

Jan. 14, 1958

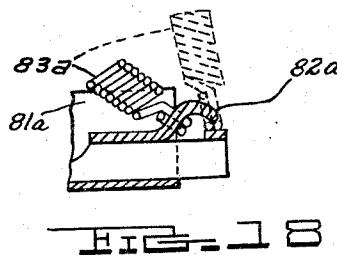
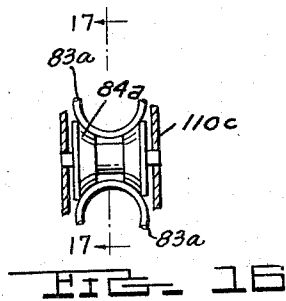
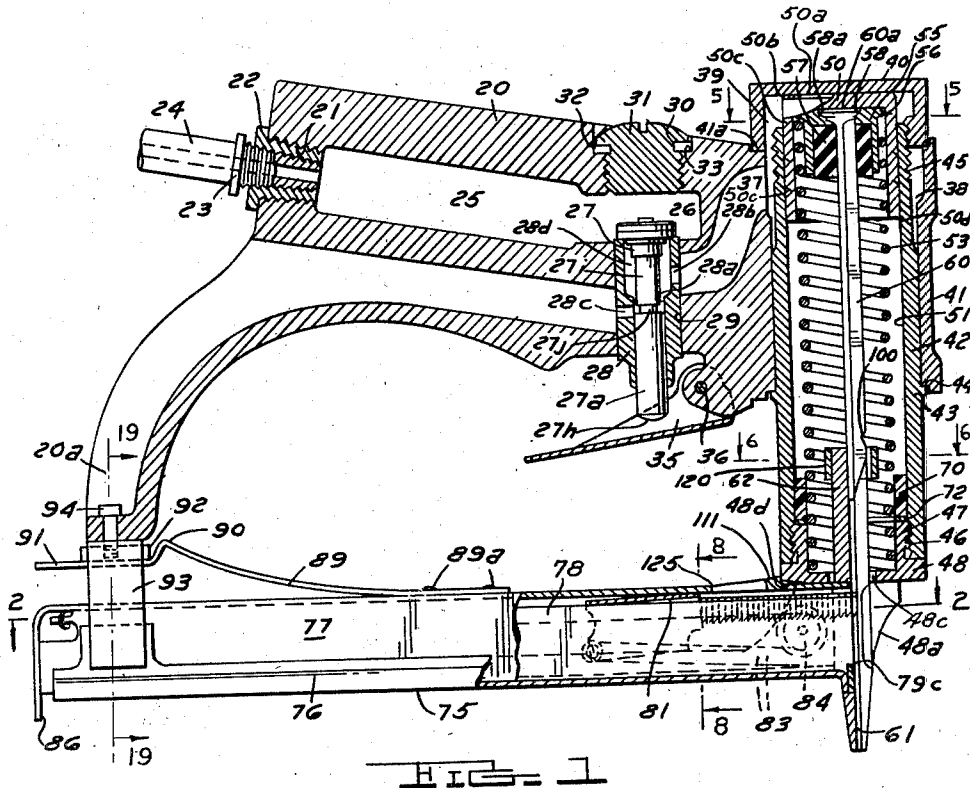
L. R. CAMPBELL ET AL

2,819,466

MAGAZINE UNIT AND FEED STRUCTURE FOR AIR STAPLING GUN

Original Filed Aug. 24, 1951

4 Sheets-Sheet 1



INVENTORS
LEE CAMPBELL
FRANK EBERT
BY ALTON SCHOENING
CLIFFORD REITERMAN
Farley Forster & Farley
ATTORNEYS

Jan. 14, 1958

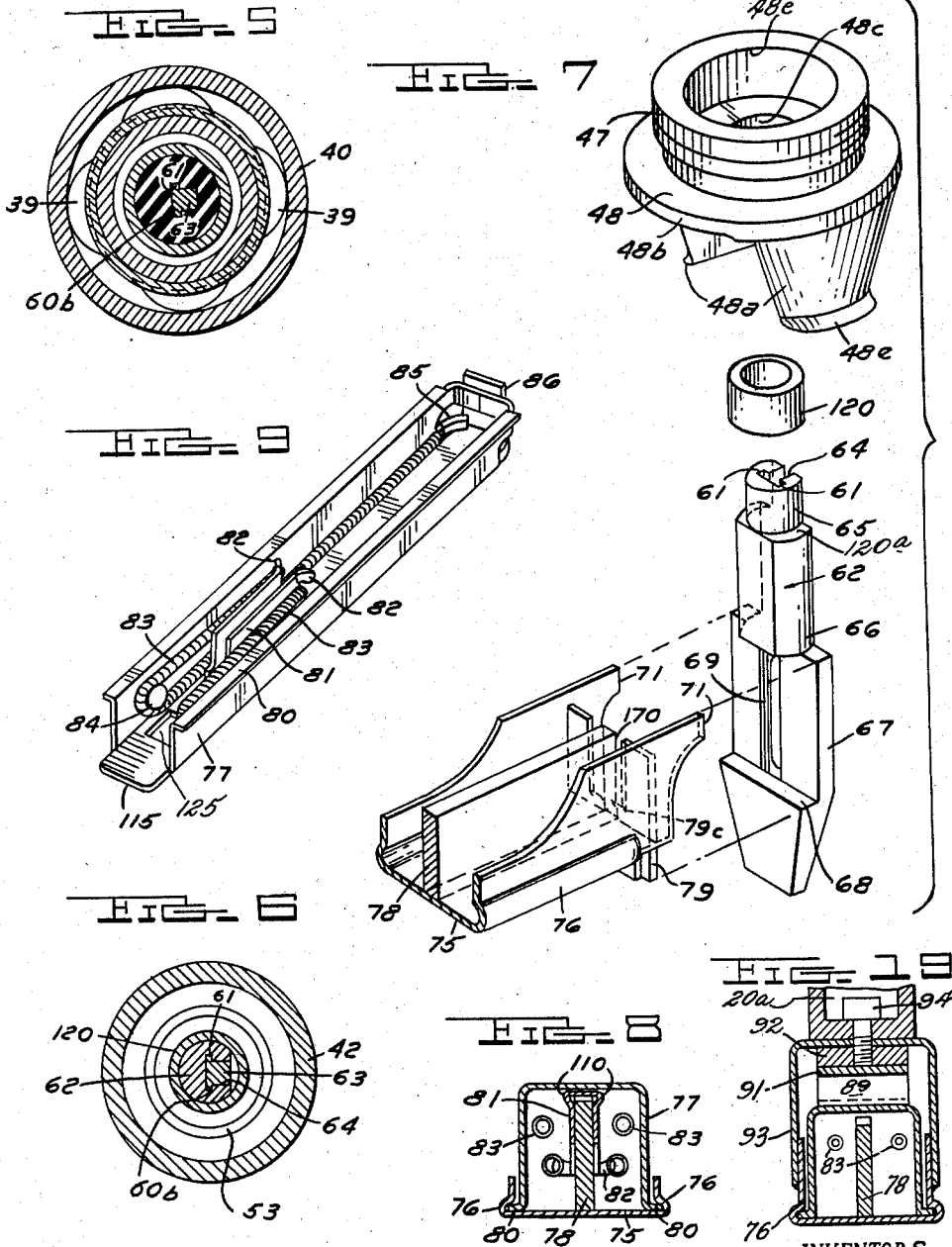
L. R. CAMPBELL ET AL

2,819,466

MAGAZINE UNIT AND FEED STRUCTURE FOR AIR STAPLING GUN

Original Filed Aug. 24, 1951

4 Sheets-Sheet 3



INVENTORS
LEE CAMPBELL
FRANK EBERT
BY ALTON SCHOENING
CLIFFORD REITERMAN

Farley Foster & Farley
ATTORNEYS

Jan. 14, 1958

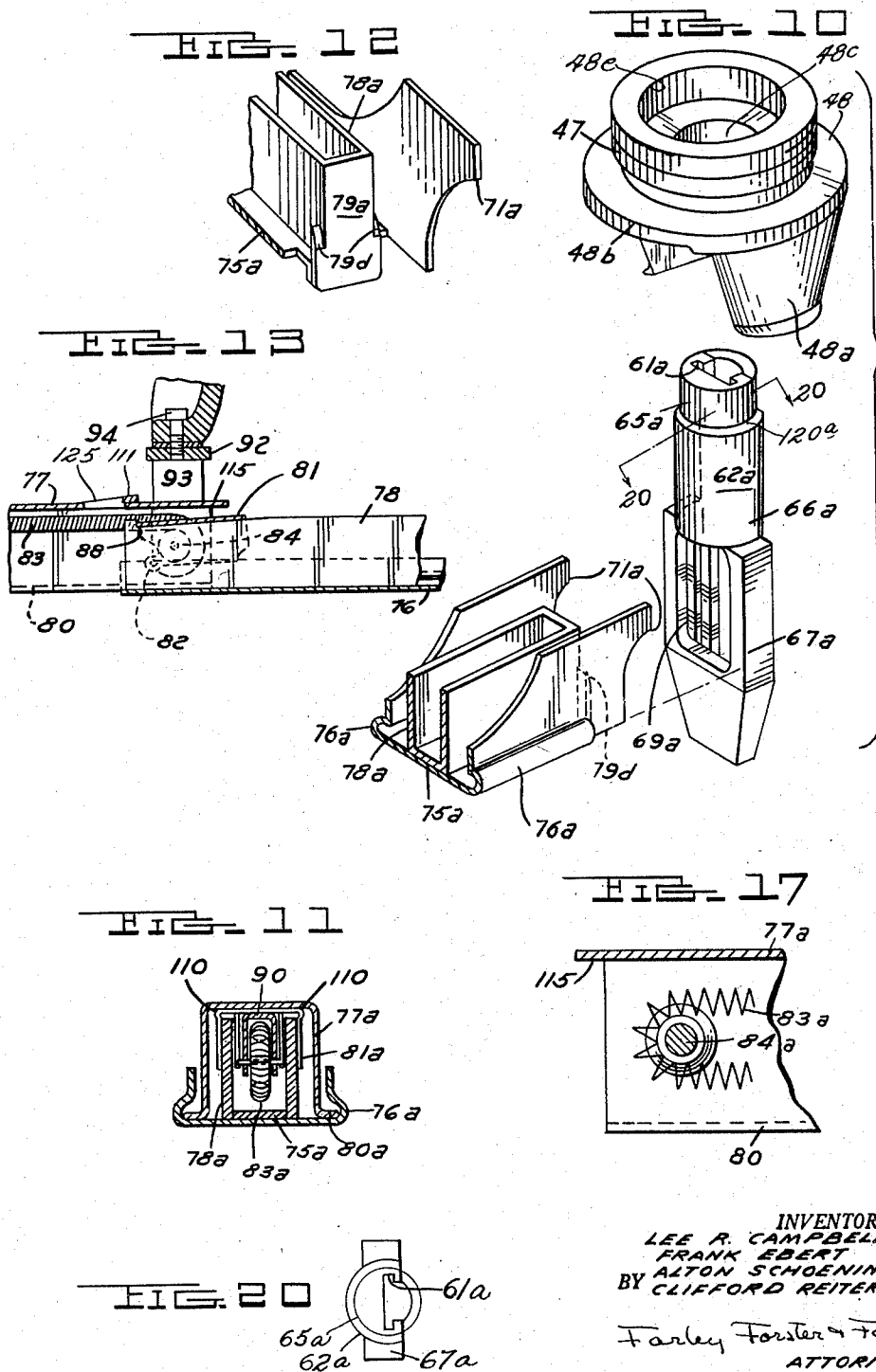
L. R. CAMPBELL ET AL

2,819,466

MAGAZINE UNIT AND FEED STRUCTURE FOR AIR STAPLING GUN

Original Filed Aug. 24, 1951

4 Sheets-Sheet 4



INVENTORS
LEE R. CAMPBELL
FRANK EBERT
BY ALTON SCHOENING
CLIFFORD REITERMAN
Farley Foster & Farley
ATTORNEYS

2,819,466

MAGAZINE UNIT AND FEED STRUCTURE FOR AIR STAPLING GUN

Lee R. Campbell, Royal Oak, and Frank E. Ebert and Alton L. Schoening, Detroit, and Leroy C. Reiterman, Warren, Mich.; Virginia C. Ebert, administratrix of the estate of said Ebert, deceased, assignors, by direct and mesne assignments, to Kenwood Industrial Development Company, Inc., Dearborn, Mich., a corporation of Michigan

Original application August 24, 1951, Serial No. 246,491, now Patent No. 2,713,165, dated July 19, 1955. Divided and this application November 29, 1954, Serial No. 471,798

15 Claims. (Cl. 1—49)

This invention relates to a power driven gun, and specifically a gun driven by air for driving staples, tacks, brads, or other fastening devices through readily pierceable material such as upholstery fabrics or the like which it is desired to attach to a foundation backing.

Although thin wire staples have been used for many years for clipping papers together as a part of ordinary office practice, it is only comparatively recently that the employment of such staples has spread to industrial uses.

Such staples are used in the form of long strips comprising a large number of individual staples interconnected together for convenience in placing them in a stapling device.

The stapling device, as employed for office use, comprises a combined staple strip magazine and driving head pivotally mounted on a suitable base, the staples being secured together in such way that a strip of staples may be put upon a feeding track of the magazine and by striking the pivotally mounted driving head the staples are detached one by one from the strip thereof and driven through the papers or other materials that it is desired to secure together.

In comparatively recent years, the employment of such staples has spread to industrial uses. As heretofore used industrially, the staple driving device has been hand driven and patterned essentially along the lines of the head of the office stapling machine removed from the customary base so that it can be used for driving staples or other fastening devices in any desired location. Industrial use of such devices however has not proven satisfactory for use in mass production because of the fatigue factor.

The principal object of the present invention is to provide an air stapling gun, namely, one in which the staple driver which causes the staple to be driven through the work to be stapled is actuated by a piston driven by air under pressure.

We have found after a long period of experimental development work, in order that a stapling air gun work satisfactorily, it is absolutely essential that the air piston which drives the driver, by means of which the staple is propelled through the materials to be fastened together, shall work with a sharp, quick driving action and not a mere pushing action such as characterized many of the prior art devices.

A further important part in the development of a practical air-driven stapling gun for industrial use centers about the constructional details and development of (a) the valve by means of which air is admitted to the air cylinder and piston so as to insure a quick, sharp, positive driving action, as distinguished from a slower pushing action, of the driving element by means of which the staple is detached from the staple strip and driven through the material to be fastened together; (b) an expansion chamber in the air conduit leading to the valve to act as an accumulator and thus insure an adequate supply of air

for obtaining the essential driving action; and (c) the piston and cylinder to which the air under pressure is admitted to provide the driving force.

A further important factor resides in reducing the construction to the simplest possible form in order to reduce to a minimum the manufacturing, construction, and assembling costs and also to insure that the guns will have the greatest possible strength to withstand the rough usage to which they are subjected by the workers, while being of minimum weight for easy handling.

As it is necessary from time to time to use different size staples or other fastening devices, it is highly desirable that the guns be so made as to be readily convertible for use from one size staples to another.

One of the principal objects of the present invention is to provide a new and improved construction of a power unit for an air stapling gun which includes the necessary air conduits, an accumulator chamber, the air piston and cylinder, the valve by means of which air is admitted to the cylinder, all in a unitary assembly, to and from which any one of a plurality of staple strip magazine units, designed for use with different size staples or other fastening devices, may be readily and quickly attached or detached.

A further object is to provide a new and improved construction and arrangement of the spring means for actuating the staple strip pusher whereby the pusher spring is located out of the line of travel of the strip pusher thereby enabling a longer strip of staples to be used and whereby the same spring means also serves to hold the pusher snugly in contact with the staple track and in engagement with the rear end of the strip of staples.

Another object is to provide a new and improved construction of a staple magazine and staple feed structure including a track cover which cooperates with a staple strip pusher and the actuating springs therefor, said cover being slidable to an open position to expose the staple track for the insertion of a new strip of staples and so that the strip pusher springs will be properly tensioned by the closing of said cover.

A still further object is to provide a new and improved construction of a unitary assembly for a plurality of magazine sections, each of which includes a track designed for the accommodation of one of the many different sized staples or other fastening devices that are to be employed, the magazine units also including as a unitary part thereof a driver for detaching the staples individually from a strip thereof and a nose piece through which the staples are driven into the materials to be fastened.

Another object is to provide a new and improved construction of a pusher device whereby the strip of staples will be positively and accurately fed to the driver and in which the pusher which engages the staple strip serves as a stop to limit the opening movement of the track cover for inserting a fresh strip of staples.

The present application which is a division of application Serial No. 246,491, filed by us August 24, 1951, now Patent No. 2,713,165, is limited to the details of the staple magazine unit assembly and staple feed structure associated therewith disclosed in said application.

The above and other objects of the present invention will appear more fully from the following more detailed description and by reference to the accompanying drawings forming a part hereof, wherein:

Fig. 1 is a longitudinal vertical view partly in section of an air-driven gun for driving staples constructed in accordance with the principles of the present invention;

Fig. 2 is a section taken substantially on the line 2—2 of Fig. 1 of a track section of a staple magazine unit for narrow crown staples;

Fig. 3 is a section similar to Fig. 2 of a magazine track section for wide crown staples;

Fig. 4 is an exploded view of parts of the unit shown in Fig. 3;

Fig. 5 is a horizontal sectional detail taken on the line 5—5 of Fig. 1 through the cap or closure for the air cylinder;

Fig. 6 is a horizontal section on the line 6—6 of Fig. 1;

Fig. 7 is an exploded view of the parts which are combined to make up the magazine and staple driver unit for narrow crown staples;

Fig. 8 is a section on the line 8—8 of Fig. 1 through the narrow-crown-staple magazine and track unit;

Fig. 9 is an inverted perspective view of the magazine track cover and pusher employed with the narrow crown staples;

Fig. 10 is an exploded view similar to Fig. 9 showing the parts of a magazine unit employed for wide crown staples;

Fig. 11 is a section taken on the line 11—11 of Fig. 3 through the wide-crown-staple magazine unit;

Fig. 12 is an enlarged detail perspective view showing the jamb plate end of a track section for a wide crown staple;

Fig. 13 is a longitudinal sectional detail through a wide crown magazine unit showing the manner in which the staple pusher serves as a stop to limit the opening movement of the track cover;

Fig. 14 is a perspective view showing the staple pusher for the wide crown staples and the means for fastening the end of the pusher spring thereto;

Fig. 15 is a view showing a retaining clip employed for holding the constituent parts of a magazine and driver unit in assembled condition;

Fig. 16 is a sectional detail through a sheave for the pusher springs on the line 16—16 of Fig. 4 for the wide crown staples;

Fig. 17 is a section on the line 17—17 of Fig. 16;

Fig. 18 is a sectional detail showing the construction of a pusher spring retaining tab;

Fig. 19 is a section on the line 19—19 of Fig. 1;

Fig. 20 is a section on the line 20—20 of Fig. 10; and

Fig. 21 is a front view of the lower portion of the nose piece shown in Fig. 15 as seen from the right.

The air gun of the present invention, briefly, consists essentially of an assembly of two parts—a combined power and handle unit and a staple magazine unit. The handle unit includes an air cylinder and piston, the handle being cored to provide an air expansion chamber and a single air conduit which serves as an inlet and exhaust passage for air to pass to and from the air cylinder and piston under the control of a trigger actuated valve, carried by the handle unit and interposed between the expansion chamber and said conduit. The invention also includes the provision of a plurality of magazine units, each of which is a complete unit assembly separate from the handle unit and which magazine units are constructed in different sizes in accordance with the size of the staple or other fastening device to be driven, each magazine unit being so constructed and arranged that it includes a staple driver and nose piece assembled with the magazine for the respective size staple to be used, the various magazine units being interchangeable with, and quickly and readily attachable to and detachable from, the handle unit.

As shown in Fig. 1 of the drawings, the handle unit consists of a cored handle 20 having at one end thereof a screw-threaded inlet opening 21 having pipe threads adapted to receive a threaded bushing 22 to receive a hose nipple 23 to which is attached a hose 24 leading to a source of air under pressure.

At its lower end the cylinder 42 is provided with interior screw threads 46 to receive the upper reduced threaded end 47 of an adapter 48, having a cup portion 48e (Fig. 10), the purpose of which will be hereinafter more fully described.

A piston 50 is slidably mounted within the bore 51 of the cylinder 42 and is normally held in its uppermost position by a coiled compression spring 53. The top 50a of the piston is flat so as to make a close sealing fit with the inner flat face of the closure cap 40 as shown in Fig. 1 of the drawings. Located immediately below and in contacting engagement with the piston 50 is a cup-shaped bumper retainer 55 having a peripheral shoulder or flange 56 at its upper end. The flange 56 serves as an abutment seat for the top coil of the compression spring 53 while the outer surface of the cup-shaped portion of the retainer 55 serves as a locating means for the top coils of said spring, the bottom coils of which are centered by their engagement within the cup portion 48e of the adapter 48. Mounted within the interior of the bumper retainer 55 is a bumper 57 of rubber or other suitable resilient or yielding material. The top wall of the bumper retainer 55 is provided with an aperture 58 shaped to conform to the configuration of a driver 60.

As shown in Fig. 1, the top face of the bumper retainer 55 is flat and seats against the inner flat face of the piston 50 and the aperture 58 in the top portion of the retainer 55 is countersunk as indicated at 58a so that the enlarged head 60a of a driver 60 will be flush within the head portion of the bumper retainer 55, all as shown in Fig. 1. The shank portion of the driver 60 is of approximately T-shaped configuration, as shown best in Fig. 5 of the drawing, having a pair of longitudinally extending ribs 60b one on each side thereof. These ribs 60b are shaped to fit neatly but slidably within a track 61 formed within a nosepiece 62 as shown best in Fig. 6.

As many different size staples are used industrially, for example, to secure upholstery or other fabrics to foundation pieces in the automotive industry, the gun of the present invention consists of two separate units, a power unit, which comprises the handle 20 with the air cylinder 42, piston 50 and air valve assembly 27, 28 forming one unit and a staple magazine forming another unit.

Each magazine unit consists of a track section, together with a track cover and nosepiece 62 which is designed for the particular size of staples for which the gun is to be used at any particular time; the driver 60, together with the nosepiece 62 being proportioned and shaped in accordance with the size of staples to be driven.

In the exploded view of Fig. 7 of the drawing we have shown a nosepiece 62, together with the track section and other parts that go to make up a magazine unit for the driving of narrow-crown staples. These narrow-crown staples for which the parts shown in Figs. 6, 7 and 9 are adapted to be used are approximately $\frac{3}{16}$ of an inch between the staple prongs.

In accordance with the present invention we provide a plurality of staple magazine unit assemblies which may be quickly and readily detached and attached from the handle section. The parts which go to make up a staple magazine unit per se comprise a screw-threaded adapter 48 and a nosepiece 62, together with a staple supporting track and a track cover which carries a staple pusher and the springs to actuate the pusher presently to be described. A magazine assembly also includes a driver 60, a bumper retainer 55, a resilient shock absorber 57 and a piston return spring 53 as hereinafter described.

As shown in Fig. 6 of the drawing, the nosepiece 62 is provided with a guideway 64 into which fits the portion 63 of the driver 60. The nosepiece 62 is also provided with a track section 61 into which fit the longitudinal ribs 60b of the driver 60. At its upper end the nosepiece is reduced, as indicated at 65 (Fig. 7) to receive a sleeve 120 that serves as a stop against which the bumper 57 strikes when the piston reaches the end of its driving stroke, sleeve 120 being seated on a shoulder 120a formed by enlarged part 66 of nosepiece 62. It will, of course,

be understood that the trackway 61 formed in the nose-piece is so proportioned as to receive but one staple at a time which fits snugly but slidably therein to prevent spreading of the staple legs as the staple is driven into the material and that the trackway extends the entire length of the nosepiece 62 and is open at both the top and bottom ends of the nosepiece. It will be likewise understood that the lower end of the nosepiece may be extended as far beyond the lower face of the track section as may be desired for reaching into otherwise inaccessible places.

The adapter 48 by means of which the magazine unit is attached to the handle unit, as shown in Figs. 7 and 10 of the drawings, in addition to having the upper reduced screw-threaded portion 47, has a pair of depending legs 48a which are adapted to embrace the widened portion 67 of the nosepiece and are suitably brazed thereto after the parts have been assembled.

The magazine section, as shown best in Figs. 7 and 8 of the drawings, consists of a lower track section 75 having a pair of beads 76 on each side thereof that form longitudinal grooves which serve as a track for the lower flanges 80 extending laterally from the lower edges of the side walls of a track cover member 77 made of a sheet steel stamping bent into a general U-shaped configuration. Secured, preferably by spot welding to the inner face of the bottom web of track section 75 is a track proper 78 which is of the proper size to fit between the legs of the staples to be driven; in this case, the narrow-crown staples.

Mounted on and brazed to the front end of the track section 75 is a jamb plate 79 which when the parts are assembled is adapted to abut tightly against the flat face of the widened section 67 of the nosepiece.

The ears 71 at the front end of track section 75 are adapted to straddle the side faces of the widened section 67 of the nosepiece. In assembling the magazine unit the track section 75 with the ears 71 astraddle section 67 has the jamb plate 79 abutted against the flat inner face of the widened section 67 of the nosepiece 62 and with the bottom of the jamb plate 79 resting upon the ledge 68 of the nosepiece. The legs 48a of the adapter 48 are then slipped down and astraddle the ears 71 and with the turned portion 66 of the nosepiece fitting neatly within the central hole 48c of the adapter.

For convenience in manufacturing, the underface of the widened flange portion 48b of the adapter has a couple of small holes drilled in it between the legs 48a and the hole 48c in which are placed small slugs of copper brazing material. The nose piece and track section, together with the adapter, are placed in assembled condition in a fixture so as to hold the nosepiece at an exact right angle to the track section and, with the parts so assembled in the fixture, a light projection weld is made through the assembly at 48c (Fig. 7). Brazing material is then placed around the edges of the parts which are in contact and the unit is then placed upright in a heating furnace and since the holes in which the brazing slugs are placed are open at the bottom, when the slugs melt the brazing material thereof together with that placed around the edges will seep by capillary action between the entire contacting areas of the assembled parts to form a fused joint therebetween which unites the parts together in assembled condition as a substantially integral strong rigid unit.

As shown best in the inverted view Fig. 9 the track cover 77 contains a pusher 81 for pushing the clips of staples forward to the driving end of the machine. The pusher 81 is of U-shaped configuration so as to fit slidably over the top of the track member 78 shown in Fig. 7. At their lower rearward ends the side walls of the pusher are provided with a pair of tabs 82 to which are adapted to be secured the forward terminal coils of a pair of coiled pusher springs 83. Each of these coil springs is trained about a pulley 84 rotatably secured by means of rivets, or other securing devices, to the side wall of the cover section. The rearward ends of the springs 83 are anchored to the inwardly projecting tabs 85 struck out from the side

walls of the track cover 77. A finger grip 86 formed by bending down the top wall of the track cover is provided to facilitate moving the cover 77 to open position while the rear face of the wide section of the nosepiece 62 forms a stop with which the forward extension 115 of the top wall of the track cover engages to limit the forward travel of the cover section in its closed position and prevent it from extending into the trackway 61 of the nosepiece 62.

An important feature of the present invention is the construction of the track section and the nosepiece 62 at the point where the jamb plate 79 abuts the nosepiece. As the staples must be fed longitudinally of the track and endwise laterally into the track portion 61 of the nosepiece, the jamb plate 79 which is welded to the track member 78 is provided with a U-shaped opening 170 through which the staples can be fed laterally into the trackway 61 of the nosepiece. At the lower end of opening 170 the jamb plate 79 is provided with inclined cam faces 79c (Fig. 7) for directing the prongs of the staples into the trackway 61.

For the purpose of permitting the staples to enter laterally into the track section, the latter is relieved, or cut away, as indicated at 69 by an amount just sufficient to permit the staples to enter trackway 61 while leaving the side walls of the trackway 61 of the correct dimension to hold the staples against spreading as they are driven into the material with which they are to be used.

It will be noted that the attachment of the ends of the lower runs of the springs 83 to the tabs 82 formed on the lower rear end of the pusher 81 causes the springs to exert a downward pull on the back end of the pusher so as to cause the lower edge thereof to be held snugly in contact with the top face of the track 78 and thus hold the pusher in an inclined position as shown best in Figs. 1 and 13. This causes the lower end of the front face of the pusher 81 to engage the bottom of the legs of the staples to be fed and thus insure that the bottom legs of the staples will be fed into the track 61 of the nosepiece. This together with the cam faces 79c will tend to prevent the legs of a staple as it is severed from the strip from being turned backwardly into the track section of the magazine unit, thus causing jamming of the staple feeding mechanism.

At its rearmost end the track section 78 is provided with a downwardly inclined section which terminates at the rear end of the track in a lug or shoulder 88 with which the rear end of the pusher 81 contacts to serve to limit the opening movement of the track cover 77 when it is pulled backwardly to insert a new strip of staples.

In the case of the narrow crown staples, the tabs 82 to which the front ends of the springs 83 are secured project laterally outward sufficiently to engage with the rims of pulleys 84 so that when the track cover is moved rearwardly to open position it will pick up the pusher and pull it to the rear end of the track. As the points of contact of these tabs with the pulley rims serve as fulcrum points about which the downward pull of the lower run of the springs 83 is exerted, the rear end of the pusher will be held snugly against the top face of track 78 and thus insure the engagement of the rear end of the pusher with the stops 88 (Fig. 3) at the top rear end of the track 78 thereby to limit the opening movement of the track cover 77.

Secured to the top of the track cover 77 is a flat leaf spring 89 which is provided intermediate its ends with a hump portion 90 and terminates in a finger tab 91 by means of which the spring may be depressed. The hump 90 is adapted to engage behind a filling piece 92 brazed or otherwise secured to the inner face of the web of a yoke 93, the lower legs of which are attached to the side walls of the track section 75, and thus lock the track cover in its closed position; the spring 89 together with an inclined surface 48d (Fig. 1) on the under side of the flange 48b of the adapter 48 holding the cover down snugly against the lower track section 75 to insure a

proper predetermined clearance between the top of the track 78 and the under surface of the top wall of the track cover and thus permit free sliding movement of the staples and pusher 81 along track 78. The filling piece 92 also serves as a means for providing the necessary screw threads to receive a fastening screw 94 by means of which the rear end 20a of handle unit 20 is secured to the staple magazine unit to prevent the handle from rotating or swinging sideways out of line with the magazine unit when the device is in use.

In Figs. 3, 10 and 12, we have shown the parts of a magazine unit for wide-crown staples. As shown in Fig. 10, the parts which comprise the magazine for wide-crown staples are essentially the same as shown in Figs. 7 to 9 for the narrow-crown staples, except there are differences in details of construction due to the difference in width of the staples to be fed. As shown in Fig. 10 the nosepiece 62a is provided with a trackway 61a similar to the trackway 61 of the nosepiece 62, except that it is, of course, wider for the wider crown staples. At its top end the nosepiece 62a is provided with a reduced portion 65a which is of a diameter such that the flange of the cup-shaped end of the bumper retainer 55 will pass over it when the latter is driven downwardly to execute a driving stroke, the top face of the nosepiece serving as an abutment against which the lower face of the yielding bumper 57 strikes. Immediately below the reduced end 65a of the nosepiece it is provided with a portion of larger diameter 66a adapted to fit within hole 48c of the adapter 48, and, just below the portion 66a, the nosepiece 62a is provided with a widened portion 67a similar to the portion 67. The inner face of the widened portion 67a of the nosepiece 62a is also cut away as at 69a to provide a ready entrance for the staples laterally into the trackway 61a of the nosepiece.

Secured to the track section 75a for the wide-crown staples (Fig. 10) is a track member proper in the form of a channel shaped piece 78a, the lower wall or web of which is spot welded to the track section 75a. At its front end the channeled track 78a proper is closed by a jamb plate 79a suitably brazed to the legs of the channeled track 78a. The jamb plate 79a is provided with a pair of laterally projecting curved cam faces 79d (Fig. 12) similar to the cam faces 79c which serve to engage the lower prongs of a staple and direct them positively into the trackway 61a of the nosepiece 62a as the staples are engaged by the driver to separate them from the strip of staples and force them downwardly into the material to be fastened.

The front end of the track section 75a is provided with a pair of ears 71a similar to the ears 71 shown in Fig. 7 which are also adapted to straddle the widened section 67a when the parts are assembled.

Due to the fact that the space between the prongs of the wider crown staples provide ample room for the housing of the spring 83a used for forcing the staple pusher 81a against a strip of staples, in the form for the wide-crown staples shown in Figs. 4 and 10 to 13 only a single spring 83a is used. This spring 83a has its rearmost end secured to a tab 83a struck from a spring housing member 90 shown best in Fig. 4, while the spring intermediate its ends is coiled about a single sheave or pulley 84a. The forward end of the spring is fastened to a tab 82a formed or struck out from the rear end of a horizontal web that connects the side walls of a U-shaped piece 130 welded to the inner face of the top wall of the U-shaped pusher member 81a as shown in Fig. 14.

After the spring 83a is assembled in the spring housing 90 as just described the hooked end 91 of the housing 90 is hooked through the slot 92 in the rear end of the track cover 77a (Fig. 4); the engagement of the rear face of the hooked end 91 with the rear end of the track cover 77a preventing movement of the spring housing 90 longitudinally of the cover. The ends 110c of the

shaft portion of the sheaves 84a engage angular portions 110b at the front of the walls 126 when the track cover is moved rearwardly thus carrying the pusher with it. The shaft ends 110c also serve as abutment stops against which the angular surfaces 110b (Fig. 14) of the pusher 81a abut when the track cover is pulled back to its full opened position and as fulcrum points against which the pull of the lower run of spring 83a is exerted to hold the rear end of the pusher snugly against the top face of track 78a and thus insure engagement of the rear end of the pusher with the stops 88a (Fig. 3) thereby to limit the opening movement of the track cover 77a.

As shown in Fig. 17, the pitch line of the sheaves 84, 84a for the springs 83, 83a is so arranged that the coils of the springs at their lowermost end will be forced into close contacting engagement with adjacent coils and thus prevent the formation of a space at the point where the coils contact with the sheave that would permit them to become engaged or hooked over the sheave in such way as would prevent the free travel of the spring over the sheave.

As shown in Fig. 18 the construction and arrangement of the tab 82a on the pusher element 81a is such that there is sufficient space between the ends of the tab and the body of the material from which it is struck out to permit the two terminal coils with which the spring 83a is provided to slip readily under the tab when the spring is held at a right angle to the pusher but which space is insufficient to permit the two coils to pass through it and thus become accidentally detached from the tab when the body of the spring lies in its horizontal operative position as shown in Fig. 4.

The track section for the wide-crown staples is assembled to the nosepiece 62a and adapter 48 in a fixture and then the parts are brazed together as hereinbefore described.

After the track section for either the wide-crown or narrow-crown staples has been properly assembled to the nosepiece, either 62 or 62a which goes with the particular track section, in the fixture provided for such purpose, and the parts have been integrally united together as a unit by spot welding and brazing as hereinbefore described, the track cover for the particular size staple is then placed over the track section proper, with the pusher 81 or 81a, as the case may be, held in place by the fingers of the person doing the assembly work, the pusher is engaged over the respective track 78 or 78a, and the cover is slid home until the end 115 of the cover 77a for the narrow-crown staples abuts against the nosepiece or an abutment piece 111 brazed to the top wall of the cover 77 for the wide-crown staples abuts against flange 48d of the adapter 48 (Fig. 15). When this occurs, the hump 90 of the spring 89 engages behind the filling piece 92, as shown in Fig. 1 of the drawings and the inclined rear face of the spring hump will force the cover forwardly and hold it in snugly locked position.

In order to facilitate the loading of a new strip of staples in the staple track 78 or 78a, a major portion of the side walls of both the narrow-crown track section 75 and the wide-crown track section 75a is cut away above the beads 76 and 76a from points adjacent to their front and rear ends thereby to expose the tracks 78 or 78a when their track covers are slid to fully opened position. It will be noted that in the case of both the narrow-crown and the wide-crown staples that after the track cover 77 or 77a with the respective pusher 81 or 81a together with the pusher springs 83 or springs 83a respectively assembled therewith has been placed on the track section the cover may be moved to opened or closed position without disturbing the unitary assembly of the track section to the nosepiece and adapter. When a strip of staples has been placed on the staple track 78 or 78a the front end of the pusher engages the rear end of the strip and as the cover is pushed forwardly to its closed position the pusher will be held by its engagement with the rear end of the strip to-

wards the rear end of the track unit, thus causing the springs 83 or 83a to be stretched and moving the pulleys 84 or 84a forwardly out of contact with the pusher. When however the cover is moved to its opened position, the pulleys 84 or 84a will contact the pusher 81 or 81a and pull it rearwardly and as hereinbefore described while the rear end of the pusher will be held snugly but yieldingly by the pair of springs 83 or 83a, as the case may be, against the top face of the track 78 or 78a, to insure its engagement with the stops 88 at the rear end of the track and thereby limit the opening movement of the track cover. If it is desired to remove the track cover 77 or 77a entirely, this may be readily accomplished by inserting a small screw driver or the like and lifting the rear end of the pusher against the action of the springs 83 or springs 83a so as to permit it to clear the stop 88 or 88a.

The manner in which a staple magazine unit is assembled is as follows: A driver 60 of the correct size and shape to go with the staples of the size for which the magazine unit is to be used is inserted into the bumper retainer with which it is intended to be used, the driver bumper 57 first having been inserted into the cup-shaped end of the retainer 55. A collar 120 is then placed over the end 65 of the nosepiece and piston return spring 53 then has its lower end inserted into the cup-shaped end of the adapter 48 and with the lower coils thereof encircling the collar 120 on the top of the nosepiece. The driver assembly consisting of the bumper retainer 55 and driver bumper 57 is then assembled to the magazine unit by inserting the lower end of the driver 60 into the trackway of the nosepiece 62 or 62a. After this has been done the spring 53 is compressed by pressing downwardly upon the top of the retainer 55 until a notch 100 in the lower end of the driver 60 reaches a position below the lower face of the adapter 48 substantially as shown in Fig. 15 of the drawing. The hooked end 101 of a spring clip 102 is then engaged within the notch 100 of the driver and the lower upturned end 103 of the spring clip is placed within a longitudinal slot 104 formed centrally in the lower part of the driver 60. The upward thrust exerted by the piston return spring 53 forces the driver upwardly and thus holds the top end 101 of the spring clip 102 firmly up into the hole 48c of the adapter 48 so that the top 101 of the clip is pressed against the right-hand wall (Fig. 15) of said hole 48c thus causing the hooked end 101 to be held firmly within the notch 100 of the driver, while the engagement of the upturned end 103 of the clip 102 with the slot 104 prevents the spring clip 102 from moving sideways and becoming accidentally disengaged.

The magazine unit assembly, consisting of the track section and its cover, the driver 60, piston spring 53 and driver 60, bumper retainer, shock absorber 57, adapter 48 and nose piece 61, may then be engaged with a handle or power unit 20 by screwing the threads on the reduced end 47 of the adapter into the threads 46 formed in the lower end of the cylinder 42, and the magazine unit is screwed home until the upper face of the flange 48d of the adapter is firmly seated against the lower face of the cylinder 42. The cylinder closure cap 40 which is then backed off a turn or so permit the rear end of the magazine unit to be rotated into alignment with the rear end 20a of the handle of the power unit, and the screw 94 is then screwed into position to hold the end 20a of the handle from rotating and with the handle secured in proper vertical alignment with the magazine unit, the cylinder cap 40 is then tightened firmly in position.

We have found after a long period of experimental development that the sealing contact provided between the flat upper face 50a of the piston 50 and the lower flat inner surface of the cylinder closure cap is of the utmost importance likewise the angle of the chamfer 50b so that a momentary hesitation of the piston will occur sufficient to permit the air pressure to build up above the piston and thereby insure a positive sharp, quick driving action of the piston as it travels downwardly on its working stroke.

As will be seen from Fig. 1 of the drawings, the driver 60 and piston 50 have an appreciable amount of travel before the lower end of the driver engages a staple to disengage it from the staple clip and force it into the material to be stapled.

We have also found it to be imperative if excessive breakage of the driver 60 is to be avoided that some shock absorbing or snubbing means be provided to relieve the drivers from the sharp impact or blow which occurs when the lower face of the skirt of the piston 50 engages with the relatively hard bumper sleeve 70. For this purpose we have provided the rubber bumper member 57 which is so proportioned and arranged within the retainer 55 that the lower end of the bumper will engage the top of the nosepiece 62 at the bottom of the piston's stroke and thus cushion the head 58 of the driver 60 from the sharp impact of the blow of the piston against the bumper 70.

When it is desired to change the gun for use with a different size staple the magazine unit assembly which has been employed is detached from the power unit as follows: The driver 60 is driven to the extreme lower end of its travel and by holding the valve 27 open driver 60 is held there. A locking clip 102 has its upper end 101 engaged within the notch 100 of the driver and in engagement with the adapter and with the upturned lower end 103 of the clip in slot 104 in nosepiece 60. The trigger 35 is then released and piston spring 53 will draw the driver 60 snugly up into locked position. The screw 94 at the rear end of the handle 20 is then removed, cylinder cap 40 is loosened and the magazine assembly is then detached from the power unit by rotating it relatively to the handle to unscrew the threaded portion 47 of the adapter from the screw threads 46 in the bottom of the cylinder 42. A new magazine unit assembly is then screwed into the cylinder until the flange 48b of its adapter 48 is seated firmly against the lower face of the cylinder. The cylinder cap 40 is then backed off to permit the handle and magazine units to be properly aligned, the screw 94 is then inserted and the cylinder cap 40 firmly tightened.

The manner in which the device operates is as follows: The handle being attached to a source of compressed air by means of hose 24, air under pressure from said source enters through the bushing 21 into the air expansion or accumulator chamber 25 from whence it flows into the valve chamber 26 to be immediately available for use when the valve 27 is opened.

When the operator wishes to drive a staple, he raises the trigger 35 so as to cause it to engage with the rounded lower end 27h of valve stem 27a and thus raise and open valve 27 to admit air under pressure to the top of cylinder 51. The air under pressure which enters bore 28d of the bushing 28 then flows through the port 28b into the conduit 37 and thence through annular chamber 38 in the cylinder to the longitudinal passages 39 in the cylinder closure cap 40. This air under pressure builds up within the cylinder closure cap 40 until it passes the chamfered edge 50b of the piston and breaks the seal between the top flat face of the piston 50 and the flat inner face of the cap 40 and thus starts the piston to travel downwardly in a driving stroke.

Upon the first stroke of the gun to drive a staple, the notch 100 of the driver passes downwardly so as to release the hooked end 101 of the clip 102 from its engagement with the notch 100 in the driver 60 and hole 48c of the adapter and the clip 102 then falls from the gun thus permitting the piston, driver and driver head to be pushed upwardly by the piston return spring 53 until the flat face 50a of the piston engages with the inner flat surface of the cylinder closure cap 40.

It will be understood that the clip 102 is used only for the purpose of holding the driver 60 and the piston return spring 53, together with the bumper retainer 55 and bumper 57 in assembled condition. As heretofore

pointed out, due to the fact that the invention contemplates the use of different sized magazine unit assemblies for use with the size staples for which the gun is to be employed and as each magazine unit when assembled consists of the track section permanently secured as by brazing to an adapter 48, the nosepiece 62, a driver 60 with piston return spring 53, bumper retainer 55 and bumper 57 and as these parts are held in assembled condition by the clip 102 as just described, the assembled magazine unit may be kept in a storeroom or any suitable place until needed for use.

It will, of course, be understood that the driver 60 moves downwardly an amount sufficient to drive the staple which has been detached from the strip thereof through the material to be fastened.

After a staple has been severed from the strip and driven home, the operator releases trigger 35 thus permitting valve 27 to drop by the air pressure being exerted upon the top face of valve seat retainer 27c thus shutting off the air flow to piston 50 and permitting the piston return spring 53 to force the piston 50 upwardly. During the upward travel of the piston the air which has accumulated above the top of the piston is now forced outwardly through the longitudinal passages 39 of the cylinder closure cap 40, the annular passage 38 and into the conduit 37, flowing from said conduit and thence through the port 28b into the chamber 28d of the valve bushing 28 and around the annular metering passage provided between the bore 28a of valve bushing 28 and the stem 27j of the valve 27 and out to atmosphere through the exhaust port 28c. As heretofore pointed out, the stem portion 27j of the valve 27 is slightly smaller in diameter than the bore 28 of the valve bushing to provide an annular metering passageway through which the exhaust passes to the exhaust port 28c. This serves to cushion the return stroke of the piston and avoid any hammering action by the piston on the inner surface of the cylinder closure cap 40 which would otherwise tend to be quite destructive.

As the staples are detached one by one by the driver 60 from the strip of staples in the magazine unit, the staple pusher 81 under the tension of springs 83 will feed the strip of staples so that the foremost staple of the strip will pass laterally into the opening 69 relieved in the nosepiece 62 until the staple lies within the trackway 61, in position to be engaged by the driver 60 on its next downward stroke.

As each staple is severed from the strip thereof the lower ends or prongs of the staple legs will engage with the cam faces 79c or 79d on the jamb plate to insure that the staple legs will be forced outwardly and positively into the track 61 of the nosepiece, thus preventing the legs or prongs of the staples from turning backwardly into the track section of the magazine unit and cause jamming of the latter.

For the purpose of preventing a staple pusher from being fed into the path of the driver 60 after the last staple of a strip has been fed and the strip is exhausted, the forward ends of a pusher are provided with a pair of small outwardly extending ears or tabs 110 (Fig. 8) which engage the inner face of the nosepiece and prevent the pusher from being pushed outwardly by the pusher springs into the trackway and in the path of the descending driver. In the wide-crown pusher (Fig. 14) the surfaces 110a are provided to supplement the tabs 110 and having as a bumping surface, the back surface of jamb plate 79a (Fig. 12).

When the last staple of a strip has been driven, the operator may grasp the projecting finger piece 91 of the spring 89 and depress it until the hump 90 of the spring is flexed below the filler piece 92. The operator may then pull the track cover section 77 rearwardly until the pusher 81 engages the stops 88 provided at the rear end of the track 78 and until the parts are in the position shown in Fig. 13; the engagement of the pusher 81 with

said stops limiting the outward movement of the track cover. In this extreme outward open position of the cover 77 or 77a the cover will be supported only at its innermost end by the engagement of the pusher 81 or 81a with the stops 88 or 88a; hence, the weight of the outwardly extending, overhanging major portion of the cover will tend to hold the cover in its fully opened position. A new strip of staples may then be inserted, after which the track cover 77 is shoved forwardly until the abutment 111 in the case of the wide-crown staples engages the flange 48b of the adapter 48; the forward stop for the narrow crown is the foremost end 115 of track cover 77—stopping against the nosepiece 62 (Fig. 1).

The track covers are provided with an observation opening 125 adjacent the adapter 48 so that the operator may readily inspect for the presence or lack of staples on the staple track or to see if the nosepiece 62 is open in the front and clear any staples which may have become jammed in the track section.

It will be noted that there is but a single driving member, namely, the driver 60, interposed between the piston and the staples and that the driving force is imparted to the driver through the engagement of the enlarged head 60a of the driver with the flat underface of the top wall of the piston.

It will also be noted that with each form of magazine unit shown, the ears 71 or 71a at the front of the side walls of the track sections 75, 75a, respectively, are clamped between the solid metal of the wide part 67 or 67a of a nosepiece 62 or 62a and the relatively thick legs 48a of the adapter so that an interlocked engagement of the parts is effected whereby the parts mutually cooperate to brace each other and form a strong rigid unit when brazed together as hereinbefore described.

While we have described and illustrated a satisfactory constructional example of our invention for use with staples that has proven highly satisfactory in actual commercial use, it will, of course, be understood that the invention may be employed for driving tacks, brads, rivets or other fastening devices by modifying the magazine units, drivers and nose pieces accordingly and many other changes, variations and modifications within the skill of the art may be resorted to without departing from the spirit of the invention as set forth in the claims hereunto appended in which the term staple is to be construed to include tacks, brads, hollow rivets or other fastening devices capable of being made in interconnected form for use with an air gun constructed in accordance with the principles of the present invention.

We claim:

1. In a stapling machine, a staple magazine and feed structure comprising an elongated track section having a bottom wall and a pair of laterally spaced side walls, each of said walls being provided along its bottom edge with an inwardly open longitudinal groove, a staple-carrying track secured to said bottom wall along the longitudinal central portion thereof, and a track cover of inverted U-shaped cross-section having a lateral flange extending from the bottom of each side wall thereof for slidable engagement within the open longitudinal grooves of the side walls of said track section, thereby to hold the top wall of said cover in predetermined spaced relationship to the top of said staple-carrying track as said cover is slid to and from opened to closed positions.

2. In a stapling machine, a staple magazine and feed structure comprising an elongated track section having a bottom wall and a pair of laterally spaced side walls, each of said walls being provided along its bottom edge with an inwardly open longitudinal groove, a staple-carrying track secured to said bottom wall along the longitudinal central portion thereof, and a track cover of inverted U-shape cross-section having a lateral flange extending from the bottom of each side wall thereof for

slidable engagement within the open longitudinal grooves of the side walls of said track section, thereby to hold the top wall of said cover in predetermined spaced relationship to the top of said staple-carrying track as said cover is slid to and from opened and closed positions, and the upper major portion of the side walls of said track section being cut away from points adjacent to the front and rear ends thereof to expose said staple-carrying track for easy accessibility thereto and to facilitate the loading of staples thereon when said cover is moved to opened position.

3. In a stapling machine, a staple magazine and feed structure comprising a track upon which a staple strip may be slidably supported, a track cover slidably mounted over said track, and a staple-strip feeding assembly comprising a staple pusher for slidable engagement with said track, a housing detachably connected at its rear end with the rear end of said track cover and having a sheave pulley rotatably mounted at the front end thereof, and a coiled tension spring encased within said housing having its front end connected to said pusher, its rear end connected to said housing and its intermediate portion trained about said sheave pulley.

4. In a staple machine having a staple driver, a staple magazine and feed structure comprising a track section having a track upon which a strip of interconnected staples is slidably supported to be fed to said driver, a track cover slidably carried by said track section for movement to and from a closed to an open position to expose said track and permit it to be loaded with a staple strip, staple strip feeding means comprising a staple pusher slidably mounted on said track and a coiled tension pusher spring attached thereto supported by said cover for movement therewith for causing said pusher to engage said staples and feed them one at a time to said driver, and stop means on said track for engagement by said pusher for limiting the opening movement of said cover, said pusher spring normally urging said pusher in a position to engage said stop means when said cover is moved to its fully opened position.

5. A staple magazine unit and feed structure as set forth in claim 4 in which a rotatable sheave pulley, about which said spring is trained intermediate its ends, is supported by said cover adjacent to the forward end thereof.

6. A staple magazine unit and feed structure as set forth in claim 5 in which said pulley is positioned laterally of said track out of the path of movement of said staples.

7. A staple magazine unit and feed structure as set forth in claim 5 in which portions of said pulley project into the path of movement of said pusher for engagement therewith upon rearward movement of said cover from its closed towards its open position thereby to cause said pusher to be moved rearwardly by said rearward movement of said cover, and when said cover is moved from open to closed position, said pusher will be engaged and held by the rear end of a staple strip on said track and said spring will be extended to exert a forward feeding pressure on said strip.

8. A staple magazine unit and feed structure as set forth in claim 7 in which the front end of the lower run

of said spring is secured to the lower rear end of said pusher and the projecting portions of said sheave pulley engage said pusher at points above that at which the end of said spring is secured thereto whereby said projecting portions serve as fulcrums about which said spring exerts a downward pull on the rear end of said pusher normally to hold it yieldingly in contacting engagement with the upper face of said track.

9. A staple magazine unit and feed structure as set forth in claim 8 in which the upper face of said track is provided at its rear end with upwardly projecting stop means for engagement by said pusher to limit the opening movement of said cover.

10. A staple magazine unit and feed structure as set forth in claim 9 in which the rear end of said pusher may be manually raised against the downward pull of said spring a sufficient distance to clear said stop means for entirely removing said cover and feeding means carried thereby from said magazine unit.

11. A staple magazine unit and feed structure as set forth in claim 4 in which means are provided for connecting the upper run of said spring to the rear end of said track cover and the lower run of said spring to the lower rear end of said pusher whereby said spring serves to hold said pusher in engagement with the upper face of said track and in contact with said strip of staples to feed the latter forwardly of said track.

12. A staple magazine unit and feed structure as set forth in claim 4 in which a pair of said coiled tension pusher springs are each connected at one end with said cover adjacent the rear end thereof and a pair of said pulleys are mounted on the inside of said cover, one at each side of said track.

13. A staple magazine unit and feed structure as set forth in claim 5 in which said staple pusher and said coiled tension pusher spring that comprise said staple strip feeding means are mounted within a housing detachably connected at its rear end with the rear end of said track cover with said sheave pulley rotatably mounted in the front end of said housing and with the said coiled tension pusher spring encased within said housing having its front end connected to said pusher, its rear end connected to said housing, and its intermediate portion trained about said sheave pulley.

14. A staple magazine unit and feed structure as set forth in claim 4 in which releasable lock means are provided between said track section and cover elements for holding said cover in closed position, said lock means including a spring member carried by one of said elements and yieldably engageable with fixed structure on the other of said elements.

15. A staple magazine unit and feed structure according to claim 14 wherein the said spring member is secured to and projects from the upper face of the track cover and said fixed structure is secured to said track section, extending upwardly therefrom and over said spring member, for yielding engagement to urge said cover into snug engagement with said track section while locking said cover in closed position.

No references cited.