May 18, 1937. W. SCHAFROTH 2,080,634

STAPLING DEVICE

Filed June 6, 1935 2 Sheets-Sheet 1

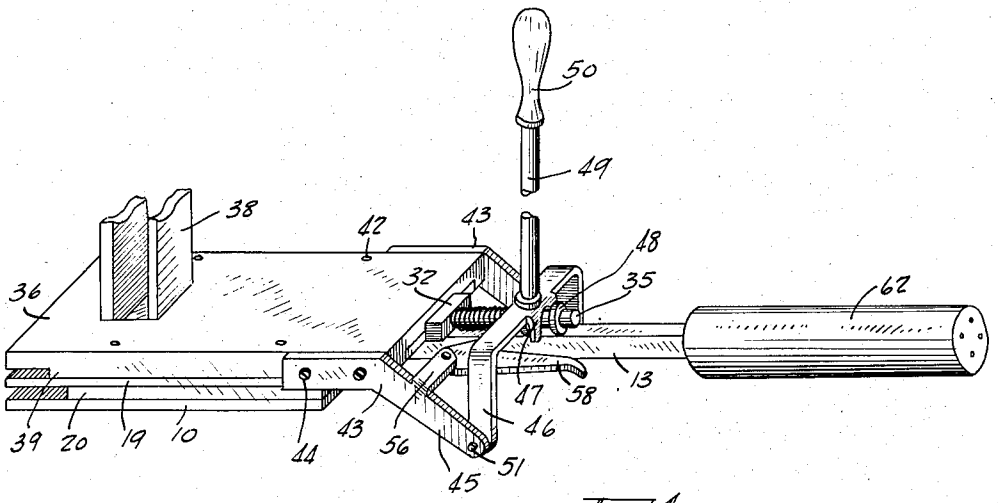


Fig 1

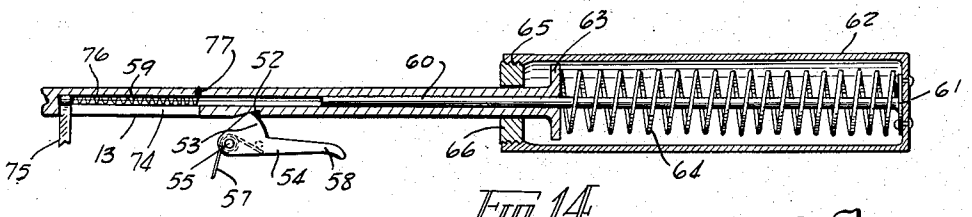


Fig 14

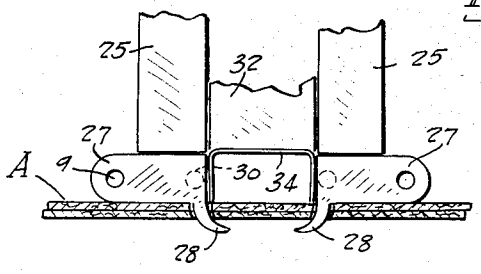


Fig 15

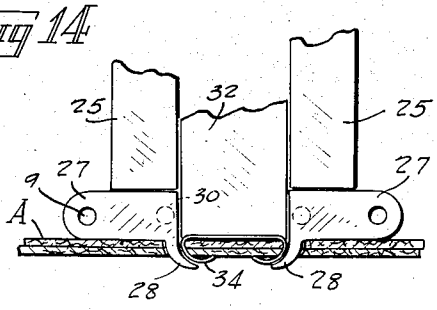


Fig 16

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May 18, 1937. W. SCHAFROTH 2,080,634

STAPLING DEVICE

Filed June 6, 1935 2 Sheets-Sheet 2

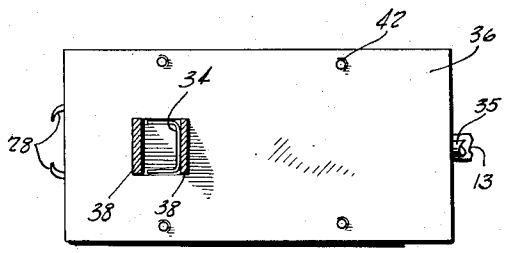


Fig 13

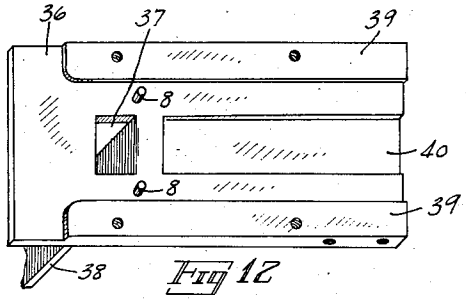


Fig 12

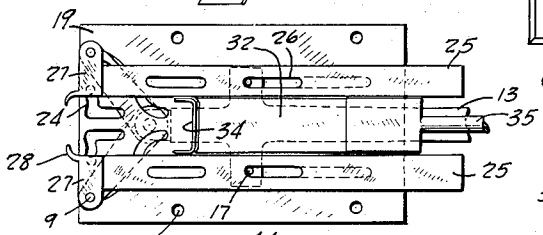


Fig 11

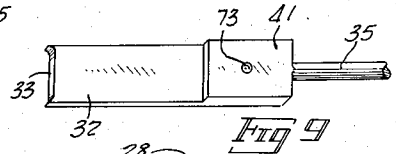


Fig 9

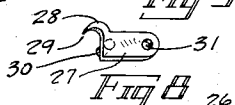


Fig 8

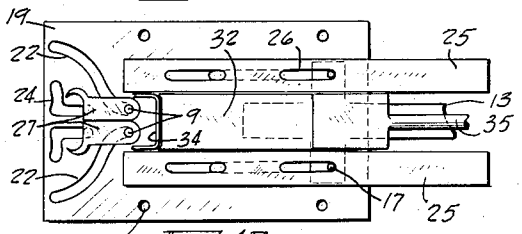


Fig 10

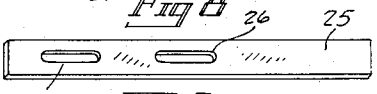


Fig 7

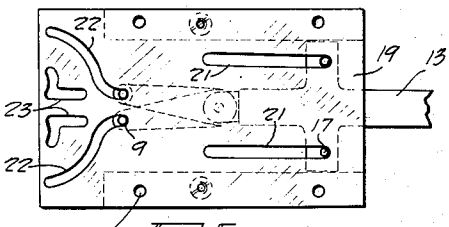


Fig 6

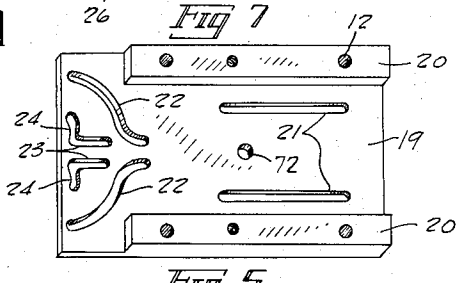


Fig 5

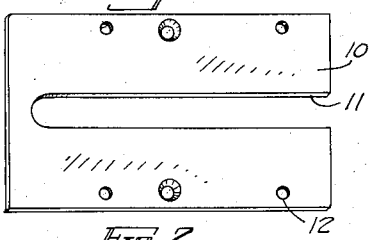


Fig 2

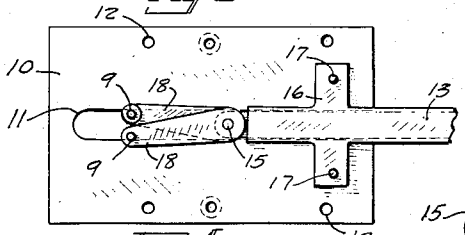


Fig 4

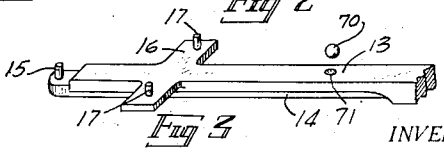


Fig 3

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Patented May 18, 1937 2,080,634

UNITED STATES PATENT OFFICE

2,080,634

STAPLING DEVICE

Werner Schafroth, Upper Darby, Pa.

Application June 6, 1935, Serial No. 25,199

15 Claims. (Cl. 1—49)

This invention deals with the art of stapling machines. Under certain conditions of actual usage, it becomes desirable to perform stapling operations from one surface only of any given article, and which surface does not have any appreciable backing to support it. I have in mind the present day widespread use of cardboard boxes, corrugated and otherwise, which are essentially characterized by the inclusion of flaps which are folded over to form the complete package.

At the present time, considerable difficulty and annoyance is being experienced in fastening these flaps together, in that there is not available a stapling device which will function properly on such unsupported surface, and which will operate entirely from the outside surface of the box. Obviously, there are other situations in which it is desirable to fasten together, as by stapling, similarly unsupported surfaces, or surfaces which can be accessible only from one side.

With these conditions in mind, this invention has in view, as an important object, the provision of a stapling machine which is designed for operation entirely from one surface of any articles to be stapled, and which machine is operable under conditions of little or no support existing beneath the surfaces being stapled.

In attaining these broad objectives, certain conditions are inherently presented which must be adequately taken care of in order to provide a practical operating machine. The first of these, and perhaps the more important, is that of insuring of proper penetration of the material being stapled.

It is well recognized by those skilled in the mechanical arts that when unsupported material is to be penetrated, the only force tending to hold the material in position so that the penetrating instrumentalities may operate is the inertia of the material. Where the material being operated upon is light and of the nature of corrugated cardboard, the resisting effects provided by the inertia are not very great. Hence, it is necessary that the penetrating instrumentalities move at comparatively high speed in order to carry out their piercing functions.

With the foregoing in view, an important object of the present invention is to provide in a stapling machine of the character described penetrating instrumentalities for piercing the material to be stapled, which penetrating instrumentalities are operable at a high rate of speed.

Another ever existent condition associated with the provision of a practical stapling machine of this type is the need for clinching the staples after they have penetrated the material.

It is universally recognized in the stapling art that in order for staples to have their proper fastening effects, that the ends thereof be bent over and slightly backwardly in the material, and it has been the practice to carry out these so-called clinching operations from that side of the material opposite to that which was originally pierced. However, this necessitated working from both sides of the material which, as above pointed out, is not possible under certain service conditions.

Another characteristic feature of now known stapling operations is that the staples are not guided while they are penetrating the material; that is, once the point of the staple enters the material, it must depend on its own rigidity and strength to resist any tendencies to be deflected or bent, which might be created by irregularities in the consistency of the material being pierced. As a result, the staples are not truly inserted, and subsequent clinching operations are not carried out with the best effects.

Accordingly, this invention has in view, as another important object, the provision of instrumentalities for positively guiding a staple while it penetrates material and as it is being clinched.

More in detail, the invention contemplates penetrating instrumentalities which are first operated to penetrate the material, and then assume a position in which they constitute both a guiding means and a means for clinching the staple.

The invention also has as an object the provision of a stapling device which includes instrumentalities for penetrating the material prior to the insertion of the staples therein. In carrying out this thought, the penetrating instrumentalities are first operated, after which the staple is inserted and clinched into its ultimate fastening position. With this arrangement, it is possible to attain high speed in the operation of the penetrating instrumentalities, where it is needed, but a lower speed with a consequential increase in power in the inserting of these staples.

The invention, therefore, comprises a stapling machine including penetrating instrumentalities which are movable into position constituting a guide and clincher means for a staple, means for operating the penetrating instrumentalities, and means for inserting a staple under power to

cause the latter to be influenced by the clincher means to assume a clinched fastening position.

Other more detailed objects and advantages of the invention are associated with the carrying out of the above noted objectives in a practical stapling machine.

For a full and complete understanding of the invention, reference may be had to the following description and accompanying drawings, wherein:

Figure 1 is a perspective illustration of a stapling device embodying the precepts of this invention,

Figure 2 is a perspective view of one of the plate members entering into the make-up of the stapling device,

Figure 3 is a detail perspective of one of the operating parts of the penetrating instrumentalities,

Figure 4 is a plan view showing the structure of Figure 3 added to that of Figure 2,

Figure 5 is another detail perspective of one of the plates entering into the make-up, while

Figure 6 shows the built up structure of Figure 4 with the plate shown in Figure 5 added thereto,

Figure 7 is a detail perspective of one of the slides constituting a part of the operating means for the penetrating instrumentalities,

Figure 8 is a detail perspective view of one of the penetrating instrumentalities, while

Figure 9 is a perspective showing of the stapling inserting member,

Figure 10 develops in plan, structure shown in Figure 6 with the operating parts shown in Figures 7, 8 and 9 added thereto,

Figure 11 is a view somewhat similar to Figure 10, bringing out the penetrating members in their ultimate clinching position,

Figure 12 is a perspective showing of the plate to which is connected the staple magazine,

Figure 13 is an elevational showing of the built up structure, with the plate shown in Figure 12 added thereto,

Figure 14 is a sectional view through the operating mechanism for the penetrating instrumentalities,

Figure 15 is an enlarged sectional view, somewhat fragmentary, showing the penetrating members in clinching position and the staple just prior to being inserted in the materials, and

Figure 16 is a view similar to Figure 15, bringing out the ultimate clinching position assumed by the staple.

Referring now to the drawings, wherein like reference characters denote corresponding parts, I have shown in Figures 15 and 16 two sheets of material designated A, which are intended to be stapled together by the stapling machine provided by this invention. This material A ordinarily may be flaps of a corrugated cardboard box, which is a type now meeting with wide usage. Obviously, the invention is not to be limited in this respect as the machine may be used any place where stapling operations are deemed necessary.

However, as shown in Figures 15 and 16, these flaps A are brought out as being unsupported, this being a common condition, either where the box of which they constitute a part is not completely filled, or when the box is filled with such a material as will provide no supporting effects.

In describing the structure of a stapling machine, as contemplated by this invention, I begin with a plate shown in Figure 2 and designated 10, and shall depict the various parts as they are added thereto. The plate 10 is formed with an open ended slot 11 for a purpose to be later described, and also with a plurality of openings designated 12, which cooperate with certain fastening means to maintain the plate in a complete assembly.

Referring now to Figure 3, a plunger is shown therein and designated 13. This plunger is provided with a rib 14 that is received in the slot 11 of the plate 10, while the main body portion of the plunger 13 extends over the face of the plate 10 along each edge of the slot 11. At one end the plunger 13 is connected to certain operating instrumentalities as will hereinafter be described in detail, while at its other end, the rib 14 is prolonged and formed with a pin 15 that projects upwardly. A cross piece 16 is carried by the plunger 13, being preferably formed integral therewith, and at each extremity the cross piece 16 has pins 17.

Figure 4 develops the plunger 13 as applied to the plate 10, and in addition, a pair of links 18 are shown as being pivotally connected at one end to the pin 15. At their other extremities the links 18 carry pins 9.

Passing on to Figure 5, an intermediate plate 19 is shown in an inverted position and with side pieces 20 connected thereto. Extending substantially parallel to the side pieces 20, and spaced therefrom a slight distance, are a pair of slots 21. It is noted that the slide pieces 20 stop short of one end of the plate 19, and at this end of the plate 19, the latter is formed with a pair of complementally curved slots 22 of the formation clearly developed in the drawings, and in that portion of the plate 19, embraced by the slots 22, a second pair of slots are formed, each slot of which comprises a straight portion 23 and a curved end portion 24.

Figure 6 develops the structure with the plate 19 added to the showing of Figure 4, but being in a turned-over position with respect to the showing of Figure 5. In this view, the pins 17 on the cross piece 16 are shown as slidable in the slots 21.

Figure 7 develops one of the slide members, there being two included in the assembly. Each of these slide members is designated 25, and is formed with a pair of spaced slots 26 through which extend the pins 17. When the slides 25 are assembled, the side edges thereof engage the side pieces of a back plate to be later described, and the slots 26 nearer the center of the slides receive the pins 17 to limit and at the same time, cause movement thereof.

A penetrating member is shown in Figure 8 as comprising a main body portion 27 that is integrally formed at one end with a crescent-shaped tang 28 which has a penetrating edge 29 that, obviously, may be ground down finely to provide penetrating qualities of a high degree. The body member 27 carries a pin 30 which is received in one of the slots made up by the parts 23 and 24. At its other end the penetrating member 27 has an opening 31 which receives one of the pins 9 which is carried by the links 18, the pins 9 extending through the curved slots 22.

A staple plunger 32 is shown in Figure 9 as formed with an end edge 33 designed to grip the back of a staple, the latter being of U-shape, as shown at 34 in Figure 13. This plunger 32 is provided with a shank 35 for connecting it to operating instrumentalities, to be later described.

Figure 10 develops the structure of Figure 6 with the addition of slides 25, penetrating mem-

bers 27, and staple plunger 32. One of the staples 34 is also shown in the position prior to being affected by the plunger 32. In this view, the penetrating members 27 are shown in their fully retracted position, in which event the pins 9 engage the uppermost extremities of the slots 22. Also, the pins 30 on the members 27 abut against the upper edge of the slots 23.

Figure 11 shows the position of the parts after the plunger 13 has been operated. In this position, the pins 9 have reached the other extremity of the slots 22, while the pins 30 have traveled through the slots 23 and 24 to reach the closed end of the latter. In this position, the members 27 are at right angles to the position they formerly assumed, and the crescent-shaped tangs 28 project beyond the end edge of the several plates making up the assembly. In this view the staple 34 is shown in position prior to being inserted through the materials.

Referring now to Figure 12, a back plate 36 is shown as formed with an opening 37 at the upper and lower edges of which are connected a pair of flanges 38 which constitute a means for operatively positioning a magazine of staples. The back plate 36 carries a pair of pins 8 which are designed to be slidably received in the slots 26 at the extremities of the slides 25.

In this connection I note that the invention is illustrated and described in conjunction with a source of staple supply commonly referred to as a magazine which delivers staples at the opening 37 in a U-shape. However, the invention is not to be limited in this respect, as I am aware of the various devices for forming strand wire into U-shaped staples. The invention is adapted for use with such machines, but is concerned only with the operations affecting the staples after they have assumed their U-shape.

The back plate 36 is shown as formed with side pieces 39 which cooperate with the side pieces 20 to define the full side of the assembled machine. The plate 36 is formed on its inner face, and centrally thereof, with a flat groove 40 in which slides a thickened portion 41 of the plunger 32, the extremity of the groove 40 constituting an abutment which cooperates with the enlarged portion 41 to limit movement of the plunger 32 with respect to the assembled plates.

Figure 13 develops the structure with the back plate 36 added. Fastening members 42 may take the form of screws which pass through the openings in the several plates provided for that purpose.

It is evident that the handle 50 may be depressed to cause a corresponding movement on the part of the shank 35 and the staple plunger 32. In view of the pivotal mounting of the U-shaped frame 46 on the brackets 45, as shown at 51, a comparatively great mechanical advantage is provided to insert high pressure on the staple as it is being inserted and clinched.

Referring now to the operating mechanism for the plunger 13, which operates the penetrating members 27, attention is called to Figures 1 and 14. The plunger 13 is shown as provided with a notch at 52 and this notch receives a tooth 53 of a locking detent 54 which is pivoted at 55 to an arm 56 extending inwardly from one of the brackets 45. A leaf spring is shown at 57 and is normally maintaining the tooth 53 in locking position in the notch 52. The locking member 54 is shown formed with an arm 58 which constitutes a cam means to cause disengagement of the tooth 53 from the notch 52.

The plunger 13 is centrally bored, as indicated at 59, and received in this bore is a guiding rod 60 which is secured at its free end to a disk 61 that constitutes the closed end of a cylindrical casing 62. At its upper extremity, the plunger 13 is provided with a circular head 63 which is received in the cylindrical casing 62. A coil spring 64 is disposed in the casing 62 and has one end abutting the closed end 61 and its other end engaging the head 63. The normal influence of the spring 64 is to spread the end 61 from the head 63 of the plunger 13. At its open end the casing 62 may be interiorly threaded, as shown at 65, and a closure member 66 may be threaded therein.

Referring now particularly to Figure 15, the crescent-shaped tangs 28 of the penetrating members 27 are shown as having penetrated the sheets A and the cutting edges thereof turned over and spaced slightly from the lower sheet A. From this view it will be noted that the members 27 rest along the upper surface of the top sheet A, and are positively held in this position by the two-point support at the pins 9 and 30. In this view, the staple 34 is shown as having been pressed downwardly by the plunger until the extremities of the arms thereof have reached the surface of the material A. Up to this point in its movement the staple 34 has been accurately guided on four sides, namely, the slides 25 and the plates 19 and 40.

As it passes through the sheet A, the tips of the arms of the U-shaped member are guided by the crescent-shaped tangs 28, while that portion of the staple which remains above the surface of the sheet material, continues to be guided on the four sides by the plates 19 and 40 and the members 27. As the staple is rammed downwardly under the influence of the plunger 32, there is no escape from its assuming the clinched position shown in Figure 16.

Referring now particularly to Figure 1, the operating mechanism for the staple plunger 32 is shown as comprising brackets 43 which may be secured to the plates at the sides thereof, as indicated at 44, and which brackets 43 having outstanding arms 45 between which is pivoted a U-shaped frame 46. The latter is formed with a yoke at 47 that is received between collars 48 on the shank 35. A lever arm 49 extends rearwardly and its extremity is formed with grasping means in the form of a handle 50.

It is notable that the open edge of the casing 62 is adapted to engage the arm 58 and pawl at 54 to move the latter against the influence of the spring 57 to disengage the tooth 54 from the notch 62.

When it is desired to staple two of the sheets A together, the machine is positioned on the upper surface thereof with the lower edge of the various plates resting thereon. The casing 62 is now depressed, and during the initial movement thereof, the locking pawl 54 prevents downward movement of the plunger 13. During this time energy is being stored in the spring 64 as it is being compressed. When the edge of the open end of the casing 62 strikes the arm 58 of the pawl 54, the plunger 13 is released so that it is urged downwardly at a high rate of speed by the spring 64. This downward movement causes the sharp edges of the crescent-shaped tangs 28 to penetrate the material and the penetrating members are swung over to the position shown in Figures 11, 15 and 16.

This swinging movement of the penetrating

members is further helped by the engagement of the crescent-shaped tangs with the material, the curve of the former tending to swing the arms outwardly, as shown in the drawings. With the tangs in the position illustrated in Figure 15, the handle 50 may now be grasped and depressed, whereupon the staple is moved downwardly and clinched, as shown in Figure 16.

In order to insure of the operation of members 62 and 50 in their proper sequential order, I propose to employ a locking device which will prevent operation of the staple plunger 32 until the plunger 13 for the penetrating instrumentalities has been operated to insert the latter. The locking device will also be effective to prevent return of the plunger 13 to its normal position prior to return of the staple plunger 32.

This locking device comprises a ball member 70, which is shown in Figure 3 as being partially seated in a recess 71 formed on the upper face of the plunger 13. The plate 19 is provided with an opening 72 centrally thereof and the ball member 70 is at all times received in this opening. The staple plunger 32 is formed with a cup-shaped recess 73 which at times has the ball 70 seated therein, this recess being similar to the recess 71 in plunger 13.

With both of the plungers upraised, the ball 70 will be received in the opening 72 and the recess 73 in the staple plunger 32, it being maintained in this position by the engagement of the faces of the plunger 13 and plate 19. When the plunger 13 is completely depressed the recess 71 becomes aligned with the opening 72, whereupon the plunger 32 may be operated as a downward movement of the plunger will force the ball 70 out of position, locking the plunger 32 against movement over into the recess 71 in which it locks the plunger 13 against motion. After a complete cycle of operation of the staple plunger 32 the opening 73 again becomes aligned with the opening 72 after which the plunger 13 may be raised into its normal position.

In order to maintain the plunger 13 in its normal upraised position, the latter is slotted, as shown at 74. An arm 75 is carried by the plate 10 and extends through the slot 74 into the bore 59. A spring 76 is disposed in the bore 59 and abuts the arm 75 at one end and is anchored at 77 to the plunger 13. This spring 76 normally maintains the plunger in an upraised position, it being depressed against the influence of this spring.

While a preferred specific embodiment of the invention is hereinbefore set forth, it is understood that I am not to be limited to the exact mechanisms illustrated and described, as various modifications of these details may be provided in putting the invention into practice, within the purview of the appended claims.

I claim:—

1. A stapling machine comprising pivoted penetrating instrumentalities adapted to penetrate material to be stapled with a pivoting movement, the pivot points of said penetrating instrumentalities being movable, operating means for the penetrating instrumentalities, and means independent of the penetrating instrumentalities for inserting a staple in the material subsequent to operation of the penetrating instrumentalities.

2. In a stapling machine, means for forcing a staple to cause the latter to be inserted in material, and means for guiding that portion of the staple which is embedded in the material as it is inserted therein, said guide means also cooperating with the forcing means to bend the staple into clinched condition.

3. A stapling machine of the character described comprising a supporting plate, a pair of penetrating members pivotally carried by the supporting plate, means for causing the pivotal points of the penetrating members as well as the penetrating members themselves to move with respect to the plate to cause effective operation thereof, said means including a means for swinging the penetrating members over with respect to the plate, and a staple-engaging plunger carried by the plate and movable with respect thereto.

4. A stapling machine of the character described comprising a supporting plate, a pair of penetrating members pivotally carried by the supporting plate, means for causing the pivotal points of the penetrating members to move with respect to the plate to cause effective operation thereof, said means including a means for swinging the penetrating members over with respect to the plate, a staple-engaging plunger carried by the plate and movable with respect thereto, and mechanism for operating the penetrating members at a high rate of speed.

5. A stapling machine of the character described comprising a supporting plate, a pair of penetrating members pivotally carried by the supporting plate, means for causing the pivotal points of the penetrating members to move with respect to the plate to cause effective operation thereof, said means including a means for swinging the penetrating members over with respect to the plate, a staple-engaging plunger carried by the plate and movable with respect thereto, and operating mechanism for the staple-engaging plunger for causing the latter to apply high pressure to the staple.

6. A stapling machine of the character described comprising a supporting plate, a pair of penetrating members pivotally carried by the supporting plate, means for causing the pivotal points of the penetrating members to move with respect to the plate to cause effective operation thereof, said means including a means for swinging the penetrating members over with respect to the plate, a staple-engaging plunger carried by the plate and movable with respect thereto, operating mechanism for the penetrating members to move the latter at a high rate of speed with respect to the plate, and independent operating mechanism for the staple-engaging plunger to move the latter at a comparatively low rate of speed.

7. A stapling machine comprising a supporting plate, a guiding plate mounted on the supporting plate, said guiding plate being formed with grooves, a pair of penetrating members having pins extending into said grooves, each of the penetrating members being formed with a crescent shaped anvil surface, means for operating the penetrating members to cause the pins thereof to move in the grooves, and a staple-engaging plunger operatively carried by the supporting plate.

8. A stapling machine comprising a supporting plate, a guiding plate mounted on the supporting plate, said guiding plate being formed with grooves, a pair of penetrating members having pins extending into said grooves, each of said penetrating members being formed with a curved anvil surface, means for operating the penetrating members to cause the pins thereof to move in the grooves, means for operatively con-

necting a magazine of staples to the supporting plate, and a staple-engaging plunger operatively carried by the supporting plate.

9. In a stapling machine, a plate having a pair of arcuate slots therein, penetrating members having pins entering said slots, slides carried by the plate and having one end adapted to engage the penetrating members, and a plunger operatively connected to the penetrating members and the slides.

10. In a stapling machine, a plate having a pair of arcuate slots therein, penetrating members having pins entering said slots, slides carried by the plate and having one end adapted to engage the penetrating members, a plunger operatively connected to the penetrating members and the slides, and spring mechanism for moving the plunger at a high rate of speed.

11. In a stapling machine, a plate having a pair of arcuate slots therein, penetrating members having pins entering said slots, slides carried by the plate and having one end adapted to engage the penetrating members, a plunger, links pivotally carried by the plunger and connected at their ends to the penetrating members, and means for operatively connecting the plunger to the slides.

12. In a stapling machine, penetrating members, a shaft for causing operative movement of the penetrating members, means for locking said shaft in its movement, an operating member movable with respect to the shaft and adapted to engage the locking means to render the same inoperative, and spring means interposed between the operating member and the shaft.

13. A stapling machine comprising face plates, a guide plate interposed between the face plates, said guiding plate being formed with a pair of curved slots, said plate also being formed with a pair of slots having straight and curved parts and which slots are embraced within the first mentioned curved slots, a pair of penetrating members each having two pins thereon, said pins being slidably received in the slots in said guiding plate, a plunger movable with respect to the plates, links connecting the plunger to the penetrating member, slides operatively connected to the plunger and having extremities adapted to engage penetrating members, and a staple-engaging plunger carried by the plates.

14. In a stapling machine of the character described, penetrating instrumentalities including a member movable to cause operation of the said pentrating instrumentalities, staple driving means including a member movable to cause effective operation thereof, and a locking device controlling the relative operations of the said movable members.

15. In a stapling machine of the character described, penetrating instrumentalities including a member movable to cause operation of the said penetrating instrumentalities, staple driving means including a member movable to cause effective operation thereof, and means to prevent operation of the operating member for the staple driving means prior to operation of the member operating the penetrating instrumentalities.

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