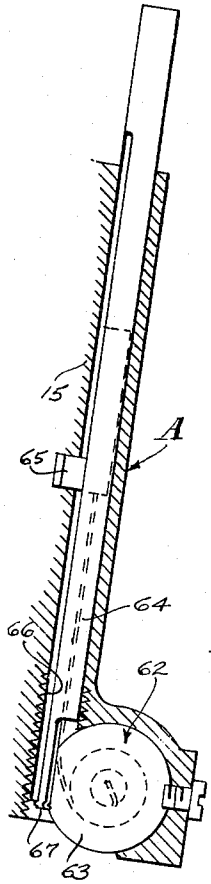


FIG. 12.

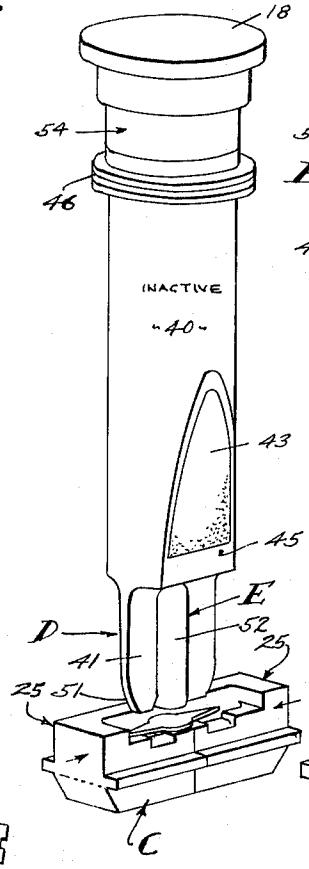


FIG. 13.

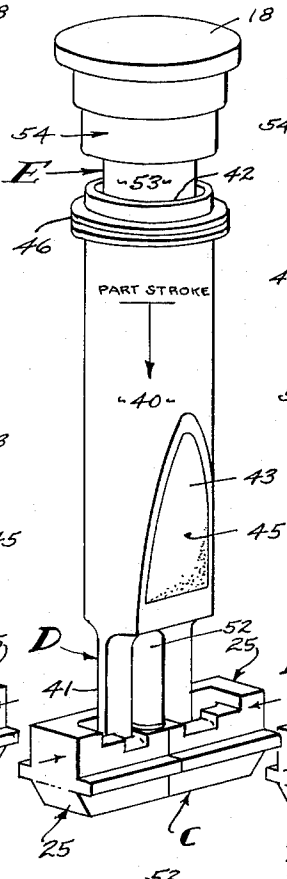


FIG. 14.

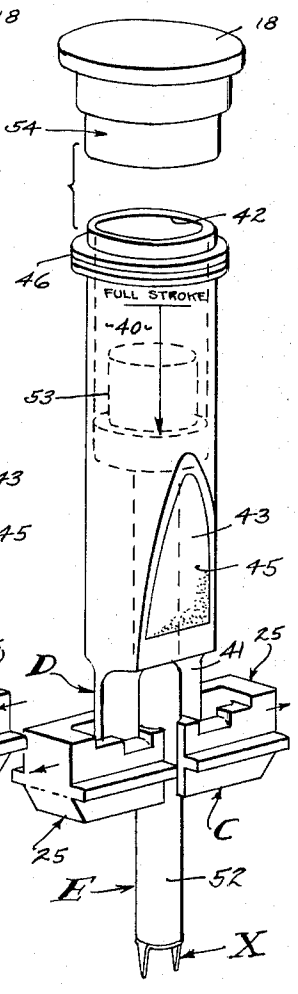


FIG. 15.

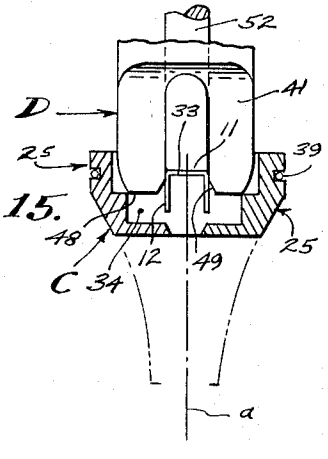
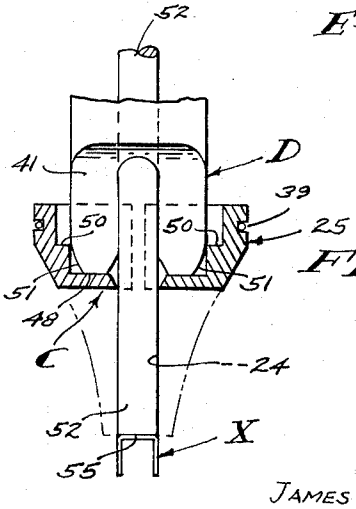


FIG. 16.



INVENTOR.
JAMES E. WARD
BY
W. H. Maxwell
AGENT

United States Patent Office 3,231,168
Patented Jan. 25, 1966

3,231,168

FASTENER FORMING AND DRIVING TOOL

James E. Ward, Glendora, Calif., assignor to Powers Wire Products Company, Inc., El Monte, Calif., a corporation of California

Filed Nov. 18, 1963, Ser. No. 324,462
8 Claims. (Cl. 227—88)

This invention relates to fasteners and is particularly concerned with a tool that delivers fastener blanks one at a time, forms them into finished fasteners, and then drives them into work.

The art relating to fasteners and tools for driving them is characterized by air operated tools that drive U-shaped staples. There are, of course, other types of fasteners but it is a U-shaped fastener of improved construction with which the present invention is concerned. For instance, U-shaped fasteners have been made of both round and flattened wire, formed into U configuration and cemented together into "stick" formation. These "sticks" of aligned fasteners are inserted into the magazine of a tool which severs one fastener at a time from the "stick" and drives it into work. The usual arrangement of the tool involves a magazine extending at a right angle to the axis of driving, whereby each fastener is driven off the end of the "stick" and directly into work, the magazine being disposed parallel to the plane of the work in order for the fastener to enter the work at a normal angle. It becomes obvious that this ordinary arrangement of the magazine relative to the driving axis of the tool is space consuming and cumbersome. That is, with "sticks" of appreciable length the magazine becomes extensive in a lateral direction, and this lateral extension of the magazine imposes limitations on the use of the tool, in that there are places and conditions where such a tool is inoperable and useless.

Further, "sticks" of completed U-shaped fasteners have disadvantages. For example, staples made of wire have limited head area and consequently have cutting action when driven onto work. If the work involves the holding of fabrics and the like the usual bar-shaped head will cut and pull through the work. Therefore, the usual fastener in the form of a wire staple has disadvantages and has limited use.

A general object of this invention is to correlate an improved tool of the type under consideration with an improved fastener of the type under consideration, whereby lateral projection of the magazine is avoided and whereby a fastener of substantially increased head area is possible when so desired.

It is an object of this invention to provide a fastener driving tool that handles a "stick" of fastener blanks, to advance the blanks one at a time to form the blanks into finished fasteners and then to drive said finished fasteners into work.

It is an object of this invention to provide a fastener driving tool as thus far referred to wherein the magazine for storage of fastener blanks is substantially parallel to the drive axis of the tool. By this relationship, projected extension of a magazine is eliminated and said magazine lies alongside the drive means of the tool.

It is an object of this invention to provide a fastener driving tool as thus far referred to wherein fastener blanks are advanced by means sequenced with the drive means of the tool, all controlled by a simple three-way valve.

It is an object of this invention to provide a fastener driving tool as thus far referred to wherein fastener blanks are advanced and supported by die-blocks while formation of the finished fastener occurs, all controlled by a simple three-way valve.

It is an object of this invention to provide a fastener driving tool as thus far referred to wherein fastener blanks are advanced and formed into fasteners and then driven into work, all controlled by a simple three-way valve.

Another object of this invention is to provide improved U-shaped fasteners wherein the head portion extending between the two legs is flat and will not cut into work, and wherein "sticks" of blanks for the formation of such fasteners can be advantageously made up of a stick of flat identical sheet metal punched parts.

Still another object of this invention is to provide an extremely compact tool for handling "sticks" of fastener blanks, to form and then drive said blanks, and wherein the magazine of the tool extends alongside the drive means, thereby exposing the driving head of the tool without any encumbrances which usually characterize such tools.

The various objects and features of this invention will be fully understood from the following detailed description of the typical preferred form and application thereof, throughout which description reference is made to the accompanying drawings, in which:

FIG. 1 is a vertical sectional view of the fastener driving tool. FIG. 2 is a perspective view of a blank to be formed into a fastener. FIG. 3 is a perspective view of a "stick" of assembled blanks. FIG. 4 is a perspective view of a finished fastener as formed by the tool shown in FIG. 1. FIG. 5 is a cross-section through work showing the manner in which the U-shaped fastener is driven into said work. FIG. 6 is a sectional view taken as indicated by line 6—6 on FIG. 1. FIGS. 7, 8 and 9 are enlarged detailed sectional views taken substantially as indicated by lines 7—7, 8—8 and 9—9 on FIG. 1. FIG. 10 is an enlarged perspective view of one of the die-blocks involved in forming the finished U-shaped fastener. FIG. 11 is a fragmentary sectional view taken as indicated by line 11—11 on FIG. 9. FIGS. 12, 13 and 14 are perspective views illustrating the progressive positions of the working parts of the tool in the formation and driving of the finished U-shaped fastener. FIG. 15 is a detailed section illustrating the position of parts as they occur in FIG. 13, and FIG. 16 is a detailed section illustrating the position of parts as they occur in FIG. 14.

The fastener forming and driving tool hereinafter disclosed is preferably a hand tool operated pneumatically and adapted to be manipulated on an axis disposed normal to the work into which fasteners are to be installed thereby. In FIG. 1 the general relationship of elements is best illustrated and wherein the tool comprises a frame A with a drive axis *a* normal to the surface 10 of the work W, a drive head B disposed on said axis *a*, blank support means C at the head B, blank forming means D cooperating with the means C to bend the blank into a finished U-shaped fastener, fastener driving means E cooperating with the forming means D to drive the finished U-shaped fastener through and from the head B, a magazine supply means F storing the blanks, blank advance means G moving individual blanks into supporting engagement on the means C for engagement by the forming means D, and valve means J supplying air under pressure to the means D, E and G to actuate the same and to exhaust air therefrom.

The fastener X, as shown in FIGS. 1, 4, 5, 6, 14 and 16, is essentially a U-shaped fastener having a transverse head 11 and a pair of spaced parallel legs 12. This particular U-shaped fastener is unique in that the head 11 is a flat disc-shaped element with a pair of legs 12 depending from opposite peripheral points, it being understood that ordinary U-shaped fastener blanks made of straight wire can also be finished and driven by the tool hereinafter described. In accordance with the invention, the fastener X is formed from a blank Y which is of flat

formation patterned to have the features of the finished fastener X. FIG. 2 illustrates the blank Y as it is formed with diametrically opposite projecting extensions 12' which are to be bent so as to form the legs 12, the blank Y being a sheet metal punching or stamping. As shown, the extensions 12' are symmetrical and tapered to sharp points, the widest portion of each leg being at the point of joinder with the head 11 and about one-third the width of the head. As is clearly illustrated in FIG. 3 the blanks Y are assembled or stacked together and aligned one exactly over the other so as to form a stick Z when cemented together. The stick Z is straight and composed of a multiplicity of identical blanks Y.

The frame A is typical of tools of this type and is shown as a casting having a cylinder portion 15 and a grip portion 16. The frame A, which is essentially the complete tool, comprises only these two portions 15 and 16 with no other major protuberances to encumber the same. The cylinder portion 15 is bored at 17 to have a cylinder opening therethrough, there being a cylinder head 18 closing the top of the cylinder and secured in place by a lock wire 19. The grip portion 16 extends laterally from one side of the portion 15 and carries the valve means J and receives the service connection 20. The connection 20 is, for instance, an air hose connection that supplies air under pressure to the valve means J.

The drive head B is located at the lower end of the cylinder portion 15, the said portion 15 and head B being centered on the axis *a*. In practice, the frame A and head B are separate parts, the former being cast of light weight metal and the latter being machined of some durable metal such as steel. Thus, the frame A terminates in a lower end face 21 (see FIG. 6), and the head B has an upper end face 22 engaged against face 21. The frame A and head B can be rigidly joined, however, it is preferred that the head B be removable, in which case it is pinned to the frame A at 23 so as to swivel downwardly and forwardly away from the frame. The head B is secured in operating position by a suitable hook or latch (not shown). The head B has a central driveway 24 therethrough, a driveway of round cross-section and concentric with the axis *a*. The driveway 24 opens at the bottom of the head B at a point spaced substantially downward from the face 21.

The blank support means C is provided to receive and carry a blank Y as is shown in FIGS. 1, 6, 9 and 12. In these figures it will be seen that the blank Y has been advanced into alignment with the axis *a* and is supported for engagement by the forming means D. The means C involves one or more separable blocks and is shown as a pair of of separable blocks 25 which are identically opposite in form, the right hand block 25 being illustrated in detail in FIG. 10. From FIGS. 1, 6 and 9 it will be seen that the head B has a transverse opening 26 therethrough and which opens at the top and opposite sides of the head B. The blocks fully occupy the opening 26, coming together at a center plane coincidental with the axis *a*. Further, the blocks 25 have opposite flanges 27 engaged in corresponding channels 28 in the head B, whereby said blocks are captured and permitted to move transversely and apart only. Specifically, each block has an inner end 29, a top 30 and an open side 31. There is a recess 32 at the open side 31 for receiving blanks Y and the block 25 is characterized by a blank supporting shelf 33 and by a well 34. The shelf 33 is parallel to and located below the top 30 a distance substantially greater than the thickness of a blank Y, the depth of recess 32 being the same. However, the shelf 33 is confined to an area which will underlie the disc-shaped head 11 of the blank Y, while the recess 32 continues laterally so as to adequately clear the leg extension 12'. In practice, the well 34 is of the same lateral extent as the recess 32. The well 34 terminates short of the bottom of the block 25 and opens at the inner end 29. The foregoing are the general and necessary features of the blocks 25 which receive and support the blanks Y, which permit operation therein of the forming means D, and which permit movement of the blocks 25 so as to allow driving of the finished fasteners X.

As shown throughout the drawings, the blocks 25 are refined so as to position blanks Y advanced therein as clearly shown in FIG. 9. Notice that when the ends 29 are together the recess is enlarged arcuately at 35, above the plane of shelf 33, to be engaged by and to stop the curved periphery of the head 11. Also, the blocks are relieved at 36 so that when they are apart, as will be later described, the driveway 24 is in effect continued through and between said blocks. Also, the blocks are notched at 37 so as to pass enlarged or reinforced parts of the blank advance means G to be described. As is best shown in FIG. 9 a spring clip 39 partially encompasses the head B and is carried in a retaining groove and has end portions biased to urge the two blocks 25 together.

The blank forming means D is provided to finish the blank Y into a finished fastener X by turning or bending down the two extensions 12' so that they present straight depending parallel legs. The means D involves, generally, a piston 40 operable in the bore at 17 and a former 41 carried and driven by the piston and operable into the wells 34 of the pair of blocks 25. In accordance with the invention the piston 40 is a tubular element which has a bore 42 for means E hereinafter described and which has a snubber cushion 43 to arrest motion of the means E. The tubular element or piston 40 and cushion 43 are truncated at 45 so as to clear the magazine supply means F which advantageously feeds closely to the axis *a*. Piston 40 has a head 46 with an O-ring seal operable in the bore 17 so that air under pressure beneath head 18 forces the piston downwardly. The former 41 is a flat element about the thickness of the width of legs 12 and it depends from the piston 40 in a plane that extends transversely through the axis *a*. The bottom end of frame A is provided with an opening 47 to guide the former 41 and so that the former 41 will project into the wells 43 when it is operated. In accordance with the invention, the former 14 is bifurcated so as to have a pair of parallel arms spaced to pass by the disc-shaped head 11 of the blank Y. However, the lower active ends 48 engage directly on and depress the extensions 12' and bend them downwardly to form the legs 12, as best illustrated in FIGS. 13 and 15. In practice, the arms of former 41 are chamfered at 49 which initiates and facilitates bending. Notice that the former 41 has moved about or little more than half its stroke in order to fully accomplish bending of the blank Y into a finished fastener X which is still supported fully by the shelves 33 of the two blocks 25 (the blocks 25 have not yet moved).

Referring now to FIGS. 15 and 16 it will be seen that a part stroke of piston 40 (FIGS. 13 and 15) effects full formation of a fastener X, after which completion of or a full stroke (FIGS. 14 and 16) effects lateral and opposite shifting of the two blocks 25. FIGS. 9, 10 and 15 show that the blocks 25 when closed together for support of the blanks Y do not permit passage of the finished fastener X and driver into the driveway 24, whereby said driver acts as a presser that holds the blank Y on said shelves 33. Therefore, and in accordance with the invention, final movement of the piston 40 and former 41 into its full stroke position is utilized to effect re-positioning of the blocks 25 so as to release the finished fastener X and to separate the relieved portions 36 of the blocks to form a continuation of the driveway therebetween. As described above, the two blocks 25 are urged together in which case they can be forced apart, preferably by cam means incorporated in the former 41 and co-acting with opposed steps 50 in the blocks. As shown, the steps 50 are positioned intermediate the tops 30 and bottoms of wells 34, the opposite edges of the former 41 being chamfered or curved at 51 to have a cam action that spreads the blocks to the positions shown in FIGS. 14 and 16.

With the forming means D fully operated as above described, the tool is conditioned for operation of the fastener driving means E which is a normal means of this type except that it operates within the tubular piston 40. In accordance with the invention the means E involves a driver 52 actuated by a piston 53 and under delaying control of a valve 54. Since the fastener X has a round head 11 the driver 52 is round and in the form of an elongated rod with a flat drive face 55. The driver 52 operates along the axis *a* and when in a normal unactuated position the face 55 is in a plane coincidental with the ends 48 of the former 41, while the piston 53 projects from the top of piston 40 so as to engage within the valve 54. A return spring 56 is seated in the piston 40 and engaged under piston 53 so as to lift the forming means D to the unactuated position shown in FIGS. 1, 6 and 12, and a return spring 56' is seated in the frame A and engaged under piston 53 to lift the driving means E. The valve 54 can vary widely and is preferably a cylindrical recess 57 in head 18 to receive the top portion of piston 53, there being an O-ring seal 58 to effect a tight fit. A check valve 59 is carried in the head 18 to exhaust air from the recess 57 and so as to permit free entry of piston 53 into the head 18. The head portion of the piston 53 which engages in recess 57 is somewhat smaller in diameter than the portion which slides in the bore 42 so that the pressure exerted on the driver 52 is limited. In practice, the piston moves but a short distance (between the positions shown in FIGS. 12 and 13) in order for the driver 52 to press upon the blank Y supported by support means C, all without retraction of piston 53 from recess 57. Thus, full force and effect of piston 53 is not gained until the support means C is released so as to permit retraction of piston 53 from recess 57, whereupon the driver 52 is operated to the position shown in FIGS. 14 and 16 to accelerate the fastener X and to strike said fastener into the work W (see FIG. 5).

The magazine supply means F is uniquely situated with respect to the frame A of the tool, being characterized by its disposition alongside the cylinder bore 17. As it is shown the means F is substantially parallel to the axis *a* but preferably inclined somewhat with its lowermost delivery end at or as close as is possible to the axis *a* without interfering with movement of the driver 52. In the particular case illustrated the means F is inclined upwardly and away from bore 17 at about 9°, in which case the lower and rear side portion of bore 17 is truncated, thereby requiring the truncation of piston 40 and snubber 43 at 45, as above described. As shown in FIGS. 1, 7, 8 and 11 the magazine supply means F involves a guideway 60 that extends along an inclined axis *b* offset rearward of the axis *a*, the axes *a* and *b* being in a common plane disposed normal to the transverse movement of the blocks 25. Since the guideway 60 is formed through the body of material of frame A and intersects the bore 17, the forward side thereof is established by a liner 61 which makes the truncation and closeness of delivery feasible (see FIGS. 1 and 8). The cross-section of guideway 60 freely passes the plan configuration of the blanks Y and opens at the top and the bottom of the frame. In order to deliver blanks Y at the bottom face 21 of the frame a presser 62 engages the top of stick Z of blanks to force them into supported engagement on the face 22 of head B. The presser 62 involves a spring-wheel 63 that is anchored and comprises a clock-type spring which draws a follower downwardly in a tube 64. A finger 65 projects from the follower and through aligned slots in the tube and frame A, said finger 65 entering the guideway 60 to press the blanks Y downwardly. The tube 64 is withdrawable from frame A for loading purposes, upwardly, and is pulled into the operating position by the spring pressure and held secure by serrations 66 engaged by a detent 67 at the lower end of tube (see FIG. 11).

In accordance with the invention the blank advance means G is provided to insert blanks Y into forming position in the head B. Since a blank Y must be in said forming position upon actuation of the tool, whereupon the means D first operates, the means G now under consideration is operative to advance a blank Y upon release of means D and E to a normally unactuated position. The means G is then operative to retract upon operation of means D and E to function as above described. That is, the means G functions reversely in respect to the function of the above described means D and E. As shown, the blank advance means G involves a slide 70 operable from a retracted position to an advanced position in a plane at and normal to the lower end of the guideway 60, means 71 yieldingly urging the slide 70 to said advanced position, and retracting means 72 to withdraw the slide 70 from said advanced position. The slide 70 is illustrated in FIGS. 1 and 9 and is a flat knife-like element that has an upper face to support the stick Z. When the slide 70 is retracted the face 22 of head B supports the stick Z with one blank Y positioned below the guideway 60, whereby advancement of the slide 70 severs the lowermost blank Y from the stick Z and places said blank in alignment with axis *a* to be supported by shelves 33. The means 71 is preferably a spring means that yieldingly urges the slide into said advanced position. The retracting means 72 is preferably a pneumatic means, shown as a cylinder 74 and piston 75 that retracts the slide 70. In practice, the means 72 is disposed on an axis normal to the slide 70, in which case it is coupled to the slide through a rack and pinion drive which transfer reciprocation of piston 75 to the slide 70. In the case illustrated, the said drive involves, a rack-shaped piston rod moved forwardly by piston 75 and biased backwardly by spring means 71, and a pinion idler 76 driven by the rack and driving the slide with a rack 77 thereon. Thus, the means G lies alongside the means F and does not protrude from the tool.

The valve means J is a fluid pressure supply and exhaust means that admits and exhausts operating fluid to and from the top end of the cylinder bore 17 hereinabove described. The valve means J is preferably formed in and carried by the frame A of the tool and, as shown, is housed in the grip 11. In the case illustrated, the valve means J involves a valve chest 85 formed or machined in the grip 11, and a slide 86 that is shiftably carried in the chest to control flow of fluid. As shown, the chest 85 extends through the grip 11 to open at both the front and back thereof, there being a recess 87 at the back of the chest and a recess 88 at the front of the chest. The recesses 87 and 88 are in the form of counterbores, the recess 87 handling the inlet of fluid under pressure and the recess 88 handling the exhaust of fluid. A pressure supply passage 89 connects the recess 87 to the service connection 20 while the recess 88 simply opens to the outside atmosphere at the exterior of the grip 11.

The slide 86 of the valve means J is freely shiftable in the chest 85 and involves a plunger 90 that is operable in the recess 88 and a valve disc 91 that is operable in the recess 87. A spring 92 is seated in a cap 93 that confines the spring to the recess 87, the spring engaging and yieldingly urging the disc 91 into contact with a seat in the recess. An extension 94 projects from the plunger 90 and is engaged by and is operated by a trigger 95. When the valve means J is actuated to depress the extension 94 the disc 91 is lifted from the seat allowing passage of fluid under pressure to a passage 100 that is in communication with the upper end of the cylinder bore 17 and upper end of cylinder 14, while the plunger 90 enters the chest 85 to close the exhaust recess. When the valve means J is released to the position shown in FIG. 1 the disc 91 is seated to close the recess 87 while the plunger 90 opens the recess 88 to exhaust fluid from the upper end of the cylinder bore 17 and upper end of cylinder 74.

From the foregoing description it will be apparent that the blank advancing means G is operative when the valve means J is released, to sever a blank Y from the stick

Z and to advance the blank into supporting engagement with the shelves 33. This advancement of the blank into position is by the spring bias permitted to function when air under pressure is exhausted from the means G. When the means D and means E are unactuated the ends 48 and face 55 are at the plane of the face 21, to the end that the blank Y is contained within a chamber from which it cannot be displaced. Upon manual actuation of the valve means J the blank forming means D operates with the aid of the presser action afforded by limited movement of the driving means E, followed by full operation of the driving means E, and during the time that movement of the driving means E is limited by the support means C the slide 72 of means G is retracted so as to receive the next successive blank Y. Upon release of the valve means J the above operations are repeated.

Having described only a typical preferred form and application of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any modifications or variations that may appear to those skilled in the art and fall within the scope of the following claims.

Having described my invention, I claim:

1. A tool for the formation of blanks into fasteners and for driving said fasteners, and comprising,
   (a) a frame having a cylinder portion disposed on a drive axis,
   (b) a drive head at the lower end of the frame and with a fastener driveway therethrough on said axis and with an opening disposed transversely through the driveway,
   (c) means to advance fastener blanks into the driveway at said opening, one at a time,
   (d) means including separable blocks movable together in said opening to releasably support a blank in said driveway,
   (e) means actuated by a piston operable in said cylinder portion to form the supported blank into a finished fastener and then to separate the blocks,
   (f) and means actuated by a piston operable in said cylinder portion to drive the finished fastener through and from the driveway,
   (g) there being means to sequentially operate the two pistons in the order described.

2. A tool for the formation of blanks into fasteners and for driving said fasteners, and comprising,
   (a) a frame having a cylinder portion disposed on a drive axis,
   (b) a drive head at the lower end of the frame and with a fastener driveway therethrough on said axis and with an opening disposed transversely through the driveway,
   (c) means to advance fastener blanks into the driveway at said opening, one at a time,
   (d) means including separable blocks movable together in said opening and each block having a blank supporting shelf,
   (e) means actuated by a piston operable in said cylinder portion to form the blank supported on said shelves and into a finished fastener and then to separate the blocks, thereby removing the shelf support,
   (f) and means actuated by a piston operable in said cylinder portion to drive the finished fastener through and from the driveway,
   (g) there being means to sequentially operate the two pistons in the order described.

3. A tool for the formation of blanks into fasteners and for driving said fasteners, and comprising,
   (a) a frame having a cylinder portion disposed on a drive axis,
   (b) a drive head at the lower end of the frame and with a fastener driveway therethrough on said axis and with an opening disposed transversely through the driveway,
   (c) means to advance fastener blanks into the driveway at said opening, one at a time,
   (d) means including separable blocks movable together in said opening and each block having a blank supporting shelf positioned in the driveway when said blocks are together, and each block having a well therein adjacent the shelf and driveway,
   (e) means actuated by a piston operable in said cylinder portion and having a depending former operable into each of said wells to form the blank supported on said shelves establishing a finished fastener,
   (f) and means actuated by a piston operable in said cylinder portion to drive the finished fastener through and from the driveway,
   (g) there being means to sequentially operate the two pistons in the order described.

4. A tool for the formation of blanks into fasteners and for driving said fasteners, and comprising,
   (a) a frame having a cylinder portion disposed on a drive axis,
   (b) a drive head at the lower end of the frame and with a fastener driveway therethrough on said axis and with an opening disposed transversely through the driveway,
   (c) means to advance fastener blanks into the driveway at said opening, one at a time,
   (d) means including separable blocks movable together in said opening and each block having a blank supporting shelf positioned in the driveway when said blocks are together, and each block having a well therein adjacent the shelf and driveway and with a step in each well,
   (e) means actuated by a piston operable in said cylinder portion and having a depending former operable into each of said wells to form the blank supported on said shelves establishing a finished fastener and to engage said steps to separate the blocks thereby withdrawing said shelves from the driveway and releasing said finished fastener,
   (f) and means actuated by a piston operable in said cylinder portion to drive the finished fastener through and from the driveway,
   (g) there being means to sequentially operate the two pistons in the order described.

5. A tool for the formation of blanks into fasteners and for driving said fasteners, and comprising,
   (a) a frame having a cylinder portion disposed on a drive axis,
   (b) a drive head at the lower end of the frame and with a fastener driveway therethrough on said axis and with an opening disposed transversely through the driveway,
   (c) means to advance fastener blanks into the driveway at said opening, one at a time,
   (d) means including separable blocks movable in said opening to releasably support a blank in said driveway,
   (e) forming means operable in said cylinder portion and including a normally raised and downwardly operable tubular piston to form the supported blank into a finished fastener and then to separate the blocks, there being means biased against the frame to raise the said tubular piston,
   (f) and drive means operable in said cylinder portion and including a normally raised and downwardly operable piston within a bore in the first mentioned piston to drive the finished fasteners through and from the driveway, there being means biased against the first mentioned piston to raise the second mentioned piston,
   (g) and there being means to sequentially operate the two pistons in the order described.

6. A tool for the dispensing of blanks stacked in stick formation by formation thereof of each individual blank

into a finished fastener and for driving said fasteners into work, and comprising,

(a) a frame having a cylinder portion on a drive axis,

(b) a drive head at the lower end of the frame and with a fastener driveway therethrough on said axis and with an opening disposed transversely through the driveway,

(c) means including separable blocks movable together in said opening to releasably support a blank in said driveway at said opening,

(d) forming means operable in said cylinder portion and including a returned biased downwardly operable piston to form the supported blank into a finished fastener and then to separate the blocks,

(e) drive means operable in said cylinder portion and including a return biased downwardly operable piston to drive the finished fastener through and from the driveway,

(f) a magazine supply means storing said stick of blanks alongside the cylinder portion and discharging the blanks at the drive head and adjacent the driveway therein,

(g) and advance means to move fasteners discharged from the supply means and including a slide movable toward said drive axis and engageable with successive blanks to move them to said drive axis,

(h) and there being a control to reversely operate the said forming and drive means with respect to the said advance means to simultaneously form and drive and retract the slide to receive the next successive fastener.

7. A fluid operated tool for the formation of blanks into fasteners and for driving said fasteners, and comprising,

(a) a frame having a cylinder portion disposed on a drive axis,

(b) a drive head at the lower end of the frame and with a fastener driveway therethrough on said axis and with an opening disposed transversely through the driveway,

(c) means to advance fastener blanks into the driveway at said opening, one at a time,

(d) means including transversely separable blocks movable together in said opening to releasably support a blank in said driveway at said opening,

(e) means actuated by a piston operable in said cylinder portion to form the supported blank into a finished fastener and then to separate the blocks,

(f) and means actuated by a piston operable in said cylinder portion to drive the finished fastener between the separated blocks and from the driveway,

(g) there being means to sequentially operate the two pistons in the order described.

8. A fluid-operated tool for the formation of blanks into fasteners and for driving said fasteners, and comprising,

(a) a frame having a cylinder portion disposed on a drive axis,

(b) a drive head at the lower end of the frame and with a fastener driveway therethrough on said axis and with an opening disposed transversely through the driveway,

(c) means to advance fastener blanks into the driveway at said opening, one at a time,

(d) means including transversely separable blocks movable together in said opening to releasably support a blank in said driveway at said opening,

(e) means actuated by a piston operable in said cylinder portion to form the supported blank into a finished fastener and then to separate the blocks,

(f) and means actuated by a piston operable in said cylinder portion to press the supported blank into firm engagement with said blocks and then to separate the blocks and to drive the finished fastener through and from the driveway,

(g) there being valve means controlled by movement of the last mentioned means to apply reduced pressure to the last mentioned piston to press the supported blank and to apply increased pressure to the last mentioned piston to drive the finished fastener through and from the driveway.

References Cited by the Examiner

UNITED STATES PATENTS

1,841,217	1/1932	Seizer	1—382
2,195,889	4/1940	Maynard	1—382
2,886,815	5/1959	Young	1—44.4
2,923,937	2/1960	Laucher	1—44.4

FOREIGN PATENTS

637,926	2/1928	France.

GRANVILLE Y. CUSTER, JR., *Primary Examiner.*