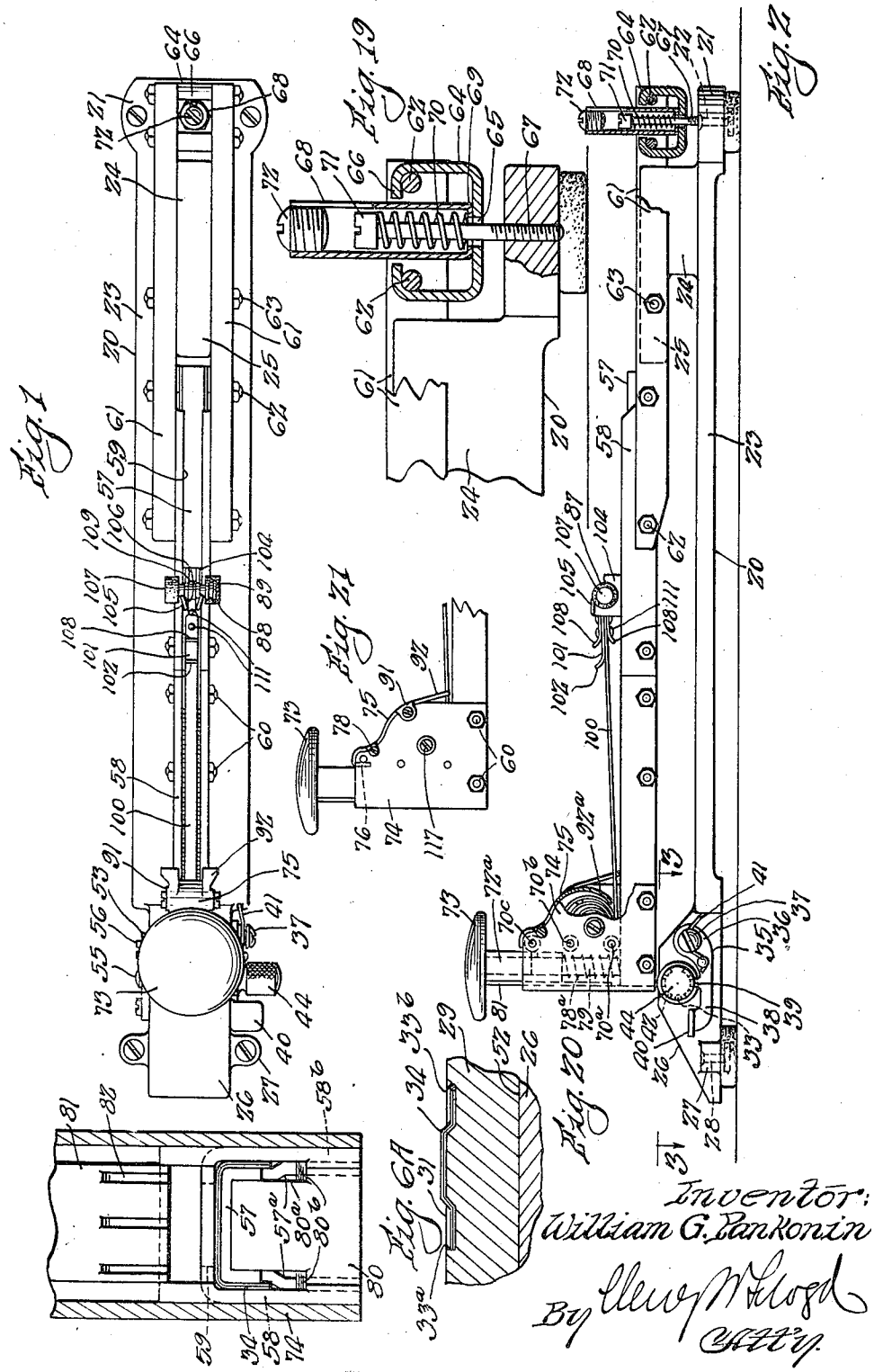
March 3, 1936. W. G. PANKONIN 2,033,049

STAPLING DEVICE

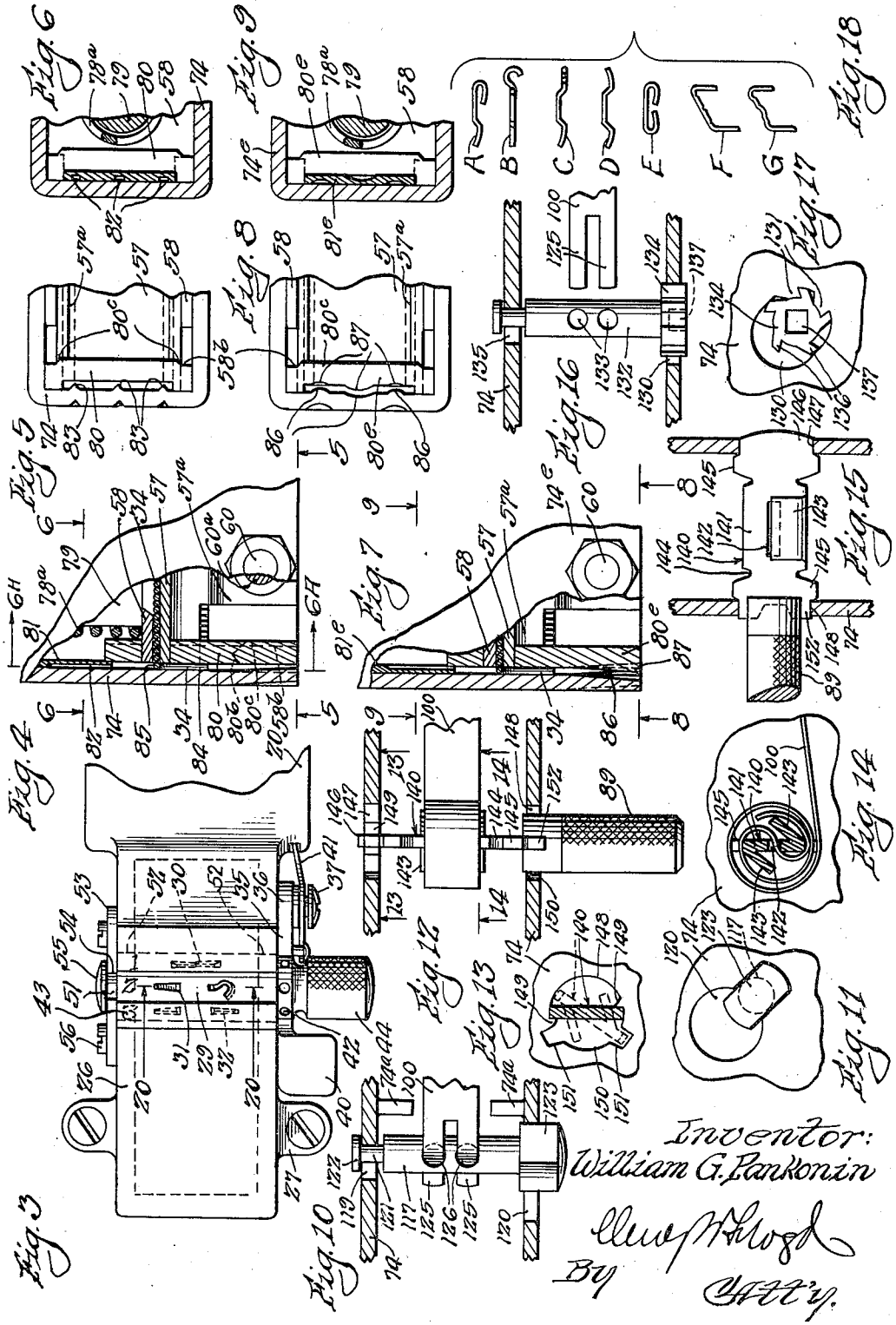
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STAPLING DEVICE

Filed Jan. 9, 1932 2 Sheets-Sheet 2



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STAPLING DEVICE

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Application January 9, 1932, Serial No. 585,710

58 Claims. (Cl. 1—3)

The present invention relates to a stapling device. Its objects particularly relate to improvements in means for securing a staple driving mechanism to a base; to an extension for a staple driving arm; to means for connecting a staple driving device or an extension thereon to a base; to an improved stop for a spring spool or end; to an improved means for attaching an actuating spring to a stapler follower; to an improved handle for a follower block; to a new and unique means for holding a follower spring in a staple ejector housing; to a new and improved anvil for a stapling device; to means for preventing the buckling of a staple during its insertion into material; to staple deforming mechanism; to means for preventing staples from being accidently ejected from a stapling device; to a new improved means for forming the end of a staple follower spring; and to a generally improved staple driving device.

The objects of the invention also include a new and improved means for limiting and defining the movement of a staple driving arm relative to its supporting base.

These objects, and such other objects as may hereinafter appear are obtained by a novel construction, unique arrangement, and improved combination of the several elements forming the embodiments of the invention illustrated in the accompanying two sheets of drawings, hereby made a part of this specification, and in which the numerous improvements mentioned hereinabove are illustrated.

In the drawings referred to:—

Figure 1 is a plan view of a complete stapling device made in accord with the invention;

Figure 2 is a side elevation of the device illustrated in Figure 1;

Figure 3 is a horizontal section on the line 3—3 of Figure 2;

Figures 4, 5 and 6 are a vertical section, a bottom view, and a horizontal section of one form of a staple driving head, Figures 5 and 6 being taken on the lines 5—5 and 6—6, respectively, of Figure 4;

Figure 6a is a vertical transverse section on the line 6a of Figure 4;

Figures 7, 8 and 9 are a vertical section, a bottom view, and a horizontal section of a second form of head, the Figures 8 and 9 being taken on the lines 8—8 and 9—9, respectively, of Figure 7;

Figure 10 is a horizontal section through a stapling head illustrating one form of tensioning device for a staple follower spring and the manner of attaching the latter;

Figure 11 is a fragmentary side elevation of a stapler head possessing the tensioning device illustrated in Figure 10;

Figures 12, 13, 14 and 15, respectively, are a transverse horizontal section, and three vertical sections of a second tensioning device, Figures 13 and 14 being on the lines 13—13 and 14—14 of Figure 12, and Figure 15 being a vertical transverse section;

Figures 16 and 17, respectively, are a transverse horizontal section and a side elevation of a third form of tensioning device;

Figure 18 is a group of staples, A to G, as deformed in the various types of stapling devices herein described and illustrated;

Figure 19 is an enlarged sectional detail of the rear end of the base extensions, and connecting members therebetween;

Figure 20 is an enlarged section on the line 20—20 of Figure 3 showing a staple in clinched position; and

Figure 21 is a fragmentary side elevation of reduced size of the head of the device.

Like reference characters are used to designate similar parts in the drawings and in the description of the invention which follows.

In the present invention, there is a base 20 usually of cast metal or other suitable material and of a length greater than the staple magazine illustrated and the extension disposed thereon. As illustrated, the rear end 21 of the base 20 is enlarged. At each side of the enlarged section 21 are apertures 22 into which feet may be secured, these generally having a protective bottom to engage furniture. The enlarged portion 21 of the base 20 may reach to a lower horizontal plane than the body 23 of the base. Said enlarged section is used to mount the parts employed for limiting the movement of the staple carrying and driving arm.

Also, at the rear end 21 of the base 20, is an L shaped lug 24 integral with or secured to the base 20 in a suitable manner. The lug 24 is parallel to the base 20 and the leg 25 thereof projects toward the front of the device.

At the front of the base 20, the material of the base is narrowed and forms a platform 26 in which an anvil is supported. At the sides of the platform section 26 are ears 27 in which are apertures 28 to receive feet. The feet may have covered bottoms to prevent the base 20 from marring furniture or other surfaces on which the device may be used as shown.

Pivoted in the side walls of the platform 26 at the front of the machine is a barrel like anvil 29 which is mounted for selective rotation. The anvil 29 illustrated has four seats 30, 31, 32 and 33 to receive staple legs, each of the seats causing a staple leg to be bent or deformed. All four seats may be different one from the other. When desired two or more of the seats may be identical, or all may be of the same type. The selection of seats is a matter of choice.

Attached to the platform section 26 is an anvil locking lever 35 which has a heel section 36 held in position by a machine screw 37 or the like, a main body 38 having a detent 39 thereon, and an extension formed into a finger piece 40. A spring 41 (leaf or wire) is associated with the lever 35 to urge it clockwise about screw 37 so that the detent 39 engages in one of four slots 42 provided therefor in anvil 29 to hold the anvil 29 in a selected position whereby a selected seat (30, 31, 32 or 33) is in operable position in respect to a staple driving plunger shortly to be described. There are as many slots 42 as there are usable seats (30, 31, 32 and 33) and each slot 42 is disposed to register with the detent 39 to maintain the selected seat in alignment with the staple plunger.

At one end of the anvil 29, there is an index 43, so that by number or by other insignia, a particular seat is indicated to be in registry with such staple plunger. To permit of a change in the position of the anvil 29, the finger piece 40 is depressed with one hand or a finger. With the other hand or another finger or fingers, the anvil 29 is rotated by a knurled head 44 projecting to the side of the platform 26. Such handle may be an integral part of the anvil structure.

The anvil locking member 35 may be at the side of the platform 26 as illustrated. It could be internally disposed of base 20. The lever 35 may have thereon a lug projecting laterally. Under the lug, the leaf spring 41 may extend about the machine screw 37 on which the locking lever 35 is pivoted and be anchored in the platform 26 adjacent the rear thereof. A seat may be arranged in the vertical shoulder intermediate platform 26 and body 23. Any suitable fastening means may be employed between spring 41 and its associated parts. When desired usually, and as shown, it is positively held.

The anvil 29 may be mounted in the platform 26 in any suitable manner. One method of mounting is to provide an anvil 29 in which the knurled head 44 is of less diameter than the body of the anvil (Figure 3.) Intermediate the anvil 29 and the handle 44, there is provided a bearing part which is adapted to fit in an aperture in the side wall of the platform 26. The other end of said anvil is seated in an aperture 52 provided therefor in the side wall of the platform 26.

On the side wall of platform 26 is a plate 53 having a slot 54. The plate 53 is secured to the side wall of the platform 26 with the opening in the slot 54 upwardly or downwardly disposed, as preferred, so that a reduced section part 51 at the end of anvil 29 will be partially surrounded. A screw or rivet 55 may be inserted into the reduced part 51, the head thereof engaging the plate 53 at the side of the slot 54 to prevent longitudinal movement. Screw 55 may be replaced by an integral head which is the preferred structure. Plate 53 may be attached to the platform 26 in any suitable manner to firmly secure it in position, as for example screws 56. The head 55 prevents axial displacement of the anvil 29 relative to the platform 26 by reason of the engagement of the head 55 with plate 53, while providing ready assembly of the parts.

Several forms of anvil dies are shown. That shown as numeral 30 is of a common type and is adapted to bend a staple 34 with its ends underneath as is shown in Figure 18E. In the form of the anvil indicated 33, the staple 34 may have one end bent under and the other end bent outwardly as shown in Figure 18A.

For providing a bend in the staple 34 which will result in the form of a pin, the type of anvil indicated 31 in Figure 3 is employed. In such anvil, one end of the staple 34 is bent outwardly in the same fashion as the end of a staple in anvil die 33. By the employment of an undercut seat as is shown in Figure 3, the other end of the staple is bent or formed into a hook like section whereby it may be readily manipulated with the fingers. The staple, as it is bent outwardly, has its end away from the undercut seat impinge against a square detent shoulder 33*a* which arrests the end of wire while the other end is forced around a semi-circle groove 33*b* with an undercut portion preventing the wire from jumping up. The seat is so designed for easy removal when material has been shaped as shown in Figures 18B and C. Thus, an elongated staple is formed which may be withdrawn from a stack of papers by a straight pull, the staple behaving in the fashion of a pin. The anvil just described is not designed for use with staple engaging means such as are illustrated in Figures 4 to 9, inclusive, but is appropriate for use when the staple path is free from friction increasing parts contacting the bridge of the staple.

Die 32 in anvil 27 bends both ends of the staple outwardly as is shown in Figure 18D.

The staple carrying member includes a solid member 57 having its end 57*a* milled into a U-shape forwardly and under the plunger housing. About the member 57 is a U-shaped member 58 which also extends into the plunger housing. The members 57 and 58 form a track which guides staples under a staple driving plunger, the staples 34 being of a type individually formed and adhesively secured in an elongated U-shaped strip.

In the upper member 58 is a longitudinal slot 59 to allow the passage of a staple follower. The members 57 and 58 are joined one to another by suitable machine screws or by rivets, as preferred, the drawings illustrating pins 60 with threaded ends.

The material of the members 57 and 58 may have shoulders therein or be formed to effect the track for the staples 34 while providing a lower section through which the pins 60 pass without interfering with the movement of the staples. Spacer sleeves 60*a* may be disposed on the shanks of the pins 60 at the milled out section 57*a*.

At the rear of the members 57 and 58 are parallel extension members 61. Intermediate members 61 are a plurality of pins 62, these being suitably spaced. By these pins the extension members 61 may be rendered true. In Figures 1 and 2, two of said machine screws 62 pass through the members 61, 57 and 58, and two are disposed adjacent the rear of the extensions 61. Intermediate the two pairs of machine screws 62 just mentioned, the extension members 61 are pivoted to extension 25 of the lug 24 by a bearing pin 63. The position of the pins 62 and 63 in relation to the parts 57 and 58 is such that no interference is had with the ready loading of staples 34 into

the magazine or track formed by members 57 and 58 or with the operation of the staple plunger.

At the rear of the device intermediate the extension members 61 is a U-shaped housing 64 having a central aperture 65 and ears 66. The rear pair of the pins 62 is disposed to pass through the extensions 61 beneath the ears 66. The extensions 61 are suitably apertured to receive the pins 62. A post 67 which may be in the form of a machine screw extends upwardly through the base 20 projecting through the aperture 65 which does not fit tightly thereabout.

Within the open section of the U-shaped housing 64 is a sleeve 68 with turned in end 69, which end fits closely about the post 67. Within the sleeve 68 and engaging the turned in ends 69 is a spiral spring 70, the upper end of which is adapted to be seated beneath the head of a screw member 71 which is secured to the post 67. In this manner, the tension of the extension arms 61 about their pivot 63 is regulated because movement of the head 71 rotatively determines the spring pressure on the said extensions.

The upper internal face of the sleeve 68 which is longitudinally split is threaded to receive a nut or cap 72 and to firmly hold said cap in adjusted position. The position of the base of nut 72 determines the limit of the upward movement of the extensions and the adjustment of the head 71 determines the rebound thereof. Because the sleeve 68 is loose about the post 67, the cap 72 provides an effective stop for the angular movement of the extensions. Usually the adjustments of the spring 70 are made at the factory but the adjustments of cap 72 may be made in the hands of the user to allow the head of the device being set as low as the thickness of the material to be stapled will permit.

Plunger guiding rollers 70*a*, 70*b* and 70*c* are disposed on pins in the housing and are arranged to provide guides for the rear face of the plunger. The rollers or collars may be on such pins to facilitate ready manipulation of the plunger. The plunger 72*a* may be square in cross section and the plunger may have means to prevent a partial driving stroke. The staple driver may be arranged to deform a staple head in one of the two manners shown in the drawings.

The plunger 72*a* is spring actuated on its upward stroke and has a driver 81 secured thereto in any suitable manner. Any desired arrangement of stops to limit the uppermost and lowermost position of the plunger or driver may be had.

There may be disposed upon the staple carrier, a housing member 74. The plunger 72*a* may be formed by articulating a sheet of material with the contiguous edges thereof brought together upon any side as, for example, upon the rear as illustrated. Upon the top of the plunger 72*a*, the handle 73 may be secured in any desired fashion as by a process of riveting or of spot welding or otherwise. The staple driving member 81 comprises a relatively thin sheet of hard material suitably secured to the plunger 72*a*.

A cover 75 employed to close the open back of the U-shaped housing 74 has ears 76 which engage against the outer wall of said housing to be secured tightly thereagainst. Screws 78 extend through the ears into the U-shaped housing member 74. A spring 78*a* may extend about a standard 79 and is used for forcing the plunger 72*a* upwardly whereby the staple driver 81 normally is maintained in its upmost position.

Within the housing 74 is a die block 80 having a body in which a track in the form of a staple wide vertical groove is provided. There is a U-shaped slot 80*a* in the die block 80 to receive the ends of members 57 and 58 which terminate in part upon the face of the track portion and flush therewith.

The inner member 57 is undercut at its front end to provide an opening 57*a* cooperating with the die block opening 80*a* to provide an always open passageway in under side of the staple carrying arm for the discharge of mutilated or broken staples.

Because of the inverted U-shape of the aperture 80*a* in the die block 80, there is an upwardly projecting tongue therein. In the vertical sections of slot 80*a* between the outer edges of the opening and the tongue are angular shearing faces 80*b* against which a bent or deformed staple is driven by the staple driving plunger 81 in the course of the downward movement of the plunger 72*a* to discharge a staple from the device.

The end of the outer magazine member 58 is secured in the die block 80 in such a manner that the lip of the member 58 at its top edge, is adapted to extend through the die block, the front face of the member 58 being flush with the back face of the track therein.

The inner member 57 of the magazine terminates in a U-shaped extension which is adapted to rest on the top of the tongue in die block 80 and extend wholly thereacross. At its back, the die block 80 has a shouldered section 80*c* to receive the ends 58*b* of the magazine member 58 and to render more secure the assembly.

In Figures 4, 5 and 6 the staple driver 81 is shown with its lowermost end having three vertical grooves 82, the grooves 82 being in parallelism. One of the grooves 82 is at each edge of the driver 81 and the other is at the center.

In the housing 74, there is provided by stamping or by other suitable means, three complemental ridges 83 which register with the grooves 82 in the driver so that the driver 81 may make a full stroke without any part of it binding upon the housing 74.

A staple discharged over the end of the U-shaped track member 57 is adapted to rest in the track in the die block 80 until the plunger 81 strikes it across its top to force it along the die block 80 by way of the track therein and into material beneath the head 73 and on the anvil 29. The ends and bridge of a staple 34 are adapted to normally rest upon the top of the ridges 83 in the housing 74, there to be held against accidental displacement and in readiness for the driver to strike.

When the driver 81 is forced down by a manually delivered blow upon its handle 73, the driver 81 strikes the staple 34 across its flat top and forces its legs 84 and top 85 downwardly between the complemental parts 82 and 83. The two outer ridges 83 bite into the metal of the staple 34 adjacent its legs 84 and the other ridge 83 bites into the top 85 of the staple 34 at its center giving to the staple when forced from the device the appearance shown in Figure 18F.

An important feature of this arrangement of ridges to engage the staple is that the center ridge which tapers from the beginning or upper part to the bottom, the distance being closer at the bottom than the top, causes a steady friction on the middle of the top of staple, the friction increasing on the staple as it is being forced downwardly into the material. This friction holds the top of the staple firmly against the bottom of the driver and keeps the middle of staple

from buckling while going through material. The outer ridges are not tapered but are so spaced that they prevent the inside of the staple legs from bending inwardly or buckling while being driven into material. This makes it possible to drive the staple through harder materials or more material than otherwise would be possible.

In such an arrangement the staples **34** cannot be freed from the die block **80** accidentally, and no amount of shaking or manipulation of the device will dislodge a staple **34** in the die block **80** from its normal position therein. When desired, the track in the die block **80** may be provided with ridges and the driver **81** supplied with grooves (at the opposite side from that now shown) to produce the same effect as that which has just been described.

Another way to support a staple at its top to prevent buckling downwardly in its center is by having the center deformed as shown, the center ridge being straight or slightly tapered closer to die block at the bottom. The wire of the staple is bent sideways and the temper in the wire is sufficient to keep the upper part or bridge of staple pressing upwardly against bottom of plunger blade to prevent it from bending or buckling while setting into material. The outer grooves or ridges are brought to the inside of the legs to keep the legs of the staple from buckling or bending inwardly. Another advantage in forming the upper or bridge of staple as shown is to have it lay more flat and square after stapling the material. Offsetting the wire sideways helps to maintain it flat.

In Figures 7, 8, and 9, the die block **80** has a channel or track which is irregular in horizontal cross section. The irregularities on the vertical face of the die block **80***e*, those on the front of the housing **74***e* and on the two faces of the driver **81***e* are complemental and corresponding. Means for preventing buckling of a staple **34** in its downward course with coincidental deformation is provided by such irregularity in cross section. The housing **74***e* at the front may have ridges **86** therein and the die block **80***e* at the rear may have a corresponding formation **87** so that the staple **34** as it is moved down in the track in the die block **80***e* is frictionally supported to the extent that it is bent across its top section in two directions as is shown in the staple illustrated in Figure 18G. A staple with a laterally formed bridge similar to that illustrated in Figure 18G is disclosed and claimed in an application Serial No. 39,247, filed September 5, 1935, by William G. Pankonin, the applicant herein. The faces of the driver **81***e*, the housing **74***e* and die block **80***e* are such that the driver **81***e* in its downward flight, under manual urge, does not bind against the housing or die block but is free to move the full length of the die block track without material frictional obstruction. The die block and housing shown in Figures 7, 8 and 9 also prevent any accidental dislocation of a staple **34**.

In the present form of the invention, the cover **75** for the housing **74** instead of being secured in close proximity to the U shaped housing at the point where track members **57** and **58** pass thereinto has ears **91** which overlap onto the housing **74**, there to be secured by screws or rivets. The lower end **92** of the cover **75** is away from the housing **74** to allow the passage of the staple follower which is positively stopped at the end of the slot in member **58**. The sides of the cover adjacent such cut away position are at an angle to the rear edge of the housing **74** so that if the staple follower spring is released, the spool or cross bar at the end thereof will impinge the angularly disposed sections of the cover **75** which act as a spring-like cushion to break the force of any blow which the spring might otherwise deliver against the housing **74** when the spool is released from the follower. In the center of the cover is a tongue **92***a* which is bent to accommodate the follower spring so that when the spring is lifted upwardly it will be bent around the tongue **92***a* rather than at an abrupt and disrupting angle.

New means for securing a spool or cross bar to a spring is illustrated. At the end of a spring **100** is an auxiliary leaf spring **101** which is disposed on the top of the staple follower spring **100**. The outer end **102** of the leaf spring **101** may be turned upwardly.

In association therewith is a staple follower block. Such lock has a body with wings, the wings extending upwardly and providing at the rear a face at an angle of forty-five degrees or less from the perpendicular. The seat thus formed is in substantially the same horizontal plane as the outlet for the follower block spring from housing **74**, so that there may be seated therein a spring handle or spool which comprises a body section by which the spring is secured in the manner heretofore described. There is at the ends of said body section enlarged collars or extensions for preventing lateral movement of the body from the seat provided therefor.

Beyond said collars or extensions, there may be provided enlarged sections comprising flanges over which rubber or other elastic ring members may be supplied as shown. The ring member has a section which extends over the ends of the body as is shown. An alternative form has a rubber web closing the ring at its outer end. Said rubber members provide cushions, facilitate finger gripping of the end of the body, and also tending to prevent bending or damaging of the housing or the cover therefor should the spring be released under tension and the handle or spool strike the housing or the cover therefor.

The staple follower is designated **104**. It has ears **105** with a shallow generally vertically disposed seat **106** therein. The seat **106** is to receive a spool or cross bar **107** having at its ends soft rubber finger seats or cushions such as are illustrated in Figures 1 and 2. One form of cushion is a ring **87**, Figure 2, and the other a ring **88** with a web **89** across one side thereof, Figure 1.

The spring **100** is centrally disposed in respect to the cross bar **107** and is secured thereto by a U-shaped clip **109** which extends therearound, the cross bar **107** falling within the closed end of the U-shaped member **109**. Between the legs **108** of the U-shaped member **109** is the end of spring **100** and the flat spring **101**, the staple follower spring **100** and the flat spring **101** being secured to the U-shaped member **109** by one or more rivets **111** passing through the U-shaped member, the leaf spring, and the staple follower spring. More than one leaf spring may be employed when desired. When a plurality of springs are used, the springs are staggered as to length, the top spring being shortest. Such an arrangement prevents any possibility of the staple follower spring **100** kinking and buckling and insures a firm attachment of the staple follower spring to the cross member, but without undue binding and with certainty of correct assembly of the parts in use. Such an arrangement also

gives a strengthened connection between spring 100 and its manipulating member, the bar 107.

Extending through the U-shaped housing 74 is a spring shaft 117. For controlling and maintaining the tension upon the staple follower spring, three different mechanical arrangements are shown. In Figures 10 and 11, one form of such spring tensioning apparatus is shown. A conjoint reading of the transverse section (Figure 10) and of the fragmentary elevation (Figure 11) should be had. In the U-shaped housing 74 at one side thereof is a relatively short slot 119 to receive one end of the spring shaft 117 while at the other side of the U-shaped housing 74, there is a key-hole slot 120.

The shaft 117 comprises a body having a reduced end section 121. The reduced end section 121 is adapted to rest in the smaller and shorter slot 119. To maintain the staple follower spring shaft 117 against lateral displacement, there is placed upon the outer end of the reduced portion 121 of said shaft a head 122 which is of greater diameter than the width of the slot thus preventing transverse movement of the shaft, the shaft adjacent the reduced section being of a diameter greater than the width of the slot.

The outer end of said shaft has an oblong head 123. The width of said oblong head is substantially the width of the narrow section of the key-hole slot 120 so that when said shaft 117 has been placed in an adjusted position, it will be held against rotation by the relatively close fit of the rectangular head 123 of the shaft 117 in the narrow and complemental portion of the key-hole slot 120.

The enlarged portion of the slot 120 is of a diameter slightly greater than the major transverse dimension of the head 123 so that when the shaft 117 is moved to its extreme forward position in the machine, the shaft 117 may be rotated by a wrench or by any other suitable tool in a clockwise direction to increase the tension upon the staple follower spring 100. When sufficient tension has been obtained by the rotation of the shaft 117 while its head is in the upper part of the key-hole slot 120, the shaft 117 is allowed to slide back in the narrower portion of the slot so that the tension upon the spring 100 obtained by the adjustment just described will be maintained. While one end of the shaft 117 is advanced in the slot 120, the other end moves in slot 119 preventing angular displacement of the shaft 117 to the spring 100 or to housing 74. The tension of the spring 100 maintains the said shaft in the slot while in use.

In Figure 10, a simplified means for attaching the staple follower spring 100 to the shaft 117 is also illustrated. The spring 100 at its wound end may be bifurcated as shown or provided with a greater number of tongues than shown. The tongues 125 are adapted to be threaded through circular transverse apertures 126 arranged in parallelism adjacent the longitudinal center of the spring shaft 117, after which the spring shaft 117 may be rotated to maintain the spring 100 in position. Fastening members of suitable form may be supplied on spring 100 as desired but are not required.

This method of attaching a spring allows a smaller diameter of shaft to be used. The holes are drilled in said shaft without removing the metal between holes. One or more slots are punched in the spring to clear the metal between holes and leave as much cross section metal on said spring which is threaded into the shaft as possible, thereby making that end strong and full width for winding purposes. In the manner described, a very wide spring may be attached securely to a comparatively small diameter shaft with but slightly reducing the strength of the spring at its starting end.

At the same time, the spring is maintained in position upon the shaft 117 so that as the shaft 117 is rotated to increase the tension upon the spring, no undue angular strain is placed upon that part of the spring 100 which is in juxtaposition to the shaft 117. There can be no lateral movement of a spring so held.

A second form of spring tensioning device is shown in Figures 12, 13, 14, and 15. In said form of tensioning device, the staple follower spring shaft 140 which is primarily a flat piece of metal or the like has a central body portion 141 provided with a slot 142 therein. The body of flat material has opposed wings 143. These are extensions and are bent over until substantially parallel. The metal of the member 140 may be cut away to provide reduced sections 144 to facilitate bending of the wings 143. Adjacent said reduced sections 144, the shaft 140 is enlarged, the width of the enlarged sections 145 being greater than the average diameter of the slots in the housing 74 in which it rides. By the enlarged sections 145, the shaft 140 is normally held against lateral displacement, when the ends of the shaft 140 are disposed in the opposed walls of housing 74. One end 146 of the shaft 140 comprises a relatively narrow rectangular portion projecting from the enlarged portion 145 and is adapted to turn freely in the slot 147. The slot 147 may be truly circular when desired. It may be of the same configuration as the slot opposed to it now to be described, or it may be elliptical, the preferred form.

At the opposite side of the housing 74, a second slot 148 is provided. Said slot is of a shield shape and it has teeth 149 complementally but oppositely disposed. One section of said slot is substantially semi-circular, such half circle being broken substantially diametrically by the inwardly projecting teeth 149. A line drawn through the body 141 when resting on the teeth 149 would be truly diametric.

The slot 148 has an enlarged section 150 having two extending portions 151 which are approximately one hundred twenty degrees apart. The ends 152 of the shaft 140 comprise a normally rectangular section which has a length equal to the diameter of the half-circular section of the slot 148.

The shaft 140 is inserted through the slot 148 by employing the enlarged end 152 thereof. After a spring 100 is threaded through and about the shaft 140 as shown in Figure 14, there is no tendency for the shaft to escape because the tension of the spring 100 wound around the shaft in the manner shown in Figure 14 maintains a constant tension avoiding movement of the shaft toward the front of the device.

Under the influence of a winding tool 89, movement of the shaft 140 to increase spring tension is in a clockwise direction. To accomplish this movement, one end of the head 152 at the bottom of slot 148 is displaced away from the radial tooth 149. Such head section is advanced into the enlarged section 150 during which time the upper head section is riding on the semi-circular periphery of the slot 148. When the shaft 140 has been rotated nearly one hundred eighty degrees, the previously upper head section of the

shaft 148 strikes the lower tooth 149. As it cams thereover, the lower (now upper) head section is moved in the enlarged upper part 151 of the slot to allow the camming over of the other head section. When such camming is completed, the further rotation of the shaft 140 forces the now lower head section into the enlarged lower section 151 of the slot while the now upper head section cams over the upper tooth 149.

With the upper head section behind the upper tooth 149, the lower head section recedes into engagement with the lower tooth 149, the two teeth 149 preventing accidental counterclockwise movement of the shaft 140. Such counterclockwise rotation of the shaft 140 is prevented because the length of the head section 152 taken is greater than the diameter of the slot 148 from one tooth 149 to a point approximately one hundred eighty degrees therefrom. The rotation of the shaft 140 in a clockwise direction, however, is relatively simple, once it is understood. The head 152 of the rectangular shaft 140 provides cam faces operating about slot 148 and the teeth 149 in the slot 148, the periphery of the toothed slot forcing the winged sections into one or the other extensions 151 of the enlarged part 150 of the slot.

Reduction of the tension upon the spring 100 by a rotation of the shaft 140 in a counterclockwise direction, on the other hand, is more difficult, except under the guidance of a proper tool. Such reduction required selective manipulation of the parts to move the shaft and its wing sections away from the teeth 149 which normally prevent counterclockwise movement, the avoidance of the teeth being one at a time to procure a reverse rotation. The tension of the spring 100, even though very slight, is sufficient to snap the shaft 140 into position against the teeth 149 to prevent further counterclockwise movement at all times, except when a tool 89, as shown in Figures 13 and 15, is applied to the shaft 140 and the operator carefully guides the head 152 of the shaft 140 in the two extensions 151 and away from the teeth 149.

A third form of spring tensioning device is shown in Figures 16 and 17. In such third form of the invention, elongated openings 130 and 135 are used in the U-shaped housing 74 now to be described. The opening 130 has teeth 131 in its periphery at the lower and rear sides thereof. The spring shaft 132 comprises a main body through which parallel transverse circular slots 133 are formed to receive the bifurcated ends 125 of the spring 100. Like in the first previously described form of tensioning device, one end of shaft 132 rides in an angularly disposed slot 135 and is held in position therein by a head. The slot 135 is complemental to slot 130.

At its other end, the shaft 132 has a toothed head 134 having a key receiving slot 137 preferably centered upon the axis of shaft 132. The head 134 may be permanently or removably secured to said shaft 132. The diameter of the head 134 is in excess of the width of the slot 130 at the point at which the teeth 131 are disposed. The back end of the slot 130 is devoid of teeth and head 134 may be rotated therein.

The angle of narrow slot 135 is coincidental with that of the larger slot 130 at the opposite side of the housing 74. The number of teeth upon the member 134 is a matter of choice, five being shown. The shaft 132 may be moved upwardly and rotated in the two slots 130 and 135 in the housing 74 by a suitable tool (not shown) inserted in slot 137.

When spring tension of sufficient intensity has been had upon the follower spring 100, the shaft 132 is allowed to move forwardly in the slots described, the teeth 131 in the larger slot 130 being adapted to resist counterclockwise movement because of their engagement with the teeth 136 on head 134. The shape and position of the teeth 131 is such, however, that for clockwise revolution of shaft 132 whereby the spring tension is increased, rotative pressure on the shaft 132 will unseat the member 134, forcing it upwardly and forwardly in the slot 130 sufficiently to permit of such rotation. The spring acts to hold the shaft firmly into position. The greater the tension on the spring the more firm the shaft is held in locked position.

This form of spring tensioning device admits of a ready rotation of the shaft 132 with a suitable tool to increase the tension of the spring, and a firm resistance against rotation in the opposite direction to reduce the tension of the spring 100 unless the shaft 130 is moved to its extreme forward extent of the two slots 130 and 135 in the U-shaped housing.

Flanges 74*a* may be used in the housing 74 (see Figure 10) to provide spring guides and to prevent displacement of the wound spring axially thereof. Such guiding flanges may be formed as an integral part of the housing 74 as shown.

For the assembly of the device in the manner herein indicated, adjustments are made in connection with the tension of the spring controlling the rebound of the staple driving arms and the distance which the staple driving arm will rise under the influence of the spring 70. The anvil is turned so that the desired anvil die registers with the staple driving head.

The spring for the follower, by manipulating its handle, is released from the staple follower. The staple follower is then removed from the track and a strip of staples is placed in the magazine. The staples are in the form of an elongated strip, which strip is obtained by gluing wire staples together. The individual staples are readily separated one from another by forcing them apart, and in the machine, the end staple is broken from the strip by the die block which is adapted to impinge the end staple only. The thickness of the staple track in the die block is such that but one staple from the magazine can project thereinto under the urge of the staple follower.

As a strip of staples has been placed in the magazine, the staple follower is replaced at the end of the strip, and then the staple follower spring is put in position to urge the follower along the magazine to force the staples, one at a time, into the die block in the path of the staple driver.

The machine is now ready for use. Material is intermediate the driving head and the anvil. The staple driving head is forced downwardly thereon by a push or by a blow of the hand. The staple driver detaches a staple from the strip and forces it against the anvil, penetrating any material that may be resting upon the anvil. The character of the deformation depends on the particular portion of the anvil which is in registry with the staple driver and the structure used for preventing the buckling of the staple, two of which are described in the present application.

When the staple driving head is released from the anvil, it rises under the influence of the spring 70, the portion of the device disposed on the rear section of the base determining to what extent

the staple driving arm will rise under the urge of the staple arm spring 70. As the staple driver rises, another staple is brought into position in the staple track by the urge of the staple follower spring. The device is thus made ready for further use.

As soon as the machine is emptied of staples by the operation of the staple driver, the magazine may be refilled in the same manner in which it was originally loaded. If a different type of clinching or deformation for the staple is desired, the anvil is adjusted to meet the requirements or desires of the user.

Should the tension on the follower for the staple become reduced or it be considered desirable to increase the tension of the staple follower spring, this is accomplished by rotating the staple follower spring shaft in the clockwise direction. Deformed or defective staples are broken apart or cut into pieces by the staple driver forcing the legs thereof against the face 80*b*.

The length of the beam is such that the staples may be placed a great distance from the edges of the sheets to be stapled. The character of staple deformation has already been discussed. The staple carrying arm is capable of varied adjustment, stops being provided for limiting the upward movement thereof, and the spring tension therein being adjustable to control the rebound.

While several forms of the invention are shown, it is not to be understood that the forms illustrated are the only forms which the invention may take. The scope of the invention is to be measured by the appended claims.

What I claim is new and desire to secure by Letters Patent in these United States is:

1. A stapling device comprising a beam magazine having a discharge end and a loading end, a base of greater length than said magazine and having one end in registry with the discharge end of said magazine, and an extension member in alignment with said magazine secured to and projecting a substantial distance from the loading end thereof and pivoted to the other end of said base to provide a loading throat for said device between said base and said magazine of substantially greater depth than the length of said magazine.

2. In a stapling device, a base, a staple driving part, a rotary anvil in said base and having selected sections cooperating with said staple driving parts to clinch staples, and means for positively locking said anvil in any selected position comprising spaced apart recesses in said anvil, and a dog having a pivot at one side of said anvil and an operating handle at the other side thereof mounted on said base and having a tooth intermediate its pivot and said handle insertable into a selected recess.

3. In a stapling device, a base, a staple driving mechanism pivoted thereto, an anvil mounted transversely of said base and rotatable to selectively determine a section thereof to be used for clinching a staple, and means for positively locking said anvil against rotation comprising spaced apart recesses in said anvil and a substantially horizontal dog mounted longitudinally of said base and transversely of said anvil and having a tooth insertable into a selected recess.

4. In a stapling device employing a preformed U-shaped staple, a stapling anvil having a die section having a laterally curved face adapted to deform a leg of such staple into a hook end, the body of the hook being in a plane parallel to the bridge of such staple and normal to the direction of the leg of the staple before deformation.

5. In a stapling device employing a preformed U-shaped staple, a stapling anvil having a die seat provided with an undercut part adapted to deform a leg of such staple into a hook the body of which lies in a plane parallel to the face of the anvil.

6. In a staple driving device having a magazine, a staple follower, a staple follower spring having transverse extensions, and rings of cushioning material on the ends of said extensions.

7. In a staple driving device, a housing for a staple driver, a follower for staples, and a cover for said housing having a spring-like section projecting away from said housing and forming a cushion stop for said follower.

8. In combination with a staple driver, a housing, a magazine projecting therefrom, a follower in said magazine, and a cover for said housing and having a spring-like portion projecting away from said housing and over said magazine and forming a cushion stop for said follower.

9. In a stapling device, a housing having transverse walls, a section of said walls having flat faces parallel to the bridge of a staple and forming a track for unobstructed movement of such staple, and another section of said walls having faces with complemental opposed irregularities obstructing the free passage of such staple and deforming the bridge thereof when such staple is forced therepast.

10. In a staple driving device having a magazine, and a staple follower in said magazine, a spring for said follower, and a shaft for said spring, said shaft having parallel openings thereacross, and said spring having end furcations insertable into said openings.

11. In a stapling device, a housing having an eccentrically shaped aperture in the side thereof, a magazine, a follower in said magazine, a spring for said follower, and a shaft for said spring having a head normally held against rotation by the walls of the housing about said eccentrically shaped aperture and rotatable therein when displaced against the tension of said spring.

12. Spring holding means in a stapling machine having a staple magazine, a follower in said magazine, and a spring for said follower, and comprising a housing having a toothed aperture therein away from the periphery thereof, and a shaft for said spring and having a toothed head adapted to be seated in the aperture in said housing.

13. Spring holding means in a stapling machine having a staple magazine, a follower in said magazine, and a spring for said follower, and comprising a housing having a serrated shield-like aperture therein, and a flat member rectangular in form, one end of which is disposed in said aperture and forms a shaft for said spring.

14. In combination, a staple driving head, a magazine for staples, extension members on said magazine, a base to which said extension members are pivoted to support said magazine, and spring means adjustably disposed with respect to said extension members for limiting upward movement of said driving head.

15. In a stapling device, a beam magazine for a preformed staple having a bridge, a housing at the discharge end of said magazine and comprising members spaced apart a distance substantially equal to the thickness of and form-

ing a track for the discharge of such staple, such track comprising two sections, one section being adjacent the discharge end of said magazine and having flat opposed walls parallel to the bridge of such staple, and the other section being a continuation of the first section and having opposed walls areas of which are not in parallelism with the bridge of such staple.

16. A stapling device comprising a beam magazine having a discharge end and a loading end, a base of materially greater length than said magazine and having one end in registry with the discharge end of said magazine, magazine supporting members having an end pivoted to the other end of said base, connecting members between the loading end of said magazine and the free ends of said supporting members for holding said supporting members and said beam magazine in alinement, said supporting members projecting from said magazine for providing a loading throat for said device between said base and magazine substantially more extensive than the length of said magazine, spring means actuating said supporting members to lift said magazine, and means for determining the height to which said magazine may be lifted under the urge of said spring.

17. A stapling device comprising a beam magazine having a discharge end and a loading end, a base of materially greater length than said magazine and having one end registry with the discharge end of said magazine, extension members at the other end of said base and pivoted at one end thereto, connecting means between the free end of said extension members and the loading end of said magazine for maintaining said magazine and extension members in alinement and for providing a loading throat for said device between said base and said magazine substantially more extensive than the length of said magazine, and means upon said extension members for regulating the angular position of said magazine relative to said base.

18. A staple driving head comprising a plunger, a driving blade secured to said plunger, a housing about said plunger, and pins having rollers thereon to form bearings for said plunger.

19. A staple anvil comprising a body having a depression provided with an undercut portion for forming a semiloop in a staple, and means for preventing axial movement of said staple in said anvil during its deformation.

20. In a stapling machine, an anvil having a seat provided with a shouldered section at one end to spread one leg of a staple and to arrest the movement thereof, and a grooved section and an undercut part at the other end to deform the other leg of said staple into an arcuate section lying in a horizontal plane.

21. In a staple driving device, a staple driving section comprising a beam magazine for staples having a loading end and a discharge end, a base, and paired parallel complemental members pivoted to said base and secured to the sides of said beam magazine adjacent to and projecting from its loading end in alinement therewith to provide a loading throat for said device between said magazine and said base of substantially greater length than said magazine.

22. In a stapling device, a base, a pivoted arm, a standard in said base, transverse members on said arm, a housing about said transverse members, a sleeve about said standard, a spring surrounding said standard, means for adjusting the tension of said spring, and a cap for said sleeve and cooperating with said spring adjusting means to limit the movement of said arm about its pivot.

23. In a staple driving device having a spring, and a cross bar at the free end of said spring, cushion rings for the ends of said bar, said cushion rings having webs extending across the ends of the cross bar.

24. A staple driver having a housing, a magazine projecting therefrom, and a staple follower in said magazine, in combination with a spring for said follower and wound within said housing, and a leaf spring secured to said follower spring at its end to facilitate attaching of said wound spring, the two springs separating one from another away from such end.

25. A terminal for the free end of a staple follower spring for use in a staple driver, comprising the combination with said staple follower spring of a leaf spring, a clip fitting over said staple follower spring and said leaf spring, and fastening means extending through said staple follower spring, leaf spring, and said clip.

26. In a staple driving device, a housing, a staple driver in said housing, and a die block, the housing and die block forming a track for the discharge of a staple, said parts having irregular faces, and said driver having opposed faces complemental to the adjacent faces of said housing and die block.

27. In a stapling machine, a housing having a keyhole slot in one side, a staple magazine, a follower in said magazine, a spring for said follower, and a shaft for said spring having a rectangular head rotatable in the circular part of said slot and held against rotation in the extension portion of said slot.

28. The combination described in claim 12, and in which the teeth in said housing and said head are arranged to facilitate a winding of the spring to increase the tension thereof, and to firmly resist unwinding of the spring.

29. Spring holding means in a stapling machine having a staple magazine, a follower in said magazine, and a spring for said follower, and comprising a housing having walls with an aperture of irregular configuration therein, and a shaft member comprising a flat sheet of material extending from one wall to the other wall of said housing and seated and braked in said aperture, said shaft member having extensions from the body thereof intermediate said walls and folded about said shaft, and said spring being rolled about said extensions.

30. The combination described in claim 13, and in which said shaft member comprises a blank having a central slot and extensions folded angularly to provide an arbor for said spring, the end of which spring is disposed in the slot in said blank.

31. A staple driving head having walls defining a path for U-shaped staples to be discharged therefrom, a staple discharging plunger, and means upon one of the walls of said head for engaging and deforming the bridge of a staple laterally to support said bridge against buckling while being driven into material.

32. A staple driving head comprising walls forming a staple discharge path, one of said walls having a section possessing ribs extending in parallelism with and of a length substantially equal to the length of the legs of a staple driven therepast and providing a stop for a preformed staple before being driven, said ribs engaging the in-

terior faces of the legs of such staple longitudinally thereof to support such legs against buckling while being driven into material.

33. A stapling device comprising a head having parallel walls spaced apart the thickness of a staple and extending transversely the length of the bridge of such staple, said walls defining a path for a staple into material under the urge of a driving member, said walls intermediate their wide faces having means frictionally engaging the bridge of a staple driven therepast to prevent the bending of such bridge by such driving member.

34. In a stapling device, a head having a side wall with an aperture therein, said aperture being away from the edge of said wall, a spring in said head, and a shaft for said spring, said shaft and said aperture having complemental and cooperating teeth adapted to interlock under the tension of said spring.

35. In a stapling device, a head having a side wall with an aperture therein, said aperture being away from the edge of said wall, a shaft in said head, and a spring on said shaft, said shaft and said aperture having complemental and cooperating teeth adapted to interlock under the tension of said spring.

36. In a stapling device, a head having a wall with a keyhole slot therein away from its edge, a shaft having a rectangular section adapted to be seated in the complemental extension of said slot, and a spring on said shaft the tension of which prevents the unseating of said shaft from said extension.

37. In a stapling device, a housing, having vertical parallel side walls, a shaft in said housing, and a coil spring, said housing in proximity to said shaft having inwardly directed transverse tangs the edges of which engage the edges of the coiled spring to arrest movement of said spring axially of said shaft.

38. A stapling device having a housing with walls forming a path for a staple as it is driven into material and coextensive in width with the bridge of said staple, said walls having one section with straight flat parallel walls spaced apart a distance equal to the thickness of the staple material, and another section having oppositely undulating complementary walls deforming the bridge of a staple into a multiplicity of transverse curves.

39. A stapling machine comprising a U-shaped housing, a die block arranged transversely of said housing and providing therewith a staple discharge path, said die block having an inverted U-shaped opening therein, a beam magazine comprising an inner and an outer member between which staples are advanced for discharge one at a time through such staple discharge path, said inner member at its front having its sides removed to provide a lip extending through the U-shaped opening in said die block and partly surrounding the tongue thereof, and said outer member also having sections of its sides removed and registering with the opposite wall of the U-shaped slot, the material of said outer member engaging the rear of said die block.

40. A stapling machine comprising a housing U-shaped in cross section, a die block arranged transversely of said housing and having at its rear face parallel longitudinal shoulders, said die block having an inverted U-shaped slot therein, and a magazine comprising a U-shaped inner member having a front extension partly surrounding the tongue in said U-shaped opening, and an outer member U-shaped in cross section and having a top and side extensions spaced one from another, the top extension being disposed in said U-shaped slot and the side extensions being seated against the material of said die block at the shouldered sections thereof.

41. A stapling machine comprising a housing U-shaped in cross section, a die block arranged transversely of said housing and having at its rear face parallel longitudinal shoulders, said die block having an inverted U-shaped slot therein, and a magazine comprising a U-shaped inner member having a front extension partly surrounding the tongue in said U-shaped opening, there being a space at each side of said member beneath said extension and between its front end and said die block to provide an ever open passage auxiliary to the staple path between the die block and housing, and an outer member U-shaped in cross section and having a top and side extensions spaced one from another, the top extension being disposed in said U-shaped slot and the side extensions being seated against the material of said die block at the shouldered sections thereof.

42. In a stapling device, a staple magazine comprising opposed complemental staple guiding parts, and a die block at the front end of said magazine having an opening therethrough and in which the front ends of said magazine parts interlock.

43. In combination in a stapling machine, a staple driving head having therein a die block providing a staple ejection chute and having a transverse opening, and a magazine comprising upper and lower guide members for staples, the upper member engaging the opening in said die block from one direction and the lower member engaging the opening in said die block from another direction to position said die block in said driving head.

44. In a stapling device, a housing U-shaped in longitudinally transverse cross section for a staple driving mechanism, a beam magazine for staples in said housing, a spring coiled about an axis in said housing and operating a staple follower, a staple follower in said magazine, and a cover plate to close the open side of said U-shaped housing, said cover plate having an inwardly bent section in alignment with and engaging said spring to prevent said spring from being sharply bent as it is withdrawn from the magazine.

45. In a stapling device, a staple driving tool, and a staple discharge chute into which a preformed staple having a straight bridge portion is received, said chute and driving tool coacting with one another and with such staple to laterally deform the bridge of such staple during its movement through said chute.

46. In a stapling machine, a staple driving mechanism, and a discharge chute through which staples are ejected one at a time by said driving mechanism, there being ribs projecting into said discharge chute away from the legs of a staple therein to engage the bridge of such staple and to support such bridge from buckling or bending as such staple is being discharged from said chute into material by said driving tool.

47. A stapling machine comprising an ejection chute through which staples are driven, and a reciprocal driving tool, and in which said machine has ribs projecting into said ejection chute to contact the bridge of a staple as said staple is driven therethrough, and said tool has grooves

complemental to the ribs in said machine to form a clearance space between said tool and chute.

48. In a stapling machine having a staple discharge chute, a beam magazine for staples comprising a core upon which staples ride, guiding means directing the staples along said core, a die block forming a wall of such ejection chute and having an opening in such wall, the ends of said core and of said guiding means extending through such opening in said die block and being substantially flush with such wall of the ejection chute, said beam magazine delivering staples to said chute, and said die block having cutting edges to sever bent or crooked staples and an aperture adjacent said cutting edges and removed from such chute through which parts of severed staples may fall.

49. In a stapling machine, a housing, a reciprocal staple driving plunger in said housing and having bearing walls, and antifriction means in said housing operative upon one of said walls during the reciprocation of said plunger within said housing.

50. In a stapling device, a staple magazine, a staple follower in said magazine, a staple follower spring, connecting means between said follower spring and said follower, and a cushioning means upon said connecting means.

51. A stapling machine having a die block providing a portion of a staple ejection chute, a staple driving means, and a staple magazine comprising upper and lower guide members for staples, the upper member engaging said die block from one direction and the lower member engaging said die block from another direction, and said members guiding staples through said block into said ejection chute.

52. In combination, a staple driving tool, and a staple driving head therefor comprising walls forming a staple discharge path, said head having at least one wall with a rib positioned therein away from the legs of a staple, said rib engaging the bridge portion of a staple to prevent such bridge portion from buckling or bending as the staple legs are driven into and through material.

53. A stapling device comprising a base, a beam magazine for staples having a discharge end and a loading end, extension members upon the sides of said magazine and extending to the rear of the loading end of said magazine and pivoted to said base, and spring means for elevating said beam magazine from said base, said spring means being positioned to the rear of the pivot between said extension members and said base.

54. In a stapling device having walls forming a discharge chute, a magazine for staples, and a die block at the end of said magazine and forming a part of the walls of such staple discharge chute, said block having an inverted U-shaped slot therethrough, said magazine comprising opposed parts one of which is upon the upper edge of the tongue of material forming the interior face of such U-shaped slot in said block and the other part being upon the outer face of said U-shaped slot, and there being a space between said magazine parts for staples to slide to such discharge chute.

55. In combination, in a stapling device having a staple discharge chute, a staple driving tool, a beam magazine for staples to be fed to said tool and comprising a member forming a staple track upon which staples ride and guide means to maintain staples on said track, and a die block forming the rear wall for such staple discharge chute and having an opening therethrough, the material of said track and of said guide means extending through the opening in said die block and the ends of said track and guide means being substantially flush with the face of said block forming the rear wall of said ejection chute whereby said staple driving tool may act upon staples in said magazine one after another to drive them out of said discharge chute.

56. In a stapling device having a discharge chute with front and back walls, a beam magazine for staples comprising a core forming a staple track and guide means to maintain staples on said track, and a die block having an inverted U-shaped slot therein, the material of said core extending through the U-shaped slot in said die block and partly surrounding the tongue of material in said block forming the inner face of said U-shaped slot, the material of said guiding means also extending through said U-shaped slot, and the front ends of said core and of said guiding means and the front face of said die block being in substantial alignment and forming the rear wall of such ejection chute.

57. In a stapling device having walls forming a discharge chute through which staples are discharged one at a time, a beam magazine for such staples, a staple driving tool for discharging such staples, and a die block having a slot therein and forming one of the walls of said discharge chute, the ends of said beam magazine extending into said slot and being substantially flush with the front face of said ejection chute, and a portion of said die block extending above said magazine and forming a rear guide for said driving tool.

58. In a staple driving device, staple driving means, a driving tool in said means, a staple carrying arm, there being a staple discharge chute between said arm and driving means, said arm having a face with ridges projecting into said chute to act as supporting means for a staple and said driving tool having complemental grooves to clear such ridges and to prevent friction between said tool and arm.

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