Jan. 31, 1961 H. G. ALLEN 2,969,545

FASTENER-APPLYING IMPLEMENT

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FIG. 9

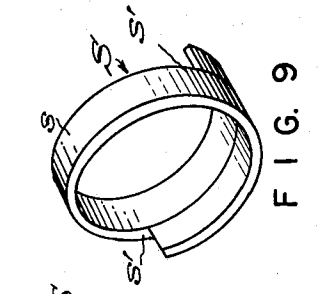


FIG. 8

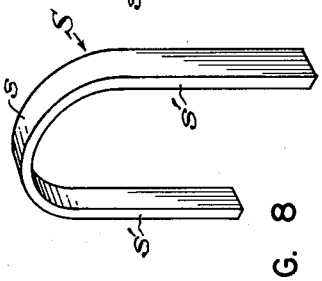


FIG. 1

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FASTENER-APPLYING IMPLEMENT

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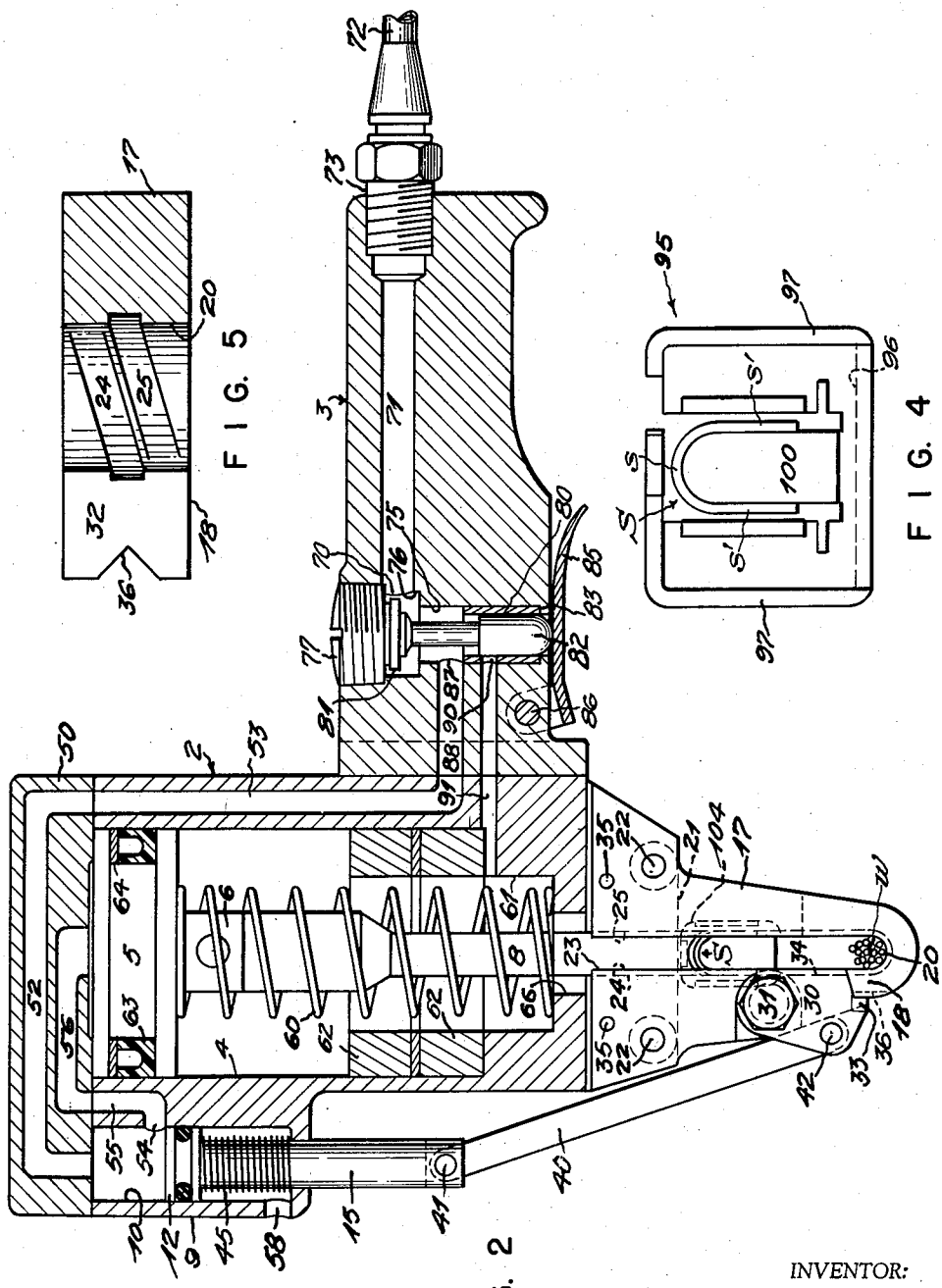


FIG. 2

FIG. 5

FIG. 4

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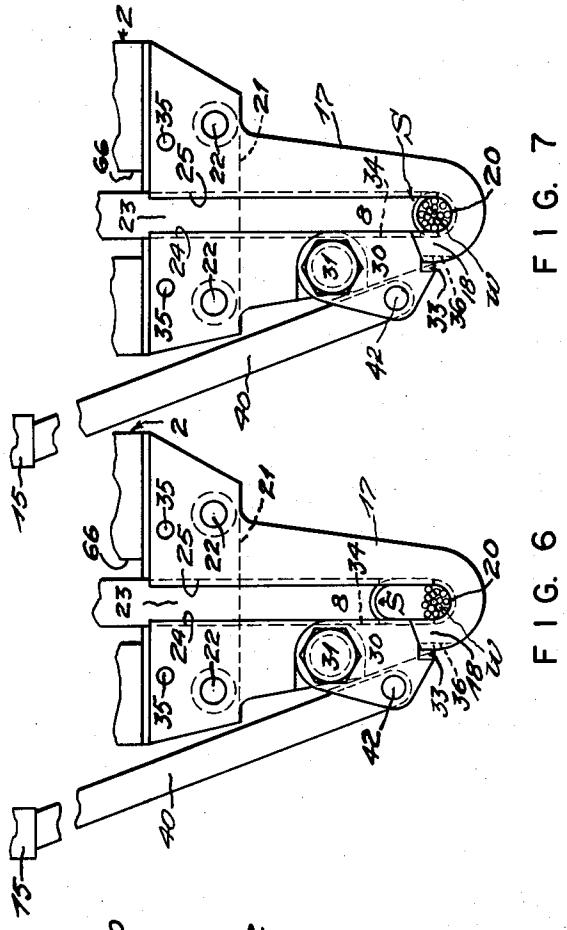


FIG. 7

FIG. 6

FIG. 3

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2,969,545

FASTENER-APPLYING IMPLEMENT

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16 Claims. (Cl. 1—187)

This invention relates to a machine for forming fasteners around various objects to bind together a plurality of strands, such as the conductor of wires of an electrical harness; or a single article such as a cord or small rope for binding off its ends; also for binding together the crossed strands of wire mesh fabric; fastening in place the coil springs of upholstery; and in other instances, for closing and sealing the mouths of sacks or bags used in commerce for containing commodities.

More particularly, the present machine is provided with a cavity for receiving and holding the work and embodies means for driving a fastener, such as a wire staple, into the cavity to bend it around the work in the form of a ring having its ends overlapped in close relationship to effect a substantially permanent clinch.

As herein shown the invention is embodied in a portable implement which may be operated by pneumatic or hydraulic pressure for actuating reciprocable pistons. In other instances, however, the invention may be applied to use in a stationary machine driven by any suitable power means.

One object of the invention is to provide an implement of the type indicated of light weight capable of being held in one hand for operation to apply it to use.

Another object is to provide an implement or machine of the type indicated capable of being operated continuously at a high rate of speed and efficient in operation for the purposes described.

Another object is to provide an implement of the type specified adapted for economical cost of construction and proof against undue wear and deterioration in use.

One preferred form of construction of the implement is described, by way of example, in the following specification illustrated by the accompanying drawings. In the drawings:

Fig. 1 is a side elevational view of the machine shown partly in vertical section along the axis thereof and illustrating the work-receiving cavity as open for insertion of the work;

Fig. 2 is a similar sectional view showing the opening to the cavity closed by a gate after the work has been placed therein;

Fig. 3 is a part-sectional elevational view of the machine taken in a plane at right-angles to the plane of the sections shown in Figs. 1 and 2;

Fig. 4 is an enlarged front end view of the staple magazine showing the core on which the staples are mounted to feed forwardly to the driving means;

Fig. 5 is a transverse sectional view on line 5—5 of Fig. 1, greatly magnified to illustrate the helical formation of the grooves in the work-holding cavity for guiding the legs of a staple to clinch them in offset parallel relationship;

Fig. 6 is a front elevational view of the hook-shaped nosepiece projecting below the head of the implement and having a cavity for receiving the work with an opening thereinto closed by a gate;

Fig. 7 is a similar view showing the gate closed with the staple finally driven and formed into a ring encircling the work for binding together a plurality of objects;

Fig. 8 is a greatly enlarged perspective view of a preperred form of staple for use in the machine; and

Fig. 9 shows the staple as finally formed with its legs displaced helically in close contact and clinched in a ring.

As herein exemplified the invention is embodied in a portable stapling implement comprising a vertical head 2 for containing the operating elements of the machine and a horizontal handle 3 projecting rearwardly therefrom. The head 2 may be of hollow rectangular or cylindrical construction with a relatively large vertical bore 4 therein containing a reciprocable piston 5 for actuating a plunger 6 carrying a staple-driving blade 8 of usual form. The head 2 is formed with an enlargement 9 at the front in which is a vertical bore 10 containing a smaller piston 12 for actuating a plunger 15. Projecting downwardly from the bottom of the head 2 is a nosepiece 17 terminating in a hook-shaped portion 18 recessed to provide a circular cavity 20 for receiving and holding the work to be bound.

The nosepiece 17 may be fastened to a depending ledge 21 on the under side of the head 2 by means of screws 22 (Figs. 1–2) passing therethrough from the rear and threaded into the nosepiece. The nosepiece 17 is formed with a vertical slot 23 extending downwardly throughout its length and provided with grooves 24 and 25 in the sides thereof to form a throat for receiving the edges of the driver-blade 8 to slide therein; it being noted that the groove 25 extends clear down and completely around the circular cavity 20. An aperture or opening 26 extends transversely into the slot 23 above the cavity 20 and thereby interrupts the continuity of one side of the slot 23 in which the groove 24 is located. The opening 26 is adapted to be closed by a gate 30 pivoted on a stud 31 screwed into the nosepiece 17.

The closure or gate 30 is of generally tapering formation or wedge-shaped with its free end adapted to engage across the beveled end 32 of the hook 18 at the end of the nosepiece 17 (Fig. 2) to aline its rearward side with the forward edge of the slot 23. This rearward side of the gate 30 is formed with a groove 34 adapted to aline with the groove 24 in the edge of the slot 23 when the gate is closed; thus providing a continuation of the throat in which the driver-blade 8 slides. A pair of dowel pins 35 are employed for locating the nosepiece 17 with its throat or slot 23 in accurate alinement with the driver-blade 8. For insuring accurate alinement of the groove 34 in the side of the gate 30 with the groove 24 in the edge of the throat 23 a V-shaped projection 33 at the end of the gate engages in a V-shaped notch 36 (Fig. 5) on the side of the hook 18.

A link 40 pivotally connected at 41 to the plunger 15 of the piston 12 has its lower end pivoted at 42 to the gate 30 for operating it. A helical spring 45 encircling the plunger 15 is seated on the bottom of the bore 10 at the front of the head 2 with its upper end engaging under the piston 12 to normally maintain it raised with the gate 30 rocked open as shown in Fig. 1.

A cap or cover 50 overlies the top of the head 2 and is fastened down thereagainst by means of screws 51 (Fig. 3) having their heads seated in counterbores in the cap and their shanks engaging in threaded holes in the top of the bead. The cap 50 is formed with a horizontal air-passage 52 at the top directed downwardly at one end to communicate with a vertical passage 53 at the side of the head 2 that receives the fluid pressure from a source

in the handle 3 as later described. At its opposite end the passage 52 is directed downwardly to discharge into the top of the bore 10 for applying pressure to the piston 12 which actuates the plunger 15 for moving the link 40 to close the gate 30. Near the top of the bore 10 a port 54 opens through its side into a vertical passage 55 that communicates with the end of a horizontal passage 56 opening into the top of the larger bore 4. It will thus be seen that when the piston 12 descends for closing the gate 30 the port 54 will be opened in sequential order (Fig. 2) to apply the pressure to the main piston 5 for causing the descent of the driver-blade 8. A port 58 at the bottom of the bore 10 is open to the atmosphere to exhaust the pressure under the piston 12 as the latter descends. A helical spring 60 surrounding the blade 8 and plunger 6 normally maintains the piston 5 raised. The lower end of the spring 60 is seated on the bottom of a reduced extension 61 of the bore 4 with a pair of annular buffers 62 in the bottom of the main bore 4 adapted to cushion the shock of the piston 5 as it reaches the end of its downward stroke. The piston 5 is recessed around its rim to receive a resilient gasket 63 of U-shape in cross-section held down by a flat retainer ring 64. A relatively large opening 66 at the bottom of the bore 61 provides for exhausting the air as the piston 5 descends.

Pneumatic or hydraulic pressure may be applied to drive the pistons 5 and 12 by means of a manually-operable valve 70 in the handle 3. A passage 71 extending longitudinally of the handle 3 may be connected to a suitable source of pressure by means of a hose 72 having a threaded nipple 73 at its end screwed into the end of the handle to communicate with said passage. A vertical bore 75 in the handle 2 has an enlargement 76 at its upper end for communication with the inlet passage 71, being closed at the top by a screw-plug 77. A poppet 80 has a head 81 adapted to seat across the upper end of the bore 75 to close admittance of the pressure thereinto; the lower portion of its stem 82 being enlarged to slide in a bushing 83 fitted to the bore 75. A trigger 85 pivoted at 86 to the under side of the handle 2 is normally engaged with the rounded end of the stem 82 of the poppet 80 for raising it to open the bore 75 for admitting pressure thereinto from the passage 71. On one side of the bore 75 is a port 87 opening into a passage 88 connected at its end with the vertical passage 53 at the side of the bore 4. A second port 90 in the bore 75 connects it with a passage 91 continued through the side of the head 2 to debouch into the lower portion 61 of the bore 4. The purpose of this latter passage is to relieve the pressure above the pistons 5 and 12 as they are raised by their springs 45 and 60 when the valve 70 is closed. It will thus be observed that when the trigger 85 is lifted to raise the poppet 80 the lower enlarged portion of its stem 82 will close this latter port 90 in the manner and for the purpose as later explained.

A preferable type of staple S (Fig. 8) for use in the present machine may be shaped with an arcuate or curved crown *s* and opposite parallel legs *s'* projecting downwardly therefrom. Staples of this form may be fed to the driving means in the head 2 of the implement from a magazine 95 such as shown in Fig. 3. The magazine 95 may be attached to the depending nosepiece 17 on the under side of the head 2, being usually constructed as shown in Fig. 4 with a bottom 96 and upstanding sides 97. The sides 97 are folded inwardly at the top to overlie a core 100 extending longitudinally within the magazine. Adjacent the forward end of the magazine 95 is an upstanding flange 101 fastened to the rearward face of the depending portion 21 of the head 2 by screws 102 to mount the magazine horizontally at the rear of the head extending at right-angles to the handle 3. The forward end of the magazine 95 abuts the rearward face of the nosepiece 17 with the end of the core 100 in alinement with the throat 23. At this point the rearward wall of the nosepiece 17 is cut away to provide an opening or door 104 (Fig. 2) through which the staples S are fed into the throat 23.

The staples S are supported in straddled relation across the core 100 that has a rounded or crowned top corresponding to the shape of the head of the staples S which are advanced along the core by means of the usual follower or pusher 105 drawn forwardly by a spring 106; these parts of the device not being described in detail as they may be of conventional construction for functioning in a well-known manner.

The mechanism of the present machine having been described in detail, its method of operation is explained as follows: After the magazine 95 has been loaded with fasteners, such as U-shaped staples of the type shown in Fig. 8, and the end of the handle 3 has been connected to a source of fluid-pressure by means of the hose 72, the handle is grasped in one hand and the implement applied to use by placing the work in the cavity 20 at the bottom of the nosepiece 17. As before indicated, the work may consist of various objects and articles such as a collection of parallel wires; the crossed strands in wire fabric; the coils of upholstery springs to be fastened in place; and numerous other articles such as bags to be sealed. With the gate 30 opened as shown in Fig. 1 the work is inserted through the aperture 26 to seat it in the cavity 20 of the nosepiece 17, as illustrated for example in Fig. 2. At this time the foremost staple S in the magazine 95 will have been fed off from the end of the core 100 and entered through the door 104 into the throat or raceway 23 of the nosepiece 17. The spring-actuated pusher 105 will thus hold the staple pressed against the sides of the grooves 24 and 25 in the throat 23 to sustain it above the work *w* held in the cavity 20.

After the work *w* has been placed in the cavity 20 the opening 26 is closed by the gate 30 which is operated automatically by the smaller piston 12. To accomplish this, the operator lifts the trigger 85 (Fig. 2) by drawing his finger upwardly, thereby raising the poppet 80 and opening the valve 70 to admit the pressure from the passage 71 down into the bore 75. At this juncture, the port 87 being open permits the air to flow through the passages 88, 53 and 52 and enter the upper end of the bore 10 to drive the piston 12 downwardly. As the piston 12 descends its plunger 15 acts through the link 40 to rock the gate 30 downwardly for closing the opening 26 to the cavity 20 and confining the work *w* therein prior to applying the staple thereto. During the descent of the piston 12 in the bore 10 it uncovers the port 54 to admit pressure through the passages 55, 56 into the upper end of the larger bore 4. Pressure will therefore be applied to the piston 5 to drive its plunger 6 downwardly and thereby slide the driver-blade 8 down in the throat 23. It is to be noted that when the gate 30 is closed its grooved side provides full support for the staples and the driver-blade 8 as they descend across the opening 26. The lower edge of the driver-blade 8 is preferably of arcuate shape to correspond with the shape of the crown of the staple S and as it engages therewith the staple is rapidly driven down to cause the ends of its legs to be guided in the helical grooves 24 and 25 in the cavity 20 to bend them into a ring. The legs of the staple S will thus be disposed in overlapping helical relationship (Fig. 9) and clinched in substantially permanent connection enclosing the work as indicated in Fig. 7.

After the staple has thus been formed and bound around the work, the trigger 85 is released to permit the poppet 80 to descend under the pressure in the passage 71 and close the end of the bore 75. As a first result of this action, pressure in the upper end of the bore 4 is released to escape through the passage 56 down through passage 55 and into the upper end of the bore 10 above the depressed piston 12. The pressure is released from the upper end of the bore 10 to flow through the passage 52, channel 53 and passage 88 to enter the bore 75. With the valve 70 closed the pressure escapes

through port 90 and channel 91 and exhausts to the atmosphere at the opening 66 in the bottom of the head 2. As pressure is released above the piston 5 the spring 60 will return it to its initial raised position for repeating its operative stroke. After the piston 5 is released by the exhaust of pressure in the bore 4 the air will also be exhausted from the bore 10 passing through the channel 52 down through passage 53 into the bore 75, whence it may escape through the port 90 and passages 91 into the atmosphere from the opening 66. The piston 12 will thus be returned to initial relationship by the spring 45 and the implement will then be ready for another operation without further preparation.

It will be observed from the description in the foregoing specification that the present invention provides an exceedingly simple and efficient machine for applying binding bands or rings to various types of work. As before stated, the present implement is capable of being operated repeatedly at short intervals for rapidly producing the work and since it is of light weight and convenient to operate in one hand, fatigue is avoided. Moreover, the implement is convenient for insertion of the work and its removal therefrom since the gate to the work-holding cavity is operated automatically, being closed as soon as the work is inserted thereinto and immediately opened thereafter for its removal therefrom.

While the invention is herein described as embodied in a preferred form of construction and applied to a certain type of machine, it is to be understood that variations may be made in the form and structure of the parts of its mechanism and in the class of machine with which it is used without departing from the scope thereof as expressed in the appendant claims. Therefore, without limitation as to the exact form of construction herein disclosed, I claim:

1. A fastener-applying implement having a cavity for holding the work, an opening on the side of the cavity for insertion of the work thereinto, a gate movable to close said opening, a plunger for operating said gate, a fastener-driver, a second plunger for actuating said driver, and power means to initially operate the first-named plunger for closing said gate and thereafter operate said second plunger to actuate the fastener-driver.

2. In a fastener-applying implement having a head, a nosepiece on said head formed with a cavity for receiving the work to be fastened, an opening leading into said cavity, a member movable to open and close said opening, a piston in the head for moving said member to close said opening prior to driving a fastener, a second piston in the head, a staple-driver operated by said second piston for driving a fastener into the cavity to form it, means for actuating said pistons in sequence, and means for returning each piston to initial position after completion of driving a fastener and forming it around the work.

3. In a machine of the type indicated having a head, means below said head formed with a cavity having an entrance aperture opening thereinto, a gate movable to close and open said aperture, a piston in said head connected to operate said gate, a second piston in said head, a driver connected to said second piston for movement toward said aperture, fluid pressure means for driving said pistons, and manually-operable valve-means for applying said pressure to said pistons in sequence to first close said gate and thereafter actuate said driver for driving a fastener into the cavity to shape it for enclosing the work.

4. A staple-applying machine having a head with means thereon providing a cavity for receiving the work, an opening leading into said cavity, a gate movable to close said opening to the cavity, a throat extending toward said cavity, means to feed staples singly into said throat, a staple-driver reciprocable in said throat, a piston slidable in a bore in said head for driving said staple-driver, a second piston reciprocable in said head, and means connecting said second piston to operate said gate to close said opening prior to the operation of said staple-driver.

5. In a staple-applying implement having a head with a handle thereon, a piston slidable in a main bore in said head, a staple-driver connected to said piston, a second piston slidable in a second bore in said head, a nosepiece depending from said head and having a cavity for receiving the work with an opening leading thereinto for insertion of the work, a gate for closing the opening to said cavity, means connecting said second piston to said gate for operating it, fluid pressure means to drive said pistons in sequence, and a valve in said handle for initially admitting pressure to said second piston to close the gate and thereafter admitting pressure to said first piston to actuate the staple-driver to drive a staple into the cavity and form it around the work.

6. In a stapling implement provided with a cavity for holding the work to be stapled, an opening leading into the cavity for inserting the work thereinto, a gate movable to close said opening into the cavity, said cavity and gate formed with interior grooves for guiding a driven staple and forming it into a ring bound around the work, a cylinder on the implement, a piston in said cylinder connected to operate the gate to close said opening into the cavity, a second cylinder, a piston in said second cylinder, a staple-driver connected to said second piston, and means to apply fluid pressure to the gate-operating piston to initially close said opening and thereafter apply pressure to the second piston to actuate the staple-driver.

7. In a fastener-applying machine comprising a head, a handle projecting from the side of said head, a nosepiece projecting downward from said head and formed with a cavity for receiving the work, a throat leading into said cavity, said throat having an opening on its side communicating with said cavity, a gate for closing said opening, a piston in the head, a staple-driver connected to said piston for reciprocation in said throat, a second piston in said head connected to said gate for closing it, a valve in said handle, a source of fluid pressure, a channel leading from said valve to apply pressure to the second piston for driving it to close said gate, and a port in the side of the bore for said second piston with a passage leading therefrom to the bore for the first piston, said port being opened by the descent of the second piston to supply pressure to the first piston for actuating the staple-driver after the gate has been closed.

8. In a fastener-applying implement having a head with a main bore therein and a second supplementary bore, a first piston in said main bore, a nosepiece on said head formed with a throat for guiding staples therein, a cavity at the end of said throat for receiving the work, an opening in the throat communicating with said cavity, a gate movable to close said opening and form a continuation of said throat, a second piston in said supplementary bore, means connecting said second piston for operating said gate to close said opening in the throat, a driver connected to said first piston in the main bore for operation thereby to drive a fastener into the cavity and bind it around the work, and means to apply power to drive said pistons in sequence for first closing the gate and thereafter operating the fastener-driver.

9. A staple-applying implement having a head, a raceway in said head formed with grooves in its sides for guiding the legs of a staple to slide in said raceway, means for feeding staples into said raceway, a cavity adjacent said raceway in said head for receiving the work, a helical groove in said cavity communicating with said grooves in said raceway, an aperture opening into said cavity for insertion of the work, a gate for closing said aperture, a groove in said gate for cooperation with the grooves in the raceway and the groove in the cavity, initially-operated power means for closing said gate, means slidable in said raceway to force a staple into the cavity and form it helically around the work, and power means for operating said slidable means after the gate has been closed.

10. In a fastener-applying machine having a magazine for containing a supply of U-shaped fasteners, a throat at the end of said magazine for receiving a fastener fed thereinto from said magazine, a driver for driving the fastener through said throat, the combination therewith of a cavity adjacent the end of said throat for receiving the work, an aperture opening through said throat and into said cavity for insertion of the work thereinto, a movable member for closing said aperture, power means for operating said movable member to close said aperture, and power means operative to reciprocate said driver after said movable member has been actuated to close said aperture.

11. In a fastener-applying machine having a magazine for fasteners, a throat for receiving a U-shaped fastener fed from said magazine, the combination of a cavity at the end of said throat adapted to receive the work, a restricted passage opening through said throat to give access to said cavity for insertion of the work thereinto, a closure member movable to close said passage, power means for moving said member to close said passage, a driver reciprocable in said throat for driving a fastener to form it around the work held in said cavity, and power means for reciprocating said driver after said closure member has been operated to close said passage to the cavity.

12. In a fastener-applying implement having a substantially circular cavity for receiving the work, an opening at one side of the cavity for insertion of the work thereinto, a helically extending groove in the interior of said cavity, a pivotally mounted gate for closing said opening, a throat above said cavity for receiving a fastener fed thereinto, grooves in said throat connected to said grooves in said cavity and said gate, a fastener-driver reciprocable in said throat, power-operated means for pivoting said gate to close the opening to the cavity, and power means operative thereafter for driving a fastener into said cavity to form it helically into a ring surrounding the work in said cavity.

13. In a machine for binding several articles together by applying fasteners thereto and forming them thereabout, a cavity in the machine for receiving the articles to be bound, an opening communicating with said cavity for insertion of the articles thereinto, a pivotally mounted gate for closing said opening to the cavity, a throat leading into said cavity, a driver reciprocable in said throat for driving the fasteners into the cavity and forming them around the articles to be bound, power means for pivoting said gate to close said opening to said cavity, manually-operable control means for actuating said power means, and means operated in timed relation to the first-named power means for actuating said driver after said gate has been closed.

14. In a portable fastener-applying implement having a head and a handle thereon for transporting it, a cavity in said head for receiving the work, an aperture leading to said cavity for insertion of the work thereinto, a pivotally mounted gate swingable to open and close said aperture, power-operated means for pivoting said gate to close said aperture prior to driving a fastener, a fastener-driver slidable in said throat for driving a fastener into the cavity and forming it around the work, and power-operated means for actuating said driver after said gate has closed said aperture.

15. In a fastener-applying machine having a head, a cavity in said head for holding the work, an aperture opening into said cavity for insertion of the work, a gate for closing said aperture, a throat in said head extending toward said cavity, means to feed fasteners singly into said throat, a fastener-driver reciprocable in said throat, a bore in said head, power-actuated means in said bore for moving said gate to close said aperture, a second bore in said head, and power-operated means in said second bore in the head for actuating said driver to drive a fastener into the interior of said cavity and form it around the work held therein.

16. In a fastener-applying implement having a cavity for receiving the work to be fastened, an opening communicating with said cavity for insertion of the work thereinto, a gate movable to open and close said opening to the cavity, a reciprocable member connected to said gate for moving it to close said opening prior to driving a fastener, a second reciprocable member, a driver connected to said second reciprocable member for operation thereby to drive a fastener into the cavity and form it around the work, and power means for actuating said first and second reciprocable members in timed sequence.

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