Jan. 19, 1943. D. R. LA PLACE 2,308,611

STAPLING MACHINE

Filed July 23, 1940 2 Sheets-Sheet 1

FIG. I.

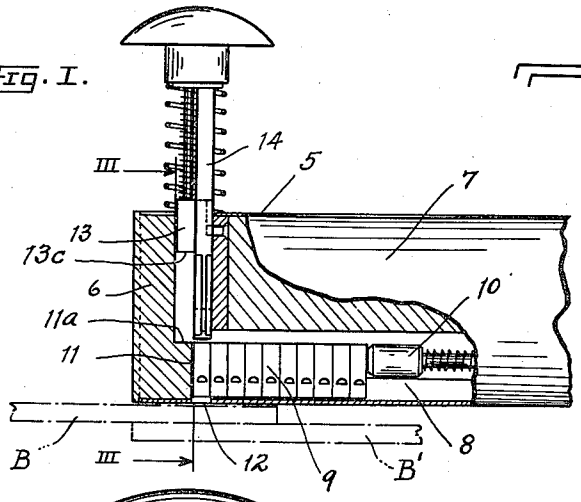
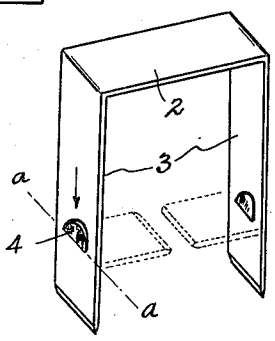



FIG. II.



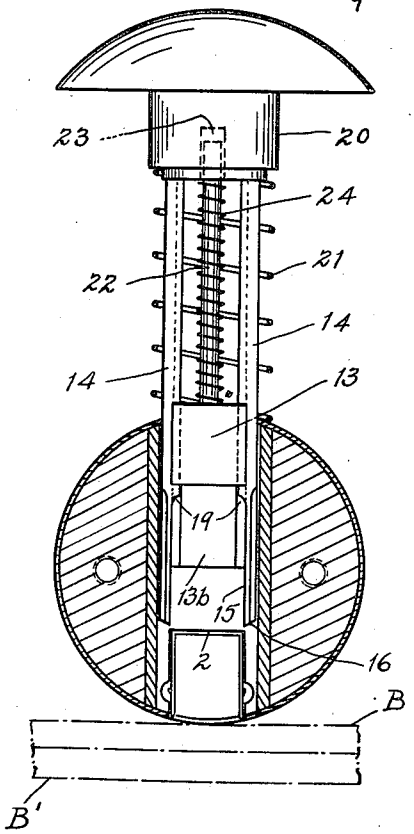
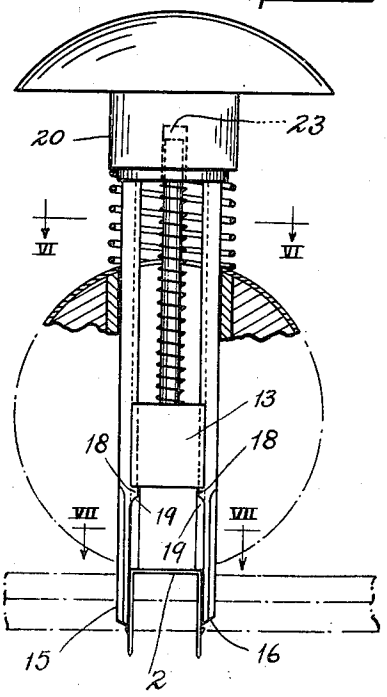




FIG. III.

FIG. IV.




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STAPLING MACHINE

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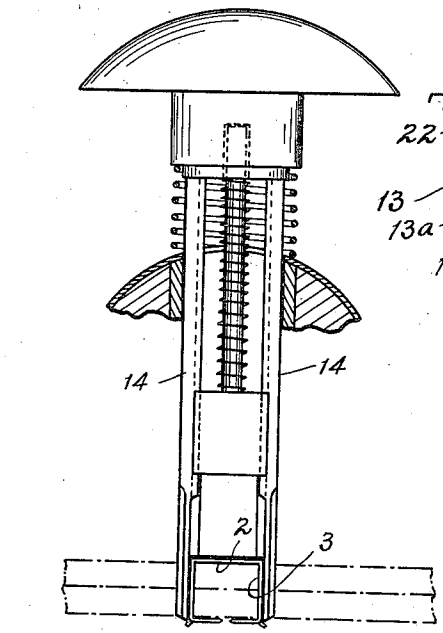



Fig. V.

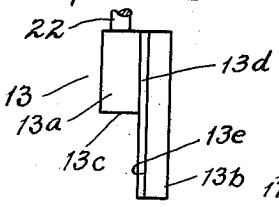



Fig. VIa.

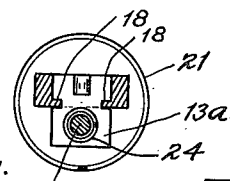



Fig. VI.

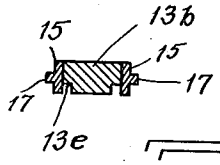



Fig. VII.

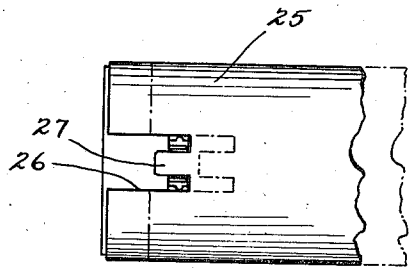



Fig. X.

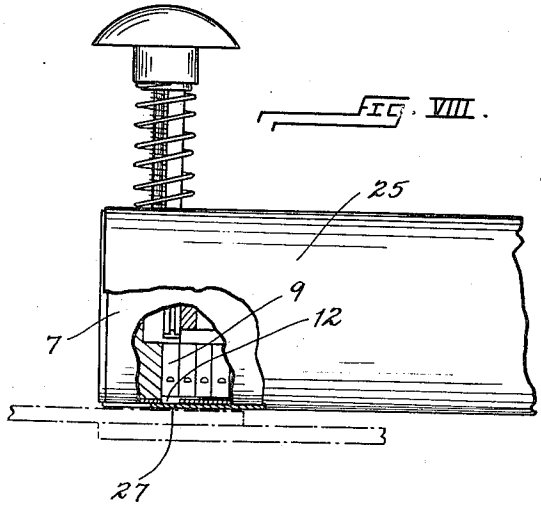



Fig. VIII.

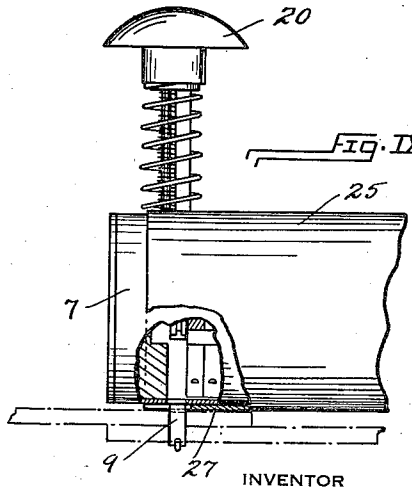



Fig. IX.

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# UNITED STATES PATENT OFFICE

2,308,611

## STAPLING MACHINE

Desmond R. La Place, Pittsburgh, Pa., assignor to Bocjl Corporation, Pittsburgh, Pa., a corporation of Delaware

Application July 23, 1940, Serial No. 346,959

18 Claims. (Cl. 1—49)

This invention pertains to a machine for driving staples and similar fasteners and to a method of stapling.

In my copending application, Serial No. 343,703, filed July 3, 1940, entitled Improvements in Stapling, I have disclosed a staple or similar fastener wherein one or more legs of the staple is provided intermediate its ends with a burr projecting laterally from the plane of the staple, the burr being preferably so formed that the leg of the staple is transversely weakened at the point where the burr is located. When this burr is subjected to pressure in a direction from the top of the staple toward the point, a bending moment is set up which causes the lower portion of the leg of the staple to be turned inwardly, thus clinching the staple. The present invention pertains primarily to a stapling machine for use with staples and like fasteners so formed with a burr or projection thereon.

In using the staple of my said copending application with the machine as disclosed in the present application, the bending or clinching of the staple is effected entirely from the driving end of the staple, and it is unnecessary to use any anvil under the points of the staple to turn them inwardly. In the stapling of soft paper boxes, as for example the stapling together of a cover of a cake box in a bakery where the cake is already placed in the box, the pressure necessary to drive and clinch the staple would normally push the top of the box inwardly. The present invention provides a stapling machine and method of stapling wherein support is given at the top of the box to resist the downward pressure and thus enable the staple to be driven and clinched without bending in the top of the box or without pushing the staple entirely through the paper. In other words, the present invention provides a stapling machine and method of stapling wherein support is given to the top of the box or other object or material into which the staple is being driven to control the depth of penetration of the staple and provides a rigid surface to partially absorb the downward thrust exerted in the clinching of the staple.

The invention may be fully understood by reference to the accompanying drawings which illustrate the essential parts of one form of stapling machine embodying my invention. It will be understood that only so much of the machine is illustrated as is necessary to show the driver and method of driving, and that the machine may be constructed in various ways insofar as the delivery of staples to the driving mechanism is concerned. In the drawings—

Figure I is a side elevation partly in section of the stapling machine, overlapping layers of material to be stapled being shown in broken lines under the machine;

Figure II is an enlarged perspective view of one form of staple to be used with the present invention;

Figure III is a transverse section through the machine shown in Figure I but on a larger scale, the view being substantially in the plane of line III—III of Figure I, and the parts are shown in the normal retracted position;

Figure IV is a view similar to Figure III in which some parts of the machine have been broken away and showing the position of the parts after the staple has been driven but before the points have been clinched;

Figure V is a view similar to Figure IV showing the position of the parts after the turning or clinching of the points;

Figure VI is a detail view showing a transverse section through the upper portion of the driving mechanism in substantially the plane of line VI—VI of Figure IV;

Figure VII is a transverse horizontal section through the driver, the view being in the plane of line VII—VII of Figure IV.

Figure VII*a* is a detail view showing a side elevation of the driver;

Figure VIII is a view similar to Figure I showing a slightly modified form of machine for the practice of the method hereinbefore referred to;

Figure IX is a view similar to Figure VIII but showing the position of the parts after the operation of driving the staple but before the machine has been removed from the surface into which the staple is driven; and

Figure X is a bottom plan view of the machine shown in Figures VIII and IX.

Referring first to Figure II, there is disclosed one form of staple or fastener of the form more fully described and claimed in my said copending application. This staple is of the usual inverted U-shaped form having a bridge or a top bar **2** and depending legs **3**. The staple is shown as being formed of thin sheet metal. Intermediate the top and bottom of the staple are integral outwardly pressed tongues or burrs **4** which are preferably formed by punching or stamping so as to sever the top edge of the burr from the body of the metal from which it is struck. This weakens the leg of the staple in a transverse direction coinciding substantially with the bottom

edge of the outwardly struck burr. The staple is shown as having a sharp edge at the end of each leg of the staple. In my copending application, the portion of the leg of the staple above the burr 4 is referred to as a primary portion, and the portion below the burr is referred to as a secondary or end portion. Because of the fact that the burr 4 projects laterally from the plane of the leg of the staple, pressure against the burr in the direction of the arrow shown in Figure II, i. e., from the top toward the end of the staple, creates a bending moment about the line *a—a* as an axis tending to fold or bend the free end portions of the staple inwardly. As hereinbefore explained, the staple forms no part of the present invention, but is more fully and completely disclosed and claimed in my said copending application, but it is herein described for a better understanding of the present invention which is specifically for use with staples or like fasteners of that general character.

Referring to Figures I to VII inclusive, 5 designates generally a stapling machine having a head 6 and a barrel 7. The barrel 7 is provided with a longitudinally extending groove or channel 8 constituting a magazine for the reception of a plurality of preformed staples 9. A spring-pressed follower 10 serves to urge the series of staples 9 along the magazine into a position to be driven. An abutment 11 formed in the head 6 of the machine constitutes a stop for limiting the travel of the staples 9 at the driving position.

The barrel 5 is provided with a slot or opening in the bottom thereof at 12 through which the staples are successively driven. Slidable in the head 6 is a driving unit for driving the staples through the opening 12 and for clinching them. This driver comprises a main driving head or block 13 adapted to be forced down into engagement with and press against the crossbar or bridge 2 of the staple and by the continued application of pressure force the staple down into the material into which it is to be driven in the same manner that the driver of stapling machines now operates, and as will be well understood by those skilled in the art. The driver 13, as shown in Figure VII*a*, has an upper portion 13*a* and a relatively thinner lower portion 13*b*, there being a shoulder formed at 13*c*. Extending down each side of the driver through the upper part 13*a* is a groove 13*d*, and this groove is continued on the lower portion 13*b* as a shoulder or ledge 13*e*.

The driver is mounted in a follower member which comprises two parallel bars or arms 14 which are also slidable up and down in the head. Figures VI and VII show the manner in which the driver is slidably guided and interfitted with the arms 14. Each of the two arms 14 is provided with a terminal portion 15, the extreme end of which is preferably beveled as indicated at 16. The terminal portions 15 are of less thickness than the upper portions of the arms, but the terminal portions are preferably provided throughout their length with a central external rib 17 (see Figure VII). Throughout the upper part of their length the terminal portions 15 are provided with inwardly turned flanges 18 that act as guides for the driver 13, said flanges engaging in the groove 13*d* of the driver and also engaging on the ledges 13*e* as shown in Figures VI and VII respectively. These flanges terminate at 19 (see Figures III and IV). The arms 14 and the driver 13 are thus slidably engaged with each other for relative longitudinal movement, but are held in transverse alinement. Below the inwardly turned flanges 18 the distance between the two inner faces of the terminal portions 15 of the arms is equal to the cutside width of the staple so that when the arms 14 are forced downwardly as hereinafter more fully described, the lower portions of the arms will straddle the staple which is to be driven.

The arms 14 are attached to a driving head or plunger 20 and a compression spring 21 interposed between the top of the barrel 5, and the underside of the plunger 20 serves to normally raise the plunger to the position shown in Figure III. The driver 13 has an upwardly extending post 22 thereon which enters a well 23 in the plunger 20. There is a relatively stiff compression spring 24 between the top of the driver 13 and the lower end of the plunger 20.

The operation of the machine may now be followed. When the operating plunger 20 is elevated, which is its normal position, the follower 10 will push the staples in the magazine until the staple which is at the left-hand end as viewed in Figure I is against the abutment 11. In use, the tool is placed over the material into which the staple is to be driven. This material is illustrated in Figures I, III, IV and V as comprising overlapping layers of cardboard or like substance such as, for example, two overlying flaps of a carton. The two layers are designated B and B' and are shown in broken lines. When the tool has thus been positioned over the material, pressure is applied to the plunger 20. The driver 13 and the arms 14 descend as a unit. The arms 14 travel down along the outside of the legs of the staple, forming an outer guide for the staples, until the end of the lower portion 13*b* of the driver engages the crossbar or bridge 2 of the staple. At this time the ends 16 of the arms are preferably just above the burr 4 on the staple. The continued application of pressure to the plunger causes the driver 13 to force the staple into the material B—B' and the terminal portions 15 of the arms 14 of course also penetrate the material. When the staple has been driven to its full depth, which is the position shown in Figure IV, the driver 13 cannot move down further because at this time the shoulder 13*c* on the driver engages the shoulder 11*a* at the top of the abutment 11 (see Figure 1), and the continued application of pressure to the plunger 20 causes the spring 24 to be compressed and the arms 14 continue to move downwardly. In this continued downward movement the ends 16 of the arms engage the burrs 4 of the staple, and this creates a bending moment tending to fold the end portions of the legs of the staple in toward each other as shown in Figure V. The over-travel of the arms 14 relative to the driver 13 is thus utilized to clinch the staple. It is only necessary that the arms 14 have a relatively short over-travel with respect to the driver 13 in order to clinch the staple. The over-travel of the arms 14, after the driver has been positively stopped by coming against the shoulder 11*a*, is restricted by the end of the post 22 engaging the bottom of the well or socket 23 in the plunger 20. After the plunger 20 has been depressed to a point where the end of the rod 22 abuts against the inner end of the well 23 and the shoulder 13*c* is solidly against the shoulder 11*a*, there can be no further downward movement of any of the parts. The spring 24 of course has to be sufficiently stiff to trans-

mit the driving pressure from the plunger to the staple and prevent over-travel until the staple has been driven to the desired extent. After the staple has been clinched, pressure is relieved from the plunger **20** and the spring **21** immediately serves to restore the parts to the normal position, the spring **24** of course also expanding to establish a normal relation between the driver and the arms **14** of the follower. As soon as the staple has been driven and the spring **21** has restored the parts to the normal position, the pusher **10** will force the next succeeding staple into a position to be driven.

In the form of the machine shown in Figures I to VII inclusive, all of the pressure of driving and clinching the staple is transmitted to the material into which the staple is being driven. In the case of a very light box top as for example, a cake box, this would have the disadvantage that the top would bend inwardly in the process of driving and clinching the staple. With the modification shown in Figures VIII, IX and X, the staple can be driven and clinched in a manner such as to prevent material into which the staple is being driven from being distorted by excessive pressure. The stapling machine shown in Figures VIII to X is the same in its general construction as that previously described, and similar reference numerals have been used to designate the corresponding parts. With this form of the invention, however, a sleeve **25** is fitted about the body **7** so as to be slidable longitudinally on the body. It is provided with a notch **26** on the forward end at the bottom thereof as shown in Figure X, this notch having a forwardly projecting tongue **27** at the inner edge thereof. At the time of driving the staple this tongue **27** is under the opening **12** through which the staple is driven. The notch **26** and the tongue **27** are of such dimensions that the points of the staple can come down at each side of the tongue **27** along with the extremities **15** of the arms **14**, but the tongue **27** will be in the path of the downward movement of the bridge of the staple. When the staple is driven, it is pressed down against the tongue **27**. The tool will then be held rigid while the plunger **20** is further depressed and the staple is being clinched. The sleeve **25** may then be slid back to the dotted line position shown in Figure X. In this position it is withdrawn from under the bridge of the staple, and the tool can be lifted away from the staple. The downward thrust on the bridge of the staple is thus transmitted, after the staple has been driven, to the tongue **27**, and by properly supporting the tool, the pressure required for clinching the staple will be resisted by the tongue rather than by the material into which the staple is driven. It is even possible with this arrangement to expel and clinch the staple without actually causing the staple to penetrate any object at all. It will of course be understood that after one staple has been driven and the sleeve **25** pulled toward the right as viewed in Figure VIII, the sleeve should be again moved to the left before the next staple is driven. The use of this tongue provides a method whereby staples can be driven and clinched under all conditions even in very soft materials, and stapling tools can be used for purposes such as closing cake boxes where it has not heretofore been thought practical to employ staples or similar fasteners.

While particular mention has been made herein of the application of the tool to the stapling of cake boxes, it will be understood that this is only for the purpose of illustration. Also, while one specific form of hand-operated tool has been shown, it will be understood that the machine may be embodied in various forms and that the staples or other fasteners may be presented to the driving mechanism in various ways and that the invention is applicable to those machines in which the staple is formed directly in the driving head, as well as to machines in which the preformed staple is delivered to the driver, all within the contemplation of my invention and within the scope of the following claims.

I claim as my invention:

1. Stapling apparatus comprising a support and a staple-driving and clinching unit on the support having relatively and coaxially movable driver and follower members, the follower member having a range of movement greater than the driver.

2. Stapling apparatus comprising a support and a staple-driving and clinching unit on the support having relatively and coaxially movable driver and follower members, a common means for operating both members of said unit, and means for limiting the movement of the driver to a range less than the movement of the follower.

3. Stapling apparatus comprising a driver for pushing a fastener into material, and a follower for clinching the fastener while it is being held down by the driver movable in the same direction as the driver and having a range of movement greater than the driver.

4. Stapling apparatus of the class described comprising a staple-delivering mechanism, a driver for driving staples which are delivered by the delivering mechanism to it, and a follower associated with the driver movable with and relatively to the driver and in the same direction as the driver for clinching the staple after it has been engaged by the driver.

5. A stapling machine of the class described comprising a supporting member, a driving unit slidably mounted in the supporting member, said unit having a driver and having parallel arms at each side of the driver adapted to be slid along each side of the staple to be driven, means for moving the driver and the arms, and means for limiting the travel of the driver to a distance less than the travel of the arms.

6. In a stapling machine for driving staples having a burr projecting from each leg thereof, a support having a staple-receiving recess therein in which the staple to be driven is positioned, a driving unit carried by the support movable in a direction to expel the staple from the recess, said driving unit comprising a pair of arms adapted to straddle the staple and which terminate in downwardly extending points, and a driver between the arms engaging the top of the staple, said driver and said arms being relatively movable.

7. In a stapling machine for driving staples having a burr projecting from each leg thereof, a support having a staple-receiving recess therein in which the staple to be driven is positioned, a driving unit carried by the support movable in a direction to expel the staple from the recess, said driving unit comprising a pair of arms adapted to straddle the staple, a driver between the arms engaging the top of the staple, means for limiting the travel of the driver in the direction to expel the staple, and other means for limiting the travel of the arms only after they

have moved relatively to the driver and after the staple has been expelled.

8. A stapling machine of the class described comprising a support, means in the support for receiving a staple to be driven, a driving unit slidably mounted in the support, said unit having a driver for engaging the bridge of the staple and expelling the staple from the tool, a pair of arms associated with the driver but movable relatively thereto, said arms being adapted to straddle the staple, and means for moving the driver and arms in unison and then moving the arms relatively to the driver.

9. A stapling machine of the class described comprising a supporting member having a recess therein for receiving a staple to be driven, a driving unit slidably mounted on the support and having a driving element adapted to engage the bridge of the staple for expelling the staple from the machine and a bifurcated follower adapted to straddle the staple as it is being driven, means for limiting the thrust of the driver, and means for moving the follower after the driver has reached its limit of movement.

10. A stapling machine of the class described comprising a supporting member having a recess therein for receiving a staple to be driven, a driving unit slidably mounted on the support and having a driving element adapted to engage the bridge of the staple for expelling the staple from the machine and a bifurcated follower adapted to straddle the staple as it is being driven, means for limiting the thrust of the driver, means for moving the follower after the driver has reached its limit of movement, and a reciprocable tongue member movable transversely of the path in which the staple is driven and against which the bridge of the staple may be driven and which may be withdrawn from under the bridge of the staple after the driving operation has been completed.

11. A stapling machine of the class described comprising a supporting member having a recess therein for receiving a staple to be driven, a driving unit mounted on the support and having a driving element adapted to engage the bridge of the staple for expelling the staple from the machine and a bifurcated follower adapted to straddle the staple as it is being driven, means for limiting the thrust of the driver, means for moving the follower after the driver has reached its limit of movement, and movable means for temporarily supporting the staple by engagement with the under face of the bridge thereof while the follower is completing its movement.

12. A stapling machine of the class described comprising a supporting member having a recess therein for receiving a staple to be driven, a driving unit slidably movable on the support and having a driving element adapted to engage the bridge of the staple for expelling the staple from the machine and a bifurcated follower adapted to straddle the staple as it is being driven, means for limiting the thrust of the driver, means for moving the follower after the driver has reached its limit of movement, and a slidable member on the support movable in a direction transversely to the driving unit and having a tongue thereon adapted to be positioned in the path of travel of the bridge of the staple when the staple is expelled from the machine by the driver and while the follower is continuing its movement, said slidable member being adapted to be withdrawn after the stapling operation is completed.

13. A stapling machine comprising a supporting structure having a staple-receiving recess therein for receiving a staple to be driven, a driver unit in the supporting structure having a pair of parallel arms adapted to straddle a staple in said recess and a driver between said arms adapted to engage the bridge of the staple to be driven, said driver being slidably guided on said arms, a stop in said support for engaging the driver to limit the movement thereof, means for operating the driver, and means for moving the arms after the driver has engaged said stop.

14. A stapling machine of the class described comprising a reciprocable driver, means for delivering a staple to the driver, a follower having arms adapted to straddle a staple and of a length such as to enter the material into which the staple is driven, and means for reciprocating the driver and the follower, said follower being movable in the direction in which the staple is driven after the driver has reached the limit of its travel.

15. Means for driving a staple having a burr projecting laterally from each leg thereof in such manner as to bend the legs of the staple after the staple has been driven into the material comprising a driver adapted to engage the bridge of the staple and force it into the material, and a bifurcated means straddling the driver and adapted to straddle the staple movable relatively to the driver for engaging the burrs on the legs of the staple after the staple has been driven.

16. In a machine for driving a staple or like fastener having a projection on the leg thereof to which pressure may be applied for bending the leg of the staple, a driver, and a member movable with the driver and relatively thereto for guiding the leg of the fastener and for engaging the said projection to bend the leg.

17. In a machine for driving a staple or like fastener having a projection on the leg thereof to which pressure may be applied for bending the leg of the staple, a driver, a member movable with the driver and relatively thereto for guiding the leg of the fastener and for engaging the said projection to bend the leg, and a common operating means for operating the driver and said member.

18. A device for driving a staple having a burr projecting laterally from each leg thereof in such manner as to bend the legs of the staple after the latter has been driven into the material comprising bifurcated means having arms adapted to straddle the staple and movable after the bridge of the staple has reached the limit of its movement for applying a force on the burrs on the legs of the staple to bend them inwardly.

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