

April 17, 1962

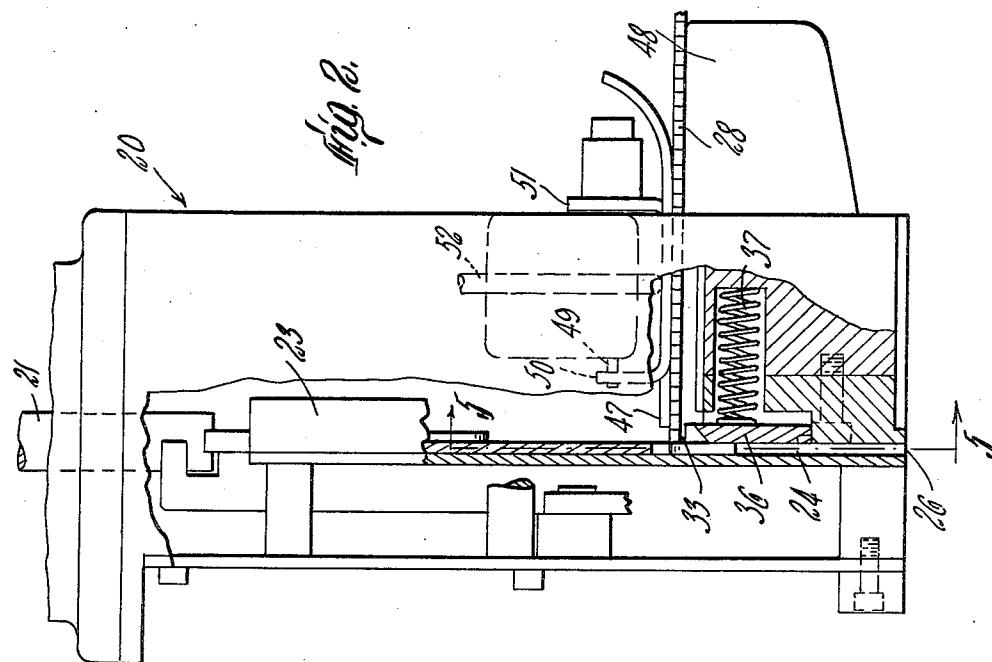
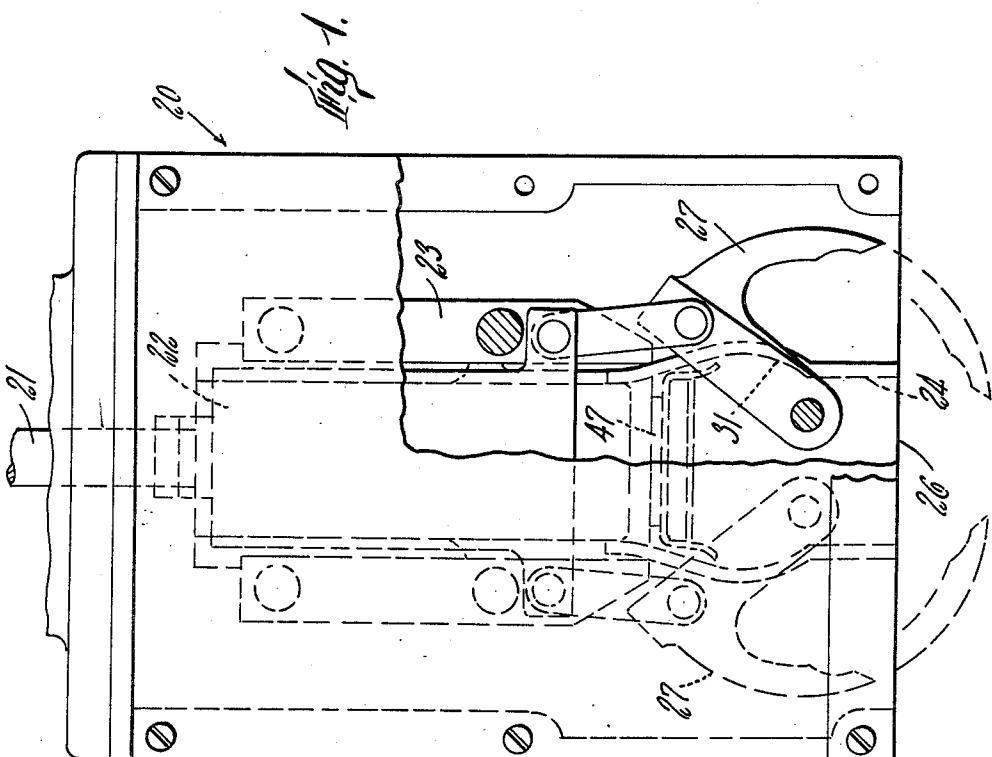
S. KUFEL, JR., ETAL

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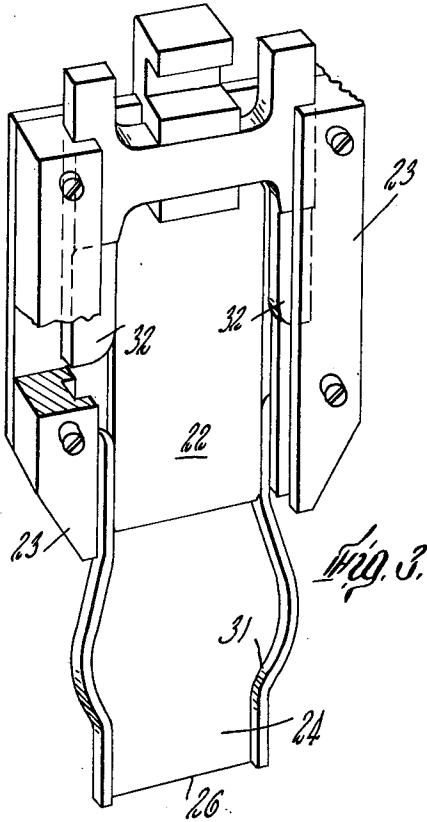
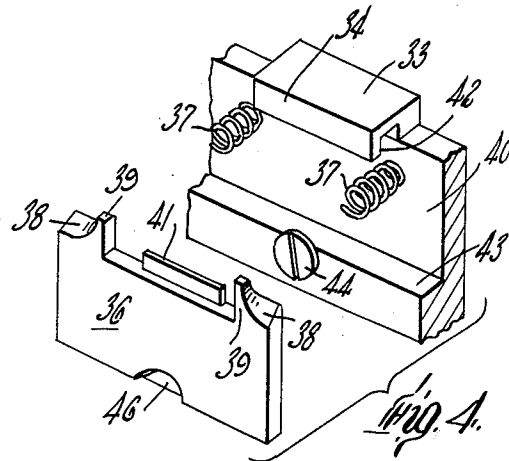
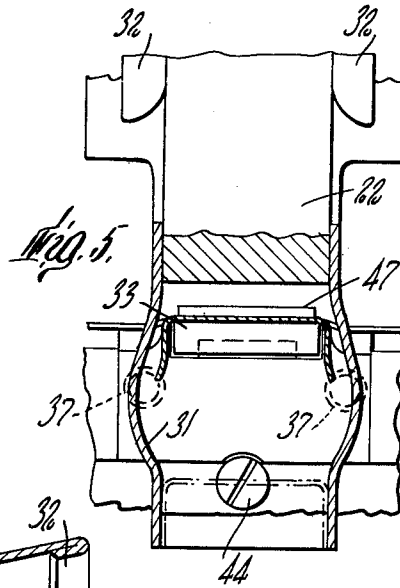
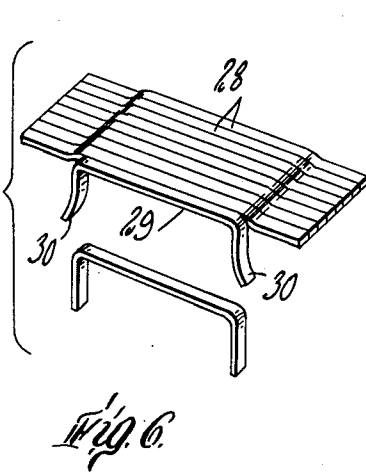
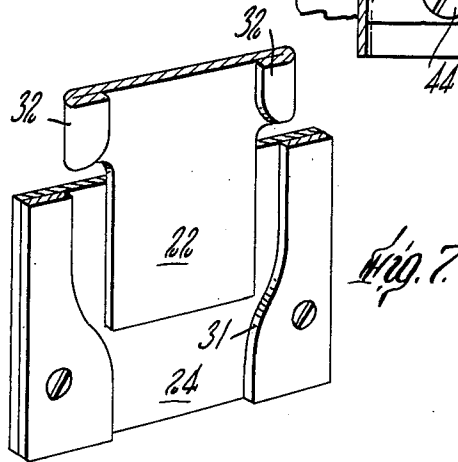
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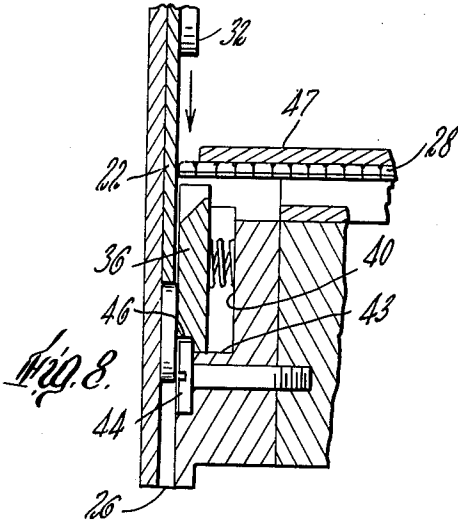
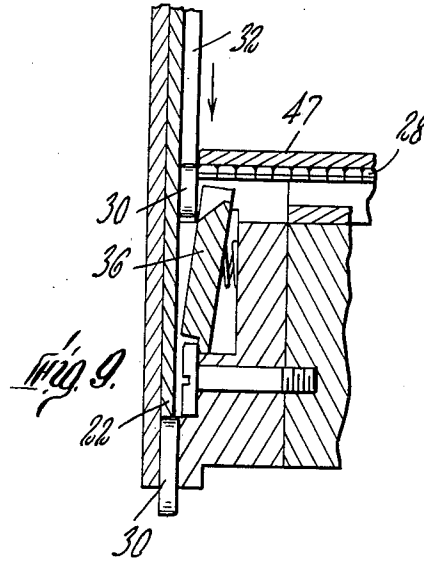
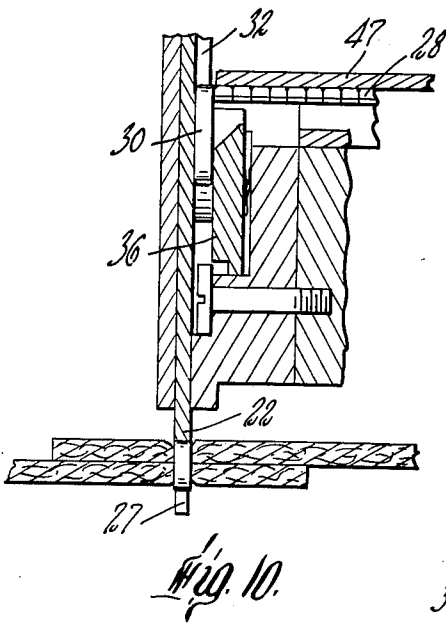
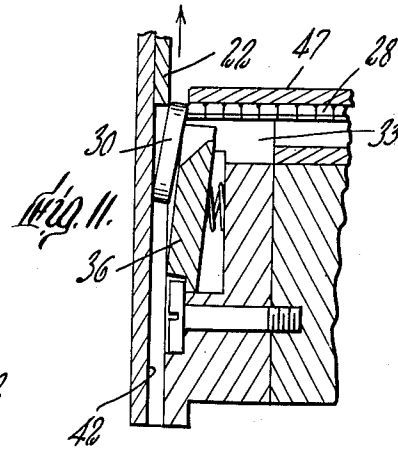
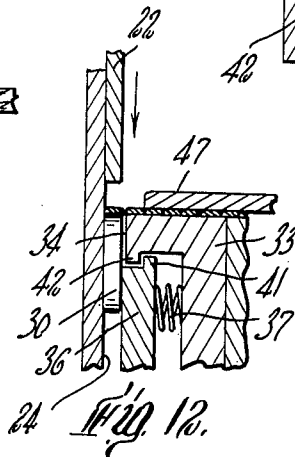
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11 Claims. (Cl. 1—48)

This invention relates to machines for forming and driving staples which are supplied from a flexible strip or roll containing many interconnected staple blanks, for example a strip or roll like the "Staple Blank" disclosed in Patent No. 2,943,436, issued July 5, 1960, to H. F. Peterssen. More particularly the invention is directed to an improved mechanism and arrangement for feeding or advancing a strip of unformed or partly formed staple blanks to mechanisms which form and drive the staples. Although the invention will be shown and described in connection with a stapler of the type used in heavy duty industrial work, the principles and structures apply equally to light duty machines such as those designed for desk or office use.

A principal object of the invention is to provide a dependable staple feeding arrangement which is simple, compact and reliable and which cooperates with the staple forming and driving devices to effect economical and rapid operation of the machine.

Another object is to provide a staple feed which operates on the first or leading element in a flexible strip or belt of interconnected staple elements to pull the stock of staples toward the staple former or driver. The arrangement of the invention therefore avoids the buckling and jamming of staples or blanks in the stapler, which sometimes may occur when a strip of staples is fed by a pushing action.

A further object is to provide a staple feeding mechanism with but few parts, which may be made easily and inexpensively. Still another object is to provide instrumentalities for holding and guiding the staple strip and individual staples in a dependable fashion during the various stages of feeding, forming and driving.

These objects are achieved generally by the provision of a spring-pressed plate of unusual design and action, so mounted and arranged that while a staple is being driven by the machine, the plate will engage behind the legs of the following staple as it is being formed, the plate thereafter pulling the formed staple and the strip of unformed staple blanks connected therewith toward the driving position as the staple driver is returned to its starting position and the spring pressure on the plate is allowed to act.

Other objects and advantages and details of preferred forms of the invention will become evident from the following description and the accompanying drawings forming a part thereof in which:

FIG. 1 is an end view of a stapling head or machine of one type to which the invention may be applied, parts being broken away to show interior construction,

FIG. 2 is a side view of the stapler of FIG. 1 with parts indicated in section or broken away,

FIG. 3 is a perspective view of the staple guiding throat, driver and former of the stapler of FIGS. 1 and 2, as seen looking to the left in FIG. 2,

FIG. 4 is an exploded perspective view showing the staple forming anvil and associated staple feeding plate of the invention, as seen looking to the right in FIG. 2,

FIG. 5 is a sectional view along the line and in the direction of the arrows 5—5 of FIG. 2 showing the relationship of the staple guiding throat, driver and former with respect to the anvil and feeding plate,

FIG. 6 is a combined perspective view showing the end of one kind of strip of interconnected staple blanks

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as used in the stapler, the last in the series of blanks being partially formed and a separated fully formed staple in the approximate position and condition in which it will be driven,

FIG. 7 is a perspective view similar to FIG. 3 but showing a modified form of staple guiding throat, driver and former,

FIG. 8 is a sectional view similar to a portion of FIG. 2 but on a somewhat larger scale showing the parts as they will appear while a staple is being driven but before the following staple is formed,

FIG. 9 is a view similar to FIG. 8 but showing the parts in the positions they will occupy while a staple is being formed,

FIG. 10 is a similar view showing the same parts when a first staple has been driven and the second staple has been formed,

FIG. 11 is a similar view showing the parts on the return stroke of the driver, just before a formed staple is to be fed into the staple guiding throat, and

FIG. 12 is a vertical sectional view scale through the center of the anvil and top of the feed plate with the parts in the positions they occupy in FIG. 2.

Referring to FIGS. 1 and 2, the stapler has a body 20 on or within which the operating parts of the stapler are mounted or supported. A reciprocating plunger 21, suitably vertically guided and supported in the body and powered by any conventional means such as a spring or pneumatic piston (not shown), furnishes the power to move a staple driver blade 22 which is slidably mounted in ways 23 which are fixed within the stapler head. The staple driver 22 is guided precisely by a guiding throat or channel 24 which also serves to guide a staple as it is being driven.

The guide throat has an open end 26 through which a staple will be driven and against which an article to be stapled may be placed. In the form of stapler shown in FIG. 1 a pair of swinging clincher arms 27 are provided which are suitably connected and driven along with the staple driver so that the ends of an emerging staple will be bent over or clinched at the proper time. These clinchers may be of the character disclosed in Patent 2,899,679, issued August 18, 1959, to H. G. Allen. Obviously if the stapler is to be used to tack, the clincher arms are not necessary. Also, other types of staple clinching arrangements are known in the art and the present invention does not relate to this feature of the apparatus.

With the form of staple being used, which as stated above may be like that shown in the Peterssen patent, the staples are supplied to the machine in an unformed or partly formed state. As shown in FIG. 6, a series of the generally straight staple blanks 28 are laterally interconnected by a flexible connecting web adhered under or otherwise joining their crown portions 29 so that the resulting strip of these staple blanks may be rolled, folded or otherwise compactly stored. This means that each staple before it is used must first be formed into a generally inverted U-shape having the central cross bar or crown portion 29 and depending leg portions 30. As shown in FIG. 6 the formed legs 30 may not at first be entirely straight but when the staple is separated from the web and finally driven, the sides of the guide throat or channel 24 will accomplish the final straightening if necessary. This is done by means of tapering side walls 31 on the guide throat leading to the open end 26.

Carried by the driver is a pair of former arms 32 with tapered or rounded ends which engage over the leg portions 30 of a staple blank and bend them downwardly from the crown portion 29 when the crown portion is resting upon an anvil 33.

In the form shown in FIG. 7, the driver 22 together with

the forming arms 32 may all be made from a single piece of sheet metal suitably folded or bent upon itself, while the guide channel 24 with its tapered side walls 31 may be made from pieces of sheet metal of the proper shape secured together in any convenient manner. This is an economical type of construction particularly useful in a light duty stapler.

It will be noted that the formers 32 are located immediately adjacent one face of the driver blade 22, which may be called the front face of the driver. Therefore, because the adjoining edge 34 of the anvil is spaced approximately the thickness of a staple away from the face of the guiding channel 24, when the driver blade moves downwardly in the guide channel and passes the edge of the anvil a staple blank which has been moved beyond the anvil edge into the guide channel will be struck by the driver and sheared off from the next adjacent blank in the series. Shortly after the driver has separated a staple from the row of blanks, the formers 32 which move with the driver will then shape the following staple over the sides of the anvil.

Although the staple driving and forming elements are here shown fastened together and operated by a single plunger, obviously they can be made as separate pieces operated by discrete mechanisms, especially if either the forming operation or driving operation in a particular stapler requires extra power or an extremely precise degree of movement.

The present invention is concerned primarily with feeding the strip of staple blanks at the proper times and in the proper amounts so that as one staple is being driven, another is being formed and upon return of the driver, the strip of interconnected staple blanks will be advanced one step to present the formed staple under the driver in its next stroke. The principal instrumentality for this purpose is the feed plate 36 shown best in its entirety in FIG. 4. Because of its peculiar action this plate may be called a "wobble" plate. It is mounted loosely under the shearing edge 34 of the anvil 33 and is resiliently biased as by springs 37 toward the guiding throat or channel 24.

The structure of this plate can best be described in connection with its action during stapling operations. Assume that a staple has previously been formed at the leading edge of the strip of staple blanks. A formed staple is pressed toward and into the guide throat 24 by the springs 37 acting on the plate 36 as shown in FIG. 2. When the plunger is actuated to move the driver 22 downwardly the driver blade will first shear off the formed staple as shown in FIG. 8 and start moving it downwardly in the guiding channel. The parts, including the driver blade and the side walls 31 of the channel 24 are so dimensioned that the "wobble" plate 36 is free to press the sheared staple against the face of channel 24 and hold the staple frictionally in the guiding throat to prevent its dropping freely or tilting before the legs 30 on the staple are engaged by the tapered side wall portions 31. When once the staple has entered the tapered portion of the channel or guiding throat the slight spread of the legs will insure frictional engagement with side walls of the channel so that frictional control by the "wobble" plate is no longer necessary.

As the driver and former elements continue in their downward movement the staple forming arms 32 will then engage the ends of the next unformed staple as shown in FIG. 9 and start to form that staple, the crown portion of the staple being supported by anvil 33. As the legs are bent downwardly and as the forming arms pass the sides of the anvil, beveled faces 38 on the plate will be engaged by the staple legs and cam the top of the wobble plate rearwardly, tilting the plate. Further downward movement of the forming arms and staple legs against the front of the plate will straighten the latter as shown in FIG. 10 while the driver completes its stroke and the driven staple is clinched.

As the driver is again raised it will finally reach the position shown in FIG. 11 when its edge is opposite the crown portion of the formed staple and above the wobble plate 36. At this point in the operation, projecting arms or extensions 39 on the plate being engaged behind the formed legs 30 on the leading staple in the strip of blanks, the pressure exerted by plate 36 tilts the tips of the legs of this staple toward the guiding throat, all as shown in FIG. 11. As soon as the driver passes the top margin of the strip of staples in its upward stroke, the spring pressure on the plate will snap or push the first or lead staple against the opposing face of channel 24, pulling the attached strip of staples forwardly with it into the position of FIG. 2 with the formed staple ready for the next driving stroke.

The plate is loosely held in a cavity 40 in the anvil 33, being restrained from excess movement at its top by a lug 41 on the plate engaging behind a shoulder 42 on the anvil. The bottom of the plate rests on the bottom wall 43 of the cavity 40 and is suitably loosely restrained as by a screw 44 the head of which is engaged in a segmental countersink 46 in the face of the plate.

The springs 37 bear against the plate 36 somewhat above its midpoint, considered from top to bottom, so that the desired tilting or wobble action of the plate is obtained as explained above.

In order to prevent the strip of staple blanks from retreating after a staple has been sheared off by the driver and before the staple former engages the following staple blank, a top guide plate or brake 47 is suitably mounted in the body of the stapler, extending over the staple blanks which are on the anvil 33 and over some of those on the guiding saddle 48 leading to the anvil. This plate applies pressure or drag to the strip of staple blanks on the saddle and anvil and is itself loosely guided by pins 49 on the stapler body extending through slots in the upturned ears 50 of this pressure plate 47. Another ear 51 may be guided similarly with respect to the frame, and pressure on the plate 47 may be applied through a plunger 52 mounted directly above the plate 47. If a constant frictional drag is satisfactory, this may be applied by a spring (not shown) bearing against the plunger 52. If a more positive holding of the plate 47 is desired, this may be accomplished through known pneumatic mechanisms arranged to push the plunger 52 against the plate 47 during the proper period in the stapling cycle, that is, from the time the driver shears off a formed staple until the former starts working on the first staple blank (FIG. 9). Pneumatic actuation of the plunger 52 should also be arranged during the return stroke of the driver and former elements until just before the parts reach the relative positions of FIG. 11 in order to urge plate 47 against the staple blanks to prevent the returning driver and former from lifting the staple strip off the anvil and guiding saddle. At this point any pressure on the plate 47 should be released so that the wobble plate 36 may be able to pull the formed staple forward and feed the strip of staple blanks attached to it.

Summarizing the action of the mechanism of this invention, with the parts shown in the position of FIGS. 2 and 12, a formed staple is pressed by the action of the springs 37 on the plate 36 into the guide throat 24. As the driver blade 22 descends, it will shear off the formed staple at the shearing edge 34 of the anvil 33 and start driving the staple downwardly in the guiding throat or channel. The pressure plate 36 will prevent the staple being driven from shifting or canting until the formed legs 30 of the staple engage with the tapered walls 31 on the sides of the guiding channel. At this point the staple will be held and guided by the sides of the channel and by the end of the descending driver blade 22.

Soon after the driver has sheared off the first staple, the staple forming arms 32 will engage the next staple blank which is in its substantially flat form, and force

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the leg portions 30 over the sides of the anvil, the crown portion 29 of the staple blank being supported by the top of the anvil 33. As the legs of this staple are being formed over the anvil they will be forced in front of the pressure plate 36 by riding on the beveled faces 38 of the plate until the plate occupies the tilted position shown in FIG. 9. Further movement of the former arms and of the legs of the staple being formed will straighten the pressure plate vertically so that it will occupy the position shown in FIG. 10. Driving of the previously formed staple will be completed with the plate 36 in this position, the newly formed staple being in front of it.

When the driver and former start their return stroke the former will first release itself from the legs of the formed staple and the driver blade will wipe against the front edge or face of the formed staple, tending to lift it away from the anvil. However, the pressure on top guide plate 47 will oppose this tendency and hold the formed staple and the connected strip of blanks in proper position. When the edge of the driver plate nears the upper edge of the crown on the leading (formed) staple blank, the springs behind the pressure plate will push the extensions 39 against the legs of the staple and tilt them forward into the guide throat as shown in FIG. 11. As soon as the edge of the driver leaves the top edge of the staple, the springs will push the plate forwardly, moving the formed staple entirely into the guiding throat, ready for the next driving stroke of the stapler, and thus feeding the strip of staple blanks to the position of FIGS. 2 and 12 again.

Terms like "above," "below," "top," "vertical," "forward" and such, are used to indicate relative position or direction only, and are not intended to define absolute orientation because stapling machines, instead of being in the attitudes here illustrated, are often inverted in use or placed against a vertical or slanted surface. With this in mind and contemplating that various modifications, adaptations or substitutions may be made without departing from the spirit or scope of the concepts involved, what is claimed is:

1. In a stapler of the character in which a series of relatively straight elongated laterally interconnected unformed staple elements is presented to a former which forms the first element of the series into an inverted U-shape and then to a driver which drives the formed staple element, that improvement which comprises an anvil member for supporting the first flat staple element in the series, said anvil having a front shearing edge and staple forming side surfaces thereon, a feed plate under the anvil spring-pressed in a direction toward the shearing edge of the anvil, staple formers movable to engage end portions of the first flat staple element in the series and cooperating with the forming side surfaces of the anvil to form said first staple element into an inverted U-shape having a central crown portion and depending leg portions, beveled edges on said feed plate, the legs of the staple as it is being formed bearing against said beveled edges and tilting the plate against its spring pressure to a position away from the front shearing edge of the anvil and in back of the staple legs, pusher surfaces on said feed plate engageable behind the formed legs of the staple, a guide channel in front of the feed plate and spaced from the front shearing edge of the anvil, a staple driver movable in said guide channel and cooperating with the front shearing edge of the anvil to shear the formed staple from the series and then to drive the formed staple in the guide channel, the spring pressure of the feed plate frictionally holding the staple in the guide channel during driving, return of the staple driver permitting the pusher surfaces on the plate to engage actively behind the staple legs whereby the spring pressure of the plate will push the formed staple toward and into the guide channel forward over the shearing edge of the anvil and pull the series of laterally interconnected unformed staples with it and the next formed staple will

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be in the guide channel in a position ready to be driven.

2. Driving, forming and feeding mechanism for a strip of generally straight staple blanks attached to one another along their side edges and each blank intended before being driven to be formed into a staple having a central cross bar and depending leg portions, said mechanism comprising a saddle for carrying and supporting said strip of blanks, an anvil at the end of said saddle adapted to support the cross bar of a staple blank, a guide throat spaced beyond said anvil, a driver blade movable in said guide throat between a position above the anvil where a formed staple may be fed into said guide throat and a position below the anvil where said blade may drive a formed staple in said guide throat, said blade as it passes the anvil in its movement from above the anvil to below the anvil acting to shear the end staple from said strip, staple forming shoulders carried by said driver blade and movable therewith on either side of said anvil to form the legs on a single staple just after the preceding formed staple is sheared from the strip, a loosely mounted feeding plate below said anvil, a spring biasing said plate toward said guide throat, portions on said plate engageable with legs formed on a staple whereby said spring will urge said plate and formed staple toward and into said guide throat when said driver blade is above said anvil, thus feeding the strip of interconnected blanks, and means frictionally holding said strip on said saddle during the period after the driver blade has sheared a formed staple from the strip and before the forming shoulders have produced legs engageable by the plate.

3. In an implement for forming and driving staples which are supplied in the shape of a flexible belt of interconnected elongated staple blanks each extending transversely of the belt, said blanks each having a central crown portion and leg portions adapted to be formed downwardly from the ends of the crown portion before being driven, a saddle for guiding and supporting said belt of blanks including an anvil supporting an end of said belt at the crown portions of the staples thereof, said anvil having a front shearing edge and side staple-forming surfaces, a guide channel with a wall spaced in front of the anvil shearing edge, a former for shaping the leg portions of a single staple blank downwardly over the side surfaces of the anvil, a feeder element engageable behind the legs of a staple as they are being formed, a spring urging said feeder element forwardly to advance said formed staple by its legs toward and against said guide channel wall, said belt of interconnected blanks also advancing accordingly, a driver movable in said guide channel for shearing a formed staple from said belt at the anvil shearing edge when a formed staple is advanced to said guide channel wall and for driving the staple thereafter in the guide channel, said spring-urged feeder element, frictionally holding said formed and sheared staple in said guide channel as it is being driven, and means frictionally restraining movement of said belt with respect to said anvil.

4. In a stapler of the character in which a series of relatively straight elongated laterally interconnected unformed staple elements is formed and driven, that improvement which comprises a stationary member for supporting the first flat staple element in the series, said stationary member having a front shearing edge and staple forming side surfaces thereon, a guide channel in front of the front shearing edge of the stationary member, a feed plate under the shearing edge spring-pressed in a direction toward said guide channel, a pair of movable staple formers engageable with portions of the first flat staple element in the series and cooperating with the forming side surfaces of the stationary member to form said first staple element into an inverted U-shape having a central crown portion and depending leg portions, beveled top edges on the ends of said feed plate, the legs of the staple as it is being formed bearing against said beveled edges to tilt the plate against its spring pressure to a

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position away from the front shearing edge of the stationary member and in back of the staple legs, said feed plate having projecting arms engageable behind the formed legs of the staple, a reciprocable staple driver movable past the front shearing edge to shear the formed staple in said guide channel from the series and then to drive the formed staple in the guide channel while said staple is frictionally held in the guide channel, return of the staple driver permitting the spring-pressed plate to push the formed staple toward and into the guide channel and pull the series of laterally interconnected unformed staples with it.

5. Driving, forming and feeding mechanism for a strip of staple blanks attached to one another along a portion of their side edges and each blank intended before being driven to be formed into a staple having a central cross bar and depending leg portions, said mechanism comprising a saddle for carrying and supporting said strip of blanks, an anvil at the end of said saddle adapted to support the cross bar of a staple blank, a guide throat spaced beyond said anvil, a driver blade movable in said guide throat between a position above the anvil where a formed staple will be fed into said guide throat and a position below the anvil where said blade will drive a formed staple in said guide throat, said blade as it passes the anvil in its movement from above the anvil to below the anvil acting to shear the end staple from said strip, staple forming shoulders carried by said driver blade and movable therewith to form the legs on a single staple over said anvil, a loosely mounted feeding plate below said anvil, a spring biasing said plate toward said guide throat, portions on said plate engageable with legs formed on a staple whereby said spring will urge said plate and formed staple toward and into said guide throat when said driver blade is above said anvil, thus feeding the strip of interconnected blanks.

6. In an implement for forming and driving staples which are supplied in the shape of a flexible belt of interconnected elongated staple blanks each extending transversely of the belt, said blanks each having a central crown portion and leg portions adapted to be formed downwardly from the ends of the crown portion before being driven, a saddle for guiding and supporting said belt of blanks including an anvil supporting an end of said belt at the crown portions of the staples thereof, said anvil having a front shearing edge and staple-forming surfaces thereon, a guide channel with a wall spaced in front of the anvil shearing edge, a former for shaping the leg portions of a single staple blank downwardly over the staple-forming surfaces of the anvil, a feeder element engageable behind the legs of a staple as they are being formed, a spring acting on said feeder element advancing said formed staple by its legs toward and against said guide channel wall, said belt of interconnected blanks also advancing accordingly, a driver for shearing a formed staple from said belt at the anvil shearing edge when a formed staple is advanced to said guide channel wall and for driving the staple thereafter in the guide channel, and said feeder element including means frictionally holding said formed and sheared staple in said guide channel as it is being driven.

7. In an implement for forming and driving staples which are supplied in the shape of a belt of interconnected elongated staple blanks each extending transversely

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of the belt, said blanks each having a central crown portion and leg portions adapted to be formed downwardly from the ends of the crown portion before being driven, a saddle for guiding and supporting said belt of blanks including an anvil supporting an end of said belt at the crown portions of staples thereof, said anvil having a front edge, a guide channel spaced in front of the anvil front edge, staple forming means for shaping the leg portions of a single staple blank downwardly from its crown portion, a feeder element engageable behind the legs of a staple as they are being formed, a spring urging said feeder element to advance said formed staple by its legs toward and into said guide channel, said belt of interconnected blanks also advancing accordingly, a driver engaging a formed staple in said guide channel for driving the staple and means frictionally restraining movement of said belt with respect to said anvil and saddle except when advanced by said feeder element.

8. In an implement for forming and driving staples which are supplied in the shape of a belt of centrally interconnected elongated staple blanks each extending transversely of the belt, said blanks each having a central portion and leg portions adapted to be formed downwardly from the ends of the central portion before being driven, an anvil for guiding and supporting an end of said belt at the central portions of the staples thereof, said anvil having a front edge, a staple driving channel spaced in front of the anvil front edge, staple forming means for shaping the leg portions of a staple blank downwardly from its central portion, a feeder element engageable behind the legs of a formed staple, a spring urging said feeder element to advance said formed staple by its legs toward and into said staple driving channel, said belt of interconnected blanks also advancing accordingly, and a driver for engaging and driving a formed staple in said staple driving channel.

9. In a stapler using a continuous strip of staple blanks, each blank extending transversely of the strip and being interconnected with adjacent blanks, the combination comprising forming means for forming an end blank of the strip into a U-shaped staple, and feeding mechanism for advancing the strip of blanks to said forming means including a movable element engageable behind the legs of the end blank while it is being formed and means for urging said element forwardly to advance said formed blank beyond said forming means and to advance the following blank to said forming means, the remainder of said strip advancing accordingly.

10. A stapler as claimed in claim 9 comprising in addition driving means for driving said formed staple, said driving means being disposed adjacent to said forming means at the side thereof opposite to said feeding mechanism, and in which said feeding mechanism advances said formed blank to said driving means.

11. A stapler as claimed in claim 9 comprising in addition driving means for driving said formed staple, said driving means being connected to the forming means at the side thereof opposite to said feeding mechanism for movement of said driving means together with said forming means, and in which said feeding mechanism advances said formed staple blank to said driving means.

No references cited.