April 27, 1965 I. D. BOYNTON ETAL 3,180,550

FASTENER FORMING AND INSERTING DEVICE

Filed Dec. 3, 1962 4 Sheets-Sheet 1

FIG. 1

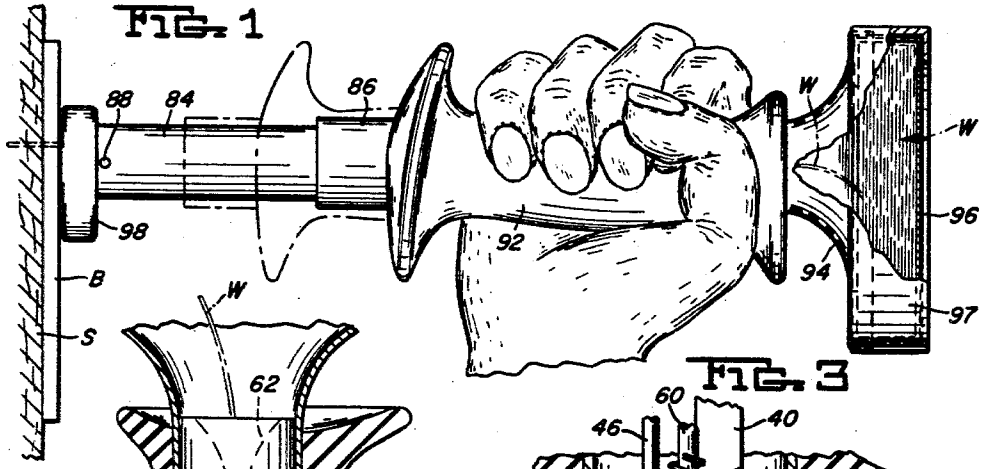


FIG. 2

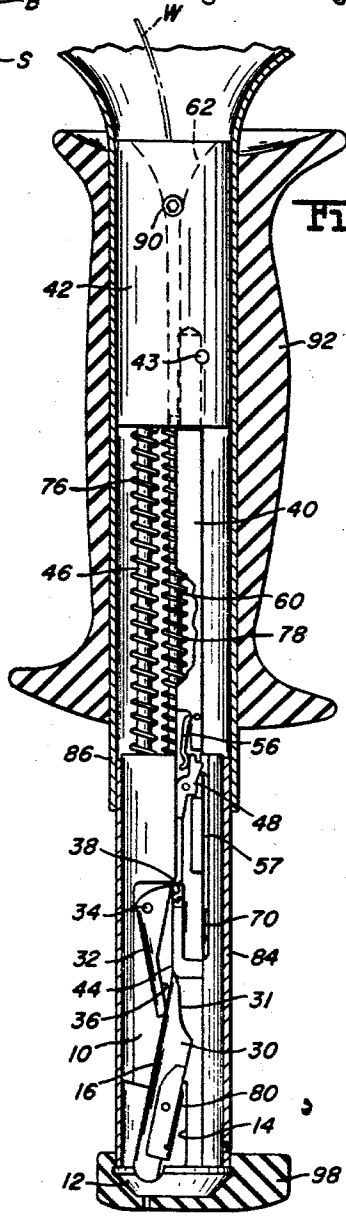
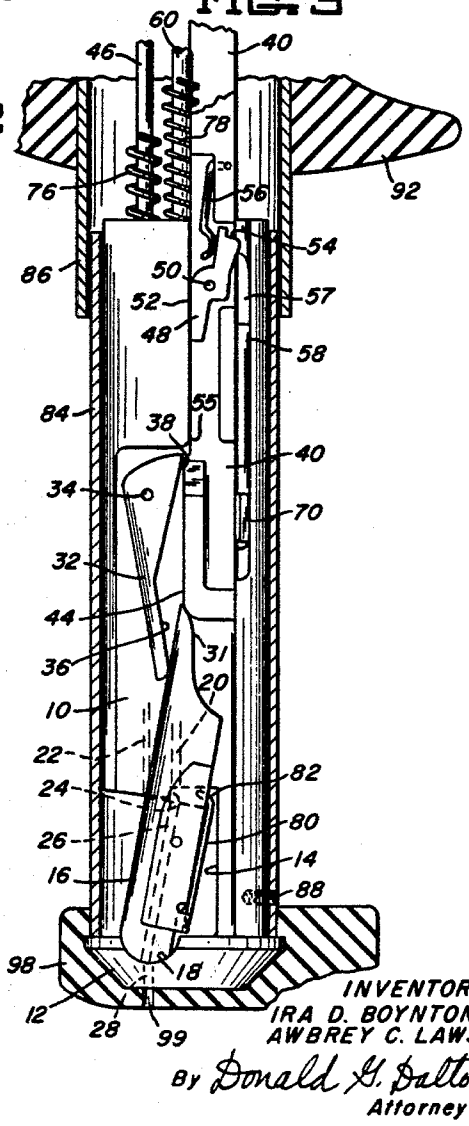


FIG. 3



INVENTORS
IRA D. BOYNTON
AWBREY C. LAWS
By Donald G. Dalton
Attorney

April 27, 1965 I. D. BOYNTON ETAL 3,180,550

FASTENER FORMING AND INSERTING DEVICE

Filed Dec. 3, 1962 4 Sheets-Sheet 2

FIG. 4

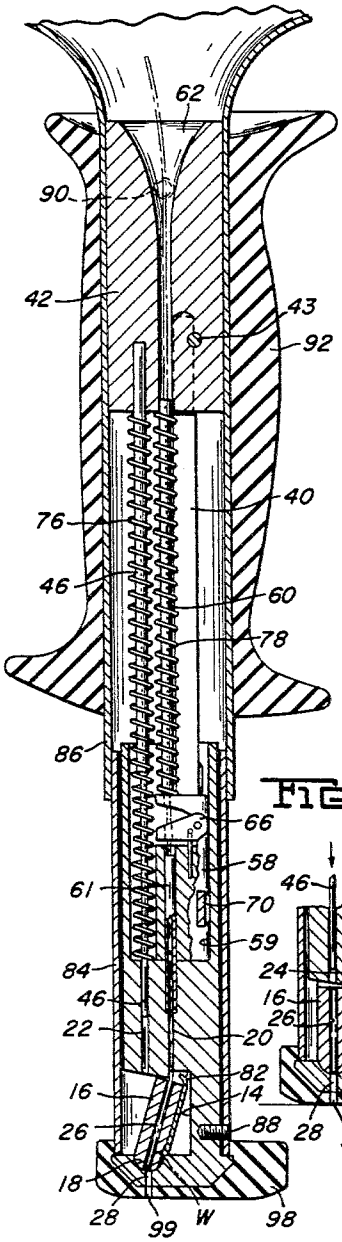


FIG. 5

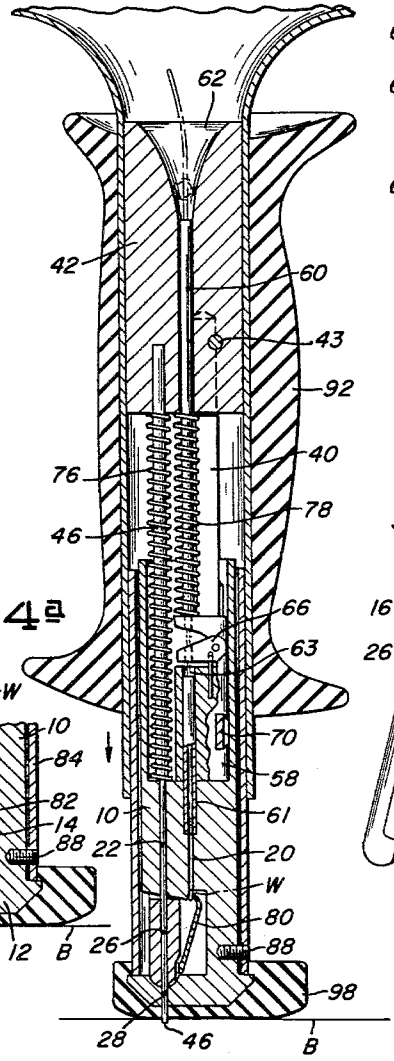


FIG. 4a

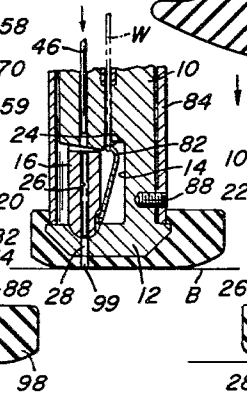


FIG. 8

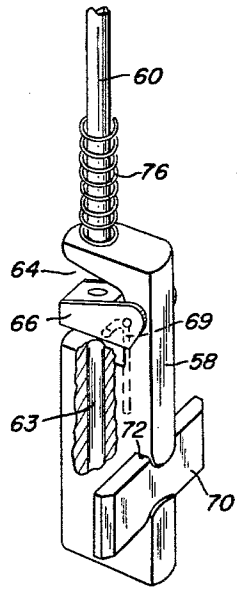
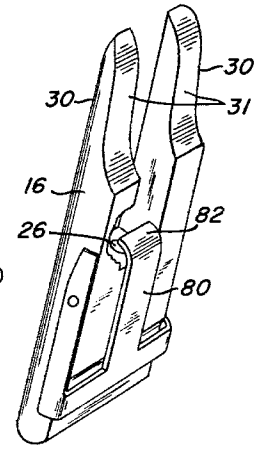


FIG. 9



INVENTORS
IRA D. BOYNTON
AWBREY C. LAWS

By Donald G. Dalton
Attorney

April 27, 1965 I. D. BOYNTON ETAL 3,180,550

FASTENER FORMING AND INSERTING DEVICE

Filed Dec. 3, 1962 4 Sheets-Sheet 3

FIG. 6

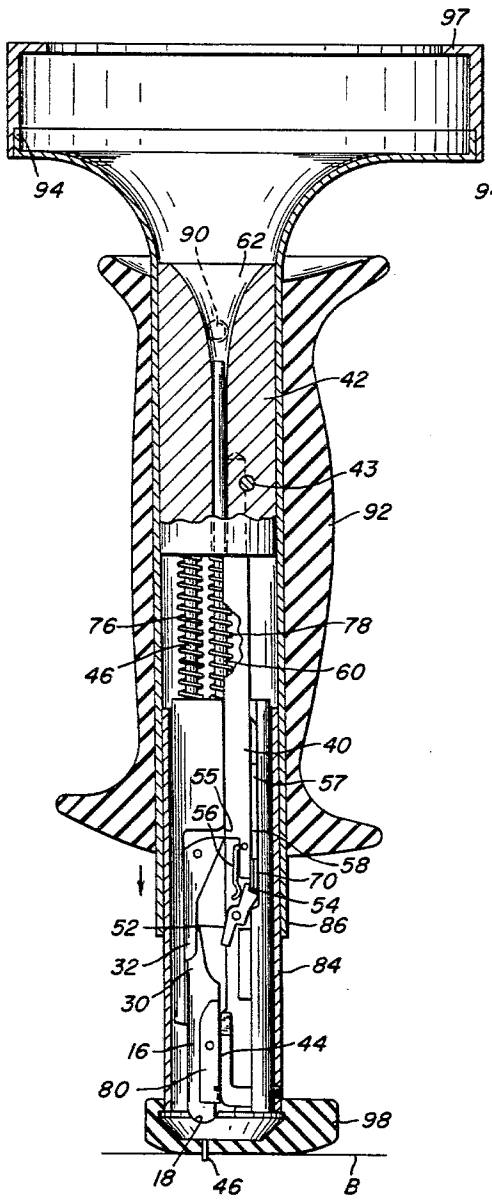
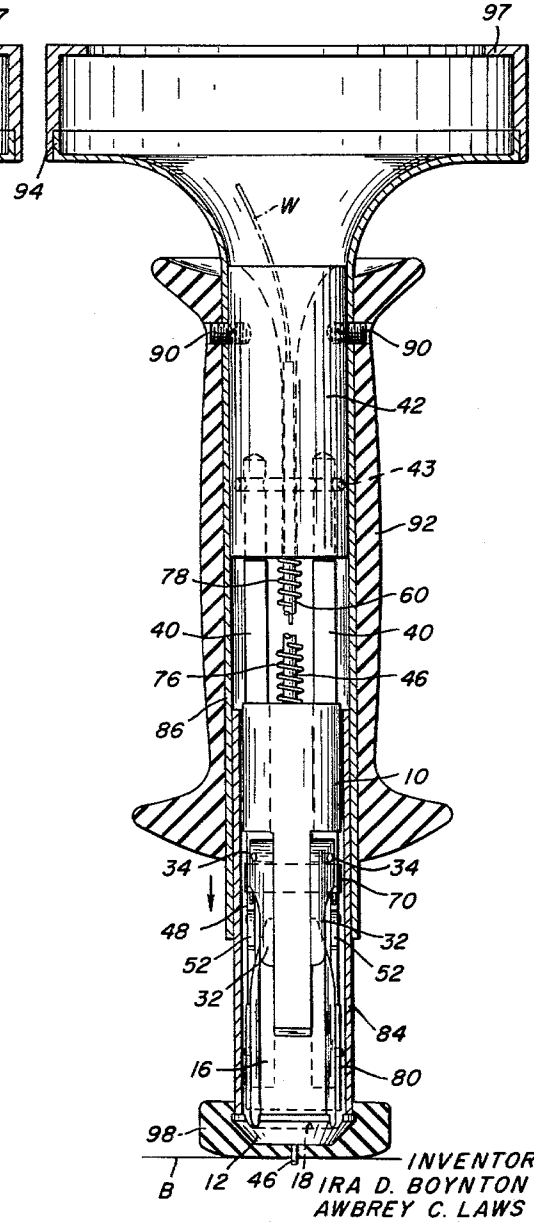


FIG. 7



INVENTORS
IRA D. BOYNTON
AWBREY C. LAWS
By Donald G. Dalton
Attorney

April 27, 1965 I. D. BOYNTON ETAL 3,180,550

FASTENER FORMING AND INSERTING DEVICE

Filed Dec. 3, 1962 4 Sheets-Sheet 4

FIG. 13

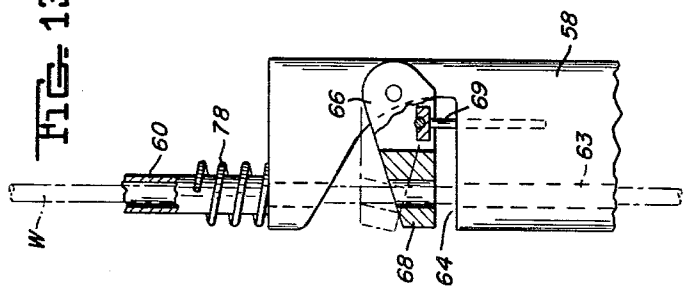


FIG. 12

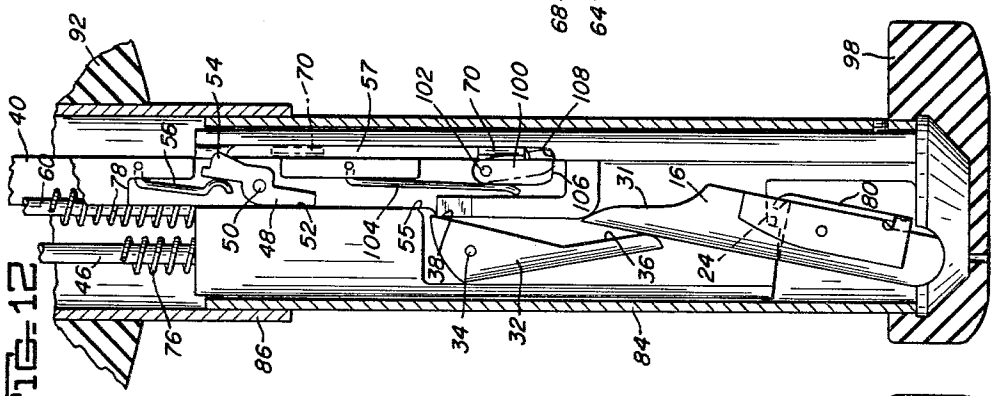


FIG. 11

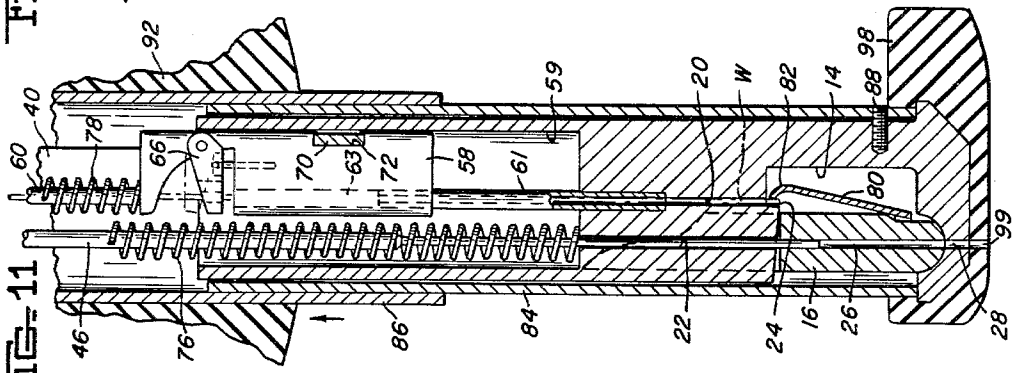
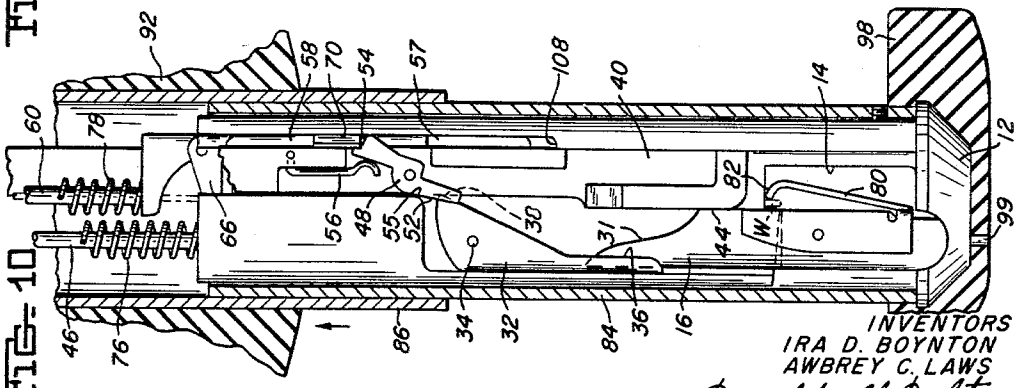


FIG. 10



INVENTORS
IRA D. BOYNTON
AWBREY C. LAWS
By Donald G. Dalton
Attorney

United States Patent Office 3,180,550 Patented Apr. 27, 1965

3,180,550

FASTENER FORMING AND INSERTING DEVICE

Ira D. Boynton, Lexington, and Awbrey C. Laws, Boston, Mass., assignors, by mesne assignments, to United States Steel Corporation, a corporation of New Jersey

Filed Dec. 3, 1962, Ser. No. 241,879
6 Claims. (Cl. 227—93)

This invention relates to devices for forming and inserting fasteners, and more particularly to a portable hand tool which, from a supply of wire, will shear and drive fasteners as required.

It is a principal object of this invention to provide a device which, from a supply of wire, will form and drive fasteners as required.

It is a further object of this invention to provide a portable hand tool which both forms and inserts wire fasteners as required.

Yet another object of this invention is the provision of an easily portable hand tool which will quickly and repetitively form and insert wire fasteners.

It is a more particular object of this invention to provide a portable hand tool which is supplied with a coil of wire, and upon each actuation will shear a fastener from the wire and drive the sheared fastener.

Still a further more specific object of this invention is the provision of a hand tool which is supplied with a coil of wire, and which upon actuation will first shear a fastener from the wire, and then insert the sheared fastener, and then return to a position ready to repeat the operation.

Other objects and advantages of the invention will become apparent from the following description and accompanying drawings, in which:

FIGURE 1 is a view of the device of this invention held in position for operation;

FIGURE 2 is an elevational view of the device on an enlarged scale from FIGURE 1 partially in section showing the parts within the housing;

FIGURE 3 is an enlarged view of a portion of the device of FIGURE 2;

FIGURE 4 is a sectional view taken along the center line of the device on its plane of symmetry;

FIGURE 4*a* is a sectional view of a portion of the device during operation after shearing the fastener;

FIGURE 5 is a view similar to FIGURE 4 showing the device as it has just completed its movement to drive a fastener;

FIGURE 6 is a view similar to FIGURE 2 showing the device after it has just completed its movement to drive a fastener;

FIGURE 7 is a view similar to FIGURE 6, the device being rotated 90°;

FIGURE 8 is a perspective view of the wire feeding slide;

FIGURE 9 is a perspective view of the wire supporting yoke with the clamping spring attached thereto;

FIGURE 10 is a view of a portion of the device during its return movement after driving the fastener;

FIGURE 11 is a sectional view of the same portion of the device as FIGURE 10 taken along the center line of the device;

FIGURE 12 shows a modification of the device wherein locking cams are provided; and

FIGURE 13 is an enlarged detailed elevational view partially in section showing the operation of a portion of the wire feeding mechanism.

Referring now to FIGURE 1, the device of this invention is shown in normal horizontal position for use to fasten a strip of panel board B to a wooden stud S. It is

with the tool in this position that the directions referred to hereinafter are oriented.

Referring now to FIGURES 2 through 4, the components of the device are shown, the device being in its retracted position ready to form and drive a fastener.

The device includes a block 10 having at one end a support base 12. The block 10 has a cut out portion 14 adjacent the base 12 in which is disposed a wire support yoke 16. The yoke 16 is mounted for pivotal movement in an arcuate groove 18 formed in the support base 12. A pair of longitudinally extending through bores 20 and 22 are formed in the block 10, the bores terminating at the cut out portion 14. A shoulder 24 is formed on the block 10 at the terminal end of the bore 20. A through longitudinal bore 26 is provided in the yoke 16 which is aligned with a bore 28 in the support base 12 when the device is in the position shown in FIGURES 2–4. The yoke 16 has a pair of extensions 30 (FIGURE 9) which are disposed on opposite sides of the block 10, each having arcuate camming surfaces 31. A pair of cam levers 32 are pivotally mounted on pins 34 on opposite sides of the block 10, and each is provided with a forward camming surface 36 and a rearward camming surface 38. The forward surfaces 36 are operable against the extensions 30 of the yoke 16.

A pair of cam rods 40 are slidably mounted on opposite sides of the block 10, and each is connected to a cylindrically-shaped drive member 42 by a retaining pin 43. The cam rods 40 each have upper camming surfaces 44 which are operable against the arcuate surfaces 31 on the yoke extensions 30 and against the rear camming surfaces 38 of the cam levers 32. The drive member 42 has extending therefrom a plunger 46 which extends into the longitudinal bore 22. Each of the cam rods 40 is provided with a generally Z-shaped camming member 48 pivotally mounted on a pin 50. The members 48 each have an upper camming surface 52 and a lower engaging surface 54. The upper camming surfaces are positioned to co-act with camming shoulders 55 on block 10 and springs 56 bias the camming members 48 to urge the lower engaging surface 54 into grooves 57 formed in the block 10.

The wire feeding mechanism includes a slide member 58 slidably mounted in a slot 59 on the block 10. The slide member 58 has a tube 60 extending rearwardly therefrom, and has a bore 63 which slidably engages a tube 61 extending rearwardly from bore 20. The tube 60 extends into a bell-mouthed bore 62 formed in the drive member 42. The slide member 58 is provided with a notch 64 in which is disposed a pivotally mounted locking collar 66 (FIGURES 8 and 13). The collar 66 has an annular tungsten carbide insert 68, the opening of which is aligned with both the tubes 60 and 61. A biasing spring 69 normally urges the collar 66 rearward toward the tube 60. A key 70 is mounted transversely on the slide member 58 in key slot 72 and the opposite ends thereof extend into grooves 57. Thus, the ends of the key 70 are positioned to co-act with the lower engaging surfaces 54 of the camming member 48. Coil springs 76 and 78 surround respectively the plunger 46 and the tube 60 normally biasing the drive member 42 and block 10 apart. A wire retaining clamp 80, in the form of a leaf spring is mounted on the yoke 16 and has a projection 82 located adjacent the shoulder 24.

The barrel and drive members are enclosed by a pair of telescoping tubes 84 and 86, with tube 84 being secured to the block 10 by set screws 88 and the tube 86 being secured to the drive member 42 by set screws 90. A synthetic rubber handle 92 is moulded onto the tube 86 to provide for gripping of the device. The remote end of the tube 86 flares outwardly to a circular rim 94 which is adapted to peripherally embrace a cylindrical

cartridge 96 of wire W. An annular clamp 97 is provided to secure the cartridge in place by clamping over the cartridge 96 and engaging the rim 94. The wire W feeds from the end of the cartridge through the tube into the bell mouthed bore 62 in the drive member, through tube 60 to the slide member 58, through the collar 66, thence through tube 61 to bore 20 and from bore 20 into the bore 26 of the yoke 16 when the yoke is in the position shown in FIGURES 2–4. Each of the bores 20, 22, 26 and 28 are slightly larger than the wire which the device uses to form the fasteners. A synthetic rubber cap 98 is placed on the base 12 and has a bore 99 aligned with bore 28 in the base.

Operation

The device is gripped as shown in FIGURE 1 and the cap 98 is placed against the board to be nailed at the desired location. The handle is then actuated to the left which will shear and drive a fastener, and then is released allowing the device to return to the right feeding the wire into position for the next use. When the handle is actuated the drive member drives the cam rods toward the support base of the block. For convenience, this movement of the drive member toward the block will be referred to as forward movement and movement of the drive member away from the block will be referred to as return movement. During the forward movement the upper surfaces of the cam rods 40 will disengage the rear camming surfaces 38 of the cam members 32 and will engage the arcuate cam surfaces 31 of the yoke extensions 30. This will cause the yoke to pivot from its position as shown in FIGURE 3 to the position shown in FIGURE 10. As the yoke pivots, the wire is sheared against the edge of the shoulder 24, thus providing a length of wire in the bore 26 of the yoke. This length of wire is the fastener. The cam rods 40 will continue moving the yoke until the bore 26 therein is aligned with the bore 22 in the block. Also, movement of the yoke will force the projection 82 of the clamp 80 against the sheared end of the wire firmly holding it against the shoulder 24. Movement of the drive member 42 will also move the plunger 46 in the bore 22, and the length of the plunger 46 is selected so that it will not project from the bore 22 until the bore 26 in the yoke 16 has been moved into alignment with the bore 22. The end of the device is shown in FIGURE 4*a* after the yoke has sheared the fastener and aligned the bore 26 with the bore 22 just prior to the entrance of the plunger 46 into the bore 26. Continued movement then of the drive member 42 will force the plunger 46 into the bore 26 of the yoke which will force the sheared length of wire from the bore 26 through bore 28 in the base 12 and through bore 99 in cap 98, thus driving the wire into the board. The length of the plunger is also selected so that it will project slightly beyond the face of the cap when the drive member has moved to its fully forward position with the end of cam rods abutting the disc. In this fully forward position the camming members 48 have cammed over the key 70 and the lower engaging surface 54 thereof is engaging the key 70. This fully forward position is shown in FIGURES 5, 6 and 7. When this position has been reached, a length of wire has been sheared to form a fastener and the fastener has been driven into the board. When pressure is released from the handle, the device will return to its normal position and in returning will advance the wire to a position ready to shear the next fastener. When pressure is removed from the handle the spring 76 which was compressed between the drive member 42 and the block 10 when the drive member was driven forward will force the drive member away from the block causing the cam rods 40 to start sliding rearwardly away from the base. When the return movement of the cam rods 40 starts the lower engaging surfaces 54 of the camming members 48 contact the key 70 moving the slide 58 rearwardly away from the support base 12.

During this rearward movement of the slide the collar 66 will pivot forwardly against the force of spring 69 to the full line position shown in FIGURE 13 and will slide along the wire, the wire being held from movement by the clamping action of the clamp 80. The slide will continue to be moved with the cam rods 40 until the upper camming surfaces 52 of the cam members 48 encounter the camming shoulders 55 on the block 10. The shoulders 55 will pivot the camming members against the bias of the springs 56 thus raising their lower engaging surfaces 54 out of contact with the key 70. When the camming members 48 disengage the key 70 the force of spring 78 which has been maintained under compression by the rearward movement of the slide 58 will tend to drive the slide toward the support base 12. This movement of the slide will cause the collar 66 to pivot to a position intermediate its rearmost position and the position shown in full lines, this being the position shown in chain lines in FIGURES 11 and 13 which will cause the carbide insert to grip the wire and urge it forward toward the support base. Shortly after the camming members 48 release the slide, the upper camming surface 44 of the cam bars engage the rear cam surfaces 38 of the cam levers 32 causing the cam levers 32 to pivot about pins 34. During this pivoting movement of the cam levers 32, the front cam surfaces 36 thereof pivot the yoke 16 back to its original position. This will release the clamp 80 from the wire, and when the bore 26 of the yoke 16 comes into alignment with the bore 20, the slide will be driven toward the support base by the spring 78 carrying with it the gripped wire. Thus, when the device has returned to its original position the wire will have been fed into the yoke ready to be sheared to a fastener.

It will be readily apparent that the length of the fastener formed will depend upon the distance of movement of the slide 58 when feeding the wire. The distance of movement of the slide is dependent upon the relative positions of the camming surfaces 44 and the camming members 48. The greater the distance that the camming member moves the slide during the return movement the greater will be the length of wire fed to the yoke.

The modification of the device shown in FIGURE 12 has provided on the cam rods (one of which is shown) locking members 100. Each locking member 100 is mounted for pivotal movement on a pin 102 and biased by a spring 104. The locking members 100 each have a forward locking surface 106 which is positioned to abut a co-acting surface 108 formed on the block 10 at the end of groove 57. When the device is in its normal position, ready for use, with the wire having been fed by the slide to the yoke, the key 70 pivots the locking member against the biasing of springs 104 to raise their forward surfaces 106 above the co-acting surfaces 108 and thus allow the cam bars free forward movement along the block 10. If, however, a malfunction should occur, and for some reason the slide should not feed the wire into the yoke and hence remain in its rearward position, the key 70 would be back in the position shown in chain lines in FIGURE 12. In this position the springs 104 would bias the locking surfaces 106 of the locking members 100 against co-acting surfaces 108 on the block. In this position any attempted forward movement of the cam bars would be blocked by the co-acting locking surfaces 106 and 108 and operation of the device would be prevented until the malfunction is corrected.

While one embodiment of our invention has been shown and described it will be apparent that other adaptations and modifications may be made without departing from the scope of the following claims.

We claim:

1. Apparatus for forming and inserting wire fasteners comprising, a frame member and a drive member, said frame member having an end cap, said cap having a through axial bore, a support yoke pivotally mounted on said end cap and movable from a wire receiving po-

sition to a fastener inserting position, said yoke having a bore aligned with the bore in said cap, said frame member having a first longitudinal bore aligned with the bore in said yoke when the yoke is in the wire receiving position and adapted to guide the wire into the bore of the yoke, and a second longitudinal bore aligned with the bore of said yoke when the yoke is in the fastener inserting position, a pair of cam bars carried by said drive member and slidably mounted on said frame member to move said yoke from said wire receiving position to said fastener inserting position when the drive member is driven toward said frame member, cam means co-actable with said cam bars and said yoke to move said yoke back to the wire receiving position when the drive member is moved away from said frame member, said frame member including a shearing surface positioned to shear the supported end of the wire as the yoke moves from the wire receiving position to the fastener inserting position, a plunger carried by said drive member and extending into said second longitudinal bore in the frame member, said plunger being reciprocally movable into the bore of said yoke when the drive member is driven toward the frame member to eject the sheared fastener from said yoke bore and retractable from said bore in the yoke when said drive member is moved away from said frame member, said cam bars being positioned to maintain said yoke in the fastener inserting position until the plunger is retracted from said yoke bore, a wire feeding slide slidably mounted on frame member for movement toward and away from said cap and adapted to feed wire to said first longitudinal bore in said frame member, said slide including a pivotally mounted gripping collar adapted to grip and move a wire when moving in a direction toward said cap and to override the wire when moving away from said cap, and key means co-actable with said cam bars and said slide to move said slide away from said cap for a predetermined distance and then release said slide when said drive member is moved away from said frame member, first spring means normally urging said drive member away from said frame member, second spring means normally urging said slide toward said cap, and handle means mounted on said drive member.

2. Apparatus for forming and inserting wire fasteners comprising a frame member, a support yoke pivotally mounted on said frame member adjacent the forward end thereof and movable between a wire receiving position and a fastener inserting position, said yoke having a through longitudinal bore adapted to provide columnar support to the end portion of a length of wire, a longitudinal reciprocating drive member movable between rearward and forward positions, means actutable by said drive member on its forward movement for moving said yoke to said fastener inserting position, said frame member having a shearing surface positioned to shear the end portion of the wire to form a fastener as the yoke moves from the wire receiving position to the fastener inserting position, a rod carried by said drive member for forcing the fastener from said yoke when the drive member is moved forwardly, means to feed the end of a length of wire to said support means when it is in the wire receiving position, and means actuatable by said drive member on its rearward movement to return the yoke to its wire receiving position and then actuate said wire feeding means to feed the length of wire into the bore of said yoke.

3. Apparatus for forming and inserting wire fasteners according to claim 2 including a clamp mounted on said yoke, said clamp preventing forward movement of the length of wire when the yoke is in fastener inserting position.

4. Apparatus for forming and inserting wire fasteners comprising a frame member, a support yoke pivotally mounted on said frame member adjacent the forward end thereof and movable between a wire receiving position and a fastener inserting position, said yoke having a through longitudinal bore adapted to provide a columnar support to the end portion of a length of wire, a longitudinal reciprocating drive member movable between rearward and forward positions, means actuatable by said drive member on its forward movement for moving said yoke to said fastener inserting position, said frame member having a shearing surface positioned to shear the end portion of the wire to form a fastener as the yoke moves from the wire receiving position to the fastener inserting position, said frame member having a first longitudinal bore aligned with the bore in said yoke when the yoke is in the wire receiving position and adapted to guide the wire into the bore of the yoke, and a second longitudinal bore aligned with the bore of said yoke when the yoke is in the fastener inserting position, a rod carried by said drive member for forcing the fastener from said yoke when the drive member is moved forwardly, and means actuatable by said drive member on its rearward movement to return the yoke to its wire receiving position and then actuate said wire feeding means to feed the length of wire into the bore of said yoke.

5. Apparatus for forming and inserting wire fasteners according to claim 4 including a clamp mounted on said yoke, said clamp preventing forward movement of the length of wire when the yoke is in fastener inserting position.

6. Apparatus for forming and inserting wire fasteners comprising a frame member, a support yoke pivotally mounted on said frame member adjacent the forward end thereof and movable between a wire receiving position and a fastener inserting position, said yoke having a through longitudinal bore adapted to provide columnar support to the end portion of a length of wire, a pair of cam bars carried by said drive member and slidably mounted on said frame member to move said yoke from said wire receiving position to said fastener inserting position when the drive member is driven toward said frame member, cam means co-actable with said cam bars and said yoke to move said yoke back to the wire receiving position when the drive member is moved away from said frame member, said frame member including a shearing surface positioned to shear the supported end of the wire as the yoke moves from the wire receiving position to the fastener inserting position, a plunger carried by said drive member, said plunger being reciprocally movable into the bore of said yoke when the drive member is driven toward the frame member to eject the sheared fastener from said yoke bore and retractable from said bore in the yoke when said drive member is moved away from said frame member, said cam bars being positioned to maintain said yoke in the fastener inserting position until the plunger is retracted from said yoke bore, a wire feeding slide slidably mounted on frame member for movement toward and away from said cap and adapted to feed wire to said bore in said yoke, said slide including a pivotally mounted gripping collar adapted to grip and move a wire when moving in a direction toward said cap and to over ride the wire when moving away from said cap, key means co-actable with said cam bars and said slide to move said slide away from said cap for a predetermined distance and then release said slide when said drive member is moved away from said frame member, first spring means normally urging said drive member away from said frame member, and second spring means normally urging said slide toward said cap.

References Cited by the Examiner

UNITED STATES PATENTS

2,315,382	3/43	Ajouelo et al.	1—29
2,698,681	1/55	Wright et al.	

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